A REPORT

Baseline Assessment
of
Capacity and Skills for micronutrient, food quality and safety analysis including rapid assessment and validation of equipment, supplies and accessories requirements

for

Drug & Food Quality Control lab, Ministry of Public health (MoPH), Central Lab, Kabul

Central Veterinary Diagnostic & Research Laboratory (CVDRL)
Ministry Of Agriculture, Irrigation & Livestock (MAIL), Kabul
&

Food Analysis Laboratory, Ministry of Public Heath, Nengerhar

Under Project

Building the Capacity of Public Sector Laboratories in Afghanistan in order to improve their Regulatory Capacity for Food Fortification and Food Safety

Submitted to
Global Alliance for Improved Nutrition
Kabul, Afghanistan
Conducted by

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Laboratory Assessment Report

Table of Contents

List of Abbreviations

AAS	Atomic Absorption Spectroscopy
ACH	Air Changes per Hour
AOAC	Association of Analytical Communities
ANSA	Afghan National Standards Authority
ACCI	Afghanistan Chamber of Commerce & industries
CRM	Certified Reference Material
CVDRL	Central veterinary Diagnostic & research laboratory
DFQCL	Drug & Food Quality Control Laboratory
ELISA	Enzyme Linked Immuno Sorbent Assay
FTIR	Fourier Transform Infrared Spectroscopy
FAL	Food Analysis Laboratory
FTL	Food Testing Laboratory
GAIN	Global Alliance for Improved Nutrition
GC	Gas Chromatography
GC/MSMS	Gas Chromatography- mass spectrometry
HPLC	High Performance Liquid Chromatography
HVAC	Heating, Ventilation & Air conditioning
ISO	International organization for standards
IDEA-NEW	Incentives Driving Economic Alternatives for the North, East and West
LC/MSMS	Liquid Chromatography – Mass Spectrometry
LIMS	Laboratory Information Management System
MoPH	Ministry of Public Health
MAIL	Ministry of Agriculture, Irrigation & Livestock
NGO	Non-Governmental Organization
OIE	World organization for Animal Health
PT	Proficiency Testing
QM	Quality Manual
QA	Quality assurance
RM	Reference Material
SOP	Standard Operating Procedure
TAT	Turn Around Time
UN-WFP	United Nation- World Food Programme
UN-FAO	United Nation- Food and Agriculture organization
USAID	United State Agency for International Development

List of Tables and Annexures

Executive Summary

Fortification is adding vitamins and minerals to foods to prevent nutritional deficiencies. The nutrients regularly used in food fortification prevent diseases, strengthen immune systems, and improve productivity and cognitive development. Fortification is successful because it makes frequently eaten foods more nutritious without relying on consumers to change their habits. Fortified food provides many of the vitamins and nutrients according to our bodies need. GAIN is implementing a project focusing on improvement and capacity building of regulatory monitoring for fortified foods in Afghanistan. This program aims to increase the availability and access to fortified wheat flour, fortified edible oil and iodized salt by strengthening the regulations and enforcement environment for fortified foods as well as to initiate monitoring of these products at the consumption level. To meet Quality standards and labeling regulations, analytical instrumentation and quality analysis provides effective method for measuring the variety of micronutrients used in fortified food. GAIN will be working to implement a capacity building program in Afghanistan to enable the regulatory labs to perform their duties.

A laboratory assessment is essential to evaluate the capacity and capability of relevant food laboratories to analyze premixes and fortified food. Gaps are identified and needs assessed regarding current laboratory capacity, personnel capability and professional expertise, analytical instrumentation, quality management and infrastructure. Assessment of three facilities has been done that impact the quality of food and drug commodities produced and /or imported into or exported out of Afghanistan.

The Drug and Food Laboratory of the Ministry of Public Health (MOPH), Central lab, Kabul has been recently shifted to new location. Since building is still under renovation, laboratory is not fully operational. It may take few weeks when all equipment is installed and lab starts operations. Laboratory needs assistance in reinstallation of equipment/instruments, implementing ISO 17025, Quality manual, procedures, Log books and formats and record control practices. Safety of laboratory personnel is also not properly addressed. Personnel training in many laboratories related procedures and operations are needed. As such, three months training wouldn't be enough, this is best achieved through a well thought of continuous program that specifically addresses the laboratory technical and management needs. Other deficiencies are discussed in more detail in this report. Some sensitive instruments are needed to be re-installed and that would be done by manufacturer's engineer.

The second facility assessed and documented in this report is the Central Veterinary Diagnostic & Research Laboratory (CVDRL) of the Ministry of Agriculture, Irrigation and Livestock (MAIL). This facility is well setup and well run as it received a lot of support national and international organizations. The laboratory does not need much assistance in drafting procedures or policies as per ISO 17025 requirements. Since much of these are already in place. However, CVDRL has developed a draft of the Quality Manual (English version) as per ISO 17025 with the help of international consultants, that is yet not been finalized but in near future they are expecting to finalized and converted into their national language called Dari and both versions will be part of the laboratory's document database.
CVDRL has also completed formalities for procurement of HPLC, GCMS and AAS. These equipment are expected to be delivered at lab in next two months. They will need training to handle those equipments and establishment of their Standard operating Procedure (SOPs) and also they have requested GAIN to facilitate for the same.

The Food analysis laboratory at Jalalabad East Regional Hospital (JERH), Ministry of Public Health compound, Jalalabad, Ningerhar province, is lacking many essential features, laboratory, safety protocols and equipment. They are not implementing Quality Management System (ISO 17025) and good laboratory practices. Moreover, requisite documentation practices are not being followed. Internal audits are not in practice. This type of inadequate and suboptimal management system could present a challenge for implementation of management system, which is the requirement of accreditation.

On the basis of findings during assessment, capacity and capability to conduct quality and quantitative testes as per required parameters for various food products, especially for micronutrient analysis of fortified foods with their current facilities are summarized below:

Test Parameters	DFQCL, MoPH*	CVDRL, MAIL*	FAL, Jalalabad
Vitamins (A)	Yes	Yes	No
Vitamin	Yes	Yes	No
Iron			
Zinc	Yes	Yes	No
Iodine	Yes	Yes	No
Food Safety Parameters			
Mycotoxins (Aflatoxins, Ochratoxins)	Yes	Yes	No
Pesticides residues	Yes	Yes	No
Heavy metals	Yes	Yes	No
Antibiotic residues	Yes	Yes	No
Proximate analysis	Yes	Yes	No
Microbiology	Yes	Yes	No

*As per the objective of this assessment, MoPH and MAIL need to be strengthening with some new equipment, chemicals/media and laboratory aids in near future.

It is important to record that this information is not only needed for good laboratory management, it is also required for ISO 17025 standards accreditation.

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Background & Objective

GAIN is implementing a project focusing on improvement and capacity building of regulatory monitoring of fortified foods. This program aims to increase the availability and access to fortified wheat flour, fortified edible oil and iodized salt by strengthening the regulations and enforcement environment in Afghanistan for fortified foods as well as to initiate monitoring of these products at the consumption level.

Specific objectives are to:

Strengthen the regulatory framework, including support for the harmonization of standards for fortification with those of neighboring countries;
Strengthen the quality control system;
Strengthen public sector enforcement mechanisms; and,
Device and test a practical and feasible system to monitor coverage, consumption and potential impact of fortified foods.

In the framework of GAIN project, Assocom-India Pvt. Ltd. conducted laboratory assessment to evaluate the capacity and capability of 3 laboratories in Afghanistan to analysis premixes and fortified food.

The overall objective of this assessment was to conduct a gap analysis of laboratories in Afghanistan that can/will be provides details of capacity building activities to be delivered to the regulatory labs in support of the fortification program in Afghanistan to test micronutrients, especially for micronutrient analysis of fortified foods. A main focus of this assessment to assess laboratories; their current analytical capacities for micronutrient testing including:

a. Iodine in salt
b. Vitamin A and D in vegetable oil and ghee
c. Vitamin A, Vitamin B1, Vitamin B12, Folic Acid, Iron and Zinc in wheat flour
d. Food safety including but not limited to mycotoxins such as aflatoxins and visible inspection parameters

In addition, the testing of general food quality and safety parameters is covered. Gaps are identified and needs assessed regarding inter alia current laboratory capacity, personnel capability and professional expertise, analytical instrumentation, quality management and infrastructure. This report gives a comprehensive overall review of the present status of these laboratories and provides recommendations for improvements, investments, trainings etc. in the field of fortified food and food safety parameters.

Methodology:

The assessment is a snapshot of the present performance of the food laboratories. Thus, it covers only the facilities, equipment, staff which are in place at the time of the assessment. Following tools/methods were used for the assessment:

Questionnaire was developed as per scope of work. The questionnaire was comprised of the following sections: General information, quality management system, methods of analysis, equipment, buildings, premises, and personnel.

The visits to the food laboratories, comprising of meetings and discussions with the head of laboratory, quality manager and other laboratory staff supported with comprehensive laboratory tour including inspection of all equipment.

Pre assessment of Laboratory personnel was also conducted for through a customized questionnaire and customized test to assess the level of their understanding and skills for allocated job roles

Assessment Report

Of

Drug & Food Quality Control lab

Ministry of Public health (MoPH), Central Lab Kabul

General Information: Laboratory building and facilities

1. The Drug & Food Quality Control Lab (DFQCL) is Directorate of Ministry of Public Health (MOPH), Government of Afghanistan. Earlier, DFQCL lab was in housed in MoPH compound with lack of various facilities and operation area. With effect from February 20, Now The DFQCL has been shifted to new location in west of Kabul Province at Afshar Main Street, Vaccine Making Bus Stop behind Dawat University. Though, couples of important equipment are still to be shifted. They don't have yet required fixtures and furnitures for make it operational.

2. Laboratory building still under renovation and it is lacking many essential facilities (faucets and sink), Laboratory safety procedures required and security system for a Quality Control Laboratory. It is also observed that the security system is non-existent. It is free entry for all staff/visitors to premises without any restrictions.

3. The DFQCL is now established in build-up area of $14.62m^2$ X $47.41m^2$ (approx.), separated with different sections. Copy of Floor layout is attached in annexure 1.

4. Power supply appears to be adequate and DFQCL, also has generators facility but that still needs to be start automatically during current outage. Also for the sensitive equipments uninterruptable power system (UPS) is required.

5. Water supply (normal and Deionized/distilled) to the laboratory is available but is limited.

6. Space for storing supplies and tools, such as cabinets and drawers are available but not in use and kept in the corridor of the laboratory. More importantly, cold storage (refrigerators and freezers) is inadequate and sub-optimal. It is a big challenge for implementing the separation of reagents, testing samples and control material which is one of the accreditation requirements.

7. It also has been noticed that for some of the departments like Water and toxicology there is not enough space to conduct analysis and also for equipments as well. Refrigerators are still lying in corridors and also many of the chemicals and reagents required for analysis are yet not been shifted to the new location. All rooms and departments are needs to re- locate according to the need of analysis and space required.

8. Also, all equipment and reagents etc. are required to be reinstalled and re-arranged. In addition, during transportation, there is a number of equipments were damaged and kept uninstalled in the rooms that should be either fixed and installed Many antiquated equipments are also available which should be retired and removed

from the DFQCL. Storage of unusable equipment in the lab (either on work benches or the floor) is both a waste of valuable space and a safety hazard.

9. The DFQCL facilities lack proper ventilation system which is not only a safety and comfort issue but also a performance problem as many analytical instruments are sensitive to temperature and humidity fluctuations.

10. Laboratory safety is a major challenge due to lack of proper safety procedures and equipment However, one such requirements that is part of the Infrastructure challenges are the lack of proper modern chemical and biological safety cabinets and chemical safety storage cabinets.

11. Laboratory does not follow good housekeeping practices; cleaning schedule is not at all in place. No waste management system is existed.

Personnel

1. The food laboratory has total 9 technical staff including lab managers. The Directorate has two sections: the Drug Section and Food & Water Section, and two offices: Registration and Administration. Each Section or Office is managed by a Section/Office Head. The two Sections are organized by type of testing to be performed. The Drug Section has 6 types of testing: Physical Chemistry, Herbal Medicine, Microbiology, Pharmacology & Toxicology, Cosmetics and Biochemistry. The Food & Water Section has 4 testing types: Physical Chemistry, Water Chemistry, Bacteriology and Toxicology. Each testing type or area is managed by one area Head (Dr. Hamid Furmuly). Copy of organization chart is attached in **Annexure – II**.

2. They have qualified Pharmacists **(listed in Table 1)** who have been working for FTL from last 5 to 15 years. Most of them have basic knowledge about food testing equipment and basic testing parameters, methods and reporting, etc.

3. An exclusive training had been conducted by Assocom-India Pvt. Ltd. under the contract of **UNITED NATION- WORLD FOOD PROGRAM (UN-WFP)** in 2016. List of parameters are mentioned in **Table 2** under which laboratory personnel were trained. Based on Post training assessment of personnel, their job responsibilities were also defined by Assocom **(listed in Table 3)**. However, they don't have regular samples for various tests during last 5 months due to shifting of the DFQCL, As such; staff could not conduct any tests and reporting during last few months. With initial orientation and assessments, it is observed that they may need to retrain in some of the analysis.

Quality Management System

The DFQCL is not accredited/ certified by any national and international recognition. They are not implementing Quality Management System (ISO-17025) and Good laboratory practices. They don't have Quality manual. In addition, good documentation practices are not being followed. Internal audits are not conducted on regular basis. Neither it is ever monitored/ inspected by any request senior officials of the MoPH.

This type of inadequate and suboptimal management system could present a challenge for implementation of management system, which are the requirements of accreditation.

Method and Sampling

1. FTL is currently analyzing 400 samples/ year (approx). They receive samples of food and water from Government for analysis. Custom and other private sectors have stopped sending their sample since December 2016, may be due to shifting of the DFQCL. Details of sample and parameters are mentioned in **Table 4**.

2. Laboratory has separate sample registration room where samples are received and archived. Drugs and Food samples are archived in one room where shelves are not identified for segregation. Even environmental conditions are not maintained.

3. Separate logbook is maintained by laboratory for sample collection including several details like Serial number, item, weight, manufactured date, Expiry date, batch no., industry, laboratory identification no. and date of issuance of test certificates.

4. The turnaround times (TAT), time between reception of sample and reporting the results) of the laboratory are short, approximately 1 to 3 days. There is no mandatory target for TATs.

5. Testing of fortified foods:– Currently, iodine is analyzed by titration in salt samples. Vitamins, Folic acid and Iron are not tested. Though staff has been trained in 2016 Under (UN-WFP) in Vitamin A analysis in fortified flour and premixes, but due to lack of sample they could not practice.

6. In the microbiological laboratory, staff had been trained on various microbiological analyses on total plate count, yeast and moulds, *E. coli*, and *Staphylococcus aureus*, but they didn't perform any analysis due to lack of samples. Currently they perform only water analysis with some non compliance method.

7. Proximate analysis (the relevant nutritional parameter) such as ash, water and protein content, carbohydrates, fat, peroxide value and acidity are analyzed in food samples routinely.

8. CRM and RM are available but are not stored properly, which might get affected/cross-contaminated in purity.

9. Laboratory has some relevant literatures for their reference, available literature are AOAC, Chemical analysis of food and ISO standards provided by ANSA.

10. Some of standard operating procedures of testing method and work instruction are available. But numbers are not yet been identified.

Equipment's

1. Since inventory of equipments has not been maintained, a significant amount of important information is missing. Much of this gap is most likely due to the lack of good record keeping (document control).

2. Laboratory also has not involved in Calibration and Maintenance of instruments. Some instruments require daily calibration or before every use while others only require annual calibration. Calibrations may be performed by the end user (lab staff) for some instruments or by the manufacturer for other instruments. Still, many instruments may require frequent calibration by the end user (e.g. weekly) and also a scheduled calibration by the manufacturer (e.g. annual). It is important that calibration is e done for all essential instruments in timely manner.

3. All these requirements must be easily accessible and must be managed by the Head of Quality Assurance of the laboratory. The last calibration date is obviously important to ensure that instruments are always ready for use as needed.

4. List of equipments are mentioned in **Table 5**.

Recommendations

1. Since DFQCL is still under shifting and renovation, it has hampered scheduled training agenda therefore, it is highly recommended that shifting and re-installation of equipment should be completed at earliest. Though Assocom team has volunteered to assist them in reinstallation of equipments and setting up of physic-o-chemical and microbiological labs during weekends.

2. The laboratory has several unique storage needs that must be implemented to satisfy accreditation requirements. In addition, proper laboratory storage space is important because it provides better efficiency, minimizes cluttering and promotes laboratory safety. In addition to base and wall cabinets the laboratory needs to have a dedicated storage room for common supplies and disposables. Hazardous chemicals such as acids, corrosives and volatile chemicals may be stored in chemical safety cabinets (see "Safety" below) or refrigerators, depending on storage temperature requirements. Small volumes of common chemicals that are used frequently may also be kept on the bench or stored in the wall mounted cabinets. Sufficient cold storage must be available in the laboratory. Typically, this requires refrigerators (4°C) and freezers (-20°C to -80°C). Storage may also be needed depending on the type of samples and controls/standards being used. ISO 17025 standard requires that storage test samples, controls and standards, and reagent kits must be stored physically apart. Ideally, the use of multiple freezers and refrigerators in the laboratory is required.

3. Proper ventilation of laboratory settings is required to promote and maintain laboratory safety and to keep sensitive instruments at their optimal operating conditions. Items such as fume containment, worker safety, filtration, air changes per hour (ACH), Point of fume capture, temperature, and relative humidity requirements are all necessary elements in the laboratory ventilation system. Although much of the lab ventilation requirements are engineering issues as there are certain fundamental concepts that need to be understood and implemented by laboratory personnel and management. HVAC engineers will be able to determine the most appropriate air exchange rate once all systems in the lab (equipment and fumes hoods) are in place and working properly.

4. Laboratory safety is a complex set of rules and procedures that are based on national or international regulation or standard with the goal of protecting the laboratory. It is recommended that, important safety features should be installed in the laboratory as standard features, as listed below.:
    a. Fume Hood
    b. Fire safety equipment
    c. Chemical safety equipments
    d. Signs and posters

5. The Waste management facilities should be operational at the waste collection sites, the following simple steps can be easily implemented.

    a. Properly designated, clearly labeled waste bins for regular trash and hazardous waste must be provided n all sections of the laboratory facility.

    b. A clear SOP for the collection and proper disposal of different types of waste (regular trash, chemical, biological and radioactive hazards, liquid and solid waste) should be drafted.

    c. An on-site incinerator to neutralize most biological and chemical hazards should be included in the laboratory infrastructure. This is usually installed outside the laboratory building.

6. Laboratory has good collection of equipments; since lab has shifted to new location currently these are not operational and require reinstallation. Some of that can be done by internal staff and externally for the installation of sensitive instruments like HPLC, GC, and FTIR. Due to lack of training it is recommended that reinstallation should done by authorized engineers

7. As instruments have not been used for a long time, these are to be re-installed and calibrated.

8. Based on the scope of work provided by GAIN, the DFQCL is required to be equipped with some additional equipment, chemicals/ reagents/ Medias and laboratory aids. **(listed Table 6)**. Also, Some of the test parameters has different methods of analysis, based on the decision of equipment to be procured test methods would be finalized which may require further reagents or laboratory aids, later.

9. In order to facilitate ease of use and accessibility to accreditation, the QM procedures were sub-categorized into Management and Technical Procedures and were numbered according to ISO -17025 requirements which should be assisted by the Trainer.

Table 1: List of laboratory staff

S. No.	Name of Personnel	Designation	Education Qualification	Experience
1	Mr. Basir Ahmad	General Manager	BSc. Pharmacy	5years
2	Ms. Nadera	Manager	BSc. Pharmacy	8
3	Miss. Rabha	Analyst	Graduated of medium medical institute	25
4	Ms. Najia	Analyst	BSc. Pharmacy	3
5	Ms. Liluma	Analyst	BSc. Pharmacy	7
6	Mr. Salim	Manager	BSc. Pharmacy	5
7	Ms. Nasrin	Analyst	BSc. Pharmacy	7
8	Mr. Mohamd Aman	Manager	BSc. Pharmacy	10
9	Ms. Malaly	Analyst	BSc. Pharmacy	25
10	Mr. Habib ulla	Manager	BSc. Pharmacy	5
11	Ms. Negena	Member	Graduated of private medium medical institute	3
12	Mr. Ghulam Naqshband	Member	Graduated of medium medical institute	10
13	Ms. Fatema	Member	Graduated of medium medical institute	10
14	Mr. Mohammad Fahem	Member	Graduated of medium medical institute	2

Table 2 : Laboratory staff had been trained by Assocom with UN-WFP in 2016.

Chemical Test Parameters	Microbiological Test Parameters	Instrumentation Test Parameters
Moisture analysis Total Ash Acid insoluble Ash Gluten Determination Soxhlet for Crude fat Total Protein By Kjeldahl Crude fiber determination Hydrogen Ion Determination (pH) Refractrometer Alcoholic Acidity	Total Plate Count Yeast and mold count Detection and enumeration of *S. aureus* Detection and enumeration of *E. coli*	Vitamin A analysis By HPLC Iron by Spectrophotometer

Note: They need to be retrained and they should practice for few months in presence of a trainer.

Table 3: Job responsibilities of Laboratory staff after Post assessment of Training under UN-WFP

S. No.	Name of Lab personnel	Designation	Area of Work	Job Responsibility
1.	Mr. Basir Ahmad	Manager	Food and water Lab	Vitamin A analysis and Iron
2.	Mr. Salim Jawed	Analyst	Food Chemical	Total protein, Crude fiber, Fat, Moisture, Ash, Acid insoluble ash, gluten determination, Alcoholic acidity, pH
3.	Mrs. Nadera	Analyst	Food Chemical	Vitamin A analysis and Iron
4.	Mrs. Nasrin	Analyst	Food Chemical	Vitamin A analysis and Iron
5.	Mrs. Rabia	Analyst	Food Chemical	Total protein, Crude fiber, Fat, Moisture, Ash, Acid insoluble ash, gluten determination, Alcoholic acidity, pH, Refractometer, vitamin A, Iron
6.	Mrs. Najia	Analyst	Food Chemical	Total protein, Crude fiber, Fat, Moisture, Ash, Acid insoluble ash, gluten determination, Alcoholic acidity, pH, Refractometer, sample extraction for HPLC
7.	Mr. Mohd . Aman	Analyst	Food Microbiology	Total plate count, *E.coli*, *S. aureus*, yeast and mold count
8.	Mrs. Malaly	Analyst	Food Microbiology	Total plate count, *E.coli*, *S. aureus*, yeast and mold count
9.	Ms. Nageena	Analyst	Food Microbiology	Total plate count, *E.coli*, *S. aureus*, yeast and mold count

Table 4: list of parameters and sample currently laboratory analyze

S. No.	Parameters	Sample type
1.	Moisture	Oil & Fat, Salt, Cereal Spices, Dietary Products Beverage, Ice cream, Dates, Conservers, Gum, Sweets and Different food such as raw material of food and beverage and water
2.	Ash	
3.	Acid insoluble Ash	
4.	Gluten	
5.	Fat	
6.	Fiber	
7.	Protein	
8.	Sugar Profile	
9.	Peroxide value	
10.	Alcoholic acidity	
11.	Acid value	
12.	Iodine	
13.	Iron	
14.	Coliforms	
15.	Refractive Index	
16.	Vitamin A	

Table 5 : List of Equipments available MoPH lab

S. No.	Equipment Name	Make	Date of purchasing	Operating manual are available (yes/ No)	Working Status		Remarks or comments
					Yes	No	
1.	HPLC (SHIMADZO)	Japan	2012	YES	yes		Need re installation and training
2.	HPLC (Agilent)	USA	2007	YES	yes		Need re installation
3.	GC (SHIMADZO)	Japan	2012	YES	yes		Need re installation and training
4.	Soxhlet apparatus	China	2015	YES	Yes		
5.	Coarse Fiber determinator	India	2015	YES	Yes		
6.	Moisture balance	Japan	2012	NO	Yes		
7.	Muffle Furnace		2015	YES	Yes		
8.	Muffle Furnace	Germany		No	Yes		
9.	Muffle Furnace			No	No		
10.	Balance	USA	2007	NO	Yes		
11.	Centrifuge	Uk		yes	No		
12.	Centrifuge			No	Yes		
13.	Centrifuge			No	Yes		
14.	Water both	Pakistan		NO	yes		
15.	Water both				yes		
16.	Ultra sound Water both			yes	yes		
17.	distilled water apparatus (MQ water)	Sweden	2015	YES	Yes		
18.	Distilled water apparatus	Germany		No	Yes		
19.	Oven			NO	Yes		
20.	Shaker		2010	No	Yes		
21.	Vortex (Shaker)	India	2016	Yes	Yes		
22.	Hot plate	Germany		No	Yes		
23.	Melting point apparatus	Chkosolvkia		No	Yes		
24.	Refract meter	Germany		No	Yes		
25.	PH-meter		2015	yes	Yes		

26.	PH-meter	UK	2007	No	No		
27.	Iron checker			Yes	Yes		
28.	Sand both			No	No		
29.	Iodine checker			No	Yes		
30.	Kjeldhal Unit	Germany	2016	Yes	Yes		Need Re installation and training
31.	Kjeldhal Unit	Italy	2015	Yes	No		Need Re installation
32.	Spectrophotometer	Japan	2010	yes	Yes		
33.	Spectrophotometer	USA	2007	No	No		
34.	FTIR	JAPAN	2007	yes	Yes		Need training
35.	Refrigerator	JAPAN		No	Yes		
36.	Refrigerator	PAKISTAN	2010	No	No		
37.	Incubator		2010	Yes			
38.	Oven		2010	No			
39.	Autoclave		2010	No			
40.	Autoclave		2016	yes			
41.	Autoclave			yes			
42.	Water bath	PAKISTAN	2016	Yes			
43.	Laminar flow cabinet	PAKISTAN	2010		Yes		
44.	Laminar flow cabinet	PAKISTAN	2016		Yes		
45.	Microscope	JAPAN	2010	Yes	Yes		
46.	Colony counter	GERMANY	2010	Yes	Yes		
47.	(water testing kit)	GERMANY	2010	No	No		
48.	Microscope plus camera	JAPAN	2012	yes	Yes		
49.	Synergy Tm HT multi-mode microplate & auto plate washer (ELISA)Reader)	USA	2012	Yes	No		
50.	Polar meter		2016	Yes	Yes		Need standard
51.	Vacuum pump	Germany	2007	No	Yes		

Table 6: List of Equipment, Chemicals/ medias and other laboratory aids need to procure for strengthen the capacity and capability of lab according to the scope of work provided by GAIN

Sl. No.	Analysis	Screening Requirements	Equipments to be procured
1.	Vitamin A	HPLC, LC/MSMS	HPLC, AAS, LCMSMS For vitamin B - Screening kits are available in the market that may can be Procured For Aflatoxins: MoPH central lab has Elisa Reader but Kit is not available, need to be procured. Reference Standards for Vitamin A, B, Iron, Zinc, Folic Acid, Aflatoxins (M1, M2, G1, G2), Ochratoxin And Pesticides need to procure
2.	Vitamin D	HPLC, LC/MSMS	
3.	Vitamin B1	HPLC, LC/MSMS, Screening kits	
4.	Vitamin B12	HPLC, LC/MSMS, HPLC, LC/MSMS, Screening kits	
5.	Folic Acid	HPLC	
6.	Iron	Spectrophotometric method	
7.	Zinc	HPLC/AAS	
8.	Mycotoxins e.g. Aflatoxins, orchatroxins etc.	HPLC and Elisa Kit	
9.	Pesticides residue	HPLC,GCMSMS,LCMSMS	

Media/Chemical required for Microbiological testing

Bacillus Cereus

Media/ Chemical	***Quantity (in gms)***	***Quantity required for 100 sample (in Nos)***
Mannitol-eggyolk- polymyxin (MYP) Agar	500gms	04
Trypticase soy-polymyxin broth	500gms	04
Gram stain Kit	NA	01
Malachite Green stain	100gms	01
Nitrate broth	500gms	02
MR-VP Broth	500gms	02
Phenol red glucose broth	500gms	02
Tyrosine agar	500gms	02
Nutrient broth	500gms	02
α napthol	100gms	01
potassium hydroxide	500gms	01
Motility agar	500gms	01
Sulphanilic acid	100gms	01
α- napthylamine	100gms	01
Zinc dust.	100gms	01
Tyrosine agar	500gms	02

Salmonella

Media/ Chemical	***Quantity (in gms)***	***Quantity required for 100 sample (in Nos)***
Buffered peptone water	500gms	04
Rappapot-vassiliadis magnesium chloride – Malachite green medium	500gms	04
Selenite F broth	500gms	04
L- cystine medium	500gms	04
Phenol red/ Brilliant green agar	500gms	02
Xylose Lysine Deoxycholate (XLD) Agar	500gms	04
Bismuth Sulphite Agar	500gms	04
Nutrient Agar	500gms	02
Triple sugar iron agar	500gms	02
Urea agar	100gms	01
l-lysine decarboxylation medium	500gms	01
β- Galactosidase reagent	500gms	01
0- nitrophenyl β – D- galactopyranoside (ONPG) Solution	100gms	01
Creatine Solution (N-amidinosarcosine)	100gms	01
Tryptone medium	500gms	01
Kovac's reagent	-	02
Anti O serum (monovalent or polyvalent)	-	02
Anti Vi serum (monovalent or polyvalent)	-	02
Anti H serum (monovalent or polyvalent)	-	02

Listeria monocytogenes

Media/ Chemical	***Quantity (in gms)***	***Quantity required for 100 sample (in Nos)***
Half Fraser broth with lithium chloride, sodium salt of nalidixic acid, acriflavin hydrochloride, ammonium iron(III) citrate, sodium hydroxide	500gms	04
Fraser broth with lithium chloride, sodium salt of nalidixic acid, acriflavin hydrochloride, ammonium iron(III) citrate, Sodium Hydorxide	500gms	04
Oxford Agar base, supplemented with cycloheximide, colistin sulfate, Acriflavine hydrochloride, cefotetan, Fosfomysin, ethanol	500	04
PALCAM agar base supplemented with polymyxin B sulfate solution, Acriflavin hydrochloride, sodium ceftazidime pentahydrate	500gms	04
Tryptone Soya yeast extract agar	500gms	02
Tryptone Soye yeast extract Broth	500gms	02
Sheep Blood agar	500gms	02
Carbohydrate utilization broth	500gms	02
rhamnose	100gms	01
xylose	100gms	01
Christie, Atkins, Munch-petersen (CAMP) Medium	500gms	01
Hydrogen peroxide solution	100gms	01
Phosphate buffered saline	500gms	01

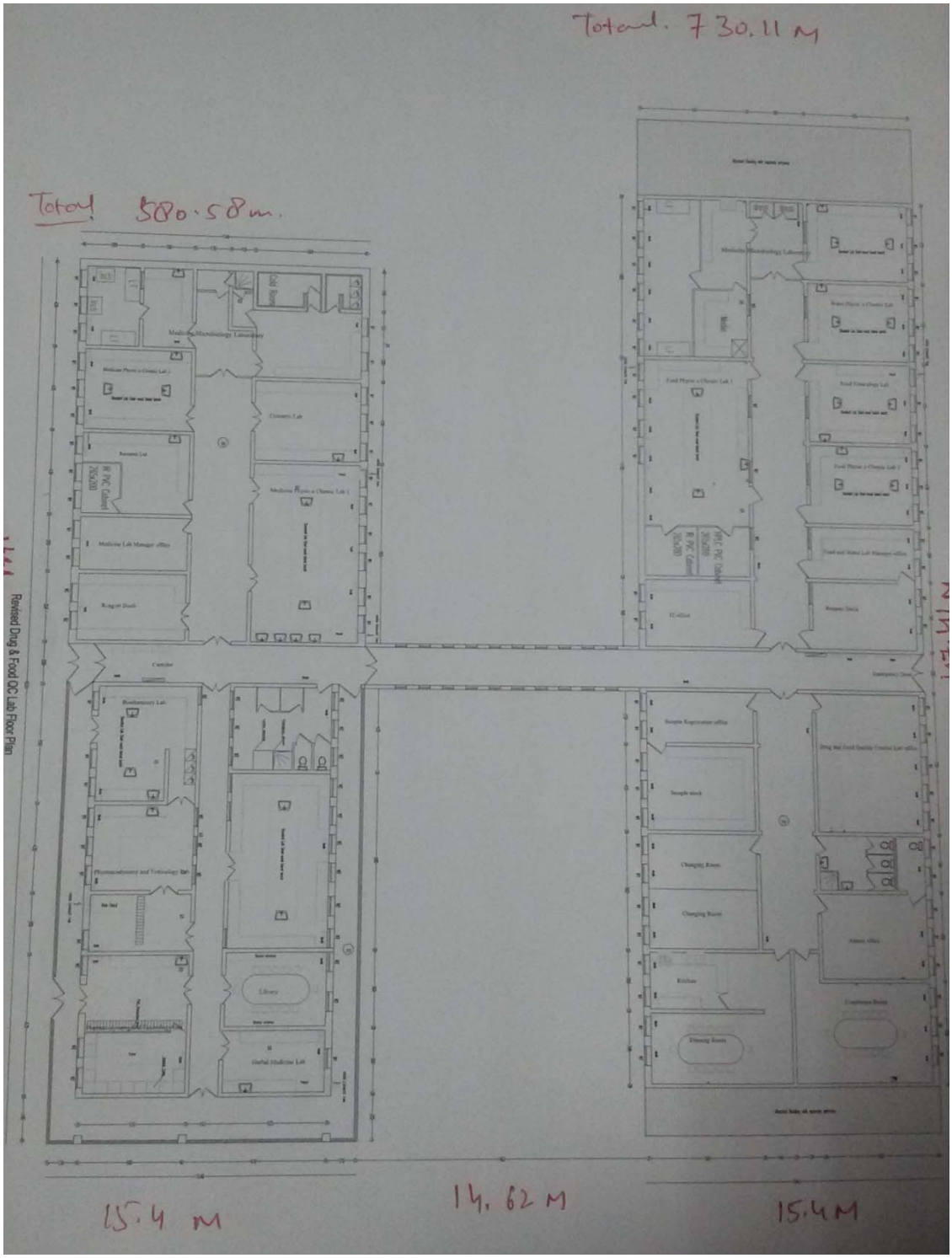
Others

Media/ chemical	Quantity (in gms)	Quantity (in Nos)
Potassium tellurite solution	100gms	01
Lactophenol blue	100 gms	01
Sodium chloride	500gms	01
Agar- Agar	500gms	01
Stomacher bag / SS Blender for homogenization of food sample	-	01
Filteration Assembly	-	01
Class II Biosafety cabinate		01
Nutrient Broth	500gms	02
Sulfamethazine	100 gms	01
Sodium Hydroxide	500gms	02
Etylenediamine tetraacetic acid (EDTA)	500gms	01
Biological autoclabe indicators		2 packs
Ethanol		
Fogger for fumigation		01
Disinfectant		
MacConkey Broth	500gms	04

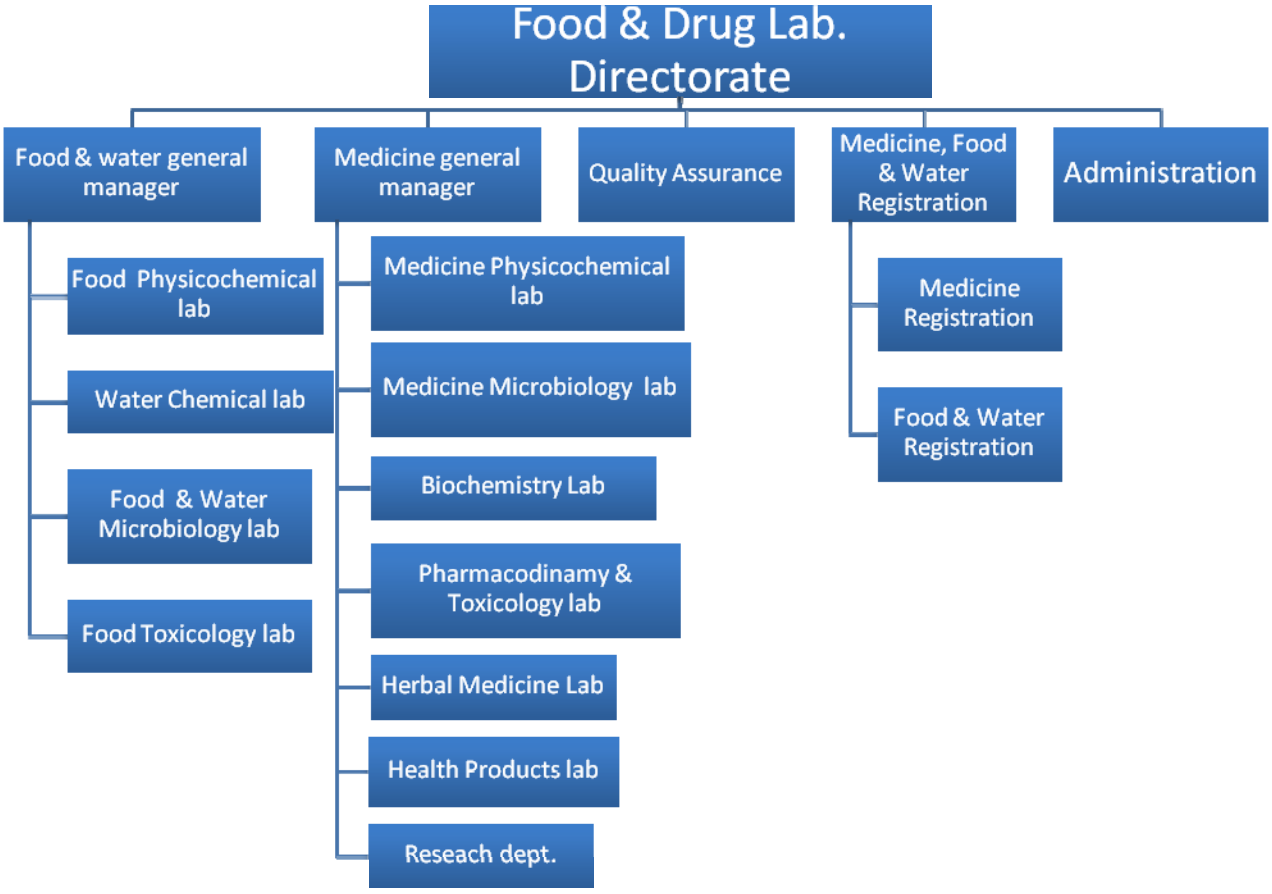
Reference standards

Reference culture	ATCC Number	Quantity
Bacillus cereus	11778	01
L. monocytogenes	19111	01
Salmonella typhimurium	14028	01
L. innocua	33090	01
S. aureus	25923	01
Rhodococcus equi	6939	01
Escherichia coli	25922	01

Annexure I - Floor layout of Drug & Food Quality Control Lab



Annexure II - Organization chart of Drug & Food Quality Control Lab



Assessment Report

of

Central Veterinary Diagnostic & Research Laboratory (CVDRL)

Ministry Of Agriculture, Irrigation & Livestock (MAIL)

General Information: Laboratory Building and Facilities:

1. The central veterinary diagnostic & research lab (CVDRL) is located at Sanaturum street, Darulaman road, Kabul and directorate by Ministry of Agriculture, irrigation & livestock.
2. CVDRL is supported and recognized nationally and internationally namely. Following are the listed below:
    a. MAIL
    b. World Bank
    c. UN-FAO
    d. USAID
    e. OIE

3. CVDRL is surprisingly inspected by MAIL but purpose of their visit and area inspected is not documented neither recorded.

4. The laboratory has total area of 150m2 (approx.) and separated in 20 rooms with different sections. Copy of floor layout is attached in Annexure III.

5. Sample receiving and storage is conducted in designated areas which are separate from the main part of the laboratory. Laboratory has areas of specialized testing are separated from general work areas. Chemical, standards and reference materials and cultures are stored separately from samples. Microbiology media preparation and sterilization areas are separated from work areas to prevent contamination of clean media.

6. The CVDRL has well setup facility and clean conditions and equipped with many hi-tech instruments. The good standard of housekeeping was noted, cleaning schedule is also in place.

7. The Laboratory has generators or Uninterruptible Power Supply (UPS) systems. However, because of some sensitive instruments laboratory are also equipped with voltage regulators (stabilizer) due to fluctuations of the electricity network.

8. The laboratory has designed to provide space and proper environmental conditions for optimal sample storage, handling, analysis and calibration, in accordance with general laboratory practices and safety. Laboratory has equipped with climate and ventilation control. The temperature and humidity within the laboratory are maintained. Laboratory also has separate fume hood cabinets for hazardous, inflammable, odorous and toxicant chemicals.

9. Laboratory has separate storage area in the laboratory to ensure that glassware, microbiological media, supplies, reagent, solvents, chemical, hazardous or regulated wastes and reference standards and materials are properly stored.

10. Workbench space is sufficient to perform operations and to prevent clutter.

11. CVDRL has facilitated with safety measures like fire extinguisher, fire alarms and First Aid kit for emergency.

12. CVDRL is secured and has optimal security system to access the some area of the laboratory like at entrance, reference culture room etc. Access is controlled by keycards/ passwords of the responsible and authorized person only.

13. Purified laboratory water is produced by water distillation unit and deionization systems

14. CVDRL has adequate procedure for waste handling, waste bins are clearly marked for different type of waste produced, CVDRL contracted locally for normal and nonhazardous waste and they also have incinerator for organic waste as well.

Personnel

1. The total number of staff in CVDRL is 21, 19 are technical including the head of laboratory and other 2 are involved in cleaning. CVDRL is head by Dr. Ghulam Mohammad Zaiy and Quality manger (Dr. Soraya Rafah). All staff of CVDRL are Qualified with appropriate degrees. Copy of organization chart is attached in Annexure IV.

2. Training of Personnel is in place and pre scheduled as well.

3. Personnel qualification file is in place and well maintained with their Job description, key responsibility area, training certificates and degrees.

Laboratory Management System

1. CVDRL has developed a draft of the Quality Manual (English version) as per ISO 17025 with the help of international consultants, yet not finalized but in near future they are expecting to finalized and converted into their national language called Dari and both versions will be part of the laboratory's document database. As part of their interest to pursue ISO 17025 accreditation they need to improve their performance in the area of document control, which is one of the main requirements for ISO accreditation.

2. Internal audits are organized on yearly basis by national (MAIL) and international recognition (OIE).

3. Quality control charts are in place and well maintained.

4. CVDRL also participated in several international inter-laboratory/ proficiency test. All PT results are well documented and have satisfactory results as well. In case of unsatisfactory results corrective actions are taken and recorded.

5. Since, CVDRL is mostly equipped with all the facilities required for analysis, but also subcontracted nationally and internationally; in case they are not able to perform or facilitate any analysis as well.

Method of analysis and sampling

1. CVDRL generally involves in Diagnostic of animal disease, Surveillance on new and present disease in animals, analysis of animal originated food products and animal feed, Export& Import products and training of laboratory concerns.

2. Laboratory receives sample from private sector, government, local bodies, NGO's, Custom and veterinary field units (national level)

3. The CVDRL has an impressive list of laboratory SOPs that have been developed by International consultants with funding provided by a number of organizations as mentioned above. The Standard Operation Procedures about validation of analytical methods and measurement uncertainty are not available. However, due to the fact that the laboratory is using exclusively only OIE specified standards, no full validation of the individual testing methods is conducted.

4. CVDRL has separate section for registration of samples where samples are registered and followed by LIMS (a Laboratory Information Management System (**LIMS**) is software that allows you to effectively manage samples and associated data to improve lab efficiency. By using a LIMS, lab can automate workflows, integrate instruments, and manage samples and associated information).

5. CVDRL also involves in sampling from veterinary fields and also procedures for sampling are also available with them.

6. CVDRL has separate space, refrigerators and deep freezers for sample storage providing adequate and optimal environment conditions as per the sample requirements.

Equipment's:

1. CVDRL is equipped with many state of art equipments and its staff is well acquainted with them. Inventory list is available and updated in place.

2. Equipments user manual and their operational log book, maintenance and calibration records are also well maintained.

3. Maintenance and calibration of equipments are handles internally and externally as well. Minor equipments like weighing balance, auto-pipette and other are maintained and calibrated by technical staff. For sophisticated equipments, laboratory has contracted some European companies as well. All records related to maintenance and calibration are well documented and in place.

4. CVDRL also has completed procurement formalities HPLC, GCMS and AAS and hopefully, would be delivered at lab in next few months. Though, they will require training to handle those equipments and establishment of their Standard operating Procedure (SOPs). They have requested GAIN to facilitate training for their staff for the same as well.

Recommendations:

As part of their interest to pursue ISO 17025 accreditation they need to improve their performance in the area of documentation control which is one of the main requirement for ISO accreditation. Document control covers all types of records including technical data, administrative and Managerial records. The document control and management procedure in the laboratory describes the process for controlling quality documents that form part of its management System. The quality documents include those required for the generation of laboratory data. These documents include those published by the laboratory and those published externally. Documents of external origin include regulations, standards, test methods, instructions and Manuals.

Based on assessment of the CVDRL facility that laboratory needs some assistance in Documentation control. In the near future they shall be implementing the recently drafted Quality manual, both those that cover management and technical laboratory procedures. The goal for implementing a document control system in the laboratory is to ensure that:

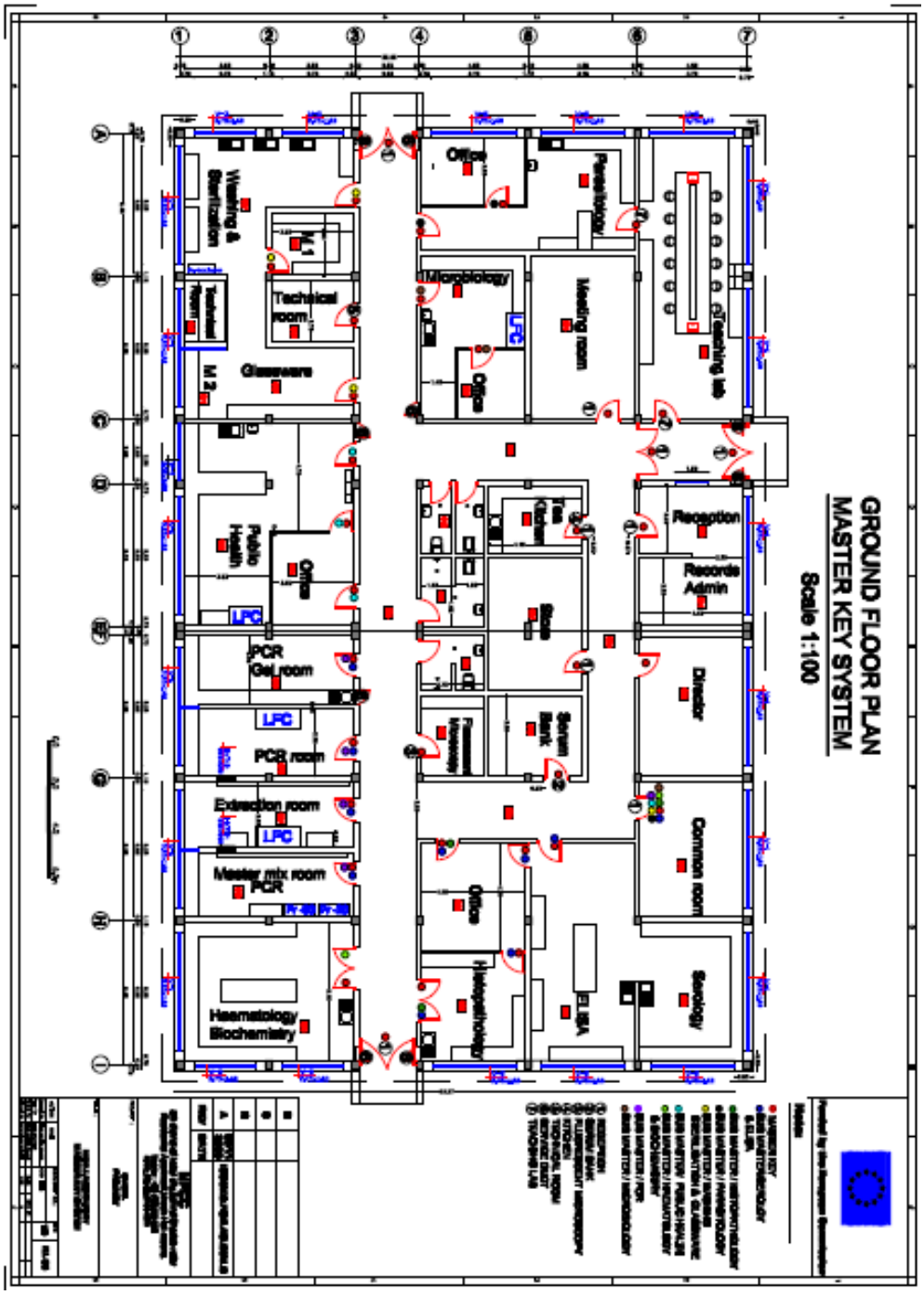
Management is aware of, and has approved, all documents used by staff to guide them in their laboratory work.

all documents specifying procedures have been checked by someone with appropriate Knowledge to ensure they are accurate, technically sound and unambiguous.

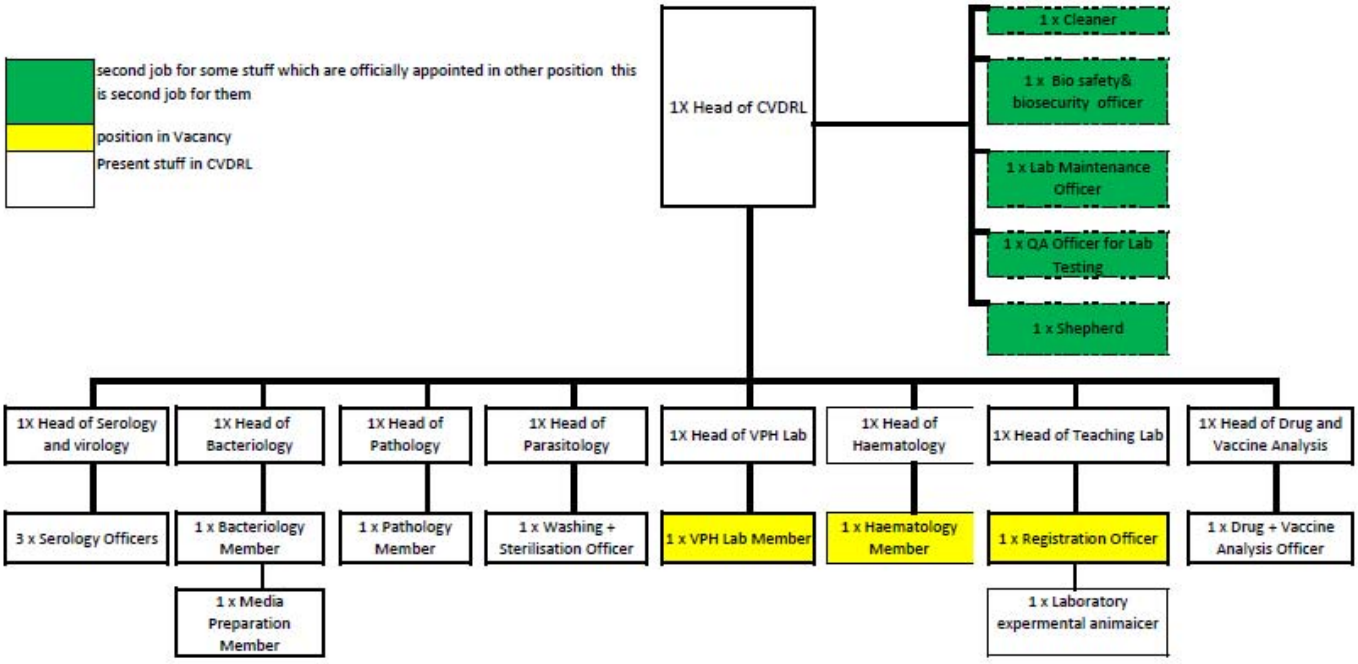
there is a record of the issuing of all copies of documents, so that if documents need to be reviewed, withdrawn or amended all copies can be subjected to the same Procedure.

Advanced training programme should be conducted in conjunction with installation of newly ordered equipments HPLC, GCMS and AAS so that it could be operationalise as soon as possible. Coordination between technical staff and manufacturer's engineer is must

Annexure III - Copy of Floor Layout



Annexure IV - Copy of CVDRL organization chart



Assessment Report

of

Food Analysis Laboratory

Ministry of Public Heath, Jalalabad, Ningerhar, Afghanistan

General Information: Laboratory building and facilities:

1. The Food analysis laboratory (FAL) is housed in the Jalalabad East Regional Hospital, Ministry of Public Health compound, Jalalabad, Ningerhar province. The building is not meant to house a laboratory facility and therefore it is lacking many essential features which are required for the laboratory.

2. Area of laboratory is about 100m^2 is separated with 4 rooms
    a. Physico-chemical lab
    b. Chemical preparation room
    c. Sample registration room
    d. Documentation

3. Working space is limited and rooms are cluttered with equipment, samples and empty reagent bottles and other unnecessary things, leaving little space for lab scientists to do their work. There is less desk space to handle paperwork, carry out computer analysis and other administrative work.

4. Cleaning of FAL are not in place as equipments, glassware, work stations are untidy, unmanaged and not cleaned which constitute a safety hazard. Since Hospital has incinerator facility for waste management in compound itself, laboratory is also using the same for their waste produced.

5. Power supply appears to be adequate. Water supply (regular and filtered/distilled) to the laboratory is available. Faucets and sinks are limited in number and size.

6. Space for storing supplies and tools, reagents and others such as cabinets and drawers, is very limited. More importantly, cold storage (refrigerators and freezers) for CRM, RM are not available. In addition, there is a number of sub-optimal, Obsolete/expired equipment that should be either fixed, installed and returned to use or retired and obsolete from the lab. Storage of unusable equipment in the lab is both a waste of valuable space and a safety hazard.

7. The laboratories lack proper ventilation system (Fume hood and mechanical system) which is not only a safety and comfort issue but also a performance problem for Sensitive analytical instruments.

8. FAL has no direct source of budget to fulfills the requirement of Laboratory whatever they income from the analysis has taken by ACCI and against that ACCI manage to fulfill their requirements. Apart from that, only the salary of FAL staff is managed by MoPH only.

9. Laboratory safety is a major challenge in this facility partly because of crowding and improper ventilation and partly due to lack of proper safety procedures and equipment. In addition to the various safety problems mentioned above, the laboratories lacks a number of safety requirements that are too many to list. However, one such requirement that is part of the infrastructure challenges is the lack of proper modern chemical and biological safety cabinets and chemical safety storage cabinets.

Personnel:

1. The FAL Head Dr. Naser is looking after Food and Water testing with the help of 4 Analyst, mostly with the background and experience of lab technician.

2. A team of total 5 qualified Pharmcistts **(listed in Table 7)** have been working for FTL from last 3 to 16 years.

3. None of them has appeared to have basic knowledge about food testing equipment and basic testing parameters, methods and reporting, etc.

Laboratory Quality management system:

Since laboratory is not accredited/certified by any national and international recognition; laboratory is not implementing Quality management system (ISO 17025), good laboratory practices, lack of good document practices and internal audits are not conducted on regular basis. This type of inadequate and suboptimal management system could present a challenge for implementation of management system, which is the requirements of accreditation.

Method and Sampling

1. Currently, FAL is analyzing 5774 (approx. value) per year. It is observed that laboratory mostly involved in qualitative analysis of various types of food products as technical staff is not good enough to conduct/ handle both testing parameters and equipments.

2. FAL doesn't perform any analysis on fortified food yet though FAL has Iron checker and iodine checker (rapid kit) available but the technical staff is not qualified enough to perform. In the microbiological analysis, only water samples are tested on coliforms by screening test kits (Rapid Count). Only positive test results are confirmed by classical plate tests.

3. Regarding proximate analysis the relevant nutritional parameter such as ash, water and protein content, carbohydrates, fat, peroxide value, acidity and organoleptic are analyzed in food samples routinely with non compliance results. Also most of the analysis is on qualitative based not quantitative.

4. List of parameters and sample type are listed in **Table 8**.

5. FAL also doesn't have any updated relevant literature for their reference, only the old version of AOAC was available in the lab.

6. No work instruction and sop's are available in the laboratory.

7. FAL generally received sample from Custom and industry. Food samples are collected by the staff of laboratory but staff didn't appear to be fully aware of the impact of improper sample collection and transport on test results.

8. Separate logbook is maintained by FAL for sample collection including several details like Serial number, item, weight, manufactured date, Expiry date, batch no., industry, laboratory identification no.

9. Sample are not archived in proper conditions as required for sample type and kept for 3-6 months depend on the sample type. The laboratory is taking 24-72 hrs from the date of sample receiving and reporting of the results.

Equipments

1. Inventory list of equipment is missing Much of this gap is most likely due to the lack of good record keeping (document control). Most of Information such as serial numbers cannot be easily captured from the equipment in the laboratory as most of them are outdated and suboptimal.

2. Most of the equipment are Donated by USAID/IDEA NEW and kept uncovered and are not in use. No proper maintenances of the equipments have been noticed during the assessment. The equipment list presented in **Table 9** shows some "not in use" equipment and their working status.

3. FAl has some equipments which are of not good quality and not fit for testing as well and were procured from Pakistan by ACCI.

It is important to remember that this information is not only needed for good laboratory management, it is also required for ISO 17025 standards accreditation

Recommendation:

Based on assessment of facility, FAL has many serious issues mentioned above including being housed in a building of hospital that was not intended for laboratory operations. Laboratory itself is not competent enough to conduct any analysis of fortified food and premixes because laboratory's accommodation and environment of the laboratory is not adequate and optimal. Though laboratory has I-checker for Iron and Iodine but due to lack in technical skills laboratory staff is not able to use it. However, staff needs exhaustive training on laboratory management system, safety Procedures and Method of analysis.

Table 7: List of Laboratory staff

S. No.	Name of Personnel	Designation	Education Qualification	Experience	Key responsibilities
1.	Dr. Naser	Lab manager	Lab technician	10 years	Supervisor
2.	Dr. Emaranullah	Technician	Lab technician	16 years	Food sample analysis
3.	Mangal	Technician	Lab technician	5 years	Food sample analysis
4.	Ibadullah	Technician	Lab technician	3 years	Food sample analysis
5.	Haji Safauddin	Sample collector	Bsc Pharmacy	3 years	Sample collector

Table 8: list of Test Parameters laboratory analyses

S. No.	Parameters	Sample type	SOP exists	Reference method
1.	Moisture	Chips, Glucose(syrup & Powder), Macroni, Biscuits, Moisture, Dry Milk, Whey Powder, Fresh Milk, oil, cream of milk, Baby Food (cerelac), Ice cream, Coffee	NO	AOAC, AS, AOCS, Codex
2.	Fat	Dry Milk, Dry milk for ice cream	NO	AOAC
3.	Protein	Honey, Pulses, Biscuits, Dry Milk, Whey Powder, Fresh Milk, cream of milk, Cheese	NO	AOAC
4.	Sugar Profile	Honey, Biscuits, Tomato Ketchups, Chewing gums, Chocolate, Kajo, Bora, Fresh Milk, Juice, Ice cream, Marmalade, Dry milk for ice cream	NO	AOAC
5.	Peroxide value	Shortening, oil	NO	AOAC
6.	Melting point	Shortening, oil	NO	AOAC
7.	FFA	Oil	NO	AOAC
8.	Appearance	Honey, Garlic, Chips, Pulses, Glucose(syrup & Powder), Macroni, Biscuits, Tomato Ketchups, Chewing gums, Soda Powder, Chocolate, Salt, Grain, Kajo, Bora, Shortening, Condiments, Dry Milk, Whey Powder, Fresh Milk, oil, cream of milk, Baby Food (cerelac), Yeast, Juice, Cheese, MSG(Mono Sodium Glutamate), Ice cream, Marmalade, Coffee, Dry milk for ice cream	NO	AOAC
9.	Organoleptic	Honey, Garlic, Chips, Pulses, Glucose(syrup & Powder), Macroni, Biscuits, Tomato Ketchups, Chewing gums, Soda Powder, Chocolate, Salt, Grain, Kajo, Bora, Shortening, Condiments, Dry milk, Whey Powder, Fresh Milk, oil, cream of milk, Baby Food (cerelac), Yeast, Juice, Cheese, MSG(Mono Sodium Glutamate), Ice cream, Marmalade, Coffee, Dry milk for ice cream	NO	AOAC
10.	Purity	Honey	NO	AOAC

11.	pH	Garlic, Glucose(syrup & Powder), Macroni, Biscuits, Tomato Ketchups, Soda Powder, Kajo, Bora, Dry Milk, Whey Powder, Fresh Milk, cream of milk, Baby Food (cerelac), Yeast, Juice, Cheese, MSG(Mono Sodium Glutamate), Ice cream, Dry milk for ice cream	NO	AOAC
12.	Acidity	Garlic, Macroni, Biscuits, Tomato Ketchups, Dry Milk, Whey Powder, Fresh Milk, cream of milk, Baby Food (cerelac), Cheese, Ice cream, Dry milk for ice cream	NO	AOAC
13.	Salt	Garlic, Chips, Pulses, Macroni, Tomato Ketchups, Cheese	NO	AOAC
14.	Citric Acid	Garlic, Pulses, Chewing gums, Chocolate, Juice, Marmalade	NO	AOAC
15.	Starch	Tomato Ketchups, Yeast, Cheese	NO	AOAC
16.	Vegetable oil	Pulses	NO	AOAC
17.	Solubility	Glucose(syrup & Powder), Soda Powder, Kajo, Bora, Dry Milk, Whey Powder, oil, Baby Food (cerelac), Yeast, MSG(Mono Sodium Glutamate), Ice cream	NO	AOAC
18.	Total Solids	Glucose(syrup & Powder), Ice cream	NO	AOAC
19.	Gum Test	Chewing gums	NO	AOAC
20.	Iodine Value	Salt	NO	AOAC
21.	Refractive Index	Juice, Glucose(syrup & Powder),	NO	AOAC
22.	Coliforms	Water	No	Not available

Table 9: List of Equipments

S. No.	Equipment Name	Make	Date of purchasing	Working Status		Remarks or comments
				Yes	No	
1.	Heater	Geepas	-	Y		Use to facilitate the analysis
2.	Muffle Furnace	-	-	Y		Donated By USAID/ IDEA-New
3.	Heating Mantle	-	-	Y		Donated By USAID/ IDEA-New and not in use
4.	Milk Analyser	Boeco Germany		-	-	Not installed
5.	Centrifuge	Made in china	-	Y		Not in Use
6.	Disintegration Tester	Microlab			N	Donated By USAID/ IDEA-New
7.	Refractometer	-		Y		-
8.	Hot air aven	Binder	-	Y	-	Donated By USAID/ IDEA-New
9.	Disintegration Tester	Microlab	-		N	Donated By USAID/ IDEA-New
10.	Water bath	Digisystem Laboratory Instruments	-	Y		Not in use
11.	Spectrophotometer	Jenway 6305	-	-	-	Donated By USAID/ IDEA-New, Not installed
12.	Biochemistry analyzer (ELISA)	Techno 786 (GMI)	-	-	-	Donated By USAID/ IDEA-New, Not installed
13.	Spectrophotometer	Perfect system (MS 4375)		-	-	Not installed
14.	Centrifuge	-	-	Y	-	-
15.	Melting Point apparatus	Gullenkamp	-	Y	-	-
16.	Analytical Balance	A & Gulf	-	Y	-	-

17.	Electronic Balance	HX - T	-	Y	-	-
18.	Analytical Balance	Sartorius (BP 121 S)	-	Y	-	-
19.	Iron Checker (I Check)	Bio analyt	-	-	-	Not in use
20.	Flame Photometer	Jenway (PFP7)	-	-	-	Donated By USAID/ IDEA-New, Not installed
21.	WHO Drinking water Guideline	Wagtech	-	-	-	Kit has been used for water analysis
22.	Microscope	Leica	-	-	-	Not in use
23.	Autoclave	-	-	-	N	
24.	Centrifuge	Boeco (C-28A)	-	-	-	Not in use
25.	Single Incubator	Wagtech	-	Y	-	
26.	Water Distillation unit		-	Y	-	For distilled water
27.	Water bath	Made in china	-	-	-	Not in use
28.	Soxhlet Apparatus		-	-	-	Not in use
29.	Electronic Balance	A & Gulf	-	Y	-	
30.	Moisture Oven	Binder	-	-	-	Donated by USAID/ IDEA-NEW Not in use
31.	pH Meter	Adwa (AD1030)	-	-	N	-
32.	TDS Meter	Adwa (AD3000)	-	-	-	-
33.	pH Meter	Lutren	-	-	-	Not in use
34.	Incubator	Sanfa	-	-	-	Donated by USAID/ IDEA-NEW Not in use
35.	Microscope	LEICA CME	-	-	-	Not in use
36.	Turbidity Meter	Hanna instrument (HI 93703-11)	-	-	-	Not in use
37.	Iodine tester	Spectroquant	-	-	-	Not in use