An evaluation of laboratory capacity and capability in selected CARICOM countries with respect to their support of agricultural health and food safety systems (AHFS) in the conduct of trade

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Executive Summary

This study was commissioned by the Secretariat of the Caribbean Community (CARICOM) with funding from the Standards and Trade Development Facility (STDF) of the World Trade Organisation (WTO). The aim was to gather information on the capacity and capability of the laboratory and diagnostic services of the region with respect to their ability to support agricultural health and food safety systems in the conduct of trade. The information gathered will form the basis of a project proposal, to be used in procuring funds to strengthen and rationalise the use of laboratory and diagnostic capacity of the region.

This report outlines the findings of the study conducted in 12 of the 15 CARICOM member countries during the period 07 May – 10 June 2006. Visits were made to the selected countries and interviews conducted with the laboratory and other personnel. A prepared questionnaire (Appendix 3) was used in the collection of general information on laboratory infrastructure, equipment and analyses conducted.

The laboratories in each of the selected member countries were assessed on their resources (housing, human and systems infrastructure), instruments, equipment and services provided. The capability of the laboratories was assessed with respect to their ability to satisfy the testing and diagnostic services required under the World Trade Organisation - Sanitary and Phyto-Sanitary Agreement (WTO-SPS), Office International des Epizooties (OIE), the International Plant Protection Convention (IPPC) and CODEX. In addition the laboratories were analysed based on the requirements of International Standards Organisation/ International Electrotechnical Commission (ISO/IEC) 17025 – "General requirements for competence of testing and calibration laboratories". Consideration was also given to the testing and diagnostic requirements the countries would have to satisfy if live plants and animals and their products were to be exported to countries within CARICOM, the European Union (EU) and the United States of America (US). The need for the rationalisation of laboratory services was also examined.

Table of Contents

Glossary

AAS	Atomic Absorption Spectrophotometer
ACP	African Caribbean and Pacific.
AGID	Agar Gel Immuno-diffusion
AHFSS	Agricultural Health and Food Safety Systems
AI	Avian Influenza
CAEAL	Canadian Association of Environmental Analytical Laboratories
CARDI	Caribbean Agricultural Research and Development Institute
CARICOM	Caribbean Community
CARIRI	Caribbean Industrial Research Institute
CEHI	Caribbean Environmental Health Institute
CIL	Central Investigation laboratory
COLEACP	Comité de Liaison Europe-Afrique- Caraïbes-Pacifique
ECD	Electron Capture Detector
ELISA	Enzyme Linked Immuno-Sorbed Assay
EU	European Union
FID	Flame Ionisation Detector
FPD	Flame Photometric Detector
GC	Gas Chromatograph
GC/MS	Gas Chromatography with Mass Selective Detector
HACCP	Hazard Analysis Critical Control Point
IADB	Inter=American Development Bank
IEC	International Electro-technical Commission
IICA	Inter-American Institute for Co-operation on Agriculture
IPPC	International Plant Protection Convention
ISO	International Standards Organisation
MALMR	Ministry of Agriculture Lands and Marine Resources
MCST	Ministry of Commerce, Science and Technology
NAMDEVCO	National Agricultural Marketing and Development Corporation
NARI	National Agricultural Research Institute
NCTE	National Centre of Testing Excellence
NPD	Nitrogen Phosphorus Detector
OECS	Organisation of Eastern Caribbean States
OIE	Office International des Epizooties
PCR	Polymerase Chain Reaction
PAHO	Pan American Health Organisation
PIP	Pesticides Initiative Programme
PPU	Plant Protection Unit
QA	Quality Assurance
QC	Quality Control
RSPFS	Regional Special Programme for Food Security
SIDA	Swedish International Development Agency
SPS	Sanitary and Phytosanitary
STDF	Standards and Trade Development Facility
SWEDAC	Swedish Board for Accreditation and Conformity Assessment
TTLabs	Trinidad and Tobago Laboratory Accreditation Services
UKAS	United Kingdom Accreditation Service
US	United States of America

VD	Veterinary Diagnostic
VPH	Veterinary Public Health
VS	Veterinary Services
VSDL	Veterinary Services Diagnostic Laboratory
WTO	World Trade Organisation

List of Tables

List of Appendices

1.0 Introduction

As signatories to the WTO's Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) the CARICOM member countries have the right to take measures to protect human, animal and plant health, as long as they are based on science, are necessary for the protection of health, and do not unjustifiably discriminate among foreign sources of supply. The SPS Agreement encourages governments to "harmonize" or base their national measures on the international standards, guidelines and recommendations set by the Joint Food and Agriculture/World Health Organization (FAO/WHO) Codex Alimentarius Commission (Codex) for food safety, the Office International des Epizooties (OIE) with respect to animal health and/or the International Plant Protection Convention (IPPC) with respect to plant health.

In order for CARICOM countries to participate effectively in international and regional trade, and to enhance their agricultural competitiveness on the international markets they must ensure that their Agricultural Health and Food Safety Systems (AHFSS) are harmonised with international standards. In doing so their SPS measures will be in compliance with the requirements set by the importing country when they seek to export their agricultural and food products to other jurisdictions. Without adequate infrastructure countries may experience problems in achieving those requirements, which in turn could seriously impede their ability to export their agricultural and food products. Weaknesses in their sanitary and phytosanitary systems and infrastructure will leave the countries vulnerable to the threat of contaminants and pests and diseases that may be introduced through the import of the myriad of agricultural and food products on an annual basis.

Given the wide range of products imported and exported and the geographically diverse trading partners it is necessary for member countries to have effective AHFSS. The system should include laboratory infrastructure to conduct the necessary scientific and other analyses and investigations required to support and safeguard animal, plant and human health in the conduct and facilitation of trade.

It is recognised that the existing laboratory facilities and competences of each member state of CARICOM are varied with respect to their scientific capacity and capability. However, the extent of the variation is not known. There is also the belief that costs of laboratory infrastructure may make it prohibitive for each member country to have a laboratory to satisfy all its testing needs. It may therefore be advantageous to rationalise the use of laboratories across the Community with some laboratories being deemed reference laboratories and could seek accreditation.

In addition it is believed that many of the laboratories operate without internationally recognised quality assurance (QA) and quality control (QC) programmes and therefore the results of test performed may not be accepted internationally. This would impact on the ability of the countries to trade internationally.

It is also believed that as a result of diverse trading partners regional animals, plants and human health could be at risk from plant and/or animal products or invasive pests

and diseases. Hence there is the need to have adequate laboratory facilities to conduct the necessary test to support and safeguard agricultural and human health.

This study therefore covers an assessment of veterinary services, analytical, produce chemist, water quality, plant protection and private sector laboratories in 12 of the 15 member states of CARICOM. The aim is to:

- gather and collate information on:
    - available laboratory equipment and relate this not only to the test that can be performed but also the level of sensitivity
    - laboratory staff
    - budgetary resources
- identify some of the gaps/needs for strengthening laboratory capacity and capability
- estimate the demand for testing services
- state the cost recovery mechanisms employed
- examine the need for the rationalisation of laboratory services
- examine the need for accreditation
- identify training needs

in an effort to determine their ability to provide a service with respect to AHFS in the conduct of trade.

A detailed outline of the Terms of Reference is presented in Appendix 1.

2.0 Method

A questionnaire was designed to collect detailed information on laboratory capacity, capability and infrastructure and sent to the member countries by facsimile or electronic mail.

During the visits discussions were held with laboratory and other personnel and the questionnaire used to collect the required information was explained. Any queries were satisfied. In only a few cases was the draft-completed questionnaire collected at the end of the visit. Listed in Appendix 2 are the laboratories and/or persons or departments visited in each of the selected countries, while presented in Appendix 3 is a copy of the questionnaire.

The questionnaire sought to obtain the following information on the laboratories:

- General information on the laboratory.
- Target users of the analyses and diagnostic services offered by the laboratory.
- Resources (human, housing and systems infrastructure) of the laboratory such as education level of employees, age and size of building, adequate availability of gas, vacuum, electrical, water supply, workbench space etcetera.

- Instrumentation and equipment used by the laboratory in the conduct of its business including the condition and adequacy of the equipment.
- Quality Assurance and Quality Control programmes of the laboratory.
- Role of the laboratory in the application of national, regional and/or international measures for the safe production, trade and consumption of plants and animals and their products and by products.
- Analyses conducted by the laboratory including veterinary diagnostic services in the areas of animal health, plant health and food safety.
- Analytical procedures used in the laboratory.
- An assessment of the laboratory's ability to adequately satisfy the requirements of its country's needs with respect to animal health, plant health and food safety not only at the national level but also in the conduct of trade.
- Training and infrastructure needs of the laboratory if it were to meet the national requirements with respect to agricultural health and food safety concerns in the conduct of trade.
- The interviewee's views on rationalisation of laboratory services on a regional scale.

In addition to the aforementioned information on the laboratories an attempt was made to garner the following information through personal interviews with the relevant persons:

- The identities of the major export crops.
- The countries to which these products are exported and the requirements of the importing country.
- Those crops that are not currently exported but have the potential of finding favourable export markets.
- The pattern of intra and extra regional trade within CARICOM.
- The concerns with respect to the risk posed to the AHFS of the country by the importation of agricultural products and by products from other jurisdictions.

The information obtained will be used to identify weaknesses in the laboratory systems, to investigate the possibility of rationalisation of laboratory services on a regional scale and to identify areas for strengthening laboratory capacity and capability including laboratory accreditation and infrastructure and human capacity.

3.0 Status of Animal Health, Plant Health and Food Safety Laboratories and systems

3.1 Animal Health

According to the OIE's Terrestrial Animal Health Code (subsequently referred to as the Code) countries are required to know their animal health status. In this regard they should be able to indicate whether the country is free of, or has free zones of the diseases found in List A and List B to the Code. The competent authority in the country, namely the Chief Veterinary Officer, must also be able to provide regular

and prompt information on the occurrence of transmittable diseases. This information is especially needed if the country is exporting live animal and animal products from its jurisdiction. In addition the VS should also be able to exercise zoo sanitary control of imports and transits of animals, animal products and other materials, which may introduce diseases within its borders.

With respect to Veterinary Public Health (VPH) the VS has responsibility for public health programmes related to the sanitary status of animal products throughout the slaughtering, processing, transport and storage of animal products. They must also be able to monitor and control zoonotic diseases, chemical residues in exported animals, animal products and feedstuffs.

In order to adequately carry out the mandate of the Code countries must be engaged in surveillance and monitoring programmes. Surveillance is defined in the code as "the continuous investigation of a given population to detect the occurrence of disease for control purposes, which may involve testing of a part the population". Monitoring on the other hand is described as "on-going programmes directed at the detection of changes in the prevalence of disease in a given population and in its environment. Hence VS should engage in the routine sampling and testing of animals on the farm, at market or at slaughter which may involve clinical or pathological examination of the animal, the identification of pathogens, and the detection of immunological or other evidence of previous exposure of animals to pathogens.

According to the OIE the Veterinary Services Diagnostic Laboratory (VSDL) plays an important role in the VS of a country. It is an integral part of a country's disease control programmes and crucial in determining on an ongoing basis the animal health and veterinary public health profiles of a country. This is necessary in order to satisfy the certification process of exported animals and animal products with respect to their zoosanitary status. It is also of use during the importation of animals. The laboratory should have rigid quality assurance (QA) procedures and use international QA programmes for standardised test methodologies and proficiency testing programmes. The EU, 2006, in a guidance document to third countries wishing to export live animals and animal products to the EU has indicated that competent authorities may use non-accredited laboratory to provide results for official controls once a satisfactory QA/QC programme is in place and accreditation will be completed by 01 January 2010. After that date all laboratories used must be accredited according to international standards for the test undertaken.

3.1.1 Laboratory capacity and capability

Of the countries visited only Jamaica, Belize, Barbados, St. Lucia, Trinidad and Tobago, Suriname and Guyana have VDLS. However, in Guyana, Suriname, St. Lucia and Belize these services were limited. No VDLS exist in St. Kitts and Nevis, Antigua and Barbuda or Dominica. Dominica has recently established a laboratory to undertake molecular testing using Polymerase Chain Reaction (PCR) reader technology. Dominica is hoping to use that equipment for some general Veterinary Diagnostic (VD) testing in the near future.

In Grenada there is a physical structure and some analytical and other equipment but much of the equipment has not been operational since the passing of Hurricane Ivan in 2004. It is therefore not known if they are still functioning. Very limited laboratory space exists in St. Vincent. The laboratory technician is on a three-year study leave programme, which ends in 2007. They perform basic test such as determination of the presence of parasites, urine analysis, post mortems and some haematology. Although no completed questionnaire was received from Suriname information gathered during the visit suggest that limited financial resources do not allow for the provision of a veterinary diagnostic service. Only diagnostic determination of parasites in blood, faeces and skin are undertaken as well as some basic bacteriology in a building located at the Centre for Agricultural Research (CELOS).

Simple tests such as urine analysis and parasitology performed by the veterinarian in St. Kitts and Nevis laboratory is done in one room, which is not isolated, and is in a building that is not secure. Generally St. Kitts and Nevis use the services of the Veterinary School of Ross University, based in St. Kitts, when needed while Grenada uses the Veterinary School associated with St. Georges University based on that island. However, the laboratories of Ross University and St. Georges University are for teaching and provide limited testing. Discussions with the Dean and other faculty members of Ross University indicate that once the gaps are identified and passed to the staff at Ross University, the University would be willing to develop a proposal with a view to establishing a diagnostic laboratory that could better service St. Kitts and Nevis and the member countries of the Organization of Eastern Caribbean States (OECS). No discussions were held with the faculty at the St. Georges University.

When the suggestion of Ross University providing VDL services for the OECS was mentioned in other OECS countries favourable responses were received. However, concern was expressed with respect to the transport of the samples from one island to another. It was also stated that the OECS spans the island chain and maybe Ross University could better cater to those countries closer to St. Kitts.

The VSDL in Trinidad and Barbados are the only ones from the countries that responded to the questionnaire that offer a wide range of tests. To date completed questionnaires have not been received from Jamaica and during the visit to Jamaica a tour of the laboratory did not occur due to time constraints. However, some discussions were held with personnel of the VS and VSDL but not enough to help form an opinion on the tests conducted and equipment available. Table 1 provides information on equipment found in the laboratories in Trinidad and Tobago, Barbados, Belize, St. Lucia, Guyana and St. Vincent and the Grenadines while Table 2 and 3 present the human resources and the testing capability of these laboratories.

Table 1 Type and quantity of equipment present in the VDL of Trinidad and Tobago, Barbados, Belize, St. Lucia, Guyana and St. Vincent and the Grenadines

Country	Trinidad and Tobago	Barbados	Belize	St. Lucia	Guyana	St. Vincent and the Grenadines
Item						
Veterinary diagnostic lab	Y	Y	Y	Y	Y	Y
Age of building (yrs)	> 15	36	NG	18	7	25
Floor space (sq ft)	7 000	3 000	NG	NG	NG	NG
Built for lab	Y	N	N	Y	N	N
Equipment						
ELISA Reader	1 O&G	1 O&G	2 O&G	1 O&A	1 O&G	1 O&G
CHARM Analyser	0	1 O&G	0	0	0	0
PCR Reader	0	1 O&G	0	0	0	0
Microscope Binocular Ultra Violet Dark field Electronic Phase Contrast	 6 O&G 0 1 O&G 0 1 O&G	 5 O&G 0 0 1 O&G 0	 2 O&G 1 O&G 0 0 0	 1 O&A;1 O&P 0 1 O&P 0 0	 1 O&G;2 O&P 0 1 O&P 0 0	 2 O&G 0 0 0 0
Stomacher	0	2 O&G	0	0	0	0
Homoginizer	0	0	0	0	0	0
Blender	2 O&G	1 O&G	3 O&G	0	0	0
Chopper	0	2 O&G	0	0	0	0
Autoclave	4 O&G	2 O&G	3 O&G	1 O&A	1	1 O&P
Incubator	6 O&G	5 O&G	3 O&G	1 O&P; 1 NO	1	1 O&A
Centrifuge Table Model Large standing Refrigerated Ultra	 4 O&G 1 O&G 1 O&G 0	 2 O&G 0 0 1 O&G	 2 O&G 0 0 0	 2 O&A 0 0 0	 2 1 0 0	 2 O&A 0 0 0
pH Meter Manual Digital	 2 O&G 0	 1 O&G 0	 1 O&G (Pocket)	 0 0	 0 0	 1 O&A 0
Laminar Flow Cabinet	0	2 O&G	1 O&G 1 O&A	0	0	0
Fume Cupboard	4 O&G	2 O&A	0	0	0	
Analytical balance	4 O&G	2 O&G	2 O&G	0	1 P	1 O&A
Distillation Apparatus	1 O&G	0	1 O&G	0	0	0
Quebec Colony Counter	1 O&G	0	0	0	1	0
Oven	2 O&G	1 O&A	0	1 O&A	1	0
Refractometer	1 O&G	1 O&G	1 O&G	1 O&A	0	1 O&P
Microtome	1 O&G	2 O&G	0	1 NO	1 P	0
Tissue Stainer	2 O&G	1 O&G	0	0	0	0
Histo-embedder	0	1 O&G	0	0	1 P	0
Refrigerator Std. With freezer Industrial Scientific	 2 O&G 4 O&G 0	 5 O&G 0 0	 2 O&G 2 O&A 1 O&G 0	 1 O&A 1 O&P 0 1 O&A	 0 0 0 1	 1 O&A 0 0 0

Country	Trinidad and Tobago	Barbados	Belize	St. Lucia	Guyana	St. Vincent and the Grenadines
Equipment Con't						
Freezers < - 10^0 C	4 O&G	2 O&G	1 O&A 1 O&P	1 O&A	1 P	0
Hotplates without agitators with agitators	 0 0	 0 4 O&G	 3 O&G 1 O&G	 0 0	 0 0	 0 0
Incinerator	1 O&G	1 O&P	1 O&P	0	1 P	0
Turbidity meter	0 O&P	1 O&G	0	0	0	0
Microhaematocrit centrifuge	0	0	1 O&G	0	0	0
Spectrophotometer	0	0	1 O&A 1 O&P	0	0	0
Coulter Cell Counter (CBC machine)	0	0	1 NO	0	0	0
Water Bath	0	0	3 O&G	0	0	0
Sterilizer Oven	0	0	1 O&P	0	0	0
Microplate Washer	0	0	1 O&G	0	0	0

Note:
O - Operational; NO – Not Operational NG - Not Given
Y – Yes G - Good; A – Average; P – Poor

Table 2 Human resources of veterinary services laboratories in selected CARICOM countries

	Number of persons employed					
	Trinidad & Tobago	**Barbados**	**Belize**	**St. Lucia**	**Guyana**	**St. Vincent & Grenadines**
University Graduate:						
MSc.	0	2	0	0	0	0
BSc.	1	2	0	0	0	0
DVM	3[a]	1	1	2[b]	1[c]	0
Tertiary Institution Graduate	6	2	2	1	0	1
Secondary (High) School Graduate with > 3 years experience	8	1	0	0	2[d]	0
Secondary (High) School Graduate with < 3 years experience	0	0	0	0	0	0
Administration (Non-Technical)	5	0	0	0	0	0
Service (e.g. Cleaners)	4	2	0	0	1	0
Total Personnel	**28**	**10**	**3**	**3**	**4**	**1**

Note:
a Plan work in haematology, histology & parasitology labs
b Spends 50% time in laboratory
c 3 days/week
d when needed

Table 3 Tests performed in Veterinary labs in select CARICOM countries

Test	Country					
	Trinidad & Tobago	**Barbados**	**St. Lucia**	**Belize**	**Guyana**	**St. Vincent & Grenadines**
Serology	[	[	[	[	[	x
Microbiology						
Clinical	[	[	[	[	x	x
Food	[	[	x	x	x	x
Bacteriology	[	[	[	[	x	x
Haematology	[	[	[	[	[	[
Mycology	[	[	x	[	x	x
Blood Chemistry	x	[	x	x	x	x
Cytology		[	x	x	x	x
Histology	[	[	x	x	x	x
Tests con't						
Histopathology	[	[	x	x	x	x
Clinical pathology	[	[	x	x	x	x
Virology	x	x	x	x	x	x
Parasitology	[	[	[	[	x	[
Urine analysis	[	[	[	[	x	[
Residue analysis	x	[	x	x	x	x
Post Mortem	[	[	[	[	x	[
Analyses conducted support						
Investigations of outbreaks	[	[		[		
Routine surveillance	[	[	[	[	[	
Support to industry	[	[	[	[	[	
Import control				[		
Export control				[		

Note:
[denotes test performed x denotes test not performed

Generally the majority of the laboratories perform simple tests; urine analysis using the qualitative dipstick method to determine biochemical parameters, haematology – determination of blood analytes like red and white blood cell and platelets and parasitology - determination of parasites in stools, skin and intestinal scrapings. These test do not require and major pieces of equipment.

The Enzyme Linked Immuno-sorbed Assay Reader (ELISA) listed among the equipment used by the Barbados, Trinidad and Tobago, Guyana, St. Lucia and Belize

laboratories can be used for the screening of some OIE List A and B reportable diseases. It is either the prescribed or alternate methodology of testing for the diseases (OIE, 2004). Only Barbados and Trinidad widely use this method to routinely screen for a number of diseases.

Guyana's veterinary diagnostic laboratory at the Ministry of Agriculture's headquarters, only use the ELISA technique to screen for Avian Influenza (AI) in poultry, mainly as a service to the poultry industry. It was through funds from that industry that the laboratory was established and equipment bought. The laboratory is currently under development and funds are required to assist in the implementation of other tests. Belize VSDL, at the time of this study only used the ELISA technique to screen for Classical swine fever and AI. Funds to purchase the kits were provided through an ongoing surveillance project. Lack of available funds to purchase the kits makes it generally prohibitive for Guyana, St. Lucia and the Belize VS personnel to undertake routine screening using the ELISA technique.

In general, of the responses received, the Barbados and Trinidad VSDL undertake a wide range of tests. This may be as a result of the status of their livestock industry compared with that in the countries of the OECS. They both have a vibrant poultry, dairy and pig industry as well as a ready cadre of trained or trainable persons within the country that could be hired to conduct the tests. Belize also has a vibrant livestock industry being self sufficient in poultry, pork and beef. However, they lack the necessary funds to routinely conduct the necessary tests.

The majority of tests done by the Trinidad and Barbados laboratories are in support of the poultry industry. In Barbados this industry contributed approximately 18% of agriculture's share of GDP in 2004 and 2005 with a dollar value of BDS $29 and $31 million respectively. Trinidad estimates that these tests account for over 40% of the tests undertaken while Barbados estimates that they could account for 60%.

Trinidad has a Poultry Surveillance Unit that conducts surveillance of poultry farms. The chickens are bled on farm by the inspector and the samples sent to the VDL for analysis. Tests conducted on samples taken include West Nile Virus, Avian Influenza, New Castle Disease and Salmonella. Both ELISA and Agar Gel Immuno-Diffusion (AGID) techniques are used. The AMES laboratory in Iowa and/or the Veterinary Diagnostic Laboratory, Weybridge, UK does verification required of any positive results. The presence of well established poultry industries in Belize and Guyana also account for testing programmes in those countries funded by the resident poultry associations.

The OIE identifies the Veterinary Authority in a country as responsible for fish and fisheries products but in many countries matters related to fisheries are handled by fisheries departments or through the Environmental Health Officers in the Ministries of Health.

Belize, Suriname, Guyana and Jamaica export fish mainly conch, shrimp, lobster and/or tilapia to the EU. The companies that export these products have HACCP programmes in place and have been visited and certified by the EU. Only companies so certified have been allowed to ship to the EU. Laboratory facilities for the analysis

of fish exported to markets in the EU exist in the Fisheries Department, Suriname while the Chemistry Food and Drug and the Central Investigation Laboratory (CIL) in Guyana and Belize respectively conduct the testing requirements of the Guyana and Belize fisheries.

The OECS countries of Grenada, Dominica and St. Vincent previously traded fish products with Martinique and Guadeloupe but since the implementation of EU directives with respect to third countries trading in fish trading has stopped. Trinidad can no longer export fish to the EU. Barbados, St. Vincent and the Grenadines and Dominica trade in tuna, marlin and dolphin with the US.

The Japanese have established fish testing laboratories in Antigua and Barbuda, Dominica, St. Vincent and St. Lucia and have upgraded fish landing sites in Grenada and the markets in St. Vincent and Dominica. However, there is very little utilisation of these laboratories. In the case of Dominica the laboratory is not manned and most of the equipment remains unused. A few pieces were transferred to the molecular laboratory when it was being established. The St. Vincent laboratory is manned by a Veterinarian, trained in Cuba. The officer has no training in fish analysis or microbiological determinations. At the time of the visit the officer was collaborating with the microbiologist in the microbiology section of the Bureau of Standards laboratory with respect to method development. Time did not permit a visit to the St. Lucia or Antigua and Barbuda laboratories and completed questionnaires were not submitted by any of the fisheries laboratories in the OECS. The VSL or the Government Analytical Services (GAS) laboratory, Barbados conduct any testing required by the Barbados fishing industry. However, very little testing is currently done.

3.1.2 Problems identified

The respective governments generally provide funding for the laboratories. In some cases private sector groups provide funds to support specific programmes as was seen in Belize and Guyana. In many cases untimely supply of funds and/or inadequate allocations prevent the laboratories from procuring the necessary equipment and consumables to adequately carry out their mandate.

Lack of an annual budget for training of staff, an inadequate number of trained persons and limited financial resources to purchase equipment reagents and to repair malfunctioning equipment were generally identified as reasons which have hampered the ability of some laboratories to implement a wide range of tests. It has also resulted in the low productivity of some laboratories.

In many cases the laboratories were occupying buildings that were not built for that purpose (Table 1). On the other hand those, which were purpose built, were not constructed to handle the range of tests now required. Hence there is inadequate workbench space and workspace distribution. Based on the nature of the work there needs to be adequate safety features in the laboratories. Many of the laboratories do not have laminar flow cabinets or fume cupboards. If present there are no routine maintenance programmes for the changing of filters. Trinidad has recently refurbished

its infrastructure to better accommodate the requirements of its QA/QC programme. Although the Barbados VDSL has recently been refurbished the current facilities cannot support all the requirements for accreditation.

None of the laboratories reviewed are accredited for any of the tests they perform. Only a few, Barbados, Trinidad and Tobago and Belize have implemented QA/QC procedures taking into account guidance given in ISO/IEC 17025. The Trinidad VSL is currently developing a QA/QC programme with the Trinidad and Tobago Laboratory Accreditation Services (TTLabs) with the hope of having select tests accredited by that body. The Barbados laboratory is not accredited but is the only one enrolled in proficiency programmes. The programmes are in food microbiology, clinical microbiology, parasitology, histopathology and clinical pathology with organisation such as the Veterinary Laboratory Association (from 1998), INFAL (CFIA) (from 2002), American Proficiency Institute (from 2003) and WHO Global Salm-Surv External QA System (since 2003). The results of which have been described by the laboratory as satisfactory.

A critical component in satisfying the mandate of the OIE code is animal health legislation. Many of the countries visited had dated legislation. However, the Barbados Office of the Pan American Health Organisation (PAHO) engaged the services of a consultant in 2004 to draft parliament ready legislation for the OECS countries and Barbados. The legislation was reviewed by the competent authority in the respective country and in most cases passed to the office of the Solicitor General. To date many of the countries still do not have their legislation enacted.

There are not many routine surveillance or monitoring programmes in the countries for OIE List A and B diseases. Hence they do not know their status with respect to these diseases.

Environmental health officers under the ministries responsible for health are the ones who mainly conduct post mortem inspections at the abattoirs and slaughterhouses. Suspected cases of diseased meat are not allowed on the market but there is generally no follow up of the suspected case with laboratory tests. In addition diagnosis by veterinarians of clinical symptoms of animal diseases are not generally followed up by laboratory testing to determine if the diagnosis was correct.

Environmental health officers under the ministries responsible for health are the ones who mainly conduct post mortem inspections at the abattoirs and slaughterhouses. Suspected cases of diseased meat are not allowed on the market but there is generally no follow up of the suspected case with laboratory tests.

Weaknesses identified are:

- Lack of a comprehensive animal health system in the countries.
- Lack of coordination between ministries dealing with animal health issues, especially those relating to veterinary public health. Both the Ministries responsible for Health and Agriculture generally handle animal health issues. In many cases there are no formal memoranda of understanding to guide the officers of both Ministries and this sometimes leads to the officers performing the same tasks.

- The lack of updated legislation to guide testing requirements
- Inadequate laboratory capacity and capability including in some cases the physical plant of the laboratory

3.1.3 Demand for service

The demand for testing services is usually driven by legislative requirements, the active export of live animals and animal products or the prevalence of a disease in a country or in a bordering country. Many CARICOM countries are not major exporters of live animals or products of animal origin but do import a large variety of animal products. CARICOM, 2006 indicate that during 2000-2003 only 0.1% of the 11.8 % of all food and live animals imported into the region was attributed to live animals other than fish, crustaceans, mollusc and aquatic invertebrates. St. Vincent indicated that they engage in trade of live chickens, pigs, sheep and goats with St. Kitts and Nevis and St. Lucia. In those cases St. Vincent had visits from the chief veterinarians of the countries and certificates were issued for the shipments. Importation of meat and meat preparations and dairy products and bird's eggs during 2000-2003 was 3.0 % (CARICOM, 2006). The fact that the animal health legislation in many of the countries is dated, and that there is limited import and export of live animals in the countries as well as not very well established livestock industries may account for the limited number of routine surveillance and monitoring programmes in many of the countries. However in countries like Barbados and Trinidad and Tobago where the industries form an important part of the economy a fairly well developed testing service exist.

3.2 Plant Health

Within the past decade the Caribbean has experienced an increase in the trade of plant and plant products. There has also been an increase in the number of pleasure and cargo vessels bringing either people and/or goods to the region. With the opening up of the market, the goods are coming from many varied ports. The increased trade and traffic has also brought an increase in the movement of pests and diseases into areas where they had never before existed. The region has seen the introduction of many new pests, for example, the Pink Hibiscus Mealybug (*Maconellicocus hirsutus*), Papaya Mealybug (*Paracoccus marginatus*), West Indian Fruit Fly (*Anastrepha oblique*) and Giant African Snail (*Acatinafulica*), to name a few. Barbados alone has recorded 13 new pests within the period 1999 to 2005. Although all the pests are not found in each of the member states their presence in the region is a threat to all the countries because of the movement of people, ships and cargo between the ports of entry. The occurrence of these pests, especially ones that can infest crops within the United States, makes it more difficult for the region to export produce to that country without a proper surveillance and monitoring programme. For example Jamaica can no longer export most of their fruit to the US and neither can St. Vincent export golden apples due to the presence of the West Indian Fruit Fly (*Anastrepha oblique)* in those countries. Jamaica cannot export sweet potato to the US market due to the presence in that country of a sweet potato weevil (*Cylas formicarius*). In addition some countries implement surveillance programmes for some species in order to ensure their continued export of produce to the US and other countries. For example

Belize is currently free of the Mediterranean fruit fly and this allows them export of citrus and papaya to the US. To ensure that the market remains available they have implemented a daily countrywide surveillance programme to determine the presence of the insect. The pest has a wide host range therefore the programme is to ensure the country remains free of the pest and that if it enters measures can be put in place at an early stage to reduce its prevalence.

The IPPC generally seeks to ensure that there is common and effective action to prevent the spread and introduction of pests of plants and plant products, especially where the international transportation of plant and plant material is involved. In addition, it aims to encourage members to adopt technical and administrative measures and to enact legislation to control pest problems. In fulfilling the requirements of the Convention member countries are required to:

- know their pest status
- demonstrate that the necessary steps are being implemented to support claims of pest free status or low pest prevalence within an area of the country or the country as a whole
- undertake surveillance of growing plants, including those under cultivation and in the wild, as well as plants and plant products in storage or in transportation
- inspect consignments of plants and plant products moving in international trade and, where appropriate conduct inspections of other regulated articles, particularly with the objective of preventing the introduction and/or spread of pests.

Plant protection organisations are also charged with the protection of endangered areas and the designation, maintenance and surveillance of pest free areas and areas of low pest prevalence. A well trained staff and a well equipped and functioning laboratory can assist in the achievement of these objectives.

3.2.1 Laboratory capacity and capability

The survey conducted in the plant health area revealed that operational laboratory facilities existed at:

- Plant Protection Laboratories, Bodles Research Station, St. Catherine, Jamaica
- Plant Health Laboratory, Central Farm, Belize
- Multi-Purpose Laboratory, St. Kitts and Nevis
- Plant Protection and Quarantine Services Diagnostic Laboratory, Roseau, Dominica
- Crop Protection (Entomology, Plant Pathology, Nematology) Laboratories, Soils Laboratory, Research Division, Union, Castries, St. Lucia
- Plant Protection and Quarantine Laboratory, Campden Park, St. Vincent and the Grenadines
- Plant Protection Laboratories, Central Experimental Station, Centeno, Trinidad

- Laboratories Associated with Agricultural Health & Food Safety unit, Paramaribo, Suriname
- National Agricultural Research Unit (NARI), Guyana, and
- Entomology and Plant Pathology Laboratories, Graeme Hall, Christ Church, Barbados

However, very few of the countries have adequate laboratory infrastructure. Many of the laboratory buildings are over 20 years (Table 4) and in some cases consist of a single room that does not have adequate workbench space, or the distribution of work areas is not acceptable, for example Barbados and St. Lucia laboratories. In general the space allocated offers little or no separation for sample receipt, equipment, cleaning, media preparation, sterilisation and analysis. All are generally done in separate areas within the same room. The areas are sometimes open to general traffic, which can compromise the accuracy of results, especially if one is conducting bacteriological analyses. These arrangements are not acceptable today with requirements for the implementation of QA/QC programmes in laboratories and the requirements for laboratories to be accredited for the test they conduct. In the past plant diseases and pests diagnostic laboratories were not subject to accreditation but with the advent of international standardization of phytosanitary measures it is becoming increasingly important for these laboratories to conform to the requirements of ISO/IEC 17025.

During the study period St. Vincent and the Grenadines, Dominica, Trinidad and Tobago and Suriname were in the process of renovating their plant protection laboratories or constructing new buildings for that purpose. In doing so St. Vincent and the Grenadines, Dominica, Trinidad and Tobago have tried to incorporate QA/QC features such as double doors between some rooms and identified specific areas for sample receipt and other activities. However, a gap analysis would have to be conducted to determine their conformity to the requirements of the ISO 17025 standard. The buildings in Suriname were unavailable for a visit. The St. Vincent and the Grenadines laboratory is in need of equipment to furnish some areas of the newly constructed buildings to make the laboratory fully operational.

The Plant Protection Officer at the CARDI office in St. Kitts and Nevis offers an entomological service to the Department of Agriculture and uses facilities at the Multi-Purpose Laboratory on St. Kitts and Nevis to conduct the test. Again that discipline is allocated a single room with very little equipment. In their response to the questionnaire they just identified the availability of a microscope. No facilities exist in Antigua and Barbuda or Grenada.

The Grenada Plant Protection Unit lost the roof of the building that housed the laboratory, as well as some of their equipment during the passing of Hurricane Ivan in 2004. The roof has not since been replaced. Members of staff occupy very cramped facilities in other buildings that do not allow diagnostic or other types of analyses.

In 2003 the Antigua and Barbuda Plant Protection Office identified the need for new facilities for the Plant Protection Unit. The needs include individual requirements for pathology and entomology laboratories. In each case a single room has been identified

Table 4 Equipment found in Plant protection laboratories in selected CARICOM member states

Country	St. Vincent & Grenadines	Barbados		Trinidad & Tobago		St. Lucia		Dominica	Jamaica
		Entomol.	Pathol.	Entomol.	Pathol.	Entomol.	Pathol.		
Plant Protection Lab.	Y	Y		Y		Y		Y	Y
Entomology	Y		Y	0	Y			Y	Y
Pathology	Y		Y	0				Y	Y
Mycology			Y					Y	Y
Bacteriology			Y					Y	Y
Virology			Y			Y		Y	Y
Nematology									
Soil									
Age of building (yrs)	1	>25	>20	19	60	50+	50+	10	21
Condition of building	G	P	A	A	NI	NI	NI	G	A
Floor space (sq ft)	2 300	1 800	NG	844	NG	200	NG	NG	NG
Equipment									
ELISA Reader	0	0	1	0	0	0	0	0	1 O&P
Polymerase Chain Reaction Reader	0	0	0	0	0	0	0	0	1 O&G
Microscope									
Binocular	2	1	1	12	3 O&G 1 no	1	1 O&G	1	7
Phase Contrast	0	1	1	1	0	1	1 O&G	0	5
Stereo	0	0	1	0	0	0	0	0	0
Inverted	0	0	0	0	1	0	0	1	0
Homoginiser	0	0	0	0	0	0	0	1	1 O&P

Country	St. Vincent & Grenadines	Barbados		Trinidad & Tobago		St. Lucia		Dominica	Jamaica
		Entomol.	Pathol.	Entomol.	Pathol.	Entomol.	Pathol.		
Blender	0	0	0	0	1	0	0	1	2
Grinder	0	0	0	0	1	0	0	0	0
Autoclave	0	0	1 O&P 1 NO	0	1 O 1 NO	1	0	0	2
Incubator	1		2	1	2 O&A&P	1	1 O&G	1	4
Centrifuge									
Table Model	0	0	1 O&G	0	0	0	0	1	4
Large standing	0	0	0	0	1	0	0	0	0
pH meter	0	0	0	0	1	1	0	0	1 O&P
Laminar Flow cabinet	0	0	0	0	3	1 NO	1	1	2
Exhaust hood	0	0	0	0	1	1 NInstal	0	0	0
Fume cupboard	0	0	0	0	0	0	0	0	1
Balances									
Top loading	1	1	0	0		0	0	0	0
Analytical	0	0	1 O&G	0	1 O&A 1 NO	0	1	1	1
Electrophoresis equipment	0	0	0	0	1	0	0	0	0
Quebec colony counter	0	0	0	0	1	0	1	0	1 O&P
Spiral plating equip.	0	0	0	0	0	0	0	0	1 O&P
Oven	1	1	1	0	1	1	0	0	0
Microtome	0	0	0	0	2	0	0	0	0
Refractometer	0	0	1	0	0	0	0	0	0
Refrigerator									

Country	St. Vincent & Grenadines	Barbados		Trinidad & Tobago		St. Lucia		Dominica	Jamaica
		Entomol.	Pathol.	Entomol.	Pathol.	Entomol.	Pathol.		
Std. With freezer	0	$1^{O\&P}$	1	1	2	1	1	2	$4^{G}\ 1^{A}\ 1^{P}$
Freezer –10 °C	0	0	0	1	0	1	1	0	$1^{O\&P}$
Hot plate with agitator	0	0	1	0	1	1	1	0	$1^{G}\ 1^{A}\ 2^{P}$

but those plans should be reviewed with respect to the implementation of QA/QC procedures.

Facilities need to be upgraded in Barbados, Guyana and St. Lucia with the most likely event being the provision of new facilities. Barbados has approached the Inter American Development Bank (IADB) to assist it in developing a project for the refurbishment of the laboratories of the Ministry of Agriculture and Rural Development. The St. Lucia Department of Agriculture on the other hand has submitted to the government of St. Lucia, a proposal for the establishment of an agricultural centre of excellence at Roseau, which would see the establishment of new diagnostic and laboratory facilities.

In general countries indicated that the status of the current building infrastructure was as a result of lack of funds over the years to undertake repairs and carry out maintenance work and that there is the need for refurbishment or construction of new facilities.

3.2.2 Equipment available and tests conducted

In general the laboratories can play an important role in:

- Providing entomology and plant pathology support to plant quarantine inspection services by examining and identifying pest and diseases in plant and plant products both for import and export
- Monitoring of storage pests and the identification of nuisance pests
- Monitoring and surveillance of established and exotic pests
- Monitoring for new pests outbreaks and certification of possible pest free areas
- Providing bacteriology, entomology, mycology and nematology tests for surveillance and control of plant pests of agricultural importance
- Conducting research and technology development for pest management
- Providing pest advisory and diagnostic services to extension services and in the creation of national pest list

Not all laboratories provided information on samples processed but for those that did the numbers of sample analysed during 2003 to 2005 are presented in Table 5.

The pieces of equipment found in the laboratories of the countries that responded to the survey are listed in Table 4. Many of them only have basic pieces of equipment and in some cases these are not enough or in the best condition to adequately carry out the mandate of a Plant Protection laboratory, which is to diagnose pest and diseases.

Jamaica and Barbados have more sophisticated pieces like an ELISA reader while Jamaica, in addition, has a Polymerase Chain Reaction (PCR) reader. Jamaica has however indicated that the ELISA reader is outdated and in poor working order while the PCR reader is not in use due to lack of additional equipment and materials necessary for the conduct of analyses. Personnel in Jamaica have the necessary

Table 5 Number of samples processed annually in plant protection laboratories during 2003-2005

Country	Barbados	Trinidad & Tobago	St. Lucia	Dominica	Jamaica		
	Pathol.	Pathol.	Entomol.		Pathol.	Entomol.	Nematol.
Number of samples processed							
2003	400	400	20	130	375	85	180
2004	450	400	20	364	408	102	110
2005	450	400	15	295	480	101	110

knowledge to operate the PCR as well as there is adequate space to undertake the work.

An ELISA reader allows for a wider range of microbiological testing as well as testing for the presence of viruses. However, this piece of equipment is relatively expensive as well as the associated kits.

Barbados, Trinidad, and Tobago and Jamaica and Belize laboratories rear natural predators as part of their integrated pest management programme to combat some of the many invasive species to the area. They however noted that the facilities are inadequate and need to be upgraded and provision made for them to undertake pesticide trials. Trinidad has some facilities for pesticide work.

Belize has the following surveillance programmes in place but inadequate human resources hampers the work to be done:

- Mediterranean fruit fly – daily surveillance country- wide and servicing of traps set. Officers are trained to identify the insect and if any are found they are brought to the laboratory to determine if sterile male or female which has mated.
- Pink Hibiscus Mealy bug – monthly surveillance to each district and also check susceptible plants to determine level of infestation. This insect is currently under control in Belize. Through FAO assistance they were able to establish a laboratory to reproduce the wasp.
- Lethal yellowing in coconut trees. No laboratory capacity to identify the disease exists in Belize. Samples for analysis are contracted out. However, hope to alleviate the disease by growing more resistant varieties of coconut.
- Thrips palmi – Not a routine surveillance. A programme was scheduled for 2006 but unsure if it was conducted.
- Monilla – survey in organically grown cocoa. Cocoa is grown for export to UK for use in chocolate industry. Although the pest has been found it two areas export still continues since pods and seeds are fermented before produce is exported.
- Suspected soya bean rust – through farmers sensitisation programme and agronomic practice pest infestation was reduced. Farmers send suspected samples to laboratory for identification.

NARI in Guyana provides soil (nutrient) analysis, entomology and plant pathology services to the Guyana Ministry of Agriculture. Quarantine officers of the Ministry submit samples to NARI for analysis, the results of which are interpreted by Ministry staff who then issue the relevant certificate or permit. NARI also assist the Ministry staff, farmers and researchers in the diagnosis of plant diseases.

A tissue culture laboratory is also present at NARI and produces “clean” plantain and pineapple planting material. There are also plans for the provision of disease free sweet potato material. However, the laboratories at NARI were affected by the 2005 floodwaters in Guyana and are now under refurbishment and reorganisation.

Tissue culture laboratory facilities are also present in Barbados and provide service to the plant quarantine department and plant protection.

3.2.3 Human resources

In the OECS and Barbados there is usually one or two officers trained at the Masters level in some area of plant protection (Table 6) while in Jamaica and Trinidad and Tobago there are a few others with persons also trained to the level of Doctor of Philosophy. They are generally supported by tertiary institution graduates in the general area of agriculture and/or secondary high school graduates with no training in agriculture. These are the persons who are generally engaged in the surveillance programmes. There therefore needs to be continuous training of these officers to ensure that adequate competence exist in the monitoring and surveillance of pests and diseases.

With the relatively large influx of invasive species to the region and the limited skills of the support staff the few graduate officers in a country spend many hours in the field and have little time left to spend in the laboratory. In addition they are generally the Head of the unit and are also engaged in administrative matters and are required to juggle that responsibility with field and laboratory work. There therefore needs to be well-trained support laboratory personnel to do the required preparative work necessary for the identification of pests and diseases.

They are very few persons trained in the region specifically in entomology, especially in the area of taxonomy and insect identification, plant pathology, virology, nematology and/or mycology. In general the trained plant protection officers are "generalists", that is , they are trained in either plant protection with a focus either on entomology or plant pathology or in general plant pathology or entomology but not specialising in any specific area of the discipline. The individuals would have taken either a one year Master of Science course in plant protection, including the preparation of a thesis or a three year Masters or Doctor of Philosophy in the area of botany or zoology. In Jamaica there are two persons with additional training, one in the field of mite identification and the other in scale and mealy bug identification. Surinam has an officer that is working specifically in the carambola fruit fly programme where identification of the pests is part of the programme. Belize, Antigua, St. Lucia, Barbados and Grenada have an officer/s on staff trained in the area of plant pathology. Barbados, Jamaica, Grenada and Trinidad and Tobago have persons trained in entomology and plant pathology on staff. However in St. Kitts and Nevis, Belize and Antigua and Barbuda, the Caribbean Agricultural Research and Development Institute (CARDI) has officers stationed in those islands that provide general entomology services. Dominica, in addition uses the services of a resident entomologist and a pathologist when the need arises. With the emergence of the myriad of new pests there is the need for a cadre of skilled persons in the areas of insect and disease identification as well as in laboratory techniques.

Table 6 Human Resources of plant protection laboratories in selected CARICOM member states

Country	**St. Vincent &Grenadines**	**Barbados**	**Trinidad & Tobago**	**St. Lucia**	**Dominica**	**Jamaica**			
		Entomol.	**Patholy.**	**Entomol.**	**Pathol.**	**Entomol.**	**Pathol.**		
University Graduate: PhD MSc BSc	 0 1 1	 1 2 0	 0 2 0	 1 2 0	 1 2 4	 0 1 0	 0 1 0	 0 0 2	 1 4 3
Tertiary Institution Graduate	0	4	1	1	2	1	0	1	4
Secondary (High) School Graduate with > 3 years experience	0	8	0	0	2	0	1	2	0
Secondary (High) School Graduate with < 3 years experience	0	1	1	0	1	0	0		1
Administration Non-Technical	0	2			1	0	0		2
Service (e.g. cleaners)	0	1	1	2	1	1	1	1	1
Total Personnel	**2**	**19**	**5**	**6**	**14**	**3**	**3**	**3**	**16**

3.2.4 Trading requirements

There is some intra and extra regional export of agricultural produce. Main products traded between the islands include ground provisions (yam, dasheen, sweet potato) from St. Vincent, Dominica and Jamaica to other island like Barbados, Trinidad and Tobago, St. Kitts and Nevis and Antigua and Barbuda. In addition vegetables such as tomatoes, pumpkins, hot peppers are shipped from Trinidad to Barbados and Antigua and Barbuda. Fruits such as banana, pineapple, watermelon, papaya, oranges and tangelo are shipped from Jamaica, Belize, Dominica and Trinidad and Tobago. Guyana exports a wide variety of vegetables and rice to many of the islands. However, volumes of these commodities are also shipped to the US, UK, Canada and other extra regional ports.

Barbados has established an agricultural trade protocol with Trinidad and Tobago, St. Vincent and the Grenadines, Antigua and Barbuda, Dominica and Guyana. Under the agreement shipment of agricultural produce to Barbados must originate from approved pack houses and registered farms that operate within pest free areas of the country. Exportation of produce from Trinidad must be to importers in Barbados who are registered with the Ministry of Agriculture and Rural Development. Both the importer and exporter are required to adhere to the conditions set out in the protocol. The Ministry of Agriculture, Lands and Marine Resources (MALMR) and the National Agricultural Marketing and Development Corporation (NAMDEVCO) oversee the process in Trinidad. One of the conditions in the agreement is that pesticides used to control pests must be restricted to those not banned for use in Barbados by the local Pesticides Control Board. Farmers are required to maintain records of all pesticides used on the crops grown. Copies of the records of pesticide use must be submitted to the exporter and NAMDEVCO. The protocol also stipulates that samples of produce destined to Barbados be analysed by Chemistry Food and Drug, Trinidad for pesticide residues, and that similar testing be conducted periodically in Barbados. However, this testing is not enforced. Antigua has also established similar trading protocols with some of the other islands.

3.3 Food Safety

Food safety is affected by:

- misuse of agricultural chemicals such as pesticides and fertilisers
- the presence of residues of drugs administered to animals
- safety of colours and the unauthorised use of various types of additives added to the food supply
- environmental pollution in the form of industrial chemicals such as polychlorinated bi-phenols (PCBs) and toxic heavy metals
- chemical contaminants such as mycotoxins
- biological contaminants in the form of food borne pathogens, and
- inadequate quality control measures

More recently concerns have been expressed with respect to the use of new technology such as the irradiation of food and the use of biotechnology in food production.

An effective food control system assures consumers about the safety and quality of the food supply and promotes the facilitation of both regional and extra regional trade. The implementation of a food control system allows better international market access, which would result in greater foreign exchange earnings and the avoidance of dumping of inferior quality products.

A food control infrastructure includes food laws and the accompanying regulations, a food inspectorate, analytical services and a complaints unit and support services. It is imperative that the legal framework of the food control system is updated where necessary. This is to ensure that it reflects as much as possible the current trading requirements and to show government's commitment to providing food that is safe and of good quality.

The analytical laboratory's function is to test and examine products to guarantee that the products are in compliance with the mandatory requirements of law and regulations. In addition, the laboratory's role is to facilitate test to ensure that food standards, established quality and safety limits for chemical and biological contaminants, packaging requirements and other factors are met. To guarantee ready acceptance of the laboratory's results a QA/QC programme should be implemented and if necessary the laboratory seek accreditation for the tests they conduct. To achieve these objectives the laboratory must be provided with the appropriate staff complement and financial resources to purchase consumables and equipment.

In today's trading environment it is not necessary for all shipments of imported products to be tested on arrival for quality and safety before release but rather that the importing country should have a certain level of confidence in the food safety systems of the exporting country. Hence the emphasis is not placed solely on laboratory analysis of finished product but rather on the processes along the production chain, from the "farm to the table" or "farm to fork".

An analysis of the food control system in the member countries show that the food laws are antiquated and need revising. The Pan American Health Organisation used the services of a consultant to prepare Parliament ready Food Safety legislation for the member countries of the OECS and Barbados. The drafted legislation has been passed on, in most countries, to the Solicitor General's office but to date the laws have not been amended. This has an impact on the ability of the country to enforce testing of food before new products are placed on the market or to ensure that adequate food safety systems are in place that will legally require monitoring and surveillance programmes and hence give importing countries the confidence to accept products from those markets.

3.3.1 Trade flows and demand for testing

The countries of CARICOM are net importers of food with imports obtained from within and outside the Caribbean region. Total imports of agricultural commodities for the period 2000 – 2003 accounted for 15% of imports of all commodities from all sources (CARICOM, 2006). Food and live animals accounted for 11.8% of which the main imported product was cereals and cereal preparations followed by vegetables and fruit, dairy products and birds eggs and meat and meat preparations as seen in Table 7.

Belize has a vibrant fishing industry and exports conch, saltwater fish and seawater aquaculture products such as shrimp, tilapia and lobster. The shrimp is exported to the US, EU, Mexico and CARICOM countries. Recently Mexico has become a major market for the shrimp because of the low overheads associated with shipping to that country. For the Mexico market very little processing is undertaken in Belize.

For Belize to export shrimp to the EU they must conduct antibiotic drug residue testing on the fish tissue, test for microbiological indicator organisms and trace metals. There must also be analysis of the processing and other waters. Limited testing occurs for trace metals due to the lack of a fully functional atomic absorption spectrophotometer (AA). Tests are limited to microbiological determinations for shipment of fish to the US and Mexico. No testing occurs of fish exported to the US market from Barbados.

Table 7 Import quantities of selected agricultural commodities into CARICOM, 2000-2003

	% imports per Year			
	2000	2001	2002	2003
Total imports of all commodities from all sources	100	100	100	100
Total imports of agricultural commodities from all sources	15.2	15.5	15.6	15.0
Food & live animals	12.1	12.4	12.2	11.8
Cereals & cereal preparations	2.4	2.7	2.5	2.5
Vegetables & fruit	1.9	1.9	1.9	1.8
Dairy products & bird's eggs	1.7	1.9	1.7	1.6
Miscellaneous edible products & preparations	1.5	1.5	1.6	1.6
Meat and Meat preparations	1.7	1.5	1.4	1.4
Fish (not marine mammals), crustaceans, mollusc & aquatic invertebrates, and preparations thereof	0.9	0.9	1.0	0.9
Feeding stuff for animals (not including unmilled cereals)	0.7	0.7	0.7	0.7

Note: 2001-2003 excludes data for Antigua & Barbuda
Adapted from CARICOM 2006

Some of the OECS countries previously exported fish to EU markets in Martinique and Guadeloupe but with the advent of the hazard analysis critical control points (HACCP) concept and the implementation of the harmonisation of the European Community fish inspection regulations many of them have lost the market. The availability of adequate testing facilities would assist in the recapturing of that market. The Grenada Produce Chemist laboratory has a relatively modern HPLC that could be used in the determination of histamines in fish. However, it is not in use due to lack of trained personnel.

Fish to the EU from Suriname must be analysed for trace metals. Suriname used a mercury analyser for this determination but it is my understanding that this method is not acceptable to the EU. The EU require that the analysis to be conducted using an AAS with a cold vapour system, an instrument currently not available in Suriname. Forty to fifty samples are therefore shipped to Belgium twice/year for analysis, an expensive exercise. However, Surinam would prefer to have samples analysed regionally and want to develop collaborative relationships with labs in the region. They have tried shipment of samples to CEHI in St. Lucia but abandoned that option since they were no direct flights to St. Lucia and the samples deteriorated on shipping. The airlift of samples from Suriname and maintenance of the integrity of the samples seems to be a problem since they are limited direct flights to CARICOM member countries.

Pesticide residue analysis is required on vegetables exported from Trinidad and Tobago to Barbados. However, NAMDEVCO has indicated that this is not done due to the lack of adequate capability. Some capability exists at the Chemistry Food and Drug laboratory, Trinidad and CARIRI's laboratory but it is not consistent and fully developed. CARIRI is currently developing a programme with the Pesticide Initiative Programme (PIP), a "Quality & Conformity Fruit & Vegetables" initiative, set up and funded by the EU and implemented by the Comité de Liaison Europe-Afrique-Caraïbes-Pacifique, that is, Europe-Africa-Caribbean-Pacific Liaison Committee (COLEACP) at the request of ACP countries. The aim of the initiative is to ensure that ACP fruit and vegetable exports comply with EU sanitary quality and traceability standards. The EU-funded programme will seek to make CARIRI a regional centre of excellence re pesticide residue analysis. However CARIRI is a private company and will demand a cost for the service, a service in other areas that is described by some clients as expensive. All the countries would like to have produce, both imported and exported, tested for pesticide residues.

Antibiotic drug residue in meat, poultry and dairy products is of concern to the member countries. There are currently no legislation regarding the registration and use of antibiotic drug residues in any of the member countries the pest has a wide host range. There is therefore concern with respect to the indiscriminate use of these chemicals by farmers. Milk products, for example ice cream, destined for the EU market must have the products tested for these compounds.

Since many of the food laws are not enacted there is no onus on persons to have imported food or food produced at the national levels tested before being placed on the market. Hence there is no great demand on national laboratories. There are also very few routine monitoring programmes for food conducted by the Ministries of Health. For laboratories to function efficiently and to maximize on the purchase and maintenance of expensive pieces of equipment there is the need for continuous analysis. In many cases the sample numbers passing through the laboratories are small and the expensive pieces of equipment are not fully utilised. This could be addressed if there was the legal requirement for testing.

3.3.2 Laboratory capacity and capability

Tables 8 and 9 present the human resources and analytical equipment present at government laboratories in selected member countries. These laboratories are those currently engaged in, or capable of, undertaking the analysis of food. They include analytical, produce chemist and multipurpose laboratories and are found either in the ministries responsible for agriculture, trade or health. In addition Tables 10 and 11 present the human resources and analytical capability of some private sector laboratories in some of the member countries.

3.3.2.1 Analytical instrumentation

A wide range of analytical equipment resides in the laboratories in the region, Tables 8 and 11. These include but are not limited to Gas Chromatographs (GC) with various detectors Flame Ionisation (FID), Electron Capture (ECD), Nitrogen

Phosphorus (NPD), and Flame Photometric (FPD) as well as the Mass Selective Detector (MSD). However, it depends on the detector and column installed in both the GC and HPLC that will determine which individual pesticide or veterinary drug residue or other constituents can be determined. For example, the NPD is selective for nitrogen and phosphorus containing compounds while the FPD is selective for phosphorus and sulphur containing compounds. Sensitivity of the detector to the compounds will also be determined by the position of the representative atom in the pesticide compound under investigation. GCs fitted with the ECD, NPD or FPD detectors have traditionally been used in the determination of organo-chlorinated and organo-phosphorus pesticides while the HPLC with multiple wavelength or Diode-array detectors and more recently fluorescent detectors have been used in the determination of carbamate and pyrethroid pesticides. All these detectors are present in the region albeit at only a few laboratories, Tables 9 and 11. However, pesticide manufacturing has been moving away from these types of compounds and it will therefore be necessary to determine what pesticides are currently used in the region and if the instruments present are applicable to their determination. GC/MS is the ultimate chromatographic confirmatory tool and would probably still be employed for newer pesticide compounds. Present also at some laboratories are High Performance Liquid Chromatographs (HPLC) fitted with multiple wavelengths, fluorescent, refractive index and diode array detectors as well as the MSD. These instruments can be used for determination of pesticide residues and/or veterinary drug residues and other constituents in food namely vitamins and sugars to name a few. HPLC/MS and HPLC/MS/MS have been gaining prominence in pesticide, veterinary drug residue and other determinations. HPLC/MS is found at both the CARIRI laboratory and the Bureau of Standards, Jamaica. The Jamaica Bureau of Standards laboratory has not returned a completed questionnaire. The HPLC at the CEHI laboratory is also fitted with a post column derivitization machine.

Table 8 Human Resources at Government laboratories engaged in food safety determinations/food analysis

Country	Barbados GAS	Barbados Veterinary Services	Grenada Produce Chemist	St. Lucia Analytical Lab.	St. Vincent & Grenadines Bureau of Standard	Dominica Produce Chemist & Water Quality Lab	Antigua Analytical lab.	St. Kitts & Nevis Multipurpose Lab.	Guyana IAST Analytical Services Lab.	Guyana Food & Drug	Trinidad & Tobago Food & Drug	Belize MOH Water Lab.	Belize Central Investigation Lab.	Jamaica Food Storage Lab.
University Graduate:														
PhD.	2	0	1	0	0	0	1	1	1	0	1	0	0	1
MSc.	4	2	1	0	1	1	0	0	1	1	3	0	0	4
BSc.	10	2	2	2	0	0	2	1	4	6	9	0	1	5
DVM	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Tertiary Institution Graduate	1	2	1	0	2	1	1	0	6	17 [AD]	00	1	3	2
Secondary (High) School Graduate with > 3 years experience	3	1	1	0	0	0	0	2	2	6	29	0	0	1
Secondary (High) School Graduate with < 3 years experience	0	0	0	0	0	0	0	1	0	1	4	0	0	0
Administration (Non-Technical)	8	0	1	0	0	0	2	1	12	4	10	0	1	0
Service (e.g. Cleaners)	2	2	1	1	0	1	2	3	4	3	15	0	1	2
Total Personnel	**32**	**10**	**8**	**3**	**3**	**3**	**8**	**11**	**30**	**29**	**71**	**1**	**6**	**15**

Note:

AD	Associate Degree	Lab.	Laboratory
GAS	Government Analytical Services	MOH	Ministry of Health

Table 9 Equipment type and numbers present in Government Analytical laboratories in selected CARICOM member countries

Description	**Barbados GAS**	**Barbados Veterinary Services**	**Grenada Produce Chemist**	**St. Lucia Analytical Lab.**	**St. Vincent & Grenadines Bureau of Standard**	**Dominica Produce Chemist. & Water Quality.**	**Antigua Analytical lab.**	**St. Kitts & Nevis Multipurpose lab.**	**Guyana IAST Analytical Services Lab.**	**Guyana Food & Drug**	**Trinidad Food & Drug**	**Belize MOH Water Lab**	**Belize Central Investigation Lab.**	**Jamaica Food Storage**
Age of building (yrs)	26	36	15	50+	20+	36	20	7	27	50	134	25+	20+	45
Condition of building	G	NI	NI	P	G	NI	NI	NI	A	NI	A	NI	G	A
Built for Lab	Y	N	Y	N	N	Y	Y	Y	Y	N	Y	N	N refur.	N
Floor space (sq ft)	13 744	3 000	-	-	-	3 000	3 500	2 840	5 886	13 625	-	-	1 200	1 917
Equipment														
Liquid Chromatograph	1	0	1	0	0	0	0	0	0	2	1	0	1	1
Multiple Wavelength Detector	[	x	[	x	x	x	x	x	x	[	[	x	x	x
Fluorescent Detector	[	x	[	x	x	x	x	x	x	[	x	x	[	[
Refractive Index (RI) Detector	[	x	x	x	v	x	x	x	x	[	[	x	x	x
Autosampler	[	x	x	x	x	x	x	x	x	[	[	x	[	[
Chemstation	[	x	[	x	x	x	x	x	x	[	[	x	[	[
Post column dervitization apparatus	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Integrator	x		x	x	x	x	x	x	x	1	[	x	x	x
Gas Chromatograph	2	0	1	0	0	0	1^{NO}	1^{NO}	1^{NO}	2	2	0	2	1
Flame Ionization Detector (FID)	[	x	[	x	x	x	[	x	x	[	[	x	x	x

Description	**Barbados GAS**	**Barbados Veterinary Services**	**Grenada Produce Chemist**	**St. Lucia Analytical Lab.**	**St. Vincent & Grenadines Bureau of Standard**	**Dominica Produce Chemist. & Water Quality.**	**Antigua Analytical lab.**	**St. Kitts & Nevis Multipurpose lab.**	**Guyana IAST Analytical Services Lab.**	**Guyana Food & Drug**	**Trinidad Food & Drug**	**Belize MOH Water Lab**	**Belize Central Investigation Lab.**	**Jamaica Food Storage**
Electron Capture Detector (ECD)	[	x	x	x	x	x	[	x	x	[	[	x	[[[	[
Nitrogen Phosphorous Detector (NPD)	[	x	x	x	x	x	x	x	x	[	[	x	x	[
Flame Photometric Detector (FPD) Phosphorous/Sulphur Mode	[	x	x	x	x	x	x	x	x	x	[	x	[	x
Auto sampler	[	x	x	x	x	x	x	x	x	x	[	x	x	[P
Chemstation	[	x	x	x	x	x	x	x	x	x	[	x	x	[
GC/Mass Selective Detector (MSD)	1	0	0	0	0	0	0	0	0	0	1P	0	0	0
Auto sampler	[	x	x	x	x	x	x	x	x	x	[	x	x	x
Chemstation	[	x	x	x	x	x	x	x	x	x	[	x	x	x
Integrator	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Ion chromatograph Manual/Automated	1	0	0	1NO	0	0	0	0	0	0	x	x	x	x
GC/MS/MS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Atomic Absorption Spectrophotometer	2	0	0	1	0	1	1 NO	1	1	1	1	1	0	0
Flame	[	x	x	[	x	[	[	[	[	[	[	[	x	x
Graphite Furnace	[	x	x	x	x	x	x	x	x	[	[	x	x	x
Cold Vapour	x	x	x	x	x	x	x	x	x	x	[	x	x	x
Manual/**A**utomated	AD	x	x	M	x	M	M	M	M	M	AD	M	x	x
Inductively Coupled Plasma (ICP)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICP/MS	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Description	**Barbados GAS**	**Barbados Veterinary Services**	**Grenada Produce Chemist**	**St. Lucia Analytical Lab.**	**St. Vincent & Grenadines Bureau of Standard**	**Dominica Produce Chemist. & Water Quality.**	**Antigua Analytical lab.**	**St. Kitts & Nevis Multipurpose lab.**	**Guyana IAST Analytical Services Lab.**	**Guyana Food & Drug**	**Trinidad Food & Drug**	**Belize MOH Water Lab**	**Belize Central Investigation Lab.**	**Jamaica Food Storage**
Ultraviolet (visible) Spectrophotometer	1	0	0	0	0	0	1 [A]	0	0	2	5	1	0	1
Spectronic 20/21 or Hach Spec.	0	0	1	2 [NO]	2	1		2	2	0	0	0	0	0
InfraRed Spectrophotometer	0	0	0	0	0	1	1 [NO]	0	0	1	1 [P]	0	0	0
InfraRed/Fourian Transform IR (IR/FTIR) Spectrophotometer	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Autoanalyser	1	0	0	0	0	0	0	1	0	0	0	0	0	0
Flame Photometer	1	0	0	0	0	1 [NO]	1	0	0	0	1	0	0	0
Flurometer	0	0	0	0	0	0	0	1	0	1	0	0	0	0
Photocolorimeter	0	0	0	0	0	0	0	0	0	0	1	0	0	0
ELISA Reader	0	1	0	0	0	0	0	0	0	0	0	0		0
Charm Analyser	0	1	0	0	0	0	0	0	0	0	0	0	1	0
Polymerase Chain Reaction (PCR) Reader	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Microscope														
Binocular	4	5	2	0	0	1	1 [O&P]	1	4	0	1	2	0	3
Dark Field	0	0	0	0	0	0	0	0	0	0	[		0	0
Electronic	0	1	1 [O&P]	0	1	0	0	0	0	0	[		0	0
Phase Contrast	0	0	0	0	0	0	0	0	0	0	1		3	0
Stomacher	1	2	0	0	1	0	0	2	0	1	1	0	0	1
Homogeniser	1	0	0	0	0	0	0	0	1 [NO]	1	0	0	0	0
Blender	3	1	2	0	1	1	1	1	2	6	4	0	4 [P]	8
Chopper	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Grinder	1	0	1	0	0	0	0	1 [P]	0	0	0	0	0	0
Mill	1	0	1	0	0	1	0	1	0	0	1	0	1	2
Autoclave	3	2	2	0	1	1	2	2	1 [G], 1 [NO]	3	1	1	2	2

Description	**Barbados GAS**	**Barbados Veterinary Services**	**Grenada Produce Chemist**	**St. Lucia Analytical Lab.**	**St. Vincent & Grenadines Bureau of Standard**	**Dominica Produce Chemist. & Water Quality.**	**Antigua Analytical lab.**	**St. Kitts & Nevis Multipurpose lab.**	**Guyana IAST Analytical Services Lab.**	**Guyana Food & Drug**	**Trinidad Food & Drug**	**Belize MOH Water Lab**	**Belize Central Investigation Lab.**	**Jamaica Food Storage**
Incubator	6	5	2^{OG} 1^{NO}	1	2	2	2	4	3	7	4	2	0	2^{G} 2^{P}
Centrifuge														
Table Model	1	2	2	0	2	1	0	1^{G}, 1^{P}	2	1	3		3	2
Large Standing Model	1	0	0	0	0	0	0	0	1	1	0		0	0
Refrigerated	x	0	0	0	0	0	0	0	0	0	0		0	0
Ultra	x	1	0	0	0	0	0	0	0	0	0		0	0
pH meter														
Manual	5	1	1	1	0	NO	0	0	0	4	0	0	1	
Digital	0	0	2	0	2	0	2	4	1	0	2	1	0	2
Laminar Flow Cabinet	0	2	1	0	1	1	2	1	0	2	2		1	1
Fume Cupboard	4	2	1	2^{NO}	0	2	2	3	5^{G},1^{NO}	3	4		1	4
Analytical Balances	8	2	$6^{G}1^{P}$	3	2	2	1	6	3	7	5	1	2	3
Fat Extraction Unit	1	0	0	0	0	4	1	1^{NO}	1	1	2		1	
Kjeldahl Unit	2	0	1^{NO}	1^{NO}	1	1^{OP}	1	0	1	2	1		1	
Electrophoresis Equipment	0	0	0	0	0	0	0	0	0	0	0			
Karl Fisher Moisture Analyzer														
Manual	0	0	0	0	0	0	0	0	1	0	0		1	0
Digital	0	0	0	0	0	0	0	0	0	2	0		0	4
Crude Fibre Apparatus	0	0	0	0	0	0	0	0	1	1	0		1	
Distillation Apparatus	1	0	2	0	0	1	0	0	5	0	0			
Quebec Colony Counter	4	0	2	0	1	A	1	1^{NO}	0	1	0	1	2	1
Spiral Plating Equipment	0	0	0	0	0	0	0	0	0	0	0			
Oven	8	1	3	0	1	3	2	2	2	8	2	1	2	5
Muffle Furnace	1	0	1	0	1	1	2	1	1	2	1		1	0
Refractometer	0	1	5	0	2	6	1	4	1^{NO}	0	1		1	3

Description	Barbados GAS	Barbados Veterinary Services	Grenada Produce Chemist	St. Lucia Analytical Lab.	St. Vincent & Grenadines Bureau of Standard	Dominica Produce Chemist. & Water Quality.	Antigua Analytical lab.	St. Kitts & Nevis Multipurpose lab.	Guyana IAST Analytical Services Lab.	Guyana Food & Drug	Trinidad Food & Drug	Belize MOH Water Lab	Belize Central Investigation Lab.	Jamaica Food Storage
Microtome	0	2	0	0	0	0	0	0	0	0	0			
Tissue Stainer	0	1	0	0	0	0	0	0	0	0	0			
Histoembedder	0	1	0	0	0	0	0	0	0	0	0			
Refrigerator														
Standard with freezer compartment	7	5	3	2	1	1	1,3[NO]	1	2	6	5	2	4	4
Industrial	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Scientific	0	0	0	0	0	0	2	2	0	2	0	0	0	0
Freezers														
-10°C	1	0	1	0	0	1[NO]	0	0	0	0	4	0		0
<-10°C	0	2	0	0	0	0	0	1[NO]	1	1	0	0		0
Hotplates														
With agitators	7	4	2	1	3	3	1	4	2	6	6	1	4	2
Without agitators	0	0	0	0	0	0	0	0	3	0	0	0	0	0
Incinerator	0	1	1	0	0	0	0	0	0	0	0	0	1	0
Ovoscope	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Microtitre	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refractometer	1	0	0	0	0	6	0	4	0	0	0	0	1	0
Titremeter	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Conductivity meter	1	0	1	0	1	0	1	2	1	2	4	1	1	0
Turbidity meter	1	0	1	0	0	A	0	1	1	1	0	1	1	0

Description	Barbados GAS	Barbados Veterinary Services	Grenada Produce Chemist	St. Lucia Analytical Lab.	St. Vincent & Grenadines Bureau of Standard	Dominica Produce Chemist. & Water Quality.	Antigua Analytical lab.	St. Kitts & Nevis Multipurpose lab.	Guyana IAST Analytical Services Lab.	Guyana Food & Drug	Trinidad Food & Drug	Belize MOH Water Lab	Belize Central Investigation Lab.	Jamaica Food Storage
Other														
Water bath	4	0	0	0	0	0	0	0	0	0	7	0	0	0
Shaker	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Food Processor	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Top Loading Balance	0	0	0	0	0	0	0	0	0	0	5	0	0	0
Moisture Balance	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Electronic balance	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Vacuum pump	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Heating mantles	0	0	0	0	0	0	0	0	0	0	0	0	0	6
UV cabinets	0	0	0	0	0	0	0	0	0	0	0	0	0	2

Note:

A	Average	M	Manual	NO	Not in Operation	x	Feature not present
AD	Automated	N	No	Y	Yes	[	Feature present
G	Good	NI	Needs Improving	P	Operating Poorly		

Table 10 Human resources in private sector laboratories engaged in food safety determinations/food analysis

Country	Grenada Nutmeg	St. Lucia CEHI	Dominica Water & Sewerage Lab.	Guyana Guysuco	Trinidad CARIRI	Jamaica UWI, Mona
University Graduate:						
PhD.	0	0	0	2	1	2
MSc.	1	1	0	2	17	1
BSc.	0	2	0	2	36	4
DVM	0	0	0	0	0	0
Tertiary Institution Graduate	0	0	3	3	13	0
Secondary (High) School Graduate with > 3 years experience	1	1	0	10	0	0
Secondary (High) School Graduate with < 3 years experience	0	0	0	3	0	0
Administration (Non-Technical)	0	0	0	3	35	0
Service (e.g. Cleaners)	1	0	0	4	6	0
Total Personnel	**3**	**4**	**3**	**29**	**126**	**7**

Table 11 Equipment number and type found in Private Sector laboratories engaged in food safety determinations/food analysis

Description	Grenada Nutmeg	St. Lucia CEHI	Dominica Water & Sewerage Lab.	Guyana Guysuco	Trinidad CARIRI	Jamaica UWI, Mona
Age of building (yrs)	17	14	5	8	35	36
Condition of building	G	A	A	G	G	G
Built for Lab	N	Y	Y	Y	Y	Y
Floor space (sq ft)	-	2 744	-	-	9 543	2 000
Equipment						
Liquid Chromatograph	0	1	0	1	2	1
Multiple Wavelength Detector	0x	[	x	[	[	[

Description	**Grenada Nutmeg**	**St. Lucia CEHI**	**Dominica Water & Sewerage Lab.**	**Guyana Guysuco**	**Trinidad CARIRI**	**Jamaica UWI, Mona**
Fluorescent Detector	x	[	x	X	[[	[
Refractive Index (RI) Detector	x	x	x	[	[[	x
Autosampler	x	[	x	x	[	x
Chemstation	x	[	x	x	[[	[
Post column dervitization apparatus	x	[	x	x	x	x
Integrator	x	x	x	1	[	X
Gas Chromatograph	1	1	0	0	2	3
Flame Ionization Detector (FID)	[	x	x	x	[[	[
Electron Capture Detector (ECD)	x	[	x	x	[[	[
Nitrogen Phosphorous Detector (NPD)	x	x	x	x	x	[
Flame Photometric Detector (FPD) Phosphorous/Sulphur Mode	x	[	x	x	[	x
Integrator	[	x	x	x	x	x
GC/Mass Selective Detector (MSD)	0	0	0	0	1	1
Auto sampler	x	x	x	x	[	[
Chemstation	x	x	x	x	[	[
LC/Mass Selective Detector (MSD)	0	0	0	0	1	0
Auto sampler	x	x	x	x	[	X
Chemstation	x	x	x	x	[	X
Integrator	x	x	x	x	x	x
Ion chromatograph Manual/Automated	0	0	0	0	1	0
GC/MS/MS		0	0	0	0	1
Atomic Absorption Spectrophotometer Flame Graphite Furnace Vapour generation access. for Hg,As,Se **M**anual/**A**utomated	0 x x x x	1 [[x M	0 x x x x	2 [x x M&AD	3 [[[[AD	2 [[x M
Inductively Coupled Plasma (ICP)	0	0	0	0	0	0
ICP/MS	0	0	0	0	0	0
Ultraviolet (visible) Spectrophotometer	0	1	0	3	2	2
Spectronic 20/21	0	0	0	0	0	0
InfraRed/Fourian Transform IR (IR/FTIR) Spectrophotometer	0	0	0	0	0	2
Autoanalyser	0	0	0	0	0	0
Flame Photometer	0	0	0	1	0	1
Flurometer	0	0	0	0	0	1
Photocolorimeter	0	0	0	0	0	0
ELISA Reader	0	0	0	0	0	0
Charm Analyser	0	0	0	0	0	0
Polymerase Chain Reaction (PCR) Reader	0	0	0	0	0	0

Description	**Grenada Nutmeg**	**St. Lucia CEHI**	**Dominica Water & Sewerage Lab.**	**Guyana Guysuco**	**Trinidad CARIRI**	**Jamaica UWI, Mona**
Microscope						
Binocular	1	1	1	1	2	0
Electronic	0	0	0	0	0	0
Phase Contrast	0	0	0	0	1	0
Stomacher	1	0	0	0	2	0
Homogeniser	0	0	0	0	1	1
Blender	1	1	0	3	0	1
Chopper	0	0	0	0	0	1
Grinder	0	0	0	2	0	0
Mill	1	0	0	3	0	1
Autoclave	1	2	0	4	2	1
Incubator	2	4	4	4	7	0
Centrifuge						
Table Model	0	1	0	2	0	1
Large Standing Model	0	0	0	1	0	0
Refrigerated	0	0	0	2^{NO}	0	0
Ultra	0	0	0	1	0	0
pH meter						
Manual	0	0	0	0	1	0
Digital	1	1	2	4	2	2
Laminar Flow Cabinet	1	0	0	2	0	0
Fume Cupboard	1	1	0	6	6	3
Analytical Balances	1	1	2	3	4	1
Fat Extraction Unit	1	1	0	9	1	0
Kjeldahl Unit	0	0	0	4	3	0
Electrophoresis Equipment	0	0	0	0	0	0
Karl Fisher Moisture Analyzer						
Manual	0	0	0	0	0	0
Digital	1	0	0	0	0	0
Crude Fibre Apparatus	0	0	0	6	1	0
Distillation Apparatus	1	1	0	4	1	0
Quebec Colony Counter	0	1	0	1	0	0
Spiral Plating Equipment	0	0	0	0	0	0
Oven	1	2	2	5	4	1
Muffle Furnace	1	0	1	2	1	1
Refractometer	1	0	0	2	1	0
Microtome	0	0	0	0	0	0
Tissue Stainer	0	0	0	0	0	0
Histoembedder	0	0	0	0	0	0
Refrigerator						
Standard with freezer compartment	4	3	1	3	8	2
Industrial	0	0	0	0	0	0
Scientific	0	0	0	0	0	0
Freezers						
$-10^{o}C$	0	1	0	1	0	1
$<-10^{o}C$	0	0	0	0	0	0
Hotplates						
With agitators	1	2	1	5	10+	4
Without agitators	0	0	0	0	0	0
Incinerator	0	0	0	0	0	0

Description	Grenada Nutmeg	St. Lucia CEHI	Dominica Water & Sewerage Lab.	Guyana Guysuco	Trinidad CARIRI	Jamaica UWI, Mona
Ovoscope	0	0	0	0	0	0
Microtitre	0	0	0	0	0	0
Refractometer	0	0	0	0	0	0
Titremeter	0	0	0	1	0	0
Conductivity meter	1	1	1	3	1	1
Turbidity meter	0	1	1	1	1	0
Other						
Water bath	0	0	6	0	0	0
Shaker	0	0	0	0	0	0
Dissolved Oxygen Meter (portable)	0	0	0	0	1	0

Note:

A	Average	M	Manual	Y	Yes
AD	Automated	N	No	[	Feature present
G	Good	NO	Not in Operation	x	Feature not present

Atomic Absorption Spectrophotometers (AAS) with Flame, Graphite furnace, cold vapour or hydride systems are also available for trace metal determinations. The AAS flame is used for determination of metals at the parts per million levels while graphite furnace is used for the determination of metal concentrations in the parts per billion ranges. However, the requisite lamp for the specific metal must be available for installation during the determination. It is not known what lamps are present in the laboratories that have AAS. The Association of Official Analytical Chemist (AOAC) and the EU recommend the cold vapour for mercury while the hydride system is generally used in the determination of arsenic and selenium. The newer technology for trace metals – Inductively Coupled Plasma (ICP) and ICP-MS are available at the Jamaica Bureau of Standards. There is also the availability of Infra Red (IR) spectroscopy and Ultra Violet/Visible (UV/Vis) spectroscopy at some laboratories in the region. Spectronic 20s and 21s spectrophotometers are simpler instruments to the UV/Vis and are used by many of the laboratories in the OECS to analyse for inorganic ions and nutrients such as nitrates and phosphates in water samples and other matrices. These instruments are good if one is looking at trends and where there are relatively high concentrations of analytes. However, where trace analyses are required the UV/Vis is the better instrument. The Ion chromatograph and the Pulse auto-analyser found at the GAS laboratory Barbados and the latter at the Multi Purpose Laboratory in St. Kitts and Nevis can also be used in the determination of inorganic ions.

It should be noted that in many cases these pieces of equipment are automated and have other ancillary attachments, for example ChemStations to the GC and HPLC systems that facilitate calculation, manipulation and analysis of the data.

Some of the pieces of equipment found in the various laboratories are provided by the same manufacturer and constitute the same model or a later or earlier model. For

example the GCs and/or HPLCs in Jamaica, Barbados, Guyana, Antigua and Barbuda, Belize, Trinidad and Grenada are by Aglient, with a manufacturers agent Analogic Solutions Inc in Trinidad able to provide adequate service. Analogic Solutions Inc. currently provide preventative and remedial service visits to many laboratories in the region and also are providers of parts and general supplies.
In some laboratories there are pieces of equipment that are not working and there are no financial resources available to have them repaired or laboratory personnel are not aware of whom to call to have the equipment repaired. For example at the Analytical laboratories in Antigua and Guyana there are no financial resources to repair the GCs present while in St. Lucia both the lack of resources and the knowledge of a competent person to assess the status of the Ion Chromatograph is the reason why it is not in use. The Ion Chromatograph in St. Lucia is a dated model and the soft ware to operate it is very old.

In laboratories in some of the member countries the same brands of equipment are present and functioning and are being serviced on an annual basis. Currently Barbados GAS uses a similar but a much later model Ion chromatograph to that in the St. Lucia Analytical laboratory. Barbados maintains an annual service visit of their instrument out of Brazil and arrangements are also made for remedial service when required. The recommendation would be to have the St. Lucia instrument assessed to see if it can be updated, since that model may be now obsolete. It seems that this instrument was hardly ever used and has been sitting without use probably since the 1990s.

In some countries there are pieces of equipment not in use because the current laboratory personnel do not know how to use them. Some of these pieces of equipment are in use in laboratories in other countries. For example Grenada does not use its HPLC because of lack of technical competence to do so while the same instrument is being used on a routine basis in Barbados, Jamaica and Trinidad to name a few. In the Grenada case the instrument is a relatively new model and could be used for the determination of parameters such as but not limited to vitamins, histamines in fish and some pesticides. Antigua and Barbuda and Dominica both have AAS not in use due to lack of trained personnel and the general lack of staff.

In some cases the unused pieces of equipment are relatively new models whereas in other cases they may have being sitting idle for many years and in some cases are now considered obsolete by the manufacturer. Hence they may not be support services and parts available as in the St. Lucia case with the Ion Chromatograph and the Antigua and Barbuda situation with one of the two GCs.

The questionnaire was so designed that one could capture the brand and model of the various pieces of equipment and if they were internal or external maintenance programmes and manuals available for the operation of the named instrument. It was hoped that the information gathered would have been used to put laboratories who had instruments not in use, because of not having the know how or knowledge of a service provide, in contact with those laboratories which are using the instruments and having them serviced. However, based on how the responses have been made it is difficult to do so as effectively as was hoped. The creation of such a database should be pursued. Linkages between laboratories in the region need to be established to foster professional interaction between the analysts.

Fume cupboards and laminar flow cabinets are some of the safety features presents in some laboratories to protect workers from hazardous chemical and microbiological organisms. However, maintenance and calibration are not a common occurrence. The AA necessary for trace metal determination in Belize cannot be used due to a problem with the hood or exhaust system.

Ovens, autoclaves, incubators and microscopes necessary for the microbiological determinations are also present.

There is a generally a lack of ready trained personnel in the use of the more sophisticated pieces of equipment, especially in the OECS countries, and in general laboratory tests. Training in the general use of these pieces of equipment is expensive. Graduates of the University of the West Indies do not have routine use of GCs, AAS and/or HPLCs as analytical tools during their undergraduate programmes. Their continuous exposure to the instrument is only if they are employed by a laboratory that uses them in their analytical determinations. Generally laboratories have internal programmes for new staff since they find it expensive to send staff to one and two day programmes overseas.

In the more developed islands in the region one finds a greater cadre of academically qualified persons. However, there seems to be a general decline in the number of chemistry graduates. The Multipurpose laboratory in St. Kitts and Nevis have been finding difficulty in sourcing a microbiologist.

Some laboratories suffer from a rapid turnover of staff. This was noted in Guyana at the Chemistry food and Drug laboratory where lack of adequate remunerations results in trained staff leaving when better prospects come up. Hence the laboratory is always in the training mode.

Countries with more widely developed laboratory facilities or with the potential for developing a wide range of analytical capability include Trinidad and Tobago, Jamaica, Barbados, Belize, St. Lucia through facilities at the Caribbean Environmental Health Institute (CEHI), Chemistry Food and Drug and IAST Analytical laboratories, Guyana, St. Kitts and Nevis at the Multi-purpose laboratory and Antigua and Barbuda. The St. Vincent and the Grenadines microbiology laboratory has potential. However, laboratories in Antigua and Barbuda, St. Lucia. Dominica, Grenada, St. Kitts and Nevis would require upgrades to their physical plant. Gap analyses should be conducted on the laboratories to determine their compliance with the requirements of ISO/IEC 17025 and acceptable QA/QC programmes. It should be noted that CEHI is a environmental laboratory and hardly analyses food samples. The staff at the Public Health laboratory at Gross Islet are eager to work on food samples but are reliant on programmes emanating from the Ministry of Health's' environmental health officers

3.3.2.2 Analytical determinations

The main concerns with respect to imports and locally produced products from a food safety perspective would be mycotoxins including aflatoxins, pesticide residues,

veterinary drug residues, microbial contaminants, chemical contaminants and trace metals.

Many of the countries are engaged in microbiological determinations of food and water. These test are fairly well established and in some cases support monitoring programmes.

Chemical determinations of food for moisture, fat content, protein/total nitrogen, nitrate.

Table 12 Number of analyses undertaken by analytical laboratories in selected member countries of CARICOM

Group of Analyses	Year	Microbiology		Food Chemistry	Feed	Pesticide Residue			Veterinary Drug Residue	Trace Metals				Other
		Food	Water			Ag. Produce	Water	Environment		Water	Food	Fish	Other	
Country/Laboratory														
Barbados GAS	2003	377	2000	109	185	2	13			2000	72			
	2004	320	1600	221	74	7	12			1659	24			
	2005	444	1096	224	15	3	32			1784	44			
Barbados Veterinary Services	2003	607							847					
	2004	-							-					
	2005	-							-					
Grenada Produce Chemist	2003	28	93	195										
	2004	199	243	277										
	2005	106	240	298										
St. Lucia Analytical Laboratory	2003													
	2004													
	2005													
St. Lucia CEHI	2003	2	750			100				50		-		
	2004	-	800			75				75		-		

Group of Analyses	Year	Microbiology		Food Chemistry	Feed	Pesticide Residue			Veterinary Drug Residue	Trace Metals				Other
		Food	Water			Ag. Produce	Water	Environment		Water	Food	Fish	Other	
Country/Laboratory														
	2005	-	1000			150				100		10		
St. Vincent & the Grenadines Bureau of Standard	2003	37	21	15										
	2004	20	130	164										
	2005	5	108	12										
St. Kitts & Nevis Multi Purpose Lab.	2003	908												
	2004	1226												
	2005	-												
Dominica Produce Chemist & Water Quality	2003		250	309										
	2004		290	295										
	2005		320	412										
Dominica Water & Sewerage Co. Lab.	2003	1500												
	2004	1600												
	2005	1900												
Antigua Analytical Lab.	2003	11	189											19
	2004	28	107											38

Group of Analyses	Year	Microbiology		Food Chemistry	Feed	Pesticide Residue			Veterinary Drug Residue	Trace Metals				Other
		Food	Water			Ag. Produce	Water	Environment		Water	Food	Fish	Other	
Country/Laboratory														
	2005	9	104											20
Guyana	2003	3	26	6	6					65				
IAST Analytical	2004	-	8	-	10					-				
Services Lab.	2005	-	-	-	23					-				
Guyana	2003	260	306	97										252
Food & Drug	2004	635	122	71										490
	2005	1088	602	190										405
Guyana	2003			-						<10	-			
Guysuco	2004			-						<10	-			
	2005			1365*						<10	15*			
Trinidad	2003													
Food & Drug	2004													
	2005													
Trinidad	2003	>300	>500	>100	5-10					>500	>100	0-5		
CARIRI	2004	>300	>500	>100	5-10					>500	>100	0-5		

Group of Analyses	Year	Microbiology		Food Chemistry	Feed	Pesticide Residue			Veterinary Drug Residue	Trace Metals				Other
		Food	Water			Ag. Produce	Water	Environment		Water	Food	Fish	Other	
Country/Laboratory														
	2005	>300	>500	>100	5-10					>500	>100	0-5		
Belize	2003													
Ministry of Health	2004													
Water Lab.	2005													
Belize	2003	115	95	-		-	20		-	-	2			
Central Investigation	2004	141	243	2		10	153		-	145				
Lab	2005	50	37	6		-	45		72	85				46
Jamaica	2003	1325	2		7	99								
Food Storage	2004	669	41		7	61								
	2005	680	1		1	60								
Jamaica	2003					200				50	20	-		
UWI, Mona	2004					300				50	20	-		
	2005					500				50	20	10		

Note* Food was sugar samples

3.4 Quality Assurance/Quality Control

3.4.1 Calibration Services and maintenance of analytical equipment

Laboratories need to have their support equipment such as balances, refrigerators, ovens, autoclaves, thermometers, stopwatches, incubators and fume cupboards to name a few calibrated on an annual or biannual basis. Calibration is the function of Standards bodies. Based on discussion with some of the Standards bodies (Dominica, Barbados, St. Kitts and Nevis, Guyana and St. Lucia) in the countries visited it appears that many of them are currently unable to offer the service. However, they seem to recognise the need to do so and some are actively developing plans to refurbish the institutions. Currently only the Bureau of Standards, Trinidad and the Caribbean Industrial Research Institute (CARIRI), Trinidad, offer calibration services. Such bodies must conform to the calibration guidelines set out in ISO/IEC17025 and be accredited for the service they perform.

Dominica has a proposal for the refurbishment of their institution. The Barbados National Standards Institution has submitted a project proposal to the Inter American Development Bank for the upgrade of the institution. The proposal calls for major infrastructural work including the construction of a new building.

Of the laboratories visited the GAS, IAST Analytical Services laboratory, Food and Drug, Trinidad and CARIRI have pieces of equipment calibrated on an annual or bi-annual basis. There is the need for more of the laboratories to have their equipment calibrated. CARIRI and Bureau of Standard Trinidad could be considered for the provision of that service until the Standards bodies in the countries are able to do so. However, the cost of calibration is expensive and this could be a deterrent to many of the laboratories.

3.4.2 Proficiency testing programmes

3.4.3 Accreditation

Only the CARIRI and the CEHI laboratories have some of the test that they conduct accredited. CARIRI is accredited for hh tests by the United Kingdom Accreditation Service (UKAS), UK while CEHI is accredited for two tests by the Canadian Association of Environmental Analytical laboratories (CAEAL), Canada. CEHI is an environmental laboratory while CARIRI undertakes a wide range of tests in the categories of analytical chemistry that includes food, inorganic, environmental and organic chemistry. However they are not accredited for test such as pesticide residue, veterinary drug residue or aflatoxins determinations or histamines and other degradation products in fish.

Not all tests need to be accredited. Countries would have to decide on which test they would want to have accredited. In addition accreditation laboratory

Both Jamaica and Trinidad and Tobago have embarked on the establishment of accreditation bodies. Jamaica is establishing its body within the National Quality Infrastructure project being managed by the Ministry of Commerce, Science and Technology (MCST). Twenty-five laboratories in Jamaica are currently being assisted

in their preparation for accreditation through this project. The laboratories will be accredited by the Jamaica accreditation body.

The Trinidad and Tobago Laboratory Accreditation Service (TTLabs) is part of the Trinidad and Tobago Bureau of Standards. TTLabs offers training courses for assessors, provides guidance to laboratories in the development of the quality system, is a repository of all the relevant documents for accreditation and the establishment of a quality system. TTLabs is geared to accredit both analytical laboratories according to ISO/IEC 17025 and medical laboratories according to ISO/IEC 15189. TTLabs will only gain mutual recognition from other accrediting bodies when it has accredited a specified number of laboratories. TTLabs is currently working with the Trinidad VSL in the laboratory's preparation for accreditation.

Laboratories in the region should consider these two regional accreditation bodies when seeking accreditation. If the two bodies build up a cadre of trained assessors within the CARICOM member countries then regional laboratories may find it cheaper to be accredited by theses bodies.

3.5 Cost recovery mechanisms

Generally the respective governments fund the laboratories. In some countries, for example, Belize and Guyana support also comes from the poultry industry. Cost recovery mechanisms include the receipt of fees for the issuance of import certificates and the inspection of imports and exports of commercial and other entities at the ports of entry and the charge for laboratory analyses. In general these costs are subsidised by the governments and revenue generated is generally less than annual expenditure.

Belize is the only country in CARICOM that has an agricultural health authority, the Belize Agricultural Health Authority (BAHA). BAHA is established so as to be self-sustaining and therefore receives little subvention from government. BAHA is however not receiving the revenue anticipated due to lack of the expected sample numbers. This is as a result of inappropriate legislation, which would give BAHA the power to apply the fees across the board. Fees are only applied to samples analysed from agricultural products for export. Hence industry pays. However, if the fees are charged for items for national good manufactures/producers unwilling to pay.

The VSL in Trinidad and Tobago and Barbados do not charge for analysis of samples taken from farm animals or for samples taken during routine programmes. Charges are only made for samples analysed from companion animals. The Barbados VS generates revenue from inspections of imports, the issuance of import certificates etcetera.

The laboratories of the plant protection units in the various countries do not charge for the services provided to farmers or householders with respect to pest and disease problems. Like the VS the PPU generates revenue from the preparation of import and export certificates and for the inspection of agricultural produce at the ports of entry. The Barbados PPU charges for none of its services and therefore has no cost recovery mechanisms in place.

The government laboratories engaged in analysis of food and other samples generally charge for some of their services. The costs of the analyses are generally subsidized by the government and in some cases the true costs of the analysis is not known. Hence the amount of the subsidy is not known. Funds collected are a small percentage of the overall budget. The funds when collected are deposited in the consolidated fund and are not available to the laboratory for its use. Only in Belize was a cost analysis done to determine the fees for services.

3.6 National Initiatives

Dominica, Antigua and Barbuda, Barbados, Guyana, Jamaica and St. Lucia currently have documented proposals for the refurbishment of agricultural health and food safety systems and/or associated laboratory services.

3.6.1 Dominica

Dominica**,** in July 2003, secured approximately EC$1.5 million dollars for the construction and equipping of a National Centre of Testing Excellence (NCTE) that is compliant with ISO/IEC 17025 "General requirements for the competence of testing and calibration laboratories". In addition the Government in 2004 allocated 1.5 acres of land for that purpose.

According to a report to Cabinet in 2006 by the "Adhoc working group on all pre-construction activities" for the NCTE it is proposed that:

(i) testing services currently conducted by the Produce Chemistry laboratory, the testing services conducted by the Water Quality Laboratory of the Environmental Health Division of the Ministry of Health, currently done at the Produce Chemist lab., and the fisheries laboratory be transferred to laboratory services at the NCTE

(ii) the above services be undertaken in a separate microbiology (food and water), environmental microbiology and an analytical chemistry laboratory to be established at NCTE

(iii) the facilities at the Produce Chemistry laboratory be maintained but that the service would concentrate on product development and training.

(iv) separate metrology and physical testing laboratories be established at NCTE to support the work of the Dominica Bureau of Standard and to house national reference standards. The laboratories would conduct calibration services for mass, temperature, measuring, dimension and pressure equipment as well as to ensure that imported new and used items conform to national standards.

(v) The CARDI laboratory, which is now non-operational, be made a national laboratory and incorporated into the NCTE

(vi) The newly constructed molecular remain separate.

(vii) The refurbished plant protection and quarantine laboratories, and the soils and materials laboratory remain at their current sites but be considered as part of the NCTE laboratory.

(viii) The entire laboratory system conform to the requirements of ISO/IEC17025

(ix) A documentation management centre be established to support the quality management system at the laboratories

(x) The NCTE should develop a certification programme for laboratory technicians

The current status of the project

3.6.2 Antigua

In 2002 the Inter-American Institute for co-operation on Agriculture (IICA) conducted an analysis of the Antigua PU, Ministry of Agriculture, Lands and Fisheries. The assessment was to provide information for the preparation of a strategic plan for the PPU, requested by the Government of Antigua. In January 2003 a proposal was submitted for the upgrade of the PPU headquarters, which included specifications for the construction of plant protection laboratories, insect rearing room and office facilities.

Currently

3.6.3 St. Lucia

In June 1999 an assessment was done of the laboratories within the Ministry of Agriculture, Forestry, Fisheries and the Environment based at the Research Department of the Ministry at the Union Agricultural Station with a view to rationalising their use. The study concluded that the rationalisation of the laboratories (Produce Chemist, Veterinary Services, Soils, Crop Protection, Tissue Culture and Fisheries) was critical for the improvement of operational efficiency, improvement to the quality of service offered and for the implementation of additional services.

The study also noted that the laboratories were understaffed and even though they were well equipped the equipment under utilised. In addition the physical infrastructure of all the laboratories, except the fisheries laboratory, needed to be expanded or refurbished. The study recommended a cost benefit analysis be done to justify the building of a new complex rather than the refurbishment of the existing buildings.

In the 2006 estimates of capital projects for 2006-2007 a proposal was made for the establishment of an Agriculture Centre of Excellence at Roseau, that would include the relocation and upgrade of the laboratories from Union Agricultural Station to Roseau in two phases, over a period of three years, 2007-2009.

3.5.4 Jamaica

In 2002, the Jamaica MCST in collaboration with the Swedish International Development Agency (SIDA) and the Swedish Board for Accreditation and Conformity Assessment (SWEDAC) implemented a National Quality Infrastructure project. Under the management of the MCST there was to be modernisation of relevant regulations and enforcement mechanisms for food/foodstuffs, establishment

of a National Accreditation Body and assistance given to 24 laboratories preparing for accreditation.

In May 2006 many of the laboratories had not achieved accreditation and were still preparing documentation.

3.6.5 Guyana

Guyana is currently developing a project with the assistance of the IADB to strengthen the services related to animal health, plant health and food safety. I t is envisaged that the strengthening of these services will allow Guyana's producers to take advantages that may be offered by CARICOM and other countries. The project as conceptualised will include updating legislation, training of laboratory personnel, acquisition of laboratory equipment and the refurbishment of the VSL and Chemistry Food and Drug.

Guyana has received assistance from the FAO in the evaluation of their food safety system. An FAO consultant completed a laboratory needs assessment and the laboratory has implemented some of the recommendations.

The USAID through the services of a consultant is assisting the laboratory with the implementation of a quality system in keeping with the requirements of 17025. The consultant is also guiding the staff through procedures necessary for the measurement of uncertainty.

3.6.6 Barbados

The Barbados' Ministry of Agriculture and Rural Development has identified the refurbishment of its laboratories (Plant Protection, Veterinary Services, Analytical Services, Tissue Culture, Cotton and Animal Nutrition) as a key component to the establishment of its agricultural health and food control system. The Government of Barbados in 2005 approached the IADB for assistance in the establishment of the Agricultural Health and Food Control Agency (NAHFCA) and the refurbishment of the laboratories. Discussions are currently ongoing.

The GAS has had a proposal drafted by the NSWC Corona Division, Measurement Science Department of the US Navy. The draft proposal seeks to prepare that laboratory for the accreditation of one set of test in each of the five sections of the laboratory over a five-year period. The Government of Barbados has granted the GAS funds for a Gap analysis and an on-site assessment but additional funds are required to undertake the other components of the project.

3.6.7 Suriname

The Government of Suriname has secured funding from the Dutch Government to improve their animal health disease monitoring and traceback system. Funds will be used to purchase computer hardware and software and to implement a British designed Inter trace software package that will use geographical information system

(GIS) technology in tracking livestock activity. The funds will also be used to purchase consumables and equipment for the veterinary services laboratory but not to improve the physical structure.

A memorandum of understanding between the Veterinary Division of the department of animal production and health has been drafted but not finalised. However discussions are ongoing as whether the VSL will be managed by the veterinary division or the agricultural research station, which is a semi-governmental parastatal entity. As a result the plans for the laboratory have not been implemented. It is hoped that implementation will occur by 2007.

3.7 Discussions with Regional and International Organisations

3.7.1 The Food and Agriculture Organisation (FAO) of the United Nations

Currently the FAO is embarking on a horizontal component to support their Regional Special Programme for Food Security (RSPFS) for CARIFORUM in the areas of Plant Health, Animal Health and Food Safety.

The consultant engaged to carry out the Plant Health aspect is using the Phytosanitary Capacity Evaluation (PCE) tool developed to identify areas of weakness in the SPS systems of the member countries. A component of that tool provides for an assessment of their laboratory capacity.

The aim of this assessment is to assist governments in identifying and prioritising the weaknesses in their plant health system. It is assumed that once identified governments will seek assistance to strengthen their capacities. If laboratory infrastructure is identified as a weakness the country can seek to have that area upgraded.

At the end of the survey, it is envisaged that a workshop will be held with all the participants to examine the results, prioritise the weaknesses nationally and regionally and identify areas for which funding will be sought.

Similar consultancies are envisaged before the end of the year for food safety and animal health but no tool has been developed to assist in these surveys.

3.7.2 Inter American Institute for Cooperation on Agriculture (IICA)

In collaboration with PAHO (?), USDA (?) and FAO, IICA is engaged in developing a preparedness programme to combat any outbreak of Avian Influenza in the region.

IICA has on staff an AHFS specialist in the Barbados office.

3.7.3 Pan American Health Organisation (PAHO)

PAHO has prepared in collaboration with FAO draft Parliament ready legislation in the areas of Plant Health, Animal Health, Pesticides and Toxic Chemicals and Environmental Services for Barbados and the OECS countries.

4.0 Summary of findings

- Very few countries have adequate laboratory infrastructure to support surveillance work in entomology and pathology.
- St. Vincent, Suriname, Trinidad and Dominica are in the process of refurbishing or building new facilities.
- No facilities exist in Antigua or Grenada. Grenada lost the roof of their building and some of their equipment during Hurricane Ivan (2004).
- Facilities need to be upgraded in Guyana, Barbados and St. Lucia.
- There is also the need for facilities for natural enemy rearing (?) to support some of the integrated pest management programmes and to control the myriad of new invasive species to the region.
- In many cases the officers who do the field work also work in the laboratory but due to the number of pest problems spend little time in the laboratory. There would be the need for dedicated laboratory personnel to assist in the preparative work for the members of the plant protection unit.
- Many of the officers have general agriculture degrees and there are very few trained persons in the areas of entomology, plant pathology or soil sciences in the region. With the emergence of the myriad of new pests there is the need for skills in the areas of insect and disease identification as well as in laboratory techniques.
- In some cases the trained officer in the area of plant protection is also head of the unit and is usually bogged down with administrative matters and finds little time to be in the laboratory or in the field.
- In some islands, namely St. Kitts, Belize and Antigua, the Caribbean Agricultural Research and Development Institute (CARDI) provides entomology services.

- In many cases, if there is adoption of international standards, there is no legal basis for enforcement. This limits the demand for testing services to satisfy enforcement requirements.
- Determination of the presence of indicator organisms in food are the more common test performed. Chemical determinations are more limited.

5.0 Recommendations

5.1 Need for testing services

There is a general need in the region for reliable services for

5.1.1 Pesticide Residue Analysis

Many countries expressed the need for pesticide residue analysis but do not have the equipment or trained personnel to conduct the necessary tests. As mentioned previously Barbados has protocols in place with Trinidad and Tobago, Guyana and St. Vincent, which outline the requirements for the shipping of fruits and vegetables to Barbados. NAMDEVCO, Trinidad and NARI, Guyana would like to have laboratory

services in their countries with respect to pesticide residue analysis to ensure that they comply with the requirements of the Barbados protocol and to ensure that farmers comply with the standards set.

In general these tests require expensive pieces of equipment that countries argue is not possible for each country to purchase and maintain. Jamaica, Belize, Barbados, Guyana and Trinidad and Tobago, laboratory facilities provided at CEHI in St. Lucia and the Produce Chemist laboratory in Grenada have the analytical capability and some facilities do undertake pesticide residue testing. Antigua and Barbuda has a trained person at the Analytical laboratory in pesticide residue analysis but no reliable instrument to operate. This may be an area where rationalisation of laboratory services across the region could be explored but a list of registered pesticides in the region would have to be compiled an a determination made as to which ones should be tested for in routine monitoring programmes.

5.1.2 Veterinary Drug Residue Analysis

Countries also see the need for this service especially since there are no registration procedures in place to regulate the use of veterinary drugs.

Only the VSL, Barbados and the CIL, Belize undertakes these determinations. The VSL, Barbados uses the CHARM reader that employs a qualitative method. CIL uses both the CHARM reader for qualitative determinations and the HPLC for quantitative determinations when necessary (positive presence with CHARM). It is this authors understanding that some antibiotic drug residue testing is conducted by Nestles, Trinidad and Pine Hill Dairy Barbados and that the Veterinary school in Trinidad has a CHARM reader. The Charm reader is not available to the Veterinary School on the same compound.

This again may be an area where rationalisation of laboratory services across the region could be explored. However, a comprehensive assessment of the veterinary drugs used in the region would have to be conducted and a determination made of the drugs to be analysed in routine programmes.

5.1.3 Aflatoxins in Grain and Nuts

5.1.4 Testing of fish

Some countries in the region export fresh water and marine fish, conch, lobster and shrimp to the European Union (EU) including the EU countries in the region namely Martinique and Guadeloupe. Some countries have been assessed and approved by the EU for the export of fish and fishery products to that region, example Belize, Jamaica, Guyana and Suriname.

Some countries have lost these markets due to lack of Hazard Analysis Critical Control Point (HACCP) procedures in the processing plants and lack of testing of fish and fishery products for various degradation products, trace metals, bio-toxins and microbiological indicator organisms, example Trinidad, St. Lucia.

- Many countries in the OECS (Dominica, St. Vincent, St. Lucia, Antigua and Barbuda, Grenada) have been provided with laboratory facilities and equipment for testing by the Japanese Government.
- In many cases these laboratories are not in operation because of lack of staff due to lack of availability of financial resources or adequately trained personnel.
- There is a need for training of personnel in fish analysis since this is a potential export product for the region and fish is widely eaten by locals and visitors to the islands.
- Suriname appears to have a fairly well organised fish-testing programme. This is however limited to the boats and processing plants that export fish. However, the country needs to find testing facilities in region that are accredited for trace metals determination. It currently sends samples to Belgium.
- In Belize there is one exporter of fish who has testing facilities. However, BAHA must undertake sampling and analysis to satisfy requirements for the issuing of certificates.

5.1.5 Trace metal determinations

5.2 Agricultural Health and Food Safety Systems

The countries have identified the need for the development of AHFS systems and have appointed national committees. However, it seems that the development of the systems could be further advanced if a project would be developed to help the countries prepare a project for the establishment of AHFS systems. A project could be developed where consultants work with each of these committees and prepare a proposal for the AHFS system for the country. The committee would act as a steering committee to the project.

The establishment of the AHFS system would then drive the testing requirements necessary and the work of the laboratories.

The challenges of Belize should be considered in developing systems for the countries. Belize created a Belize Agricultural Health Authority (BAHA). On implementation BAHA was expected to be self-sustaining. However, that is not the case. Revenue was expected to be generated based on a minimum number of samples passing through the laboratories and services offered. However the expected number of samples did not materialise. It is believed that some services should be provided as a public good and hence there should be no charge. Due to lack of revenue there is not enough funds to hire the requisite number of staff, chemicals and ancillary equipment or to provide servicing of equipment or to ensure that repairs are done on equipment as necessary.

5.3 Legislation

Updated legislation is also required for the functioning of the AHFS system and to ensure that agricultural products and food is tested. Although a PAHO project has provided Parliament ready legislation with respect to Plant Health, Animal Health, Food Safety, Pesticides and Toxic Chemicals and Environmental Health Services for Barbados and the OECS, many of these documents have not been enacted. In many countries they are in the departments of the Solicitor General.

A review, through a consultancy, of the relevant legislation is necessary for all the CARICOM member states and where necessary an updating and enhancing of the legal framework for the establishment of an AHFS system.

5.4 Laboratories

5.4.1 Development of a Quality System

If the results of the laboratories are to be acceptable internationally and to support the AHFS system then the laboratories need to implement Quality Assurance and Quality Control (QA/QC) procedures and in some cases seek accreditation for some of the analyses they conduct. This is especially so if the items are being tested for export purposes.

In establishing the quality system the laboratories should ensure that their physical plants, environmental conditions and practices conform to the requirements of the International Standards Organisation/International Electro-technical Commission (ISO/IEC) 17025. The ISO/IEC 17025 outlines the general requirements for the competence of testing and calibration laboratories.

There is also the need for the enactment of enabling legislation for the laboratories to ensure that they can be held legally responsible and for the laboratories to be identified as the national laboratories for food testing and/or testing in the areas of animal and plant health.

There is the need for a 3 – 5 year project to be developed to assist the laboratories in developing their quality system and preparing them for accreditation of selected methods. The project should not focus on training and an overview of the ISO/IEC 17025 requirements nor for consultants to come and prepare all the necessary documents but rather it should be such that the consultants would work with the lab staff in preparing all the documents required for the implementation of the quality system as are programmes currently implemented in Jamaica and Trinidad. This project should include:

- a gap assessment of all the laboratories (both government labs and those private labs identified by Governments to undertake specific tests). The gap analysis should determine the current QA/QC status, if any, and what is required for the laboratories to conform to the requirements of ISO/IEC 17025.

- a review of the laboratories test infrastructure that can impact on the final test result, that is, if the equipment available and environmental conditions under which the test are conducted conform to the requirements of ISO/IEC 17025. In so doing they may want to conduct a shortened version of an ISO/IEC 17025 audit of the test areas.
- a review of the existing laboratory design with the view to recommend improvements.
- a review of the human resources requirements.
- training of the laboratory staff in the principles of QA/QC, preparation of documents required for the quality system, for example quality manuals, guidelines on how to conduct an internal audit, etcetera.
- the establishment of support services for equipment, for example maintenance schedules for equipment.
- an assessment of the tests the laboratory would need to undertake to satisfy the requirements of each country.

At the end of the project the laboratories should have:

- enacted enabling legislation for the laboratories.
- defined the management structure of the laboratories.
- identified the staff required.
- identified the tests to be undertaken on a routine basis.
- implemented a quality system and identified requirements for its maintenance.
- developed all the necessary documentation to support the system, for example quality manuals, standard operating procedures, validated methods.
- provided physical structures that ensure the right environment for the conduct of analyses and investigations.
- engaged in the requisite number of proficiency programmes.

A draft document for the accreditation of the laboratories is being prepared to request FAO assistance

5.4.2 Training of personnel

- There is need for the training of laboratory personnel in the use of the various pieces of analytical equipment.
- This training could be accomplished by laboratory attachments at laboratories in the region using the same pieces of equipment for similar analyses. This will allow some laboratories to implement additional test methods.
- There is also the need for training in the determination of various parameters from several matrices.
- Training is expensive and usually the courses offered outside the region in analytical techniques are sometimes one and two days. It would be more cost effective if regional? programmes could be offered. Some of the companies offer onsite training but they usually recommend a minimum number. This could be explored on a regional level for areas like Gas Chromatography, Atomic Absorption Spectroscopy, to name a few.

- With respect to agricultural health there needs to be training of agricultural officers in the areas of plant protection, entomology and pathology.

5.5 Rationalisation of laboratory Services

In general countries have agreed that it is not economically feasible to have all the laboratories in the region engaged in the determination of all parameters, especially those test that use expensive pieces of analytical equipment.

Pesticide residue analysis, veterinary drug residue and trace metal determination and the diagnosis of certain animal and plant diseases and the identification of some pests fall into this category.

For pesticide residue analysis it will be necessary to identify the pesticides used in the region and the crops on which they are used to control pests. This could be done at the country level and regional level. It would then be necessary to determine which pesticides should be routinely analysed for and on what crops. The test methods would have to be identified and validated and the appropriate analytical equipment identified.

Laboratories could then be categorised to do various aspects or selected pesticides residue determination. Hence some labs could do extraction and some level of clean up and send the extract to selected lab for determination and quantification. The preliminary extraction would reduce the bulk presented for shipment.

For veterinary drug residues a similar process could be used for their determination in milk, meat and eggs. However, some screening methods do exist which do not call for expensive pieces of equipment and these could be explored.

Concerns with the rationalisation of laboratories include:

- Transport of the extracts and produce from one country to another
- Temperature and conditions under which the agricultural product is kept will determine the results obtained
- Clearance at the ports of entry
- Prioritisation of the samples at the receiving laboratory
- Turn around time for results

A project developed to look at pesticide residue analysis or other analyses at the regional level should explore all of these concerns.

Memoranda of understanding would have to be developed between the requesting and receiving laboratory. Once routines have been determined the requesting country should ensure that they are kept. It is not cost effective for laboratories to operate in an ad hoc manner. Cost for the determinations would have to be worked out.

CEHI is a regional laboratory but faces the challenge of being fully operational due to lack of samples. Countries want to have the analyses done but do not have the financial resources to pay for the service.

In addition some countries need to rationalise their laboratory services so that there is no overlap of functions.

Rationalisation of laboratory services

Although the VDL in Barbados, Jamaica and Trinidad may be able to analyse samples from other countries, the countries expressed concerns with respect to the challenges faced in the shipment of samples from one country to another. These include the airlines being prepared to take the samples and recognising the transport of the samples as a priority. Timely clearance of the samples by the customs departments at the ports of entry and the receiving laboratory prioritising the sample and returning the results in a timely manner were also identified as additional areas of concern. However, IATA system makes provisions and has protocols in place for the shipment of hazardous samples

There is need for training of persons to work in VDL. It appears that the veterinarians are trained in pathology and able to identify clinical symptoms but have no advanced training in laboratory diagnosis.

There are quite a number of young veterinarians, many of whom are trained in Cuba.

5.6 Formation of regional grouping

Regional meeting of heads of labs

- Develop a data base of equipment and laboratory personnel in the region

Form a regional group of laboratory personnel. There could then be sub groups, for example, those engaged in plant protection analyses, veterinary diagnostic determinations and food safety. There could be regional annual meetings where work conducted by the labs could be presented and discussed. This would foster linkages between scientists working in similar areas.

APPENDICIES

Appendix 1

Terms of Reference

The consultant is expected to focus on the following areas:

- Compilation of a preliminary inventory of the CARICOM Member States laboratory infrastructure and testing capabilities in relation to agricultural health and food safety
- Identification of some of the specific gaps/needs for strengthening laboratory capacity and capabilities
- Estimation of the demand for testing services related to food safety and agricultural health, differentiating between testing needs for enforcement of national regulations, meeting international standards, and meeting commercial requirements
- Identification of the range of services offered by the laboratories in the individual Member States to domestic and external clientele in relation to the trade flows
- Assessment of the ability of the laboratories to respond to emergency pest and disease outbreaks
- Determination of need for rationalisation of the use of laboratories in the region
- Determination of laboratory accreditation requirements in CARICOM member countries
- Identification of training needs of laboratory personnel in the individual states engaged in analyses and/or diagnostic services related to AHFS elements

In addition the consultant is expected to appraise relevant documents and liase with stakeholders in respect of the following:

- existing initiatives (including those of international and regional agencies) in the member states with respect to Agricultural Health and Food Safety
- preliminary analysis of intra and extra regional agricultural trade flows
- inventorying of laboratories and identification of the basic need requirement to provide the required services
- cost recovery systems and mechanisms for sustainability
- private sector participation and possible industry support in cost recovery systems and building laboratory capacity
- services provided by non-government laboratories
- possibility of rationalisation of use of laboratories
- interest in accreditation of laboratories
- liasing with CARICOM secretariat representatives and representatives of the Chief veterinary Office, Chief Veterinary Public Health Office, Ministry of Health and Ministry of Agriculture in the CARICOM member states, Pan American health Organisation and the Food and Agricultural Organisation

	Appendix 2 LIST OF COUNTRIES VISITED	MINISTRY/INSTITUTION	LABORATORY	VISITED	QUESTIONS	
					Sent	Reply
1	**Antigua and Barbuda**	Ministry of Agriculture	Agricultural Health and Food Safety Committee	✓		
2			Analytical Services Laboratory	✓	✓	✓
3	**Barbados**	Ministry of Agriculture	Entomology			
4			Pathology	✓	✓	x
5			Government Analytical Services Laboratory	✓	✓	✓
6			Veterinary Services and Laboratory	✓	✓	✓
7			Tissue Culture Laboratory	✓	✓	✓
8			Artificial Insemination Unit	✓	✓	✓
9			Cotton Laboratory	✓	✓	✓
10			Fisheries Division	✓	✓	✓
11			Public Health Laboratory	✓	✓	✓
12		Ministry of Health	Environmental Health	✓	✓	✓
13			BAHA	✓		
14	**Belize**	BAHA	Veterinary Services Laboratory	✓	✓	✓
15			Food Safety	✓	✓	✓
16			Plant Protection	✓	✓	x
17			Central Investigation Laboratory	✓	✓	✓
18			Water Quality Laboratory	✓	✓	x
19		Ministry of Health	Plant Protection	✓	✓	x
20	**Dominica**	Ministry of Agriculture	Produce Chemist Laboratory (PCL)	✓	✓	✓
21			Molecular Laboratory	✓	✓	✓
22			Fisheries Laboratory	✓	✓	x
23			Environmental Health Department	✓	✓	✓
24		Ministry of Health	Environmental Health Laboratory at PCL	✓		
25			Princess Margaret Hospital laboratory	✓	✓	✓
26			Dominica Water & Sewerage Company Laboratory	✓		
27		Dominica Water & Sewerage Company	Agricultural Health & Food Safety Committee	✓	✓	✓
28	**Grenada**	Ministry of Agriculture	Plant Protection	✓		
29			Veterinary Diagnostic Laboratory	✓		
30			Produce Chemist Laboratory	✓	✓	x
31			Environmental Health	✓	✓	✓
32		Ministry of Health	National Water & Sewerage Laboratory	✓		
33		National Water & Sewerage Authority	Grenada Cooperatives Nutmeg Association Laboratory	✓		
34		Grenada Cooperatives Nutmeg Association	Plant Health	✓	✓	✓

35	**Guyana**	Ministry of Agriculture	Veterinary Services Laboratory	✓	✓	x
36			Food & Drug Laboratory	✓	✓	✓
37		Ministry of Health	Faculty & Agriculture & Forestry Laboratory	✓	✓	x
38		University of Guyana	Guyana Bureau of Standard	✓	✓	x
39		Ministry of Commerce	Guysuco Laboratory	✓	✓	✓
40		Guysuco	Banks DIH Laboratory	✓	✓	✓
41		Banks DIH	IAST Laboratories	✓	✓	
42		Institute of Applied Science & Technology (IAST)	NARI Laboratories	✓	✓	✓
43		National Agricultural Research Institute (NARI)	Veterinary Division	✓	✓	x

Appendix 3

CARICOM STUDY

AGRICULTURAL HEALTH AND FOOD SAFETY

SURVEY OF LABORATORIES IN MEMBER COUNTRIES OF CARICOM

Person responsible for completing questionnaire:

Name: _____

Post: _____

Date: _____

Please complete as appropriate and/or attach relevant information.

1. General Information

1.1

Identification and Location of Organisation	
Name of Laboratory	
Head of Laboratory	
Address	
Country	
Post Code	
Telephone number	
Facsimile	
E mail address	
Contact person	

1.2 What are the major sources of funding for the laboratory?

_____
_____
_____

1.3

Affiliation			
Public ( )	Private ( )	Government ( )	Academia ( )
Other (Please specify):			

1.4 Indicate by Type/Sector the category in which the laboratory falls:

Public Health ( ) Analytical ( ) Water Resources ( )
Plant Health ( ) Veterinary Diagnostic ( ) Food Control ( )
Industry (Specify) ( ) University ( ) Environmental ( )

1.5 Target users of analyses/diagnostic services

Government ( ) Research ( ) Industry (State type) ( )
Private ( ) Service ( ) Clients outside Country ( )

1.6 If the laboratory performs service for clients outside the country indicate if the service is:

Routine ( ) Periodic ( ) Other (Specify) ( )

1.7 Is the service for clients outside the country related to:

Trade Flows ( ) Pest and Disease Outbreaks ( )

List the services and state how often these services were performed in the past three years.

_____

_____

2.0 Resources Information

2.1 **Human Resources** (Indicate in terms of full time staff the number of professional and general service staff and their qualifications).

	No. of persons	**% of time in laboratory**	**% of time on inspection**
University Graduate: PhD. MSc. BSc.			
Tertiary Institution Graduate			
Secondary (High) School Graduate with > 3 years experience			
Secondary (High) School Graduate with < 3 years experience			
Administration (Non-Technical)			
Service (e.g. Cleaners)			
Total Personnel			

2.1.1 List the name, title and qualification of the Director, Head of Sections/Departments/Division.

Name	Title	Qualification and area of study	Section/Department/ Division

2.1.2 Please insert laboratory organisational chart

2.1.3 Staff Training

The laboratory has:	Yes	No
A programme for regular training		
A training programme for new personnel		
Budget allocation (not subject to reduction) for training		
Annual budget for training		
Systems to evaluate the training programme		
Systems to evaluate personnel performance		
Systems to record staff training		

2.1.4 State the training needs of the laboratory.

_____

_____

_____

_____

2.1.5 State in what areas the laboratory needs assistance to help it achieve its training objectives.

_____

_____

_____

2.2 Housing and System Infrastructure

2.2.1 Premises

Was the building constructed for its present use?

Yes ( ) No ( )

2.2.2 Age of building _____ years

2.2.3 General Condition of building

Good ( ) Average ( ) Poor ( )

2.2.4 Total Floor area _____square feet

2.2.5 Workbench Space

Adequate ( ) Acceptable ( ) Needs Improvement ( )

General evaluation of working area

Adequate ( ) Acceptable ( ) Needs Improvement ( )

General evaluation of workspace distribution

Adequate ( ) Acceptable ( ) Needs Improvement ( )

2.2.6 Indicate if the following areas are available, the number of sites and the condition.

Description	Present Y/N	No. of Sites	Surface Area sq ft	Condition		
				Good	Average	Poor
Offices and Administration Area						
Electronic data processing						
Sample reception						
Laboratories						
Areas for						
Media preparation						
Sterilisation						
Incubation						
Fumigation						
Quarantine						

Sample preparation Weighing Instrumentation Washing Sample storage Dark room Storage Area for chemicals & solvents Storage area for glassware General storage area Maintenance workshop Lecture/Training Room Library/Conference Lunch Room						

2.3 Instruments and Equipment

2.3.1 In Laboratory

Description	**Number**	**Available**	**Operational**	**Features**	**CONDITIONS**		
					Good	**Average**	**Poor**
Liquid Chromatograph							
Multiple Wavelength Detector							
Fluorescent Detector							
Refractive Index (RI) Detector							
Autosampler							
Chemstation							
Integrator							
Gas Chromatograph							
Flame Ionization Detector (FID)							
Electron Capture Detector (ECD)							
Nitrogen Phosphorous Detector (NPD)							
Flame Photometric Detector (FPD) Phosphorous/Sulphur Mode							
Mass Selective Detector (MDS)							
Auto sampler							
Chemstation							
Integrator							
Ion chromatograph Manual/Automated							

Description	Number	Available	Operational	Features	CONDITIONS		
					Good	Average	Poor
GC/MS/MS							
Atomic Absorption Spectrophotometer Flame Graphite Furnace Manual/Automated							
Inductively Coupled Plasma (ICP)							
ICP/MS							
Ultraviolet (visible) Spectrophotometer							
InfraRed/Fourian Transform IR (IR/FTIR) Spectrophotometer							
Autoanalyser							
Flame Photometer							
Flurometer							
Photocolorimeter							
ELISA Reader							
Charm Analyser							
Polymerase Chain Reaction (PCR) Reader							
Microscope Binocular Ultra Violet Inverted Dark Field Electronic Phase Contrast							
Stomacher							
Homogeniser							
Blender							
Chopper							
Grinder							
Mill							
Autoclave							
Incubator							
Centrifuge Table Model Large Standing Model Refrigerated Ultra							
pH meter Manual Digital							
Laminar Flow Cabinet							
Fume Cupboard							
Analytical Balances Periodic Automatic							
Fat Extraction Unit							
Kjeldahl Unit							
Electrophoresis Equipment							
Karl Fisher Moisture Analyzer Manual							

Description	Number	Available	Operational	Features	CONDITIONS		
					Good	Average	Poor
Digital							
Crude Fibre Apparatus							
Distillation Apparatus							
Quebec Colony Counter							
Spiral Plating Equipment							
Oven							
Muffle Furnace							
Refractometer							
Microtome							
Tissue Stainer							
Histoembedder							
Refrigerator Standard with freezer compartment Industrial Scientific							
Freezers -10^{o}C <-10^{o}C							
Hotplates With agitators							
Incinerator							
Ovoscope							
Microtitre							
Refractometer							
Titremeter							
Conductivity meter							
Turbidity meter							
Other							

2.3.2 For Inspection

Equipment available for taking:

Water samples Yes ( ) No ( )

Food samples Yes ( ) No ( )

Plant samples Yes ( ) No ( )

Other samples (Specify) Yes ( ) No ( )

2.3.3 Details of equipment

Equipment/Instrument Description			Operation of Equipment			Documentation				Maintenance & Repair				
										Maintenance Programme		Performed by		
System (1)	Type (2)	Brand & Model (Include model year)	Yes	Partial	No	Operational Manual	Maintenance Manual	Record of preventative and corrective maintenance	Record Checking Calibration	Corrective	Preventative	Internal	External	Evaluation of Maintenance (3)

Notes: (1) Indicate system (e.g.) HPLC, ELISA READER, AA etc

(2) Indicate detector or other associated attachment

(3) Use the following evaluation: Very good (1); Good (2); Acceptable (3); Needs Improvement (4)

2.4 Auxiliary Services

2.4.1 Climate Control in laboratory ar**ea**

Natural ( ) Air condition ( ) Filtered Air ( )

2.4.2 Safety in laboratory

Chemical Safety Controls ( ) Microbiology Safety Controls ( )

Number of exhaust hoods _____

Number of laminar flow cabinets _____

Safety showers ( ) Eye wash stations ( )

2.4.3 Water Quality

Distilled ( ) Double distilled ( ) Deionised ( )

Water softener ( ) Ultra pure ( )

2.4.4 Illumination

Natural ( ) Artificial ( )

2.4.5 Is there adequate energy network for normal consumption?

Yes ( ) No ( )

Power generator Yes ( ) No ( )

Vacuum system Yes ( ) No ( )

2.4.6 Municipal gas supply Yes ( ) No ( )

2.4.7 Gas in cylinders Yes ( ) No ( )

2.4.8 Do the following supplies meet the laboratory needs?

Supply	Yes	No
Gas		
Vacuum		
Air		
Electrical		
Water		
Purified water system		

If “No” what would be required to improve the supply?

_____

2.5 Support Systems

2.5.1 Library

Library services available? Yes ( ) No ( )

If "Yes" does the library have an adequate supply of up-to-date reference books?

Yes ( ) No ( )

Does the library subscribe to international journals?

Yes ( ) No ( )

Is the laboratory able to obtain reference material quickly when needed? Yes ( ) No ( )

2.5.2 Information technology

Internet access available?	Yes ( )	No ( )
Network services available?	Yes ( )	No ( )
Computer access available?	Yes ( )	No ( )
Analytical equipment automated?	Yes ( )	No ( )
Analytical equipment computerised?	Yes ( )	No ( )

2.6 Maintenance

The laboratory has a calibration and general maintenance programme

Yes ( ) No ( )

If "yes", is the programme

Corrective ( ) Preventative ( )

Internal ( ) Under contract ( )

Does the laboratory have problems or difficulties in the maintenance and repair of:

Premises	Yes ( )	No ( )
Vehicles	Yes ( )	No ( )
Instruments	Yes ( )	No ( )
Equipment	Yes ( )	No ( )

2.7 Supply

Does the laboratory have problems or difficulties in the procurement of adequate supplies of the following:

Description	Yes	No
Glassware Culture Media Reagent & chemicals Other		

Indicate the factors that limit the maintenance programme and/or procurement of supplies.

_____

_____

_____

2.8 Miscellaneous

Does the laboratory maintain a:

Reference strain collection? Yes ( ) No ( )

Reference culture collection? Yes ( ) No ( )

Reference insect collection? Yes ( ) No ( )

3.0 Role of Laboratory in Agricultural Health and Food Safety

3.1 What is the role of the laboratory in the application of national, regional and/or international measures developed for the safe production and trade of plants, animals and their products and by products?

_____

_____

_____

_____

3.2 Describe the laboratory's relationship with other institutions in your country involved in activities to facilitate improved agricultural health and food safety and/or trade flows.

_____

_____

_____

3.3 What is the role of the laboratory in the registration of pesticides, feeds, fertilisers and/or veterinary drugs?

_____

_____

_____

_____

3.4 What is the role of the laboratory in recommending use patterns or maximum residue limits for the registration of pesticides, feeds, fertilisers and/or veterinary drugs?

_____

_____

_____

_____

3.5 Does the laboratory conduct supervised field trials to support the establishment of maximum residue limits?

Yes ( ) No ( )

If the answer to the above is "No", please give the reasons and/or state the short comings (facilities, manpower, technical know how etcetera).

_____

_____

_____

3.6 Describe the laboratory's relationship with other institutes in your country involved in analysing contaminants, pesticides and veterinary drug residues in food, feed and/or the environment.

_____

_____

_____

3.7 Describe how the laboratory's results are utilised to refine trade flows, use patterns and /or alter quality specifications in registration documents and or requirements for food safety and trade.

_____

_____

_____

_____

3.8 List specific animal diseases that are of major public health interest to your country.

_____

_____

_____

_____

3.9 List specific animal diseases that are of major trade interest to your country.

_____

_____

_____

_____

3.10 Laboratory Services

3.10.1 Is the laboratory engaged in any of the following activities?

Feed analysis ( )	Food microbiology( )
Pesticide residue analysis ( )	Food surveillance ( )
Veterinary Drug residue analysis ( )	Water quality ( )
Fertiliser analysis ( )	Clinical microbiology ( )
Plant pathology ( )	Serology ( )
Entomology ( )	Histology ( )
Bacteriology ( )	Virology ( )
Mycology ( )	Parasitology ( )
Haematology ( )	Urine analysis ( )
Blood chemistry ( )	Post mortem ( )
Food chemistry ( )	Histopathology ( )
Cytology ( )	Other ( )

3.10.2 Do the services provided adequately address the needs of your country with respect to agricultural health and food safety?

Yes ( ) No ( )

3.10.3 Identify from the list below the disciplines that need to be:

(a) improved (indicate by tick [)

(b) introduced (indicate by cross x)

to satisfy the needs of your country

( )	Feed analysis	( )	Food microbiology
( )	Pesticide residue analysis	( )	Food surveillance
( )	Veterinary Drug residue analysis	( )	Water quality
( )	Fertiliser analysis	( )	Clinical microbiology
( )	Plant pathology	( )	Serology
( )	Entomology	( )	Histology
( )	Bacteriology	( )	Virology
( )	Mycology	( )	Parasitology
( )	Haematology	( )	Urine analysis
( )	Blood chemistry	( )	Post mortem
( )	Food chemistry	( )	Histopathology
( )	Cytology	( )	Other

3.10.4 Indicate the factors that limit the performance of your laboratory in conducting the test listed above.

Space ( ) Training ( ) Financial resources ( )

Equipment ( ) Staff ( ) Other (specify) …….

Location ( ) Quality Assurance/Quality Control programme ( )

3.10.5 For each of the above indicated please elaborate.

Space

_____

_____

_____

Equipment

_____

_____

_____

Location

_____

_____

_____

Training

_____

_____

_____

Staff

_____

_____

_____

Financial resources

_____

_____

_____

Quality Assurance/Quality Control programme

_____

_____

_____

Other

_____

_____

_____

3.10.6 Identify in the table below the:

(a) routine analyses and/or

(b) tests performed; and

(c) equipment utilised

by the laboratory to identify specific

(a) animal diseases

(b) plant diseases

(c) analytes [food contaminants, food pathogens, residues (pesticides, veterinary drug), food additives, preservatives, etcetera]
that are of public health, animal health, plant health and/or food safety concerns for your country or that are conducted to facilitate trade flows.

Where necessary, using the codes provided below, indicate in the same table the purpose of the test/analysis, the category and all other information as appropriate.

Notes:

1.

Code	**Purpose**
A	Enforcement of national regulations
B	Application of international standards
C	Commercial requirements (Import/export control)
D	Fairness in trade
E	Adulteration of products
F	Technical support to industry
G	Food Safety
H	Research
I	Investigation of outbreaks
J	Other

2.

Code	Category
A	Verification programme
B	Monitoring programme
C	Food borne disease/surveillance programme

3.

Code	Type of analysis
N	Quantitative
L	Qualitative

4.

Code	Reference for methods
1	ISO
2	AOAC
3	USEPA
4	OECD
5	Scientific literature
6	AWWA/APHA
7	OIE
8	Others

5.

Code	Status of method
A	Accredited
B	Validated
C	Certified
D	None

List of routine analyses, test performed and equipment used

Disease/ Contaminant	Test performed	Purpose (1)	Category (2)	Type (3)	Equipment Used	Detection Limit	Bibliographic Reference (4)			Modified Method? Y/N	Status of method (5)	Sample Matrix	Estimated number of samples /year
							Source	Year	No.				

3.6.7 According to the type of analysis indicate the number performed over the past three years.

Group of analyses	**2003**	**2004**	**2005**
Microbiology Food			
Microbiology Water			
Food Chemistry			
Feed			
Pesticide Residues			
Agricultural Produce			
Veterinary Drug Residues			
Plant Health Diagnostic Test			
Veterinary Diagnostic Test			
Trace Metals			
Water			
Food			
Fish			
Other			

3.6.8 If the laboratory does not perform a particular test(s) does it use another laboratory?

Yes ( ) No ( )

If the answer to the above is "Yes", is the laboratory located in or out of the country? _____

If the answer is "out", state the country. _____

3.6.9 Is the laboratory satisfied with the services of the contracted laboratory?

Yes ( ) No ( )

If "No", with what aspects of the service are you dissatisfied?

_____

_____

3.6.10 Do the services the laboratory perform support

Internal Control ( )	Investigation of pest/disease outbreaks ( )
Import Control ( )	Routine surveillance ( )
Export Control ( )	Technical support to industry ( )
Research ( )	Other (Specify) ( )

3.6.11 List the services the laboratory does not perform but could be capable of undertaking. Explain.

_____

_____

_____

_____

3.6.12 What is required for the implementation of the service?

Financial resources ( )	Human resources ( )
Request for service ( )	Consumables ( )
Legislative requirements ( )	Other (Specify) ( )

4.0 Quality Assurance Programmes

4.1 Has the laboratory implemented a quality management system?

Quality Assurance	Yes ( )	No ( )
Quality Control	Yes ( )	No ( )

4.2 Indicate which of the following elements of a quality management programme exist at the laboratory and in which analysis or group of analyses.

Elements of QA/QC programme	Exist
Quality Manager	
Quality Assurance Unit	
Quality Manual	
Review schedule for manual	
Environmental Controls	
System for laboratory waste disposal	
Calibration of equipment	

Preventative maintenance programme for instruments Control charts Documented standardized procedures and methods Internal Control of laboratory procedures (for example procedures conducted on a regular basis for the distribution of blind spiked samples for laboratory tests to ensure quality of results obtained) Use of standards and reference material Test report forms Procedure to authorise staff to issue and sign the results of analysis	

4.3 State the basis of the QA programme

ISO/IEC Guide 17025 ( ) ISO Guide 9000/2000

Other, specify ( )

4.4 List the group of analyses and/diagnostic test in which the QA/QC system exist?

_____

_____

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_____

4.5 Is the laboratory accredited or certified for any of its procedure?

Yes ( ) No ( )

4.6

If "Yes", please indicate the nature of the accreditation body	If "Not", why
Governmental ( )	Government Policy ( )
Private National Body ( )	Policy of laboratory management ( )
International ( )	Lack of funds for accreditation ( )
Name of Agency ( )	Lack of funds to strengthen or implement the QA programme ( )
Address of Agency ( )	Other (Specify) ( )

If “Yes” specify the scope of accreditation, for example, pesticide residue analysis, and water analysis).

_____

_____

_____

_____

4.7 Has the laboratory participated in national or international proficiency testing programmes?

Yes ( ) No ( )

Name the programme and state the length of time the laboratory has been enrolled in the programme.

_____

_____

_____

4.8 List the parameters involved in the proficiency programme

_____ _____

_____

_____ _____

_____

_____ _____

_____

4.9 How would you rate the results of each test in the proficiency programme?

Programme	Satisfactory	Questionable	Unsatisfactory/ Unacceptable

If “unacceptable” give reasons.

_____

_____

4.10 State which of the following procedures in the quality system are documented.

Documents on	**Yes**	**No**	**Last date of review**	
			Date	**Periodicity**

4.11 Analytical procedures are according to methods described by:

- USEPA (United States Environmental Protection Agency)
- AOAC Official Methods
- AWWA/APHA Methods of analysis of water and waste water
- OIE Manual of standards for diagnostic test and vaccines
- FDA Bacteriology analytical manual
- APHA Compendium of Methods
- USDA Methods
- ISO Standards
- IUPAC
- ICMSF Micro-organisms in food
- CMMEF
- Scientific literature
- Other

5.0 What standards or reference samples do you use?

_____

_____

_____

_____

5.1.1 Sample handling

5.1.2 Is there a person assigned for receipt of samples?

Yes ( ) No ( )

5.1.3 Are there documented criteria for the receiving or rejecting of samples?

Yes ( ) No ( )

5.1.4 Are there documented criteria for the recording of samples?

5.1.5 Is there a permanent record of samples received?

Yes ( ) No ( )

5.1.6 Are there procedures for sample disposal?

Yes ( ) No ( )

6.0 State in what aspects your organisation needs assistance to help it achieve its objectives

_____

_____

_____

7.0 Service to other laboratories

7.1 Is the laboratory able to offer training to technicians from other laboratories?

Yes ( ) No ( )

If yes state areas where training can be made available.

_____

_____

7.2 Does your laboratory act as a reference or contracted laboratory for any other country?

Yes ( ) No ( )

7.3 If the answer is “Yes”, list the countries that use your laboratory.

_____

_____

7.4 Are there any services which you think your laboratory can act as a reference or contract laboratory for other countries?

Yes ( ) No ( )

If “Yes” list the services.

_____

_____

Rationalisation of laboratory services

8.1 What are your views on the rationalisation of laboratory services on a regional scale?

_____

_____

_____

8.2 State how your laboratory could be of assistance in such a system.

_____

_____

_____

8.3 State how your laboratory could benefit from such a system.

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8.0 General Comments

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