TECHNICAL SPECIFICATIONS FOR CONTINUOUS AMBIENT AIR QUALITY MONITORING (CAAQM) STATION (REAL TIME)



 

 **Punjab Pollution Control Board**

**Vatavaran Bhawan, Nabha Road, Patiala**.

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**MINIMUM REQUIREMENTS FOR A CAAQM STATION**

The equipment’s are intended for one Continuous Ambient Air Quality Monitoring (CAAQM) Station. The system should be completely functional. Any balance of material not specified but required for the purpose must be supplied by the vendors.

|  |  |  |
| --- | --- | --- |
| **Sl.****No.** | **Item / Analyzer Name** | **Total Quantity** |
| 1. | Monitoring Station foundations. | Actual |
| 2. | Air Conditioner, Split Type, Wall mounted/roof mounted along with voltage stabilizer (2 X 2 ton, 1 X 1 Ton). at the CAAQM Station | Three |
| 3. | On line UPS (1X10KVA, 1 hr. back up and 1X5 KVA, 2 hr. back up) at the CAAQM Station | Two |
| 4. | Sampling System having 10 port manifold | One |
| 5. | 19” Rack cabinet to accommodate all analyzers & systems | Three |
| 6. | Continuous Ambient Oxides of Nitrogen (NO/NO2 / NOx) Analyzer | One |
| 7. | Continuous Ambient Ammonia (NH3) Analyzer | One |
| 8. | Continuous Ambient Sulphur Dioxide (SO2) Analyzer | One |
| 9. | Continuous Ambient Ozone (O3) Analyzer | One |
| 10. | Continuous Ambient Carbon Monoxide (CO) Analyzer | One |
| 11. | Continuous BTEX Monitor / Analyzer | One |
| 12. | Multi calibration System for Gas calibration and Meteorological, Flow and Electronic Calibration | One set |
| 13. | Automatic PM2.5 Particulate Matter Monitor | One |
| 14. | Automatic PM10 Particulate Matter Monitor | One |
| 15. | Meteorological Sensors for Wind Direction, Wind Speed, Ambient Temperature, Rainfall, Relative Humidity, Solar Radiation and Telescoping Crank – up Meteorological Tower | One set |
| 16. | **ITPERIPHERLS:** |  |
|  | (a) Data Acquisition System (DAS): One for each CAAQM Station | One |
|  | (b) Computer System for DAS: One for each CAAQM Station | One |
|  | (d) Laser Printer Color MFP : One for each CAAQM Station | One |
|  | (e) Server Rack: One for PPCB | One |
|  | (f) Rack Server: One for PPCB | One |
|  | (g) Access Point: One for PPCB | One |
|  | (h) UTM: One for each PPCB | One |
|  | (i) 24Ports CISCO Switch: One for PPCB | One |
|  | (j) Central Management Software with License w.r.t. Data Acquisition: One for PPCB | One |
|  | (k) Remote Calibration & Validation Software: One for PPCB | One |
|  | (l) Remote Connectivity Tool/Software: One for each PPCB | One |
| 17. | Data display Board Transmission Device (two no’s)(One for Data Display Board near to the station and another for data display at the SPCB display board\* or any other site identified by the Board) | Two |
| 18. | Day & Night Visible Data Display Board (Near to the station) | One |
| 19. | Day & Night Visible Data Display Board at PPCB-H.O.\* or any other site identified by the Board | One |

|  |  |  |
| --- | --- | --- |
| **Sl.****No.** | **Item / Analyzer Name** | **Total Quantity** |
| 20. | Continuous Automatic Monitoring Stations with Sampling line, Internal fitting, Instruments racks, Electrical fittings and Gas line fittings, Tools (electrical and mechanical), Data display system, Recommended spares in a Housing Container | One set  |
| 21. | Lease Line for Internet AND Broadband (for Station) AND Data Card as mode Communication system (for display Board) | One set |
| 22. | RCC foundation, pillars misc. works including Caging, civil & electrical work (for CAAQM stations as well as Data Display Boards) | Actual |

# TECHNICAL SPECIFICATIONS

## CAAQM STATION – HOUSING/CONTAINER

* 1. **Housing/Container**: It is designed for housing the ambient air quality monitoring instruments to protect them from dust and heat. Temperature and Humidity sensors shall be installed in the housing for checking the humidity and temperature inside the station. Three Nos. 19” racks shall be installed inside the station so that the analyzers are easily accessible from front & back for calibration and maintenance.
		1. **Dimensions**: Inside length: 4200mm

Inside width: 3500 mm Inside height: 2500 mm (As per the Drawing given)

* + 1. **Frame**: All the material used for the construction of the floor, frame, roof frame etc., the 4 corner posts and 8 integrated, reinforced container corners should be of metal. The exterior panel of the container shall be made of pre-coated MS Sheet of approved colour shade. All other steel parts should be hot dipped galvanized having minimum rate of galvanization of 275 gram per square meter**(IS277)**. All joints of like metal such as steel-to-steel or aluminum-to-aluminum shall be protected against corrosion by liberal application of joining compound. All joints of dissimilar metals such as steel to aluminum shall be protected against corrosion due to galvanic action by liberal application of dielectric compound as well as jointing compound on both mating surfaces. For lifting / fixing the container, International Standard eyebolts should be provided at the corners.
		2. **Paneling**: The outer paneling will be of 1.2 mm of Pre-coated MS sheet to withstand external impacts and abrasions. Outer side of the MS Sheet i.e. exposed face of the sheet, shall be permanently colour coated with silicon modified polyester coating of dry film thickness (DFT) 20 micron (min.) of approved colour shade over primer. Inner face of the sheet shall be provided with suitable pre- coating of minimum 7 micron off-white colour. The inner paneling will be of PVC coated 2 mm thick aluminum sheet, fixed over an inlay of 4 mm marine plywood. 100 mm thick polyurethane insulation will be used between the outer and inner walls (Pre-coated MS sheet and Marine plywood) as insulating material. Z spacers if required shall be made out of at least 2 mm thick galvanized steel sheet of grade 275 as per IS:277
		3. **Floor**: The floor will be laid in frame of 600 x 600 mm center to center with 50 x50 x 6 mm MS angle. The floor surface will be of 19 mm marine plywood covered with robust quality Vinyl flooring, 2 mm thick of approved colour. The floor should be of acid and alkaline resistant, waterproof, easily cleanable / washable. Bottom plate of thickness 2 mm hot dipped galvanized MS Plate shall be provided.
		4. **Outer Door**: One door of size 2000 x 900 mm will be provided at the front side (L = 4200 mm) of the station with isolated 3 – point locking & door handle flush fitted.
		5. **Electric Power Supply Box**: Three - phase (3 Ø) electrical wiring will be laid in ducts. Copper wiring of appropriate gauge will be used. The terminal board should be mounted in a central power distribution box. Over voltage protection for each phase shall be provided along with the lightning arrestor. 2 numbers Emergency cut off switch & Thermostat switch (max 350C) for power disconnection, 6 free sockets and 3 fluorescent lamps for lighting will be provided.

The station shall be properly grounded with chemical earthing or as per BIS Standards with proper plate and only copper strip at least on 2 corners (diametrically opposite). One three phase energy meter (Digital Type) shall be installed. Weatherproof cubicles / enclosure for housing of MCB / TP & N Switch of main power termination (outside shelter) and weatherproof telephone junction box for terminations of telephone line are to be provided. Proper earthing for telescopic mast of meteorological system shall be provided. There should be conduction between the telescopic mast of the meteorological system and the station. The guy ropes or wires shall be provided for supporting the mast.

### List of Consumables:

|  |  |  |
| --- | --- | --- |
| All Fuses | : | 02 set |
| Lightning arrestor | : | 02 set |
| Emergency Switch | : | 02 pcs |
| Thermostat | : | 01 pc |

* + 1. **Partitioning for Calibration Gas Cylinders, Meteorological Mast and UPS:**

The housing will be partitioned as per drawing to create space for storing of gas cylinders, Meteorological mast & UPS. The size will be 2000 x 1400 x 2300 mm. A lockable door of size 900 x 2000 mm along-with 3 – Point locking system shall be provided on the outer wall of the housing. A 300 mm, single-phase (230 volts 

10 volts AC and 50 Hz 3%) exhaust fan with safety grills will be provided. Mounting brackets in 2 levels for fixing of at-least 06 (six) gas cylinders should be provided. The internal lights of the housing should be sensor based.

Air conditioners shall be mounted on proper rust proof supporting structures with rubber blocks to avoid vibration of structures. Proper caging / grill should also be provided for the safety of ACs. Sun shades for external AC units shall be provided with fabricated pre-coated MS sheet (same as monitoring station) with supporting arrangements. AC unit’s external piping shall be placed in GI trays. Cable trays fixed on exterior wall shall be covered with pre-coated MS sheet, of same colour shade of monitoring station. Roof top sheet to be leveled and sloped properly. Rain water spout shall be fixed at top with rain water down pipe at two corners. The external lights of the station should be Solar operated.

### Station Furnishing:

* + - 1. 19” racks – 04Nos.
			2. Fire extinguishers – 02 Nos. (Clean Agent – 2 KG each)
			3. Furniture:
				1. Material - Furniture made of water resistant laminated board
				2. Cupboard – As per drawing
				3. Working table – Powdered coated MS frame size 1400 x 900 x 750 mm (w x d x h) and top19mm thickness Board
				4. Revolving tilting chair – 02Nos.
			4. Miscellaneous
				1. The exhaust gases from the analyser should be collected and discharged by a common exhaust pipe and vented.
				2. Folding aluminum ladder for roof access (Maximum open Length.4.00metres with 1 feet wide steps)
				3. Sensor for measuring the inside temperature of the station and Display
				4. Hygrometer for measurement of Humidity inside the station and Display
				5. Mounting bracket for the ladder
				6. No smoking stickers
				7. Vacuum cleaner with minimum 100 watt power
				8. Tool Kit having following tools:

One screw driver set

One Digital multi-meter (Philips, Micro or equivalent make)

One box spanner set

One D spanner set

One watch maker set

One Hammer set

One precision screw driver set

One pliersset

One Tong tester

One Soldering Iron withstand

* + - * 1. One Emergency LED Cluster light
				2. Sign boards along-with logo of Punjab Pollution Control Board, to be embedded with size 1500 x 900 mm on the front of the container and on the two side of the container, The name of the Station i.e. Continuous Ambient Air Quality Monitoring Station, (Location) both in English, Hindi and Punjabi to be inscribed. The Signs boards to be mounted on the station with proper spacers.

### Container Foundation (RCC)

#### L X W 6000 x 6000 mm

**Height 300 mm from ground**

**Pillars**: Nine concrete pillars of 300 mm above the ground level and below the ground level with 200 x 200 mm beam and between pillar bricks to be used for filling the space**(concrete ratio of 1:2:4)**. Outer wall of the foundation to be plastered with 1:4, Cement: Sand ratio and same has to be painted with weather proof coat.

**Top of the platform**: RCC 150 mm with concrete ratio of 1:1:2 and to plaster and painted with weather proof paint.

**Staircase**: RCC Steps to approach the main door of the container and the UPS / Gas room door in the side to be provided and each step should not be more than 150mm

### SPLIT AIR CONDITIONER

* 1. **SPLIT AIR CONDITIONER (2.0 TON CAPACITY)**
		1. Type& Capacity: 2 Nos. split type, 2 ton cooling capacity Inverter AC, roof mounted / Wall Mounted of 5 star rating with an automatic timer. Separate Automatic Voltage stabilizer will be provided with each unit.
		2. The indoor units should be running alternately at an interval of four hours with timer control and the temperature inside the station should be maintained at 250C inside during all the time including peak summer months.
			1. Cooling Capacity:7000W
			2. Star Rating: BEE 5 star Inverter with Copper Coil
			3. Indoor Noise Level: 40-50 dB A(cooling)
			4. Control Type: Remote
			5. Compressor: Inverter
			6. Refrigerant: Ecofriendly
			7. Feature: filter clean Indicator, defrosting Sensor
			8. Power supply: 230 volts 10volts AC and 50 Hz 3%
			9. Standard Warranty
			10. Remote: LCD Wireless.

### SPLIT AIR CONDITIONER (1.0 TON CAPACITY)

* + 1. Type & Capacity: 1 Nos. split type, 1 ton cooling capacity Inverter AC, roof Mounted/ Wall Mounted of 5 star rating with an automatic timer. Separate Automatic Voltage. stabilizer will be provided with each unit.
		2. The indoor units should be running alternately at an interval of four hours or as required with timer control and the temperature inside the station should be maintained at less than 250C during peak summer months.
1. Cooling Capacity:3400W
2. Star Rating: BEE 5 star Inverter with Cooper Coil
3. Indoor Noise Level 40-50dbA
4. Control Type: Remote
5. Compressor: Inverter
6. Refrigerant: Ecofriendly
7. Feature: filter clean Indicator, Pre-coated Aluminum finest.
8. Power supply: 230 volts 10volts AC and 50 Hz 3%.
9. Standard Warranty
10. Remote: LCD Wireless.

### ONLINE UNINTERRUPTED POWER SUPPLY (UPS)

* 1. **ONLINE UPS 10 kVA, CAPACITY (Three Phase I/P &Single Phase O/P, with 01 hours backup) (for Air Conditioner)**

Three phase 10 kVA UPS along with Automatic Delayed Restoration Device (ADRD) with 1 hour backup in full capacity should be provided for the smooth operation of one 2 Ton capacity split AC at the station. Automatic Phase Sequencer Device has to be installed along with the UPS.

|  |  |  |  |
| --- | --- | --- | --- |
| a) | Capacity | : | 10.0 kVA |
| b) | Technology | : | PWM using IGBT / MOSFETS |
| c) | Crest Factor | : | More than 3: 1 |
| d) | Input | Voltage | : | 415 V AC |
| Voltage Range | : | ± 25% |
| Frequency | : | 50 Hz ± 3% |
| e) | Output | Voltage | : | 230 V AC |
| Voltage regulation | : | ± 1% |
| Frequency | : | 50 Hz |
| Frequency regulation | : | ± 0.01% |
| Waveform | : | Pure sine wave |
| f) | Battery | Battery type | : | Sealed maintenance free |
| Back up time | : | 1 Hour at full load |
| Battery Capacity | : | For required backup time |
| Recharge time | : | 5 hrs. to 90% after complete discharge |
| g) | Distortion | : | Less than 1% on linear load |
| h) | Power factor | : | 0.9 to 1 |
| i) | Indicator | : | L.E.D. – Battery Charge, Load level, on Line, over load, on battery, replace battery |
| j) | Alarm | : | Audible alarm for battery backup, battery low, and fault |
| k) | Protections | Surge | : | Surge suppression meets BIS or International standard |
| Overload | : | Fuse & current limited |
| Short circuit | : | Fuse & current limited & cut – off |
| Battery low cut – off | : | No battery drain after cut - off |
| l) | Overload Capacity | : | 110% for continuous load |
| m) | Efficiency | : | More than 90% |
| n) | Environment | Operating Temp. | : | 0 – 500 C |
| Operating Hum. | : | 10% to 95% (Non condensing) |
| Audible Noise | : | Less than 45 dB (at 1 meter) |

### ONLINE UPS 5 KVA, CAPACITY (Single Phase I/P & Single phase O/P, with 02 hours backup) (01 for Analysers & 01 for Server at Central Station):-

Single phase 5 kVA UPS along with Automatic Delayed Restoration Device (ADRD) with 2 hours backup in full capacity should be provided for the smooth operation of Analyzers and peripherals at the station:

|  |  |  |  |
| --- | --- | --- | --- |
| 3.2.1 | Capacity | : | 5.0 kVA |
| 3.2.2 | Technology | : | PWM using IGBT / MOSFETS |
| 3.2.3 | Crest Factor | : | More than 3: 1 |
| 3.2.4 | Input | Voltage | : | 230 V AC |
| Voltage Range | : | ± 25% |
| Frequency | : | 50 Hz ± 3% |
| 3.2.5 | Output | Voltage | : | 230 V AC |
| Voltage regulation | : | ± 1% |
| Frequency | : | 50 Hz |
| Frequency regulation | : | ± 0.01% |
| Waveform | : | Pure sine wave |
| 3.2.6 | Battery | Battery type | : | Sealed maintenance free |
| Back up time | : | 2 Hours at full load |
| Battery Capacity | : | For required backup time |
| Recharge time | : | 5 hrs. to 90% after complete discharge |
| 3.2.7 | Distortion | : | Less than 1% on linear load |
| 3.2.8 | Power factor | : | 0.9 to 1 |
| 3.2.9 | Indicator | : | L.E.D. – Battery Charge, Load level, on Line, over load, on battery, replace battery |
| 3.2.10 | Alarm | : | Audible alarm for battery backup, battery low and fault  |
| 3.2.11 | Protections | Surge | : | Surge suppression meets BIS orInternational standard |
| Overload | : | Fuse & current limited |
| Short circuit | : | Fuse & current limited &cut –off |
| Battery low cut – off | : | No battery drain after cut - off |
| 3.2.12 | Overload Capacity | : | 110% for continuous load |
| 3.2.13 | Efficiency | : | More than 90% |
| 3.2.14 | Environment | Operating Temp. | : | 0 – 500 C |
| Operating Humidity | : | 10% to 95% (Non condensing) |
| Audible Noise | : | Less than 45 dB (at 1 meter) |

## CONTINUOUSAMBIENT AIR QUALITY MONITORING ANALYSERS for SO2, NO-NO2-NOx, NH3, CO, O3 and BTEX

#### (General Specifications for all Analysers)

* + 1. The analyzers should be 19” rack mounting model with facilities for fixing the analyzers from front side.
		2. The front panel preferably has ON / OFF Switch.
		3. The display of the entire important status signal viz. Sample flow, temperature, concentration, range selection, manual / auto mode, zero / span mode and all error messages should be on front panel.
		4. The analyzers should operate at operating voltage 230 volts 10 volts AC and 50Hz

3% frequency. The power supply input to be protected against spikes from and to the analyzer by an LC filter. The power connection cable should be CEE type complete with 15 Amperes plug adaptable to Indian mains socket.

* + 1. The analyzers must function properly in Indian conditions without any defect between 0 – 40o C ambient temperature, 10 – 95% relative humidity and in high ambient dust levels. The data capture rate should not be less than 90% of operational time.
		2. The Manufacturer shall provide comprehensive hands-on training for operational & preventive maintenance for one week in the respective State for three persons per station.
		3. The analyzers should complete with calibration system. The calibration system should be delivered along-with respective span gas cylinder and permeation tubes. The span gas concentration should be within 60 – 90% of first measuring range. **The analyzer must have zero-point internal calibration system and in agreement with minimum detection limit of each analyzer**. The calibration procedures are to be integrated into the software system for automatic calibration & remote calibration.

#### CALIBRATION GAS CYLINDER

* + 1. **The supplier has to supply the calibration gas cylinder (highly polished aluminum 10 liters water capacity), along with SS Regulator, traceable to NIST for each components (SO2, NO, CO, NH3, Benzene & Toluene) along with SS regulator for the multipoint calibration**. The synthetic air and N2 cylinder (99.99% purity with certificate) should be in Carbon Steel cylinder of 47 Liters water capacity along with SS Regulator.
		2. The analyzers shall be supplied with all ancillaries necessary for operation with pump (preferably in- built) and any other items such as charcoal scrubber, Teflon air sample intake filter, drier, Teflon tubing suitable for connection to air sampling manifold. All such items are to be itemized. Dust filter in all the analyzers should be provided before solenoid valve to protect frequent chocking of solenoid valve.
		3. The connector systems for out-going signal for recording and the computer terminal should be on back panel with screw type connecting pins.
		4. All ambient gas analyzers shall be approved by the USEPA / TUV. However, in case of BTEX Analyzer, it shall be approved by USEPA/TUV/MCERT. For Ammonia Analyzer specifications as given will be considered. **Method of measurement used shall also comply with the stipulation on National Ambient Air Quality Standards (NAAQS) 2009** (Details of Methods of Measurement is available at MoEF and CPCB websites). All analyzers shall be micro – processor controlled with automatic calibration using an external dilution calibrator and calibration standards. All analyzers should be fully integrated in the rack cabinet, fully calibrated & tested before supply and ready for start – up at the respective sites. Analyzer must exhibit performance equal to or better than values specified in the Calibration & test certificate provided with each analyzer.
		5. The manufacturer shall specify the cross sensitivity of measurement for all the analyzers.
		6. Each set of analyzers shall be supplied with two copies of elaborate operation manuals comprising details as below:

Part (I) should comprise installation, operational and troubleshooting details;

 Part (II) should have details about preventive, routine and corrective maintenance;

Part(III)should comprise details of all electrical, electronic and pneumatic circuit diagrams, details of each spare parts, catalogue No. etc. and details of each electronic card / PCB’s; and

Part (IV) Schematic diagram for possible repair & maintenance. Part (V) Standard Operating Procedure (SOP) for each analyzer.

Part (VI) List of equipment’s and other accessories along with contact details of supplier.

* + 1. Digital Output:

a) Multi drop RS 232 port shared between gas Analyzers, Dust Analyzer (PM2.5& PM10), Meteorological Sensors and computer for data, status and control. Communication should have a USB port, TCP/IP Ethernet connection

* + 1. Quality Control and Standard

Data shall be collected and validated according to US EPA standards, using the methodologies included in 40 Code of Federal Regulations. All analyzers shall have current US EPA reference or equivalent method designation and shall be of the latest design.

The supplier shall submit a Standard Operating Procedure for the air quality monitoring stations to the Buyer at the time of bid submission. This Standard Operating Procedure shall be approved by the Buyer prior to award. The Standard Operating Procedure shall contain the following:

1. Operating procedures for all analyzers and meteorological sensors
2. Calibration procedures
3. Calibration schedule
4. Maintenance procedures
5. Maintenance schedule
6. Data validation procedures
7. Quality Assurance procedures
8. Sample quality assurance documentation
9. Sample Air Quality Report

The calibration procedures for analyzers shall conform to US EPA methodologies and shall include daily calibration checks, weekly precision checks and linearity checks every six weeks. All analyzers shall undergo full multipoint calibration once in every three months or re-calibration of all the equipment as per manufacturer’s instructions whichever is earlier or after any major repair or replacement of lamp as per requirements. Data obtained from these calibration checks and copies of associated Quality Assurance and calibration documentation, shall be submitted to the Buyer along with the Air Quality Data.

Air Quality Data shall be submitted to the Buyer on Real Time basis through automated system and on a monthly basis in the form of an Air Quality Report. This report shall include tabular and graphic information on gas and dust concentrations as well as meteorological data for each site. The data shall be reported in the form of 15 minute averages and shall also include daily, weekly and monthly averages, minimum, maximum, standard deviations, total data captured and percent data capture. It should also have stat validation

mechanism and delayed data check mechanism. The Air Quality Report shall also include wind roses where wind speed and direction are measured.

* 1. **SAMPLING SYSTEM**

A suitable sampling system as specified by USEPA having 10 ports manifold and fitted with a suction pump to draw ambient air. System duly equipped with moisture removal systems should be provided for sampling of ambient air separately for gaseous and dust measurement.

#### Gases sampling system:

* + 1. Height of the sampling system: Approx. 1.0 meter above thereof
		2. Roof entry cutout: Stainless-steel
		3. Conduit: Stainless-steel
		4. Inner sampling system: Borosilicate glass
		5. Sampling head: Stainless-steel
		6. Manifold: 10 port for tubes 6 x 1 mm, self-tightening.
		7. Sample air flow sensor Uni-directional sample air flow measuring

device should be installed at the sampling system to measure the flow of ambient air through sampling system. The output of signal should be connected to computer to ascertain the continuous flow of sample from ambient air. The suction pump operational status should also be connected to the computer as a separate channel.

### 19” RACK

Suitable 19” Rack cabinet to accommodate all analyzers, calibrators, Zero air generators, data logger etc. The dimension of the rack without doors, with aluminum section and rear of 2 mm steel sheet, one removable roof plate, fitted with 4 filling eyebolts. Four roof fixing screws included in package to replace the lifting eyebolts. One gland plate three part, one pair of 475 mm (19”) mounting angles depth adjustable in 25 mm pitch pattern fitted on two fixing angles approximately 150 mm unit from the front standard. To accommodate panel width of 19” size: width = 600 mm, Height = 1400 mm and Depth = 800 mm. The 19” racks should be screwed to the floor of the station with anti-vibration pads. All nuts and bolts shall be cadmium coated.

## AMBIENT AIR QUALITY MONITORING ANALYSERS(GAS)

### AMBIENT SULPHUR DIOXIDE (SO2) ANALYSER

|  |  |  |  |
| --- | --- | --- | --- |
| 01. | Principle | : | UV Fluorescence |
| 02. | Measurement | : | SO2 in Ambient Air |
| 03. | Display | : | Digital |
| 04. | Ranges | : | Auto ranging 0 - 200 ppb |
| 05. | Lower Detectable Limit | : | 1 ppb |
| 06. | Noise Level | : | 0.5 ppb |
| 07. | Zero Drift | : | < 1 ppb/24 Hrs. with automatic zero compensation |
| 08. | Span Drift | : | <1 ppb in 24 hrs. |
| 09. | Linearity | : | ± 1% of full scale |
| 11. | Response Time | : | 120 sec or less |
| 12. | Calibration | : | Please see Multi-calibration section (Sl.No.7) and also calibration section inGeneral Specifications(4.1.7 to 4.1.9) |
| 13. | Analog Output | : | 0 – 1 V, 0 – 10 V, 2 – 20 mA / 4 – 20 mA |
| 14. | Digital Output | : | Multiple drop RS 232, USB port /TCP/IP,Ethernet |
|  |  |  |  |

* 1. **AMBIENT OXIDES OF NITROGEN (NO-NO2-NOx) ANALYSER**

|  |  |  |  |
| --- | --- | --- | --- |
| 01. | Principle | : | Chemiluminiscence |
| 02. | Measurement | : | NO-NO2- NOx in Ambient Air |
| 03. | Display | : | Digital |
| 04. | Ranges | : | Auto ranging 0-2000 ppb |
| 05. | Lower Detectable Limit | : | 1 ppb |
| 06. | Noise Level | : | 0.5 ppb |
| 07. | Zero Drift | : | < 1 ppb/24 Hrs. |
| 08. | Span Drift | : | < 2% in 15 days of full scale |
| 09. | Linearity | : | 1% of full scale |
| 10. | Response Time | : | 120 sec or less |
| 11. | Calibration | : | Please see Multi-calibration section (Sl. No. 7) and also calibration section in General Specifications (4.1.7 to 4.1.9). |
| 12. | Analog Output | : | 0 – 1 V, 0 – 10 V, 2 – 20 mA / 4 – 20 mA |
| 13. | Digital Output | : | Multi drop RS 232 port, USB port /TCP/IP,Ethernet |

* 1. **AMBIENT AMMONIA ANALYSER(NH3)**

|  |  |  |
| --- | --- | --- |
| 01. | Principle | Chemiluminiscence (NH3 conversion to NO by oxidation. NO2 also converted to NO. The difference obtained by measuring NO in outputof two sample stream as equal to NH3) |
| 02. | Measurement | NH3 in Ambient Air |
| 03. | Display | Digital |
| 04. | Ranges | Auto ranging 0-1000 ppb |
| 05. | Lower Detectable Limit | 1 ppb |
| 06. | Noise Level | 0.2% of reading |
| 07. | Zero Drift | <5 ppb /24 Hrs. |
| 08. | Span Drift | < 2% in 15 days of full scale |
| 09. | NH3/NO converter | Quartz at approx. 10000 C |
| 10. | Linearity | 1% of full scale |
| 11. | Response time | <300 second |
| 12. |  |  |
| 13. | Calibration | Please see Multi-calibration section (Sl. No. 7) and also calibration section in General Specifications (4.1.7 to 4.1.9). |
| 14. | Analog Output | 0 – 1 V, 0 – 10 V, 2 – 20 mA /4 – 20 mA aDigital output |
| 15. | Digital Output | Multi drop RS 232 port, USB port /TCP/IP,Ethernet |

* 1. **AMBIENT CARBON MONOXIDE (CO)ANALYSER**

|  |  |  |  |
| --- | --- | --- | --- |
| 01. | Principle | : | Non Dispersive Infra-Red (NDIR) with Gas Filter Correlation/ Cross Flow Modulation Method |
| 02. | Measurement | : | CO in Ambient Air |
| 03. | Display | : | Digital |
| 04. | Ranges | : | Auto ranging 0 - 100 ppm. |
| 05. | Lower Detectable Limit | : | 0.1 ppm |
| 06. | Noise Level | : | 0.05 ppm with time constant30 seconds |
| 07. | Zero Drift | : | < 0.2 ppm/7 days |
| 08. | Span Drift | : | < 1% full scale in 24 hrs. |
| 09. | Linearity | : | Continuous + 1% |
| 10. | Response Time | : | 60 seconds or less |
| 11. | Calibration | : | Please see Multi-calibration section (Sl. No. 7) and also calibration section in General Specifications (4.1.7 to 4.1.9). |
| 12. | Analog Output | : | 0 – 1 V, 0 – 10 V, 2 – 20 mA / 4 – 20 mA |
| 13. | Digital Output | : | Multiple drop RS 232 port, USB port /TCP/IP,Ethernet |

* 1. **AMBIENT OZONE (O3)ANALYSER**

|  |  |  |  |
| --- | --- | --- | --- |
| 01. | Principle | : | UV Photometric / Chemiluminiscence |
| 02. | Measurement | : | O3 in Ambient Air |
| 03. | Display | : | Digital |
| 04. | Range | : | Auto ranging 0 - 500 ppb |
| 05. | Lower Detectable Limit | : | 1.0 ppb |
| 06. | Noise level | : | 0.5 ppb |
| 07. | Zero Drift | : | < ½% per month |
| 08. | Span Drift | : | < 1% per month |
| 09. | Linearity | : | Continuous + 1% |
| 10. | Response Time | : | 30 seconds or less |
| 11. | Calibration | : | With built in Zero and span generator and also see Multi-calibration section (Sl. No. 7) |
| 12. | Analog Output | : | 0 – 1 V, 0 – 10 V, 2 – 20 mA / 4 – 20 mA |
| 13. | Digital Output | : | Multiple drop RS 232 port, USB port /TCP/IP,Ethernet |

* 1. **AMBIENT BTEXANALYSER**
		1. **GENERAL**

A complete analyzer system comprising of sampling pump, transfer line, analyzer, detector, calibrator, computer hardware and software for instrument control, data storage, display, acquisition, processing and for selective determination of volatile compounds in ambient air optimized for Benzene, Toluene, Ethyl Benzene and o, m, p –Xylenes. Continuous unattended measurement system of individual BTEX should work without external cryogenic cooling. System should have protocol compatible to communicate & transfer data to DAS. Raw data storage capacity without erase minimum for three month or more. The system should be delivered with all necessary spares, consumables, tubing etc. for making it functional.

### TECHNICALSPECIFICATIONS

A single stage membrane Pump collect ambient sample automatically an inbuilt adsorption trap. Subsequent, the sample will be dissolved and injected on wide bore capillary gas chromatographic separation. Sample volume controlled by thermal mass flow controller (dust protected). Sample flow range may be 20 -100 ml/min or more (adjustable). Sample volume should be between 400 ml – one liter or more of ambient air over a 10-15 min sampling cycle. All sample transfer tubing should be in stainless steel and flow & pressure sensor to be preferred with digital display.

### DETECTOR

Photo Ionization Detector (**PID**) or other equivalent detector as per EPA/EU/TUV/MCERT approved specifications, which do not require hydrogen or other das to operate it. The system should have auto-clean & auto calibration facilities. PID Lamp eV should be 10.6eV. PID sensitivity sensor should be available to check sensitivity.

### MINIMUM SPECIFICATIONS

|  |  |  |
| --- | --- | --- |
| Principal | : | Based on gas Chromatographic separation and Photo Ionization Detector (PID) |
| Measurement | : | Benzene, Toluene, Ethyl-benzene, m.p-Xylene and 0-Xylene. |
| Display | : | Digital |
| Range | : | 0 - 100 ppb(0.32 – 325g/m3) |
| Lower detectable limit | : | 0.2 ppb (0.65g/m3) for 15 min cycle for Benzene |
| Temperature Range | : | 5 - 35oC or more |
| Repeatability | : | Retention Time :<0.1% RSD Concentration: <1.0% RSD |
|  |  |  |
| Typical Cycle Time | : | Total Cycle Time should not exceed 15 min i.e. Sample Collection Time -15 min approx.Analytical Time- 15 min approx. |
| Sample Volume | : | 1 liter for 15 min cycle. |
| Desorption tube | : | Carbotrap |
| Pre concentration | : | Carbopack |
| Calibration | : | The Analyzer should be capable to calibrate through Multi Calibration System also. Please see Multi-calibration section (Sl. No. 7) And also calibration section in General Specifications (4.1.7 & 4.1.9). |
| Analog Output | : | 0 – 1 V, 0 – 10 V, 2 – 20 mA / 4 – 20 mA |
| Digital Output | : | Multi drop RS 232 port, USB port /TCP/IP ,Ethernet |
| Approval | : | USEPA/TUV/ MCERT approved BTEX Analyzer |

1. **CONTINUOUS AMBIENT AIR QUALITY MONITORING ANALYSERS (PARTICULATES)**
	1. **CONTINUOUS PM10 MONITORING ANALYSER (-RAYATTENUATION**)

Based on the principle of -ray attenuation, particulate sampled through the instrument and collected on fiberglass filter tape. Before and after sampling,- ray radiation is measured by scintillation / G.M. counter. An internal microprocessor handles all sequences and automatically calculates the concentration of PM10.

|  |  |  |  |
| --- | --- | --- | --- |
| 01. | Principle | : | -ray attenuation |
| 02. | Particle Size Cut Off | : | 0 - 10 Microns |
| 03. | Measuring Range | : | 0 – 1000 g/m3 |
| 04. | Resolution | : | 1% of the measurement range |
| 05. | Lower Detection Limit | : | < 4.8 g/m3(1 hour) |
| 06. | Detector | : | Plastic Scintillator / GM Counter / Silicon- Semiconductor base |
| 07. | Air Flow Rate | : | 16.7 Liters / minute |
| 08. | Filter Material | : | Glass Fiber Filter |
| 09. | Display | : | LED / LCD |
| 10. | Sampling Head | : | Dynamic heated sampling line with proper outerinsulation for measurement of PM10, with adjustable temperature 20 – 70 0C |
| 11. | Calibration | : | Reference membrane facility should be provided for calibration of analyzer. |
| 12. | Compatibility | : | Analyzer should be compatible with protocols ofDAS system to be used in station. |
| 13. | Analog Output | : | 0 – 1 V, 0 – 10 V, 2 – 20 mA / 4 – 20 mA |
| 14. | Digital Output | : | Multi drop RS 232 port USB port /TCP/IP /Ethernet |
| 15. | Roll Length | : | Minimum 20 meters |
| 16. | Measurement cycle time | : | 1 hour |
| 17. | Approval | : | USEPA/TUV approved Analyzer |

### CONTINUOUS PM2.5 MONITORING ANALYSER (-RAYATTENUATION)

Based on the principle of -ray attenuation, particulate sampled through the instrument and collected on fiberglass filter tape. Before and after, sampling - ray radiation is measured by scintillation / G.M. counter. An internal microprocessor handles all sequences and automatically calculates the concentration of PM2.5.

|  |  |  |  |
| --- | --- | --- | --- |
| 01. | Principle | : | -ray attenuation |
| 02. | Particle Size Cut Off | : | 0 – 2.5 Microns |
| 03. | Measuring Range | : | 0 – 1000 g/m3 |
| 04. | Resolution | : | 1% of the measurement range |
| 05. | Lower Detection Limit | : | < 4.8 g/m3 (1 hour) |
| 06. | Detector | : | Plastic Scintillator / GM Counter / Silicon- Semiconductor base |
| 07. | Air Flow Rate | : | 16.7 Liters / minute |
| 08. | Filter Material | : | Glass Fiber Filter |
| 09. | Display | : | LED / LCD |
| 10. | Sampling Head | : | Dynamic heated sampling line with proper outerinsulation for measurement of PM2.5 with adjustable temperature 20 – 70 0C |
| 11. | Calibration | : | Reference membrane facility should be provided for multipoint calibration of analyzer. |
| 12. | Compatibility | : | Analyzer should be compatible with protocols ofDAS system to be used in station. |
| 13. | Roll Length | : | Minimum 20 meters |
| 14. | Analog Output | : | 0 – 1 V, 0 – 10 V, 2 – 20 mA / 4 – 20 mA |
| 15. | Digital Output | : | Multi drop RS 232 port ,USB port /TCP/IP ,Ethernet |
| 16. | Measurement Cycle Time | : | 1 hour |
| 17. | Approval | : | USEPA/TUV approved Analyzer |

***Note: A distance of around 1.5 meter should be maintained between two sampling heads of PM2.5 and PM10samplers.***

### MULTICALIBRATOR

Calibration system should provide for the calibration of the ambient air quality monitoring analysers (Gas).

### MULTI POINT GAS CALIBRATIONSYSTEM:

1. The Gas Calibration System should be capable to do the following:
	1. Multipoint calibration using automatic dilution system for the calibration of SO2, NO, CO, NH3 and BTEX analyser.
	2. Auto calibration (user selectable).
	3. Generate zero air of 99.9% purity (High Performance Zero Air Generator to be provided).
	4. Having facility for O3 Generator for stable and repeatability calibration.
	5. Gas Phase Titration (GPT) with O3 generator having 100% converter efficiency for conversion of NO to NO2.
	6. Calibration using permeation tubes for which at least two chambers based Permeation system has to be provided.
	7. The Permeation System should be capable to accept permeation tubes up to 6 cm in length and 2cm in diameter with user selectable temperature setting of 40 OC and 50OC.
2. System should be 19” rack mountable.
3. System should be DAS compatible for remote calibration from Central Server.
4. The system should also have facility for multipoint calibration of Ozone analyzer.

### METEOROLOGICAL, FLOW AND ELECTRONICSCALIBRATION

**The supplier should provide calibration devices or calibration check devices for all the meteorological parameters** namely temperature, wind speed, wind direction, relative humidity, solar radiation, rain fall as per the specifications of the manufacturers.

1. **METEOROLOGICALSYSTEM**
	1. The meteorological instrumentation should be interfaced directly with the Data Acquisition System after passing through a lightning protection isolation box. Crank

- up telescopic 10 meters tower should be erected for mounting of meteorological sensors. The relative humidity and solar radiation sensors should be mounted on the tower. The specifications are as follows:

#### WIND SPEED

|  |  |  |
| --- | --- | --- |
| Range (Operation) | : | 0 – 60 m/s or better |
| Sustainability | : | Unto 75 m/sec |
| Accuracy | : | ± 0.5 m/sec or better |
| Resolution | : | 0.1 m/sec |
| Sensor Type | : | Ultrasonic |
| Threshold | : | 0.5 m/sec or less |
| Response time | : | 10 sec or better |

1. **WIND DIRECTION**

|  |  |  |
| --- | --- | --- |
| Range | : | 0 – 359 degree |
| Accuracy | : | ± 3 degree or better |
| Resolution | : | 1 degree |
| Sensor type | : | Ultrasonic |
| Threshold | : | 0.5 m/sec or less |
| Response time | : | 10 sec or better |

1. **AMBIENTTEMPERATURE**

|  |  |  |
| --- | --- | --- |
| Range | : | -10 o C to 60 o C |
| Accuracy | : | ± 0.2 o C or better (with radiation shield) |
| Response | : | 10 seconds in still air |
| Resolution | : | 0.1 °C |
| Sensor type | : | Resistance type |
| Response time | : | 10 sec or better |

1. **RELATIVEHUMIDITY**

|  |  |  |
| --- | --- | --- |
| Range | : | 0 to 100% RH |
| Accuracy | : | ± 3.0 % or better |
| Resolution | : | 1% |
| Sensor type | : | Capacitive / Solid State |
| Response Time | : | 10 sec or better |

1. **SOLAR RADIATION**

|  |  |  |
| --- | --- | --- |
| Range | : | 0 to 1500 W/m2 or better |
| Accuracy | : | ± 5.0 % or better |
| Resolution | : | 5W/m2 |
| Sensor type | : | Silicon Photo diode |

1. **RAINFALL**

|  |  |  |
| --- | --- | --- |
| Range | : | 0.2 mm to 100 mm /hr. |
| Accuracy | : | ± 5% or better |
| Resolution | : | 0.2 mm |
| Sensor type | : | Tipping bucket rain gauge or any other suitable sensor |
| Response Time | : | 10 sec or better |

1. **TELESCOPIC CRANK – UP METEOROLOGICALTOWER**

The wind speed, wind direction, temperature, relative humidity and solar radiation sensors are to be mounted on the Meteorological Tower. The tower is to be a free standing four section telescopic tower provided with a hand crank to raise and lower the instruments mounted on the tower. Specifications are as follows:

|  |  |  |
| --- | --- | --- |
| Extended Height | : | 10 meters |
| Retracted Height | : | 2 meters |
| Wind load Limit | : | 0.7896 sq. m. (8.5 sq. ft) at 50 mph |
| Number of Sections | : | 4 |
| Construction material | : | Galvanized steel or aluminium |

#### Note:

* 1. Humidity and temperature sensors are to be supplied with weather and thermal radiation shield made of anodized aluminium and sensor should be supplied with all necessary cables, connector and mounting arrangements as required.
	2. All the meteorological sensor should be certified/ traceable to World Meteorological Organization (WMO) and software should also have certification from the appropriate international agency.

### DATA ACQUISITION AND COMMUNICATIONSYSTEM

* 1. **Typical Architecture for Data Connectivity**



* This architecture defines data transmission from all connected CAAQM Stations to State Data Center and Central Data Centre in parallel through internet (leased lines) in real time basis.
* All Stations are to be connected by static IP address with CPCB Server (Central Data Server) for uninterrupted NAQI.
* There should also provision in the station itself for data display of Pollutants parameters, Meteorological parameters and NAQI on display system near to Station.
* Each CAAQM Stations measure their respective pollutant and meteorological parameters and get them stored in data logger before transmission.
* From Data logger, data transmits for data display, and also through internet the same data is transmitted to Central server as well as State server for data display at Central level and State level, parallel.
* Data display system at all locations display Pollutant, Meteorological and NAQI data on real time basis of all connected CAAQMS Stations.

### Data Acquisition and Handling System at Station

Type I: System comprises of data logger having DAS and station computer. Or

Type 2: System comprises of station computer with DAS facilities.

Data logger/DAS with 8 analog, 24 digital inputs. Ability to log channels at different intervals and should have capability of averaging and displaying real time data and averaged data over a period of 1 min, 15 min, ½ hr., 1 hr., 4 hrs., 8 hrs., 24 hrs., 1 month and year. Communication between data logger and station computer should be using standard USB/RS232/RS485/ Ethernet Connector. The data logger should have internal battery with charger and if it is PC based UPS serves the purpose.

The data logger/DAS should support LAN and Internal GSM modem/ Wi-Fi for data transfer to central server. Station computer for data logging will be in addition to workstation computer required for calculating AQI, and will be of same or better specifications that of work station computer.

The supplier is supposed to install Computer System alngwith DAS of suitable high- end specification as per the design & specifications of DAHS. Real Time Data to be simultaneously transmitted from station computer to Central Servers at respective SPCB and CPCB.

Computer:

Brand new Computer of reputed make like HP, Dell, Lenovo, Compaq, IBM, Acer, Apple, Microsoft of configuration mentioned below or better and compatible with DAHS to be supplied. Presently network is envisaged for 250 such stations.

This PC would be controlled through remote mechanism with PPCB for the purpose of installation & maintenance of AQI Software. The supplier will maintain the Computer System (Hardware, OS,etc.)

|  |  |
| --- | --- |
| **Sr.No** | **Specifications** |
| 1 | **CPU** | Intel® Core i7 8thgeneration or higher |
| 2 | **Memory** | 8 GB DDR-IV, or better |
| 3 | **Ethernet ports** | Integrated Intel ® Ethernet LAN 10/100/1000 |
| 4 | **PCI Slots** | Two PCIex16 half height |
| 5 | **Optical Drive** | DVD R/W Internal |
| 6 | **HDD’s** | 3.5” 1TB, SATA drives |
| 7 | **Power Supply** | Standard suitable power supply |
| 8 | **Key board** | Optical Keyboard same as OEM |
| 9 | **Mouse** | Standard Optical Mouse same as OEM |
| 10 | **I/O ports** | Minimum 6 USB (at least 4 ports of 3.0) |
| 11 | **Monitor** | 22” Wide or higher LED FHD Color Monitor |
| 12 | **Wireless adapter** | USB Wireless adapter x 1 no. |
| 13 | **OS support** | Open source Linux Centos |
| 14 | **Warranty** | Warranty on site OEM warranty – comprehensive |
| 15 | **Type** | Desktop (Flat)/Tower |

### MANAGEABLE CISCO SWITCH (RACKMOUNTABLE)

#### Ethernet switch with LAN and WAN ports.

24 port managed fast/ gigabit Ethernet Cisco Switch with LAN and WAN ports (At least 04 Poe Ports) of latest series for installation at respective SPCBs OR better

* 1. **REMOTE MONITORINGTOOL/SOFTWARE**

Remote calibration & validation management software and its licenses for the entire project duration for stations computer and central servers located at SPCBs and CPCB.

Data Acquisition Software (DAS) &it’s licenses to be provided for Central Servers at each SPCB and CPCB.

The remote connectivity tool/software like Team viewer with License, procurement, installation & up-data ion for the complete duration for each SPCB & CPCB, is to be done by the supplier.

### 21 U BLACK INDUSTRIALRACK

This is to be installed at Central Sever location at PPCB.

|  |  |  |
| --- | --- | --- |
| **Sr. No** | **Specifications** | **QTY / site** |
| 1 | **19" Industrial Rack, 21U , Color Black Consisting of:-** | **1** |
| 2 | Steel Enclosure, 9 Folded profile of dimensions 800 mm width \* 1000 mm Depth \* 42 U height, supporting 1000 Kgs load. Bottom cover with knock out holes for cable entry to be provided. Three pairs of horizontal support shall be fitted on both right and left sides. | 1 |

|  |  |  |
| --- | --- | --- |
| **Sr. No** | **Specifications** | **QTY / site** |
| 3 | Foldable Front & Rear Door to its half size while opening, shall be of 100% perforated. Provision for mounting fans on Rear door with concealed AC wiring. | 2 |
| 4 | Fan 230V, 90 CFM to be mounted on Rear Door. | 4 |
| 5 | AC Main Channel vertical two nos., 12x 5/15 Amps Sock RT-AQMP Make: Anchor with 32 Amps MCB make : Northwest or better | 2 |
| 6 | Horizontal Cable Manager | 20 |
| 7 | Vertical Cable Manager | 10 |
| 8 | Copper based Electrical Grounding / Earthing Strip. Provision for Fifteen (15) points. | 1 Set |
| 9 | Each set of: a) Castor with Brake -- 2 Nos. | 1 Set |
|  | b) Adjustable screw legs --4 Nos. OR |  |
|  | c) Base frame – 1 No**.** |  |
| 10 | Light provision activation in the rack up on opening of the front/rear door. | 1 |
| 11 | H/W Packet of 20 SRT-AQMP. | 2 |

#### If anything else is required to setup the system, vendor need to have provision at the time of quoting.

* 1. **RACKSERVER**

This is to be installed at Central Sever location at PPCB along with the 21U Industrial Rack.

|  |  |
| --- | --- |
| **Sr.No** | **Specifications** |
| 1. | CPU | Single CPU, Intel Xeon Quad Core E51620V3 3.50 GHz or higher, 10MB Cache per socket or higher. The Mother Board should support Dual Sockets. |
| 2. | Memory | 32 (32 GB Support for each CPU) DDR-4, 1333/1600/1866/2133MHz, upgradable to 128GB |
| 3. | Mother Board | Intel motherboard having compatibility to configuration desired |
| 4. | HDD | 3\*500GB SAS or better |
| 5. | Ethernet Port | 2 \*Dual port Gigabit NIC Cards with autosensing and on copper (total 4 ports). All four ports supporting iSCSI protocol to connect to iSCSI based SAN storage |
| 6. | PCI Slots | Provision for 2 \*PCI express 2 \* PCIe X2 or more slots to accommodate additional FC/Gigabit Cards Graphics Adaptors |
| 7. | Optical Drive | DVD R/W 16X Drive or better, External USB based |
| 8. | Form Factor | 2U rack model with rail kit or better |
| 9. | Key board | Standard Optical wireless Keyboard |

|  |  |
| --- | --- |
| **Sr.No** | **Specifications** |
| 10. | Mouse | Standard Optical Wireless Mouse |
| 11. | I/O ports | 2 \*USB ports, front & 2USB port Back, |
| 1 VGA Port, 1 external SAS, 1\* Serial |
| 12. | Monitor | 22” Wide LCD TFT Colour monitor |
| 13. | RAID Controller | RAID 5 minimum |
| 14. | Wireless adapter | USB Wireless adapter x 2 nos. |
| 15. | Antivirus | Standard Antivirus (McAfee / Norton / Trend Micro) for duration of 3 years |
| 16. | Redundant Power Supply & Fans | Redundant Power Supply 1+1, Redundant Fans |
| 17. | Warranty | Warranty is comprehensive 24x7 on site including spares for 3 / 3 / 3 years with 4 hours support |
| 18. | OS | Compatible OS should be provided. |

### WIRELESS ACCESS POINT(AP)

This is required along with server at respective central station (PPCB).

|  |  |  |
| --- | --- | --- |
| S. No. | **Type of Access Point** | **Stand alone** |
| 1 | Deployment | Indoor |
| 2 | Mounting | Ceiling/ Wall |
| 3 | Antenna Type | Internal |
| 4 | Number Of Radios | Dual |
| 5 | Frequency Band | 2.4GHz, 5.0GHz, 2.4GHz & 5.0GHz |
| 6 | Supported Wi-Fi Standards | 802.11 a/b/g/n/ac |
| 7 | Wireless Speed Up to (Mbps) | 800 |
| 8 | Max Wireless Signal Range in Mts | 20 |
| 9 | Channel Width (MHz) | 80 |
| 10 | Maximum Data Rate MBps | 800 |
| 11 | Supported Encryption | WEP, WPA-PSK, WPA-TKIP, WPA2 AES, 802.11i, EAP-TLS.,WEP,WPA- PSK,WPA-TKIP,802.11,EAP-TLS,WPA AES |
| 12 | Receiver Sensitivity in dB | -99 |
| 13 | Transmit power (TX)(dBm) | 3 |
| 14 | Radio Resource Management such for power channel, coverage hole detection and performanceoptimization | Available |
| 15 | Support for Load Balancing between 2-4 GHz and 5 GHz | Available |
| 16 | Support for Configurable Carrier Threshold | Available |
| 17 | Device Management | Web-based Configuration Interface (GUI) |
| 18 | Support for Mesh Networking | Available |

|  |  |  |
| --- | --- | --- |
| 19 | Support for QoS for Voice over Wireless | Available |
| 20 | Support for MU-MIMO | Available |
| 21 | Number of MIMO supported & Spatial Streams | 2 x 2 :2 |
| 22 | Number of WLAN (SSID) per AP | 16 |
| 23 | Maximum clients Nos | 100 |
| 24 | Support for Autonomous access- point option | Available |
| 25 | Number of 10/100/1000 port | 1 |
| 26 | mGig support | Available |
| 27 | Support for Beam forming | Available |
| 28 | Support for QoS and Video Call Admission Control capabilities | Available |
| 29 | Support for Rogue access point detection | Available |
| 30 | WPC certified | Yes |
| 31 | Wi-Fi CERTIFIED | Yes |
| 32 | Powering options (Such as AC/DC, 802/3af PoE, 802/3at PoE+), specify | 802.3af PoE |
| 33 | Power POE (Watt) | 11 |
| 34 | Environmental Standard : plenum-rated (UL2043) for Indoor and IP67 for Outdoor | Yes |
| 35 | Operating Temperature Range(Degree C) | 0-40 |
| 36 | Operating Humidity (%RH) | 95 |
| 37 | Dimension (mm x mm x mm) | 13.8\*13.5\*3.3 |
| 38 | Weight (grams) | 220 |
| 39 | On Site OEM Warranty (Years) | 5 Years |

### UTM (UNIFIED THREAT MANAGEMENT) DEVICE

This is required at respective SPCBs Central station

#### Support and Warranty

Appliance should have EAL4+ Certification and ICSA certification for Firewall.

#### Appliance Throughput

* Firewall throughput of more than 5Gbps.
* Minimum 1.2 Gbps of Antivirus Throughput
* Minimum 1 million Concurrent sessions
* Minimum 1 Gbps of IPS throughput
* Minimum 45,000 New Sessions/second
* Minimum 800 Mbps of IPsec VPN through put
* Minimum of 1000 IPsec tunnel support and 50 SSL VPN user support. License for the same should be included in the BOM.
* 810/100/1000 interfaces supporting Hardware Bypass.

#### General Features

* Should be appliance based and rack mountable
* Identity based Firewall
* Intrusion Prevention System
* Gateway Anti-virus
* Gateway Anti-spam
* Web Content & Application Filtering
* Band width Management
* Inbuilt-on Appliance Reporting
* Network: OSPF, Round Robin load balance, RIPv2, BGP, equal &unequal cost load balance, High Availability, QOS, etc. Round Robin Balance, Server Load Balancing.
* Support for user authentication overs MS.
* Country Based Blocking, FQDN support and should support MIX mode deployment
* 4 Eye Authentication feature for data integrity.

#### Gateway Antivirus, Anti-Spyware and Anti-Spam

* The proposed integrated Anti-Virus/Ant-Spyware should have Web Coast Checkmark Certification as part of a UTM. Virus, Worm, Trojan Detection and Removal, Automatic Virus signature database update, Real-Time blacklist, MIME header check, and Redirect spam mails to dedicated email address, image-spam filter, Spam Notification, Zero hour Virus outbreak protection. Recurrent pattern Detection Technology for AS. Self Service Quarantine area.

#### Web and Application Filtering:

* The proposed Content Filtering should have at least one Certification as part of a UTM viz. Web coast Checkmark. URL, Keyword, File type block, Block Java applets, cookies, ActiveX, Block malware, phishing, pharming URL, block P2P application, anonymous proxies, Customized block on group basis. System should have Minimum of 70+ categories with more than 100 million URLS supported with more than 5000 application support.

#### Security Features

* **Intrusion Prevention System (IPS):** The proposed IPS should have Certification as part of a UTM viz. Web coast Checkmark. For different attacks like Mail Attack, FTP Attack, HTTP Attack, DNS Attack, ICPM Attack, TCP/IP Attack, DOS and DDOS Attack, Telnet Attack. Signatures: Default (more than 2000+), Custom , IPS Policies: Multiple, Custom, User-based policy creation, Automatic real-time updates from CR Protect networks, Protocol Anomaly Detection
* **VPN**:

IPsec, L2TP, PPTP and SSL as a part of Basic Appliance, VPN redundancy, Hub and Spoke support, 3DES, DES, AES, MD5, SHA1 Hash algorithms, IPsec NAT Transversal, VPNC Certified.

#### Load Balance:

For Automated Failover/Failback, Multi-WAN failover, WRR based Load Balancing. High availability: Active-Active. QOS, OSPF, RIPv2, BGP, Policy routing based on Application and User Support Round Robin Load Balancing.

#### Bandwidth Management:

Application and user identity based bandwidth management, Multi WAN bandwidth reporting, Guaranteed and Burstable bandwidth policy. Bandwidth for User, Group, Firewall Rule, URL and Applications.

#### Monitoring and Reporting System:

Should Include reports for Centralized management, Monitoring & Logging, Command line interface. Monitoring Gateways, **Monitoring suspicious activity and alerts,** Graphical real-time and historical monitoring, email notification of reports, viruses and attacks reports. IPS, Web filter, Antivirus, Anti-spam system reports. IP and User basis report, >40+ Compliance reports and >1000+ drilled down reports on the appliance with 250+ GB of storage.

#### License for UTM (Unified Threat Management)

Three Years for Gate Way Antivirus, spyware, Anti-Spam, content and application filtering. IPS, reporting and support License period will be counted after activation

#### PRINTER SPECIFICATIONS

COLOUR Laser Jet Multi-Function Printer (Print-Scan-Copy)

* Print speed black: 25 ppmmin
* Print Speed Color : 5 ppmmin
* Scanner
* Resolution: 1200 x 1200dpi
* Processor speed 1200 MHz Print or better
* Paper handling input, standard 250-sheet input tray or better
* Duplex printing Automatic(standard)
* Media sizes supported A4A5
* wireless connectivity and automatic two-sided printing
* automatically connect to wireless network,
* Easily print from virtually anywhere in the office with Ethernet and wireless connectivity
* Connect via USB, and access tools from PC to manage printer.
* 1,500-page toner cartridge or better

#### CONNECTIVITY FOR DATA TRANSFER

1. **LEASED LINECIRCUIT**

**1Mbps capacity leased line connectivity** with 99% uptime service level agreement (SLA) to be provided by the firm at each station location. The leased line may be provided on copper or optical fiber or through RF depending upon the location. 04 nos. of Real IPs to be obtained along with the Lease Line Circuit. Router equipped with 01 WAN Port and minimum 08 LAN Ports is to be procured along with the Leased Line Circuit.

1. **BROADBAND**

1Mbps capacity broadband connectivity from other than one already providing leased line connectivity shall be provided by the firm at each station.

1. **GSM /Hotspot Connectivity**

Internet connectivity will have to be provided by the firm for the entire project duration at LED location either using GSM or Hotspot connectivity

### DATA ACQUISITION SOFTWARE FOR STATION(CAAQM)

The software captures data from all channels in the system and stores in the station Computer.

### Data Acquisition

* 1. Frequency of data acquisition
		1. User selectable 1,5,30,60,120 second averaging duration online digitally.
		2. Minimum frequency will be subject to capability of analyzer cycle.
	2. Channelize
		1. 32 Channels or more supported
		2. Expandable to 64 channels, if required in future
	3. Data input

Either Analog (0-1 volt/0-10 volt/2-20mA/4-20mA)

or Digital to configure with the PC. The condition is that system should remotely portable.

* 1. User configurable channels, stations and equipment with communication parameters.
	2. Analyzer data channel should comprise of Name, Units, Communication Address, Validity Range, Operation and Error Status.
	3. Provision to incorporate conversion factors such as PPB to µg/m3etc.Software should be equipped to configure the analyzers with it, irrespective of company make and communication protocol of the analyzer and the output mode i.e. Analog or Digital (RS 232) of the instrument.
	4. The output should be provided in user defined units.

### Data Collection

* 1. Average data over user selectable time (1,5,30,60 seconds time interval) period.
	2. Operational status, Error status, calibration status and calibration values observed from the analyzer should be captured and should be made available along with the data with a frequency of maximum five minutes.
	3. System should collect of the diagnostics of the instrument comprising actual diagnostics parameters and their values at least once in every five minute to check the state of the health analyzer.
	4. Calibration parameters
		1. Provision to entering zero calibration, span calibration values of gas cylinder/permeation to devices
		2. Provision for collecting zero calibration, span calibration values(pre calibration & post calibration) in to the database for further analysis.
		3. Provisions to collect electronic system pre calibration & post calibration values from the analyser to ascertain the percentage deviation/ correction applied during each calibration and record it in database at station &Central computer.

### Data Storage

* 1. Data along-with diagnostic, calibration, alarms should be stored at station computer at a defined path.
	2. Interval of data dumping will be same as defined in the data collection.
	3. System should be capable to keep every second acquired data from 32 channels for a period of minimum five years.
	4. Current data should be stored as per ISO-7168-1:1999I format and should be available in folder named as c:\Data\ at an interval of 15 minutes. As an example c:\data\01.05.2015.xml. the file will be appending without double data entry and as per ISO format.
	5. Data should also be stored for last two years in E:\data\Year\Month\day i.e. e:\data\2015\05\01.05.2015.xml….
	6. If data encryptions done, then decryption procedure should be made available in soft file format to check the data at station at any point of time. To convert data on continuous basis for exporting to AQI software, procedure should be available without any licensing. AQI calculating Software will be provided by CPCB/SPCB.

### Data Display (Statistical analysis of data)

* 1. Main window for real time display of all measured parameters with status of all analyzers/sensors.
	2. In 4-in-4 graphs and4-in-1 graph formats
	3. In tables of 4-in-1format
	4. Real time multi – graphs over user selectable time period i.e. 6.00 AM to 6.00 AMetc.
	5. Display of graphic & tabular display of the current data.
	6. Graphical form should comprise of 4-4 graphs, 4-1 graphs in user defined format ( 1, 5, 10, 15, 30 min, 1hour, 4, 8, 24 hour, 30 days and yearly; user definable time series)
	7. Tabular form should comprise of 4 channel list in user defined format (1, 5, 10, 15, 30 min, 1hour, 4, 8, 24 hour, 30 days and yearly; user definable time series)
	8. Station instruments basic configuration etc. should be visible on screen continuously.
	9. Statistical analysis tools like regression analysis, co-relation analysis and other analysis as per industry standards in the field of environment should be available and if not the firm should develop these for CPCB within a time frame of six months.
	10. The system should have procedures for normal analysis tools like calculation of data with respect to a threshold value, average, minimum, maximum, calculation of violating value with respect defined values(National Air Quality Standards) for defined period for the databases.
	11. Data analysis of diagnostics parameters
	12. Data analysis of Pre calibration and post calibration data (if facility not available, should be developed within six months)
	13. Data analysis of corrections applied of each calibration cycle (if facility not available should be developed within six months)

### Data Backup

* 1. There should be defined data backup procedure through which data can be extracted from station computer in simple text format/excel/ ISO format(user definable).
	2. There should be defined restore procedure also to restore the data in case of data loss.
	3. A display screen should be available to update the user about data availability.

### Data Validation automatic checks at station software.

* 1. Zero level and span level checks if performed cyclically and defined results are not obtained up to +/- 5%(user definable 0-10%) then system should alarm the user of system failure and the recorded alarm should be transmitted to central software.
	2. After instruments perform the calibration the results obtained should be recorded and should be transmitted to central computer.
	3. There should be provision of two databases one is raw database and another corrected database.
	4. Validation of data through calibration database Pre calibration & post calibration values collected.

### Calibration of systems

1. Calibration window for analyzer for the calibration from computer.
2. Remote Access to Calibration: Calibration exercise need to be done remotely. All necessary arrangements for it should be made in the system.
3. Calibration data file may be prepared separately and data should be excluded from the database
4. Calibration database need to be formed, stored and transmitted to central server.
5. Calibration cycles to be as per the models of the instruments.
6. Calibration records should store the calibration values displayed by instrument.
7. Diagnostics during calibration should also be recorded.

### Location of station

* 1. Fixed and Mobile Stations location to be recorded and North correction feature should be available.
	2. Latitude and longitude of stations be recorded

### Data transfer to Central

All data captured at station computer should be transferred to central software.

* 1. User selectable time frame for transmission of data to central server.
1. Diagnostics (actual diagnostics parameter values recorded each time in the station), configurations (station channel configurations), alarms(generated alarms) should be transmitted.Data transfer to Display Boards at Public site

software should have provisions to connect data output including current pollutants concentration, AQI, advertisement, etc. to the display boards (LEDs), to be installed at public site. For the purpose Data display device has been recommended in the document.

### DATA ACQUISITION SOFTWARE AT THE CENTRAL STATION AT PPCB&CPCB

Data communication system handles the data transmission of an ambient air quality network and receives incoming messages / signals from remote stations. The central software processes signals and data and displays it. Detailed requirement is as below:

### A (i) Software at Central Station

1. Software should not have any restriction on number of locations and computers either technologically or in terms of licensing.
2. Should display multiple stations on – line data (momentary values) in tabular text and graphic format.
3. Data should be received by the central from all locations maximally within 5minutes duration or at user defined time intervals.
4. Data along-with diagnostics and calibration details should be transmitted at central from all connected locations.
5. Should support dialup systems, broadband connectivity, wireless connectivity, 2G or 3G or any new technology which shall be in place during project time should be compatible and if not, need to developed by the system provider up- to project duration without additional charges.
6. Should have the remote control facilities for calibrations (Zero & Span) of instruments and measuring range modifications.
7. Should have facility for displaying data communication error reports, image management which should be recorded and should be available for display.

### Data Display at Central Station

* 1. In 4-in-4 graphs, 4-in-1 graph and/or 16-in-1 graph formats
	2. In terms of 4-in-1 table format

a) Real time multi – graphs over user selectable time period .ie. 6.00 AM to 6.00 AM etc.

1. Display of graphic & tabular display of the current data like simple 3D line and column chart, polar diagnostics and 3D perspective column chart.
2. Graphical form should comprise of 4-4 graphs, 4-1 graphs in user defined format i.e. 1, 5, 10, 15, 30 min, 1hour, 4, 8, 24 hour, 30 days and yearly. (user definable time series)
3. Tabular form should comprise of 4 channel list in user defined format i.e. 1, 5, 10, 15, 30 min, 1hour, 4, 8, 24 hour, 30 days and yearly. (user definable time series)
4. Display of data using selectable name of different stations.
5. Generation of Wind Roses, Pollution Roses (minimum 12 directional) with user defined time limits.
6. Calculate vector mean of wind direction.
7. Programmable downloading of data.
8. Comparison of data w.r.t. Standards in Graphical form and tabular form with information of values exceeds the Standards.
9. Specific data zooming facility
10. Database correction procedure
11. Separate user ID and Password for correction of database so that all regional level users, if authorized, can validate their regions data and the events be recorded along with ID, date & time, on monthly basis.
12. Data validation trail recording.

### Data Export

* 1. Data export in ISO 7168 format is required to be done automatically.
	2. Possibility to export the data files in Excel, Text and other formats Tabular form should be in user defined format i.e. 1, 5, 10, 15, 30 min, 1 hour, 4, 8, 24 hour, 30 days and yearly.

### Data Import

* 1. In case of communication medium fails there should a mechanism to shift the data into Pen drive (Physical medium for data collection) physically and a procedure to import the same on central software.

### Printing

* 1. Possibility to connect different types of printers and auto printing facility for all displays generated throughout the analysis of data at any point of time.

### Delayed data checks & Validation of data at Central Software at PPCB

* 1. After instruments perform the calibration the results obtained should be recorded and should be transmitted to central computer and stored.
	2. Zero level and span level checks if performed cyclically and defined results are not obtained up to +/- 5% (user definable 0-10%) then system should generate alarm to the user for system failure and the recorded alarm should be transmitted to central software and stored. There should be provisions to read these alarms in a database for corrective actions and for comparison of data for acceptability or rejection.
	3. Software utility should be provided through which validation of data could be done at SPCB and the validated data files be synced with database at CPCB.
	4. The utility should provide date wise access to the data available in the station computer in the editable form along with provision to record events/remarks and should store in the database in the station computer as “Validated Data”. However, the raw data should remain intact.
	5. Validated files should also be stored in the stations computer in a folder at C:\Data\stationName\Datevalid.txt (Ex:

C:\Data\NehruNagar\21062019valid.txt). This file format should be same as

**csv file format** as mentioned at Annexure-I.

### Data display at CAAQM Locations and PPCB Offices

1. At CAAQM Station:

A display board will have to be supplied & installed by the supplier at each CAAQM Station or nearby to it (may be few kilo meters) for which space to be provided by PPCB.

1. At PPCB Offices:

A display board will have to be supplied & installed by the supplier at each PPCB Office for which space shall be provided by PPCB.

1. CPCB/PPCB intends to show the content:
2. Information from External Sources
3. Information drawn from Internal databases
4. Advertisement in the form of Text, Slides, Charts, Videos etc.
5. Live Feeds
6. Content Management System

Content Management for Data Display Boards is to be managed both locally &centrally. Hence, the supplier is requested to provide software for local (at CAAQMS) & Central content management (at CPCB &PPCB). The central software should be capable to operate simultaneously at SPCB and CPCB. There could be two different software’s at PPCB & CPCB to manage contents of display boards of CAAQM Station &PPCB Office.

Therefore, Display Board Data Transmission Device (DBDTD) should be capable to collect the content from local station, PPCB Central Software and CPCB Central Software manually through scheduling procedure for different durations (Minutes, Hours, Days, Weeks, Months, Years etc.), zone-wise, state-wise, group-wise, device- wise, content-wise separately as there will be of different contents to be displayed at different locations.

The central software should have the capability of Remote machine status monitoring & management. It should be capable to provide on-screen display of remote display board (live screen of display board).

Establishing the required connectivity by using necessary devices (either through LAN, Wi-Fi, GSM etc.) between the DBDTD and CPCB &PPCB to run the content seamlessly is within the scope of the supplier.

### Remote Procedures (if not available facility should be developed by the firm)

* 1. Central software should have capability to allow to connect any station computer through remote.
	2. Central software administrator should be able to go for remote calibration of any of the systems.
	3. Software should be capable to operate remote stations configurations.
	4. Control panel window should be available for controlling each analyzer that means each analyser should be controllable separately through remote software being provided with the software system.
	5. Alarm window for valid alarms of all analyzers and sensors.
	6. It should have transparent data – connection to each analyzer from remote.
	7. System should be capable to remotely configure all stations through remote location using configuration file to maintain the uniformity. The configuration command from central at PPCB location should be active.

### Data Reports Generation

* 1. To prepare reports hourly, weekly, monthly, yearly in user defined interval and formats.
	2. Mean, Median, Percentile, Maximum, Standard deviation, Frequency analysis and Maximum Frequency analysis.
	3. Data Comparison

Software should be able to compare any of the four channels irrespective of type of data in the system with respect to each other on a single time scale user selectable.

* 1. Data Comparison on different timescale

Software should be able to compare data on the basis of different time scales like one station (x) parameter (y) of one given date is compared with other station (z) parameter (y) on any other date in a single graph.

* 1. Data reports, calibration reports and status reports with user time periods.
	2. Historic multi – curves / graphs over user selectable time period.
	3. Report generation over user selectable time period (instantaneous or averaged over a period of 1, 15, 30 min, 1 hr, 4, 8, 12, 16 and 24 hr set.).
	4. Diurnal variation, standard deviation, regression and other statistical parameter reporting possibilities with various available mathematical methods.
	5. If required separate report generation procedures have to be developed for which firm will be responsible for project duration.
	6. Daily report from each station should be generated and sent through email for hourly data of each parameter (including meteorological parameters, diagnostics of instruments and calibration of instruments if performed during that day) automatically format for which can be mutually agreed upon.
	7. Data should be downloadable in Excel Sheet, CSV format through user selection.
	8. Provision should be there to use raw as well as validated data for generation of all types of graphics including wind roses and pollution roses.

### SECURITY

* 1. Software should be totally secured with protection against virus, malware etc.
	2. Security device like firewall for VPN Tunneling should be installed.

### OTHER TECHNICALCONDITIONS

1. Compatible Hardware required for data transmission through Data Display Connection Device has to be installed.
2. Should support the latest formats of Windows 32 bit or 64 bit. Any new patches developed or upgraded software during project duration should be provided without additional cost.
3. Manual of complete system should be provided.
4. Firm should provide the hardware required for data acquisition along with all the software’s required like OS, Networking software, Remote functionality software and should maintain hardware and software for project duration.
5. All software’s like OS, Data Acquisition Software, Remote Calibration Software, Content Management Software etc. used for the entire project, should be either open source or with license. Copy of licenses should be provided to SPCB/CPCB.

### DISPLAY BOARD DATA TRANSMISSIONDEVICE

|  |  |  |
| --- | --- | --- |
| **S. N** | **Item Desk.** | **Specifications** |
| 1. | PROCESSOR | Intel® Corei5 equivalent Or Better |
| 2. | Memory | 6 GB, Memory slots for Micro SD or full size SD card slot with Memory support for at-least 8 GB |
| 3. | Ports | 1. One HDMI
2. LAN Port for Ethernet Network Connection
3. Minimum of 3 USB Port with support for USB

2.0 or USB 3.0. |
| 4. | OS Support | Linux, or Windows OS |
| 5. | Communication Options | 1. LA Communication
2. Wi-Fi Communication – Wi-Fi Hotspot enabled/ GPRS Comm. Enabled
 |
| **S. N** | **Item Desk.** | **Specifications** |
| 6. | Power Supply | 5 to 12 V DC through 220 V 50Hz AC Supply adapter or USB driven. |
| 7. | Size | Mechanical Chassis Size not to exceed 10’’ x 6’’x 6’’ with standalone tower/box. |
| 8. | Operating Environment | Operating Temperature 0° C to +50° C Humidity upto90% |
| 9. | Device Support | 05 Years |
| 10. | Antivirus | It should be secured. If Windows, than licensed anti- virus should be there during the project duration. |
| 11. | General | Supplier will configure and deploy the communication mechanism.Complete manual of the device should be provided. |
| 12 | Accessories | 01 Meter HDMI Cable |
| 13. | Internet | To be provided by the vendor either through GSM SIM or through Wi-Fi Enabled Dongles. |
| 14. | Display Board should show | Last data saved. |
| 15. | Display board should show | Last updated time should be displayed |
| 16 | Software | The vendor is responsible to provide software which can download the data from Station computer, AQI,Advertisements etc. store it and display on the Display Board seamlessly. |

#### DAY LIGHT & NIGHT VISIBLE TRUE COLOR DATA DISPLAYSYSTEM

1. **LOCATION NEAR TO CAAQM STATIONOR at location specified by PPCB**

|  |  |  |
| --- | --- | --- |
| 1. | Size of Display System ( H X W ) feet and Pixel | 4 X 8 feet , P6, 6mm (+/- 0.5 mm ) pixel pitch, |
| 2. | Visibility Range | ~10 Meters (Day time) |
| 3. | Brightness | 7000 NIT or higher |
| 4. | Display of Color Elements | SMD 3535 or better |
| 5. | Minimum Life span of the system | LED Life 100000 Hours |
| 6. | Viewing angle | Viewing angle of 140o Horizontal/140o Vertical |
| 7. | Operating and non-operating Temperature | -15 to 550 C |
| 8. | No of Color | 281 trillion Colors , 256 brightness level dimming capability |
| 9. | Data processing | 16 bit data processing, 100 % Digital |
| 10. | Scan rate and refresh frequency | Scan Ratio 1:1 and with minimum 1920 Hz refresh frequency |
| 11. | LED internal and External Cabinet type ,Serviceability | Internal LED frame should be made of Aluminium and External cabinet should be factory made without pin holes , LED Display should be serviceable from front and back. |
| 12. | Color Temperature - Adjustable | 4500 - 9000 K range |
| 13. | Input Power Requirement/ Consumption | 220 V, 50/60Hz , Power consumption 200 W (maximum ) / m2 |
| 14. | Display Board Mounting | Structure based upon location. Uni-Pole (05 meters) arrangement or Handing is in the scope of supplier |
| 15. | General | The system should also have the facility to display the environmental picture through video camera/vcr/cd player etc. for public awareness. |
| 16. | Power Cable Laying | Depending upon location, cabling is to be done by the firm |
| 17. | Device at Display Board to pick up data from stations and transmit it to LED Display. | Display data connectivity device/system with GSM SIM has to be installed nearby LED board which will pick up data from station computer through Internet. LED to be placed away from through Internet .LED to be placed away fromthe station premises. |
| 18. | Certification | BIS |
| 19. | IP Rating | Display Module IP67, Cabinet IP 65 |

1. **DAY LIGHT & NIGHT VISIBLE TRUE COLOR DATA DISPLAY SYSTEM LOCATION AT PUNJAB POLUTION CONTROL BOARD(PPCB) OR ANY OTHER LOCATIONS AS SPECIFIED BY PPCB**

|  |  |  |
| --- | --- | --- |
| 1. | Size of Display System ( H X W ) feet and Pixel | 4 X 8 feet , P6, 6mm (+/- 0.5 mm ) pixel pitch, |
| 2. | Visibility Range | ~10 Meters (Day time) |
| 3. | Brightness | 7000 NIT or higher |
| 4. | Display of Colour Elements | SMD 3535 or better |
| 5. | Minimum Life span of the system | LED Life 100000 Hours |
| 6. | Viewing angle | Viewing angle of 140o Horizontal/140o Vertical |
| 7. | Operating and non-operating Temperature | -15 to 550 C |
| 8. | No of Color | 281 trillion Colors , 256 brightness level dimming capability |
| 9. | Data processing | 16 bit data processing, 100 % Digital |
| 10. | Scan rate and refresh frequency | Scan Ratio 1:1 and with minimum 1920 Hz refresh frequency |
| 11. | LED internal and External Cabinet type ,Serviceability | Internal LED frame should be made of Aluminium and External cabinet should be factory made without pin holes , LED Display should be serviceable from front and back. |
| 12. | Color Temperature - Adjustable | 4500 - 9000 K range |
| 13. | Input Power Requirement/ Consumption | 220 V, 50/60Hz , Power consumption 200 W (maximum ) / m2 |
| 14. | Display Board Mounting | Structure based upon location. Uni-Pole (05 meters) arrangement or Handing is in the scopeof supplier |
| 15. | General | The system should also have the facility to display the environmental picture through video camera/vcr/cd player etc. for public awareness. |
| 16. | Power Cable Laying | Depending upon location, cabling is to be done by the firm |
| 17. | Device at Display Board to pick up data from stations and transmit it to LED Display. | Display data connectivity device/system with GSM SIM has to be installed nearby LED board which will pick up data from station computer through Internet. LED to be placed away from through Internet .LED to be placed away fromthe station premises. |
| 18. | Certification | BIS |
| 19. | IP Rating | Display Module IP67, Cabinet IP 65 |

1. **ANNEXURE**
2. **Drawing of a CAAQM Station**





|  |  |  |  |
| --- | --- | --- | --- |
| 1. | Roof/Wall mounted split AC | 9. | Working table  |
| 2. | 19"RACK | 10. | Racks for spare parts  |
| 3. | Gas Bottles  | 11. | Ambient air sampling system  |
| 4. | Mast for meteorological sensor | 12. | Dust sampling system (PM10 & PM2.5) |
| 5. | Battery box for UPS | 13. | Sun Shed  |
| 6. | UPS Unit (5 and 10 kVA) | 14. | Air conditioning unit |
| 7. | Electric supply box | 15. | UPS Room AC (1 Ton capacity) |
| 8. | Exhaust fan |  |  |

1. **Architecture of CAAQM System**

1. **Protocol for Data Transmission from CAAQM Stations**

Presently CPCB is operating NAQI network which uses this protocol mentioned below for the data collection at central server to generate NAQI which is made available to the public. The Instrument Supplier will have to generate the data output immediately after installing the CAAQMS at any location in this format so that station gets integrated into the existing system immediately.

However, the proposed procedure given in this document of data management through ISO 7168 format would be applied after proper system checks and setup. In parallel both systems will be operated for nearly six months and finally, ISO based system will be adopted for future data management from CAAQMS in the entire country.

#### Data Format

* Data file on real time basis having 15 minutes average values in a prescribed format attached at Annexure-I should be generated at the station for which Instrument Supplier irresponsible.
* File should be updated after every 15minutes.
* Data intervals like 00:15, 00:30, 00:45, 01:00 should be fixed at the station.
* Station file name should be exactly as the name of the station to be displayed on the web portal. i.e. Sanath Nagar, Nehru Nagar. Here precaution is to be taken that no space between words should be given or no special characters should be used.
* File should be recorded in a folder c: \data \sanathnagardata.txt
* File should allow data appending sequentially.
* Date of last file record appended in the file should be recorded and data afterwards be placed in the data file.
* File appending should continue subject to max 97 lines. First in First out mechanism shall be followed in keeping file size to 97lines.
* Hence, in the specified folder c:\Data\ there will be a single file

Which will keep appending as per format attached.

* Duplicate entry of any data should not be made in the file.
* System should have capability to create previous record data file for which user will give the date. This is required to have lost data makeup in the final database, if any.

#### Data Mapping

* Protocol for each parameter is fixed as below:
	1. 15 Minutes average value will be provided by the operator of the CAAQMS
	2. Each SPCB will have the parameter as mentioned in the table only. Not even a small gap or space is provided other than the mentioned table is acceptable.

#### Standard Parameter Naming Protocol and Conversion factors Table

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameters Name** | **Parameter Abbreviations** | **Unit** | **Conversion factors****at 25°C** |
| Rack Temperature | Temp | °C |  |
| Carbon Monoxide | CO | mg/m3 | 1ppm=1.145mg/m3 |
| Sulphur Dioxide | SO2 | µg /m3 | 1ppb=2.62 µg/m3 |
| Nitric Oxide | NO | µg /m3 | 1ppb=1.23 µg/m3 |
| Nitrogen dioxide | NO2 | µg /m3 | 1ppb=1.88 µg/m3 |
| Oxides of Nitrogen | NOx | Ppb | -- |
| Ozone | Ozone | µg /m3 | 1ppb=1.96 µg/m3 |
| Particulate Matter less than | PM10 | µg /rn3 | -- |
| 10 Micron size |  |  |  |
| Wind Speed | WS | m/s | -- |
| Wind Direction | WD | Deg | -- |
| Ambient Temperature | AT | °C | -- |
| Relative Humidity | RH | % | -- |
| Barometric Pressure | BP | mmHg | -- |
| Solar Radiation | SR | W/mt2 | -- |
| Rain Fall | RF | Mm | -- |
| Vertical Wind Speed | VWS | Degree | -- |
| Particulate Matter less than2.5 micron size | PM2.5 | µg /m3 | -- |
| Benzene | Benzene | µg /m3 | 1ppb=3.19 µg/m3 |
| Toluene | Toluene | µg /m3 | 1ppb=3.77 µg/m3 |

|  |  |  |  |
| --- | --- | --- | --- |
| Xylene | Xylene | µg /m3 | 1ppb=4.34 µg/m3 |
| Ethyl Benzene | Eth-Benzene |  | 1ppb=4.34 µg/m3 |
| M+P\_Xylene | MP-Xylene |  | 1ppb=4.34 µg/m3 |
| Methane | CH4 | µg /m3 | 1ppb=0.65 µg/m3 |
| Ammonia | NH3 | µg /m3 | 1ppb=0.70 µg/m3 |
| Formaldehyde | HCHO | µg /m3 | 1ppb=1.23 µg/m3 |
| Mercury | Hg | µg/m3 | 1ppb=8.20 µg/m3 |

Note: 1. Any other parameter can be added with the prior approval of IT Division ONLY.

#### Internet Connectivity

* Internet connectivity should be available on 24X7 basis for data transmission with an uptime of 99.9%. For this purpose every CAAQM station should have two kind soft connection:
	+ 1. Leased Line Circuit of at least 01 Mbps capacity
		2. Broad Band connectivity through telephone line. Both facilities should be configured in ready to use condition. If possible auto failover should be created.

Note: Connectivity through Data card is not acceptable except in any special circumstances, where both of these types of connectivity’s are not available. For such case PPCB IT Division shall be consulted before taking a final decision.

#### Other Information:

1. Area Map showing station location
2. Latitude, Longitude and altitude of the station
3. Photo of station along with nearby areas
4. One page write-up about the station activities in the vicinity of station including major pollution sources like nearby road, rail, restaurants, generator sets, etc.

#### Annexure — I

**File Name: sanath Nagar**

1,2,3,4,5,6,7,8,

Station name, Parameter, Date from, Date to, Value, calibration flag, maint flag, Remark,

Sanathnagar,CO,27-04-2015 13:00,27-04-2015 13:15,0.2497,0,0,analyserfaulty,

Sanathnagar,C0,27-04-2015 13:15,27-04-201513:30,0.2470,0,0,analyserfaulty,

Sanathnagar,C0,27-04-2015 13:30,27-04-201513:45,0.2470,0,0,analyserfaulty,

Sanathnagar,C0,27-04-2015 13:45,27-04-201514:00,0.2470,0,0,analyserfaulty,

Sanathnagar,Ozone,27-04-2015 13:00,27-04-2015 13:15,59.6710,0,0,flowproblem,

Sanathnagar,Ozone,27-04-2015 13:15,27-04-201513:30,59.5960,0,0,analyserfaulty,

Sanathnagar,Ozone,27-04-2015 13:30,27-04-201513:45,59.5960,0,0,analyserfaulty,

Sanathnagar,Ozone,27-04-2015 13:45,27-04-201514:00,59.5960,0,0,analyserfaulty,

Sanathnagar,N0,27-04-2015 13:00,27-04-2015 13:15,0.5922,0,0,analyserfaulty,

Sanathnagar,N0,27-04-2015 13:15,27-04-201513:30,0.4435,0,0,0,

Sanathnagar,N0,27-04-2015 13:30,27-04-201513:45,0.4435,0,0,0,

Sanathnagar,N0,27-04-2015 13:45,27-04-201514:00,0.4435,0,0,0,

Sanathnagar,So2,27-04-2015 13:00,27-04-201513:15,3.5233,0,0,0,

Sanathnagar,So2,27-04-2015 13:15,27-04-201513:30,3.7278,0,0,0,

Sanathnagar,So2,27-04-2015 13:30,27-04-201513:45,3.5233,0,0,0,

Sanathnagar,So2,27-04-2015 13:45,27-04-201514:00,3.7278,0,0,0,

Sanathnagar,RT,27-04-2015 13:15,27-04-201513:30,33.2260,0,0,0,

Sanathnagar,RT,27-04-2015 13:30,27-04-201513:45,33.2240,0,0,0,

Sanathnagar,AT,27-04-2015 13:45,27-04-201514:00,33.0960,0,0,0,

Sanathnagar,AT,27-04-2015 14:15,27-04-201514:30,33.3740,0,0,0,

Sanathnagar,RH,27-04-2015 13:15,27-04-201513:30,41.3080,0,0,0,

Sanathnagar,PM10,27-04-2015 13:15,27-04-201513:30,30.3000,0,1,analyserfaulty,

Sanathnagar,PM10,27-04-2015 13:30,27-04-201513:45,30.3000,1,0,analyserfaulty,

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Please note:

Here 0-zero stands for normal operation of instruments in **calibration flag status**

1-Stands for calibration mode ON and data will not be considered for averaging purpose.

Same is true for Maintenance mode where 0-normal and 1 maintenance mode ON

**References:**

1. Technical Handbook for Installation, Maintenance, Calibration, Data Connectivity and Data Quality Check of Continuous Ambient Air Quality Monitoring System (Real-time)
2. Guidelines for the Measurement of Ambient Air Pollutants, Volume-II
3. National Ambient Air Quality Standards (2009)