



Aga Khan Foundation
Water Emergency Relief Project
(WERP, P179311)

Employer's Requirements
for
Water Quality Testing Laboratory

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Employer's Requirement for Water Quality Testing Laboratory

1. Background

The Aga Khan Foundation, Afghanistan (AKF-A) is an agency of the Aga Khan Development Network (AKDN), a group of international, private, non-denominational development agencies working to improve living conditions and opportunities for people in some of the poorest parts of the developing world. The Network's organizations have individual mandates that range from the fields of health and education to architecture, rural development and promotion of private-sector enterprise and institutions that seek to empower communities and individuals, usually in disadvantaged circumstances, to improve living conditions and opportunities.

The Aga Khan Foundation (AKF) is a non-denominational international development agency established in 1967 by His Highness the Aga Khan. Its mission is to develop and promote creative solutions to problems that impede social development, primarily in Asia and East Africa. Created as a private, non-profit foundation under Swiss law, it has branches and independent affiliates in 19 countries. AKF seeks to provide sustainable solutions to long-term problems of poverty, hunger, illiteracy, and ill health. In Afghanistan, AKF works with rural communities in mountainous, remote or resource poor areas to improve quality of life in the areas of natural resource management, market development, governance, education, and health.

Afghanistan's development gains are at risk due to the economic crisis following the political upheaval in August 2021, which led to the cessation of international aid and security assistance. The crisis has exacerbated poverty, food insecurity, and the need for humanitarian assistance, with an estimated 20 million people acutely food-insecure and over 28 million requiring aid. Water is critical for economic recovery and public health, particularly affecting women and girls who bear the burden of water collection. Decades of underinvestment, severe droughts, and climate change have intensified the water crisis. The Water Emergency Response Project (WERP) aims to restore access to drinking water, sanitation services, and surface water irrigation in 20 drought-affected provinces. Implemented by AKF-USA and UNOPS, WERP leverages community-led institutions like Community Development Councils to deliver WASH services and support vulnerable populations, especially women, in rural areas.

In Afghanistan, the economic and humanitarian crises have worsened water scarcity and quality, particularly affecting rural communities. Ensuring safe water is crucial for health and economic recovery, with women and girls disproportionately impacted by water collection challenges. The Water Emergency Relief Project (WERP) focuses on restoring access to safe drinking water, requiring rigorous water quality testing to prevent waterborne diseases and safeguard public health. Implementing effective water quality testing is vital for the project's success in providing sustainable WASH services amidst the country's severe water crisis.

2. Objective:

The objective of the water quality testing is to ensure the safety and reliability of drinking water across multiple provinces in Afghanistan. By systematically testing water sources for various physical, chemical, and biological parameters, the aim is to identify potential contaminants and assess water quality against national and international standards. This rigorous testing is essential for safeguarding public health, preventing waterborne diseases, and supporting the sustainable provision of safe drinking water to vulnerable rural communities affected by the ongoing water crisis.

3. Scope of Work:

The scope of work entails comprehensive water quality testing across 46 districts in several provinces of Afghanistan, focusing on physical, chemical, and biological parameters. This includes collecting samples from diverse water sources, ensuring proper field documentation, and transporting samples under controlled conditions to accredited laboratories. The selected laboratories must conduct tests using standardized methods, maintain data confidentiality, and adhere strictly to health and safety protocols. Results from these tests will be promptly reported to the Aga Khan Foundation to inform decision-making and ensure continuous monitoring of water quality, crucial for supporting public health and sustainable development initiatives in rural communities.

4. Information, Terms, reference and responsibility for Water Quality Testing Laboratory

1. Geographical Coverage:

- The resources of water to be tested are available in the following provinces and districts:

No	Province	Name of all 46 Districts
1	Baghlan	Doshi, Bano, Pul Hesar, Dahani Ghori, Khinjan, Khost wa Frinig
2	Samangan	Dara-e Sof-e-Bala, Roy-e-Doab, Feroz Nakhchir, Hazrat-e- Sultan
3	Balkh	Zari, Khulm, Balkh, Sharak-e-Hayratan, Nahr-e- Shahi, Charbolak, Kaldar, Dawlatabad, Shortepa, Keshenda, Chemtal
4	Bamyan	Sayghan, Panjab, Shebar, Yakawlang, Bamyan, Kahmard
5	Parwan	Shekhali, Koh Safi, Ghorband (Siah Gerd), Jabal saraj
6	Panjshir	Shutul, Onaba (Anawa), Rukha, Paryan, Khinj (Hisa-e- Awal), Bazarak
7	Takhar	Namakab, Rostaq, Bangi, Ishkamish
8	Kunduz	Khan Abad, Dashti Archi, Kunduz Qala Zal, Gul Tapa, Aqtash

2. Field Sheet Recording:

As a minimum, the following details should be recorded on a field sheet for each water sample collected.

- Location name, GPS points, date and time of sampling.
- Source type (Brief water source information), source number
- Sample type, sample number
- Sampler name
- Signature/initials of sampler

3. Sampling and Transportation:

- The sampling and transportation of the samples are the responsibility of the laboratory.

- The laboratory must use standardized methods for sampling and ensure the samples are kept in appropriate conditions to maintain their integrity.

4. Water Sample Label:

The following details should be recorded on each collected water sample.

- Location name, GPS points, date & time of sampling, type of source, number of source/samples.

5. Sampling Procedure.

The following general guidelines can be applied to the collection of water samples from surface water sources (river, stream, pond, and lake).

- Before collecting any sample, make sure that you are at the right place.
- Remove any attachments (e.g. hoses) or plastic inserts were fitted to the tap which could contaminate the sample. Any issues with the sample point which may affect the sterilization of the tap, or the sample results should be noted on the field sheet.
- While collecting sample from Surface water, do not include large, non-homogeneous pieces of trash, such as leaves, in the sample. Avoid touching and disturbing the bottom of a water body when taking a depth sample, because this will cause particles to become suspended.
- When taking the sample at the maximum depth it is important to ensure that the bottom of the sampler is at least 1 m above the bottom.
- A bottle that is to be used for transport or storage of the sample should be rinsed three times with portions of the sample before being filled. This does not apply, however, if the storage/transport bottle already contains a preservative chemical.
- The temperature of the sample should be measured and recorded immediately after the sample is taken.
- Separate portions of the sample should be set aside for pH and conductivity determinations. The same portion must not be used for both determinations because of the possibility of potassium chloride diffusing from the pH probe.
- A small air space should be left in the sample bottle to allow the sample to be mixed before analysis.
- sample bottles should be resealed and stored in a clean, cool, dark environment and protected from recontamination. Additional methods of preservation include freezing and the addition of chemical preservatives. Suggested chemical preservatives and recommended maximum storage times for samples for various analyses. The preservative treatment may be applied immediately on sampling or may already be contained in the sample bottle.

6. Supervision and Permissions:

- During sampling water resources, the AKF and PRRD representatives must be available, or the laboratory must obtain permission to collect samples in their absence.

7. Offices Location:

- The laboratory should be in areas where water samples can be delivered within the standard 12-hour timeframe for bacteriological, physical and chemical tests, to ensure the integrity of the samples is maintained during transportation and testing.

8. Accreditation and Compliance:

- The laboratory must be accredited by a recognized national or international accreditation body.

- The laboratory must comply with all relevant national (ANSA) or international (WHO) standards for water quality testing.
9. **Quality Control and Assurance:**
- The laboratory must implement rigorous quality control and assurance procedures to ensure the reliability and accuracy of test results.
10. **Health and Safety:**
- The laboratory must adhere to all relevant health and safety regulations to ensure the safety of its personnel and the environment.
 - Appropriate safety measures must be in place during sampling, transportation, and testing.
11. **Contingency Plan:**
- The laboratory must have a contingency plan in place to address any issues that may arise during sampling, transportation, or testing.
12. **Types of Tests:**
- The following chemical, physical, and biological tests must be conducted:

a) Physical Tests for Water Quality Testing

1. **PH Level:** Measures the acidity or alkalinity of water.
2. **Turbidity:** Measures the cloudiness or haziness of water caused by suspended particles. High turbidity can indicate the presence of microorganisms and sediments that can harbor pathogens.
3. **Temperature:** Water temperature affects chemical reactions, biological activity, and solubility of gases. It can influence the rate of chemical reactions and the metabolic rates of aquatic organisms.
4. **Color:** Natural color can be caused by dissolved organic matter, while unusual colors can indicate contamination from industrial waste or other pollutants. The color is usually measured in Platinum-Cobalt units (PCU).
5. **Odor:** The presence of unusual or strong odors can indicate contamination from pollutants such as organic waste, chemicals, or industrial effluents.
6. **Electrical Conductivity:** Measures the ability of water to conduct electrical current, which is directly related to the concentration of ions in the water. High conductivity can indicate the presence of dissolved salts and other inorganic materials.
7. **Taste:** Unusual tastes can indicate contamination from chemicals, metals, or organic matter. Taste is usually assessed through sensory evaluation.

b) Biological Tests for Water Quality Testing

1. **Total Coliform Bacteria:** Measures the presence of coliform bacteria, which are indicators of microbial contamination. Coliforms are not necessarily harmful but suggest that other pathogenic microorganisms may be present.
2. **Fecal Coliform Bacteria:** Specifically measures coliform bacteria from fecal contamination. The presence of fecal coliforms, especially *E. coli*, indicates recent fecal contamination and a higher risk of pathogens.
3. ***E. coli*:** The *E. coli* test detects the presence of *Escherichia coli* bacteria in water, indicating fecal contamination and potential health risks.
4. **Hydrogen sulfide (H₂S) Test:** The H₂S test detects the presence of hydrogen sulfide-producing bacteria in water, indicating possible contamination from organic matter or sewage. The presence of H₂S can also suggest the presence of pathogenic bacteria.

c) Chemical Tests for Water Quality Testing

1. **Total Dissolved Solids (TDS):** Indicates the total concentration of dissolved substances in water, including minerals, salts, and metals. High TDS can affect water taste and quality.
2. **Total Hardness:** Measures the concentration of calcium and magnesium ions in water. Hard water can cause scaling in pipes and reduce soap effectiveness.
3. **Nitrate (NO₃):** High nitrate levels can be harmful, especially to infants and pregnant women, causing conditions such as methemoglobinemia or "blue baby syndrome."
4. **Chloride (Cl):** High levels of chloride can indicate pollution and affect the taste of water.
5. **Sulfate (SO₄):** High sulfate levels can cause a laxative effect and affect the taste of water.
6. **Fluoride (F):** While low levels of fluoride can prevent tooth decay, high levels can cause dental and skeletal fluorosis.
7. **Phosphate (PO₄):** High phosphate levels can indicate pollution from agricultural runoff or industrial waste and contribute to algal blooms in water bodies.
8. **Arsenic (As):** Toxic and carcinogenic, often found in groundwater.
9. **Residual Free Chlorine:** Measures the amount of chlorine available to disinfect the water. It must be conducted using appropriate methods.
10. **Total Chlorine:** Measures both free chlorine and combined chlorine. Appropriate testing methods must be used to ensure accuracy.
11. **Total Iron:** Measures the concentration of both dissolved and particulate iron in the water.
12. **Calcium:** Measures the concentration of calcium ions.
13. **Potassium:** Measures the concentration of potassium ions.
14. **Sodium:** Measures the concentration of sodium ions.
15. **Bicarbonate:** Measures the concentration of bicarbonate ions.
16. **Carbonate:** Measures the concentration of carbonate ions.
17. **Magnesium:** Measures the concentration of magnesium ions.
18. **Alkalinity as Bicarbonate:** Measures the buffering capacity of water.
19. **Calcium Hardness as Milligrams of Carbonate:** Measures the concentration of calcium ions expressed as calcium carbonate.

Note: The parameters will not be limited to those mentioned above; additional parameters may be included under physical, chemical, and biological categories in case required in the site or requested by engineer.

5. Time Duration of services:

The time duration for Water Quality Testing (WQT) starts from the contract start date with the laboratory and extends until June 30, 2025.

6. Equipment to be provided by Laboratory:

- The laboratory must have all necessary equipment for conducting the required above mentioned tests.
- All equipment must be regularly calibrated and maintained to ensure accurate and reliable test results.

- All equipment used must meet or exceed relevant national and international standards for accuracy and reliability in water quality testing.
- Equipment Requirements for Water Quality Testing:
 1. **pH Meter:** A calibrated pH meter with electrodes suitable for water testing.
 2. **Turbidimeter:** A turbidimeter capable of measuring turbidity levels in NTU (Nephelometric Turbidity Units).
 3. **Spectrophotometer:** A spectrophotometer for measuring concentrations of various chemical parameters such as nitrates, phosphates, and Arsenic etc.
 4. **Conductivity Meter:** A conductivity meter to measure the electrical conductivity of water, indicating the presence of dissolved ions.
 5. **Microbiological Testing Equipment:** Equipment for microbiological testing, including incubators, autoclaves, and microbiological media.
 6. **Gas Detection Equipment:** Equipment for detecting gases such as hydrogen sulfide (H₂S), including gas detection tubes or sensors.
 7. **Chlorine Testing Equipment:** Equipment for measuring chlorine levels, including DPD kits for free and total chlorine testing.
 8. **Titration Equipment:** Titration equipment for determining alkalinity, hardness, and other parameters requiring titration methods.
 9. **Atomic Absorption Spectrometer (AAS):** For the analysis of heavy metals such as arsenic etc., and other trace elements in water samples.
 10. **Incubators and Shakers:** Incubators and shakers for microbial culture and biochemical tests.
 11. **Refrigeration Units:** Refrigerators and freezers for sample storage before analysis.
 12. **Safety Equipment:** Personal protective equipment (PPE) and safety cabinets for handling hazardous chemicals and pathogens.

7. Deliverable and Reporting:

- **Test Results:** The laboratory shall provide comprehensive and accurate test results for each water sample, including all parameters specified in the testing protocol.
- **Reports:** A detailed report for each sample tested, including test methods used, results interpretation, and any observations or recommendations based on the findings.
- **Data:** All raw data collected during testing, including quality control measures and calibration records, should be provided upon request.
- **Timelines:** The results of each sample must be shared with AKF promptly upon completion of testing.
- **Format:** Reports should be in a standardized format agreed upon by the AKF, detailing each parameter tested, the method used, results in numerical values, and any relevant notes or observations.
- **Accuracy and Precision:** Test results must meet specified accuracy and precision standards as per APHA or other recognized methods.
- **Confidentiality:** All test results and associated data are confidential and should only be shared with authorized personnel of the AKF.
- **Documentation:** Proper documentation of all testing procedures, results, and reports must be maintained and made available for audit purposes or upon request by the AKF.

8. Staff and Laboratory Experience:

- The laboratory must have at least 4 years of relevant experience.
- The laboratory must have completed at least one similar projects..
- The laboratory must employ qualified personnel who have at least a 12th-grade education and a minimum of 2 years of experience in water quality testing.

9. Payment Schedule:

The laboratory can submit invoices after delivering each of the 20 Water Quality Testing (WQT) results to AKF.

By agreeing to these terms and conditions, the laboratory commits to providing high-quality, reliable, and timely water quality testing services.