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GUIDELINES FOR RECOGNITION OF ENVIRONMENTAL LABORATORIES UNDER THE ENVIRONMENT (PROTECTION) ACT, 1986

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भारत सरकार
पर्यावरण एवं वन मंत्रालय

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FOREWORD

The existence of humankind is inextricably linked with the well being of nature and natural resources. The Ministry of Environment & Forests (MoEF), since its establishment, has been actively engaged in the implementation of its various programmes and activities for protection, conservation and development of environment.

For effective implementation of environment protection programmes there is an inescapable need for an efficient and reliable institutional arrangement and facilities for survey, identification, quantification and systems for monitoring. In this context, the role of an environmental laboratory assumes paramount importance and significance especially for the assessment of the status of environment and its components and can facilitate effectively in prevention and control of pollution. The Ministry has been implementing a programme for recognition of environmental laboratories with the aim of increasing facilities for analysis of environmental samples.

The extant guidelines (1994-95) for establishment and recognition of the laboratories have been revised and procedures streamlined. The revision had become necessary as the Environment (Protection) Act, 1986 has been strengthened over the years with the enactments of various rules and notifications there under. Further, environmental standards have been formulated for various parameters in different industrial sectors. The revised guidelines (2008) are a definite improvement in the content and the procedures for recognition of the environmental laboratories, which have been prepared by the Central Pollution Control Board (CPCB) in consultation and guidance of the MoEF.

The revised guidelines have been organized into 6 Chapters viz. (1) Introduction, (2) Environmental Laboratories- Infrastructural Requirements, (3) Environmental Sample Handling, (4) Accreditation of Environmental Laboratories, (5) Quality Assurance and Quality Control in Environmental Laboratories and (6) Guidelines for Recognition of Laboratory under the Environment (Protection) Act, 1986. Each Chapter in turn provides guidance on procedures, processes and requirements for recognition.

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जहाँ है हरियाली !
वहाँ है खुशहाली !!

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The information contained in the revised guidelines has been updated, collated and compiled by Sh. B.K. Jakhmola, Dr. C.S. Sharma and Dr. S.D. Makhijani of CPCB under the overall guidance of Sh. J.M. Mauskar, Chairman, CPCB and Dr. B. Sengupta, Member Secretary, CPCB.

In this context, contributions made by Shri R.K. Vaish, Joint Secretary, Dr. N. Bhat, Advisor and Dr. M. Raina, Additional Director, Ministry of Environment & Forests were significant in devising harmonization of the relevant provisions of the Air (Prevention and Control of Pollution) Act, 1981, Water (Prevention and Control of Pollution) Act, 1974 and Environment (Protection) Act, 1986. The guidelines are a response to the strategic policy initiatives and good governance in the implementation of the Environment (Protection) Act, 1986.

I hope that the information and guidelines contained in these revised Guidelines will provide necessary assistance to the State Pollution Control Boards/Committees, the State Governments and all the concerned organizations in the domain of establishment, evaluation and recognition of environmental laboratories.

(Meena Gupta)

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1.0 INTRODUCTION

"Pollution is an undesirable change in physical, chemical or biological characteristics of our air, water or land that may or will harmfully affect human life, flora, fauna and materials". In our environment inter relationship exists between water, air, land and human beings, other living creatures, plants, micro-organism and property. This inter-relationship is disturbed due to undesirable alteration in abiotic component because of addition of solid, liquid or gaseous substances. "Any solid, liquid or gaseous substances present in such concentration as may be, or a tend to be injurious to environment is know as "environmental pollutant" and their presence indicate the environmental pollution". With the advancement of science and technology and rapid industrialization and urbanization, the environmental management becomes a major concern for our country. The need for maintenance of ecological balance and environmental protection has increased more than ever before.

"For successful implementation of environmental protection programme, it is essential to identify and quantify the pollution sources, pollutants, conduct baseline survey, lay down standards and build-up monitoring systems". To meet out these requirements, a competent laboratory is required with all necessary instruments, equipment, expertise, capabilities etc.

1.1 Environmental Laboratory

The environmental laboratory plays a very important role in assessing the status of environment comprising both abiotic (soil, water and air) and biotic (flora, fauna and human being) components. An environmental laboratory is a laboratory processing samples taken from the environmental media (air, water, soil, biota) both from the environment as well as from sources disposing into the environment (industries, domestic and agriculture sources, automobiles etc.).

The laboratories are the essential corner stones of any effective pollution control programme. The analytical laboratories provide qualitative as well as quantitative data for good decision making purpose. For generating this valuable data with a desired accuracy and to quantify concentration of the constituents present in the samples, the laboratory should have the desired facilities and capabilities to achieve the above goal.

1.2 Legal Provisions of Recognition of Environmental Laboratories

The need for laboratories in implementation of the various pollution control acts laid down for the protection of the environment is essential under the following sections of various acts.

1.2.1 The Water (Prevention and Control of Pollution), Act, 1974

Under Section 17 (2)

Under Section 17(2), the Board (State) may establish or recognize a laboratory or laboratories to enable the Board to perform its functions under this Section efficiently, including the analysis of samples of water from any stream or well or of samples of sewage or trade effluents.

Under Section 25 & 26

Any person desirous of discharging any effluent (domestic or industrial) into a stream or well has to obtain the consent of the pollution control board before discharging the same. The consent application is supported by an analysis report obtained from a recognized laboratory of the Board.

Under Section 51 & 52

Central/State Government has to establish a Central/State Water Laboratory and under section 53 subsection (i) and (ii), a government analyst (Central/State) is appointed to analyse the samples.

Under Section 53 Subsection (iii)

The Central/State Board is required to appoint a Board Analyst(s) to any laboratory established or recognized under section 16 or 17 of the Water Act, 1974. The analysis report signed by a Government/Board Analyst is used as an evidence for the legal matters.

1.2.2 The Air (Prevention and Control of Pollution) Act, 1981

Under Section 17 (2)

Under Section 17(2) of The Air (Prevention & Control of Pollution) Act, 1981, a State Board may establish or recognize a laboratory or laboratories to enable the Board to perform its functions under this Section efficiently.

Under Section 21

No person can operate any industrial plant in an air pollution control area without the previous consent of the Board. The analysis report obtained by the recognized laboratory in respect of the quantity of emissions is to be enclosed with the consent application.

Under Section 28 & 29 Subsection (i)

State Government should establish or specify one or more State Air Laboratories for the analysis of the samples of air. Also under Section 29 sub-section (1), the State Govt. shall appoint the Government Analyst for the purpose of analyzing the samples received by the Government Laboratory under Section 28.

Under Section 29 Sub-section (ii)

The State Government is required to appoint the Board Analyst(s) for analysis of the air samples under section 17.

1.2.3 The Environment (Protection) Act, 1986

Under Section 12

The Central Govt. shall establish or recognize one or more environmental laboratories to carry out the functions entrusted to an environmental laboratory under the said Act.

Under Section 13

Under this Section, Central Govt. shall appoint the Government Analyst(s) for carrying-out the analysis of samples of air, water, soil or these substance sent for analysis to the environmental laboratory established under section 12 of the Act.

2.0 ENVIRONMENTAL LABORATORIES – INFRASTRUCTURAL REQUIREMENTS

The laboratory should have sufficient space, proper design, interior furnishing, proper ventilation, proper lighting, temperature control, dust free atmosphere etc. since all these factors influence the quality of analytical data generated in a laboratory and also may affect the production of reliable data. Regular and proper supply of some of the essential needs like water and electricity is to be ensured for smooth functioning of the laboratory. In addition to these, other important factors like facilities for preservation of samples, weighing, cleaning of glassware, quality of chemicals, fire-fighting facilities, laboratory safety and first-aid facilities are also an essential requirements.

2.1 Laboratory Design/Housing/Building

Laboratory design plays a major role for efficient functioning of laboratory activities. Laboratory design should incorporate good spacing, proper ventilation system, well-ventilated stack rooms, store rooms, laboratory hoods, sinks, miscellaneous safety equipment like eye wash fountain, safety showers and arrangement for safe disposal of wastes. Laboratory building must have proper space for carrying out following activities separately for environmental samples:

A. Water Analysis Section

i. Physico-chemical analysis
ii. Microbiological examination
iii. Biological examination

B. Air Analysis Section

i. Ambient Air Monitoring & Analysis
ii. Source Emission Monitoring & Analysis
iii. Vehicular Emission Monitoring & Analysis
iv. Noise Monitoring

C. Soil and Solid Waste (including hazardous wastes) Analysis Section

D. Instrumentation Section (Analysis requiring sophisticated instruments)

i. Inorganic analysis
ii. Organic analysis

All Infrastructural supply and discharge facilities for water, power, gas and air must be easily accessible and serviceable without constructional changes. All materials selected and specified must be of high quality and suitable for their functional end use. Laboratory design, outlay and materials should be selected and specified to minimize maintenance and operational costs of the facilities. It is envisaged that newly assigned tasks to the laboratory or any changes with reference to new instrument/equipment methods, analysts etc. can be easily and fastly accommodated.

The laboratory should maintain the following work areas with adequate instrumentation and infrastructure:

(i) Analytical Lab
(ii) Balance room
(iii) Instrument room with adequate provision of Gas cylinders etc.
(iv) Microbiology room
(v) Sample pre-treatment
(vi) Digestion & extraction room for pesticides & metals
(vii) Sample receipt section
(viii) Sample storage
(ix) Conference room-cum-library
(x) Staff room
(xi) Computer room
(xii) Store room
(xiii) Maintenance room
(xiv) Laboratory Record room
(xv) Field monitoring equipment room
(xvi) Waste storage room

2.2 Laboratory Furniture

The laboratory furniture and work benches with ergonomic designs to be given more emphasis to provide suitable laboratory work environment. The convenience and easiness of laboratories works depend upon the quality, dimension and placement of laboratory furnitures as well as their ergonomic design. The laboratory working benches top surface are to be made up of acid and alkali resistant materials. The steel/aluminium frames used in furniture or

any fittings are to be non-corrosive type. Wherever stainless steel materials are needed, the same is to be provided. The writing desks are also to be laminated and non-corrosive. The storage cupboard shall be made up clipboard covered with melamine sheets. All the furnitures are to be designed specifically according to the requirement of the laboratory so as to maximize the quality of work output.

2.3 Electricity Supply and Electrical Services

Regular and stabilized electricity supply (220-230 volts) is essential for smooth functioning of the laboratory and its instruments. Necessary and adequate provisions should be made for continuous supply, constant voltage, adequate load, desired level of illumination, proper electrical fittings etc.

Because of the specialized nature of analytical work in laboratories, the lighting system are specific and different from those in other areas since laboratory works involve accurate readings of glassware-graduations, balance, verniers, and other measuring lines, level of illumination, brightness, glass and location of light source should be controlled to facilitate ease in making these measurements and to provide maximum comfort for the laboratory analysts.

Some sophisticated instruments like Spectrophotometer, Flame photometer, Atomic Absorption Spectrophotometer, Gas chromatograph, Mercury Analyzer, Balance etc. requires constant voltage to maintain stabilized and drift-free instrument operation. The electric voltage regulation is therefore utmost necessary and can be achieved through use of voltage stabilizers and Uninterrupted Power Supply (UPS) system. Since the electrical supply for laboratory needs to be continuous, there should be the additional provision of Diesel Generator (D.G.) sets for continuous supply of power to equipment like BOD Incubator, Oven etc.

Care must be taken to ground all equipment that could constitute a shock hazard. The three-pronged plugs that incorporate grounds are best for this purpose.

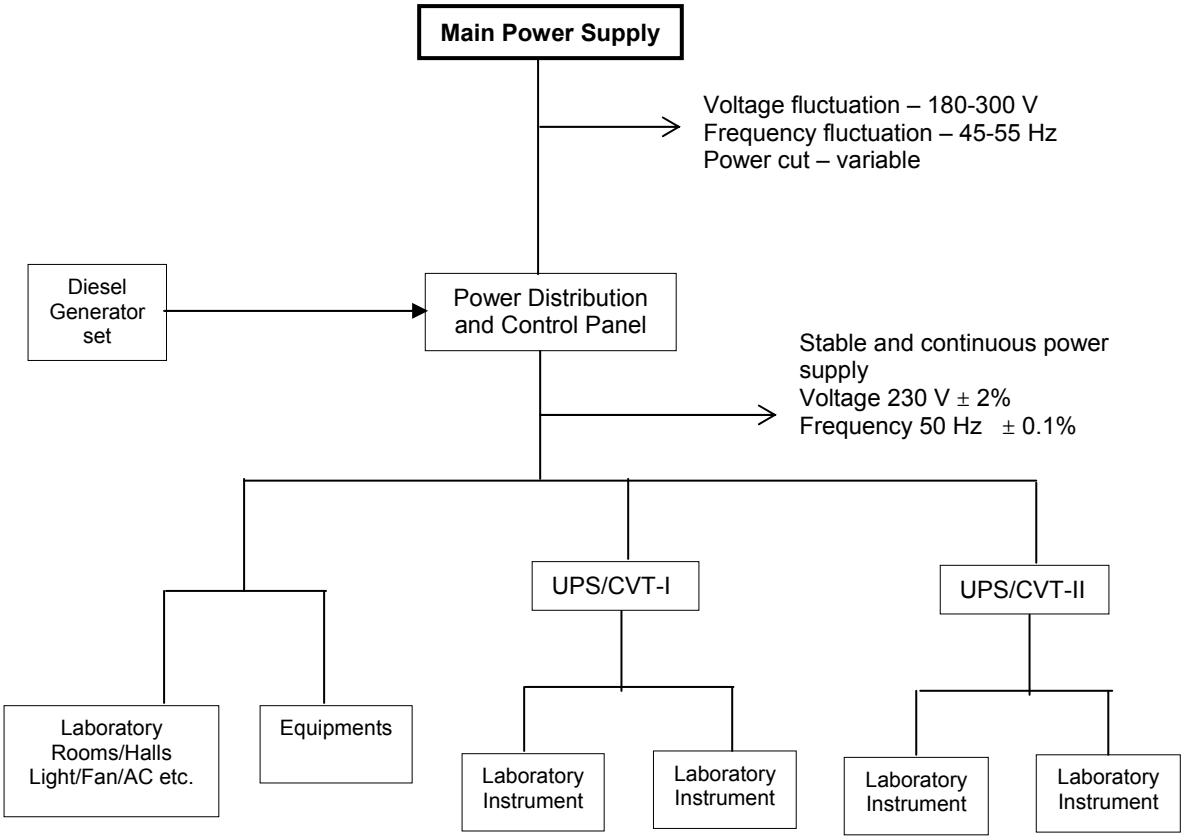


Fig. 1: Schematic diagram of the power supply system at Environmental Laboratory

2.4 Laboratory Instruments/Equipment

2.4.1 General

The laboratory shall maintain sufficient analytical and support instruments/ equipment to conduct required analytical operations since modern analytical laboratory depends heavily upon instrumentation. The list of instruments/ equipment commonly used for analysis of water, wastewater, soil, hazardous wastes, air and measurement of noise level are presented in Table 4.3. The laboratory shall maintain up-to-date inventory of all instruments/equipment. The inventory list should carry the following information:

- Name of the equipment/instruments
- Manufacturer, model and serial number
- Date of instrument receipt in the laboratory
- Condition when received
- Date of start of the operation of the instrument/equipment
- Current location in the laboratory
- Copy of manufacturers operating instructions
- Preventive maintenance schedule

2.4.2 Check up of New Instrument/Equipment

When a new instrument is inducted for analytical operations at a laboratory, the completeness of the shipment should be checked against the purchase order. The instrument environment as required in manufacturer's specifications must be maintained at the laboratory and different modules or subunits should be connected to each other using appropriate cables as recommended by the manufacturer.

The new instrument to be inducted for laboratory operation should be verified for proper functioning according to its intended use. The type of calibrations and tests depend on the instrument type, its configuration and on its intended use. The results of the test should be compared with previously defined acceptance criteria. Before and during routine use, the instrument should be tested and calibrated to perform analytical tasks properly.

2.4.3 Maintenance

The manuals/operating procedure of all equipments/instruments should be kept preferably in the working area where the instrument is located for ready reference by the analysts. In addition, each instrument should have an instrument maintenance logbook to record all maintenance issues and corrective actions.

Constant care and maintenance should be implemented in the laboratory to assure proper working of the laboratory instruments and equipments. Maintenance activities described in the manufacturers instruction manual (supplied with the instrument/equipment) shall be followed. The analyst or operator of the equipment is responsible for routine maintenance, operation and performance for trouble free operation. All operational activities are to be recorded in the logbook of the equipment. It is essential that the group supervisor shall review the Maintenance – Register to confirm that regular schedule of maintenance is being performed and that all malfunctions and repairs are properly documented. A list of some more common maintenance activities and their frequency is presented in Table 2.4.3.

Table 2.4.3: Suggested Routine Maintenance Activities for Common Laboratory Instruments/Equipment

Instrument	Suggested Maintenance Activity	Frequency	Remarks
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	Contractor
	Adjust the Scale Deflections	Annually	Contractor

Instrument	Suggested Maintenance Activity	Frequency	Remarks
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	Contractor
Laminar Flow	Cleaning of HEPA filters and pre-filters, general upkeep and maintenance	Twice in a year	Contractor
Turbidity meter	Clean the instrument housing	Monthly	
	Clean the cells	Daily/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.*

2.4.4 Calibration of Instruments/Equipment

Calibration of instruments/equipment may be categorized in two categories:

(i) Requirement for analytical support equipment
(ii) Requirement for instrument calibration
  (a) Initial instrument calibration
  (b) Continuing instrument calibration / verification

All information related to calibration of the instruments/equipment should be fully documented in the appropriate Records. The data of each calibration, analytical method used and analyst name are to be recorded. All calibrations have to be based on pre-determined criteria to establish acceptability of the calibration.

The laboratory requires calibration of all devices that may not be the actual test instrument but are necessary to support laboratory operations. These include balances, ovens, refrigerators, freezers, incubators, water bath, temperature measuring devices, volumetric dispensing devices etc. Since the measurements taken using these equipment are important for accuracy and precision, calibration is essential for getting accurate analytical data. Table 2.4.4 summarizes the calibration requirement of some of the commonly used support equipment.

Table 2.4.4: Calibration Requirements for some of the Common Laboratory Support Equipment

Equipment	Calibration Requirements
Balances	Must be serviced and calibrated annually by an approved vendor. Calibration must be checked daily or before balance use by analyst with weight(s) classified as Class I (formerly termed Class S) by nationally recognized organization. Acceptance criteria vary according to weights used and accuracy of balance. Acceptance criteria must be documented in the log. All Class I weights must be certified by an outside vendor every three years. All non-Class I weights must be checked annually against nationally recognized Class I weights.
Thermometers	Working glass thermometers must be calibrated against a certified thermometer at least annually as described in operation-specific SOPs. The nationally recognized thermometer must be re-certified every three years.
Refrigerators/Freezers	Thermometers must be immersed in a liquid such as mineral oil or glycol. Temperature of units used for sample / calibration standard storage must be checked daily as identified in operation-specific SOPs. Refrigerator temperature acceptance limits between 2 ^{0}C -6 ^{0}C; Freezer acceptance limits: < - 10 ^{0}C
Ovens	Temperature of units must be checked daily or before use. Acceptance limits vary according to use as described in identified operation-specific SOPs and must be documented in the logbook of oven.
Micropipettors	Calibrations are checked gravimetrically as required by the operation specific SOP. Must be calibrated at the frequency required by the manufacturer at the minimum.
Incubators	Thermometers must be calibrated immersed in a liquid such as mineral oil or glycol. Incubator acceptance limits: 35 ^{0}C - 37 ^{0}C or as required.
Autoclaves	Autoclave Pressure must be 1.02 $\pm$ 0.03 kg/cm^2 gauge pressure temperature acceptance criteria: 120^0 $\pm$ 2 ^{0}C.
Syringes, volumetric glassware and graduated glassware	All syringes and volumetric glassware must be purchased as Class A items. Class A items are certified by the manufacturer to be within ± 1% of the measured volume; therefore, calibration of these items by the laboratory is not required.

2.5 Sample Digestion System/Hood System

An efficient hood system is necessarily required at laboratories in order to remove various toxic and hazardous fumes from the work place generated during use of organic solvent/or during acid digestion.

2.6 Water Supply & Distilled/De-ionized Water

Water is an essential and basic need for laboratory operations, washing, cleaning etc. therefore the laboratory should have provision for continuous

water supply either from a direct supply source or through storage tanks. It is preferred, if a dedicated water storage tank is made available exclusively for laboratory use. To avoid deterioration of stored water, frequent cleaning of storage tank is essential, particularly if the stored water is being used for drinking purpose also.

Distilled water is one of basic requirement of the laboratory and analytical errors are encountered because of improper quality of distilled water. Distilled or deionize water is used in the laboratory for preparation of reagents, dilution, and final rinsing of glasswares. Ordinary distilled water may be contaminated by dissolved gases from surrounding environment, materials leached from the container, in which it is prepared or stored. Hence for specific determinations, deionized/distilled water may require further purification. Generally, distilled water with electrical conductivity of 2.0 µsiemen/cm or less is considered reasonably ideal for routine work. The degree of purity of distilled water can be further classified as:

Purity	Maximum conductivity µsiemen/cm	Approximate concentration of electrolyte (mg/l)
Pure	10	2-5
Very pure	1	0.2-0.5
Ultra pure/Nanopure	0.1	0.01-0.02
Theoretically pure	0.05	0.00

Any method of preparation of reagent water, distilled or deionized water may be acceptable provided that the requisite quality is achieved and maintained. Reverse osmosis, distillation and de-ionization processes singly or in combinations can produce high quality distilled water if prepared in properly set arrangement. Ultra-filtration and/or ultraviolet treatment also may be used as part of the process.

2.7 Glassware/Polytheneware/Other Lab wares

Generally, glassware of borosilicate glass, which is relatively inert, is used for the analytical work. Plastic bottles of polythene (PE) or polypropylene (PP) are suitable for collecting and transporting water samples. Unless instructed otherwise, borosilicate glass bottles may be used for the storage of reagents and standard solutions. Standard solutions of silica, boron and alkali metals should be stored in polyethylene bottles. Whenever necessary, amber or dark coloured glass bottles must be used for storing photo-reactive chemical solutions.

2.8 Quality of Chemicals

The quality of chemicals/solvents used in the analytical laboratory may vary from laboratory grade to Analytical or Guaranteed Grade [Analar or AR or G.R.). The quality of chemical/solvents may become one of the causes of analytical errors may affect the analytical instrument or may lead to interferences during determinations. Hence, selection of laboratory chemicals

of an appropriate quality is most important factor for achieving result with desired accuracy.

For preparation of all standard solutions only “Analytical reagent grade (AR) or guaranteed reagent grade (GR) should be used, since their purity levels are known. Reference Materials (RM’s) or Certified Reference Materials (CRM’s) should be used for calibrations during analysis of metals, pesticides, and other organics such as THM, PAH’s, BTX etc.

2.9 Laboratory Work Environment

Laboratory staff working in the laboratory is expected to develop healthy congenial environment for smooth analytical work. It is necessary to develop and encourage safe habits, avoid unnecessary exposures to chemicals by any route and avoid working alone at the laboratory as far as possible. The laboratory or other staff should not eat, drink, smoke, chew gum or apply cosmetics within laboratory work place since it is hazardous due to presence of all types of chemicals, solvents etc. Always wash hands before undertaking these activities. It is better to avoid storage, handling or consumption of food or beverage in storage area, laboratory refrigerators or glassware and utensils that are used for laboratory operations. Avoid practical jokes or other behaviour that might confuse, startle or distract other laboratory official. Do not use mouth suction for pipetting or starting a siphon. Handle and store laboratory glassware with care to avoid damage. Keep work area clean and uncluttered with chemicals and equipment properly labelled and stored. Clean up work area on completion of an operation and at the end of each day.

2.10 Safe Laboratory Practices

It is essential that laboratory officials while working at laboratory must make every effort to protect themselves and their fellow workers by conscientiously adhering to the health and safety programme that has been developed and documented specifically for the laboratory. The following facilities are essential to safeguard the health of laboratory staff:

- Multiple story buildings, especially laboratory should have adequate Exit doors in case of emergency.
- Adequate facilities for high toxic or highly inflammable materials or gases.
- Adequate number of exhaust fans for proper air circulation
- Cleanliness and good house keeping reduces frequency of laboratory accidents.
- Adequate fire fighting facilities and training to laboratory personnel in its operation. Fire fighting equipment shall be located at strategic points in the laboratories. Laboratory officials should also be trained regarding fire pertinent hazards with their work.
- Large gas cylinders should be securely fastened.
- Laboratory personnel may get exposure to toxic chemicals and solvents during laboratory analysis through following route:

- *Contact with skin and eyes*
- *Inhalation*
- *Swallowing*

To avoid this exposure, the safety gadgets like hand gloves, vacupets, dispensers, gas masks, goggles etc must be used by the laboratory officials whenever necessary. Other protective equipment and / or apparel as appropriate may also be used.

2.11 Environmental Laboratory Soundness

The environmental laboratory facility during its operation should not itself be nuisance to the environment but it should be developed as state of the art facilities with environmental and energy considerations. In this respect it must be ensured that the environmental laboratory operations:

- does not unduly pollute air, water, soil or biota
- that hazards and accidents are prevented as far as possible
- that energy consumption at the laboratory is minimized as far as feasible.

For these requirements the environmental laboratory should adopt such work environment, which demonstrate appropriate solutions such as:

- review of analytical methods with reference to their environmental implications and replacement of extremely pollution methods, whenever feasible.
- Recovery and recycling of solvents and reagents.
- Treatment of laboratory effluents in a suitably designed effluent treatment facility.
- Separate collection of hazardous substances and their proper treatment and disposal
- Thermal insulation of the building to save energy costs for climatization
- Use of solar light and energy wherever possible. For example, the solar energy may be utilized for following operation:
  - Thermal heaters (in winter)
  - Water distillation
  - Power generation (photovoltaic)
  - Hot water preparation
  - Provision for natural lighting to rooms/halls whenever possible.

3.0 ENVIRONMENTAL SAMPLE HANDLING

Samples are received at the laboratory from field sampling programmes conducted by laboratory staff and also from the client organizations seeking analysis of samples. When the samples are received at the laboratory, they should be scrutinized for any leakage, pilferage and to assess their conditions thereafter, these may be accepted, stored, and analyzed by the laboratory as per identified standard operating procedure. The following sections elaborate the guidelines for sample tracking and receipt procedure adopted at the laboratories.

3.1 Sample Tracking

a) The laboratory shall maintain a documented system for uniquely identifying the items to be tested / analyzed to ensure that there can be no confusion regarding identity of such items at any time. This system shall include identification for all samples, sub-samples and subsequent extracts and/or digested. The laboratory shall assign a unique identification (ID) code to each sample container received in the laboratory. The identification of sample using container shape, size, or other physical characteristics, such as amber glass or purple top are not acceptable scientific means for identifying the sample.

b) This laboratory code shall maintain an unequivocal link with the unique field ID code assigned on each sample container.

c) The laboratory ID code shall be placed on the sample container in form of durable label.

d) The laboratory ID code shall be entered into the laboratory records and shall be the link that associates the sample with related laboratory activities such as sample preparation or calibration.

e) In cases where the sample collector and analysts are the same individuals or the laboratory pre-assigns numbers to sample containers, the laboratory ID code may be kept as same as the field ID code.

3.2 Sample Acceptance Requirement

The laboratory shall maintain written sample acceptance policy that clearly outlines the circumstances under which samples will be accepted for analysis at the laboratory. Data from any samples that do not confirm to the criteria as mentioned ahead will be flagged in an unambiguous manner, clearly defining the nature and substance of the variation. The sample acceptance policy have to necessarily include (but is not limited to), the following areas of concern:

(i) Proper and complete documentation to be accompanied with the samples for analysis, which shall include sample identification, the location, date and time of collection, collector's name, preservation type, sample type and any special remarks concerning the sample;

(ii) Proper sample labelling to include unique identification and a labeling system for the samples with requirements concerning the durability of the labels

(water resistant) and the use of indelible ink; wide adhesive cotton tape may be used for labeling;

(iii) Use of appropriate sample containers;

(iv) Adherence to specified holding times for samples before analysis;

(v) Adequate sample volume. Sufficient sample volume must be available to perform all the necessary tests/ analysis;

(vi) SAR Guidelines/Procedures to be used when the submitted sample depict signs of damage or contamination.

3.3 Sample Receipt Protocol

The condition of the sample including any abnormalities or departures from standard condition as prescribed in the relevant test method should be recorded in the sample receipt protocols. The conditions as specified in sample acceptance requirements specified above shall be checked immediately after receipt of sample to the laboratory.

All the samples, which require thermal preservation, shall be considered acceptable if the arrival temperature is either within ± 2 ^{0}C of the required temperature or range specified in the method. For example - with specified sample temperature condition of 4 ^{0}C, the samples having temperature just above freezing temperature to 6 ^{0}C shall be acceptable. Samples that are hand delivered to the laboratory immediately after collection may not meet this criterion. In these cases, the samples shall be considered acceptable; if there is an evidence that chilling process has begun in the sample because of preservation in ice.

The laboratory will establish during preliminary check of the sample and record in the protocol that whether the sample has received all necessary preparation, procedure or whether the client requires preparation to be undertaken or arranged by the laboratory. If the sample does not meet sample receipt acceptance criteria as below the laboratory will have to inform the indenter the following:

(i) Fully document any decision to proceed with the analysis of samples not meeting the acceptance criteria. The condition of these samples shall, at a minimum, be noted on the chain of custody or transmit form and laboratory receipt documents.

(ii) The laboratory shall utilize permanent chronological record, such as log book or electronic database, to document receipt of all sample containers. This sample receipt log shall record the following:
- Project Client name;
- Date and time of laboratory receipt;
- Unique Laboratory ID code; (the placement of the laboratory ID code on the sample container may not be considered as a permanent record;
- Signature or initials of the person making the entries.

(iii) During the log-in process, the following information must be unequivocally linked to the log record or included as a part of the log. If such information is recorded/documented elsewhere, the records shall be part of the laboratory's permanent records, easily retrievable upon request, and readily available to laboratory officials who will process the sample for analysis should maintain the following:
- Retain correspondence and/or records of conversations concerning the final disposition of rejected samples; or

- The field ID code that identifies each container must be linked to the laboratory ID code in the sample receipt log.
- The date and time of sample collection must be linked to the sample container and to the date and time of receipt in the laboratory.
- The requested analysis (including applicable approved test method numbers) must be linked to the laboratory ID code.
- Any comments resulting from inspection for sample rejection shall be linked to the laboratory ID code.

(iv) All documentation, such as memos or transmittal forms that is transmitted to the laboratory by the sample transmitter shall be retained.

(v) A complete chain-of-custody (COC) record shall be maintained.

3.4 Legal samples

Legal samples are the environmental samples collected and analyzed for compliance check as well as a follow up of legal requirement. It is mandatory that all the samples have to be submitted to laboratory in the state, in which these are collected in the field. It is the legal requirement to seal the samples in the field to avoid any apprehension of pilferage, etc. during transit to keep intact the integrity of the collected sample. With this in view, the following guidelines for sealing the environmental samples are proposed:

(i) It is mandatory that all industrial representative samples collected for checking compliance purpose or any other legal samples or samples collected as per court orders should be sealed on site immediately after collection. Samples should be preserved by addition of suitable preservatives (as per BIS or APHA / EPA standard method) before it's sealing.

(ii) Samples collected for other than the compliance check purposes need not be sealed. Unsealed samples for checking compliance and legal samples may not be accepted for analysis.

(iii) Sealing kit having following items for sealing of field samples may be got issued.

a. Brass seal
b. Candle
c. Blade
d. Adhesive tape
e. Sealing wax
f. Match box
g. Thread ball

(iv) The sealing kit may be checked thoroughly for presence of items identified at Para (iii) before leaving for sampling.

(v) Officer empowered to take samples, shall collect the environmental sample in sufficient quantity to be divided into two uniform portions and effectively and appropriately sealed. The representative of concerned industry from where the sample is taken may be allowed to add his own seal or mark on all or any of the portions so sealed and marked. The procedure for taking and

submission of sample may be followed as per water rules 1975 and Environment (Protection) Act, 1986.

(vi) Before sealing of samples it has to be ensured that sample is collected in sufficient quantity and sample container is not having any leakage. Lid of the container should be properly fixed.

(vii) Specimen impression of seal of the officer empowered to take samples along with the seal/mark, if any, of the representative of industry from where the sample is taken shall be sent separately in a sealed cover.

(viii) The appropriate one-side open cotton bags may be used to cover entire sample container. These bags have to be arranged in advance for sampling. The sample container may be kept inside the bags and mouth may be closed by stitching with the help of needle and thread. Then it may be sealed at least four places. The seal should have clear impression on the sealing wax on cooling.

(ix) In case, cotton bags for sealing purpose are not available, good quality adhesive tape may be used for sealing purposes. The adhesive tape of desired length may be cut, its one end at a suitable point may be stitched and entire lid may be wrapped by completing one circle and sticking other end opposite to the previous one. Take another piece of adhesive tape covering lid from its top in such a way that it lies in perpendicular position to the previous piece of the tape applied.

(x) The melted sealing wax may be applied carefully at the stitches and on all corners of the adhesive tape. The seal may be pressed carefully on the melted sealing wax. There should be clear impression of the seal on the wax when it gets cool.

(xi) Sealed samples must contain all details like date & time of sample collection, location, parameters etc. Sealed samples must be preserved with ice, if required during transportation.

(xii) For any damage or break of seal, necessary precautions may be taken till the samples are handed over to the concerned officer. Compliance/legal samples with broken/damaged seal may not be accepted at Sample Receiving Window.

(xiii) Retain correspondence

3.5 Sample Storage Conditions

The laboratory shall maintain documented procedures and appropriate facilities to avoid deterioration, contamination, or damage to the sample during storage, handling, preparation, and testing. The samples have to be stored or conditioned under specific environmental conditions, these conditions shall be maintained, monitored and recorded.

Samples shall be stored according to the conditions specified by preservation protocols summarized in Table 3.5.

Table 3.5: Collection and Preservation of Environmental Samples

S. No.	Determination	Container	Minimum sample size ml	Preservation	Maximum storage recommended	Regulatory
1.	Acidity	P.G. (B)	100	Refrigerate	24 h	14 d
2.	Alkalinity	P.G.	200	Refrigerate	24 h	14 d
3.	BOD	P.G	1000	Refrigerate	6 h	48 h
4.	Boron	P.G. (PTFE) or quartz	1000	HNO_3 to pH <2	28 d	6 months
5.	Bromide	P.G.	100	None required	28 d	28 d
6.	Carbon, organic, total	G.(B)	100	Analyze immediately or refrigerate and add HCl, H_3PO_4 or H_2SO_4 to pH <2	7 d	28 d
7.	Carbon dioxide	P.G.	100	Analyze immediately	0.25 h	N.S.
8.	COD	P.G.	100	Analyze as soon as possible or add H_2SO_4 to pH<2 refrigerate	7 d	28 d
9.	Chloride	P.G.	50	Non required	N. S.	0.28 d
10.	Chlorine, total, residual	P.G.	500	Analyze immediately	0.25 h	0.25 h
11.	Chlorine dioxide	P.G.	500	Analyze immediately	0.25 h	N.S.
12.	Chlorophyll	P.G.	500	Unfiltered dark 4 ^{0}C filtered dark – 20 ^{0}C (do not store in frost free freezer)	24-48 h 28 d	-
13.	Color	P.G.	500	Refrigerate	48 h	4 h
14.	Specific conductance	P.G.	500	Refrigerate	28 h	28 d
15.	Cyanide total	P.G.	1000	Add NaOH to pH>12, refrigerate in dark	24 h	14 d, 24 h if sulfide present
16.	Cyanide amenable to chlorination	P.G.	1000	Add 0.6 g ascorbic acid if chlorine is present and refrigerate	stat	14 d, 24 h if sulfide present
17.	Fluoride	P	100	None required	28 d	28 d
18.	Hardness	P.G.	100	Add HNO_3 or H_2SO_4 to pH<2	6 months	6 months
19.	Iodine	P.G.	500	Analyze immediately	0.25 h	N.S.
20.	Metal general	P(A) G(A)	1000	For dissolved metals filter immediately, add HNO_3 to pH<2	6 months	6 months
21.	Chromium VI	P(A) G(A)	1000	Refrigerate	24 h	24 h
22.	Mercury	P(A) G(A)	1000	Add HNO_3 to pH <2, 4 ^{0}C refrigerate	28 d	28 d
23.	Nitrogen ammonia	P.G.	500	Analyze as soon as possible or add H_2SO_4 to pH<2 refrigerate	7 d	28 d
24.	Nitrate	P.G.	100	Analyze as soon as possible, refrigerate	48 h	48 h (28 d for chlorinated samples)
25.	Nitrate + nitrite	P.G.	200	Add H_2SO_4 to pH<2 refrigerate	1-2 d	28 d
26.	Nitrite	P.G.	100	Analyze as soon as possible refrigerate	None	48 h
27.	Organic kjehldal	P.G.	500	Refrigerate add H_2SO_4 to pH<2	7 d	28 d
28.	Odor	G.	500	Analyze as soon as possible, refrigerate	6 h	N.S.
29.	Oil & grease	G. wide mouth	1000	Add H_2SO_4 to pH<2 refrigerate	28 d	28 d
30.	Pesticides	G. (S) PTFE – lined cap	1000	Refrigerate add 1000 mg ascorbic acid/l if residual chlorine present	7 d	7 d until extraction 40 d after extraction
31.	Phenols	P.G.	500	Refrigerate add H_2SO_4 to pH<2	-	28 d until extraction
32.	Oxygen, dissolved electrode method	G. BOD bottle	300	Analyze immediately	0.25 h	0.25 h
	Winkler method	G	1000	Titration may be delayed after acidification	8 h	8 h
33.	pH	P.G.	50	Analyze immediately	0.25 h	N.S.
34.				Analyze immediately	0.25 h	0.25 h
35.	Phosphate	G(A)	100	For dissolved phosphate filter immediately, refrigerate	48 h	N.S.
36.	Phosphorus, total	P.G.	100	Add H_2SO_4 to pH <2 and refrigerate	28 d	
37.	Salinity	G.Wax seal	240	Analyze immediately or use wax seal	6 months	N.S.
38.	Silica	P (PTEE) or quartz	200	Refrigerate, do not freeze	28 d	28 d
39.	Sludge digester gas	G. gas bottle	-	-	N.S.	

S. No.	Determination	Container	Minimum sample size ml	Preservation	Maximum storage recommended	Regulatory
40.	Solids	P.G.	200	Refrigerate	7 d	2-7 d, see cited reference
41.	Sulfate	P.G.	100	Refrigerate	28 d	28 d
42.	Sulfide	P.G.	100	Refrigerate, add 4 drops 2 N zinc acetate/100 ml, add NaOH to pH >9	28 d	28 d
43.	Temperature	P.G.	-	Analyze immediately	0.25 h	0.25 h
44.	Turbidity	P.G.	100	Analyze same day, store in dark up to 24 h, refrigerate	24 h	48 h

Remarks:

1. Sample can be collected in a appropriate big size container instead of individual parameter-wise sampling requiring similar container and preservation requirement.
2. For determinations not listed, glass or plastic container should be used; preferably refrigerate during storage and analyse as soon as possible.

P	=	Plastic (polyethylene or equivalent)
G	=	Glass
G (A) or P(A)	=	Rinsed with 1 + 1 HNO_3
G(B)	=	Glass, borosilicate
G(S)	=	Glass, rinsed with organic solvents or baked
Refrigerate	=	Storage at 4 ^{0}C ± 2 ^{0}C in dark
Analyze immediately	=	analyze usually within 15 min of sample collection.

Samples that require thermal preservation shall be stored under refrigeration, which is ± 2 ^{0}C of the specified preservation temperature unless method specific criteria exist. For samples, with a specified storage temperature of 4 ^{0}C, storage at a temperature above the freezing point of water to 6 ^{0}C shall be acceptable. When refrigeration or freezing is required, the laboratory shall ensure that monitoring is performed 7 days per week to ensure that the samples remain within an acceptable range.

Samples shall be stored away from all standards, reagents, food, and other potentially contaminating sources. The laboratory shall have procedures in place to ensure that cross contamination does not occur. Samples designated for volatile organics testing shall be segregated from other samples. Samples suspected to contain high levels of volatile organics shall be further isolated from other volatile organics samples or storage blanks shall be used to verify that no cross contamination has occurred.

a) Sample fractions, extracts, leachates, and other sample preparation products shall be stored according to provided specifications in the test method.

b) Where a sample or portion of the sample is to be held secure (e.g. for reasons of record, safety or value, or to enable check calibrations or tests to be performed later), the laboratory shall have storage and security arrangements that protect the condition and integrity of the secured items or portions concerned.

c) Decide priorities for analysis of parameters based on their storage/holding time.

3.6 Unused Sample Disposal

The laboratory shall have SOPs for the disposal of samples, leftover digested sample, leachates and extracts or other sample preparation products. The laboratory shall maintain appropriate documentation and records demonstrating that samples have been properly disposed off as per the applicable rules and there will not any environmental hazards due to disposal of samples leftovers.

4.0 ACCREDITATION OF ENVIRONMENTAL LABORATORIES

Accreditation has been defined in the European Norm EN 45001 as the formal recognition that a testing laboratory is competent to carryout specific tests or specific types of tests.

Laboratory accreditation provides recognition of technical competence including quality system management of the laboratories. Such recognition is considered the first essential step towards mutual acceptance of test results and test certificate.

Accreditation is voluntary. A laboratory or inspection body that achieves and; maintains accreditation has proven that it is competent for environmental analysis and the results produced by it are reliable. Users of those results, including regulators can be confident that compliance decisions are based on sound technical knowledge and professional judgment. Accreditation is a transparent and objective method of checking that laboratories, inspection bodies and certification bodies are doing their work properly.

Accreditation of a laboratory is concern with the organizational processes and the conditions under which the laboratory shadings are planned, performed, monitored, recorded and reported. The reasons, why an environmental testing and calibration laboratory undertakes accreditation, are as below:

- The concept of laboratory accreditation was developed to provide third party certification of the competence of laboratories to perform specific environmental testing and calibration.

- Laboratory accreditation provides formal recognition of competent laboratories, thus providing a ready means for customer to find reliable testing and calibration services, in order to meet their demands.

- Laboratory accreditation enhances customer confidence in accepting testing/calibration reports issued by accredited laboratories.

- The globalization of economy, the liberalization in trade barriers and greater thrust to export makes it imperative for testing laboratories to achieve international level of competence by acquiring accreditation.

4.1 Accreditation Bodies/Standards for Laboratory Accreditation

National Accreditation Board for Testing and Calibration Laboratories (NABL) is an autonomous body under the aegis of Department of Science & Technology, Govt. of India and is registered under the Societies Act. NABL has been established with the objective to provide Govt. Industry Associations and Industry in general with a scheme for third party assessment of the quality and technical competence of testing and calibration laboratories.

In order to achieve this objective, NABL provides laboratory accreditation services to laboratories that are performing tests/calibrations in accordance with NABL criteria, which are based on internationally accepted standards and guidelines such as ISO/IEC Guide 25, ISO/IEC 17025 and EN 45001.

ISO/IEC 17025	General requirement for the competence of testing and calibration of laboratories
ISO/IEC Guide 25	General requirement for the competence of calibration and testing laboratories.
EN 45001	General Criteria for the operating of testing laboratories
NAMAS	General criteria of competence for calibration and testing laboratories

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

4.2 Benefits of Accreditation

Formal recognition of competence of a laboratory by reputed accreditation body in accordance with international criteria has many advantages:

- Better control of laboratory operations and feedback to system and are technically competent.

- Increase of confidence in testing/calibration data and personnel performing work.

- Savings in terms of time and money due to reduction or elimination of the need for re-testing of products.

- Potential increase in business due to enhanced customer confidence and satisfaction.

5.0 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 documented laboratory quality system.

The laboratory quality system consists of a quality assurance manual, operating procedures, work instructions and records. The manual includes a quality policy that defines the statistical level of confidence include to express the precision and bias of data, as well as the method detection limits. Quality system, which include quality assurance policies and all quality control processes to ensure the quality of analytical data produced by the laboratory and to demonstrate the competence of the laboratory. Quality systems are essential for any laboratory seeking accreditation under NABL accreditation programme. Glossary of some of the terms on Quality Assurance (QA) and Quality Control (QC) system are given at Annexure-XI.

5.1 QUALITY ASSURANCE PLAN

A laboratory which plan to conduct quality assurance should organize in such a way that it also apply conditions, listed below but not limited to:

Quality assurance unit (QAU)

QAU must be designated to audit the laboratory studies and the accompany in data. It serves as an internal control function. It is responsible for monitoring each study to assure management that facilities, equipment, personnel, methods, practices, records, controls, SOPS, final reports.

Standard Operating Procedure

Standard Operating Procedures (SOPs) are written procedures for a laboratories programme. They define how to undertake protocol, specified activities. SOP's include chronological listing of action steps with respect to:

- Routine inspection, cleaning, maintenance, testing, calibration and standardization of instruments.
- Action to be taken in response to equipment failure
- Analytical methods
- Definition of raw data
- Data handling, storage and retrieval
- Health and safety precautions.

- Receipt, identification, storage, mixing and method sampling of test and control articles.

- Record keeping, reporting, storage and retrieval of data

- Coding of studies, handling of data

- Operation of quality assurance personnel in performing and reporting study audits, inspections and final study report review.

Personnel

Each individual engaged in the conduct of or responsible for the supervision of a study shall have education, training and experience or combination thereof, to enable that individual to perform the assigned function. Personnel must be qualified to do the work. Operators of instrument should have sufficient training and or experience to operate the instrument properly and to identify a malfunction of the instrument.

The laboratory may maintain a current summary of training and experience and job description for each individual engaged in or supervising the laboratory, Job description and participation in training courses. The documentation needs to be regularly updated, retained and archived.

Reagents and Solutions

All reagents and solutions in laboratory areas shall be labeled to indicate identity, titer or concentration, storage requirement and expiry date. Certified standards are recommended which can be purchased form appropriate suppliers.

Raw Data

Raw data refers to any laboratory worksheets, records, memoranda, notes or exact copies thereof that are the results of original observations and activities of a study. For raw data entries, it is recommended to use a laboratory notebook for each study. This should be robust, bound and numbered with pages. All entries should be made in indelible ink.

Equipment

Equipment used in generation, measurement or assessment of data and equipment used for facility environmental control shall be appropriate design and adequate capacity to function according to the protocol and shall be suitably located for operation, inspection, cleaning and maintenance. The equipment should undergo a validation process to ensure that it will constantly function as intended.

Equipment shall be adequately inspected, cleaned and maintained. Equipment used for generation, measurement or assessment of data shall be adequately tested, calibrated and or standardized. A laboratory shall establish schedules for such operations based on manufacturer's recommendations and laboratory experience.

Written records shall be maintained of all inspection, maintenance, testing, calibration and or standardizing operations. These records, containing the date of inspection, shall describe whether the maintenance operation; followed written SOPs.

5.2 QUALITY CONTROL

5.2.1 Use of Reference Materials (RMS)/Certified Reference Materials (CRMS)

Accurate and precise measurement of environmental pollutants such as metals and organics is becoming more and more important with increase in industrial, agricultural and other human activities. Quantitative and qualitative analysis of such pollutants i.e. metals, pesticides, Polynuclear aromatic hydrocarbon (PAH's), Polychlorinated Biphenyls (PCB's), Dioxins & Furances, Benzene, Toluene, Xylene etc. some of which are very toxic and carcinogenic at very low levels, requires sophisticated instruments like AAS, ICP, GC, GC-MS, HPLC, BTX Analyzer etc. Further, analysis of any such pollutants on these instruments need proper calibration of the involved instruments using standard solution of the appropriate chemicals of required purity as instrument is used to compare an unknown sample with that of known composition. The sample of known composition is known as Reference Material or RM and if the known composition has been obtained through the internationally accepted certification procedures, the material is called as "Certified Reference Material" (CRM).

Reference Material (RM)

A material or a substance, one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. The RM may be in the form of a pure or mixed gases, liquid or solid or even a simple manufactured object.

Certified Reference Material (CRM)

A reference material one or more of whose property values are certified by the technically valid procedure, traceable to a certificate or other documentation which is issued by the certifying body. A CRM may consist of units, which are certified individually or certified by examination of representative samples from a batch.

Use of CRM may not be essential as long as Reference Materials with purity details are available, and the purity provided is adequate in context of the

parameters to be measured. CRM's should be preferred over RM's for better assurance of quality eradicate matrix interference and to enhance credibility of the results.

5.2.2 Analytical Quality Control (AQC)

Analytical Quality Control (AQC) is one of the main components of a quality assurance (QA) system, wherein the quality of analytical data being generated in the laboratory is controlled through minimizing or controlling errors to achieve a target accuracy. A particular Water Quality study or any organized water quality monitoring program involves the collection, comparison and interpretation of analytical data, which leads to a decision for the management and use the water resource. The correctness of decision or action depends largely upon the accuracy of the analytical results. If the errors of the analytical results were high, the Manpower, Material and Money spent on any monitoring programme or study would be futile and further lead to wrong decision and improper action plans. In order to generate good and reliable environmental data, the following features are required:

- Suitable laboratory facilities;
- Laboratory instruments, sampling equipment, glassware reagents;
- Standardized analytical procedures covering the desired variables ranges of concentration;
- Well-trained and experienced laboratory personnel;
- Well-maintained equipment and facilities;
- Adequate filing and reporting system; and
- Systematic analytical quality control programme.

Level of Analytical Quality Control Programme

The AQC scheme is taken up at two levels:

(a) **Internal AQC or Within laboratory AQC:** It is necessary basis for checking the precision and accuracy of analytical results within laboratory. It is initial demonstration of capability of the laboratory analytical functions. Various sequential stages involved for each parameter are:

a. Choosing an analytical method suitably free from bias and ensuring the complete and unambiguous description of that method.
b. Checking that satisfactory precision is obtained with the method.
c. Establishing a control chart as a continuing check on precision and some sources of bias.
d. Ensuring accuracy of standard solution.

(b) **External AQC or Between laboratory AQC:** A group of laboratory has to achieve comparability of results by controlling the precision and accuracy of each laboratory.

AQC tests between laboratories are necessary for the following reasons:

(i) To test for possible has caused by sources not already checked in within-laboratory AQC and
(ii) To provide direct evidence that the required comparability of results between laboratories has been achieved.
(iii) Accuracy may deteriorate with time and hence subsequent regular tests are required as a continuing check on between laboratories bias.
(iv) The procedure to convert a method to standard status is done through collaborative test (inter-laboratory studies).

(C) Intra-Laboratory (Within Laboratory) AQC Procedures

A periodic reassessment should be made of available analytical methods, in view of appropriateness and applicability. In addition, each method selected should be evaluated for sensitivity, precision and accuracy. The benefits of intra-laboratory as well as inter-laboratory Analytical Quality evaluations, should be known to the analytical team. These procedures should not be interpreted as an examination of their abilities by their superiors, but as a normal quality assessment procedure.

As a first step of within laboratory AQC procedures, the analytical team must check standards or unknown concentrations and evaluate the results. This practice can uncover weakness of analytical procedures, which can then be improved. These weaknesses can be accounted to faulty sample treatment, improper elimination of interference, poor calibration practices, sloppy experimental technique, impure or incorrectly standardized reagents, defective instrumentation, or even mistakes in arithmetic.

Method blank/Reagent blank

The method blank/Reagent blank is a quality control sample that consists of reagent water and all reagents that are normally added in the sample during analytical procedure. The method blank is used to identify any interferences or contamination of the analytes that may lead to the reporting of elevated concentrations or false positive data. Potential sources of contamination include solvent, reagents, glassware, other sample processing hardware and the laboratory environment etc. As a minimum, one reagent blank may be included with each sample set (batch) or on a 5% basis, whichever is more frequent. The results of this analysis is one of the quality control measures used to assess batch acceptance. The source of method blank contamination shall be investigated and measures taken to correct, minimize or eliminate the problem.

Laboratory – Fortified Blank (LFB)

A laboratory-fortified blank is a reagent water sample, to which known concentration of analysis of interest has been added. A LFB is used to evaluate laboratory performance and analyte recovery in a blank matrix. One LFB is included with each sample set (batch) or on a 5% basis, whichever is more

frequent except for analyte, for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, colour, odor, temperature, dissolved oxygen or turbidity. The LFB may be evaluated for percent recovery of the added analyte. If LFB results are out of control, corrective action to be taken by re-preparation and reanalysis of associated samples.

Laboratory – Fortified Matrix (LFM) / Laboratory-Fortified Matrix Duplicate (LFMD)

Laboratory-Fortified Matrix (LFM) is an additional portion of a sample, to which known amount of the analytes of interest are added before sample preparation. The LFM is used to evaluate analyte recovery in a sample matrix. The concentrations same as for the LFB is used to allow the analyst to separate the effect of matrix from laboratory performance.

A laboratory – fortified matrix duplicate is second aliquot of a sample that is spiked with the selected target analyte (s) and analyzed with associated sample LFM sample. The results of the LFM and LFMD are used together to determine the bias introduced by the sample matrix and precision of the analytical process. The acceptance criteria of the LFM are expressed as the percent recovery of the known concentration, spiked to the environmental sample. This is identical in principle to the calculation of the percent recovery of LFB.

The acceptance criteria for the LF/LFMD analysis are based on the relative percent difference (RPD) between the samples, provided both samples meet the acceptance criteria for spike recovery.

Sample Duplicate

A laboratory sample duplicate is a second aliquot of an environmental sample taken from the same sample container that has to be processed identically alongwith the first aliquot. Sample duplicates are processed as independent samples, within the same analytical batch. Sample duplicate may be used to assess sample homogeneity and the precision of the analytical process.

Internal Standard

Internal Standards (IS) are used for organic analysis by GC-MS, certain GC analysis and some metal analysis by ICP-MS. An internal standard is an analyte included in each standard and added to each sample or sample extract/ digestate just before sample analysis. Internal standards usually mimic the analytes of interest, but not interferes with analysis. If internal standard results are out of control, corrective action should be taken by the laboratory, including reanalysis of samples.

Surrogate Standard

A surrogate standard is a compound of a known amount added to each sample before extraction, surrogate mimic the analytes of interest and are compared unlikely to be found in environmental sample. Surrogate are used specifically for organic analysis.

Poor surrogate recovery may indicate problem with the sample composition or problem with the isolation of target analyte from the sample matrix prior to chromatographic analysis.

Post Digestion Spike (PDS)

A Post Digestion Spike (PDS) is an analytical spike, created by adding known concentrations of target analytes into prepared portion (i.e. post digestion) of sample, just before to analysis. It is used frequently in inorganic instrumental analysis. It provides information on matrix effects encountered during analysis, such as suppression or enhancement of instrument signal levels. It is used in elemental analysis involving various forms of atomic emission or atomic absorption spectroscopy, to ensure that neither positive nor negative interferences are operating on any of the analyte elements to distort the accuracy of the reported values. A single analytical spike serves as a single point application of the method of standard addition.

Dilution Test

A dilution test (serial dilution) is performed, if the analyte concentration is sufficiently high (minimally a factor of 10 above the instrumental detection limit after dilution). The analysis of 1:5 dilutions should agree within ±10% of the original determination. If not, a chemical or physical interference effect is suspected. It is most often used in elemental analysis involving various forms of atomic emission or atomic absorption spectroscopy to ensure that neither positive nor negative interferences are operating on any of the analyte elements to distort accuracy of the reported values.

The abovementioned within laboratory analytical tests may not be possible all the time, while analyzing various types of samples collected from various sources. Therefore, it is advised that relevant tests be selected by the analyst as per their convenience and performed at regular intervals.

Quality Control Chart

Analytical quality can be violated by random and systematic errors during determination. Random errors are recognized to produce reduction in precision, while systematic errors give rise to reduction in accuracy. To check on both types of errors, quality control chart should be made for each variable. The application of quality control chart is based upon the assumption that the experimental data have normally distributed errors. The quality control chart should be plotted from the results repeatedly obtained from standard samples

of known concentration against time. In order to prepare the quality control chart, the mean and standard deviation are calculated. based on initial calibration study (analysis of at least 20 replicate standards of realistic concentration). The control chart is then constructed with the calibration mean as its center line. Warning and rejection areas are added at ± two times and ± three times the standard deviation from the mean (a), respectively. The analysis is performed each day for the same standard. If the analytical result of standard analysis falls outside the ± 3 standard deviation line, the analysis is said to be out of control and an immediate check is required to know the cause for this gross analytical errors. After corrective measures the analysis should be repeated. The occurrence of an unduly high percentage of results exceeding the warning limits (2 standard deviation) is an indication that laboratory precision may not be as good as expected or that the frequency distribution of the results are not normal. The control limits may be recalculated periodically as experience is gained with the technique. Preferably use several standards that span a range of concentrations to ascertain linearity and to avoid unintentional bias due to familiarity with the fixed results. The typical control chart is presented in Fig. 1.

If internal quality control data are available, it is possible to indicate the accuracy of the data. Accuracy is a measure of the systematic nature of the errors in the analysis, and can be calculated as the difference between the mean of series of subsequent standard determinations and the true concentration of the standard sample. It is expressed as mean error:

$$\text{Mean Error} = X - TV$$

Where: X = mean; TV = true value

If the difference between the true value and the standard mean is greater than one standard deviation, the method, reagents, glassware, and instrumental check to be made for deviations and corrective actions are taken.

During series of observations it is often observed that one or more values of the results deviate from the mean, whereas the other values are in close agreement with it. At this point, decide whether to reject disagreeing values. Theoretically no result should be rejected, because the presence of large percentage of disagreeing results indicate faulty techniques and may doubt the acceptance of analytical results.

Checking Recovery in Analytical Procedures

Recovery methods are tools to remove doubt about the applicability of method to a sample. The recovery procedure involves applying the analytical method to a reagent blank; to a series of known standards covering the expected range of concentration of the environmental sample; to the environmental sample itself; and to recovery samples composed by adding a range of known quantities of the analyte to separate aliquots of the environmental sample. The analyte should be added in sufficient quantity to overcome the limits of error of the

analytical method, but not to cause the total in the sample to exceed the concentration range of the standards used. Correct the analytical results by subtracting the reading from the reagent blank from all other readings. Make a calibration graph from the corrected results of standard determinations. Use this graph to convert the readings of the spiked and non-spiked environmental samples to the actual concentrations. Subtract the concentration of the unspiked sample from each of the concentrations of sample plus known concentration of added substance. The resulting concentration of substance divided by the actually added concentration, multiplied by 100, gives the percentage recovery.

Rigid rules regarding the percentage of recovery required for the acceptance of results can not be stipulated, because the recoveries in the range of sensitivity may vary. In general, intricate and exacting procedures for trace substances that have inherent errors due to their complexity may give recoveries that could be considered very poor. Yet, from a practical point of view, these analysis may be considered useful (no alternative).

Inter-Laboratory (Between Laboratories) AQC

To confirm the comparability of the results produced by different laboratories taking part in a monitoring programme, aliquots of the same reference samples should be analyzed once or twice a year by all laboratories performing the same types of analysis. These reference samples may be the same as the standard samples. In evaluating proficiency testing results, the laboratory issuing the reference samples may use control charts. The rejection and warning limits are generally set larger than those used in internal quality control because the variation between laboratories is normally larger than the variation within one laboratory as a result of the difference in instruments, glassware etc.

Sources of Errors

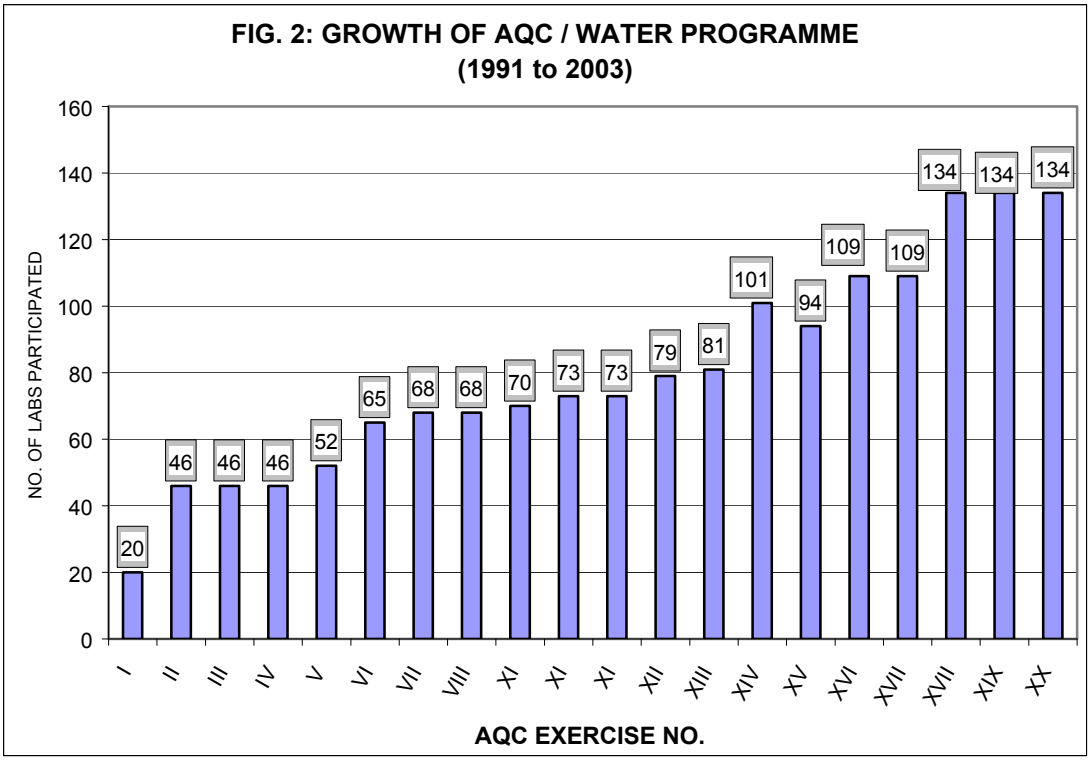
Errors in results may also arise through non-representative sampling and through changes in the sample between sampling and analysis. The first source of error must be controlled through the choice of appropriate time, location and procedure of sample collection. The second source of error must be controlled by using appropriate technique of sample preservation and by analyzing samples without undue delay. The specification of appropriate sample preservation techniques must be an integral part of any analytical method and any effective AQC scheme must include all necessary precautions required for sample preservation. Besides analysis laboratory staff must be acquainted with sampling, preservation and transportation (Table 3.5) of environmental samples.

5.2.3 Inter Laboratory Proficiency Testing Programme by Central Pollution Control Board

Background

The Central Pollution Control Board (CPCB) is monitoring 784 water quality monitoring stations under GEMS, MINARS, GAP and YAP Programmes comprising rivers, lakes, wells, and ground waters spread over 28 states and 5 Union Territories through various State Pollution Control Boards (SPCB). In order to obtain reliable and accurate analytical data, CPCB has started regular and organized Analytical Quality Control (AQC) exercise for laboratories participating under these monitoring network programme from 1991 onwards as a continuous programme, with addition to the laboratories of pollution control boards, other laboratories recognized under The Environment (Prevention & Control of Pollution) Act, 1986 numbering around 50 are also covered under this programme. Under this project, 9 rounds of AQC exercises in 20 slots covering 21 physico-chemical parameters were carried out upto March 2003. The year wise growth in terms of number of participating laboratories under the scheme is presented in Fig. 2.

FIG. 2: GROWTH OF AQC / WATER PROGRAMME (1991 to 2003)



Objectives of AQC Programme

The main objectives of Analytical Quality Control Programme are:

- to assess the status of analytical facilities and capabilities of concerned laboratories.

- to identify the serious constraints (random & systematic) in the working environment of laboratories.

- to provide necessary assistance to the concerned laboratories to overcome the shortcomings in the analytical capabilities.

- to validate the Water Quality Monitoring data.

- to promote the scientific/analytical competence of the concerned laboratories to the level of excellence for better output.

- to enhance the internal and external quality control of laboratories in an organized manner.

I Methodology

Two synthetic samples labeled as A & B of each 1 litre volume prepared in laboratory by adopting standard procedures and precautions are distributed to all participating laboratories Samples were also analysed in CPCB laboratory for arriving *"**Reference value"*** for comparison and arriving the acceptable limits of the reported values. The acceptable limit was arrived using *"Youden 2 sample plot"* method. The data are also processed using a software called "**PROLAB"** (developed by Dr. S.Uhlig, Professor in Statistics, Germany) which was provided by GTZ (German Technical Cooperation) under Quality Assurance programme for various applications using ISO-, DIN-, Q-method, Huber estimator, Youden plot, Z-scores and other robust statistical methods.

Suggestions to Enhance Laboratory Proficiency

The following suggestions are provided for improving the analytical capability and achieving accuracy of analytical data:

- It is suggested that the laboratories, which have not qualified for any of the parameters, should give much attention for rectifying problems associated with the concerned parameter.

- Internal AQC system is to be introduced in all the laboratories on regular basis, if not already introduced.

- Improvement in Internal AQC system is to be made with reference to selection of method, quality of chemicals and glassware, analytical balance, preparation of control charts etc.

- All the laboratories are to be equipped with required instruments and equipment.

- All the laboratories should have good distilled water generation facility to have better quality and sufficient quantity of distilled water supply.

- Analar grade quality of chemicals is to be used wherever necessary.

- All laboratories should follow standard uniform analytical method for which a user manual may be prepared and used by all the laboratories.

- The analyst may be trained in methods of testing, handling and calibration of instruments etc. to improve the analytical performance.

- It is utmost necessary to calibrate and standardise the instruments periodically to generate good analytical results

- It is suggested to have continuous and regular participation of AQC exercise for the participating laboratories in order to improve the analytical ability.

- It is suggested to have in-house/outside training on Analytical Quality Control for better accuracy of analysis. Laboratories may be provided with known standards for each parameter to standardise the methodology and check the results in order to confirm correctness of analysis.

- Training cum workshop may be organised to discuss the results and possible sources of error to improve the performance in future

- Since the performance of all laboratories needs many improvements, it is very essential to find out the constraint faced by each laboratory individually and strategies are to be evolved for improvement.

6.0 GUIDELINES FOR RECOGNITION OF LABORATORY UNDER THE ENVIRONMENT (PROTECTION) ACT, 1986

LEGAL PROVISIONS

- Under Section 12 (1) The Central Government may, by notification in the Official Gazette-

  (a) establish one or more laboratories,
  (b) recognize one or more laboratories or institutes as environmental laboratories to carry out the functions entrusted to an environmental laboratory under this Act.

- The Central Government may, by notification in the Official Gazette, make rules specifying-
  (a) the functions of the environmental laboratory
  (b) the procedure for the submission to the said laboratory of samples of water, air, soil or other substance for analysis or tests, the form of the laboratory report there on and the fees payable for such report;
  (c) such other matters as may be necessary or expedient to enable that laboratory to carry out its functions.

- Under Section (13) The Central Government may by notification in the official Gazette, appoint or recognize such persons as it thinks fit and having the prescribed qualification to be Government Analysts for the purpose of analysis of samples of water, air, soil or other substances sent for analysis to any environmental laboratory established or recognized under sub-section (1) of section 12 of The Environment (Protection) Act, 1986.

As per the Gazette Notification No. S.O.145(E), the powers delegated for recognition of the laboratories are as below:

In exercise of the powers conferred under section 23 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby issue the following orders namely:-

1. The Central Government hereby delegates the powers with respect to grant of recognition to laboratories or institutes as environmental laboratories and to appoint or recognize Analysts as Government Analysts, as conferred by clause (b) of Sub-section (i) of Section 12 and section 13 respectively of the Environment (Protection) Act, 1986 to the Central Pollution Control Board.

2. Recognition of private laboratories under clause (b) of sub-section (i) of section 12 of the Environment (Protection) Act, 1986 as well as recognition of their Analysts as Government Analysts under section 13 of the Environment (Protection) Act, 1986, will continue to be done by the Central Government.

3. The laboratories recognized under clause (b) of sub-section (i) of section 12 of the Environment (Protection) Act, 1986 shall be specified as Government/ Autonomous/Public Sector Undertaking/Educational Institution/ State or Central Pollution Control Board Laboratories.

Procedure for Recognition of Lab

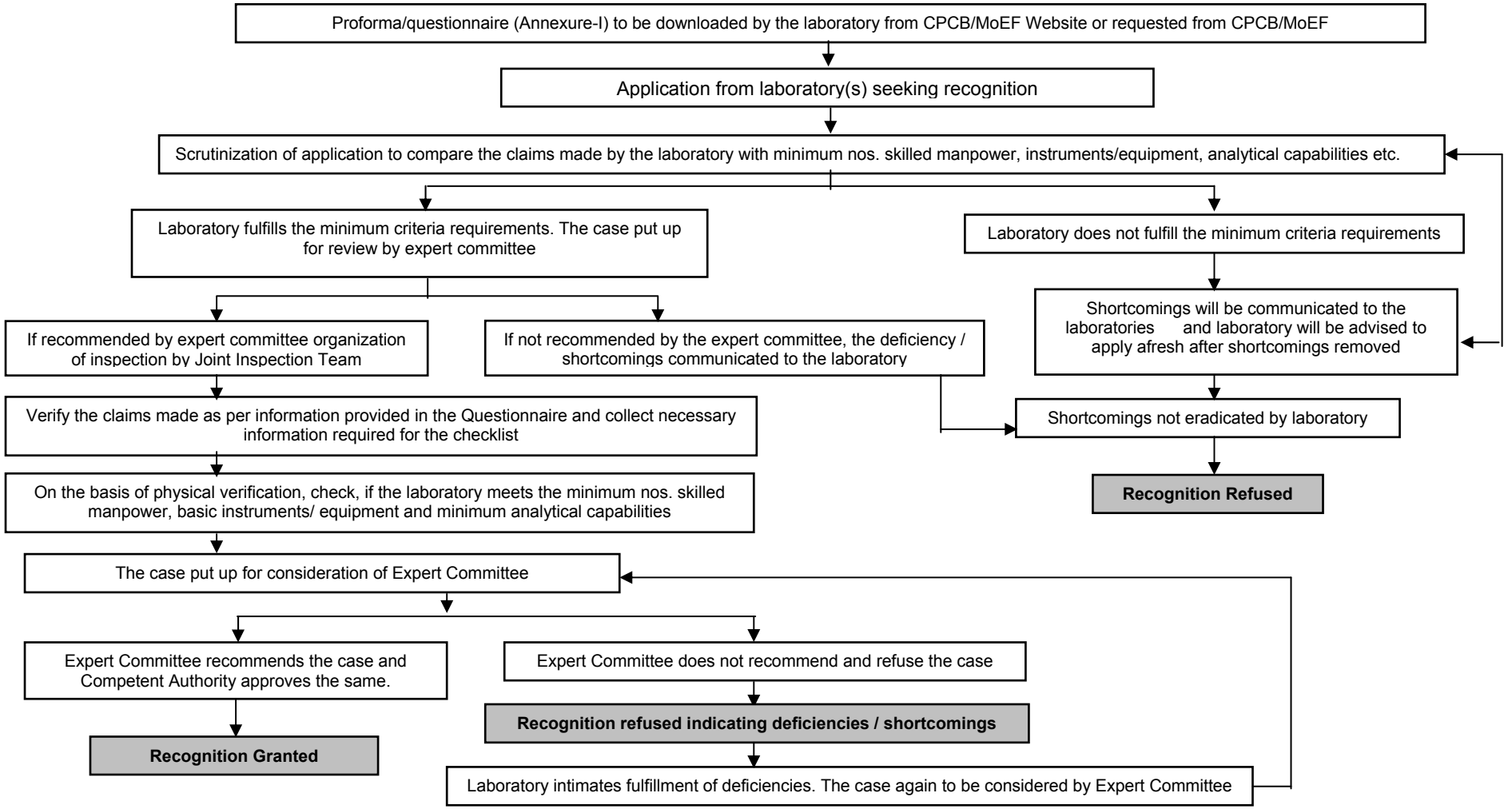
Step-I	Issuance of application form by CPCB or downloading it from Ministry's / CPCB's Website <www.envfor.nic.in> / <www.cpcb.nic.in> and receiving of duly filled applications (3 copies) along with the enclosures and desired information by the MoEF and CPCB.
Step-II	Preliminary scrutiny of the application received based on criteria for evaluation & assessment of environmental laboratory by CPCB & SPCB(s).
Step-III	Communication of shortcoming (if any) to the respective laboratory by CPCB, under intimation to the Ministry.
Step-IV	If laboratory fulfills minimum requirements, as endorsed by Expert Committee, organization of joint inspection.
Step-V	If not approved by the Expert Committee, deficiencies will be communicated to applicant laboratories by the CPCB.
Step-VI	During the joint inspection, the joint inspection team has to verify the claims made as per information provided in the questionnaire and to collect the necessary information as per check list (Annexure-II).
Step-VII	The inspection report will be put up to Expert Committee. If the laboratory fulfills the minimum requirements, Expert Committee may recommend for recognition.
Step-VIII	If the Joint inspection team / Expert Committee does not recommend and refuse the case, deficiencies will be communicated to the applicant laboratory.
Step-IX	If the Expert Committee finally recommends the case and Competent Authority at CPCB / MoEF accepts the same, further steps at X, XI & XII will be followed.

Step-X Acceptance of Terms & Conditions by the laboratory and concerned analyst for acceptance as Govt. Analyst.

Step-XI Approval by the MoEF / CPCB for eligible recommended laboratory(ies) for their recognition.

Step-XII Gazette Notification of approved environmental laboratory and Govt. Analysts. The list of approved laboratories will be posted on Websites of MoEF / CPCB.

Procedure for Evaluation of Environmental Laboratories for Recognition under The Environment (Protection) Act, 1986



Who can apply for recognition

The Environment laboratories of any of the following organizations shall be eligible to apply for recognition:

- Autonomous & Govt. Dept./Institutions
- Public Sector Undertaking
- Educational Institute (Govt./Govt. Aided/Private)
- Private Laboratories
- Non Govt. Organization (NGO)
- Cooperative Sector Laboratories

Application Proforma

The laboratory (Private & NGO), seeking recognition, may request for application proforma (Annexure-I) from MoEF / CPCB or the proforma may be down loaded from their Websites.

Laboratory of Govt./Semi. Govt./Autonomous Organization/ Public Sector Undertaking and Educational Institute may request for application proforma (Annexure-I) from Central Pollution Control Board (CPCB) or the proforma may be down loaded from its Website.

Pre-requisite for recognition

The laboratory should ensure that it fulfills the following essential requirement by itself through self assessment before submitting an application seeking recognition under The Environment (Protection) Act, 1986:

(i) Laboratory (Private / NGO) is registered by the local govt./State Govt./Central Govt.

(ii) Laboratory has minimum 9 nos. of full time working skilled manpower with following qualification:

S. No.	Qualification	Nature of Job	Nos.
1.	High School/Intermediate with Science	Assistance in sampling & analysis	2
2.	Bachelor's Degree in Basic Science or equivalent	Sampling & analysis	4
3.	Master's Degree in Science or equivalent or Bachelors Degree in Engineering / Technology or equivalent or Ph.D.	Sampling and Analysis Supervision of Analysis	3
Total Manpower (Minimum)			**9**

(iii) Environmental laboratory should have minimum space required as given below:

a)	Water Laboratory	=	100 Sq. mtr
b)	Air Laboratory	=	100 Sq. mtr
c)	Water & Air Laboratory	=	150 Sq. mtr *

* (in case of existing & functional Labs in big cities / metropolises which are already recognized, decision left to joint inspection team)

(iv) Laboratory should compulsorily meet mandatory parameter requirement as Appendix A & F of Annexure-I.

(v) Laboratory fulfills minimum requirement of equipment/instrument as Appendix B, D & G of Annexure-I.

(vi) Laboratory should analyze samples adopting any standard methods i.e. USEPA, APHA, BIS, ASTM, ISO, EU or CPCB only.

(vii) Laboratory must have environmental journals/books/ analytical methods for sample analysis.

(viii) Laboratory should have not been revoked/discontinued the recognition by any SPCB/PCC and Govt. Department. If revoked, recognition case will not be considered before a period of three years from the date of revoked.

a. Laboratory must have comprehensive facilities, expertise for water and / or air related parameters.

b. Laboratory has applied accordingly as per the prescribed format.

Submission of Duly filled up Application

The duly completed application alongwith enclosures have to be forwarded for consideration of recognition, if it fulfills minimum criteria to MoEF (Private & NGOs only) and others to CPCB at the following address:

i) Private/NGOs/Corporative Organization Laboratory
Director / Addl. Director (CP Division)
Ministry of Environment & Forests,
Paryavaran Bhawan, CGO Complex,
Lodi Road,
New Delhi–110 003

ii) Govt./Semi. Govt./Autonomous Organization/Public Sector Undertaking and Educational Institute Laboratories:

The Member Secretary,
Central Pollution Control Board,
Parivesh Bhawan, East Arjun Nagar,
Delhi–110 032

Scrutinization of Application

The applications received from applicant laboratories for consideration of recognition in the prescribed proforma will be scrutinized at first instance by concerned section of CPCB/SPCB. The scrutinized cases alongwith the comments of CPCB based on the criteria laid down in the guidelines will be put up for consideration of Expert Committee.

Communication of shortcomings in the infrastructure facilities of the laboratory

If deficiencies have been found in the proposal with respect to laid criteria for recognition, the same should be communicated to concerned laboratory with detailed statement of deficiencies for rectification. The application will be considered again on getting communication from the laboratory that the deficiencies are fulfilled and the matter will be put up before the expert committee for consideration again.

Expert Committee

Only one Expert Committee would be constituted at CPCB to review all Govt. and Pvt. Lab cases. The Committee would comprise of (i) an External Expert, (ii) CPCB Expert, (iii) CPCB Member Convener and (iv) an Expert Member from MoEF as Permanent Invitee.

Educational Qualification and experience of Expert Committee Members: Master Degree in Science or equivalent or Bachelors Degree in Engineering / Technology or equivalent having minimum 15 years of experience in operation and management of environmental laboratory.

Expert Committee Meeting

The Expert Committee, which is proposed to be constituted, would meet only once during a month on a fixed day and time to review that all the proposals received fulfill the minimum requirements as per the requirement laid down in the guidelines based on the comments received from CPCB. The Committee would also consider proposals for recognition of the laboratory for a period of 5 years.

Time Limit for Disposal of Applications

It is proposed to dispose Applications received after fulfilling the minimum requirements i.e. from Step I to XII, in a period of 120 days with Steps I to III of procedure completed within 45 days.

Criteria for Evaluation of the Laboratory

The criteria of evaluation and assessment of environmental laboratory under The Environment (Protection) Act will be as below:

S. No.	Group of parameter	Number of parameters			Minimum number required for approval			
		Mandatory	Secondary	Total	Parameter to be qualified			Groups to be qualified
					Mandatory	Secondary	Total	
I.	**WATER/SOLIDS/SOIL/SLUDGE ANALYSIS**							
A.	Physical	10	5	15	10	3	13	S. No. A to E
B.	Inorganic							
	(i) General & non-metallic	13	8	21	13	3	16	S. No. A to E
	(ii) Metals	15	13	28	15	4	19	
C.	Organic	5	8	13	5	3	8	
D.	Microbiological	4	3	7	4	1	5	
E.	Toxicity	1	4	5	1	1	2	
F.	Biological	-	8	8	-	3	3	
G.	Hazardous waste	-	6	6	-	3	3	
H.	Soil, sludge, sediments	15	22	37	15	10	25	
II.	**AIR ANALYSIS**							
A.	Ambient air/fugitive	4	12	16	4	4	8	S. No. A to D
B.	Stack emission	8	10	18	8	5	13	
C.	Noise level	2	-	2	2	-	2	
D.	Meteorological	4	2	6	4	1	5	
E.	Vehicular emission	3	1	4	3	-	3	

Remarks: Laboratory seeking recognition in water parameters must qualify minimum S. No. A to E group of parameters. Minimum 4 groups A to D group of parameters in Air.

For remaining groups of parameters also laboratory is expected to develop the facilities and expertise.

Joint Inspection of Environmental Laboratories

Environmental laboratory(s) seeking recognition under the Environment (Protection) Act, 1986 will be inspected by joint inspection team.

Inspection Team

The inspection team will comprise of atleast two/three officers with not less than rank of Group 'A' or equivalent, manager, senior officer, laboratory Incharge, regional or zonal officer having following qualification and experience.

Qualification: Master's Degree in Science or equivalent or Bachelor's degree in Engineering/ Technology or equivalent.

Experience: Minimum ten years of experience in relevant field.

Joint inspection team may include one of the members from respective State Pollution Control Board, CPCB Head Office or Zonal Office and / MoEF HQ / Regional Office.

Joint Inspection Report

The joint inspection team will submit the joint inspection report in the inspection report format as per Annexure-II of the guidelines. The joint inspection team will provide clear-cut remarks about fulfillment of the criteria, adequacy of infrastructure and recommendations regarding consideration of recognition of laboratory.

Terms & Conditions for Recognition of laboratory

Based on joint inspection report, if the laboratory meets the minimum skilled manpower requirement, minimum space requirement, minimum requirement of basic instrument / equipment and minimum analytical capabilities, it will be recommended by the joint inspection team for consideration of recognition. The recommended laboratories will have to accept Terms & Conditions as specified in Annexure-III of the guidelines.

Acceptance of Term & Conditions by the laboratory

The laboratory shall have to accept the terms and conditions as specified in Annexure-III and provide the acknowledgement receipt as per the proforma at Annexure-IV of the guidelines within a fortnight of receiving the communication.

Government Analyst

A person shall not be qualified for appointment or recognized as a Government analyst unless he or she is possessing following qualification and experience, which will replace the qualification and experience prescribed under Section 10 A, a, b & c of the Environment (Protection) Rules, 1986 from the date of publication of Amendment in Gazette Notification:

Qualification: Master's Degree in Science or equivalent or Bachelor's Degree in Engineering / Technology or equivalent

Experience: After above qualification, minimum five years of experience in environmental laboratory.

The applicant laboratory should recommend the names of senior officials involved in analytical operation in the laboratory and fulfilling the criteria for govt. analyst in the application proforma at para 2(xi).

Terms & Conditions for recognition of Government Analyst

The analysts recommended by the laboratory in the application at para 2(xi) will be considered and selected by CPCB/MoEF as Government Analyst. These selected analysts will have to accept the terms and conditions unconditionally, as specified in Annexure-V of the guidelines.

Acceptance of Terms & Conditions by Govt. Analyst

The nominated Govt. Analyst have to accept the terms and conditions jointly at end of the format at Annexure V of this guideline as well as individually in the format at Annexure VI of the guidelines.

Gazette Notification of Environmental Laboratory and Govt. Analyst

The Environmental Laboratory and Govt. Analyst found qualified and recommended by the Expert Committee, after unconditional acceptance of Terms & condition may be Gazette notified in Govt. of India Gazette. The format of Gazette notification may be followed as per Annexure-VIII.

The Gazette notification of private NGO/Cooperative Organization laboratories will continued to be undertaken by Ministry of Environment & Forests, while the Gazette notification of Govt./Semi-Govt./Autonomous Organization / Public Sector Undertaking and Educational Institute will be undertaken by Central Pollution Control Board.

Superannuation and Resignation of Govt. Analyst during the period of recognition

In case, any of the recognized govt. analysts by Central Govt. vacates his position due to superannuation / death / resignation from the services of the concerned laboratory, the recognized laboratory may nominate substitute, which will be considered by Central Govt. and if found qualified as per laid guidelines will be accepted and notified as Govt. analyst.

Duration of recognition

Environmental laboratory will be recognized for a period of 5 years from the date of publication of Gazette Notification.

Analytical Quality Control at Recognized Laboratories

Analytical Quality Control (AQC) is one of the main components of a quality assurance (QA) system, wherein the quality of analytical data being generated at the laboratory is controlled through minimizing or controlling errors to achieve a target accuracy. The correctness of decision or action depends largely upon the accuracy of the analytical results. If the errors of the analytical results are high, it will lead to wrong interpretation of data. In order to generate good and reliable environmental data, the following features are required to be maintained by recognized environmental laboratories:

- Suitable laboratory facilities;
- Laboratory instruments, sampling equipment, glassware reagents;
- Standardized analytical procedures covering the desired variables ranges of concentration;
- Well-trained and experienced laboratory personnel;
- Well-maintained equipment and facilities;
- Adequate filing and reporting system; and
- Systematic analytical quality control programme.

The Analytical Quality Control will be taken up by recognized laboratories at two levels:

(a) **Internal AQC or within laboratory AQC:** It is required for checking the precision and accuracy of analytical results within laboratory. Various sequential stages as below will be maintained by environmental laboratories:

ii) Choosing an analytical method suitably free from bias and ensuring the complete and unambiguous description of that method.
iii) Checking that satisfactory precision is obtained with the method.
iv) Establishing a control chart as a continuing check on precision and some sources of bias.
v) Ensuring accuracy of standard solution.

(b) **External AQC or Between laboratory AQC:** The recognized environmental laboratories has to participate in external AQC organized by other external organization to achieve comparability of results through controlling the precision and accuracy:

Compulsory Participation of Recognized Environmental Lab in AQC Exercise

The environmental laboratories recognized under The Environment (Protection) Act, 1986 have to compulsorily participate in Analytical Quality Control exercises organized by the Central Government / Central Pollution Control Board or an organization designated to test the capabilities and integrity of the data generated by the recognized laboratories.

The Central Government / CPCB may also send dummy environmental samples to the recognized laboratory to keep constant check over the analytical results generated by the recognized laboratory and results will be provided to the Central Government.

AQC Performance of Environmental laboratory

The performance of recognized environmental laboratory in Analytical Quality Control Exercise should be satisfactory (should not be less than 60% success at any time) during the period of recognition. In case, the performance of the laboratory has been found below the desired standard, the laboratory has to take immediate necessary action to maintain the analytical quality at the laboratory. The performance of the laboratory in Analytical Quality Control exercise will also be considered at the time of renewal of recognition. In case, the performance of the laboratory is not found satisfactory for three consecutive years in past, the renewal of recognition of the laboratory will not be granted.

Annual Fees for Participation in AQC programme

The recognized laboratory under The Environment (Protection) Act will have to deposit annual fees for participation in Analytical Quality Control exercise to Central Pollution Control Board, Delhi or any other organization designated by the Central Government / CPCB. The fees for participation in AQC exercise will have to be submitted by various categories of environmental laboratories as below:

i) Laboratories of Govt./Semi-Govt./Public Sector Undertaking/ Autonomous Body – Rs.15,000/- per year
ii) NGO's / Private Sector Laboratories – Rs.20,000/- per year

Submission of Application for Renewal of Recognition

The Environmental laboratories desirous of renewal of recognition at the expiry of earlier recognition period have to submit application for renewal of recognition at least six months before the expiry date of earlier recognition.

The environmental laboratory has to submit application for renewal in the same proforma as appended at Annexure-I providing details of earlier recognition at Para 1(xii) of Annexure-I of application. The application will be processed and considered as per the procedure laid down in the guidelines.

Renewal of Recognition

As per the existing provisions, the laboratories would be considered for renewal of recognition after a period of 5 years. The renewal of recognition of a Lab shall be continued for a period of five years as per the present practice.

Authorized Signatory of Analysis Report issued by recognized Labs

The analysis report depicting analytical results of environmental samples will be issued by the recognized environmental laboratory under signature of concerned analyst, supervisor analyst and have to be countersigned by any one of government analysts designated by the Central Govt. The government analyst recognized with the environmental laboratory will be the authorized signatory of analysis reports generated by the concerned laboratory.

Use of Phrase "Recognized Environmental Laboratories under The Environment (Protection) Act, 1986"

The recognized environmental laboratory under The Environment (Protection) Act, 1986 may use the phrase "Recognized Environmental Laboratories under The Environment (Protection) Act, 1986" on the analysis report, as well as on the official stationary. However, the validity period of recognition has also to be mentioned alongwith the phrase.

Periodic Surveillance of Environmental Laboratories

Periodic surveillance of recognized environmental laboratory under The Environment (Protection) Act will be undertaken by Central Government / Central Pollution Control Board every alternate year to assess the proper functioning, systematic operation and reliability of data generated at the laboratory.

Revoking of Recognition

The Central Govt. reserves its right to de-recognize or revoke its recognition at any time in public interest without assigning any reason, if it is deemed necessary by the Central Govt./CPCB. The recognition will also be revoked during following events:

i) In case, the laboratory indulges in malpractices and issuing fraudulent reports.

ii) There are complaints against the laboratory regarding analytical malpractices.

iii) The laboratory violates the accepted terms & conditions for recognition of environmental laboratory under the Act.

iv) The laboratory not complying the rules and regulations notified under The Act.

Jurisdiction of E(P) Act Recognized laboratories and Specific Provisions	The laboratories recognized under The Environment (Protection) Act, 1986 will have jurisdiction to function as Environmental laboratory in any state of the country. However, sample collection, preservation and transport protocol will have to be adopted and maintained by the laboratory as per standard references. The laboratories recognized under The Environment (Protection) Act, 1986 are intended to be simultaneously recognized under the Water Act, 1974 for carrying out the functions as per provisions of the Water (Prevention & Control of Pollution) Act, 1974 and also under the Air Act, 1981 for carrying out the functions as per provisions of The Air (Prevention and Control of Pollution) Act, 1981.
Amendments / changes with application proforma and evaluation criteria	If felt necessary MoEF/CPCB may amend / change application proforma and criteria.

Annexure-I

PROFORMA

RECOGNITION OF LABORATORY UNDER THE ENVIRONMENT (PROTECTION) ACT, 1986

(To be filled in by all existing laboratories to be considered for recognition as Environmental Laboratories under the Environment Protection Act, 1986)

1. General

(i) Name of Organization : _____

(ii) Name of the Laboratory : _____

(iii) Address

a) Postal : _____

_____

_____

b) Telephone : _____

c) Fax : _____

d) E-mail : _____

(iv) Year of establishment of organization : _____

(v) Year of establishment of environmental laboratory/wing : _____

(vi) Type of Organization (Please tick the appropriate to your Organization) :

Government	Autonomous	Public Sector
Pollution Control Board/Committee	Educational Institute (Govt./Govt. added/private)	
Private	NGO	Any other

(vii) If laboratory/organization is private/NGO, give details:

a. Whether registered with local, state or central govt. authorities : Yes / No

b. If yes, mention Registration No. and date :_____

c. Nationality of owner/head of the Organization :_____

d. Laboratory is located in (tick relevant)

- Commercial/Business complex
- Residential area
- Industrial area
- Other

e. Laboratory is situated in authorized/ approved area notified by the govt. : Yes / No

(viii) Objectives & scope of the organization*

_____

_____

_____

_____

(Please indicate, among others, whether it includes specialized testing, measurement, services)

(ix) Head of the Organization :

a) Name : _____

b) Designation : _____

c) Address : _____

_____

_____

d) Telephone : _____

e) Fax No. : _____

f) E-mail : _____

(x) Laboratory Incharge, if different than (ix) above.

a) Name and Designation :_____

b) Address : _____

_____

c) Telephone: _____ Fax _____ E-mail _____

(xi) Name of accreditation body(s)/organization i.e. ISO, NABL, GLP, SPCB's, PCC's etc. from which the laboratory has been already recognized/accredited, give details.

S. No.	Name of the certification/recognition body/organization	Accreditation / recognition granted for the activities	Environmental Parameter covered	Validity up to

(xii) If applied for renewal of laboratory recognition under EPA, 1986, give previous recognition details:

a. Validity period : From _____ to _____
b. Reference of Gazette notification : _____
c. CPCB/MOEF reference No. : _____

(xiii) Whether laboratory ever been de-recognized before its validity period of recognition under The Water Act, 1974, The Air Act, 1981 and The E(P) Act, 1986 by State Pollution Control Board/Pollution Control Committee/Central Government/ CPCB, if yes, give details:

_____

_____

2. Infrastructural details of Laboratory: (please enclose brief lay out plan map of laboratory) with organizational chart and laboratory position in there to:

(i) Total floor space of the environmental laboratory (in sq. mtr): _____

a) Water Laboratory = Sq. mtr

b) Biological & Microbiological Laboratory = Sq. mtr

c) Air Laboratory = Sq. mtr

d) Provide scanned photograph of above with layout plan.

(ii) Details of major projects undertaken pertaining to environmental studies:
[Please attach separate sheet, if space is insufficient]

(iii) Which of the following type of analytical tests are being carried out in the laboratory [please mark Yes (√)/No (x)]:

a) Physical
b) Inorganics general and non metallic
c) Inorganic (Trace metals)
d) Organics (General)
e) Trace Organics
f) Microbiological
g) Toxicity
h) Biological
i) Hazardous waste
j) Soil, sludge, sediment
k) Hazardous waste Characterization
l) Ambient air
m) Source emission
n) Air Toxics
o) Hazardous Air Pollutants
p) Volatile Organic Carbon
m) Noise measurement
n) Meteorological
o) Vehicular emission/Auto exhaust

(iv) Laboratory scientists/chemist or officials are fully conversant for sampling, monitoring, preservation and transportation [please tick Yes(√)/No(x)].

(a) Water & wastewater
(b) Hazardous waste
(c) Solid waste
(d) Soil
(e) Municipal waste
(f) Biomedical waste
(g) Ambient air/fugitive emission
(h) Air Toxics analysis
(i) Hazardous Air Pollutants analysis
(j) Volatile Organic Carbon analysis
(k) Noise monitoring
(l) Meteorological monitoring
(m) Source emission
(n) Auto exhaust monitoring
(o) On line ambient air quality monitoring

(v) Laboratory scientists/chemists or officials are capable of analyzing desired/ relevant parameters in various types of matrix [please tick [Yes(√)/No (x)]

a. Liquid Samples (water & wastewater)

b. Solid Samples (soil/mud/solid waste/sludge etc.)

c. Semi-solid samples (sludge/slurry)

d. Gaseous samples (Ambient air, source emission, vehicular emission)

(vi) a) Mark the parameters given in Appendix `A` which can be analyzed in the laboratory:

b) Mark the equipment given in Appendix `B` which are available in the laboratory:

c) Mark the glass apparatus/assembly given in Appendix `C`, which are available in the laboratory.

d) Mark the Instruments given in Appendix `D` which are available in the laboratory.

e) Mark the methodology employed for analysis in Appendix `E'.

f) Mark the Air Quality Parameters, which can be analyzed in the laboratory in Appendix `F'.

g) Mark the Instruments/equipment given in Appendix `G`.

h) Give details about instruments/equipment in Appendix `H`.

i) Give details about the analytical methods adopted in Appendix `I`.

j) Give details about the facilities available for analysis of specific organic compounds in Appendix `J`.

(vii) Which of the methods given below are being followed for the [Tick √]:

(a) Water and Wastewater Analysis:

1.	APHA	2.	BIS	3.	USEPA
4.	ASTM	5.	ISO	6.	Any other

(b) Air Pollution Monitoring and Analysis

1.	APHA	2.	BIS	3.	USEPA
4.	CPCB	5.	ASTM	6.	ISO
7.	Any other				

(viii) Provide details for participation in inter-laboratory (between laboratories) Analytical quality control proficiency testing programme during last 5 years. Attach copy of performance report with the application

Coordinating Agency i.e. CPCB, WHO, NABL, SPCB/PCC etc.	Period (Month / year)	Parameter covered	Percentage of performance

(ix) Name, designation and qualifications of staff/officials posted at environmental laboratory/branch (with expertise in environmental analysis/testing): (*Please enclose separate sheet if space is inadequate)*

S. No.	Name	Designation	Qualification	Total experience in any. Field (years & months)	Nature of present job assignment (√ only)		
					Administrative	Supervisory	Analysis/ sampling

(x) Details of training programme/s related with the environment field attended within last five years by the officials working at the laboratory as mentioned at (ix)

S. No.	**Name of official/s**	**Training conducted by the institution/organization**	**Title/topic**	**Duration**

(xi) Please indicate by asterisk (*) the name/s of personnel (maximum three) & having desired qualification and experience as mentioned in Annexure-IV to be considered for nomination as Govt. Analysts. Brief bio-data of these persons should be enclosed as per annexure-V.

S. No.	Name	Designation	Qualification	Experience in years related with Environmental Analysis

(xii) If applied for renewal of recognition under EPA 1986, please outline steps taken for up gradation of laboratory (please attach details as annexure) during recognition period with respect to:

a) Procurement of new sophisticated instrument
b) Addition of new parameters
c) Participation in Analytical Quality Control (AQC) exercise of CPCB.

Signature :(Head of organization) (Head of laboratory)

Full name :_____ _____
(In capital letters)

Seal of laboratory

(Forward application for consideration of inspection/recognition, if fulfill minimum criteria to MOEF (Private & NGOs only) and others to CPCB at following address with duly completed applications along with enclosures)

(i) Private/NGOs/Cooperative Organization Laboratory:

Director / Addl. Director (CP Division)
Ministry of Environment & Forests
Paryavaran Bhawan
CGO Complex, Lodi Road
New Delhi-110 003

(ii) Govt./Semi-Govt./Autonomous Organization/Public Sector Undertaking and Educational Institute Laboratories:

The Member Secretary
Central Pollution Control Board
`Parivesh Bhavan', East Arjun Nagar
Delhi - 110 032

Self-Assessment by the Laboratory

Pre-requisite for Recognition of Environmental Laboratories under The Environment (Protection) Act, 1986

The laboratory should ensure that it fulfills the following essential requirement by itself through self assessment before submitting an application seeking recognition under The Environment (Protection) Act, 1986:

(i) Laboratory (Private / NGO) is registered by the local govt./State Govt./Central Govt.

(ii) Laboratory has minimum 9 nos. of full time working skilled manpower with following qualification:

S. No.	Qualification	Nature of Job	Nos. of Manpower
1.	High School/Intermediate with Science	Assistance in sampling & analysis	2
2.	Bachelor's Degree in Basic Science or equivalent.	Sampling and analysis	4
3.	Master's Degree in Science or equivalent or Bachelors Degree in Engineering / Technology or equivalent or Ph.D.	Sampling & Analysis. Supervision of Analysis	3
	Total Manpower (Minimum)		**9**

(iii) Environmental laboratory should have minimum space required as given below:

a)	Water Laboratory	=	100 Sq. mtr
b)	Air Laboratory	=	100 Sq. mtr
c)	Water & Air Laboratory	=	150 Sq. mtr

(iv) Laboratory should compulsorily meet essential parameter requirement as Appendix A & F.

(v) Laboratory fulfills minimum requirement of equipment/instrument as Appendix B, D & G.

(vi) Laboratory should analyzed samples adopting any validated methods i.e. USEPA, APHA, BIS, ASTM, ISO, EU or CPCB only.

(vii) Laboratory must have environmental journals/books/analytical methods for sample analysis with adequate space.

(viii) Laboratory should have not been revoked the recognition by any SPCB/PCC and Govt. Department. If revoked, recognition case will not be considered before a period of three years from the date of revoked.

(ix) Laboratory must have comprehensive facilities, expertise for water or air or both related parameters.

(x) Laboratory should apply strictly as per the format with desired enclosures.

APPENDIX `A`

LIST OF PARAMETERS BEING ANALYSED

A) Physical Tests : [Please mark Yes(√)/No (x)]

S. No.	Mandatory parameter	S. No.	Secondary parameter
1.	Conductivity	1.	Flocculation test (Jar test)
2.	Colour	2.	Odour
3.	pH	3.	Salinity
4.	Fixed & volatile solids	4.	Settleable 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 nos. of parameters Minimum required 3 parameters

B) Inorganic [Please mark Yes (√)/No (x)]

(i) General & Non-metallic

S. No.	Mandatory parameter	S. No.	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 Minimum required– Atleast 3 parameters

(ii) Trace Metals [Please mark Yes(√)/No (x)]

S. No.	Mandatory parameter	S. No.	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

(C) Organics (General) and Trace Organics [Please mark Yes(√)/No (x) and give details at Appendix J for Trace organics]

S. No.	Mandatory parameter	S. No.	Secondary parameter
1.	Bio-chemical oxygen demand (BOD)	1.	Total organic carbon (TOC)
2.	Chemical oxygen demand (COD)	2.	Adsorbable 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

D) Microbiological Tests [Please mark Yes(√)/No (x)]

S. No.	Mandatory parameter	S. No.	Secondary parameter
1.	Total Coliform	1.	Total plate count
2.	Faecal Coliform	2.	Enterococcus
3.	Faecal Streptococci	3.	Coliphage
4.	E. Coli		

Minimum required – All 4 parameters Minimum required – Atleast 1 parameters

E) Toxicological Tests [Please mark Yes(√)/No (x)]

S. No.	Mandatory parameter	S. No.	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

F) Biological Tests [Please mark Yes(√)/No (x)]

S. No.	Parameter	S. No.	Parameter
1.	Benthic organism identification and count	5.	Saprobity Index
2.	Macrophytic identification	6.	Chlorophyll
3.	Planktonic identification count	7.	Primary productivity
4.	Measurement of various diversity index	8.	P/R Ratio

Minimum required – Atleast 3 parameter

G) Characterization of Hazardous Waste [Please mark Yes(√)/No (x)]

S. No.	Parameter
1.	Preparation of Leachate (TCLP extract/water extract)
2.	Corrosivity
3.	Ignibility (Flash point)
4.	Reactivity
5.	Toxicity
6.	Measurement of heavy metals/pesticides in the waste/leachate

Minimum required – Atleast 3 parameters

H) Soil/Sludge/Sediment and Solid Waste [Please mark Yes(√)/No (x)]

S. No.	Mandatory parameter	S. No.	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.	Phosphate (total)	9.	H. Acid
10.	Potassium	10.	Heavy metal
11.	SAR in soil extract	11.	Magnesium

S. No.	Mandatory parameter	S. No.	Secondary parameter
12.	Sodium	12.	Mechanical soil analysis
13.	Soil moisture	13.	Nitrate
14.	TKN	14.	Nitrite
15.	Calorific value	15.	PAH
		16.	Pesticide
		17.	Potash (available)
		18.	Sulphate
		19.	Sulphur
		20.	TOC
		21.	Total water soluble salt
		22.	Water holding capacity

Minimum required: All 15 parameters

Minimum required: Atleast 10 parameters

Remarks: Besides minimum instruments/equipment facilities laboratory must qualify minimum 5 essential groups i.e. A to E for water and similarly A to D for air analysis.

APPENDIX `B`

a) LIST OF EQUIPMENT FOR WATER / WASTEWATER ANALYSIS

[Note: Please mark Yes (√)/No(x)]

S. No.	Equipment	Yes/No	Nos. available**
	BASIC EQUIPMENTS		
1.	Ice Box/s* (2)		
2.	Filtration assembly* (1)		
3.	Heating Mantle		
4.	Stop watch		
5.	Hot air oven* (2)		
6.	Hot plate* (2)		
7.	Muffle furnace* (1)		
8.	Standard weight		
9.	Water bath		
10.	Thermometer/s* (4)		
11.	Refrigerator/s big size* 300 litres or above (2)		
	SPECIFIC EQUIPMENTS		
1.	Autoclave* (1)		
2.	Bottom sampler		
3.	BOD Incubator* (1)		
4.	Centrifuge* (1)		
5.	Aquarium for bioassay test* (4)		
6.	COD Digester with aluminium heating blocks * (1)		
7.	Colony Counter		
8.	Depth Sampler		
9.	Digester with condensers		
10.	Digestion chamber* (1)		
11.	Dissolved oxygen sampler		
12.	Flocculator (Jar testing apparatus)		
13.	Flow meter		
14.	Incubator for bacteriological test* (2)		
15.	Laminar flow* (1)		
16.	Magnetic Stirrer with hot plate* (2)		
17.	Mechanical Shaker *(1)		
18.	Microwave digester		
19.	TKN Analyzer semi automatic with aluminum block digester		
20.	Ultrasonic water bath		
21.	Vacuum pump* (1)		
22.	Water purification / distillation assembly* (1)		
23.	Ekman Dredge		
24.	Water sampler		

S. No.	Equipment	Yes/No	Nos. available**
25.	Oil & Grease sampler		
26.	Water Testing kit		
27.	Chloroscope for residual chlorine		
28.	Any other equipment (please attach details on separate sheet)		

* Besides minimum analytical capabilities, expertise, laboratory must be equipped with these items if seeking recognition with desired nos. as mentioned against each item.

** Provide minimum numbers of items, in case exact numbers are not available.

Certified that all the above equipments are properly of _____ _____ (Name of laboratory) and procurement records/bills of instruments/equipment are available at the laboratory. The list of instruments / equipment taken on loan is appended herewith.

Signature of Laboratory Incharge

APPENDIX `C`

a) LIST OF GLASS APPARATUS AND DISTILLATION ASSEMBLIES

[Note: Please mark Yes (√)/No (x)]

S. No.	Particulars	Yes or No	Total nos. available
1.	Fluoride distillation assembly		
2.	Cyanide distillation assembly		
3.	Ammonia distillation assembly		
4.	Water distillation assembly		
5.	Soxlet extraction assembly		
6.	Arsenic estimation assembly		
7.	Phenol distillation assembly		
8.	Any other (please enclose details on separate sheet)		

Remarks: If actual figures are not available give minimum / least nos. available.

APPENDIX `D`

a) LIST OF INSTRUMENTS FOR WATER / WASTEWATER ANALYSIS

[Note: Please mark Yes (√)/No (x)]

S. No.	Name of instrument	Yes/No	Total Nos. **
	BASIC INSTRUMENTS		
1.	Analytical Balance +* (1) 1 mg		
2.	Conductivity Meter* (1)		
3.	Dissolved oxygen meter		
4.	pH Meter with combined glass electrode* (1)		
5.	Turbidity meter* (1)		
	SPECIFIC INSTRUMENTS		
1.	Alpha/Beta Radioactivity Counter		
2.	Atomic Absorption Spectrophotometer (Flame) with the following cathode lamps + (√ available HCL)* (1)		
	(i) Aluminium; (ii) Antimony; (iii) Arsenic; (iv) Barellium; (v) Barium; (vi) Boron; (vii) Cadmium; (viii) Calcium; (ix) Chromium; (x) Copper; (xi) Iron; (xii) Lithium; (xiii) Lead; (xiv) Magnesium; (xv) Manganese; (xvi) Mercury; (xvii) Nickel; (xviii) Potassium; (xix) Selenium; (xx) Silver; (xxi) Sodium; (xxii) Strontium; (xxiii) Tin; (xxiv) Cobalt; (xxv) Vanadium; (xxvi) Zinc; (xxvii) Other, pl. specify		
3.	Atomic Absorption Spectrophotometer with Graphite Furnace and Hydride Generation System		
4.	Organic Halogen Analyzer (AOX/TOX)		
5.	Binocular Microscope		
6.	Flame Photometer* (1)		
7.	Gas Chromatograph with following detector*++ (1)		
	- ECD-NPD - FID-TID - FPD - Other detector		
8.	Gas Chromatograph with Mass Spectrometer (GC-MS)		
9.	High Pressure Liquid Chromatograph (HPLC)		
10.	Ion Chromatograph		
11.	Inductively Coupled Plasma (ICP) Spectrometer		
12.	Mercury Analyzer Digital* (1)		
13.	Portable Analyzer Kit (DO, pH, Temp. Cond.)		
14.	Precision Balance weighing up to 1 mg* (water / air)		
15.	Rotary Evaporator* (1)		
16.	Spectrophotometer (Visible)* or Ultraviolet & visible* (1)		
17.	Specific Ion Meter		
18.	Stereo Microscope		
19.	Total Organic Carbon Analyzer		
20.	Any other instruments (Please enclose details on separate sheet)		

* Besides minimum analytical capabilities, expertise, laboratory must equipped with these items if seeking / applying for recognition with desired nos. as mentioned against each item.

** Provide minimum number of item, in case exact numbers are not available

\+ All H.C.L. may not required essentially

++ GC equipped minimum ECD, NPD & FID with capillary column.

\- If equipped with ICP Spectrophotometer then AAS is not required essentially.

\- Mercury Analyzer Digital may not required essentially, if Mercury is measured 1 ppb or below by AAS/ICP.

b) LIST OF SPECIFIC EQUIPMENTS/INSTRUMENTS FOR HAZARDOUS WASTE ANALYSIS

[Note: Please mark Yes (√) /No (x)]

S. No.	Instruments	Nos. Available
1.	Bomb colorimeter	
2.	Elemental analyzer	
3.	Flash point apparatus	
4.	Moisture content meter	
5.	Rotary evaporator	
6.	Toxicity characteristic leaching procedure (TCLP) extractor	
7.	Toxic Gas analyzer	
8.	X-ray fluorescence (XRF) Spectrometer	
9.	Zero head space extractor (ZHE)	

c) MAINTENANCE CONTRACT STATUS OF IMPORTANT SOPHISTICATED INSTRUMENTS

[Note: Please mark Yes (√)/No (x)]

S. No.	Name of the instrument	Repair job undertaken on Annual Maintenance contract / emergency call basis	Whether sufficient spares available
1.	AAS (Flame & Flameless)		
2.	AOX		
3.	Total Organic Carbon Analyzer		
4.	Gas Chromatograph		
5.	Water purification system		
6.	Analytical balance		
7.	Specific ion meter		
8.	Mercury analyzer		
9.	UV-Visible spectrophotometer		
10.	Alpha/Beta Radioactivity Counter		
11.	Any other		

d) REFERENCE MATERIAL (RMS) AND CERTIFIED REFERENCE MATERIAL (CRMS)

S. No.	Parameters	Availability of RMS/CRMS	
		(√/X)	Nos. of standards
1.	Trace Metals		
2.	Organo-chlorine pesticides		
3.	Organo-nitrogen phosphorous pesticides		
4.	Polychlorinated Biphenyls (PCB's)		
5.	Polycyclic aromatic hydrocarbon (PAH)		
6.	Benzene, Ethylene, Toluene & Xylene		
7.	Dioxins and Furans		

Note: - Please enclose details on separate sheet, if space is inadequate.
- Provide list of standards (RM/CRM) with their names, make & expiry date.

APPENDIX `E`

METHODOLOGY EMPLOYED FOR ANALYSIS

[Please tick √ relevant adopted method]

(A) PHYSICAL PARAMETERS

S. No.	PARAMETER	METHOD ADOPTED
1.	Colour	a. Visible comparison method (only potable waters)
		b. Spectrophotometric Method (All)
2.	Odour	Threshold odour test
3.	Conductivity	Conductivity Meter
4.	pH Value	Electronic (pH Meter)
5.	Total solids dried at 103-105 ^{0}C	Gravimetric
6.	Total suspended solids dried at 103-105 ^{0}C	Gravimetric
7.	Total dissolved solids dried at 180 ^{0}C	Gravimetric
8.	Fixed and volatile solids ignited at 550 ^{0}C	Gravimetric
9.	Settleable solids	Volumetric using Imhoff concentration
		Gravimetric
10.	Sludge volume index (SVI)	Volumetric followed by gravimetric (using Imhoff conc. and filtration device)
11.	Salinity	a. Electrical conductivity method
		b. Density method
12.	Settled sludge volume	Volumetric
13.	Turbidity	Nephelometric
14.	Temperature	Thermometer
15.	Velocity and discharge measurement of river, drain, industrial effluent stream etc	a. Cross-Section-velocity Method
		b. Weirs (Rectangular or V Notch or U-Notch)
		c. Chemical Methods.
16.	Flocculation test (Jar test)	Dosing of coagulants
17.	Other Parameters (Please specify)	

(B) INORGANIC (GENERAL & NON-METALLIC)

S. No.	PARAMETER	METHOD ADOPTED
1.	Acidity	a. Electrometric/Potentiometric titration
		b. Color Indicator titration
2.	Alkalinity	a. Electrometric/Potentiometric titration
		b. Color Indicator titration
3.	Ammonical Nitrogen	a. Distillation followed by colorimetric method (Nesselerization or phenate)
		b. Distillation followed by titrimetric method
		c. Distillation followed by ion Selective electrode method
4.	Bromide	Colorimetric (Curcumin or Carmine)
5.	Carbon Dioxide	a. Titrimetric
		b. Nomographic
6.	Chloride	a. Titrimetric (Argentometric or Mercuric Nitrate)
		b. Potentiometric
7.	Chlorine demand	Dosing of sampling chlorine solution
8.	Chlorine Residual	Titrimetric
9.	Cyanide	a. Distillation followed by Titrimetric
		b. Distillation followed by Colorimetric
		c. Distillation followed by Cyanide - Selective Electrode
10.	Dissolved Oxygen	a. Winkler titrimetric-azide modification
		b. Membrane electrode method
11.	Fluoride	a. Distillation followed by Colorimetric (SPADNS or Alizarin Red)
		b. Distillation followed by Fluoride selective electrodes
12	Iodine	a. Leuce Crystal violet method
		b. Amperometric titration method
13.	Total kjehldal nitrogen	a. Macro kjehldal method
		b. Semi micro kjehldal method
14.	Nitrite nitrogen	Colorimetric
15.	Nitrate nitrogen	a. Colorimetric
		b. Cadmium reduction method
		c. Electrode method
16.	Phosphate	Colorimetric
17.	Sulphate	a. Turbidimetric
		b. Gravimetric method with residual/ignition of residue
18.	Sulphide	a. Iodometric method
		b. Ion selective electrode method
		c. Methylene blue method
19.	Sulphite	a. Titrimetric
		b. Phenonthralin method
20.	Silica	a. Molybdosilicate method
		b. Heterotopy blue method
21.	Total hardness	Titrimetric (EDTA method)
22.	Other parameters (pl. specify)	

II. **TRACE METALS** (Tick for applicable methods for elemental analysis)

S. No.	Elements	Flame atomic absorption (direct)	Flame atomic absorption (extracted)	Flame photometry	Electro thermal atomic absorption	Hydride/cold vapour atomic absorption	Inductively coupled plasma (ICP)	ICP/MASS Spectrometry ICP/MS	Anodic stripping voltametry	Alternative methods (colorimetric/ titrimetric by difference etc)
1.	Aluminium (Al)									
2.	Antimony (Sb)									
3.	Arsenic (As)									
4.	Barium (Ba)									
5.	Beryllium (Be)									
6.	Boron (B)									
7.	Cadmium (Cd)									
8.	Calcium (Ca)									
9.	Chromium (total) (Cr^{3})									
10.	Chromium (Hexa) (Cr^{+6})									
11.	Cobalt (Co)									
12.	Copper (Cu)									
13.	Iron (Fe)									
14.	Lead (Pb)									
15.	Lithium (Li)									
16.	Magnesium (Mg)									
17.	Manganese (Mn)									
18.	Mercury (Hg)									
19.	Nickel (Ni)									
20.	Potassium (K)									
21.	Selenium (Se)									
22.	Silver (Ag)									
23.	Sodium (Na)									
24.	Sodium Absorption Ratio (SAR)									
25.	Strontium (Sr)									
26.	Tin (Sn)									
27.	Vanadium (V)									
28.	Zinc (Zn)									

1. Total nos. of metal analysis claimed _____;
2. Metal digestion method adopted (pre treatment (please tick appropriate)

   (a) Using hot plate
   (b) Closed loop system
   (c) Microwave digestion

C. ORGANIC (GENERAL) & TRACE ORGANICS

[Please mark Yes (√) /No (x) for adopted method]

S. No.	PARAMETER	METHOD
	GENERAL	
1.	Bio-chemical Oxygen Demand (BOD)	a. Three days BOD at 27 ^{0}C
		b. Five days BOD at 20 ^{0}C
2.	Chemical oxygen demand (COD)	a. Open reflux method
		b. Closed reflux titrimetric method
		c. Closed reflux colorimetric
3.	Oil & Grease	a. Grass metric (simple extraction)
		b. Soxhlet extraction
4.	Phenol	a. Distillation followed by colorimetric
		b. Chloroform extraction
5.	Adsorbable organic halogens	Adsorption pyrolysis titrimetric
6.	Organic carbon (in solids)	Rapid titrametration method
7.	Total organic carbon	a. High temperature combustion
		b. Persulphate ultraviolet or heated persulphate oxidation
		c. Wet oxidation method
8.	Surfactants	a. Surfactant separation by sublation
		b. Anionic surfactants as MBAS
		c. Non imic surfactants as CTAS
9.	Carbon/Nitrogen Ratio	By calculation
10.	Tannin & lignin	Colorimetric method
	TRACE ORGANICS	
11.	Pesticides	a. Organo-chlorine (Please specify adopted method)
		b. Organo-phosphorous (Please specify adopted method)
		c. Carbamates (Please specify adopted method)
		d. Herbicides (Please specify adopted method)
		e. Fungicides (Please specify adopted method)
12.	Polychlorinated biphenyl (PCB's)	Please specify adopted method
13.	Poly nuclear aromatic hydrocarbon	Please specify adopted method
14.	Volatile Organics	Please specify adopted method
15.	Trihalomethanes	Please specify adopted method

D. MICROBIOLOGICAL TESTS (Adopted method)

S. No.	PARAMETER	METHOD
1.	Total coliform	a. Multiple tube technique
		b. Membrane filter technique
2.	Faecal coliform	a. Multiple tube technique
		b. Membrane filter technique
3.	Faecal streptococci	a. Multiple tube technique
		b. Membrane filter technique
4.	Enterococcus	a. Multiple tube technique
		b. Membrane filter technique
5.	Total plate count	a. Pore plate method
		b. Spread plate method
		c. Membrane filter method
6.	E. Coli	a. Multiple tube technique
		b. Membrane filter technique
7.	Others (Please specify)	

E. HAZARDOUS WASTE PARAMETERS (Adopted method)

S. No.	PARAMETER	METHOD
1.	Preparation of Leachate (TCLP extract/water extract	-
2.	Determination of various parameter in Leachate i.e. metal, pesticides etc.	Methods as prescribed in water analysis
3.	Corrosivity	a. Electrometric (by pH meter)
		b. Corrosivity toward steel
4.	Reactivity	Identification of characteristic properties i.e. explosive, reading violent, violently react with water forms potential explosive mixture with water etc.
5.	Ignitability	a. By Pen sky martens apparatus
		b. By seta flash closed cap tester
6.	Toxicity	Toxicity characteristics leaching procedure (TCLP)
7.	Other (Please specify)	

APPENDIX `F`

AIR QUALITY PARAMETERS

Facilities available [Please mark Yes (√)/No (x)]

A. Ambient Air / Fugitive Emissions

S. No.	Group of parameter	Yes/No (√ / x)	Adopted method
(i)	**Mandatory Parameters**		
1.	Nitrogen dioxide as NO_2		
2.	Sulphur dioxide (SO_2)		
3.	Total suspended particulate matter		
4.	Respirable suspended particulate matter (PM_{10})		
(ii)	**Secondary Parameters**		
1.	Ammonia		
2.	Carbon monoxide		
3.	Chlorine		
4.	Fluoride		
5.	Non methane hydrocarbon		
6.	Lead		
7.	Methane		
8.	Ozone		
9.	Benzene Toluene Xylene (BTX)		
10.	Polycyclic aromatic hydrocarbon (PAH) Benzo-a-pyrine & others		
11.	$PM_{2.5}$		
12.	Volatile Organics Carbon		

Minimum required - At least 4 parameters from secondary parameters

B. Stack gases/source emission

S. No.	Group of parameter	Yes/No (√ / x)	Adopted method
(i)	**Mandatory Parameters**		
1.	Particulate matter		
2.	Sulphur dioxide		
3.	Velocity & flow		
4.	Carbon dioxide		
5.	Carbon monoxide		
6.	Temperature		
7.	Oxygen		
8.	Oxides of nitrogen		
(ii)	**Secondary Parameters**		
1.	Acid mist		
2.	Ammonia		
3.	Chlorine		
4.	Fluoride (Particulate)		
5.	Fluoride (Gaseous)		
6.	Hydro-chloric acid		
7.	Total Hydro carbon		
8.	Hydrogen Sulphide		
9.	Carbon disulphide		
10.	Mercaptan		

Minimum required - At least 5 parameters from Secondary parameter

C. Noise level

S. No.	Group of parameter	Yes/No	Adopted method
(i)	**Mandatory Parameters**		
1.	Noise level measurement (20 to 140 dba)		
2.	Ambient Noise & Source specific noise		

D. Meteorological Monitoring

S. No.	Group of parameter	Yes/No	Adopted method
(i)	**Mandatory Parameters**		
1.	Ambient Temperature		
2.	Wind direction		
3.	Wind speed		
4.	Relative Humidity		
(ii)	**Secondary Parameters (Minimum required at least one parameter)**		
1.	Solar radiation		
2.	Rain fall		

E. Vehicular Emission Monitoring

S. No.	Group of parameter	Yes/No	Adopted method
(i)	**Mandatory Parameters**		
1.	Carbon monoxide		
2.	Smoke Density		
3.	Hydrocarbon		
(ii)	**Secondary Parameters (Optional)**		
1.	Oxides of Nitrogen		

Remark: *Laboratory seeking recognition must qualify minimum 4 groups A to D groups of parameters with appropriate space requirement, skilled manpower and adequate infrastructure facilities.*

APPENDIX-G

LIST OF EQUIPMENT/INSTRUMENTS

[Please mark Yes (√)/No (x)]

S. No.	Instrument	Yes/No	If yes, give Total Nos. **
1.	BTX analyzer (PID/FID detector)		
2.	BTX calibrator		
3.	Charcoal Tubes		
4.	CO Analyzer (Non-dispensive Infrared principle)		
5.	Detector Tubes with Pump of different pollutants (Please specify details)		
6.	Dust analyzer (Beta Attenuation/TOEN)		
7.	Exhaust CO/HC analyzer		
8.	Flue gas analyzer		
9.	Gas Chromatograph with Air sampling port, FID & PFPD detectors		
10.	Handy sampler for gaseous monitoring* (2)		
11.	High Volume sampler with flow controller (4)		
12.	Low flow pump		
13.	Meteorological sensors with mast (WS, WD, Temp., Humidity)* (1)		
14.	Micro balance (Readability 1 µg)		
15.	Multi calibration system		
16.	Multi channel recorder		
17.	Multi calibration kit (portable)		
18.	Noise level meter* (2)		
19.	NO-NO_2-Nox Analyzer (Chemiluminescence based)		
20.	Ozone analyzer (Ultraviolet)		
21.	Permeation tubes for calibration		
22.	RSPM sampler with flow controller/brush less motor + calibration kit* (4)		
23.	Smoke density meter		
24.	SO_2 Analyzer (Pulsed Fluorescence based)		
25.	Soap bubble meter		
26.	Stack monitoring kit with High Temp. Probes* (2)		
27.	Toddler Bags		
28.	Wet gas meter		
29.	Any other (please specify)		

LIST OF INFRASTRUCTURAL EQUIPMENT/ITEMS FOR AIR ANALYSIS

[Please mark Yes (√)/No (x)]

S. No.	Items	Yes/No	If yes, give Total Nos.**
1.	Air conditioner (split type)		
2.	Air Conditioner (Window type)		
3.	Breathing apparatus		
4.	Cold room far sample storage		
5.	Computer with printer		
6.	Constant voltage transformer		
7.	Face shield and helmet		
8.	Gas mask		
9.	Refrigerator (frost free, CFC free)		
10.	Tool Kit (Electrical & Mechanical)		
11.	Uninterrupted power supply (UPS) system		
12.	First aid box		
13.	Trolley for sample transportation		
14.	Fume Hood		
15.	Exhaust System		
16.	Fire Extinguisher		
17.	Electricity Generator		
18.	Gas Cylinder Trolleys		
19	Any other (please specify)		

** Provide minimum numbers of items, in case exact numbers are not available

* Besides minimum analytical capabilities, expertise laboratory must equipped with these items, if seeking / applying for recognition with desired numbers as mentioned against each item.

Appendix H

Details of equipment/instruments available in the Laboratory

(Please enclose separate sheet if space is inadequate)

S. No.	Instrument/Equipment	Make/Model	Procurement document/bills available (√/x)	Standard operating procedure (SOP's) available (√/x)	Measuring range	Accuracy % ±	Month & year of purchase	Month & year placed in service	Calibration Status Internal/External
1.	AAS								
2.	GC								
3.	Flame photometer								
4.	Mercury analyzer								
5.	BOD incubator								
6.	Analytical balances								
7.	Autoclave								
8.	pH meter								
9.	Conductivity meter								
10.	Bacteriological incubator								
11.	Spectrophotometer (visible)								
12.	Turbidity meter								
13.	Noise level meter								
14.	High volume sampler								
15.	Stack monitoring kit								
16.	RSPM sampler								
17.	Meteorological sensor								

(Please provide details on separate sheet, if space is inadequate)

* If external, mention date of calibration validity.

Appendix I

METHOD DETAILS OF TEST PARAMETERS MARKED AS √ AT APPENDIX A TO F

(Please enclose separate sheet, if space is inadequate)

S. No.	Parameter	Method adopted (Please provide method details viz. Method Nos., page details)	Measuring Range	Minimum Detection Limit (MDL)	SOP's Available (√/x)
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					

Appendix J

Please provide the name of compounds being analyzed in the laboratory using Gas Chromatography technique for the following groups:

S. No.	Pesticides			Polychlorinated Biphenyls (PCB's)	Polynuclear aromatic hydrocarbon PAH	Dioxins & Furans	Benzene ethylene toluene & Xylene	Trihalomethanes
	Organo-chlorine	Organo Nitro phosphorous	Carbonates					

Attachments

1. Provide coloured scanned photograph showing inner view / work area of the laboratory for the following sections.

Water and Wastewater Section	Microbiology Section
Instrumentation Section	Air and Emission Testing Section
Library / Conference Room	Outer view of the laboratory building

2. Enclose Layout Plan of the laboratory with the application.

Annexure II

INSPECTION REPORT FOR EVALUATION OF LABORATORY TO BE RECOGNIZED UNDER ENVIRONMENT (PROTECTION) ACT, 1986

Name of Laboratory : _____

Name of Organization : _____

Letter Ref. No. of the Laboratory : _____

Date of Inspection : _____

Inspection undertaken by : _____

_____

_____

(A) CHECK-LIST FOR THE WATER QUALITY PARAMETERS AND INSTRUMENTS :

1. Check `Physical Parameters' of Appendix `A' marked as √ (Yes) in respect of

   (i) Facilities _____

   _____

   (ii) Expertise _____

   _____

2. Check `Inorganic (General & non-metallic)' of Appendix `A' marked as √ (Yes) in respect of

   (i) Facilities _____

   _____

   (ii) Expertise _____

   _____

3. Check `Inorganic (Metals)' at Appendix `A' marked as √ (Yes) in respect of

   (i) Facilities _____

   _____

   (ii) Expertise _____

   _____

4. Check `Organic tests' of Appendix `A' marked as √ (Yes) in respect of

(i) Facilities _____

_____

(ii) Expertise _____

_____

5. Check `Microbiological Tests' of Appendix `A' marked as √ (Yes) in respect of

(i) Facilities _____

_____

(ii) Expertise _____

_____

6. Check `Toxicological Tests' of Appendix `A' marked as √ (Yes) in respect of

(i) Facilities _____

_____

(ii) Expertise _____

_____

7. Check `Biological Tests' of Appendix `A' marked as √ (Yes) in respect of

(i) Facilities _____

_____

(ii) Expertise _____

_____

8. Check `soil, sludge, sediment test' of Appendix `A' marked as √ (Yes) in respect of

(i) Facilities _____

_____

(ii) Expertise _____

_____

9. Check `Characterization of hazardous waste test' of Appendix `A' marked as √ (Yes) in respect of

(i) Facilities _____

_____

(ii) Expertise _____

_____

10. (a) Verify the `List of Equipment' marked as √ (Yes) in the Appendix `B'.

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' marked as √ (Yes) in the Appendix `D'.

_____

_____

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

_____

_____

12. Check the list of glass apparatus & distillation assemblies marked as √ (Yes) in Appendix-C

_____

13. Sophisticated instruments covered under AMC

_____

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

_____

_____

15. If the Laboratory is having the Atomic Absorption Spectrophotometer name the Hollow Cathode Lamps, which are useable

_____

_____

16. Whether facilities available for digestion of samples

_____

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

_____

18. 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

19. 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 of Appendix `F' marked as √ (Yes) in respect of:

(i) Facilities

_____

_____

(ii) Expertise

_____

_____

2. Check stack emission parameter of Appendix `F' marked as √ (Yes) in respect of:

(i) Facilities

_____

(ii) Expertise

_____

3. Check Noise parameter of Appendix `F' marked as √ (Yes) in respect of:

(i) Facilities

_____

(ii) Expertise

_____

4. Check the Micro meteorological parameter of Appendix `F' marked as √ (Yes) in respect of:

(i) Facilities

_____

(ii) Expertise

_____

5. Check the auto exhaust/vehicular emission parameter at Appendix `F' marked as √ (Yes) in respect of:

(i) Facilities _____

(ii) Expertise_____

6. Verify the list of instruments for monitoring Ambient Air/Fugitive emission/Stack gases claimed in Appendix `G'

_____

_____

_____

7. Verify the list of Micro meteorological Instruments marked as √ (Yes) in Appendix `G'

_____

_____

8. Verify the list of vehicular emission monitoring instruments claimed in Appendix `G'

_____

_____

_____

9. Specify the name of the instrument, which are available but not in working condition (As Appendix `G')

_____

_____

_____

10. Verify the facilities for calibration of various flow measuring devices claimed at Appendix `G`.

(i) Blower Calibration System : _____

(ii) Rotometer Calibration System : _____

(iii) Pitot Tube Calibration System : _____

(iv) Dry Gas Meter Calibration System : _____

11. Check the frequency of calibration of various flow meters used in Ambient Air/Stack Emission Monitoring

_____

_____

_____

12. Which of the methods given below are being followed for the 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 Ambient Air/Fugitive

_____

_____

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

(i) EPA _____ (ii) Central Board _____

(iii) ASTM _____ (iii) Any other _____

15. 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 fire fighting 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.) etc.

_____

9.(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) Nanopure system
(v) 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 organizations from which the laboratory has been already recognized:

_____

_____

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

(i) APHA	(ii) BIS	(iii) USEPA
(iv) ASTIM	(v) ISO	(vi) Any other

19. Documentation (water & air)

(i) Standard operating procedures available (√) / not available (x) for
   a. Routine inspection, cleaning, maintenance, testing, calibration and standardization of instruments
   b. Analytical methods
   c. 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 & 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/bills of instruments/equipments:

_____

(i) Available working area of Environmental Laboratory is approx. _____ sq. m. for water lab _____ for Air Lab _____ for Microbiology Lab, say approx. total _____ sq. m (Adequate/Inadequate)

(ii) Confirmation of manpower given in application at VIII

_____

_____

OBSERVATIONS & RECOMMENDATIONS OF INSPECTION COMMITTEE:

Signature/s of official/s
Inspecting the Laboratory _____ _____ _____

Name _____ _____ _____

Designation _____ _____ _____

Deptt./Organization _____ _____ _____

ACKNOWLEDGEMENT

Certified that vide letter No. _____ dated _____ through which an application was submitted for consideration of laboratory recognition under The Environment (Protection) Act, 1986. In this regard, today as on _____ our laboratory (name & address) _____ was inspected by the team / representatives from MOEF (Govt. of India)/Central Pollution Control Board/_____State Pollution Control Board/ _____ Pollution Control Committee.

Dated: (Head of Laboratory)

Place: Full Name:

Seal of Laboratory

ANNEXURE - III

TERMS & CONDITIONS FOR RECOGNITION OF LABORATORIES UNDER THE ENVIRONMENT (PROTECTION) ACT, 1986

The following terms and conditions shall be observed for recognition of laboratories under Section 12 (1) (b) of the Environment (Protection) Act, 1986.

1. The laboratory (Private/NGOs) shall be legally identifiable and registered with an appropriate statutory body i.e. local govt., state govt. or central govt.

2. The laboratory shall perform all the functions as mentioned in Rule 9 of the Environment (Protection) Rules, 1986.

3. It shall carry out the tests as per the method prescribed by the Central Government of any authorities constituted under Section 3 (3) of the Environment (Protection) Act, 1986 from time to time.

4. The test report shall be recorded in Form III of the Environment (Protection) Rules 1986 in triplicate. It shall be signed by the Government Analyst and be sent to the officer from whom the sample is received by the laboratory.

5. It shall carry out those tests, which are specified in APPENDIX-A to F of the application and it shall not carry out any other test on the samples given.

6. The laboratory shall charge rates not exceeding those fixed for EPA recognized laboratories.

7. The laboratory shall not charge rates higher than the rates they charge to any other Government or Public Sector organization.

8. The laboratory shall ensure that a sample submitted to it for testing will only be tested by a person, recognized as `Government Analyst' by Central Government under provisions of the Environment (Protection) Act and as notified in the official gazette from time to time.

9. When a Government Analyst ceases to be in the services of the Laboratory, the Head of the Laboratory shall report this fact to the Central Government within fifteen days and simultaneously take steps for filling up this vacancy.

10. Any report signed by the Government Analyst may be used as evidence of facts in a court of law as per Section 14 of the Environment (Protection) Act, 1986. The laboratory shall provide all facilities to the `Government Analyst' for giving evidence in a court of law, if it becomes necessary.

11. It shall maintain complete secrecy in respect of the test results. These shall not be divulged to any person or authority other than the Officer empowered under Section 11 of the Act of the court having jurisdiction.

12. Laboratory shall remain open for all working days except weekly off, Central & State Govt. holidays. Environmental laboratory of an educational institute/college will make arrangement of acceptance of samples and their analysis during any vacation exceeding more than 5 days i.e. summer/winter vacation etc.

13. It shall maintain proper records and registers and the calculations and test results in respect of tests conducted by them.

14. The laboratory and the Government Analysts employed by the laboratory shall participate in (Analytical Quality Control Exercises) organized by the Central Government or an organization designated by it to test the capabilities of the recognized laboratories and analysts from time to time. The fee if so, for AQC exercise has to be paid by the participating laboratory to the designated organization.

15. If feel necessary, Central Government will send dummy environmental samples to the laboratory to keep constant check over the laboratories of the results of the sample, which are to be analyzed, free of cost by the laboratory and results will be provided to the Central Government.

16. If the laboratory is sent samples from an establishment with which it has got connections through ownership or other means which make it improper for the laboratory to carry out the tests with respect to that sample, it shall disclose the fact to the empowered officers or authority sending the sample and shall refuse the samples.

17. It shall be the responsibility of the laboratory to maintain properly the necessary infrastructure for conducting tests successfully.

18. In case the laboratory desires to make a mention of its recognition as environmental laboratory in its letter heads, printed material, signboards, etc., it shall specify the period of recognition and such mention of the recognition shall cease immediately after the expiry of recognition.

19. The laboratory shall comply with all the rules and regulations notified under the Environment (Protection) Act, 1986.

20. The recognition shall become effective from the date of its Gazette Notification up to a period of five years or revocation whichever is earlier.

21. The Central Government / CPCB shall have the right to de-recognize the laboratory at any time in public interest without assigning any reason, if it is deemed necessary by the Central Government.

22. Private/NGO's laboratory shall maintain complaint register (bounded and numbered) having the following columns

Customer's name and address	Ref. No. if any	Date on which sample received	Name of complainer	Complaint has been rectified in the laboratory

23. The recognition accorded to Government Analysts in an environmental laboratory ceases along with the de-recognition of that environmental laboratory.

24. Each of environmental sample test report provided by the private laboratory to the customer must give in their footnote regarding availability of complaint register with the owner.

25. If the laboratory has shifted within city from the place, where it has been granted recognition earlier the laboratory will inform Central Govt. regarding the change as well as.

26. In case of take over of a recognized private laboratory, its ownership changes; occurrence of such changes must be communicated to the recognition body MOEF/CPCB within one month. Through, an appropriate mechanism that the laboratory continues to comply with the criteria against which recognition was originally granted will be verified.

27. After recognition, laboratory can be re-inspected at any time for its periodic assessment/performance.

The aforesaid terms and conditions are acceptable to us.

Dated:

Signature _____
(Head of Laboratory)

Full Name _____
(in capital letters)
Address _____

_____

Seal of laboratory

ACKNOWLEDGEMENT RECEIPT FOR THE LABORATORY

I hereby acknowledge the receipt of the Central Pollution Control Board, (Ministry of Environment & Forests) Letter No._____dated_____ regarding the recognition of our laboratory as Environmental Laboratory under Section 12 of the Environment (Protection) Act, 1986.

I accept the terms & conditions mentioned in the MOEF/Central Board's letter cited.

Dated : _____

Signature _____
(Head of laboratory)

Full name _____
(in capital letters)

Address : _____

_____

_____

SEAL OF THE LABORATORY

ANNEXURE - IV

TERMS AND CONDITIONS FOR RECOGNITION OF GOVERNMENT ANALYSTS UNDER THE ENVIRONMENT (PROTECTION) ACT, 1986

1. A person working as analyst in a laboratory recognized as Environmental Laboratory under the Environment (Protection) Act, 1986 may be recognized as a Government Analyst if he has the qualifications and experience as prescribed in the Rule 10 of the Environment (Protection) Rules, 1986.

2. The recognition of a Government Analyst is with respect to the laboratory where he is employed at the time of recognition and which is recognized as an environmental laboratory under Section 12 of the Environment (Protection) Act, 1986. If he ceases to be in the services of the said laboratory, his recognition ceases forthwith from the date of termination of his service with the laboratory.

3. The recognition accorded to the Government Analyst in an Environmental Laboratory ceases along with the de-recognition of that environmental laboratory.

4. The recognition shall become effective from the date of Gazette Notification up to a period of five years or revocation, whichever is earlier.

5. The Government Analyst shall participate in any `Round Robin Test' organized by the Central Government or an organization designated by it for testing his capabilities for conducting various environmental tests.

6. It shall be the responsibility of the Government Analyst to see that the instruments necessary for conducting various environmental tests are properly maintained and calibrated.

7. The test report by the Government Analyst submitted to the appropriate authority shall bear the seal of the laboratory.

8. The Government Analyst shall appear in a court of law for giving evidence, if required by the appropriate court / Central Govt.

9. The Government Analyst shall maintain complete secrecy in respect of test results.

10. The Government Analyst shall comply with the rules and regulations notified under the Environment (Protection) Act, 1986.

11. The Central Government shall have the right to derecognize the Government Analyst any time in public interest without assigning any reason.

The undersigned accept the above terms and conditions for recognition as Government Analyst.

1. Signature _____

Name _____

2. Signature _____

Name _____

3. Signature _____

Name _____

ACKNOWLEDGEMENT RECEIPT FOR THE ANALYST

I hereby acknowledge the receipt of the Central Pollution Control Board, (Ministry of Environment & Forests, Govt. of India) Letter No._____dated _____ enclosing the terms and conditions for recognizing me as a Government Analyst under Section 13 of the Environment (Protection) Act, 1986.

I accept the terms and conditions mentioned in the Central Board's letter cited.

Place :

Signature_____

Name _____

Address :_____

_____

_____

SIGNATURE ATTESTED

Signature of the Head of the Laboratory

SEAL OF THE LABORATORY

ANNEXURE V

BIO-DATA PROFORMA FOR CONSIDERATION OF RECOGNITION AS GOVT. ANALYST UNDER THE ENVIRONMENT (PROTECTION) ACT, 1986

1. Name in full (In block letters) : _____
2. Father's name : _____
3. Date of birth : _____
4. Nationality : _____
5. Permanent Address : _____

_____

_____

_____

6. Tel No. _____ Fax _____ E-Mail _____
7. Educational qualification (Give detail in chronological order from graduation & onward):

S. No.	Exam passed	Name of Board/ University/ Institution	Year of passing	Subjects taken	Division
1.					
2.					
3.					

8. Professional Training taken during last 3 years:

S. No.	Organization	Period of training		Subject of the training
		From	To	

9. Previous and current employment records:

S. No.	Name & address of employer	Type of organization Govt./Semi-Govt./ Public Sector/ Private/NGO	Period of service		Post held	Salary drawn	Job nature	Reason for leaving
			From	To				

Note: Please attach separate sheet, if space is inadequate.

10. Experience in Analysis of Environmental Samples _____ years.

11. Please provide details if earlier appointed / recognized as Govt. Analyst under The Environment (Protection) Act, 1986:

12. Declaration:

I declare that the foregoing information is correct and complete to the best of my knowledge and belief and nothing has been concealed / distorted. Documents in support of my educational qualification and experience will be provided, if required so.

Place:

(Signature of candidate)

Date:

Signature of the Head of the Laboratory

SEAL OF THE LABORATORY

Annexure-VI

Draft Gazette Notification

TO BE PUBLISHED IN THE GAZETTE OF INDIA EXTRAORDINARY

PART ……. SECTION ……..SUB-SECTION……..

CENTRAL POLLUTION CONTROL BOARD
MINISTRY OF ENVIRONMENT & FORESTS

NOTIFICATION

New Delhi, Dated ……..

No. _____In exercise of the powers conferred by clause (b) of Sub-section 1 of Section 12 and Section 13 read with clause 1 of the Notification No. 145(E), dated 21st February, 1991, issued under Section 23 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Pollution Control Board, Parivesh Bhawan, East Arjun Nagar, Delhi - 110032 hereby recognizes, (a) the laboratories specified in column (2) of the Table below as 'Environmental Laboratories' to carry out the functions entrusted to the environmental laboratories under the said Act, and the rules made thereunder, and (b) specified persons in column (3) of the Table as the Government Analysts for the purposes of analysis of samples of air, water, soil or other substances sent for analysis, specified for respective groups of parameters mentioned in Column (4).

After Sr. No._____ of the Notification No. _____, dated _____, and the entries relating thereto, the following Serial Nos. and entries shall be added namely:-

S. No.	Name of Laboratory	Name of the Govt. analysts	Recognized for parameter groups
1.	2.	3.	4.

The Environmental Laboratories and the Govt. Analysts so mentioned shall remain valid for a period of five years from the date of issue of Notification.

Authorized Signatory
CPCB / MoEF

Foot Note:

The principal notification was published in the Gazette of India vide SO NO. 728(E), dated 21.7.1987 and subsequently amended vide:-

(I)SO 838(E), dated 23.9.87 (2) SO 989(E) dated 17.11.87 (3) SO 489(E) dated 17.5.88 (4) SO 156 (E) dated 24.2.89 (5) SO 846(E) dated 24.10.89 (6) SO 375(E) dated 26.4.1990 (7) SO 803(E) dated 23.9.92 (8) SO 97(E) dated 5.12.1994 (9) SO 418(E) dated 31.3.1996 (10) SO 889 (E) dated 31.8.1996 (11) SO 452 (E) dated 31.5.97 (12) SO 631 (E) dated 31.5.1998 (13) SO (E) 336 dated 1.1.1999(14) SO.44(E), dated 15.1.2001, (15) S.O.No.490(E), dated 1.6.2001, (16) S.O. No. 532(E), dated 1.1.2002, (17) S.O. No.1168(E), dated 1.6.2002, (18) S.O.No.888(E), 1.6.2003, (19) No.Legal/42(3)/87/, dated 1.6.2004, (20) Legal/42(3)/87, dated 1.3.2005, (21) Legal42(3)/87, dated 1.9.2005, (22) Legal 42(3)/87, dated 15.12.2005 and (23) Legal 42(3)/87, dated 1.5.2006.

ADDENDUM

Addendum-A

SCHEDULE OF SAMPLING AND ANALYSIS CHARGES APPLICABLE AT CPCB LABORATORIES FOR ENVIRONMENTAL SAMPLES

(Applicable w. e. f. April 01, 2008)

Note: (i) This schedule supersedes all schedules of sampling and analysis charges notified earlier as such earlier schedules stand cancelled & withdraw.
(ii) 50% discount on analytical charges shall be applicable for the samples forwarded from North-East States.

A. SAMPLING CHARGES

(I) Sampling charges for Ambient Air/Fugitive emission samples

S. No.	Type of sampling	Charges in Rs.	Proposed Rate (Rs)
1.	**Air Monitoring**		
	(a) Sampling (upto each 8 hrs) for suspended particulate matter and gaseous pollutants	1500.00	2000.00
	(b) Sampling (24 hrs) for suspended particulate matter and gaseous pollutants	4500.00	6000.00
	(c) Sampling of Volatile Organic Compounds (VOCs)/ Benzene Toluene Xylene (BTX)	-	2000.00
	(d) Sampling of Poly Aromatic Hydrocarbons (PAHs)	-	2500.00

Note: (i) Transportation charges will be separate as per actual basis.
(ii) Sample analysis charges of respective parameters are separate as per list.

(II) Source Emission Monitoring/Sampling charges

S. No.	Type of Sampling	Charges in Rs.	Proposed Rate (Rs)
(a)	Sampling/measurement of Velocity, Flow rate, temperature and molecular weight of Flue Gas (each specific location/each sample in duplicate for the mentioned parameter)	4,000.00	5500.00
(b)	Sampling of SO_2/NO_2	-	2000.00
(c)	Sampling of PAHs	-	3000.00
(d)	Sampling of VOCs/BTX	-	3500.00

Note : (i) Transportation charges will be separate as per actual basis.
(ii) Sample analysis charges of respective parameters are separate as per list.

(III) Noise Monitoring

Type of Sampling	Charges in Rs.	Proposed Rate (Rs)
First Monitoring	Rs.3,000.00	4000.00
Each Subsequent Monitoring within same premises	Rs.1,500.00	2000.00
For 08 hours Continuous Monitoring or more	-	10,000.00

Note: (i) Transportation charges will be separate as per actual basis.

(IV) Sampling charges for water & wastewater samples

S. No.	Type of sampling	Charges in Rs.	Proposed Rate (Rs)
1.	**GRAB SAMPLING:**		
	1) Grab sampling/sample/place	400.00	550.00
	2) For every additional Grab sampling/same place	200.00	250.00
2.	**COMPOSITE SAMPLING:**		
	1) Composite sampling/source/place upto 8 hrs.	750.00	1000.00
	- do - upto 16 hrs.	1500.00	2000.00
	- do - upto 24 hrs.	2250.00	3000.00
	2) For every additional composite sampling/same place but different source upto 8 hrs.	400.00	550.00
	- do - upto 16 hrs.	800.00	1100.00
	- do - upto 24 hrs.	1200.00	1650.00
3.	Flow Rate measurement/source - once	300.00	400.00
	- do - - every additional	100.00	150.00

Note: (i) Transportation charges will be separate as per actual basis.
(ii) Sample analysis charges of respective parameters are separate as per list.

(V) Sampling charges for Soil samples

Type of Sampling	Charges in Rs.	Proposed Rate (Rs)
Grab sampling/sample/place	400.00	600.00
For additional Grab sampling/same place	200.00	300.00

Note : (i) Transportation charges will be separate as per actual basis.
(ii) Sample analysis charges of respective parameters are separate as per list.

(VI) Hazardous Waste Sample collection charges at the premises of Industry/Import site/Disposal site

Type	Charges in Rs.	Proposed Rate (Rs)
Integrated sample collection charges	800.00	1000.00

Note: (i) Transportation charges will be separate as per actual basis.
(ii) Sample analysis charges of respective parameters are separate as per list.

B. ANALYSIS CHARGES

1.0 Analysis charges of Ambient Air/ Fugitive Emission Samples

S. No.	Parameters	Analysis charges per sample in Rs.	Proposed Rate (Rs)
1.	Ammonia	450.00	600.00
2.	Analysis using dragger (per tube)	300.00	400.00
3.	Benzene Toluene Xylene (BTX)	-	1000.00
4.	Carbon Monoxide	450.00	600.00
5.	Chlorine	450.00	600.00
6.	Fluoride (gaseous)	450.00	600.00
7.	Fluoride (particulate)	450.00	600.00
8.	Hydrogen Chloride	450.00	600.00
9.	Hydrogen Sulphide	450.00	600.00
10.	Lead & Other metals (per metal)	250.00	As mentioned in respective group at Clause 5.0
11.	NO_2	450.00	600.00
12.	Ozone	-	1000.00
13.	Poly Aromatic Hydrocarbons (PAHs)	750.00	As mentioned in respective group at Clause 5.0
14.	Suspended Particulate Matter (SPM)	450.00	600.00
15.	Particulate Matter ($PM_{2.5}$)	-	1000.00
16.	Respirable Suspended Particulate Matter (PM_{10})	450.00	600.00
17.	Sulphur Dioxide	450.00	600.00
18.	Volatile Organics Carbon	-	2000.00
19.	Trace Metals on air filter paper using EDXRF Aluminium, Antimony, Arsenic, Barium, Bromine, Cadmium, Calcium, Cesium, Chlorine, Chromium, Cobalt, Copper, Gallium, Germanium, Gold, Iodine, Iron, Lanthanum, Lead, Magnesium, Manganese, Molybdenum, Nickel, Palladium, Phosphorous, Potassium, Rubidium, Rutherfordium, Selenium, Silicon, Silver, Sodium, Strontium, Sulphur, Tellurium, Tin, Titanium, Tungsten, Vanadium, Ytterbium, and Zinc.	-	3000.00 Per filter paper
20.	Water Extractable ions in Air Particulate Matter using Ion Chromatograph (IC) (i). Processing / Pretreatment Charge per Sample (Filter Paper) (ii). Cations (Na^+, NH_4^+, K^+, Ca^{++} & Mg^{++}) and Anions (F^-, Br^-, Cl^-, NO_3^-, NO_2^-, SO_4^{--} & PO_4^{---})	 - -	 300.00 1200.00 (for 12 ions)
21.	Organic and Elemental Carbon (OC/EC) on quartz filter paper	-	2000.00

2. Analysis Charges for Source Emission Parameters

S. No.	Parameters	Analysis Charges per test in Rs.	Proposed Rate (Rs)
1.	Acid Mist	450.00	600.00
2.	Ammonia	450.00	600.00
3.	Carbon Monoxide	450.00	600.00
4.	Chlorine	450.00	600.00
5.	Fluoride (Gaseous)	450.00	600.00
6.	Fluorides (Particulate)	450.00	600.00

S. No.	Parameters	Analysis Charges per test in Rs.	Proposed Rate (Rs)
7.	Hydrogen Chloride	450.00	600.00
8.	Hydrogen Sulphide	450.00	600.00
9.	Oxides of Nitrogen	450.00	600.00
10.	Oxygen	-	500.00
11.	Polycyclic Aromatic Hydrocarbons (Particulate)	750.00	As mentioned in respective group at Clause 5.0
12.	Suspended Particulate Matter	450.00	600.00
13.	Sulphur Dioxide	450.00	600.00
14.	Benzene Toluene Xylene (BTX)	-	1500.00
15.	Volatile Organic Compounds (VOCs)	-	3000.00

3. Ambient Air Quality Monitoring using on-line monitoring instruments by Mobile Van

Parameters	Charges in Rs.	Proposed Rate (Rs)
PM_{10}, $PM_{2.5}$, SO_2, NOx, SPM, CO along with Meteorological data viz. temperature, Humidity, Wind speed, Wind direction	Rs.2,500/hour (minimum charges Rs.10,000/-) + Rs.25.00/km run of the van	Rs.3,500/hour (minimum charges Rs.15,000/-) + Rs.50.00/km run of the van for 24 hours monitoring.

4. Auto Exhaust Monitoring - One time checking of vehicular exhaust

Parameters	Charges in Rs.	Proposed Rate (Rs)
Carbon Monoxide %	Rs.25.00	As per rate notified by Transport Department NCT Delhi
Hydrocarbon, PPM	Rs.25.00	
Smoke Density, HSU	Rs.50.00	

5. Analysis charges of Water & Wastewater samples

S. No.	Parameters	Analysis charges per test in Rs.	Proposed Rate (Rs)
	PHYSICAL PARAMETERS		
1.	Conductivity	40.00	60.00
2.	Odour	40.00	60.00
3.	Sludge Volume Index (S.V.I.)	150.00	200.00
4.	Solids (dissolved)	75.00	100.00
5.	Solids (fixed)	100.00	150.00
6.	Solids (volatile)	100.00	150.00
7.	Suspended Solids	75.00	100.00
8.	Temperature	40.00	60.00
9.	Total Solids	75.00	100.00
10.	Turbidity	40.00	60.00
11.	Velocity of Flow (Current Meter)	150.00	200.00
12.	Velocity of Flow (other)	400.00	550.00
	CHEMICAL PARAMETERS		
Inorganic			
1.	Acidity	75.00	100.00
2.	Alkalinity	75.00	100.00

S. No.	Parameters	Analysis charges per test in Rs.	Proposed Rate (Rs)
3.	Ammonical Nitrogen	150.00	200.00
4.	Bicarbonates	75.00	100.00
5.	Biochemical Oxygen Demand (BOD)	450.00	600.00
6.	Bromide	75.00	100.00
7.	Calcium (titrimetric)	75.00	100.00
8.	Carbon Dioxide	75.00	100.00
9.	Carbonate	75.00	100.00
10.	Chloride	75.00	100.00
11.	Chlorine Demand	150.00	200.00
12.	Chlorine Residual	75.00	100.00
13.	Chemical Oxygen Demand (COD)	250.00	350.00
14.	Cyanide	250.00	350.00
15.	Detergent	150.00	200.00
16.	Dissolved Oxygen	75.00	100.00
17.	Fluoride	150.00	200.00
18.	H. Acid	250.00	350.00
19.	Hardness (calcium)	75.00	100.00
20.	Hardness (total)	75.00	100.00
21.	Iodide	75.00	100.00
22.	Nitrate Nitrogen	150.00	200.00
23.	Nitrite Nitrogen	150.00	200.00
24.	Percent Sodium	450.00	600.00
25.	Permanganate Value	150.00	200.00
26.	pH	40.00	60.00
27.	Phosphate (ortho)	150.00	200.00
28.	Phosphate (total)	250.00	350.00
29.	Salinity	75.00	100.00
30.	Sodium Absorption Ratio (SAR)	450.00	600.00
31.	Settlable Solids	75.00	100.00
32.	Silica	150.00	200.00
33.	Sulphate	100.00	150.00
34.	Sulphide	150.00	200.00
35.	Total Kjeldahl Nitrogen (TKN)	250.00	350.00
36.	Urea Nitrogen	250.00	350.00
37.	Cations (Na^+, NH_4^+, K^+, Ca^{++} & Mg^{++}) and Anions (F^-, Br^-, Cl^-, NO_3^-, NO_2^-, SO_4^{--} & PO_4^{---}) in surface & ground water sample using Ion Chromatograph	-	1200.00 (for 12 ions)
Metals			
	Processing / pretreatment Charge per Sample	-	500.00
1.	Aluminium	250.00	300.00
2.	Antimony	250.00	300.00
3.	Arsenic	250.00	300.00
4.	Barium	250.00	300.00
5.	Beryllium	250.00	300.00
6.	Boron	250.00	300.00
7.	Cadmium	250.00	300.00
8.	Chromium Hexavalent	150.00	200.00
9.	Chromium Total	250.00	300.00
10.	Cobalt	250.00	300.00
11.	Copper	225.00	300.00
12.	Iron	250.00	300.00
13.	Lead	250.00	300.00
14.	Magnesium	150.00	200.00
15.	Manganese	250.00	300.00
16.	Mercury (Processing & Analysis)	250.00	800.00
17.	Molybdenum	250.00	300.00
18.	Nickel	250.00	300.00
19.	Potassium	150.00	200.00

S. No.	Parameters	Analysis charges per test in Rs.	Proposed Rate (Rs)
20.	Tin	250.00	300.00
21.	Selenium	250.00	300.00
22.	Silver	250.00	300.00
23.	Sodium	150.00	200.00
24.	Strontium	250.00	300.00
25.	Vanadium	250.00	300.00
26.	Zinc	250.00	300.00
Organics			
	Organo Chlorine Pesticides (OCPs)		
	Processing / pretreatment Charge per Sample	-	1000.00
1.	Aldrin	-	400.00
2.	Dicofol	-	400.00
3.	Dieldrin	-	400.00
4.	Endosulfan-I	-	400.00
5.	Endosulfan-II	-	400.00
6.	Endosulfansulfate	-	400.00
7.	Heptachlor	-	400.00
8.	Hexachlorobenzene (HCB)	-	400.00
9.	Methoxy Chlor	-	400.00
10.	o,p DDT	-	400.00
11.	*p,p'*-DDD	-	400.00
12.	*p,p'*-DDE	-	400.00
13.	*p,p'*-DDT	-	400.00
14.	α-HCH	-	400.00
15.	β-HCH	-	400.00
16.	γ-HCH	-	400.00
17.	δ-HCH	-	400.00
	Organo Phosphorous Pesticides (OPPs)		
	Processing / pretreatment Charge per Sample	-	1000.00
18.	Chlorpyriphos	-	400.00
19.	Dimethoate	-	400.00
20.	Ethion	-	400.00
21.	Malathion	-	400.00
22.	Monocrotophos	-	400.00
23.	Parathion-methyl	-	400.00
24.	Phorate	-	400.00
25.	Phosphamidon	-	400.00
26.	Profenophos	-	400.00
27.	Quinalphos	-	400.00
	Synthetic Pyrethroids (SPs)		
	Processing / pretreatment Charge per Sample	-	1000.00
28.	Deltamethrin	-	400.00
29.	Fenpropethrin	-	400.00
30.	Fenvalerate	-	400.00
31.	α-Cypermethrin	-	400.00
32.	β-Cyfluthrin	-	400.00
33.	λ-Cyhalothrin	-	400.00
	Herbicides		
	Processing / pretreatment Charge per Sample	-	1000.00
34.	Alachlor	-	400.00
35.	Butachlor	-	400.00
36.	Fluchloralin	-	400.00
37.	Pendimethalin	-	400.00
	Polycyclic Aromatic Hydrocarbons (PAHs)	750.00	
	Processing / pretreatment Charge per Sample	-	1000.00
38.	Acenaphthene	-	400.00
39.	Acenaphthylene	-	400.00
40.	Anthracene	-	400.00
41.	Benz(a)anthracene	-	400.00

S. No.	Parameters	Analysis charges per test in Rs.	Proposed Rate (Rs)
42.	Benzo(a)pyrene	-	400.00
43.	Benzo(b)fluoranthene	-	400.00
44.	Benzo(e)pyrene	-	400.00
45.	Benzo(g,h,i)perylene	-	400.00
46.	Benzo(k)fluoranthene	-	400.00
47.	Chrysene	-	400.00
48.	Dibenzo(a,h)anthracene	-	400.00
49.	Fluoranthene	-	400.00
50.	Fluorene	-	400.00
51.	Indeno(1,2,3-cd)pyrene	-	400.00
52.	Naphthalene	-	400.00
53.	Perylene	-	400.00
54.	Phenanthrene	-	400.00
55.	Pyrene	-	400.00
	Polychlorinated Biphenyls (PCBs)		
	Processing / pretreatment Charge per Sample	-	1000.00
56.	Aroclor 1232	-	400.00
57.	Aroclor 1242	-	400.00
58.	Aroclor 1248	-	400.00
59.	Aroclor 1254	-	400.00
60.	Aroclor 1260	-	400.00
61.	Aroclor 1262	-	400.00
	Tri Halo Methane (THM)		
	Processing / pretreatment Charge per Sample	-	800.00
62.	Bromo dichloromethane	-	400.00
63.	Bromoform	-	400.00
64.	Chloroform	-	400.00
65.	Dibromo chloromethane	-	400.00
	Other Organic Parameter		
66.	Adsorbable Organic Halogen (AOX)	1500.00	2000.00
67.	Tanin / Lignin	250.00	350.00
68.	Oil & Grease	150.00	200.00
69.	Phenol	150.00	200.00
70.	Total Organic Carbon (TOC)	300.00	500.00
71.	Volatile Organic Acids	250.00	350.00
	BIOLOGICAL TEST		
1.	Bacteriological Sample Collection	150.00	200.00
2.	Benthos Organism Identification & Count (each sample)	450.00	600.00
3.	Benthos Organism Sample collection	750.00	1000.00
4.	Chlorophyll Estimation	450.00	600.00
5.	E. Coli (MFT technique)	300.00	400.00
6.	E. Coli (MPN technique)	250.00	350.00
7.	Faecal Coliform (MFT technique)	300.00	400.00
8.	Faecal Coliform (MPN technique)	250.00	350.00
9.	Faecal Streptococci (MFT technique)	375.00	450.00
10.	Faecal Streptococci (MPN technique)	300.00	400.00
11.	Plankton Sample collection	150.00	250.00
12.	Plankton (Phytoplankton) count	450.00	600.00
13.	Plankton (Zooplankton) count	450.00	600.00
14.	Standard Plate Count	100.00	200.00
15.	Total Coliform (MFT technique)	300.00	400.00
16.	Total Coliform (MPN technique)	250.00	350.00
17.	Total Plate Count	250.00	350.00

S. No.	Parameters	Analysis charges per test in Rs.	Proposed Rate (Rs)
18.	Toxicological - Bio-assay (LC_{50})	2000.00	2800.00
19.	Toxicological - Dimensionless toxicity Test	1200.00	1600.00

Note : (i) *Sampling charges for water and waste water samples are separate as specified in clause A (IV), but subject to minimum of Rs.700/- irrespective of number of samples.*

(ii) *Transportation charges are separate on actual basis.*

6. Analysis charges of Soil/Sludge/Sediment/Solid waste samples

S. No.	Soil Parameters	Analysis charges per test in Rs.	Proposed Rate (Rs)
1.	Ammonia	200.00	300.00
2.	Bicarbonates	150.00	200.00
3.	Boron	300.00	400.00
4.	Calcium	100.00	150.00
5.	Calcium Carbonate	250.00	350.00
6.	Cation Exchange Capacity (CEC)	300.00	400.00
7.	Chloride	100.00	150.00
8.	Colour	40.00	100.00
9.	Electrical Conductivity (EC)	75.00	100.00
10.	Exchangeable Sodium Percentage (ESP)	400.00	550.00
11.	Gypsum Requirement	250.00	350.00
12.	H. Acid	300.00	400.00
13.	Heavy Metal	300.00	As mentioned in respective group at Clause 5.0
14.	Trace Metals using ED-XRF Aluminium, Antimony, Arsenic, Barium, Bromine, Cadmium, Calcium, Cesium, Chlorine, Chromium, Cobalt, Copper, Gallium, Germanium, Gold, Iodine, Iron, Lanthanum, Lead, Magnesium, Manganese, Molybdenum, Nickel, Palladium, Phosphorous, Potassium, Rubidium, Rutherfordium, Selenium, Silicon, Silver, Sodium, Strontium, Sulphur, Tellurium, Tin, Titanium, Tungsten, Vanadium, Ytterbium and Zinc, per sample.	-	4000.00
15.	Magnesium	200.00	300.00
16.	Mechanical soil analysis (soil texture)	100.00	150.00
17.	Nitrate	200.00	300.00
18.	Nitrite	200.00	300.00
19.	Nitrogen available	250.00	350.00
20.	Organic Carbon/Matter (chemical method)	250.00	350.00
21.	Polycyclic Aromatic Hydrocarbons (PAHs)	1000.00	As mentioned in respective group at Clause 5.0
22.	Polychlorinated Biphenyls (PCBs)	-	As mentioned in respective group at Clause 5.0
23.	Pesticides	400.00	As mentioned in respective group at Clause 5.0
24.	pH	75.00	100.00
25.	Phosphorous (available)	300.00	400.00
26.	Phosphate (ortho)	200.00	300.00
27.	Phosphate (total)	300.00	400.00
28.	Potash (Available)	150.00	200.00
29.	Potassium	200.00	300.00
30.	Sodium Absorption Ratio (SAR) in Soil extract	500.00	650.00
31.	Sodium	200.00	300.00
32.	Soil Moisture	75.00	100.00

S. No.	Soil Parameters	Analysis charges per test in Rs.	Proposed Rate (Rs)
33.	Sulphate	150.00	200.00
34.	Sulphur	250.00	350.00
35.	Total Kjehldhal Nitrogen (TKN)	300.00	400.00
36.	TOC	400.00	550.00
37.	Total water soluble salts	150.00	200.00
38.	Water Holding capacity	75.00	100.00

Note: (i) *Sampling charges for soil samples as specified in clause A(V).*
(ii) *Transportation charges are separate on actual basis.*

7. Analysis charges for Hazardous Waste samples

S. No.	Parameters	Analysis Charges per test in Rs.	Proposed Rates (Rs)
1.	Preparation of Leachate (TCLP extract/Water Extract)	750.00	1000.00
2.	Determination of various parameters in Leachate	As per water sample analysis charges	As mentioned in respective group at Clause 5.0
3.	Flash point/Ignitibility	400.00	550.00
4.	Reactivity	400.00	550.00
5.	Corrosivity	400.00	550.00
6.	Measurement of Toxicity		
	- LC_{50}	2000.00	2800.00
	- Dimensionless Toxicity	1200.00	1600.00
7.	Total Organic Carbon	300.00	500.00
8.	Absorbable Organic Halogen (AOX)	1500.00	2000.00

8. AQC Participation Fees:

To be charged by CPCB from respective SPCB's/PCC's or Recognized laboratory for Analytical Quality Control exercise (AQC) samples.

1.	Laboratories of Govt./Semi Govt./ Public Sector Undertaken/ Autonomous bodies.	7500.00	10000.00
2,	Private Sector Laboratories.	10000.00	15000.00

Addendum-B

SELECTED LIST OF SUPPLIERS OF REFERENCE MATERIALS (RMS) AND CERTIFIED REFERENCE MATERIAL

(a) SUPPLIERS OF REFERENCE MATERIAL (RM)

1. Aldrich-Chemie GmbH & Co. KG
   P.O. Box 1120
   D-7924 Steinheim
   West Germany

2. BDH Laboratory Supplies
   Poole BH 15 1TD
   U.K.

3. Chem Service Inc.*+
   680 Tower Lane
   P.O. Box 3108
   West Chester
   PA 19381-3108, USA

4. Chrompack
   P.O. Box. 8033
   4330 EA Middleburg
   Netherlands

5. E. Merck
   Frankfurter Str. 20
   Post Fach 4119
   D-6100 Darmstadt
   West Germany

6. Johnson Mathey Gmbh
   Postfach-6540, Zeppelinstrasse-7
   D-7500 Karlsruhe
   West Germany

7. MBH Analytical Ltd.*
   Holland House
   Queens Road, Barnet
   Hertz EN5 4DJ
   U.K.

8. National Oceanic and Atmospheric Administration (NOAA)*
   Oceanographic and Marine Assessment Office
   US Department of Commerce
   6001 Executive Bld., Room 323
   Rock Ville, MD 20852
   USA

9. Polyscience
   6600 West Touhy Ave
   Niles IL 60714
   USA

10. Promochem GmbH*+
    Postf. 1246 D 4230 Wesel
    West Germany

11. Riedel-de-Haen
    Aktiengesellscheft
    Wunstrofer Strasse 40
    D-3016, Seelze 1
    West Germany

* Stocks CRM's also
\+ Stockist for all type of organic and inorganic compound related to environment

(b) SUPPLIER OF CERTIFIED REFERENCE MATERIALS (CRMS)

1. Supelco Canada Ltd./Ltee
   46-220 Wycroft Road
   Oakville
   Ontario L6K 3v1
   Canada

2. ULTRA SEIENTIFIC
   25, Smith Street
   North Kingstown
   RI 02852 USA

3. Spex Industries Inc.
   3880 Pak Avenue
   Edison, NJ 08820
   USA

4. Fisher Scientific International
   Carretere No. 1
   Km 56.4, Barrio Montellano
   Cayey, Puerto Rico 00633
   P.Box 1760

5. National Institute of Standard & Tech. (NIST)
   Building 202, Room 204
   Gaithersburg, MD 20899
   USA

6. Laboratory Of The Government Chemist
   Office of Reference Materials
   Qeens Road, Teddington
   Middlesex TW 11 OLY
   U.K.

7. Bureau of Analysed Samples Ltd.
   Newharm Hall, Newby
   Middlesbrough
   Cleveland
   England TS8 9EA

8. NSI Environmental Solutions Inc.
   P.O. Box 12313
   2 Triangle Drive, Research Triangle Park
   NC 27709
   U.S.A.

For more details i.e. name and addresses of manufacturer, suppliers, pack size available, matrix etc. refer the Central Pollution Control Board's publication "International Directory of Supplier and Dealers of Standard Reference Materials for measurement of metals and organics (Laboratory Analytical Technique Series: LATS/8/1991-92).

ADDRESS OF SOME OF THE SUPPLIERS FOR STANDARDS

1. **AccuStandard, Inc.**
   125 Market Street
   New Haven, CT 06513
   USA

2. **The Laboratory of the Govt. Chemist (LGC)**
   Queens Road, TEDDINGTON
   Middlesex, TW 11 024, UK

3. **Chem Service, Inc**
   PO Box 599
   West Chester, PA 19381-0599
   USA

4. **Varian, Inc.**
   3120 Hansen Way
   Palo Alto, CA 94304-1030
   USA

5. **Dr. Ehrenstorfer GmbH**
   Bgm.-Schlosser-Str. 6A
   86199 Augsburg
   Fed. Rep. Of Germany

6. **Sigma-Aldrich**
   #16, B-6
   Local Shopping Centre
   Safdarjung Enclave
   New Delhi-110 029

7. **High-Purity Standards**
   PO Box 41727
   Charleston, SC 29423
   USA

8. **National Institute of Standards and Technology**
   Office of Standards Services
   100 Bureau Drive, MS 2100
   Gaithersburg, Maryland
   20899-2100, USA

9. **NSI Environmental Solutions, Inc.**
   Research Triangle Park
   NC 27709, USA

10. **PolyScience**
    6600 West Touhy Ave.
    Niles, IL 60714, USA

11. **Agilent Technologies India Pvt. Ltd.**
    Chandiwala Estate
    Maa Anand Mai Marg
    Kalkaji
    New Delhi-110 019

Note : While ordering for RMS/CRMS with certificate of analysis, following information may also be obtained:

1. Product name
2. CAS No.
3. Catalog No.
4. Lot No.
5. Solvent / Matrix
6. Manufacturing date
7. Product expiration date
8. Certified Value
9. Standard deviations
10. Uncertainty value
11. Purity (if applicable)

Addendum-C

GLOSSARY OF TERMS - LABORATORY QUALITY ASSURANCE (QA) AND QUALITY CONTROL (QC) SYSTEM

1.	**Accreditation**	Formal recognition of the competence of a body or an organization for a well-defined purpose. It is the procedure by which a laboratory is assessed to perform a specific range of test or measurements
2.	**Accuracy**	The closeness of agreement between the "true" value and the measured value. The smaller the systematic error of the analysis is, the more accurate is the analytical procedure. It is assessed by means of reference samples and percent recoveries
3.	**Audit Sample**	Prepared reference sample inserted into the sample processing procedure as close to the beginning as possible.
4.	**Background Sample**	A sample taken from a location on or proximate to the site of interest and used to document baseline or historical information
5.	**Bias**	Systematic error, consistent deviation of measured values from the true value.
6.	**Calibration**	In chemical measurement, Calibration refers to the process by which the response of a measurement system is related to the concentration or the amount analyte of interest
7.	**Calibration Laboratory**	Laboratory that performs calibration.
8.	**Calibration Method**	Defined technical procedure for performing a calibration.
9.	**Calibration Standards**	A series of known standard solutions used by the analyst for calibration of instrument (i.e. preparation of the analytical curve).
10.	**Certified Reference Material (CRM)**	A certified reference material is a material or substance whose property or properties can be defined so exactly that it may be used for the calibration of measuring instruments, the check of results obtained from measuring, testing and analytical processes, and for the characterization of substance properties.
11.	**Chain of Custody (COC)**	Documentation of the history of the sample. The components of chain of custody are sample seals; log book, record and sample analysis request sheet and the procedures used for estimation.
12.	**Confidence Interval**	Set of possible values within which the true value will lie with a specified level of probability.
13.	**Confidence Limit**	One of the boundary values defining the confidence interval
14.	**Contamination**	Something inadvertently added to the sample during the sampling or analytical process.
15.	**Control**	Type of sample against which the results of a procedure are judged.
16.	**Conventional true value**	Value attributed to a particular quantity and accepted, sometimes by convention, as having an uncertainty appropriate for a given purpose
17.	**Data Quality Objectives (DQOs)**	Statements on the level of uncertainty that a decision-maker is willing to accept in the results derived from environmental data.
18.	**Environmental sample**	An environmental sample or field sample is a representative sample of any material (aqueous, no aqueous or multimedia) collected from any source for which determination of composition of contamination is requested or required.

19.	**Error**	Difference between a measured value and the true value.
20.	**Good Laboratory Practice(GLP)**	Good laboratory Practice(GLP) is concerned with the organizational process and the conditions under which laboratory studies are planned, monitored, recorded and reported
21.	**Gross error**	Which makes it necessary to begin a new analysis (Ex. using a wrong reagent, taking a wrong pipette, measuring at a wrong wavelength. instrument breakdown, heavily contaminated glassware etc.). These errors should easily be recognized.
22.	**Instrumentation Detection Limit**	The concentration equivalent to a signal due to the analyte which is equal to three times the standard deviation of a series of 7 replicate measurements of a reagent blank's signal at the same wave length
23.	**Inter Laboratory Precision**	(Reproducibility) Variation associated with two or more laboratories or organizations using the same measurement method.
24.	**Inter Laboratory Test**	A series of measurements of one or more quantities performed independently by a number of laboratories on samples of a given material (other terms: Round robin test, Collaborative trial, Collaborative reference program, Collaborative analytical study, ring test).
25.	**Interferences**	Compounds whose presence obscures the measurement of the analyte of interest by the introduction of an unrelated analytical signal where the analyte is measured.
26.	**Internal Quality Control**	Internal quality control encompasses all measures, which are planned, ordered and executed by a laboratory itself.
27.	**Intra-laboratory Precision**	(Repeatability) Variation associated with a single laboratory or organization.
28.	**Limit of detection (LOD)**	The LOD of an individual analytical procedure is the lowest analytical amount of an analyte in a sample, which can be detected but not necessarily quantified as an exact value. For many purposes, the LOD is arbitrarily taken to be $3s_b$ or 3 x the standard deviation of the blank value or of background
29.	**Limit of determination**	The lower level where measurements become arbitrarily meaningful and is defined arbitrarily as LOQ-$10s_b$ (10 x the standard deviation of the blank value or of background) At this concentration, the relative confidence in the measured value is $\pm$ 30% at the 95% confidence level.
30.	**Limit of Quantitation (LOQ)**	The constituent concentration that produces a signal sufficiently greater than it can be detected within specified limits by good laboratories during routine operating conditions. Typically it is the concentration that produces a signal time 10s above the reagent water blank signal.
31.	**Matrix**	The matrix of a material is the totality of all parts of a material and their chemical and physical properties including mutual influences.
32.	**Matrix /Spike Duplicate Analysis**	In matrix/spike duplicate analysis, predetermined quantities of stock solutions of certain analytes are added to a sample matrix prior to sample extraction/digestion and analysis. Samples are split into duplicates, spiked and analyzed. Percent recoveries are calculated for each of the analytes detected. The relative percent difference between the samples is calculated and used to assess analytical precision. The concentration of the spike should be at the regulatory standard level or the estimated or actual method quantification limit. When the concentration of the analyte in the sample is greater than 0.1% no spike of the analyte is necessary.

33.	**Method Detection Limit (MDL)**	The minimum concentration of a substance that can be measured and reported with 99 % confidence that the analyte concentration is greater than zero. The MDL is determined from analysis of a sample in given matrix containing analyte which has processed through the pre-operative procedure
34.	**Method Quantification Limit (MQL)**	The Method Quantification Limit is the minimum concentration of a substance that can be measured and reported.
35.	**Optimum Concentration Range**	A range defined by limits expressed in concentration, below which scale must be used and above which curve correction should be considered. This range varies with the sensitivity of the instrument and the operating conditions employed.
36.	**Outlier data**	The data, which are suspected to be extremely low or high from the expected value or mean.
37.	**Precision**	The closeness of agreement between the results obtained by applying the experimental procedure several times under prescribed conditions. (The smaller the random part of the experimental errors, which affect the results, the more precise is the procedure). Within run and between day precisions have to be considered. (See repeatability and reproducibility)
38.	**Proficiency Testing**	Determination of the laboratory calibration or testing performance by means of inter-laboratory comparisons.
39.	**Protocol**	Thorough written description of the detailed steps and procedures involved in the collection of samples.
40.	**Quality Assessment**	Procedure for determining the quality of laboratory measurements by use of data from internal and external quality control measures.
41.	**Quality assurance**	All those planned and systematic actions necessary to provide adequate confidence that a product or a service will satisfy given requirements for quality
42.	**Quality Assurance Programme Plan (QAPP)**	An orderly assemblage of management policies, objectives, principles and general procedures by which an organization involved in environmental data generation activities outlines how to produce data of known quality.
43.	**Quality Assurance Project Plan (QAPP)**	An orderly assemblage of detailed procedures designed to produce data of sufficient quality to meet the DQOs for a specific data collection activity.
44.	**Quality Characteristic**	The characteristics and characteristic values (or expressions) of something (e.g. a method, a piece of equipment, a measurement result etc.) in relation to their suitability to fulfill set requirements.
45.	**Quality Control**	Set of measures within a sample analysis methodology to assure that the process is in control.
46.	**Quality Control Charts**	A Quality control chart is a sequential plot of some quality characteristic. It may be a day-by –day measurement of any interest of analyte (e.g. COD or BOD or Nitrate). The Chart consists of central line and two pairs of limit lines, the Upper and Lower Warning Limits (UWL, LWL)and Upper and Lower Control Limits (UCL., LCL) Example : Shewart's Quality Control Chart
47.	**Quality Manual**	A document stating the quality policy, quality system and quality practices of an organization.
48.	**Quality System**	The organizational structure, responsibilities, procedures, processes and resources for implementing quality management.

49.	**Random Errors**	Random errors are indicated by the scatter of the results of repeated measurements on the aliquot of same sample about the mean value. The sign and magnitude of the error of any particular result varies at random and cannot be known exactly. Random errors arise from uncontrolled variations in the conditions of the analytical system (factors like analyst, equipment, instrument, method, quality of glassware and chemicals, reagents etc.,) during different analysis.
50.	**Range**	Spread of values calculated by subtracting the lowest value from the highest value
51.	**Reagent Blank**	A reagent blank is an aliquot of analyte –free water or solvent analysed with the analytical batch.
52.	**Reference material**	A material or substance one or more of whose property value are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning value to materials
53.	**Reference Standard**	A standard, generally of the highest meteorological quality available at a given location, from which measurements made at that location, is derived.
54.	**Relative Standard Deviation (RSD)**	Estimate of the average error in the measurement due to unassignable causes and usually expressed as a percentage of the average sample concentration.
55.	**Repeatability**	The closeness of agreement between successive results obtained with the same method on identical test material under the same condition. (Same operator, same apparatus, same laboratory and short intervals of time) can also be interpretable as within – run precision.
56.	**Replicate Sample**	A replicate sample is a sample prepared by dividing a sample into two or more separate aliquots. Duplicate sample is considered to be two replicates.
57.	**Reproducibility**	The closeness of agreement between individual results obtained with the same method and on identical material but under different test conditions (different operator, different time's etc.) Can also be interpreted as "Between-run precision".
58.	**Sample Holding Time**	The storage time allowed between sample collection and sample analysis when the designated preservation and storage techniques are employed.
59.	**Sampling**	Attempt to choose and extract a representative portion of a physical system from it's surroundings.
60.	**Sensitivity**	Sensitivity describes the ability of an experimental method to differentiate between related values (e.g. concentrations). It indicates to which degree value changes depending upon the signal of the measuring system and can be quantified using the slope of the calibration curve.
61.	**Standard Curve**	A standard curve is a curve, which plots concentrations of known analyte standard versus the instrument response to the analyte.
62.	**Standard Deviation**	Square root of the variance (statistical analysis).
63.	**Standard Methods**	A standard method is an acknowledged analytical method according to an international or national standard or guidelines or to a given legal statue.
64.	**Standard Operating procedure (SOP)**	Standard Operating procedure (SOP) means written procedure, which describes how those routine laboratory operations, are to be performed.

65.	**Stratified Random Sampling**	Sampling technique in which estimates of strata means are combined to yield estimates of the population mean.
66.	**System Blank**	(Instrument Blank): Measure of the instrument background or baseline response in the absence of a sample.
67.	**Systematic Error**	Systematic errors are indicated by a unidirectional tendency of results, which could be greater or smaller than the true value. When systematic error is present, the result are said to be biased (bias = systematic error) Systematic errors in analytical results may occur when: method used is not specific for the analyte; due to presence of some interfering substances; improper performing of the analysis, instability of samples between sample collection and analysis.
68.	**Test**	A technical operation that consists of the determination of one or more characteristics or performance of a given product, material equipment organism, physical phenomenon, process or service according to a specified procedure.
69.	**Test Method**	Defined technical procedure for performing a test
70.	**Traceability**	The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons.
71.	**True value**	Real amount or concentration of an analyte in a certain sample. It is an ideal value, which could be arrived at only if all causes of measurement error were eliminated. The amount or concentration given for an analyte in a certified reference material is a good substitute for the true value.
72.	**Trueness**	The closeness of agreement between the average value obtained from a large series of test results and an accepted reference value
73.	**Uncertainty of measurement**	Parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand
74.	**Validation**	Validation is the total testing procedure if an analytical method is free of random and systematic error, not only within calibration but also and especially frees of interference when analyzing real samples.
75.	**Variance**	Measure of the variability in a population / set of analytical data. It is the square root of the standard deviation

IMPORTANT ABBREVIATIONS USED IN LABORATORY ACCREDITATION PROGRAMME

S.NO	ABBREVIATION	EXPANSION
1.	**AOAC**	Association of Official Analytical Chemists
2.	**APLAC**	Asian Pacific Laboratory Accreditation Co-Operation
3.	**APMP**	Asia Pacific Metrology Program
4.	**AQC**	Analytical Quality Control
5.	**BIPM**	International Bureau of Weights and Measures
6.	**CEN**	European Committee for Standardization
7.	**CITAC**	Co-Operation on International Traceability in Analytical Chemistry
8.	**COC**	Chain Of Custody (Sample)
9.	**CRM**	Certified Reference Material
10.	**DAR**	German Accreditation Council
11.	**DAP**	German Accreditation Body
12.	**EAL**	European Accreditation of Laboratories
13.	**ECD**	Organization for Economic Co-Operation & Development
14.	**EFTA**	European Free Trade Association
15.	**EN**	European Norms
16.	**GLP**	Good Laboratory Practice
17.	**IEC**	International Electro-technical Commission
18.	**ILAC**	International Laboratory Accreditation Conference
19.	**IRMM**	Institute for Reference Materials and Measurements
20.	**ISO**	International Standard Organization
21.	**JAB**	Japan Accreditation Board
22.	**LIMS**	Laboratory Information Management System
23.	**LRM**	Laboratory Reference Material
24.	**MRA**	Multilateral Mutual Recognition Arrangement
25.	**NABL**	National Accreditation Board for Testing and Calibration of Laboratories
26.	**NC**	Non-Conformity (in Quality System)
27.	**NIST**	National Institute of Standards and Technology
28.	**PAC**	Pacific Accreditation Co-Operation
29.	**PT**	Proficiency Testing
30.	**QA**	Quality Assurance
31.	**QC**	Quality Control
32.	**QCI**	Quality Council of India
33.	**QM**	Quality Manager
34.	**QS**	Quality System
35.	**RM**	Reference Material
36.	**SOP**	Standard Operating Procedure
37.	**TM**	Technical Manager
38.	**TQM**	Total Quality Management
39.	**US EPA**	United States Environmental Protection Agency
40.	**WTO**	World Trade Organization
41.	**ACIL**	American Council of Independence Laboratory
42.	**NELAC**	National Environmental Laboratory Accreditation Conference