REPORT ON ASSESSMENT OF FOOD LABORATORIES IN TAJIKISTAN

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Report on Assessment of Food Laboratories in Tajikistan

Prepared for:
The Agency for Standardization, Certification, Accreditation, Metrology and Trade Inspection under the Government of Tajikistan
The United States Agency for International Development (USAID)
Global Alliance for Improved Nutrition (GAIN)

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1. Acronyms

AACC	American Association of Cereal Chemists
AAS	Atomic Absorption Spectroscopy
ADB	Asian Development Bank
BIPEA	'Bureau Interprofessionnel des Etudes Analytiques', French PT provider
CIS	Commonwealth of Independent States
CRM	Certified Reference Material
DAkkS	'Deutsche Akkreditierungsstelle' (German Accreditation Body)
DDT	Dichlorodiphenyltrichloroethane
EASC	Euro-Asian Council for Standardization, Metrology and Certification
ECD	Electron Capture Detector
EHS	Environment, Health and Safety
ELISA	Enzyme Linked Immuno Sorbent Assay
FAPAS	Food Analysis Performance Assessment Scheme (British PT provider)
GAIN	Global Alliance for Improved Nutrition
GC	Gas Chromatography
GC/MS	Gas Chromatography-Mass Spectrometry
GC/MSMS	Gas Chromatography-(Tandem) Mass Spectrometry
GMO	Genetically Modified Organism
GOST	'Gossudarstwenny Standart', Soviet standard/Interstate CIS countries Standard
HCH	Hexachlorocyclohexane
HPLC	High Performance Liquid Chromatography
IAF	International Accreditation Forum
ICP	Inductively Coupled Plasma
ICP-MS	Inductively Coupled Plasma-Mass Spectrometry
ICP-OES	Inductively Coupled Plasma-Optical Emission Spectroscopy
IDA	Iron Deficiency Anemia
IDD	Iodine Deficiency Disorder
ILAC	International Laboratory Accreditation Cooperation
IR	Infrared
ISO	International Organization for Standardization
LC/MSMS	Liquid Chromatography - (Tandem) Mass Spectrometry
LGC	Laboratory of the Government Chemist (British company providing chemicals, CRMs and PTs)
MS	Mass Spectrometry
NCA	National Center of Accreditation of the Republic of Kazakhstan
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PND	Phosphorous Nitrogen Detector
POP	Persistent Organic Pollutant
PT	Proficiency Test
PTB	Physikalisch-Technische Bundesanstalt (German National Metrology Institute)
QAQC	Quality Assurance/Quality Control
RTK	Rapid Test Kit
SES	State Sanitary and Epidemiological Service
SOP	Standard Operating Procedure
SUN	Scaling up Nutrition
SVIS	State Veterinary Inspection Service
TAT	Turnaround Time
TJT	Agency on Standardization, Metrology, Certification and Trade Inspection (Tajikstandart)
UPS	Uninterruptible Power Supply
USAID	United States Agency for International Development
USI	Universal Salt Iodization
Vitamins B_x	Several vitamins of the vitamin B group for wheat flour fortification: vitamin B_1 (thiamine), vitamin B_2 (riboflavin), vitamin B_3 (niacin) and vitamin B_9 (folic acid)
WFP	World Food Programme

2. Executive Summary

Despite significant advances in the reduction of undernutrition, the population of Tajikistan is still affected by iron deficiency anemia, neural tube defects and other conditions caused by micronutrient deficiencies. Fortification of wheat flour can be a cost efficient mechanism for providing adequate levels of nutrients in the diets and help offset some of the micronutrient deficiencies for the most vulnerable segments of the population.

Notwithstanding previous efforts to introduce wheat flour fortification in Tajikistan, there is currently no national flour fortification program. On the other hand, there is a high per capita level of wheat consumption, bread is consumed usually at every meal by all the population. The new project, starting in late 2014, *Tajikistan Flour Fortification Project* funded by the United States Agency for International Development (USAID) will allow the Global Alliance for Improved Nutrition (GAIN) to work with partners to establish a sustainable national wheat flour fortification program. In the framework of this GAIN/USAID project, GAIN conducted recently a series of assessments. **A laboratory assessment is essential to evaluate the capacity and capability of relevant food laboratories in Tajikistan to analyze premixes and fortified food.** Reliable analysis is required not only for regulatory purposes, but also for the support of food industry installing technological processes and for national monitoring programs. This laboratory assessment focus primarily on the three main food laboratories of the Agency on Standardization, Metrology, Certification and Trade Inspection (Tajikstandart, TJT) under the Government of the Republic of Tajikistan:

- Testing Center of Food and Agricultural Products of Tajikstandart Dushanbe ('TJT Laboratory Dushanbe'),
- Testing Center of Food and Agricultural Products of Tajikstandart Center in Sogd Province, Khujand ('TJT Laboratory Khujand'),
- Testing Center of Food and Agricultural Products of Tajikstandart Center in Khatlon Province, Kurghan Tube ('TJT Laboratory Kurghan Tube').

Besides the TJT laboratories, also, three other academic and public laboratories were visited in order to receive an overview of the laboratory network in Tajikistan. The assessment was based upon the data of a questionnaire with accompanying documents and the visits to the food laboratories. The assessment took place on the ground in the time 22 to 26 June 2015. Beside general information, **this assessment mainly focused on the laboratory accreditation and quality management, testing scope and sample capacity, instrumentation, facilities/building and training status of personnel.** Beside the testing capability and capacity relating to fortified foods also the **analysis of food quality and safety parameters was including in this evaluation.**

The three assessed TJT laboratories are analyzing mainly official food samples which are delivered mostly from TJT inspectors, in small amounts the samples derive also from food industry and retail. These laboratories are accredited according to the International Organization for Standardization ISO17025:2005 (General requirements for the competence of testing and calibration laboratories) by the internationally recognized accreditation body, the National Center of Accreditation (NCA) of the Republic of Kazakhstan, however, the accreditation schedule is limited only to several analytical methods for basic food proximate testing (nutritional parameters). Exclusively, GOST (the Interstate CIS Standards/ Soviet Standard) standards are used literally for food analysis, thus no full validation of the testing methods is conducted, only a kind of verification. Additionally, the TJT laboratories are nationally accredited by the TJT Directorate of Metrology and Accreditation. A comprehensive and well-organized laboratory quality management is in place in all 3

visited TJT laboratories. The TJT Laboratory Dushanbe functions equivalent to a reference laboratory and training center for the other TJT testing centers. The laboratory has established an annual proficiency test scheme for the other TJT testing centers which includes constructive advice and training in case of unsatisfactory results.

In summary, the main focus and expertise of the three TJT laboratories is in proximate analysis and basic food quality parameters. Microbiological testing is only limited in scope and quantity, in two laboratories only as screening tests on a small scale. Regarding fortified food parameters only iodine in salt is tested in all three laboratories. Iron and zinc are analyzed in two laboratories, but mostly only in drinking water and liquid food samples, either by colorimetry or voltammetry. Vitamins or premixes are not tested at all. Regarding food safety only the heavy metals cadmium and lead are tested, mainly by insensitive voltammetry technique and only in drinking water and liquid food samples. TJT Laboratory Dushanbe is analyzing these elements also by flame Atomic Absorption Spectrometer (AAS) after ashing. However, the AAS system is not fully functional due to the lack of some accessories. Some mycotoxins are only screened in the TJT Laboratory Dushanbe. A genetically modified organism (GMO) analysis for maize and soya products is under development in two laboratories. Two radioactive nuclides are screened in TJT Laboratory Dushanbe. At the moment fortified food (with the exception of salt) and food safety parameters like pesticides, mycotoxins, environmental contaminants and antibiotics cannot be tested according to international standards, due to the non-availability of the necessary equipment and expertise. Thus, the main constraints are the shortage of sophisticated instrumentation and the limited budget for technical service/maintenance, accreditation (to increase the scope), participation in the international proficiency tests (PTs) and for technical trainings of the laboratory staff. There are also problems with non-permanent and unstable power supply, the low number of working fume hoods and in some cases with limited floor space, hampering the laboratory work. Detailed recommendations are given in this report regarding general aspects of the Tajik food control system, the analysis of fortified food and for future projects also for the analysis of relevant food safety parameters.

3. Introduction

Despite significant advances in the reduction of undernutrition, the population of Tajikistan is still affected by iron deficiency anemia (IDA), neural tube defects and other conditions caused by micronutrient deficiencies. Fortification of wheat flour can be a cost efficient mechanism for providing adequate levels of nutrients in the diets and help offset some of the micronutrient deficiencies for the most vulnerable segments of the population.

Despite previous efforts to introduce wheat flour fortification in Tajikistan in the late 1990s and again from 2002-2007, there is currently no national flour fortification program in Tajikistan. The new project, starting in late 2014, *Tajikistan Flour Fortification Project (Tajikistan Field Support)* funded by USAID will allow GAIN to work with partners to establish a sustainable national wheat flour fortification program. The project will build the enabling environment for flour fortification by:

- Completing a multi-sectoral scale-up plan for flour fortification in Tajikistan;
- Working with government to build commitment for wheat flour fortification and to position this intervention as a public health priority and as part of the Scaling up Nutrition Movement (SUN);
- Supporting the establishment of a premix supply system and assessing equipment needs among industry;
- Initiating voluntary fortification and building technical capacity.

In the framework of this GAIN/USAID project GAIN conducted recently a series of assessments, including an in-depth wheat milling industry assessment in Tajikistan. A laboratory assessment is essential to evaluate the capacity and capability of relevant laboratories in Tajikistan to analyze premixes and fortified food. Reliable analysis is required not only for regulatory purposes, but also for the support of food industry installing technological processes and for national monitoring programs. This laboratory assessment in Tajikistan focused primarily on the three main food laboratories of the Agency on Standardization, Metrology, Certification and Trade Inspection (Tajikstandart, TJT) under the Government of the Republic of Tajikistan. Besides the TJT laboratories, also, three other academic and public laboratories were visited in order to receive an overview of the laboratory network in Tajikistan.

4. Background information about food fortification in Tajikistan

According to the Codex Alimentarius 'General Principles for the Addition of Essential Nutrients to Foods'[1] fortification or enrichment is defined as "the addition of one or more essential nutrients to a food whether or not it is normally contained in the food for the purpose of preventing or correcting a demonstrated deficiency of one or more nutrients in the population or specific population groups". The Codex General Principles further states that fortification should be the responsibility of national authorities since the kinds and amounts of essential nutrients to be added and foods to be fortified will depend upon the particular nutritional problems to be corrected, the characteristics of the target populations, and the food consumption patterns of the area.

Salt Iodization

There were several projects since the early 1990s in Tajikistan achieving universal salt iodization (USI). A hallmark in progress toward USI came in 2002 when the Tajikistan Government passed a national law requiring that all edible salt (domestically produced and imported) be iodized. The fortification level for iodine in salt (40±15 µg/g) was laid down in the National Standard (Standart Respubliki Tajikistan) ST RT 1000-2004.

[1] Codex Alimentarius CAC/GL 09-1987 (amended 1989, 1991), http://www.codexalimentarius.org/input/download/standards/299/CXG_009e.pdf

Despite substantial improvement over the past 20 years, progress toward USI in Tajikistan has not been fully successful. A 2009 national Micronutrient Nutrition Survey found that iodine deficiency affected more than 58% of women and almost 53% of children nationally. Regional variation was shown to be wide, ranging from more than 7% in some southern districts to less than one percent in some northern areas. Low levels of urine iodine were found in almost 85% of women in Khatlon, the province with the highest IDD (Iodine Deficiency Disorder) prevalence.

There are still key remaining issues: USI legislation and regulatory enforcement, key USI-related production elements, potassium iodate issues (procurement, supplies, production, quality assurance, monitoring), iodized salt marketing, distribution and market level quality control, and consumer use of good quality iodized salt in terms of social mobilization.

The USAID/GAIN Universal Salt Iodization Project started in 2012 began addressing some of these issues. Specifically, the project worked to improve the availability of adequately iodized salt in retail outlets in Khatlon Province; improving basic salt iodization quality assurance capacity of salt producers and inspection agencies; and generating community awareness about salt iodization and iodine deficiency disorders. To achieve these objectives GAIN partnered with UNICEF to replicate a highly effective community mobilization and awareness creation strategy using Rapid Test Kits (RTK) that was successfully implemented in Kyrgyzstan resulting in displacement of non-iodized salt from the market. This effort is complemented by support to salt producers within Khatlon to build quality assurance and control capacity and enable access to affordable fortificants for salt iodization.

Wheat flour fortification

Wheat flour fortification started in Tajikistan in 2002 with support from the regional ADB (Asian Development Bank) funded food fortification project that aimed at reducing the prevalence of iodine deficiency disorders and iron deficiency anemia. Key milestones included the establishment of a National Salt Producers and Flour Millers' Association, procurement of the fortification equipment, training and technical assistance to large flour mills, the submission of a draft mandatory fortification law to the Parliament for consideration, the adoption of the unified premix formulation (KAP-1 Premix) and common standards on fortified wheat flour and bakery products. The National Standards ST RT 1057-2004 and 1058-2004 laid down the fortification levels of iron, zinc and four vitamin B substances in wheat baking flour and bread and bakery products, respectively (see also chapter 9.1). In the course of the project, flour fortification began on a voluntary basis.

Due to the general economic situation in the country, Tajikistan failed to sustain the wheat flour fortification without external support. The actual production of fortified wheat flour has been stopped since April 2007 due to the lack of the premix. It was believed that only the adoption of the legislation on mandatory wheat flour fortification could secure wheat flour fortification in Tajikistan.

Currently, the only wheat flour in Tajikistan that is fortified for consumption is supplied by World Food Programme (WFP) for its school feeding programs, representing about 12,000 tons per year. About 7,000 tons of this is donated directly by Russia and fortified according to WFP specifications. WFP procures the remainder via tenders in Russia with cash from the Russian Federation.

In the past seven years the economic situation has somewhat stabilized, and in 2014 with USAID support, GAIN started a new activity in Tajikistan to build the enabling environment for fortification by:

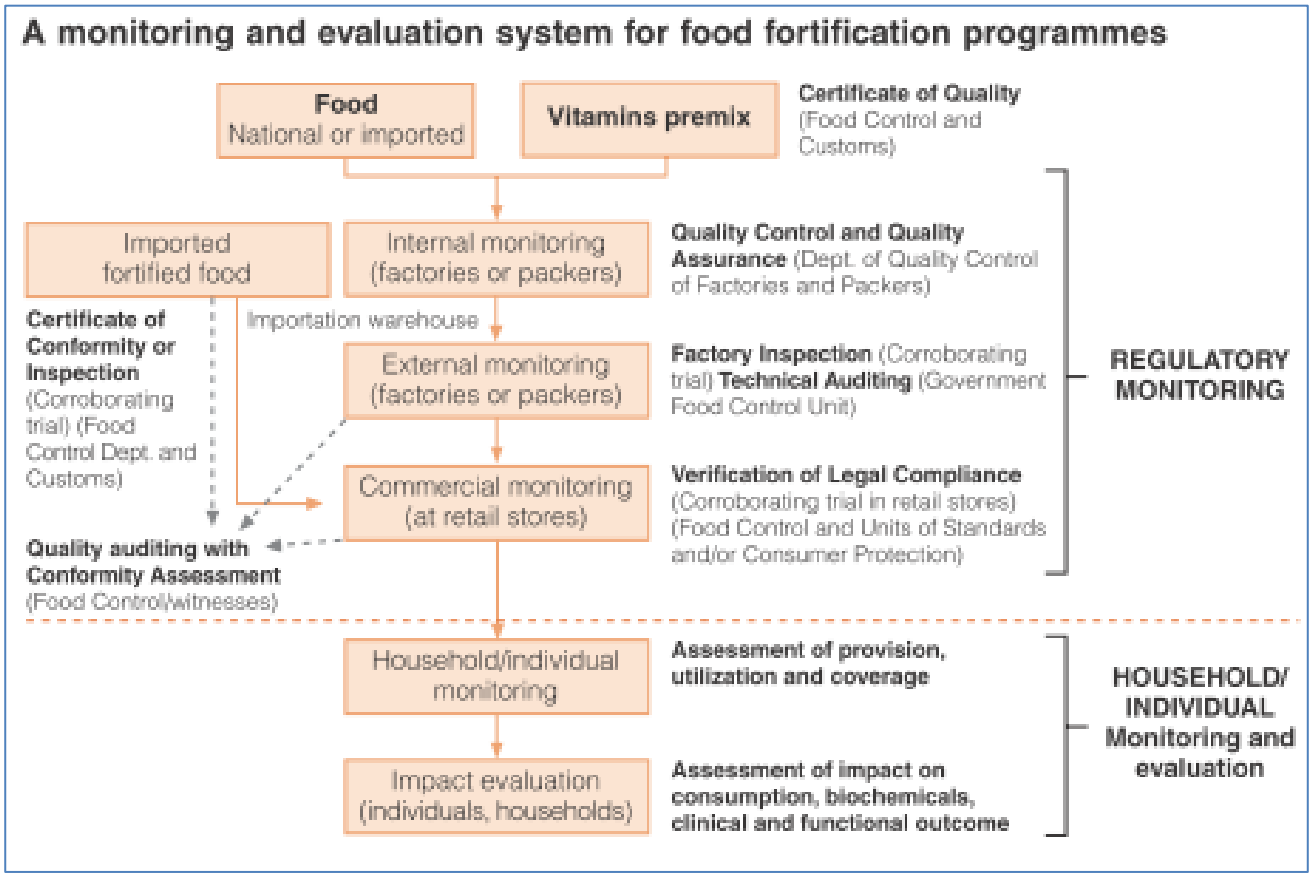
- Developing a national plan for flour fortification,
- Working with government to build commitment for wheat flour fortification and to position the intervention as a public health priority and as part of the Scaling up Nutrition Movement (SUN),

- Supporting the establishment of premix supply system and assessing equipment needs among industry,
- Initiating voluntary fortification and building technical capacity.

Food Fortification Regulatory Monitoring

Monitoring and evaluation are essential components of food fortification systems and have to be designed and planned when food fortification is started. They provide an opportunity to assess the quality of food fortification, its impact on households and individuals, and nutritional goals. For food fortification to have a health impact, it is essential that the fortified food maintain its expected quality from the time of leaving the factory, during storage, and up to the time of consumption. Thus, the quality of a fortified food needs to be internally and externally monitored at key points along the distribution system (see **Figure 1**).

Figure 1 A monitoring and evaluation model for food fortification programs[2]



Internal monitoring refers to procedures, actions and tests carried out by the flour producers (mills) to manufacture fortified wheat flour detailed in standards. It includes Quality Assurance and Quality Control (QA/QC). QA refers to the activities that are undertaken during production to ensure that the fortified wheat flour will meet the standards, and QC refers to tests and assessments of the fortified wheat flour to document and prove that it meets the standards.

[2] Guidelines on food fortification with micronutrients (WHO/FAO 2006). Edited by Lindsay Allen, Bruno de Benoist, Omar Dary and Richard Hurrell

External monitoring refers to the activities and actions carried out by government authorities to check for appropriate performance of QA/QC procedures at the mills that are required to fortify and to confirm compliance of wheat flour characteristics with its corresponding standards. In addition, government authorities in charge of food control have the responsibility to inspect fortifiable wheat flour at importation sites (import monitoring). Government authorities also verify that wheat flour available to the consumer in the markets meets the standards (commercial monitoring). Commercial monitoring confirms that locally produced and imported fortifiable wheat flour available to the consumer in the market complies with packaging, labeling and the fortification standards and is particularly important in areas where wheat flour may have bypassed import controls. Laboratory analysis plays an important role in regulatory monitoring, both internal and external.

In Tajikistan, there are 2 agencies mandated to conduct external monitoring such as Tajikstandart and the State Sanitary and Epidemiological Service (SES), both mandated by the government to provide laboratory analysis of fortified products.

Tajikstandart's mandate is multi-faceted and among many other responsibilities, it ensures the safety, unity of measurement, quality assurance, and develops standards and specification for business. In total, Tajikstandart has 14 testing centers across Tajikistan.

The State Sanitary and Epidemiological Service's main responsibilities include:

- observance, estimation and forecasting of the state of health of population in connection with the state of their dwelling environment,
- revealing and establishment of the reasons and conditions of emergence and extension of infectious, non-infectious diseases and poisoning of the population,
- elaboration of necessary offers for the execution of measures providing sanitary-epidemiological well-being of the population,
- realization of the control on carrying out of hygienic and anti-epidemic measures on observance of working sanitary rules by the enterprises, organizations and citizens,
- employment of measures of suppression of a sanitary offence and attraction to the responsibility of the persons made them,
- conduct of the state registration of infectious, professional, non-infectious diseases and poisonings of the population in connection with unfavorable influence on health of the factors of his dwelling environment, as well as the sanitary statistics.

5. Objectives of the Assessment

The overall objective of this assessment was to conduct a gap analysis of selected laboratories in Tajikistan that can/will be used within future national fortification programs regarding their capacity and capability to test micronutrients, especially for micronutrient analysis of premixes and fortified foods. **A main focus of this assessment was the analysis of iron, zinc and vitamins B_1, B_2, B_3 and B_9 in wheat flour and bread/bakery products**. In addition, the testing of general food quality and safety parameters was 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.

6. Organization of the Assessment

Intertek Food Services Germany has been working in partnership with GAIN already for several years. Intertek has been involved in several food fortification projects for GAIN, mainly in Africa. In addition, samples for GAIN-supported programs are regularly analyzed by the Intertek Food Services Laboratory in Bremen, Germany, and laboratory assessments were performed for GAIN in several countries. In May 2015, GAIN commissioned Intertek Food Services for a food laboratory assessment in Tajikistan. It was agreed that the following main food testing laboratories of Tajikstandart are assessed:

- Testing Center of Food and Agricultural Products of Tajikstandart Dushanbe ('TJT Laboratory Dushanbe')
- Testing Center of Food and Agricultural Products of Tajikstandart Center in Sogd Province, Khujand ('TJT Laboratory Khujand')
- Testing Center of Food and Agricultural Products of Tajikstandart Center in Khatlon Province, Kurghan Tube ('TJT Laboratory Kurghan Tube')

Intertek Food Services prepared a questionnaire for this assessment. The questionnaire comprised of the following sections: general information (address, type of laboratory etc.), quality management system, methods of analysis, equipment, buildings and premises, personnel, samples management and miscellaneous (comments). The questionnaire contained three annexes (Analytical Methods, Main Laboratory Equipment and Personnel) which also had to be completed. As a basic tool of the assessment the completed questionnaire comprehended all essential components for the operation of a laboratory. The questionnaire was sent before the assessment visit to the GAIN Tajikistan Coordinator for translation into Tajik/Russian language. The translated questionnaire was given to Tajikstandart Dushanbe for completion. **Appendix 1** shows the used questionnaire template for this assessment. The assessor received the completed questionnaire (one for all 3 TJT laboratories) back in English before the assessment visit, together with Annex 1 of the questionnaire (Analytical Methods). Annex 2 (Main Laboratory Equipment) was received during the visit in TJT Laboratory Dushanbe and Annex 3 (Personnel) was not completed at all. Requested additional documents were not received before the visit, but partially during the visit.

A work schedule for this assessment was drafted together with the GAIN Tajikistan Coordinator. The assessment took place on the ground in the time 22 to 26 June 2015. **Appendix 2** shows the final work schedule for this laboratory assessment.

Besides the audits of the three TJT laboratories, additional visits to the following three laboratories were organized:

- Laboratories of the Khujand Branch of Tajik Polytechnic Institute in Khujand;
- Laboratories of Tajikistan National University, Department of Biology and Chemistry, in Dushanbe;
- Laboratories of the State Sanitary and Epidemiological Service (SES) of Tajikistan in Dushanbe.

A short summary of these visits is given in Chapter 8.

In addition, meetings with the following stakeholders were arranged:

- Tajikstandart Headquarter Dushanbe, Deputy Directors Mirali Olimov and Karomat Saidova
- Tajikstandart Center of Sogd Province, Khujand, Director Auyb Boboev
- USAID Tajikistan, Dushanbe, Ms. Malika Makhkambaeva

All audits and meetings were in Tajik or Russian language, the assessor was assisted the entire week by interpreters.

7. Food Laboratory Gap Assessment

This laboratory assessment is a snapshot of the present performance of the visited TJT food laboratories in Tajikistan. Thus it covers only the facilities, equipment, staff which are in place at the time of the assessment. In general it does not include future planning of the individual labs and institutes.

The Assessment is based upon:

- the data of the completed questionnaire; and
- the visits to the food laboratories (comprising of meetings and discussions with the head of laboratory, quality manager and other laboratory staff and a comprehensive laboratory tour around the facilities including all equipment).

The laboratories are discussed in detail below in the chronological order of the laboratory visits on the ground.

7.1. Testing Center of Food and Agricultural Products of Tajikstandart Dushanbe ('TJT Laboratory Dushanbe')

Tajikstandart under the Government of the Republic of Tajikistan is the National Authority for Standardization representing the interests of the Republic of Tajikistan in international standardization organizations. Tajikstandart develops and maintains standards in Tajikistan; it has coordination and controlling functions. Tajikstandart is active in the fields of standardization, quality management, product safety, metrological monitoring of production, calibration services, product certification, certification and inspection of works and services and accreditation of metrology services of legal entities and individuals. Besides the Headquarter in Dushanbe there are several provincial and regional Tajikstandart standardization, metrology, certification and trade inspection centers, in total 14 testing centers:

- 5 testing centers in Sogd Province (including TJT Laboratory Khujand);
- 3 testing centers in the Districts of Republic Subordination (including TJT Laboratory Dushanbe);
- 4 testing centers in Khatlon Province (including TJT Laboratory Kurghan Tube);
- 2 testing centers in Gorno-Badakhshan Autonomous Province.

Only the 3 TJT testing centers TJT Laboratory Dushanbe, TJT Laboratory Khujand and TJT Laboratory Kurghan Tube have an international accreditation according to ISO 17025:2005 and were included in this assessment.

Under the director of the Tajikstandart Headquarter in Dushanbe, there are the following Directorates:

- Administration,
- Directorate of Standardization,
- Directorate of Metrology and Accreditation,
- Directorate of Trade Inspection,
- Directorate of Cotton Inspection,
- Directorate of Inspection of Oil Products,
- Directorate of Conformity and Certification,
- Testing Centre of Food and Agricultural Products.

The Testing Centre of Food and Agricultural Products of Tajikstandart Dushanbe has in total 7 sections/laboratories:

- Grain laboratory,
- Physical-chemical laboratory,

- Atomic absorption Spectroscopy (AAS) laboratory,
- Analytical laboratory,
- Toxic elements laboratory,
- Microbiology laboratory,
- GMO (Genetically Modified Organism) Laboratory.

The TJT Laboratory Dushanbe is testing mainly all kind of food products (domestic and imported food), and also small numbers of non-food products such as toys, tobacco and hygienic products (e.g. washing powder, soap, tooth paste).

The main details of the current status of the TJT Laboratory Dushanbe are listed below:

Laboratory quality management

- Three laboratories (grain laboratory, AAS laboratory and analytical laboratory) of the TJT Laboratory Dushanbe are accredited according to ISO 17025:2005 by the NCA of the Republic of Kazakhstan (Accreditation number KZ.I.00.1336) since August 2012, with an accreditation period of 5 years up to August 2017. NCA is an internationally recognized accreditation body as a member of ILAC and IAF. The NCA certificate and schedule of accreditation are given in the **Appendices 3 and 4**, respectively. According to this document in total 23 analytical methods for chemical analysis are accredited:

    - Several basic parameters, ions and metals in drinking water;
    - Moisture and saccharose in white sugar;
    - Crude gluten, ash and moisture in wheat flour;
    - Lead and cadmium in food;
    - Basic parameters such as acidity, soluble solids and chloride in a variety of food products.

    The next surveillance audit of Kazakhstan NCA is announced for July 2015. The laboratory will not apply for the accreditation of additional methods, due to the shortage of budget.

- All analytical methods are based and follow strictly so-called GOST standards. GOST standards are the State Union Standards, administered by the Euro-Asian Council for Standardization, Metrology and Certification (EASC), a standard organization chartered by the Commonwealth of Independent States (CIS). There are GOST standards regarding composition, quality and maximum limits for all different food items and on the other hand standards regarding test methods (see Appendix 4).

- Before the Kazakhstan NCA accreditation the TJT Laboratory Dushanbe was accredited according to ISO 17025:2005 by the German accreditation body, the German Accreditation Body (DAkkS) for one year (2010-2011), including 11 analytical methods. DAkkS has prepared this first accreditation of the TJT Laboratory Dushanbe by several intensive trainings and seminars.

- In addition, the TJT Laboratory Dushanbe has also a national accreditation according to ISO 17025:2005 by the TJT Directorate of Metrology and Accreditation (Accreditation number TJ 762.37100.03.0015-2015) since February 2015, with an accreditation period of 3 years up to February 2018. Tajikstandart is planning that this Directorate will become in near future an independent agency, which will also prepare for international recognition. The scope of this national accreditation is much broader and covers more or less all testing methods/GOST standards which are available and used in the laboratory.

- TJT Laboratory Dushanbe has a comprehensive quality management with a committed and professional quality manager. A quality manual and well-organized documentation of all procedures

are in place. The Standard Operation Procedures (SOPs) about validation of analytical methods and measurement uncertainty are available. However, due to the fact that the laboratory is using exclusively only GOST standards no full validation of the individual testing methods is conducted, only a kind of verification. Quality control charts are not used, the laboratory plans to attend a training session by the German National Metrology Institute (PTB) in autumn 2015.

- Internal audits are organized once a year for the three accredited laboratories; the last internal audit took place in December 2014. There is a team of trained internal auditors. The reports of these audits including the findings and corrective actions in case of non-conformity are well filed by the quality manager.

- Balances and other instruments are calibrated once a year by the TJT Directorate of Metrology, the calibrations are well-documented.

- In the last years TJT Laboratory Dushanbe has participated in several international inter-laboratory comparisons/proficiency tests. In 2008 and 2010, basic parameters were tested in drinking water and wheat flour, respectively, in the framework of the PTB Central Asia Project. In 2011, 2012 and 2014 the laboratory participated in PTs organized by the Central Laboratory of Kyrgyzstan Agency for Geology (scope of testing: twice basic parameters in drinking water, once a control sample for the analysis of cadmium and lead). All PT results are well documented, most of the results were satisfactory. In case of unsatisfactory results corrective actions were taken and recorded.

- Since some years TJT Laboratory Dushanbe is organizing regular national PTs in total 12 TJT testing centers. Twice a year test materials are sent out for testing, in 2015 the following tests were/will be performed:

    - Vegetable oil for color, acidity, and peroxide
    - Alcoholic beverage (vodka) for alcohol content, acidity, and toxic elements lead and cadmium
    - Wheat flour for ash, moisture, and gluten
    - Non-alcoholic beverage for acidity and dry matter
    - Control samples for lead and cadmium

  The quality manager of TJT Laboratory Dushanbe is the PT coordinator, assessing after the rounds all test results of the different TJT laboratories. In case of unsatisfactory results recommendations are given to the specific laboratory and re-analysis is requested. All testing results are summarized and assessed according to international standards in annual reports.

<u>Sample numbers and testing scope</u>

- In 2012, 2013 and 2014 in total 7800, 6650 and 5723 samples, respectively, were tested in the TJT Laboratory Dushanbe.

- Most of the food samples are official samples from TJT inspectors, only a very small amount of additional samples derive from private sector (food industry and retailers).

- There is a central sample reception for all sections of the TJT Laboratory Dushanbe. The samples arrive with an official sampling protocol and receive a running laboratory code number.

- 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.

- Regarding testing of fortified food only iodine is analyzed by titration in salt samples. In 2012, 2013 and 2013 in total 20, 17 and 14 salt samples, respectively, were tested, with some non-compliant results. Vitamins are not tested (only vitamin C in some food items by titration). Iron and zinc are only analyzed in drinking water, by colorimetry and voltammetry, respectively. Premixes are not analyzed.

- In the microbiological laboratory food samples are tested on total plate count, yeast and moulds, coliforms, E. coli, salmonella, and staphylococcus aureus by screening test kits (Rida®Count). Only positive test results are sometimes confirmed by classical plate tests. In total about 200 food samples per annum are tested.

- Regarding 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.

- Concerning the analysis of food safety parameters (contaminants and residues), the mycotoxins aflatoxin B_1, Deoxynivalenol (DON) and fumonisins are screened by immuno-chromatographic test strips (Rida®Quick), and a high-performance liquid chromatography (HPLC) system for confirmation of positive test results is not operational and used. The heavy metals cadmium and lead are analyzed by flame AAS after ashing and in parallel by voltammetry. A new established GMO laboratory is developing at the moment analytical methods for the detection of GMOs in soya and maize products (at the moment there is no national legislative framework for GMOs in food in Tajikistan). Additionally, the radioactive nuclides Cesium-137 and Strontium-90 are screened in the physical-chemical laboratory.

Analytical instrumentation and equipment

- The chemical laboratory is in general only equipped with basic instruments for the proximate food analysis, including UV and IR spectrometers. No automatic Soxhlet or Kjeldahl system for the determination of fat and nitrogen/protein are available. **The HPLC/fluorescence detector system from 2004 is not operational and not in use anymore**. A voltammetry system is used for the analysis of lead and cadmium in food samples and of Zinc and Copper in drinking water. A flame AAS system from 2008 is in place for the analysis of lead and cadmium in food samples. **No other elements are analyzed by the AAS system mainly due to the fact that no acetylene as fuel gas is available.** Several AAS lamps are in place (for analysis of mercury, copper, selenium, arsenic), but not used. The Certified Reference Materials (CRMs) for the analysis of metals in wheat and rice flour are available, but expired.

- A GMO laboratory including all appropriate equipment was installed in separate renovated rooms last year.

- The equipment for microbiology is aged and seldom and not regularly used. Mostly screening tests are applied.

- There are log sheets and an inventory in place for all instruments. Balances and other instruments are calibrated by the TJT Directorate of Metrology once a year and calibrations are well documented. Also, some maintenance service is delivered by the TJT Directorate of Metrology, however there is no budget available for maintenance and repair service by the suppliers/companies of the instruments.

Building and facilities

- The facilities of the TJT Laboratory Dushanbe are in appropriate and clean condition. The good standard of housekeeping was noted, a cleaning schedule is in place.

- The Laboratory has a total floor space of about 300sqm, including the microbiological and GMO laboratories in separate rooms.

- There are sometimes power cuts in Dushanbe. The Laboratory has no generators or Uninterruptible Power Supply (UPS) systems. However, some sensitive instruments are equipped with voltage regulators due to fluctuations of the electricity network.

- The central heating system of the building is out of order, thus during winter time the temperature in the laboratory facilities is dropping up to 12°C, the rooms are heated then provisionally by electric heaters. These low temperatures can also influence the quality of analytical results.

- In the chemical laboratories there are three fume hoods, partly aged and out of order. The laboratory facilities are sufficient air-conditioned. Purified laboratory water is produced by water distillation, deionization systems are not in place.

- There is a management for the Environment, Health and Safety (EHS). The building is secured and visitors are registered.

Personnel and training

- The total number of staff in the Chemistry Laboratory is 22, including the head of laboratory. All staff has a university degree, either in chemistry or food chemistry / technology or veterinary medicine (microbiological laboratory).

- There are training schedules and competency files for the technical staff in place. Most of the trainings are in-house training, **there is no sufficient budget for external trainings.**

Summary

The TJT Laboratory Dushanbe is the Testing Center of Food and Agricultural Products of Tajikstandart Headquarter Dushanbe. It is the biggest Tajikstandart testing center in a network of 14 TJT laboratories, it serves equivalent to a reference laboratory and training center for the other TJT testing centers. The laboratory has established an annual PT scheme for the other TJT testing centers which includes also the final assessment of the results in reports and constructive advice in case of unsatisfactory results. TJT Laboratory Dushanbe is analyzing mainly food samples which are delivered mostly from TJT inspectors. Three sections of the laboratory are accredited by the internationally recognized accreditation body NCA of the Republic of Kazakhstan. However, the accreditation schedule is limited to basic food proximate analysis (basic nutritional parameters) and to three of seven sections. Additionally, the laboratory is nationally accredited by the TJT Directorate of Metrology and Accreditation. A comprehensive and well-organized laboratory quality management is in place. The Laboratory has primarily only the instrumentation and expertise for food proximate analysis (analysis of nutritional components) and some food quality parameters. **There is no analysis of vitamins (with the exception of vitamin C in some food items).** Microbiological testing and the analysis of some mycotoxins are by screening/field tests. Some minerals and metals are analyzed by photometry or voltammetry, only lead and cadmium are tested by flame AAS. Sample preparation for this kind of analysis is by ashing. At the moment fortified food (with the exception of salt) and food safety parameters like pesticides, mycotoxins, environmental contaminants and antibiotics cannot be tested according to international standards, due to the non-availability of the necessary equipment and

expertise. **Thus, the main constraints are the shortage of sophisticated instrumentation and the limited budget for technical service/maintenance, accreditation (to increase the scope), participation at the international proficiency tests and for technical trainings of the laboratory staff. Also the problems with the non-permanent power supply, the defect heating system and the low number of working fume hoods are hampering the laboratory work.**

7.2. Testing Center of Food and Agricultural Products of Tajikstandart Khujand ('TJT Laboratory Khujand')

TJT Laboratory Khujand is the central TJT Laboratory of the northern province, Sogd. Besides this testing center there are additional four smaller TJT laboratories in the province. In Sogd Province, there are in total 32 mills, which receive the grain mainly from Kazakhstan. The wheat flour is for the domestic market and export to Kyrgyzstan and Afghanistan.

The TJT Laboratory Khujand is testing all kind of food products (domestic and imported food). The main details of the current status of the TJT Laboratory Khujand are listed below:

Laboratory quality management

- TJT Laboratory Khujand is accredited according to ISO 17025:2005 by the National Center of Accreditation (NCA) of the Republic of Kazakhstan (Accreditation number KZ.I.00.1309) since August 2012, with an accreditation period of 5 years up to August 2017. NCA is an internationally recognized accreditation body as member of ILAC and IAF. In total 17 analytical methods for chemical analysis are accredited:
    - Drinking water: total hardness, sulfate, sediment
    - Beverages: acidity, dry matter, sulfate, acidity
    - Fruits: dry matter, acidity and alkalinity, moisture, alcohol content.

  The next surveillance audit of Kazakhstan NCA is announced for July 2015.

- All analytical methods are based and follow strictly so-called GOST standards. There are GOST standards regarding composition, quality and maximum limits for all different food items and on the other hand standards regarding test methods.

- In addition the TJT Laboratory Khujand has also a national accreditation according to ISO 17025:2005 by the TJT Directorate of Metrology and Accreditation since January 2015, with an accreditation period of 3 years up to January 2018. The scope of this national accreditation is much broader and covers more or less all testing methods/GOST standards which are available and used in the laboratory.

- TJT Laboratory Khujand has a comprehensive quality management with a committed quality manager. A quality manual and well-organized documentation of all procedures are in place. Due to the fact that the laboratory is using exclusively only GOST standards no own SOPs are in place and no validation of the individual testing methods is performed, only a kind of verification. Quality control charts are not used.

- Internal audits are organized once a year; the last internal audit took place in October 2014 and the next is planned for August/September 2015. The checklists and reports of these audits including the findings and corrective actions in case of non-conformity are well filed by the quality manager.

- Balances and other instruments are calibrated once a year by the TJT Directorate of Metrology, the

calibrations are well-documented.

- TJT Laboratory Khujand is participating regularly in the national PTs organized by TJT Laboratory Dushanbe (described in chapter 7.1). The PT results are mostly satisfactory, in case of unsatisfactory results recommendations are given by the PT coordinator in TJT Laboratory Dushanbe and re-analysis is requested.

Sample numbers and testing scope

- In 2013 and 2014 in total 7,424 and 8,069 samples, respectively, were tested in the TJT Laboratory Khujand.
- Most of the food samples are official samples from TJT inspectors, only a very small amount of additional samples derive from private sector (food industry and retailers).
- There is a central sample reception with a central log book. The samples arrive with an official sampling protocol and receive a running laboratory code number.
- The Turnaround Time (TATs) of the laboratory are short and depend upon the products analyzed, e.g. for flour 4 to 5 days and for oil 2 to 4 days. There is no mandatory target for TATs.
- Regarding testing of fortified food only iodine is analyzed by titration in salt samples. **Vitamins are not tested at all. Iron and zinc are analyzed only in liquid samples by colorimetry and voltammetry, respectively. Premixes are not tested.**
- The microbiological laboratory is under development, it is planned to test food samples on total plate count, yeast and moulds, coliforms, E. coli, salmonella, enterobacteriaceae and staphylococcus aureus by screening test kits (Rida®Count). At the moment only some liquid samples are analyzed.
- Regarding proximate analysis the relevant nutritional parameter such as ash, water content, carbohydrates, fat, peroxide value and acidity are tested in food samples routinely. The nitrogen/protein content is not analyzed.
- Regarding the analysis of metals and minerals some elements are analyzed by voltammetry (lead, cadmium, zinc, copper), titration (calcium, magnesium) and colorimetry (iron). Mainly drinking water and liquid food samples (e.g. beverages, milk) are tested.
- Concerning the analysis of food safety parameters (contaminants and residues), mycotoxins like aflatoxins are not tested. Only the heavy metals cadmium and lead are analyzed by voltammetry. A new established GMO laboratory is developing at the moment analytical methods for the detection of GMOs in soya and maize products.

Analytical instrumentation and equipment

- The chemical laboratory is only equipped with basic instruments for the proximate food analysis, including UV and IR spectrometers. No automatic Soxhlet or Kjeldahl system for the determination of fat and nitrogen/protein are available. A voltammetry system is used for the analysis of some metals.
- A GMO laboratory including all appropriate equipment was installed in separate renovated rooms last year.
- The microbiological laboratory is for the time being not fully equipped and therefore only some screening tests are performed.

- There are log sheets and an inventory in place for all instruments. Balances and other instruments are calibrated once a year by the TJT Directorate of Metrology, the calibrations are well-documented. Also some maintenance service is delivered by the TJT Directorate of Metrology, however there is no budget available for maintenance and repair service by the suppliers/companies of the instruments.

Building and facilities

- The facilities of the TJT Laboratory Khujand are in appropriate and clean condition. There is a good standard of housekeeping, a cleaning schedule is in place.
- The Laboratory is situated in a block of apartments and shops, the floor space is limited and apparently not extendable.
- There are sometimes power cuts in Khujand. The Laboratory has a generator and UPS systems for some instruments.
- In the laboratory for sample preparation there is one working fume hood. The laboratory facilities are sufficient air-conditioned. Purified laboratory water is produced by water distillation, deionization systems are not in place.
- The building is secured and visitors are registered.

Personnel and training

- The total number of staff is 7, including the head of laboratory. All staff has a university degree, either in chemistry or food technology or biology or veterinary medicine (microbiological laboratory).
- New staff is trained and the training is documented. Competency files for the technical staff are not existing. **Most of the trainings are in-house training, there is no sufficient budget for external trainings.**

Summary

TJT Laboratory Khujand is the central TJT Laboratory of the northern province of Tajikistan, Sogd. Besides this testing center there are additional four smaller TJT laboratories in the province. TJT Laboratory Khujand is analyzing only food samples which are delivered mostly from TJT inspectors. The laboratory is accredited by the internationally recognized accreditation body NCA of the Republic of Kazakhstan, however the accreditation schedule is limited to basic food proximate analysis (basic nutritional parameters). Additionally the Laboratory is nationally accredited by the TJT Directorate of Metrology and Accreditation. A comprehensive and well-organized laboratory quality management is in place. The Laboratory has primarily only the instrumentation and expertise for food proximate analysis (analysis of nutritional components) and some food quality parameters. Some microbiological testing is performed by screening/field tests. Several minerals and metals are analyzed by photometry/colorimetry or voltammetry. **At the moment fortified food (with the exception of salt) and food safety parameters like pesticides, mycotoxins, environmental contaminants and antibiotics cannot be tested due to the non-availability of the necessary equipment and expertise. Thus, the main constraints are the shortage of sophisticated instrumentation and the limited budget for technical service/maintenance, accreditation (to increase the scope), and for technical trainings of the laboratory staff.** Also the limited floor space and the low number of fume hoods are hampering the laboratory work.

7.3. Testing Center of Food and Agricultural Products of Tajikstandart Kurghan Tube ('TJT Laboratory Kurghan Tube')

The TJT Laboratory Kurghan Tube is the central TJT Laboratory of the southern province of Tajikistan, Khatlon. Besides this testing center there are additional three smaller TJT laboratories in the province. The TJT Laboratory Kurghan Tube is testing all kind of food products (domestic and imported food). The Laboratory has in total 3 sections:

- Grain laboratory,
- Physical-chemical laboratory,
- Microbiology laboratory.

The main details of the current status of the TJT Laboratory Kurghan Tube are listed below:

Laboratory quality management

- TJT Laboratory Kurghan Tube is accredited according to ISO 17025:2005 by the National Center of Accreditation (NCA) of the Republic of Kazakhstan (Accreditation number KZ.I.00.1337) since August 2012, with an accreditation period of 5 years up to August 2017. The NCA is an internationally recognized accreditation body as member of ILAC and IAF. In total 4 analytical methods for chemical analysis are accredited:
    - Acidity and dry matter in non-alcoholic beverages
    - Acidity in fruits and vegetables
    - Dry matter in juice

  The next surveillance audit of Kazakhstan NCA is announced for July 2015.

- All analytical methods are based and follow strictly so-called GOST standards. There are GOST standards regarding composition, quality and maximum limits for all different food items and on the other hand standards regarding test methods.

- In addition the TJT Laboratory Kurghan Tube has also a national accreditation according to ISO 17025:2005 by the TJT Directorate of Metrology and Accreditation (Accreditation number TJ 762.37100.03.0036-2015) since March 2015, with an accreditation period of 3 years up to March 2018. The scope of this national accreditation is much broader and covers more or less all testing methods/GOST standards which are available and used in the laboratory.

- TJT Laboratory Kurghan Tube has a comprehensive quality management with a committed quality manager. A quality manual and well-organized documentation of all procedures are in place. Due to the fact that the laboratory is using exclusively only GOST standards no own SOPs are in place and no validation of the individual testing methods is conducted, only a kind of verification. Quality control charts are not used.

- Internal audits are organized once a year; the last internal audit took place in November 2014. The checklists and reports of these audits including the findings and corrective actions in case of non-conformity are well filed by the quality manager.

- Balances and other instruments are calibrated by the TJT Directorate of Metrology once a year, the calibrations are well-documented.

- TJT Laboratory Kurghan Tube is participating regularly in the national PTs organized by TJT Laboratory Dushanbe (described in Chapter 7.1). The PT results are mostly satisfactory, in case of unsatisfactory results, recommendations are given by the PT coordinator in TJT Laboratory Dushanbe and re-analysis is requested.

Sample numbers and testing scope

- In 2013 and 2014, in total, 4,070 and 5,306 samples, respectively, were tested in the TJT Laboratory Khujand.
- Most of the food samples are official samples from TJT inspectors, only a very small amount of additional samples derive from private sector (food industry and retailers).
- There is a central sample reception with a central log book. The samples arrive with an official sampling protocol and receive a running laboratory code number.
- The TATs of the laboratory are short and depend upon the products analyzed and the analytical methods used. There is no mandatory target for TATs.
- Regarding testing of fortified food only iodine is analyzed by titration in salt samples. Vitamins, iron and zinc are not tested at all. Premixes are not tested.
- The microbiological laboratory is analyzing food samples on total plate count, yeast and molds, salmonella, and enterobacteriaceae.
- Regarding proximate analysis the relevant nutritional parameter such as ash, water content, carbohydrates, fat (only in milk), peroxide value and acidity are tested in food samples routinely. The nitrogen/protein content is not analyzed.
- Regarding the analysis of metals and minerals only a few elements are analyzed, either by voltammetry (lead, cadmium) or titration (magnesium in drinking water).
- Concerning the analysis of food safety parameters (contaminants and residues), mycotoxins like aflatoxins are not tested. Only the heavy metals cadmium and lead are analyzed by voltammetry.

Analytical instrumentation and equipment

- The chemical laboratory is only equipped with basic instruments for the proximate food analysis, including UV and IR spectrometers. No automatic Soxhlet or Kjeldahl system for the determination of fat and nitrogen/protein are available. A voltammetry system is used for the analysis of some metals in drinking water and liquid food samples.
- The microbiological laboratory has the appropriate equipment, is fully functional and in clean condition.
- There is an inventory in place for all instruments. Balances and other instruments are calibrated by the TJT Directorate of Metrology Kurghan Tube or Dushanbe once a year, the calibrations are well-documented.

Building and facilities

- TJT Laboratory Kurghan Tube moved to new facilities in 2009, they are in appropriate and clean

condition. There is a good standard of housekeeping, a cleaning schedule is in place.

- There are sometimes power cuts in Kurghan Tube. The Laboratory has a generator and UPS systems for some instruments.
- In the laboratory there is one working fume hood. The laboratory facilities are sufficient air-conditioned. Purified laboratory water is produced by water distillation, deionization systems are not in place.
- There is an EHS manager. The building is secured and visitors are registered.

Personnel and training

- The total number of staff is 6, including the head of laboratory. All staff has a university degree, either in chemistry, food technology or biology.
- New staff is trained, the training is documented. Competency files for the technical staff are in place. Most of the trainings are in-house training, there is no sufficient budget for external trainings.

Summary

TJT Laboratory Kurghan Tube is the central TJT Laboratory of the southern province of Tajikistan, Khatlon. Besides this testing center there are additional three smaller TJT laboratories in the province. TJT Laboratory Kurghan Tube is analyzing exclusively food samples which are delivered mostly from TJT inspectors. The laboratory is accredited by the internationally recognized accreditation body NCA of the Republic of Kazakhstan, however the accreditation schedule is very limited to some basic food proximate analysis. Additionally the Laboratory is nationally accredited by the TJT Directorate of Metrology and Accreditation. A comprehensive and well-organized laboratory quality management is in place. The Laboratory has primarily only the instrumentation and expertise for food proximate analysis (analysis of nutritional components) and some food quality parameters. In addition some microbiological testing in food samples is performed. Some minerals and metals are analyzed by photometry/colorimetry or voltammetry, mainly in drinking water and liquid food samples. At the moment fortified food (with the exception of salt) and food safety parameters like pesticides, mycotoxins, environmental contaminants and antibiotics cannot be tested due to the non-availability of the necessary equipment and expertise. Thus main constraints are the shortage of sophisticated instrumentation and the limited budget for technical staff, accreditation (to increase the scope), and for technical trainings of the laboratory staff.

8. Summary of the visits to other Tajik laboratories

Besides the audits of the three TJT laboratories, additional visits to the following laboratories were organized:

- Laboratories of the Khujand Branch of Tajik Polytechnic Institute in Khujand,
- Laboratories of Tajikistan National University, Department of Biology and Chemistry, in Dushanbe,
- Laboratories of State Sanitary and Epidemiological Service (SES) of Tajikistan in Dushanbe.

The main aim of these short visits was to receive an overview about additional laboratory capacities and capabilities in Tajikistan. In addition, the visits to the two university laboratories should clarify to what extend these academic laboratories can give future training to the technical staff of the TJT laboratories regarding their new sophisticated instrumentation and techniques.

The food laboratories of the Khujand Branch of Tajik Polytechnic Institute in Khujand are in newly renovated rooms with new furniture and equipment. The facilities are in appropriate and clean condition. However, the instrumentation is only for the food proximate analysis of basic nutritional parameters. There are no instruments for the analysis of e.g. metals, vitamins, mycotoxins and pesticides.

Several laboratories of different institutes of the Tajikistan National University in Dushanbe were shortly visited. Besides some aged spectrometers in several laboratories, in one institute a latest and state-of-the-art flame AAS system has been installed, which will be operational soon. Also a latest microwave digestion system is installed in another laboratory. Both systems together, microwave digestion system and flame AAS, are universal techniques for the analysis of many metals in all kind of food (see chapter 9.2). Thus it is recommended to start collaboration between these institutes and the TJT Laboratory in Dushanbe. Perhaps the university institutes can also give some training in modern metal analysis.

The State Sanitary and Epidemiological Service (SES) is a national agency under the Ministry of Health and Social Protection. SES has inter alia a supervisory function and the state control over the quality and safety of food products. SES has a mandate to inspect the different levels of food business (including food import and export) and to take and test food samples. Food samples are taken by the SES inspectors. There are a number of food testing and microbiological testing centers in Tajikistan. The visited SES Testing Center in Dushanbe has laboratories for e.g. virology, food chemistry, toxicology, radioactivity and microbiology. The food chemistry laboratory was involved in the ADB wheat fortification project, running from 2002 to 2007. The laboratory has the instrumentation and knowledge to analyze iron and zinc in wheat flour by photometry and to screen vitamin B_3 (niacin) by a color reaction. However, this kind of analysis is not performed anymore after the completion of the ADB project. The laboratory is not accredited. Instruments are calibrated annually by the TJT Directorate of Metrology in Dushanbe. The SES Nutrition Center has a sizable microbiological laboratory, with appropriate and clean facilities. All typical microbiological parameters are tested in approximately 1000 food samples per annum.

9. Recommendations for the performance improvement of the visited TJT food laboratories

On the basis of the described findings and the data from the questionnaires including accompanying documents, recommendations for the performance improvement of the visited TJT food laboratories are given. The expertise of the three visited TJT food laboratories is summarized in the following **Table 1**:

Table 1

	TJT Laboratory Dushanbe	**TJT Laboratory Khujand**	**TJT Laboratory Kurghan Tube**
Fortified food parameters			
Vitamin B group	No	No	No
Iron	Yes (C,V)	Yes (C,V)	No
Zinc	Yes (C,V)	Yes (C,V)	No
Iodine in salt	Yes (T)	Yes (T)	Yes (T)
Premixes	No	No	No
Proximate Analysis	Yes	Yes (NP)	Yes (NP)
Microbiology	Yes (S)	Yes (S,D)	Yes
Food safety parameters			
Heavy metals	Yes (AAS,V)	Yes (V)	Yes (V)
Aflatoxins	Yes (S)	No	No
Pesticides	No	No	No

PAHs, PCBs	No	No	No
Antibiotics, vet.drug residues	No	No	No
Radioactive nuclides	Yes (S)	No	No
GMO	Yes (D)	Yes (D)	No

*AAS-atomic absorption spectroscopy, C-Colorimetry, D-under development, NP-protein/nitrogen not tested, S-screening, T-titration, V-voltammetry

Regarding fortified food there are obvious gaps. Only iodine in salt samples by titration is analyzed in all three laboratories. Iron and zinc are tested in two laboratories, but mostly only in drinking water and liquid food samples, either by colorimetry or voltammetry. Vitamins B_x (vitamins B_1, B_2, B_3, B_9) and also premixes are not tested at all.

Proximate analysis is performed in all three laboratories, however in two laboratories no protein/nitrogen is tested.

There is microbiological testing in all three laboratories, but in the two laboratories Dushanbe and Khujand only as screening tests on a small scale.

Regarding food safety only the heavy metals cadmium and lead are tested, mainly by voltammetry and only in drinking water and liquid food samples. TJT Laboratory Dushanbe is analyzing these elements also by flame AAS after ashing. Some mycotoxins are screened only in the TJT Laboratory Dushanbe. GMO analysis for maize and soya products is under development in two laboratories. Two radioactive nuclides are screened in TJT Laboratory Dushanbe.

In summary, the main focus of the three TJT laboratories is on proximate analysis and basic food quality parameter. Microbiological testing - essential in particular for food of animal origin - is only limited in scope and quantity. Regarding fortified food parameters only iodine in salt is tested in all three laboratories. Iron and zinc are tested in two laboratories, however mainly in drinking water and liquid food samples. Testing of food safety parameters is generally restricted to the heavy metals lead and cadmium, which are analyzed mostly by a relatively insensitive technique in drinking water and liquid food samples.

9.1. General remarks

Several authorities and ministries in Tajikistan are responsible for the state control and supervision of food quality and food safety. TJT has the mandate to take and test food samples on compliance to national and international standards. Also the State Sanitary and Epidemiological Service (SES) under the Ministry of Health and Social Protection is involved in food inspection, sampling and testing. The State Veterinary Inspection Service (SVIS) under the Ministry of Agriculture has the mandate to inspect and test food of animal origin and live animals. There are differences in responsibilities, expertise and resources between these agencies. Due to the lack of cooperation and coordination between the authorities there is a lot of overlapping and duplication of food safety control activities and food testing[3,4]. It is recommended, that an overall assessment of the regulatory food control framework in Tajikistan is initiated in order to recognize gaps and overlaps in the system and to give recommendations for pooling of resources and improving the efficiency. The report by European Commission and FAO from 2007 (footnote 4) could be a basis for this assessment. Further on it would be recommendable to set up a standing coordination mechanism to merge

[3] Mission Report 'TRADE PROMOTION IN TAJIKISTAN - PHASE III, 6 to 12 November 2011, Project TAJ/61/124A' by International Trade Centre https://itctj.files.wordpress.com/2011/01/tj-mission-report-digby-nov-2011-eng.pdf

[4] Report on 'INSTITUTIONAL, POLICY AND LEGISLATIVE FRAMEWORK OF FOOD SECURITY OF TAJIKISTAN' by European Commission and FAO http://www.fao.org/docrep/016/ap600e/ap600e.pdf

the different activities in the field of food safety and testing. In a first step it is advisable to install a working group to coordinate the testing activities of fortified food and other relevant food safety parameters. One initial task of this working group would be the summarization and assessment of the scattered results of food testing of the different Tajik authorities, in order to receive a first preliminary overview about the food safety situation in the country.

Regarding fortified food (at the moment only salt, in future probably also wheat) it is advisable to start systematic and coordinated food monitoring programs. In these programs the quantity of annual samples, the sampling locations (e.g. primary production, wholesale, retail, market, import) and sampling frequency should be defined. The testing of the different laboratories must be harmonized by inter-laboratory comparison exercises in order to receive comparable test results (see chapter 9.2). These monitoring programs need a professional coordination for planning, supervising, reporting and final assessments of the results. The above-proposed working group should be involved. Only this monitoring approach will give a realistic overview about the fortification situation in the country and can be the sound basis for follow-up activities. Gaps and temporal and spatial trends will be recognized by the monitoring results. Such monitoring programs – once implemented – can be also extended to other food quality or food safety parameters.

Two national Standards (ST RT 1057-2004 and 1058-2004) specify the fortification levels of iron, zinc and four vitamin B substances in wheat baking flour, bread, and bakery products. The Standard ST RT 1058-2004 'Bread and Bakery Products produced from Flour, fortified with Vitamin-Mineral Supplements (Premix)' defines in Table 4 of its Appendix the concentrations of vitamins B_1, B_2, B_3, B_9, electrolytic iron, and zinc in bread and bakery products, produced by extra grade and first grade flour. However, no dimensions (e.g. mg/100 g or mg/kg) are given for these concentrations in the Standard. Thus at the moment there is no clear information about the fortification levels in bread and bakery products and it is recommended to specify unambiguously these concentrations.

Recommendations

It is recommended:

- to merge the different activities of the various authorities in the field of food safety and testing,
- to install a working group to coordinate the testing activities of fortified food and other relevant food safety parameters,
- to summarize and assess in a first step the scattered results of food testing of the different Tajik authorities in order to receive a first preliminary overview about the food safety situation in the country,
- to start systematic and coordinated food monitoring programs, regarding fortified food and later on also for other food parameters,
- to specify unambiguously the fortification levels for bread and bakery products in national Standard ST RT 1058-2004,
- to initiate an overall assessment of the regulatory food control framework in Tajikistan in order to recognize gaps and overlaps in the system and to give recommendations for pooling of resources and improving the efficiency.

9.2. Analysis of fortified food

In **Table 2** the various methods to analyze fortified salt and wheat samples are summarized:

Table 2

Analysis	Screening/Field tests	Confirmation/Reference methods
Analysis of fortified salt		
Iodine in salt	Rapid test kit® Spectrophotometric method (e.g. iCheck®, WYD®)	titration ICP-MS
Analysis of fortified wheat flour		
Iron in flour	Iron spot test (AACC 40-40.01) spectrophotometric method (e.g. iCheck®)	flame AAS, ICP-OES or ICP-MS after acid (microwave) digestion
Zinc in flour	spectrophotometric method (e.g. iCheck®)	(voltammetry), flame AAS, ICP-OES or ICP-MS after acid (microwave) digestion
Vitamins B_x in flour	VitaFast® by r-biopharm, for folic acid in addition Ridascreen®Fast by r-biopharm	HPLC, LC/MSMS

Regarding the analysis of iodine in salt samples, all visited TJT laboratories are using the titration method. It is advisable to integrate this analytical method also in the scope of the international accreditation by the Kazakh NCA. In addition, the analysis of iodine in salt samples should be included in the annual national PTs organized by TJT Laboratory Dushanbe, in order to secure the harmonization and reliability of these test results. If field test kits like iCheck® Iodine or WYD® are implemented in the control of the production/ processing of salt, the TJT laboratories should have also access to these field test kits. The TJT laboratories will gain expertise in handling these kits and are able to train and consult the industry laboratories. It should be discussed whether the salt industry laboratories are also invited to participate for this kind of analysis in the national TJT PTs. The participation in these interlaboratory comparison exercises would secure the quality of iodine testing in the industry laboratories and would give the possibility of support and consultancy in case of unsatisfactory results.

Recommendations

Regarding the analysis of iodine in salt samples it is recommended:

- to integrate this iodine titration method into the scope of the international laboratory accreditation by the Kazakh NCA,
- to include the iodine titration method in the annual national PT scheme organized by TJT Laboratory Dushanbe,
- to invite the salt industry laboratories to participate for the iodine analysis in the national TJT PTs,
- to provide the TJT laboratories with the same field test kits which are used in salt industry laboratories.

In former wheat flour fortification projects in Tajikistan always the so-called KAP-1 complex (recommended by the Kazakhstan Academy of Nutrition) was used as premix formulation. This formulation contains electrolytic elementary iron, thus in both national Standards ST RT 1057-2004 and 1058-2004 the iron fortification levels are specified for electrolytic iron. Electrolytic iron can be analyzed qualitatively by the iron spot test and can be used as screening test in the mill. However, a quantitative iron analysis is not possible with this field test. On the hand, the semi-quantitative test kit iCheck® Iron is not suitable for testing electrolytic iron. Regarding the analysis of zinc in wheat flour samples, it is recommended to supply the mill laboratories with the field test kit iCheck® Zinc. The manufacturer must provide appropriate training to operate these kits accurately. Due to the fact that iron cannot be test by semi-quantitative field kits like iCheck® Iron and the non-availability of screening tests for vitamins B_x (see below more details about

vitamin B_x testing), the field test kit iCheck® Zinc is the only effective tool and zinc is the only suitable marker to control the fortification procedure in the mill. Therefore this analysis should be integrated in a detailed QA/QC management in the mill to monitor the flour fortification. As mentioned already above in the context of iodine testing, it is recommended to supply also the TJT laboratories with the test kit iCheck® Zinc. This will give the laboratories the possibility to gain expertise in handling the test kits and to train and consult the mill laboratories. The analysis of iron and zinc in wheat flour should be included in the annual national PT scheme organized by TJT Laboratory Dushanbe. In addition, it is suggested to invite also the mills which will use the iCheck® Zinc to participate regularly in these annual national PTs, in order to check the quality of their own results. However, in this context it should be mentioned, that in general the field test kits iCheck® Iron and Zinc are dedicated to analyze flour samples, but not final products like bread and bakery products.

As reference method in the laboratories, the analysis of both metals by flame AAS after microwave acid digestion is recommended (a compilation of screening and reference analytical methods for monitoring flour fortification with iron is given in USAID manuals[5,6]). The advantage of the AAS technique method is its universal application, not only for these two metals in flour samples, but for many relevant elements in all kind of food samples. With the accessory devices like graphite furnace and hydride system also several toxic elements (lead, cadmium, mercury, arsenic) can be analyzed with the same instrument. Thus this technique would broaden the analytical scope of the laboratories explicitly. The old-fashioned ashing method as sample preparation technique is time and energy consuming and element/analyte losses can occur. In contrast to the ashing method, the sample preparation by a microwave digestion system in closed vessels is universally applicable to all kind of food materials and decreases extraction times, improves the digestion efficiency and prevents the loss of elements/analytes. Thus the internationally recognized combination of flame AAS and microwave digestion system would not be used only for the analysis of fortified flour and bakery products, but would increase significantly the portfolio of the TJT laboratories for testing minerals and metals in all kind of food. Intensive instrumental and application trainings for this new modern technique will be needed. In this context it should be mentioned that the laboratories of the Technical University Dushanbe which have installed both systems might also provide support and training. In addition, some accessories like gas supply, a venting system to remove the combustion fumes and vapors of the AAS and a separate fume hood for the microwave system have to be installed. The results of the field tests should be compared regularly by this reference method in the laboratories.

The TJT Laboratory Dushanbe is operating already a flame AAS instrument, however only for the analysis of lead and cadmium, without the essential fuel gas acetylene and the lamps for iron and zinc, and with the ashing method as sample preparation method. **To upgrade the AAS analysis in TJT Laboratory Dushanbe it is recommended to purchase the necessary fuel gas acetylene including a regulator assembly, AAS element lamps for iron, zinc and other elements, and a microwave digestion system together with an effectively working fume hood.** In a second step, TJT Laboratory Dushanbe as a reference laboratory should participate in international PT schemes like e.g. FAPAS, LGC and BIPEA for the analysis of metals in food. For the general quality control of metal analysis suitable certified reference materials like SRM 1567b (wheat flour) from NIST US and BCR 191 (brown bread) from IRMM Belgium should be used.

Also ICP techniques can be used as reference method for the reliable, sensitive and specific analysis of metals and minerals, however these techniques are more sophisticated, complex and expensive. The

[5] 'MANUAL FOR WHEAT FLOUR FORTIFICATION WITH IRON, Part 3' by USAID, 2000
http://pdf.usaid.gov/pdf_docs/pnack487.pdf

[6] 'MANUAL OF METHODS FOR DETERMINING MICRONUTRIENTS IN FORTIFIED FOODS' by USAID, 2010
http://a2zproject.org/pdf/Manual_Foods.pdf

voltammetry method for metals applied in two TJT laboratories is very limited in scope (iron cannot be tested), interfered by food matrix and mostly used only for liquid samples.

Finally, regarding the iron analysis it should be emphasized that special diligence is needed to avoid iron contamination from the laboratory environment and used chemicals. A major concern when conducting iron tests in a laboratory is contamination from e.g. rusted metal fixtures, equipment, and furniture. All analyses must, therefore, be conducted with utmost care to avoid contamination. This means also that all glassware must be soaked in dilute acid, thoroughly rinsed with distilled water, and dried in an oven. Moreover, all reagents must be of analytical grade suited for mineral analyses. When testing samples for iron, always so-called blanks must be prepared and tested in parallel.

Recommendations:

Regarding the analysis of iron and zinc in flour samples it is recommended

- to supply the mill laboratories with the field test kit iCheck® Zinc,
- to include the iron and zinc methods in the annual national PT scheme organized by TJT Laboratory Dushanbe,
- to invite the mill laboratories to participate for the zinc analysis in the national TJT PTs,
- to provide the TJT laboratories with the same field test kits which are used in the mill laboratories,
- to implement the universally applicable analysis technique flame AAS after microwave acid digestion as reference method in the laboratories,
- to organize intensive instrumental and application trainings for this new modern technique, probably also by the Technical University Dushanbe,
- to use suitable certified reference materials for the general quality control of metal analysis,
- to equip the TJT Laboratory Dushanbe with all required accessories for the flame AAS and with a microwave digestion system for effective sample preparation,
- to enable TJT Laboratory Dushanbe as a reference laboratory to participate in international PT schemes for the analysis of metals in food.

It is intended to fortify wheat flour in Tajikistan with several water-soluble vitamins B_x: vitamin B_1 (thiamine), vitamin B_2 (riboflavin), vitamin B_3 (niacin) and vitamin B_9 (folic acid). Some of these substances are affected or destroyed by light, air or heat. Thus it is essential to analyze the vitamin B_x content in fortified wheat flour and final products like bread and bakery products. On the other hand the analysis of these vitamins is complicated and demands sophisticated analytical methods (some methods are described in the USAID Manual of footnote 6). There are yet no simple screening tests on the market. According to Table 2 there are microbiological test kits for the analysis of the individual vitamins commercially available. However, these tests require some skills in laboratory work and a relative sterile environment which is available only in microbiological laboratories. Thus these screening tests will be not applicable in mill laboratories, but only in laboratories with a microbiological section. Trainings can be provided by the manufacturer. Some additional accessories are needed like sterile vials and filters, some chemicals and an ELISA reader for the final evaluation. It is proposed to start the screening with one typical and relevant vitamin Bx as a kick-off to learn this technique.

As reference methods there are several HPLC methods (mostly with fluorescence detection) available. However, the sample preparation for these vitamins is very laborious and elaborate and for each vitamin B_x another analytical method has to be used. Thus it is recommended to introduce this technique only in a second step, perhaps in combination with the HPLC analysis of mycotoxins (see chapter 9.3). Today, LC/MSMS is the state-of-the-art technique to analyze the vitamins B_x in one run with high sensitivity and specificity. However, this technique is very sophisticated, complex and expensive and therefore not applicable in near future.

Recommendations:

Regarding the analysis of vitamins B_x in flour samples it is recommended

- to implement the microbiological screening test kits for vitamins B_x in one or more TJT laboratories,
- to start this analysis technique with one typical and relevant vitamin Bx as a kick-off,
- to introduce the more complex HPLC methods only in a second step.

9.3. Analysis of relevant food safety parameters

During this assessment it was obvious that the main focus and field of activities of the laboratories visited are proximate analysis and basic food quality parameters. There is a strong need to test relevant food safety parameters in food products therefore this issue should be prioritized in future projects. Wheat and other cereals is the main staple in Tajikistan. There is a high rate of domestic production and import of wheat. Thus there is also the risk of contamination of wheat by mycotoxins, in particular during storage and transport. Also dried fruits and nuts are prone to mycotoxins. It is therefore recommended to start in a first step of a future food safety project with the HPLC analysis of mycotoxins like aflatoxins, DON, ochratoxin A and fumonisins. TJT Laboratory Dushanbe is the only TJT laboratory which is screening some mycotoxins, the HPLC system from 2004 is not operational and not in use anymore. Thus it is recommended to replace this instrument with a modern HPLC system to start mycotoxin analysis. This system may be used also for testing of individual vitamin B_x in fortified flour (see section 9.2).

Up to now there seems to be no routine testing of pesticides residues in Tajik laboratories. On the other hand there are many reports about the use of old and outdated pesticides and POPs (persistent organic pollutants, e.g. DDT), obsolete pesticides burial sites and contaminated soil in Tajikistan. Therefore it is very important to study also pesticides residues in all kind of food to receive an overview about the contamination of the Tajik food chain. It is recommended to start in a first step of a future food safety project the analysis of food of animal origin, fruits and vegetables by gas chromatography (GC), coupled with specific detectors like ECD and PND. This instrumentation would allow the analysis of organochlorine pesticides and contaminants (e.g. DDT, HCH, PCBs) and of organophosphates. Later on the scope of testing could be broadened by the use of mass spectrometry like GC/MS or GC/MSMS.

Finally, in the context of food safety also the microbiological testing of food should be broadened and intensified. In this respect there might be a high risk in food of animal origin like meat, milk and milk products and eggs. Currently mostly screening tests on a little portion of samples are performed.

Recommendations

Regarding the analysis of food safety parameters in future food safety projects it is recommended:

- to start with the HPLC analysis of mycotoxins in wheat and other relevant food,
- to replace the non-operational HPLC system in the TJT Laboratory Dushanbe with a modern HPLC system for mycotoxin analysis,
- to start the analysis of pesticides in food of animal origin, fruits and vegetables by gas chromatography (GC), coupled with specific detectors like ECD and PND,
- to broaden the scope of pesticides testing in a second step by the use of mass spectrometry like GC/MS or GC/MSMS,
- to broaden and intensify the microbiological testing of food of animal origin.

10. Acknowledgements

The consultant would like to acknowledge Caroline Manus and David Morgan (both GAIN London) for the

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11. Appendices

Appendix 1: Questionnaire including 3 Annexes, used in this Assessment

Appendix 2: Final work schedule of Dr Gerhard Rimkus

Appendix 3: The NCA certificate of accreditation for TJT Laboratory Dushanbe (in English)

Appendix 4: NCA schedule of accreditation for TJT Laboratory Dushanbe (in English)

Appendix 1 Questionnaire including 3 Annexes, used in this Assessment

LABORATORY ASSESSMENT TAJIKISTAN
Questionnaire on Food Laboratories
Capacity and Capability

	General Information	
1	Name of laboratory	
2	Address	
3	Telephone	
4	Fax	
5	Email Address	
6	Web Site	
7	Laboratory/Managing Director	
8	Type of laboratory: ☐ Academia ☐ Research Institute ☐ Government ☐ Private	
9	*If governmental lab: to which Ministry/ Department the laboratory is reporting?*	
10	*If governmental lab: are you audited/inspected by the Ministry regularly?*	
11	Please describe the main activities of the laboratory	
12	Source of laboratory budget	
13	Who are your main customers?	☐ Authorities/Public ☐ Industry ☐ Other
14	Are analyses sub-contracted?	☐ YES ☐ NO ☐ in future (specify timeframe)
15	*If yes, please list the sub-contracted laboratories and the criteria to choose them for sub-contracted analyses*	
16	Are you involved in food fortification monitoring programs?	☐ YES ☐ NO ☐ in future (specify timeframe)
17	*If yes, please describe since when, how many samples per year and what kind of micronutrients are analysed?*	
18	Does your laboratory belong to a network of labs?	☐ YES ☐ NO ☐ in future (specify timeframe)
19	*If yes, please specify*	

	Quality Management System	
20	Is the laboratory accredited according to ISO 17025?	☐ YES ☐ NO ☐ in future (specify timeframe)
21	*If yes: name of the accreditation body and accreditation No; please provide copy of accreditation certificate with annex/schedule and expiry date and copy of the last audit protocol*	
22	Is the laboratory working according to GLP or GMP?	☐ YES ☐ NO ☐ in future (specify timeframe)
23	*If yes, is the food laboratory also working under GLP/GMP?*	
24	Is a Quality manager/Quality team in place?	☐ YES ☐ NO ☐ in future (specify timeframe)
25	Is a Quality Manual present?	☐ YES ☐ NO ☐ in future (specify timeframe)
26	Are internal audits organised on a regular basis?	☐ YES ☐ NO ☐ in future (specify timeframe)
27	*If yes, when were the last internal audits performed, results?*	
28	Have the laboratory participated in national or international interlaboratory/ proficiency tests in 2013, 2014 and 2015?	☐ YES ☐ NO ☐ in future (specify timeframe)
29	*If yes, please list the tests of 2013 - 2015 including the provider, the analytes, and results*	
30	*What kind of corrective actions have been taken in case of non-compliance?*	
30a	Are quality control charts in place?	☐ YES ☐ NO ☐ in future (specify timeframe)
31	Are certified reference materials (CRMs) used?	☐ YES ☐ NO ☐ in future (specify timeframe)
32	*If yes, please list the CRMs used in the laboratory*	
33	Is there a process in place for handling complaints?	☐ YES ☐ NO ☐ in future (specify timeframe)
34	*If yes, please describe briefly the procedure*	
	Methods of Analysis	
35	Annex 1: Please mark available analytical methods	See Annex 1, list of analytical methods
36	Is a general SOP/directive for method validation in place?	☐ YES ☐ NO ☐ in future (specify timeframe)

36a	Are validation files for each analytical method available? Where are these files located?	
37	How are non-compliant results confirmed?	
38	How is measurement uncertainty determined and reported?	
39	Are positive (fortified) and negative (matrix) control samples used regularly?	☐ YES ☐ NO ☐ in future (specify timeframe)
40	Are methods in place for the analysis of micronutrients (vitamins and minerals) in premixes?	☐ YES ☐ NO ☐ in future (specify timeframe)
41	*If yes, please describe the test methods and provide annual number of samples per test*	
	Equipment	
42	Annex 2: Please mark available laboratory equipment	See Annex 2, list of laboratory equipment
43	Is an inventory of all equipment available?	☐ YES ☐ NO ☐ in future (specify timeframe)
44	Are log books kept for equipment maintenance?	☐ YES ☐ NO ☐ in future (specify timeframe)
45	What are the maintenance procedures?	
46	What are the calibration procedures of the equipment? Internal/external? Documentation?	
	Buildings and premises	
47	What is the surface of your laboratory in square meter?	
48	Please send a floor layout of the laboratory (if available)	Please send the floor layout
49	Type of power supply Does power back up exist? (uninterruptible power supply-UPS and/or generator)	
50	Are air conditioning systems available in the laboratories?	☐ YES ☐ NO ☐ in future (specify timeframe)
51	Are enough separate storage rooms available for chemicals, samples and disposal?	☐ YES ☐ NO ☐ in future (specify timeframe)

52	Are enough fume hoods available in the laboratories?	☐ YES ☐ NO ☐ in future (specify timeframe)
53	Are enough refrigerators and freezers available for the storage of chemicals and samples?	☐ YES ☐ NO ☐ in future (specify timeframe)
53a	Is a centralized (external) gas supply in place?	☐ YES ☐ NO ☐ in future (specify timeframe)
54	Is a cleaning schedule in place for the laboratories?	☐ YES ☐ NO ☐ in future (specify timeframe)
55	How is high purity and/or de-ionized water available in the laboratory?	
56	Is a manager/officer in charge for Environment, Health and Safety (EHS)?	☐ YES ☐ NO ☐ in future (specify timeframe)
57	Is a security system at the entrance available?	☐ YES ☐ NO ☐ in future (specify timeframe)
58	Are visitors registered?	☐ YES ☐ NO ☐ in future (specify timeframe)
	Personnel	
59	Number of total lab staff	
60	Please list all laboratory staff in Annex 3	See Annex 3, list of personnel
61	Please send the org chart (organogram) of the institute	Please send the org chat (organogram)
62	Is an annual internal and external training program for the staff in place?	☐ YES ☐ NO ☐ in future (specify timeframe)
63	*If yes, please provide the program for 2013, 2014, and 2015*	
64	How has the staff to demonstrate the competency for the individual SOPs?	
65	Is a procedure in place to train new employees on analytical methods?	
66	Please list your participation in conferences and seminars in 2013, 2014, and 2015	
67	Please list your active membership in national and international associations/working groups	
68	Has the laboratory access to relevant literature (e.g. AOAC, ISO, EPA methods, scientific journals) and/or electronic databases?	☐ YES ☐ NO ☐ in future (specify timeframe)
69	*If yes, please specify*	

70	Are scientific journals subscribed?	☐ YES ☐ NO ☐ in future (specify timeframe)
71	*If yes, please list the subscribed journals*	
	Sample Management	
72	Total number of food samples analysed per annum (2013 and 2014)	
73	Where do the samples come from?	☐ Authorities/Public ☐ Industry ☐ Other
74	Is the laboratory involved in sampling?	☐ YES ☐ NO ☐ in future (specify timeframe)
75	*If yes, are sampling procedures/ instructions/ SOPs available?*	
76	Are annual food monitoring plans/schedules available?	☐ YES ☐ NO ☐ in future (specify timeframe)
77	*If yes, please send details of these plans*	
78	How are samples registered and labelled at the laboratory? How is the traceability of samples assured from reception to the reporting?	
79	Has the laboratory an electronic LIMS (Laboratory Information Management System)?	☐ YES ☐ NO ☐ in future (specify timeframe)
80	*If yes, please name the brand of the LIMS or do you use an in-house version?*	
81	Are certificates/reports issued for each sample/parameter? Please provide a copy of examples	
82	How are samples archived? For how long?	
83	How are raw data/reports archived? For how long?	
84	Is there a target for the turnaround time (TAT, time between reception of sample and reporting the results)?	☐ YES ☐ NO ☐ in future (specify timeframe)
85	*If yes, what is the stipulated TAT and what percentage of samples does exceed this target?*	

	Miscellaneous	
86	Please comment on any relevant aspect of your laboratory that has not appeared in this questionnaire	
87	Please list and comment on the main constraints faced in your laboratory (e.g. equipment, training, laboratory space)	

Annex 1

Analytical Methods

a) Vitamins and Minerals

Parameter	YES (X)	NO (X)	Matrices	Accredited (X)	SOP exists (X)	Validated (X)	Proficiency tests participated (X)	Number of samples per year	Please specify method reference (e.g. ISO, AOAC, in-house)
Vitamin A									
Vitamin D									
Vitamin E									
Vitamin K1									
Vitamin B1									
Vitamin B2									
Vitamin B3									
Vitamin B5									
Vitamin B6									
Vitamin B9									
Vitamin B12									
Vitamin C									
Biotin									
Iron									
Zinc									

Copper									
Selenium									
Calcium									
Phosphorus									
Manganese									
Magnesium									
Potassium									
Sodium									
Iodine									

b) Microbiology

Parameter	YES(X)	O (X)	Matrices	Accredited (X)	SOP exists (X)	Validated (X)	Proficiency tests participated (X)	Number of samples per year	Please specify method reference (e.g. ISO, AOAC, in-house)
Total plate count									
Yeast and moulds									
Enterobacteria									
Coliforms									
Spore forming bacteria									
Escherichia coli									
Salmonella spp.									
Staphylococcus aur									
Bacillus cereus									
Pseudomonas aeruginosa									
Cronobacter sakazakii									
Clostridium perfringens									
Listeria monocytogenes									

c) Nutritional Content

Parameter	YES (X)	NO (X	Matrices	Accredited (X)	SOP exists (X)	Validated (X)	Proficiency tests participated (X)	Number of samples per year	Please specify method reference (e.g. ISO, AOAC, in-house)
Energy content									
Ash determination									
Water content									
Protein content									
Total carbohydrate									
Total Fat content									
Fatty acid (as triglyceride equivalents) profile									
Dietary fiber									
Sugar content									
Peroxide value									
Acid value									

d) Contaminants

Parameter	YES(X)	NO (X	In Future (specify timeframe)	Accredited (X)	SOP exists (X)	Validated (X)	Proficiency tests participated (X)	Number of samples per year	Please specify method reference (e.g. ISO, AOAC, in-house)
Heavy metals									
Pesticides (please specify which type)									
Melamine									
GMO									
Aflatoxins (please specify which type)									
Allergens (please specify which type)									
Other (please specify)									

Annex 2

Main Laboratory Equipment

Equipment	YES(X)	NO (X)	In Future (specify timeframe)	Qty	Brand	Year of purchase
UV/VIS spectrometer						
IR spectrometer						
HPLC/UV/VIS						
HPLC/Fluorescence						
HPLC/Refractive Index						
HPLC/DAD						
LC/MSMS						
GC/FID						
GC/ECD						
GC/nitrogen-phosphor detector						
GC/MS (MSD)						
GC/MSMS						
AAS-Flame						
AAS-Graphite furnace						
AAS-Hydride system						
ICP-OES						
ICP-MS						
ELISA reader						
Soxhlet						
Automatic titrator system						
Analytical balance						
Incubator						
Autoclave						
Microscope						
Centrifuge						

PH Meter						
Microwave for acid digestion						
SPE system						
Other						

Annex 3

Personnel

Staff	How many?	In Future (specify timeframe)	Education	Comments
Total lab staff				
Laboratory Manager/Director				
Senior Analysts				
Analysts				
Technicians				
Laboratory assistants				
Others (please specify)				

Appendix 2 Final work schedule of Dr Gerhard Rimkus

Date	Time	Activity	Participants	Venue
Sunday 21 June 2015		Travel Hamburg (Germany)-Istanbul-Dushanbe (Tajikistan)	GR	
Monday 22 June 2015	Morning	Meeting with the Deputy Directors of Tajikstandart Dushanbe	GR, ML, Mr. Mirali Olimov, Ms. Karomat Saidova	Tajikstandart Dushanbe, Headquarter
	Afternoon	Laboratory Assessment Tajikstandart Dushanbe, first part	GR, ML, Mr. Sangzoda Talabsho (Head of Laboratory) and laboratory staff	Tajikstandart Dushanbe, Testing Laboratory
	Evening	Flight Dushanbe-Khujand	GR, ML, GD	
Tuesday 23 June 2015	Morning	Meeting with the Director of Tajikstandart Khujand	GR, ML, GD, Mr. Auyb Boboev, Mr. Ravshan Bakaev	Tajikstandart Khujand, Headquarter
	Morning	Laboratory Assessment Tajikstandart Khujand	GR, ML, GD, Mr. Ravshan Bakaev (Head of Laboratory) and laboratory staff	Tajikstandart Khujand, Testing Laboratory
	Afternoon	Visit to the Laboratories of the Khujand Branch of Tajik Polytechnic Institute, Khujand	GR, ML, Mrs. Rahimova Aliya (Instructor of Chemistry), Mrs. Bobokhujaev Ruslan, (Lab Manager), Mr. Komilova Dilrabo (Deputy Dean)	Laboratories of the Khujand Branch of Tajik Polytechnic Institute
Wednesday 24 June 2015	Morning Afternoon	Travel Khujand-Dushanbe by car	GR, ML, GD	
	Afternoon	Visit to several Laboratories of Tajikistan National University, Department of Biology and Chemistry, Dushanbe	GR, ML, GD, Mr. Sherov Kurnonali, Director of Research Institute TNU	Tajikistan National University, Department of Biology and Chemistry; Dushanbe
Thursday 25 June 2015	Morning	Travel Dushanbe-Kurghan Tube by car	GR, GD	
	Morning	Laboratory Assessment Tajikstandart Kurghan Tube	GR, GD, Mr. Boboev Bahrom Saidohtamovich (Head of Laboratory) and laboratory staff	Tajikstandart Kurghan Tube, Testing Laboratory
	Afternoon	Travel Kurghan Tube-Dushanbe by car	GR, GD	
Friday 26 June 2015	Morning	Laboratory Assessment Tajikstandart Dushanbe, second part	GR, Mr.Sangzoda Talabsho (Head of Laboratory) and laboratory staff	Tajikstandart Dushanbe, Testing Laboratory
	Afternoon	Visit to the Laboratories of State Sanitary Epidemiological Service (SES) of Tajikistan, Dushanbe	GR, Mr. Kandakov (the Head of Food Control Department)	Laboratories of State Sanitary Epidemiological Service (SES) of Tajikistan, Dushanbe

	Afternoon	Meeting with USAID representative	GR, ML, Caroline Manus (GAIN London), Ms. Malika Makhkambaeva (USAID Tajikistan)	
Saturday 27 June 2015		Travel Dushanbe (Tajikistan)-Istanbul- Hamburg (Germany)	GR	

GR-Gerhard Rimkus; ML-Mutriba Latypova (GAIN Tajikistan); GD-Galina Davlatmamadova (QM Manager, TJT Laboratory Dushanbe)

Appendix 3 NCA certificate of accreditation for TJT Laboratory Dushanbe (English translation)

The Committee on Technical Regulation and Metrology of the Ministry of Industry and New Technologies of the Republic of Kazakhstan

The National Center of Accreditation

CERTIFICATE OF ACCREDITATION
Registered at the registry of accreditation subjects

#KZ.I.00.1336
dd. 16 August 2012
effective until 16 August 2017

Testing Center Of Food Of Agricultural Products And Goods Of The Agency For Standardization, Metrology, Certification And Trade Inspection under the Government of Tajikistan (TOJIKSTANDART)
located at Dushanbe, Karabaeva N., 42/2

is accredited by the accreditation system of the Republic of Kazakhstan in compliance with the ISO / *IEC (International Electrotechnical Commission) 17025:2005 "general requirements to the testing and calibration labs".*

Compliance of objects of testing: testing of products in accordance with accreditation areas.

Areas of accreditation are attached in the Annexes 1,2,3.

Head of accreditation body: signed T. Nurashev

Stamped by NCA

Appendix 4. NCA schedule of accreditation for TJT Laboratory Dushanbe (English translation)

The Scope of Accreditation
Test Center food and agricultural products and consumer goods
Agency for Standardization, Metrology, Certification and Trade Inspection under the Government of the Republic of Tajikistan (Tajikstandart)

Address: Tajikistan, Dushanbe, N.Karabaeva Street, 42/2, Telephone: (+992 37)2336869, Fax: (+99237)2341933
Email:info@standard.tj, Website: www.standard.tj

List of products (objects)	Code КП ВЭД	Code ТН ВЭД ТС	Legislative regulations, regulations for the products (objects)	Defining characteristics (indicators) products (objects)	Normative documents for test methods to identify characteristics (indicators)
1	2	3	4	5	6
Drinking water – treated Drinking water	11.07.11	2201 10 190 0 2201 10 900 0	ST RT 1078 -07* GOST 2874-82	total hardness	GOST 4151-72
				dry residue	GOST 18164-72
				sulphates	GOST 4389-72
				chlorides	GOST 4245-72
Mineral Water	11.07.11	220110	GOST 13273-88	sulphates	GOST 23268.4-78
				chlorides	GOST 23268.17-78
				calcium	GOST 23268.5-78
				magnesium	GOST 23268.5-78
				bicarbonates	GOST 23268.3-78
1	2	3	4	5	6
Sugar white	10.81.12	1701 99 100	GOST 31361-08	moisture	GOST 12570-98
				saccharose	GOST 12571-98
Wheat flour for breadmaking Bran	10.61.21 10.61.40	1101 00 110 0 1101 00 150 0 1101 00 900 2302 30	GOST 26574-85 GOST 7169-66	crude gluten	GOST 27839-88
				ash content	GOST 27494 -87
				humidity	GOST 9404-88
Raw materials and foods	10	Группа 01-05, 07-12, 15-22	Sanitary Rules and Norms 2.3.2. 1078-01*	lead and cadmium	GOST 30178 -96
				sample preparation	GOST 26929-94
Drinks non-alcohol, syrups and kvass	11.07.19	2202 10 000 0 2202 90 100 9	GOST 28188-89	acidity	GOST 6687.4--86
				solids	GOST 6687.2-90
CANS Juices, nectars, juices made of fruits and vegetables, and mixed	10.32.17	2009	ST RT GOST Р 52182-04*	titrated acidity	GOST 25555.0-82
Fresh Fruit juices	1032 10321 103211 103212	2009	ST RT GOST Р 52184-04*	soluble solids	GOST 28562- 90

	103213 103214 103215 103216 103217 103219 10.32.12-10.32.16				
Fruit juices from consentrates	10.32.12-10.32.16	2009	ST RT GOST Р 52185-04*		
Fruit juices restored	10.32.12-10.32.16	2009	ST RT GOST Р 52186-07*		
Drinks with fruit juices	11.07.19	2009	ST RT GOST Р 52188-04*		
Tomato Juice 10.32.1	10.32.11	2009 50 100 9	ST RT GOST Р 52183-04* GOST 937-91		
Fruit nektars	11.07.19	2202 10 000 0	СТ RT GOST Р 52187-05*		
Corn Sugar Canned	10.39.17	2001 90 300 0	GOST 15877-70		
Canned Beans	10.32.15	2004 90 500 0	GOST 15979-70		
Canned Green Peas	10.39.16	2004 90 500 0	GOST 15842-90		
1	2	3	4	**5**	**6**
Concentrated tomato products	10.39.12	2002 10 900 0	GOST 3343-89		
Canned tomatoes	10.39.12	2002 10 900 0	GOST 7231-90		
Canned cucumbers	10.39.12	2001 10 000 0	GOST 20144-74		
Fruit sauces	10.39.25	2007 10 109 0	GOST 18077-72		
Fruit and berry Marinades	10.39.25	2007 10 109 0	GOST 7694-71		
Fruits and berries are pureed or crushed	10.39.25	2007 10 109 0	GOST 22371-77	titrated acidity	GOST 25555.0-82
Cans. "Fruit Drink"	11.07.19	2202 10 000 0	ST RT 1017-95*	soluble solids	GOST 28562- 90
Rosehip drink	11.07.19	2202 10 000 0	СТ RT 918-2004*		
Compotes	10.39.25	2007 99 970 9	GOST 816-91		
Jams	10.39.22	2007	GOST 6929-88		
Jams – different type	10.39.22	2007	GOST 7009-88		
Jam another type	10.39.22	2008	GOST 7061-88		

Beans, peas or lentils with meat	10.13.15	2004 90 500 0	GOST 8687-65	chlorides	GOST 26186-84
sauerkraut	10.39.12	2004 90 300 0	GOST 3858-73		
Salted cucumber	10.39.12	2002 10 900 0	GOST 7180-73		
Salted tomatoes	10.39.12	2002 10 900 0	GOST 7181-73		
Stuffed vegetables in tomato sauce	10.13.15	2002 10 900 0	GOST 1016-90		
Marinated mushrooms and boiled	10.39.12	2001 90 500 0	GOST 28649-90		
Stuffed cabbage or peppers stuffed with meat and rice	10.13.15	2001 90	GOST 17472-72		