

1.0 Introduction

Laboratory accreditation is the employment of procedures and criteria specifically developed to determine technical competence of laboratories to carry out accurate and reliable services. It is the formal recognition, authorization and registration of a laboratory that has demonstrated its capability, competence and credibility to provide reliable testing, measurement, calibration services and all other technical services. The concept of laboratory accreditation was developed to provide third-party certification that a laboratory is competent to perform the specific test or type of tests.

With increasing advancement of science and technology, rapid industrialization, urbanization and increasing population among others, the need for ecological balance and environmental protection has increased.

For successful implementation of environmental protection practice, it is indispensable to identify and quantify environmental pollution, causal agents, sources, pathways, conduct baseline check, lay down standards and build-up monitoring systems through environmental laboratory services.

In order to ensure that environmental Laboratories in Nigeria are capable of producing quality test results, the Federal Ministry of Environment has developed this procedural guideline to guide interested persons, intending owners, professionals in the field to understand the requirements for setting up a standard accreditable environmental laboratory in Nigeria.

1.1 Purpose of this Guideline

The purpose of this Guideline is to provide clear directions and guidance for the accreditation of Environmental Laboratory in Nigeria. The guideline will stipulate the minimum criteria for accreditation.

1.2 Need for Accreditation

- Facilitates the implementation and maintenance of an effective quality management system.
- Gives confidence to users in availing the services
- Gives confidence to the laboratory for the results generated
- Provides national/international recognition of technical competence
- Helps in defending laboratories while dealing with legal disputes pertaining to laboratory results

- Reduces the operating costs of the laboratories by getting results right the first time and every time
- Helps private sector laboratories to attract more business
- Helps in national and international acceptance of results
- Meets purchase or regulatory specifications
- Increases competitiveness and market share

1.3 Regulatory Body for Environmental Laboratories in Nigeria

The Federal Ministry of Environment is the apex recognition/ accreditation body for Environmental laboratories in Nigeria.

1.4 Who Can apply for environmental Laboratory Accreditation

The Environmental laboratories of any of the following organizations are eligible to apply for recognition:

- i. Autonomous and government agencies;
- ii. Public sector undertaking;
- iii. Educational institute (Government/ Government Aided/ Private);
- iv. Private laboratories;
- v. Non Governmental Organization (NGO); and
- vi. Cooperative Sector Laboratories.

2.0 Environmental Laboratory Accreditation Process

The required standards of compliance and certification acquisition that an environmental laboratory needs before accreditation by FMEnv is presented in Annex A. Steps to laboratory accreditation are:

2.1 Environmental Laboratory Registration

Environmental laboratory (E-Lab) registration shall be a prerequisite for the operation of an E-Lab in Nigeria. The owner of the environmental laboratory shall apply to the Ministry for registration by obtaining an Application Form after paying the prescribed non-refundable fees.

The completed Application Form, Laboratory Quality Manual and other relevant documents shall be submitted to the Ministry for processing. All unreturned application(s) shall be deemed abandoned after duration of six months.

The Ministry's Laboratory Audit Checklist shall be issued to the laboratory after satisfactory evaluation of the submitted Form and other documents preparatory to inspection. Notification of mutually agreed date for Laboratory inspection will be sent to the laboratory. Terms and conditions of registration are stated in Annex B.

2.2 Environmental Laboratory Inspection/Audit Committee

The Ministry shall set up a committee for the purpose of inspecting, monitoring and ensuring full compliance to the required minimum standard for laboratory accreditation. The committee shall be headed by a Chairperson who must have been trained on inspection procedures and certified as a laboratory Auditor/Lead Auditor. The Chairperson must be conversant with laboratory registration standards and other regulatory matters. Functions of the Ministry's laboratory auditors and inspectors are stated in Annex C.

2.3 Inspection/monitoring of an Environmental laboratory

The Laboratory Inspectors from FMEnv shall request for the current laboratory quality manual which shall among others contain the following information:

- a) Owner(s) of the Laboratory
- b) Certificate of Incorporation of the company
- c) Current Laboratory Registration Licence/certificate (where applicable)
- d) Organogram of the Company.
- e) Name(s) of Environmental Analyst(s) in-charge of the laboratory.
- f) List of staff with designation, qualifications and job description(s)
- g) Current Practice Licence of the managing director/operator and other personnel who are members of the laboratory
- h) List of available instrument/equipment,
- i) Documentation records which include: books – workbooks/logbooks, certificates of analysis, client's records, product records, receipts, chain of custody, protocols of analysis, etc.
- j) Area(s) of specialization, type of product(s) to be analysed and nature of analysis to be undertaken by the laboratory.

The Laboratory Inspectors shall among other things ascertain the following, using the FMEnv's approved Analytical Laboratory Inspection Score Sheet (proposed sample in Annex D) .The score sheet shall examine, among other things;

- i. Type and make of the equipment
- ii. Adequacy of equipment/instrument, personnel and other facilities to carry out such analysis/research
- iii. Compliance of methods of analysis with standard procedure
- iv. Type and suitability of chemical reagents available
- v. Adequacy of office/laboratory spaces
- vi. Suitability of location of premises and rooms
- vii. Availability of protective and safety devices, such as laboratory coats, head gear, nose mask, gloves, safety goggle, fume-cupboard, fire extinguisher, etc.
- viii. Compliance with standard specifications on documentation for standard operating procedures, analytical results, reference standards, reference samples, work/log books, etc.
- ix. Compliance with waste disposal procedures for gaseous, liquid and solid wastes.
- x. Compliance with Good Laboratory practices
- xi. Compliance with professional ethics

2.4 Environmental Laboratory Infrastructure Requirements

For the environmental laboratory to be accredited, the laboratory shall have, among other things;

- i. Sufficient space, proper design and interior furnishing
- ii. Proper ventilation, lighting, temperature control and dust free atmosphere
- iii. Regular and proper supply of essential needs like water and electricity which are to be ensured for smooth functioning of the laboratory
- iv. Facilities for preservation of samples, weighing, cleaning of glassware
- v. Fire-fighting facilities, laboratory safety and first-aid facilities.

2.5 Laboratory Design/Housing/Building

For the environmental laboratory to be accredited, the laboratory should be designed in a way that it has;

- i. Proper ventilation system, well-ventilated stack rooms, store rooms

- ii. Laboratory hoods, sinks, miscellaneous safety equipment like eye wash fountain, safety showers
- iii. Proper arrangement for safe disposal of wastes, and
- iv. Proper space for carrying out the following environmental experimental sampling activities;
 - a) Water Analysis Section
 - b) Air Analysis Section
 - c) Soil and Solid Waste (including hazardous wastes) Analysis Section
 - d) Instrumentation Section (Analysis requiring sophisticated instruments)
 - e) Inorganic analysis and organic analysis section.
- v. Proper supply and discharge facilities for water, power, gas and air to ensure easy accessibility and serviceability without constructional challenges.
- vi. Selected and specified materials of high quality which shall be suitable for their functional end use.
- vii. The capacity to easily accommodate envisaged newly assigned tasks with reference to new instrument/equipment methods, analysts etc.

2.6 Laboratory design work area

The environmental laboratory shall maintain the following work areas with adequate instrumentation and infrastructure for accreditation. They include:

- i. Analytical Lab
- ii. Balance room
- iii. Instrument room with adequate provision of Gas cylinders etc.
- iv. Microbiology area
- v. Sample pre-treatment
- vi. Digestion and extraction area for pesticides and metals
- vii. Sample receipt section
- viii. Sample storage
- ix. Conference -cum-library area
- x. Staff room
- xi. Computer section
- xii. Store
- xiii. Maintenance room

- xiv. Laboratory Record room
- xv. Field monitoring equipment room
- xvi. Waste storage section

2.6.1 Laboratory Furniture

- i. The required furniture standard for an environmental laboratory is that the working benches top surface shall be made up of acid and alkali resistant materials.
- ii. The steel/aluminium frames used in furniture or any fittings shall be non-corrosive. Wherever stainless steel materials are needed, the same shall be provided.
- iii. The writing desks should also to be laminated and non-corrosive. The storage cupboard shall be made up of clipboard covered with melamine sheets.
- iv. The furniture shall be designed specifically according to the requirement of the laboratory so as to maximize the quality of work output.

2.6.2 Laboratory Electricity Supply and Electrical Services

For the electrical supply, a standard environmental laboratory shall have regular and stabilized electricity supply (220-230 volts) for smooth functioning of the laboratory and its instruments. Necessary and adequate provisions shall be made for continuous supply, constant voltage, adequate load, desired level of illumination and proper electrical fittings. The electric voltage regulation is utmost necessary and can be achieved through use of voltage stabilizers and Uninterrupted Power Supply (UPS) system.

2.6.2.1 Illumination

Because of the specialized nature of analytical work in laboratories, the lighting system should be specific and different from those in other areas since laboratory works involve accurate readings of glassware-graduations, balance, verniers, and other measuring lines.

Also, the level of illumination, brightness, glass and location of light source should be controlled to facilitate ease in making measurements and to provide maximum comfort for the laboratory analysts.

2.7 Laboratory work environment

A structured environmental laboratory shall not be sited in a residential building to avoid danger and exposure of residents to chemical hazards, possible fire outbreaks and explosions. Laboratories shall develop the following conducts to facilitate healthy congenial environment;

2.7.1 Safe Laboratory Practices;

- a) Multiple story buildings, especially laboratory should have adequate exit doors in case of emergency.
- b) Adequate facilities for high toxic or highly inflammable materials or gases.
- c) Adequate number of exhaust fans for proper air circulation
- d) Cleanliness and good housekeeping reduces frequency of laboratory accidents.
- e) Adequate fire-fighting facilities and training to laboratory personnel in its operation.
- f) Fire-fighting equipment shall be located at strategic points in the laboratories.
- g) Laboratory officials shall be trained regarding fire pertinent hazards with their work.
- h) Gas cylinders should be securely fastened.
- i) Safety gadgets like hand gloves, vaguest, dispensers, gas masks, goggles etc. must be used by the laboratory officials whenever necessary with other protective apparel.

2.8 Environmental laboratory instruments/equipment

For the accreditation of a standard environmental laboratory, the laboratory shall have sufficient analytical instruments/ equipment to conduct required analytical operations. A detailed list of instruments is illustrated in Annex E. The laboratory shall maintain an up-to-date inventory of all instruments/equipment.

The inventory list should carry the following information:

- i. Name of the equipment/instruments
- ii. Manufacturer, model and serial number
- iii. Warranty pass/ quality assurance
- iv. Date of instrument received in the laboratory
- v. Condition when received and maximum years of guarantee
- vi. Date of start of the operation of the instrument/equipment
- vii. Current location in the laboratory
- viii. Operating instructions/ manuals
- ix. Preventive maintenance schedule.

For accreditation, certain steps are needed to ensure instruments and equipment's compliance to standards and its availability in the laboratory. They are:

- i. Check-up of new instrument- manufacturer's specifications must be maintained at the laboratory and different modules or sub-units should be connected to each other using appropriate cables as recommended by the manufacturer.
- ii. Verification for proper functioning according to its intended use- the type of calibrations and tests depend on the instrument type, its configuration and its intended use.
- iii. Manuals/operating procedure of all equipment/instruments should be kept preferably in the working area where the instrument is located for ready reference by the analysts.
- iv. Maintenance- each instrument should have an instrument maintenance logbook to record all maintenance issues and corrective actions. Maintenance activities described in the manufacturer's instruction manual (supplied with the instrument/equipment) shall be followed. Annex F suggests routine maintenance for some environmental laboratory equipments.
- v. Calibration of Instruments/Equipment- All calibrations shall conform to the requirement of the International Organization for Standardization- ISO/IEC 17025 and information related to calibration of the instruments/equipment shall be fully documented in the appropriate records.
- vi. Water Supply and Distilled/De-ionized Water - laboratory should have provision for continuous water supply either from a direct supply source or through storage tanks
- vii. Sample Digestion System - necessarily required in order to remove various toxic and hazardous fumes from the work place generated during use of organic solvent/or during acid digestion.
- viii. Polythene ware/ Other Lab wares - borosilicate glass bottles for the storage of reagents and standard solutions; Standard solutions of silica, boron and alkali metals should be stored in polyethylene bottles.
- ix. Quality of Chemicals - selection of laboratory chemicals of appropriate quality; for achieving result with desired accuracy.

2.9 Sample Analysis

For an environmental laboratory to be accredited there shall be minimum required numbers of test/analysis that shall be carried out by such laboratory. Annex G entails the minimum Analysis such a laboratory should be able to carry out.

2.10 Waste Management

The laboratory shall have Standard Operating Procedures for the disposal of samples, leftover digested sample, leachate and extracts or other sample preparation products. The laboratory shall maintain appropriate documentation and records of assigned disposal contractors demonstrating that samples have been properly disposed off as per the applicable rules and there won't be any environmental hazards due to disposal of samples leftovers.

2.11 Quality assurance and quality control in environmental laboratories.

Quality assurance is the definite programme for laboratory operation that specifies the measures required to produce reliable data of known precision and accuracy. This programme is required to be defined in a documented laboratory quality system which is essential for any laboratory seeking accreditation. The laboratory quality system shall include;

- a) quality assurance manual - quality policy that defines the statistical level of confidence included to express the precision and bias of data, as well as the method detection limits and
- b) quality control processes.

2.11.1 Quality Assurance Plan (QAP)

A laboratory that plans to be accredited should have a good quality assurance plan. A QAP is listed below but not limited to:

- i. Quality assurance unit (QAU) - designated to audit the laboratory studies.
- ii. Standard Operating Procedure - written procedures that define how to undertake protocol of specified activities e.g. analytical methods, Health and safety precautions etc.

- iii. Personnel - individuals engaged in the conduct of or responsible for the supervision of a study with education, training and experience and can carry out assigned functions.
- iv. Reagents and Solutions - reagents and solutions in laboratory areas shall be labelled to indicate identity, titer or concentration, storage requirement and expiry date.
- v. Raw Data - laboratory worksheets, records, memoranda, notes or exact copies thereof that are the results of original observations and activities of a study.
- vi. Equipment's - appropriate design and adequate capacity to function according to the protocol and shall be suitably located for operation, inspection, cleaning and maintenance.

2.11.2 Quality Control

The Laboratory shall implement internal quality control for monitoring the quality system and record all factors affecting the quality of services. The test/analysis equipment and procedures shall be calibrated to conform to ISO 17025 and shall participate in External Quality Assessment Scheme (EQAS).

The Laboratory shall develop a sample collection manual which, among others shall include procedures for collection, transporting, storage, handling, acceptance or rejection of samples. The Laboratory shall use only the standard or validated methods for sample tests/analysis. The procedures for all test/analysis methods and calculations shall be documented and maintained. Analytical Quality Control (AQC) will be taken up by recognized laboratories at two levels:

- (a) Internal AQC or within laboratory AQC - checking the precision and accuracy of analytical results within laboratory.
- (b) External AQC or between laboratory AQC - participation in external AQC organized by other external organization to achieve comparability of results through controlling the precision and accuracy.

2.12 Organization and management structure

For an environmental laboratory to be accredited there is the need for a proper organization and management structure. The structure should have:

2.12.1 Adequate qualified Personnel

The laboratory shall have sufficient number of registered environmental scientist and other relevant laboratory scientists. The head of the Laboratory shall be experienced, trained, certified and shall be a registered member of relevant professional body (as stated in professional certification section). He or she will be responsible for duties related to instructing, managing, advising, training, budgeting, etc. and shall possess a minimum of Master degree in the Environmental field.

2.12.2 Staff Requirement

To ensure accreditation of the environmental laboratory; Laboratory manager, Chief Laboratory technician, principal analyst, laboratory technologists shall possess minimum of B.Sc /B.Tech /B.Eng /HND as a basic degree with certification by the Institute of Public Analysts of Nigeria (IPAN) and other relevant environmental analysts certification associations. Their area/ field of specialization shall be but not limited to;

- a) Analytical chemistry/ Pure chemistry/Industrial chemistry
- b) Biological science/ Biochemistry/ Microbiology
- c) Chemical engineering/ Petrochemical engineering
- d) Environmental science/ Environmental engineering
- e) Physics/ health physics and environment,
- f) Nuclear science and engineering
- g) Science laboratory technology
- h) Soil science/ earth sciences etc.

2.12.3 Procurement

The Laboratory shall specify and document its policy and procedure for selection of suppliers. There shall be an inventory control system i.e. use of Material Safety Data Sheet (MSDS) for suppliers of equipment/instruments, chemicals, stationary etc. and records of approved suppliers shall be maintained.

3.0 Report of Inspection

A report of every inspection or monitoring exercise shall be submitted within Ten (10) working days to the Ministry with details of findings and recommendations and any other measures that may be taken to aid the decision of the Ministry.

4.0 Decision by The Ministry

The Ministry, upon the consideration of the report by the environmental laboratory inspectors, shall take a decision to give a;

- a) Full Approval – if the Laboratory meets the minimum required standard set in this guideline,
- b) Conditional approval – if the Laboratory partially meets the required minimum standard in this guideline, and
- c) No approval – if the Laboratory does not meet the minimum required standard highlighted in this guideline for accreditation.

After the decision in respect to options “a” or “b” above, payment for approval shall be communicated to the laboratory owner.

For “No approval”, unmet criteria of disapproval shall also be communicated to the laboratory owner.

5.0 Laboratory License and Seal Acquisition

The Ministry shall, upon approval issue a practice license to the environmental laboratory. The license shall be valid for a period of three (3) years and shall be subject to annual renewal. The licence may be withdrawn by the Ministry at any time, if it appears that there has been violation of any provision and rules set by the ministry. Such decision to withdraw the license shall not be on mere suspicion of violation of the regulatory standards, but by proven evidence of violation.

Annex I

Standards for Laboratory Accreditation

The Federal Ministry of Environment is the accrediting authority of environmental laboratories in Nigeria. FMEnv established the objective to provide government/ industry /Associations (local and international) in general with a scheme for third party assessment of the quality and technical competence of testing and calibration of laboratories. In order to achieve this objective, FMEnv provides laboratory accreditation services to laboratories that are performing tests/calibrations in accordance with FMEnv criteria, which are based on internationally accepted standards and guidelines such as:

1. ISO/IEC standard 17025:2005 - General requirement for the competence of testing and calibration of laboratories
2. ISO/IEC Guide 25 - General requirement for the competence of calibration and testing laboratories.

These services are offered in a non-discriminatory manner and are accessible to all types of testing and calibration laboratories regardless of their ownership legal status, size and degree of independence.

Required certifications for accreditation are:

1. The Standards Organization of Nigeria (SON) Cap S9 Laws of Federation of Nigeria 2004 revalidates laboratories with NIS ISO 9001:2008 Certificate which is for conformity to Quality Management System; for the provision of Inspection, Testing, Verification, Certification and Technical Staffing Services.
2. Globally recognized ISO 9001:2008 quality management systems and ISO 14001:2004 environmental management systems standard certifications (recently updated to incorporate a wide range of changes).

Annex II

Terms and Conditions of Environmental Laboratory Registration

1. The registration shall be granted for a period of three (3) years, it shall be renewable every three years subject to satisfactory compliance with prescribed minimum standards which will be based on periodic monitoring/assessment of the laboratory operations/activities by the environmental enforcement agency (NESREA). The laboratory shall apply for its renewal at least six months before expiry of registration.
2. The laboratory shall pay the prescribed administration charge of **Fifty Thousand Naira** prior to laboratory inspection and license fees of **Twenty Thousand Naira** upon successful application. Fees are subject to review by the Ministry without prior notice.
3. The laboratory shall perform only the tests in its approved premises as per the valid scope of registration. Sub-contracting is permitted with prior permission of the client(s) in only FMEnv registered/accredited environmental laboratory with appropriate scope of registration.
4. The laboratory shall keep records of any change in the Quality Management System on which it has been registered and which may prevent it from complying with the minimum standards. It shall document all changes made to the Quality Management System and make records of such changes available to the FMEnv.
5. The laboratory shall maintain confidentiality of samples and information thereof. Its test report shall be treated as strictly confidential between it and the client. No information regarding any sample or analysis shall be divulged to any person other than that client or the Ministry as may be required.
6. The laboratory shall participate in Proficiency Testing/Inter-Laboratory Test programmes on its own or as organized by FMEnv and other recognized environmental inclined bodies.
7. The laboratory shall permit access to its facilities as may be required by the ministry for the purpose of inspection, monitoring or investigation. It shall give access to all relevant records, documents, equipment etc. for the purpose of verifying any details.
8. The laboratory shall not operate in such a manner as to bring FMEnv and environmental profession into disrepute/dispute or make any misleading statement about its registration.

9. The laboratory shall make public claim regarding its registration strictly based on the scope of its registration. Any advertisement of skill, competence or facilities by a laboratory is forbidden save as may be approved by FMEnv in professional journals and similar media.

10. The Ministry may cancel or suspend the registration of a laboratory, reduce its scope of operation or conduct a reassessment due to changes in personnel, equipment, and/or if a complaint or any other information is received which indicates and is proven to undermine the technical competence and satisfactory compliance of the laboratory.

11. The laboratory shall not operate after the expiration of its registration or during the suspension/cancellation of its registration.

12. Registration shall be accorded to a laboratory for single premise only.

Annex III

Functions of FMEnv Commissioned Laboratory Auditors/Inspectors

The Inspectors are authorized by FMEnv to:

- a) Enter a laboratory or premises, which they believe, carry out laboratory analysis/consultancy services on all environmental and safety related services, etc. or any business in the field of environmental laboratory practice/research.
- b) Examine any equipment or item in the laboratory or in any premises, which they reasonably believe, is used for the purpose of carrying out analysis, training, research or business in environmental laboratory practices.
- c) Open and examine while in the laboratory or premises any container, cubicle or cupboard which they reasonably believe may contain any equipment or things which are related to their inspection; and
- d) Examine any book, documents or other records found in the laboratory or premises, which they reasonably believe, may contain information relevant to their assignment and make copies thereof. The authorities, owners or persons in charge of laboratory or premises and every person found thereof shall give all reasonable assistance to the FMEnv Inspectors, including making available to the Inspectors all information as they may require for the purpose of carrying out their assignments

Annex IV

Inspection Report for Evaluation of Laboratory to be Recognized Under the Federal Ministry of Environment Format

Name of Laboratory	:	_____
Name of Organization	:	_____
Letter Ref. No. of the Laboratory	:	_____
Date of Inspection	:	_____
Inspection undertaken by	:	1. _____ 2. _____ 3. _____

(A) Check-List for the Water Quality Parameters and Instruments:

(c) Check 'Physical Parameters' in respect of:

(i) Facilities _____

(ii) Expertise _____

(d) Check 'Inorganic (General & non-metallic)' in
respect of:

(i) Facilities _____

(ii) Expertise _____

3. Check 'Inorganic (Metals)' in respect of:

(i) Facilities _____

(ii) Expertise _____

4. Check `Organic tests in respect of:

(i) Facilities_____

(ii) Expertise_____

5. Check `Microbiological Tests' in respect of:

(i) Facilities_____

(ii) Expertise_____

(e) Check `Toxicological Tests' in respect of:

(i) Facilities_____

(ii) Expertise_____

(f) Check `Biological Tests' in respect of:

(i) Facilities_____

(ii) Expertise_____

8. Check `soil, sludge, sediment test' in respect of:

(i) Facilities_____

(ii) Expertise_____

9. Check `Characterization of hazardous waste test' presented by laboratory. Mark as \sqrt (Yes) in respect of:

(i) Facilities_____

(ii) Expertise_____

(g) (a) Verify the 'List of Equipment'.

Name the equipment, which are marked as (Yes) but are not available in the Laboratory.

(b) Specify the name of equipment which are available but not in working condition.

11. (a) Verify the 'List of Instrument'.

(b) Specify the name of instrument, which are available but not in working condition.

12. Check the list of glass apparatus & distillation assemblies provided by the laboratory. Mark as \surd (Yes) where appropriate.

13. If the Laboratory possesses the specific Ion meter name the electrodes, which are in working order.

(h) If the Laboratory is having the Atomic Absorption Spectrophotometer name the Hollow Cathode Lamps, which are usable

- (i) Whether facilities are available for digestion of samples
-

16. Hood system is available for exhaust of toxic gases Y/N

17. If the laboratory is having gas chromatograph:

a. Name the available detector (i) (ii) (iii)

b. Column available Yes (√)/No (x)] (with Nos.)

(i) Glass; (ii) Metal; (iii) Capillary

18. Coding of samples before handing over to laboratory (Yes/No)

(B) Check List for air Pollution Monitoring Parameters and Instruments:

1. Check "Ambient Air/Fugitive Emission Monitoring Parameters" presented by laboratory. Marked as (√) (Yes) in respect of:

(i) Facilities:

(ii) Expertise:

2. Check the "Micro meteorological parameter" presented by the laboratory. Mark as (√) (Yes) in respect of:

(i) Facilities

(ii) Expertise

3. Verify the list of instruments presented by the laboratory for monitoring Ambient Air/Fugitive emission/Stack gases.

4Verify the list of Micro meteorological Instruments presented by laboratory. Mark as \surd (Yes)

5Verify the list of vehicular emission monitoring instruments available:

5Specify the name of the instrument, which are available but not in working condition

7Verify the facilities for calibration of various flow measuring devices available.

(j) Check the frequency of calibrations

(k) Which of the methods given below are being followed for the Ambient Air Quality Analysis work :

(i) APHA

(ii) BIS

(iii) USEPA

(iv) ASTM

(v) ISO

(vi) Any other_____

13. Which of the methods are followed for the Stack Monitoring:

- (i) EPA _____ (ii) Central Board _____
(iii) ASTM _____ (iii) Any other _____

- (l) Check the procedures, followed for Analytical Quality Control (AQC) for Air Pollutants Analysis.
-

(C) General Information about the Laboratory

1. Availability and use of Reference Materials/Certified Reference Materials for calibration of AAS/Gas chromatograph/HPLC etc.
-

2. Whether the laboratory has any / adequate provisions for firefighting and fire escape:
-

3. Please procure a lay-out plan from the laboratory with the positions of instrument, equipment, work benches, sanitary fittings etc., marked on it.
-

4. Electricity Supply – frequencies of failure and duration. Provision of generators and its capacity:
-

5. Water supply – continuous or irregular. Alternative arrangements if any:
-

6. General cleanliness of the laboratory:

7. Provisions for First – Aid:

8. Checking of Electrical fittings, sanitary fittings, (Wash – basin, drainage system etc.)

(a) Distilled Water – whether prepared in the laboratory or procured from outside :

(b) If prepared in laboratory, specify the methods:

- | | |
|---------------------------|-------------------------|
| (i) Metal distillation | (ii) Glass distillation |
| (iii) Double distillation | (iv) Nano pure system |

Any other _____

(c) Whether quality of the distilled water is checked regularly

10. Whether water and wastewaters are being analyzed in the same laboratory using the same glassware and reagents or any separate arrangement:

11. Whether library facilities are available with the laboratory, if yes, brief description of Journals, Periodicals, etc., available may be given:

12. Research and Development activities carried-out in last few years and being

carried –out presently(if necessary enclose a separate sheet):

13. Provision for future expansions:

14. Make and quality of glassware used in the laboratory:

15. Check accuracy of balances:

16. Whether any `Analytical Quality Control` experiments (inter or intra-laboratory) were carried – out. If yes, provide copy of the results:

17. Name the professional bodies/ institution the laboratory is associated with:

18. Which of the methods given below are being followed for the analytical work (please specify):

- | | | |
|-----------|----------|----------------|
| (i) APHA | (ii) BIS | (iii) USEPA |
| (iv) ASTM | (v) ISO | (vi) Any Other |

19. Documentation

- (i) Standard operating procedures: available (√) , not available (x) for:
- Routine inspection, cleaning, maintenance, testing, calibration and standardization of instruments
 - Analytical methods
 - Data handling storage and retrieval

- d. Health and safety precautions
 - e. Receipt identification, storage, mixing and method of sampling of test and control activities
 - f. Record keeping, reporting, storage and retrieval of data
 - (ii) Educational, training and experience records (available/Not available)
 - (iii) Maintain of records, registers, calculations and test results in respect of tests conducted.
 - (iv) Calibration of instruments/equipment records (available/not available).
 - (v) Stock registers for procurement of chemical, glassware, instruments and equipment (available/not available).
 - (vi) Procurement records (chain of custody)/bills of instruments/equipments:
20. Available working area of Environmental Laboratory is 25pprox.. _____ sq. m.
for soil/sediments/water lab _____ for Air Lab _____ for Microbiology
Lab, say 25pprox.. total _____ sq. m (Adequate/Inadequate)

21. Confirmation of manpower given in application at VIII

Observations & Recommendations of Inspection Committee:

Signature/s of official/s	_____	_____	_____
Inspecting the Laboratory	_____	_____	_____
Name	_____	_____	_____
Designation	_____	_____	_____
Dept./Organization	_____	_____	_____

Annex V

List of Minimum Equipment Required by an Environmental Laboratory for Accreditation

Type of Analysis	Equipment/Instruments
<p>Water (Physico-chemical, Microbiological, Inorganic and Organic test)</p>	<ul style="list-style-type: none"> • Ph Meter, Thermometer • Fluoride, Chloride (Meter) • Turbidity, Colorimeter, Conductivity, TDS (meter) • DO, BOD, COD (Analyzer) • Analytical weighing balance, magnetic stirrer. • Autoclave, shaker, incubator, desiccator • Refrigerator • Water bath <p>Minimum (1) of the equipments below</p> <ul style="list-style-type: none"> • Atomic Absorption Spectrophotometer • Gas Chromatograph • Flame spectrophotometer • UV Spectrophotometer • Natural gas analyzer
<p>Soil And Sediment (Physico-chemical, Microbiological, Inorganic and Organic test)</p>	<ul style="list-style-type: none"> • Precision balance • Electric heating plate with thermostat • pH, Thermometer • Colorimeter, Rheometer, TDS meter • THC Analyzer • Dryer/ Oven • Sieve mesh • Analytical weighing balance, magnetic stirrer. • Autoclave, shaker, incubator, dessicator <p>minimum (1) of the equipments below</p> <ul style="list-style-type: none"> • Total reflective x-ray fluorescence (TXRF) • Hand held x-ray fluorescence • Inductively coupled plasma optical emission

	<p>spectroscopy (ICP-OES)</p> <ul style="list-style-type: none"> • Microplate Spectrophotometer
<p>Air (emissions and gases)</p>	<ul style="list-style-type: none"> • Thermometer, anemometer • Oxygen meter • Draeger • Sound level meter • Colorimeter • RF Meter <p>Minimum (2) of the equipments below</p> <ul style="list-style-type: none"> • Ultraviolet photo-ionization detector • Stacking Machine • Infrared spectrophotometer • gamma radiation survey meter • Flame ionization detector meter • Gas chromatograph, combustible gas indicator
<p>Pre-Requisite Instruments/Equipment's and Infrastructure (S) in a Standard Laboratory.</p> <p>The instruments/equipments includes:</p> <ul style="list-style-type: none"> • Autoclave(s) • Fume hoods • Microscope(s) • Refrigerators (with temperature control) • Analytical weighing balance 	

- Micro-balances
- Water bath
- Incubators
- Ovens
- Generators (power source)
- Fridge
- Dispensers
- Hotplates

Infrastructure (s) includes:

Properly labelled laboratory cupboards (consumables) in categories.

Storage Cabinet A	<ul style="list-style-type: none"> • Non- hazardous chemicals and reagents. • Inflammables
Storage Cabinet B	<ul style="list-style-type: none"> • Hazardous and corrosive chemicals e.g. Acids etc.
Storage Cabinet C	<ul style="list-style-type: none"> • First-aid and emergency response kits
Storage Cabinet D	<ul style="list-style-type: none"> • Laboratory apparatus: flasks, Petri dishes, burettes, test-tube, reagent bottles etc.

Annex VI

Suggested Routine Maintenance Activities for Common Laboratory Equipment/Instruments

Instrument	Suggested Maintenance Activity	Frequency
Water Monitoring Analysis Instruments/Equipment		
pH meter	Clean the Electrodes	Daily
	Refill the Electrodes with appropriate solution	As needed
Conductivity meter	Clean the Electrode	Daily
D.O. Meter	Clean the Electrode	Daily
	Change the Membrane	As needed
Analytical Balance	Clean the Pan	Daily
	Replace the light ball	Annually
	Adjust the Scale Deflections	Annually
Spectrophotometer	Check the lamp alignment	Weekly
	Replace the lamp	As needed
	Clean the Windows	Daily
	Clean the sample compartment	Daily
	Clean the cuvette	After every use
Gas chromatograph	Check the septa gas flow	Daily
	Clean the G.C. Syringes	Daily
	Check the carrier gas and fuel gas supply lines for leaks	Daily
	Replace the column	Quarterly

Refrigerators	Cleanliness	Monthly
Ovens	Check temperature with certified thermometer	Annually
Autoclaves	Check the gasket	Weekly
	Clean the inverter	Monthly
	Sterilization indicator tape time mechanism check	Semi-annually
Turbidity meter	Clean the instrument housing	Monthly
	Clean the cells	After every use
Thermometer	Check for cracks and gaps in the mercury	Daily
Atomic Absorption Spectrophotometer	Check the gas	Daily
	Check the exhaust system with smoke test	Daily
	Empty the drain receptacle	Daily
	Clean the amp and sample compartment windows	Daily
	Rinse spray chamber with 50-100 ml of distilled water	Daily
	Check glass bead	Weekly
	Check nebulizer component	Weekly
	Wash the spray chamber and liquid trap	Weekly
	Scrub the burner	Weekly
	Change the liquid in the liquid trap	Weekly
Check O rings	Weekly	
Flame Photo meter	Clean the burner	Weekly

	Clean/change the sample aspiration tube	Monthly
	Clean the filter glass	Weekly
Air Monitoring Analysis Instruments/Equipment		
Thermometer (dry bulb)	Check for cracks and gaps in the liquid column	Daily
	It should be kept clean and bulbs bright	Daily
Thermometer (wet bulb)	The bulb should be enclosed by wick and kept wet by addition of water in water container	Daily
Barometer	Not to displace it from the vertical	Daily
	Never clean while operating	Daily
Anemometer	Inspected, cleaned and lubricated at quarterly intervals	Quarterly
	Check after every dust storm	As needed
Wind Vane	Fins should be vertical	Daily
	Wind vane should move freely	Daily
	Ball bearings are to be lubricated	Weekly
	Screws are to be checked once a month	Monthly
	All the parts of the instrument should be kept clean	Daily
Hygrometer	Ink should be checked regularly	Daily
Rain gauge	Collector of rain gauge should not be choked with dirt and cleaned regularly	Weekly

Remarks: In case of break down or malfunction of the instrument that is beyond the ability of the staff to fix, the service engineer / supplier will be called to service the equipment

Annex VII

Minimum List of Required Parameters a Standard Environmental Laboratory Should be able to Analyze

1. Physical Test

S/N	Mandatory parameter	S/N	Secondary parameter
1.	Conductivity	1.	Flocculation test
2.	Colour	2.	Odour
3.	pH	3.	Salinity
4.	Fixed & volatile solids	4.	Settle able solids
5.	Total solids	5.	Sludge volume index (SVI)
6.	Total dissolved solids		
7.	Total suspended solids		
8.	Turbidity		
9.	Temperature		
10.	Velocity & discharge Measurement of industrial effluent stream		
Minimum required - All (10) parameters		Minimum required (3) parameters	

2. Chemical Test (Inorganic)

(a) General & Non-metallic

S/N	Mandatory parameter	S/N	Secondary parameter
1.	Acidity	1.	Bromide
2.	Alkalinity	2.	Carbon dioxide
3.	Ammonical nitrogen	3.	Chlorine demand
4.	Chloride	4.	Iodine
5.	Chlorine residual	5.	Sulphite
6.	Dissolved oxygen	6.	Silica
7.	Fluoride	7.	Cyanide
8.	Total hardness	8.	Sulphide
9.	Total kjehldal nitrogen (TKN)		
10.	Nitrite nitrogen		
11.	Nitrate nitrogen		
12.	Phosphate		
13.	Sulphate		
Minimum required – All (13) parameters			

(b) Trace Metals

S/N	Mandatory parameter	S/N	Secondary parameter
1.	Boron (B)	1.	Arsenic (As)
2.	Cadmium (Cd)	2.	Aluminium (Al)
3.	Calcium (Ca)	3.	Beryllium (Be)
4.	Chromium (Cr) Total	4.	Barium (Ba)
5.	Chromium (Cr) Hexavalent	5.	Lithium (Li)
6.	Copper (Cu)	6.	Manganese (Mn)
7.	Iron (Fe)	7.	Selenium (Se)
8.	Lead (Pb)	8.	Silver (Ag)
9.	Magnesium (Mg)	9.	Strontium (Sr)
10.	Mercury (Hg)	10.	Tin (Sn)
11.	Nickel (Ni)	11.	Antimony (Sb)
12.	Potassium (K)	12.	Cobalt (Co)
13.	Sodium (Na)	13.	Vanadium (V)
14.	Sodium absorption ratio (SAR)		
15.	Zinc (Zn)		
Minimum required – All (15) parameters		Minimum required – Atleast (4) parameters	

Chemical Test

(c) Organics and Trace Organics

S/N	Mandatory parameter	S/N	Secondary parameter
1.	Bio-chemical oxygen demand (BOD)	1.	Total organic carbon (TOC)
2.	Chemical oxygen demand (COD)	2.	Absorbable organic halide (AOX)
3.	Oil & Grease	3.	Surfactants
4.	Phenol	4.	Tannin & lignin
5.	Pesticide (each)	5.	Poly-chlorinated biphenyl (PCB's) each
	(i) Organo-chlorine (BHC, DDT, Aldrin, Endosulphan)	6.	Polynuclear aromatic hydrocarbon (PAH) each
	(ii) Organo nitrogen-phosphorous (Malathion, methyl parathion, Chloropyriphos)	7.	Organic Carbon (in solid)
		8.	Carbon/Nitrogen ratio
Minimum required – All (5) parameters		Minimum required – Atleast (3) parameters	

3. Microbiological Tests

S/N	Mandatory parameter	S/N	Secondary parameter
1.	Total Coliform	1.	Total plate count
2.	Faecal Coliform	2.	Enterococcus
3.	Faecal <i>Streptococci</i>	3.	Coliphage
4.	<i>E. Coli</i>		
Minimum required – All (4) parameters		Minimum required – At least (1) parameters	

4. Toxicological Tests

S/N	Mandatory parameter	S/N	Secondary parameter
1.	Bioassay method for evaluation of toxicity using fish (90% survival of fish after 96 hrs in 100% effluent)	1.	Bio-accumulation, bio magnification and bio-transformation studies
		2.	Estimation of the effect at tissue level
		3.	Measurement of toxicity using Daphnia or other organism
		4.	Measurement of toxicity factor using zebra fish (dimensionless toxicity test)
Minimum required – (1) parameter		Minimum required – (1) parameter	

5. Soil and Sediment

S/N	Mandatory parameter	S/N	Secondary parameter
1.	Boron	1.	Ammonia
2.	Cation Exchange Capacity (CEC)	2.	Bicarbonate
3.	Electrical Conductivity (EC)	3.	Calcium
4.	Nitrogen available	4.	Calcium carbonate
5.	Organic carbon/matter (chemical method)	5.	Chloride
6.	pH	6.	Colour
7.	Phosphorous (available)	7.	Exchangeable sodium percentage (ESP)
8.	Phosphate (ortho)	8.	Gypsum requirement
9.	Total Phosphate	9.	H. Acid (hyaluronic acid)
10.	Potassium	10.	Heavy metal
11.	SAR in soil extract	11.	Magnesium
12.	Sodium	12.	Mechanical soil analysis
13.	Soil moisture	13.	Nitrate
14.	TKN (Total Kjeldahl Nitrogen)	14.	Nitrite
15.	Calorific value	15.	PAHs
		16.	Pesticide
		17.	Potash (available)
		18.	Sulphate

		19.	Sulphur
		20.	TOC (Total Organic Carbon)
		21.	Total water soluble salt
		22.	Water holding capacity
Minimum required: All (15) parameters		Minimum required: At least (10) parameters	

6. Air and Emissions

S/N	Mandatory parameter	S/N	Secondary parameter
1.	Particulate matter	1	Total Hydrocarbon
2.	Sulfur dioxide	2	Non Methane Hydrocarbon
3.	Nitrogen dioxide	3	Stacking
4.	Carbon monoxide	4	Benzene, Toluene and Xylene (BTX)
5.	Volatile Organic Compounds	5	Acid mist
6.	Hydrogen Sulphide	6	General stacking
7.	Oxygen	7	noise
8.	Air Temperature	8	Radio frequency
9.	Air moisture content		
Minimum required: All (9) parameters		Minimum required: At least (5) parameters	