

**GUIDANCE PACK FOR APPLICATION OF THE EMISSION LICENCE FOR STATIONARY SOURCES AS PER AIR QUALITY REGULATIONS, 2014.**

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**NINTH SCHEDULE**  
**EMISSION LICENSES**

r41

**Form IV: Application for Initial Emission License**

1. Name of Company .....
2. Address  
    P.O. Box.....  
    Tel..... Fax..... E-mail.....  
    Name of Contact Person .....
3. Location  
    LR No..... Street..... Area..... Division.....  
    Town.....District..... Province.....
4. Type of Industry.....
5. Name(s) of emitting Equipment.....  
.....  
.....  
.....  
.....
6. Site Plan Layout, (attach sketch)  
    (a) *Distance of the Stack to the nearest building*.....  
    (b) *Height of the above referred building*.....  
    (c) *Nearest sensitive area or facility*.....  
    (d) *Immission (fall-out) point*.....
7. Operating Emission levels  
    (i) .....
- (ii) .....
- (iii) .....
- (iv) .....
8. Proposed Emission Control Mitigation Measures  
    (v) .....
- (vi) .....
- (vii) .....
- (viii) .....

9. Additional information required .....

10. Start-up, and shut-down of the equipment

- a) Methods.....
- b) Expected Frequency of Occurrence .....
- c) Duration of occurrence.....
- d) Projected emitted Pollutants
  - (i) .....
  - (ii) .....
  - (iii) .....
  - (iv) .....

11. (a) Nature of emissions (gaseous, Particulates)

- (i) .....
- (ii) .....
- (iii) .....
- (iv) .....

(b) Concentration of the emissions

- (i) .....
- (ii) .....
- (iii) .....

Signature of Applicant .....Date.....

Position .....

*FOR OFFICIAL USE*

Approved/Not approved.....

Dated this.....day.....of 20.....

Signature.....

(Seal)

## **ANNEX 1: GUIDELINES ON FILLING THE EMISSION LICENCE APPLICATION FORM**

### **Form IV: Application for Initial Emission License**

r41

1. Name of Company: **(As indicated in the Certificate of Registration)**
2. Address:
  - P.O. Box: **(As indicated in the Letter Head)**
  - Tel: **(As above)**; Fax: **(As above)**; E-mail: **(official email details)**

Name of Contact Person: **(Legal Entity of the company)**
3. Location
  - LR No. **(As indicated in the title deed)**; Street: **(Name of road or street)**; Area: **(Name of the location)**; Division: **(Name of Sub-County)**; Town: **(Name of urban center)**; District: **(Name of County)**; Province: **NA**
4. Type of Industry: **(Indicate production sector)**
5. Name(s) of emitting Equipment:
  - e.g.:**
    - a) **Generators;**
    - b) **Boilers**
    - c) **Incinerators**
    - d) **Production equipment**
6. Site Plan Layout, (attach sketch)
  - (a) Distance of the Stack to the nearest building (X meters)**
  - (b) Height of the above referred building(Y meters)**
  - (c) Nearest sensitive area or facility (As guided under 6<sup>th</sup> Schedule - Annex 6)**
  - (d) Immission (fall-out) point (Point determined from the dispersion model)**
7. Operating Emission levels: **(Allowable emission limits as indicated in the 3<sup>rd</sup> Schedule –Annex 7)**
  - For instance:**
    - (a) Parameter: V  $\mu\text{g}/\text{Nm}^3$**
    - (b) Parameter: X  $\mu\text{g}/\text{Nm}^3$**
    - (c) Parameter: Y  $\mu\text{g}/\text{Nm}^3$**
    - (d) Parameter: Z  $\mu\text{g}/\text{Nm}^3$**
8. Proposed Emission Control Mitigation Measures: **(As guided under 7<sup>th</sup> Schedule-Annex 8)**
  - For instance:**
    - (a) PM – Mechanical Collectors (cyclones)**
    - (b) VOC – Adsorption/absorption systems, flares, oxidizers and bio filters**

- (c) **SOX – dry or wet scrubbers**
- (d) **NOX – Catalytic reduction systems or EGR**

9. **Additional information required: Attach Stack Emission Report and Ambient Air Quality Monitoring Report as per the attached report format – Annex 2 and Annex 3 respectively.**

**NB. Stack Emission and Ambient Air Quality Measurements shall be carried out by a laboratory designated by NEMA for the Air media. (List of designated laboratories indicated under Annex-4)**

10. Start-up, and shut-down of the equipment
- a) Methods. **Emission Reduction measures**
  - b) Expected Frequency of Occurrence: **(Number of times in a day)**
  - c) Duration of occurrence: **(Time in minutes and start time of the occurrence)**
  - d) Projected emitted Pollutants  
**For instance:**
    - (i) **Particulate Matter**
    - (ii) **Volatile Organic Compounds**
    - (iii) **Sulphur Oxides**

11. (a).Nature of emissions (gaseous, Particulates)
- (i) **Particulates**
  - (ii) **Gaseous**
  - (iii) **Odour**

- (b) Concentration of the emissions  
**Emission Results from the stack emission report.**
- (a) **Parameter:  $V_1 \mu\text{g}/\text{Nm}^3$**
  - (b) **Parameter:  $X_1 \mu\text{g}/\text{Nm}^3$**
  - (c) **Parameter:  $Y_1 \mu\text{g}/\text{Nm}^3$**
  - (d) **Parameter:  $Z_1 \mu\text{g}/\text{Nm}^3$**

Signature of Applicant .....Date.....

Position (Designation of the legal entity

FOR OFFICIAL USE

Approved/Not approved.....

Dated this.....day.....of 20.....

Signature.....

(Seal)

**NB. Attach a copy of bank deposit slip for payment of Emission licence and its application fees as guided under Annex 5.**

## **Annex 2: Stack Emission Measurement Report Format**

The results summary report must be signed by the licensee.

### **2(a) Format for the Stack Emission Measurement Report**

The stack emission measurements report must include:

#### **1.0 General Source Information**

- 1.1 Name of facility
- 1.2 Location of plant (Physical address)
- 1.3 GPS Reference
- 1.4 Legal Entity at the facility including their telephone numbers and Email
- 1.5 Certification by the legal

#### **2.0 Testing Firm Information**

- 2.1 Name and address of the firm conducting the testing and Analysis.
- 2.2 Responsible person at the testing firm and telephone number.
- 2.3 Certification by team leader
- 2.4 Certification by reviewer

#### **3.0 Introduction**

- 3.1 Purpose of the test
- 3.2 Date and time of the test
- 3.3 Test location
- 3.4 Type of process
- 3.5 Air Pollutants tested
- 3.6 Aim of the Measurements
- 3.6 Observers' names if available
- 3.7 Any other important background information

#### **4.0 Objective**

- 4.1 Statement of objectives of the monitoring plan
- 4.2 Specific objectives

#### **5.0 Production Process Information**

- 5.1 Representative raw materials and operation
- 5.2 Types of fuel used in production
- 5.3 A description of the process equipment, including a process flow sheet.
- 5.4 Type and quantity of raw materials, catalysts, and products being used or produced in the process.
- 5.5 Maximum rated capacity of the process.
- 5.6 Actual maximum operating capacity of the process.
- 5.7 Operating capacity during the previous six-months period.
- 5.8 Process data being monitored and recorded to ensure representative operation throughout the test, including during the sampling interval.
- 5.9 Normal process operating schedule during a 24-hour period.
- 5.10 Normal maintenance schedule for this process.

## **6.0 Emission Control Equipment:**

6.1 Description of emission control system, including the types of control equipment, manufacturer of control equipment, the rated capacity and efficiency of the control equipment.

6.2 Schematic diagram identifying gas flow from source point to exit point, including identification of all control devices, fans and bypasses

6.3 Data to be monitored and recorded to ensure representative operation of the control equipment during testing and the sampling period for recording.

6.4 Minimum acceptable values of all control devices parameters such as flow rates, pressure drops, temperature, and voltage of electrical input.

6.5 Description of any preconditioning of gases used with control equipment.

6.6 Normal maintenance schedule on control equipment for the previous year

6.7 Description of source and control devices.

6.7 Process and control equipment diagram.

6.8 Process and control equipment data.

6.9 Demonstration of any specially-required operation

## **8.0 Operating Conditions**

8.1 Type of process.

8.2 Plant operating conditions during the test

8.3 Brief description of the section of the plant under test relating it to the entire plant

## **9.0 Monitoring Plan Details:**

9.1 Name and model of equipment used,

9.2 A description of the emission sampling and analysis equipment including a schematic diagram of the sampling train.

9.3 Calibration certificates of the equipment;

9.4 Methods of measurement applied, and

9.5 Quality assurance program; and

9.6 Relevant quality control steps for the monitoring

## **10.0 Stack Details:**

10.1 Internal stack/duct diameters or stack/duct dimensions (metres) at the test plane;

10.2 Internal stack/duct diameter or stack/duct dimensions (metres) at the outlet of the stack;

10.3 Stack height in metres above ground level;

10.4 Location of sampling plane with respect to the nearest upstream and downstream flow disturbances

10.5 Stack/duct location (latitude and longitude with datum reference) and reference within the plant altitude above mean sea level of the base of the stack;

10.6 Attach photographs of the full stack showing measurements in progress.

10.7 Attach photographs of the full emission plume from the stack outlet while measurements are ongoing

## **11.0 Details of the Sampling Point:**

- 11.1 Description of the number of sampling ports;
- 11.2 A scale diagram showing each discharge point with each testing access port; and
- 11.3 Distances from upstream and downstream flow disturbances;
- 11.4 A scale diagram showing the sampling platform and access;
- 11.5 the dimensions of all access ports.
- 11.6 Sampling port location and cross-section with dimensions.
- 11.7 Sampling port description, including labeling systems

## **12.0 Emission Point Information:**

- 12.1 A diagram of the stack showing the dimensions, and the configuration of the sampling location, location of continuous emission monitor (CEM) probes, and the distances to the nearest upstream and downstream flow interferences.
- 12.2 A cross-sectional sketch of the stack at the sampling location, showing the locations of the sampling traverse points.
- 12.3 Estimated flue gas conditions at the sampling location, including temperature, moisture content, and velocity.

## **13.0 Test Methods**

- 13.1 Types of pollutants to be sampled and analysed
- 13.2 A description of the sampling and analysis procedures
- 13.3 Brief description of test procedure(s) used and any variations from those procedure(s) and reasons for selecting non-recommended methods;
- 13.4 Description of analysis procedures, and any deviations from standard procedures
- 13.5 Documentation for any proposed variations from approved/standard procedures
- 13.6 Sample time if different than recommended
- 13.7 Table of results from the run summaries and raw data
- 13.8 Provide sample calculations
- 13.9 Attach raw data countersigned by the Proponent and Authority Representative(Observer)

## **14.0 Data and Results**

### ***14.1 Gaseous Emissions***

- a) A photograph of the whole stack presenting sampling in progress for gaseous emissions and of the stack sampling point.
- b) Legible copies of the measuring equipment data-Logger print-outs.
- c) Table of raw data
- d) Table of results referenced to STP and corrected for the relevant gas concentration

### ***14.2 Particulate Matter Emissions***

- a) Sampling dates
- b) Sampling time (min)
- c) End of run dry gas meter reading ( $m^3$ )
- d) Start of run dry gas meter reading ( $m^3$ )



- e) Total Volume sampled ( $\geq 1\text{m}^3$ )
- f) Standard volume sampled ( $\text{dsm}^3$ )
- g) Moisture content, % v/v or w/v;
- h) Average stack/duct gas temperature, K or degrees Celsius;
- i) Average stack/duct gas velocity (metres/second) at STP;
- j) Average ambient barometric pressure during the test (kilopascals);
- k) Average stack/duct gas pressure during the test (Pascals);
- l) Average stack/duct gas flow rate, (cubic metres/second) at STP
- m) Dry standard particulate concentration corrected ( $\text{mg corr.Dsm}^{-3}$ )
- n) Average Oxygen content
- o) Percent isokinetic (%I)
- p) Composition of stack/duct gas where applicable, % volume, dry basis;
- q) Concentration of the pollutant under test such as total particulates, heavy
- r) metals, or any specific gaseous pollutant,  $\text{mg}/\text{m}^3$  at STP, dry basis, adjusted if
- s) necessary to reference conditions;
- t) Particulate emission rate ( $\text{kg hr}^{-1}$ )
- u) Estimate of the measure of uncertainty for the test results;
- v) Comments on whether data exceed the Authority emission limits and any other factors which may have affected results.
- w) Photographs of the used particulate matter filters for all the runs
- x) ***Ensure that the number of runs conform to statistical norms***

#### **15.0 Data Sheets:**

Copies of all field data sheets used during the test, including data sheets used to record process and control equipment parameters.

#### **16.0 Chain of Custody:**

- a) A description of the procedures that were followed to maintain the integrity of the samples collected.
- b) Copies of chain of custody seals and data sheets.

#### **17.0 Quality Control:**

- a) Calibration sheets for the dry gas meter, pitot tube, nozzle, and other equipment requiring calibration.
- b) Quality assurance control charts for the analytical procedures used in the analysis of the test samples.
- c) A list of pre-weighed filters during particulate emissions testing.

#### **18.0 Summary of Results**

- a) Process data
- b) Emission results.
- c) Allowable emissions.
- d) Discussion of errors, both real and apparent.

#### **19.0 Discussion and Recommendations**

#### **20.0 Annexes**

- a) Complete results with example calculations.
- b) Copies of original field and laboratory data sheets.

- c) Copies of original production data signed by plant official.
- d) Test log- data loggers
- e) Project participants and titles.
- f) Related correspondence.

**NB.**

- (i) *If an air pollutant cannot be detected, results **must not** be quoted as zero but as less than the method's limit of detection.*
- (ii) *All volumes and concentrations are normally reported as dry at a temperature of 0°C and at an absolute pressure of 101.3 kilopascals (kPa).*
- (iii) **Attach a photograph indicating the relative location of the sampling point along the stack length.**
- (iv) **Indicate the last volume sampled and the serial numbers of the equipment**

(Note: STP is 0° Celsius and 1 standard atmosphere pressure.)

**Other Requirements:**

**1) Submission of the Stack Emission Measurement Report**

**The Submission of the Stack Emission Measurement Report/Test results must be forwarded to the Authority as outlined in the Emission Licence conditions, and in any case within Eight (8) weeks after the test date. The report should be spiral bound.**

2) Where testing for reporting to the Authority is of a continuous nature over an extended period of time (greater than that for a corresponding manual stack emission test), the results must be reported as indicated in the emission licence or as agreed beforehand with the Authority.

3) Reports must be submitted to the Authority in the format required by the Authority

4) This is to be accompanied by a letter of certification from the licensee (facility).

5) The letter of certification is a statement by a person authorised to sign on behalf of the licensee that the provided report is a true and correct record of the testing conducted on the premises.

6) Testing and analytical laboratory information: All information concerning testing, monitoring and ancillary equipment, charts, raw data, calibration records and other relevant documentation must be attached to the report as indicated under **item 11 below**.

7) Monitoring equipment includes both ambient and stack monitoring equipment for both continuous or discrete testing. All data gathered from the monitoring equipment, along with a copy of the test report, must be stored on a computer data system available through the company premises for *seven years or the operational period of the plant whichever is the lesser*.

8) Information supplied may, at the discretion of the Authority, be published in full, in summary form, in annual or other reports with reference to the source.

9) The test and analytical laboratories must determine a person who is a director, or legally responsible person in the company to sign documents on behalf of the company, to verify the correctness of any reports or documents submitted to the Authority. All documents related to a test, submitted to the Authority or under emission licence requirement must be signed by the nominated person.

### **10. Adjustment to reference conditions**

10.1 Under the Air Quality Regulations, it is a mandatory requirement that all stack emissions must be reported to 0°C, 1 standard atmosphere pressure and on a dry basis (STP dry).

10.2 In addition some emissions defined under the emission standards must be adjusted to a reference concentration of oxygen or carbon dioxide. This requires that oxygen and/or carbon dioxide concentration must also be measured. Adjustments are to be made as follows:

#### 10.2.1 Adjustment to a reference concentration of carbon dioxide

$$C_a = C_i \times (CO_{2r}) / (CO_{2m})$$

where:

$C_a$  = adjusted emission concentration at 0 °C and 1 standard atmosphere on a dry basis having a specified reference concentration of carbon dioxide volume %  $CO_{2r}$

$C_i$  = initial unadjusted pollutant emission concentration at 0 °C and 1 standard atmosphere on a dry basis and at known carbon dioxide concentration ( $CO_{2m}$ ) before admixture with air or other gases

$CO_{2r}$  = a specified reference concentration of carbon dioxide (volume %)

$CO_{2m}$  = actual measured carbon dioxide concentration (volume %)

#### 10.2.2. Adjustment to a reference concentration of oxygen

$$C_b = C_i \times (20.9 - O_{2r}) / (20.9 - O_{2m})$$

where:

$C_b$  = adjusted emission concentration at 0 °C and 1 standard atmosphere pressure having a specified reference concentration of oxygen volume %  $O_{2r}$

$O_{2r}$  = a specified reference concentration of oxygen (volume %)

$C_i$  = initial unadjusted emission concentration at 0 °C and 1 standard atmosphere on a dry basis and at a known oxygen concentration ( $O_{2m}$ ) before admixture with air or other gases

$O_{2m}$  = actual measured oxygen concentration (volume %)

In both adjustments, the value reported to the Authority for purposes of compliance is the adjusted value ( $C_a$  or  $C_b$ ) at its reference carbon monoxide or oxygen concentration along with the measured oxygen and/or carbon monoxide concentration.

11. Data Charts

**USEPA Method 1a**

**USEPA Method 1— Sample and Velocity Traverses for Stationary Sources**

**Table 1 Required Number of Traverse Point for Sampling Sites**

(Clause 5.3)

Range of Stack Diameter m	Total No. of Traverse	Number of Traverse	
		Plane 1	Plane 2
(2)	(3)	(4)	(5)
ID up to 0.3			
ID>0.3 up to 0.6			
ID>0.6 up to 1.2			
ID>1.2 up to 2.4			
ID>2.4 up to 5.0			
ID > 5.0			

Signed by: Laboratory Analyst .....Date.....

Countersigned by Facility Representative.....Date.....

Countersigned by Authority Observer Representative.....Date.....

**USEPA Method 2a**

**USEPA Method 2: Velocity Traverse Determination**

Table: Velocity Traverse Data

- a) Plant or Facility \_\_\_\_\_
- b) Date \_\_\_\_\_
- c) Run No. \_\_\_\_\_
- d) Stack Dia. or Dimensions, (M.) \_\_\_\_\_
- e) Stack Height. or Dimensions, (M.) \_\_\_\_\_
- f) Barometric Press., (mm. Hg) \_\_\_\_\_
- g) Cross Sectional Area, ( $M^2$ ) \_\_\_\_\_
- h) Operators \_\_\_\_\_
- i) Pitot Tube I.D. No. \_\_\_\_\_
- j) Avg. Coefficient,  $C_p$  = \_\_\_\_\_

k) Last Date Calibrated \_\_\_\_\_

Schematic of Stack Cross Section

Traverse Pt. No.	Vel. Hd., $\Delta p$ (mm.) H <sub>2</sub> O	Stack temperature		$P_g$ (mm. Hg)	$(\Delta p)^{1/2}$
		$T_s,$ °C (( °deg;)	$T_s,$ °K (°R)		
Average(1)					

Signed by: Laboratory Analyst .....Date.....  
 Countersigned by Facility Representative.....Date.....  
 Countersigned by Authority Observer Representative.....Date.....

**USEPA Method 3a**  
**USEPA Method 3- Gas Analysis for the Determination of Dry Molecular Weight**

Table 3: Sampling Rate Data

Time	Traverse point	Q (liter/min)	% Deviation <sup>a</sup>

Average			

<sup>a</sup> % Dev. =  $[(Q - Q_{avg}) / Q_{avg}] \times 100$  (Must be  $\leq \pm 10\%$ )

Signed by: Laboratory Analyst .....Date.....

Countersigned by Facility Representative.....Date.....

Countersigned by Authority Observer Representative.....Date.....

**USEPA Method 4a**

**USEPA Method 4-1 Moisture Content Determination**

Table 4: Moisture Content

Traverse Pt. No.	Sampling time ( $\Delta$ ), min	Stack temperature $^{\circ}\text{C}$ (( $^{\circ}\text{deg;F}$ )	Pressure differential across orifice meter $\Delta H$ mm (in.) $\text{H}_2\text{O}$	Meter reading gas sample volume $\text{m}^3$ ( $\text{ft}^3$ )	$\Delta V_m$ $\text{m}^3$ ( $\text{ft}^3$ )	Gas sample temperature at dry gas meter		Temperature of gas leaving condenser or last impinger $^{\circ}\text{C}$ (( $^{\circ}\text{deg;F}$ )
						Inlet $T_{m_{in}}$ $^{\circ}\text{C}$ (( $^{\circ}\text{deg;F}$ )	Outlet $T_{m_{out}}$ $^{\circ}\text{C}$ (( $^{\circ}\text{deg;F}$ )	
Average								

Signed by: Laboratory Analyst .....Date.....

Countersigned by Facility Representative.....Date.....

Countersigned by Authority Observer Representative.....Date.....

**USEPA Method 5a**

**USEPA Method 5: Particulate Matter Field Data Sheet**

- l) Plant or Facility \_\_\_\_\_
- m) Date \_\_\_\_\_
- n) Run No. \_\_\_\_\_
- o) Stack Dia. Or Dimensions, (M.) \_\_\_\_\_
- p) Stack Height. Or Dimensions, (M.) \_\_\_\_\_
- q) Barometric Press., (mm. Hg) \_\_\_\_\_
- r) Cross Sectional Area, (M<sup>2</sup>) \_\_\_\_\_
- s) Operators \_\_\_\_\_
- t) Pitot Tube I.D. No. \_\_\_\_\_
- u) Avg. Coefficient, Cp = \_\_\_\_\_
- v) Last Date Calibrated \_\_\_\_\_

Traverse Point Number	Sampling Time (Min)	Vacuum (mm Hg)	Stack Temperature (°C)	Velocity Head (ΔP)mmH <sub>2</sub> O	Pressure Differential across orifice meter (mmH <sub>2</sub> O)	Gas Meter Reading	Gas Sample Temperature at Dry Gas Meter		Temperature	Temperature of Gas leaving condenser or last Impinger
							Inlet (°C)	Outlet (°C)		

Signed by: Laboratory Analyst .....Date.....

Countersigned by Facility Representative.....Date.....

Countersigned by Authority Observer Representative.....Date.....

**2(b) Elements of an Emission Compliance Plan**

The Emission Compliance Plan must include the following:

- a) Description of compliance status with respect to all applicable requirements.
- b) A statement that source will continue to comply with all requirements with which the source is in compliance.
- c) A statement that source will comply with any requirement that becomes effective during term of permit.
- d) For requirements not being complied with, a detailed narrative description of how you will achieve compliance.
- e) A schedule of remedial measures to come into compliance with any requirement not being met. Include any outstanding Environmental Improvement Orders and their dates

- f) An enforceable sequence of proposed actions, with target dates, leading to compliance.
- g) A schedule for submission of certified progress reports at least every 6 months for sources out of compliance



## **Annex 4: Guidelines for Construction of Particulate Matter Sampling and Testing Facilities**

### **Introduction**

Most often the installation of sampling/testing ports is an afterthought in the process of stack construction. However, sampling ports are essential to the stack testing process which is a requirement for demonstrating compliance. The Authority recommends that EPA method 1 should be taken into consideration before stack construction begins.

### **1.1. Selection of a sampling site**

Selection of a proper sampling site is vital to assure representative measurement of pollutant emissions and accurate volumetric flow rate from a stationary source is obtained. Safety and accessibility are essential considerations of site selection. Clearance for sampling equipment, access to electrical power, exposure of personnel to weather, process heat, and presence of hazardous gases must also be considered in construction of sampling facilities.

#### **1 Regulatory Basis**

The Air Quality Regulations, 2014 states:

61 (2) An owner or operator of a controlled facility shall provide portholes, and platforms which shall be conveniently located for easy access and all other facilities required for taking samples of air or emission from any chimney, flue or duct, plant or vessel or any other outlets.

62. Where the Authority requires stack emission tests to be performed under these Regulations, an owner of a facility shall provide the following-

- (a) sampling ports which are adequate for the test methods applicable to the facility;
- (b) safe sampling platforms or other suitable and safe permanent or temporary structures or equipment; and
- (c) safe access to sampling platforms.

#### **2 Sampling Ports**

The ideal sample location would have flow characteristics such that the gas flows in a linear pattern parallel to the axis of the stack or duct, have a uniform velocity profile and not flow in a cyclonic or swirling pattern. The following port location directions are provided to guide you in selecting a stack sampling location close to ideal.

### 1.1. Port Location.

Ports should be located at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, or contraction in the stack, or from a visible flame. For a rectangular stack or duct utilize an equivalent diameter to determine distances from flow disturbances. Calculate the equivalent diameter as follows:

Equivalent Diameter =  $D_e$

$$D_e = \frac{2LW}{L+W}$$

where

$D_e$	=	equivalent diameter, in m;
$L$	=	length of the rectangle, in m; and
$W$	=	width of the rectangle, in m.

### 3.2. Port Type

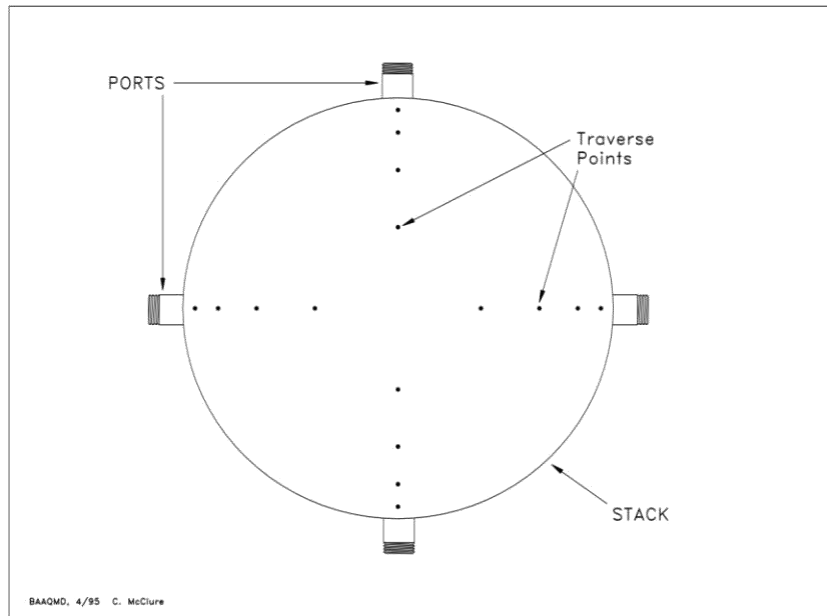
A sampling port should be a welded pipe nipple with screw cap or a pipe with flange. A gate valve should be used for stacks handling hazardous gases or gases over 94°C under positive pressure. Stacks or ducts having a thin wall may be provided with ports consisting of appropriately sized surface holes with plugs. For determination of Total Suspended Particulate (TSP) emissions, the sampling ports must be at least 87.5mm I. D. (Inside Diameter) pipe nipple. Particulate sampling to determine the PM10 or PM2.5 (Particulate Matter less than 10 or 2.5 microns) fraction of the TSP emissions requires sampling ports be 150mm I. D. pipe nipples.

### 3.3 Port Installation

Ports must be flush with the interior stack wall and extend outward from the exterior wall at least 50mm and not more than 150mm. Ports must be located at least 1.2m and not more than 1.5m above the work platform floor and meet clearance zone requirements described below. The ports must be located parallel and in a plane perpendicular to longitudinal axis of the stack.

### 3.4. Number of Ports

For circular stacks, if the sum of the stack inside diameter plus the port length is 1.625m or less, two ports must be installed 90 degrees apart. If this sum is over 1.625m, four ports must be installed 90 degrees apart. See Figure 1.



## 2.1 Figure 1

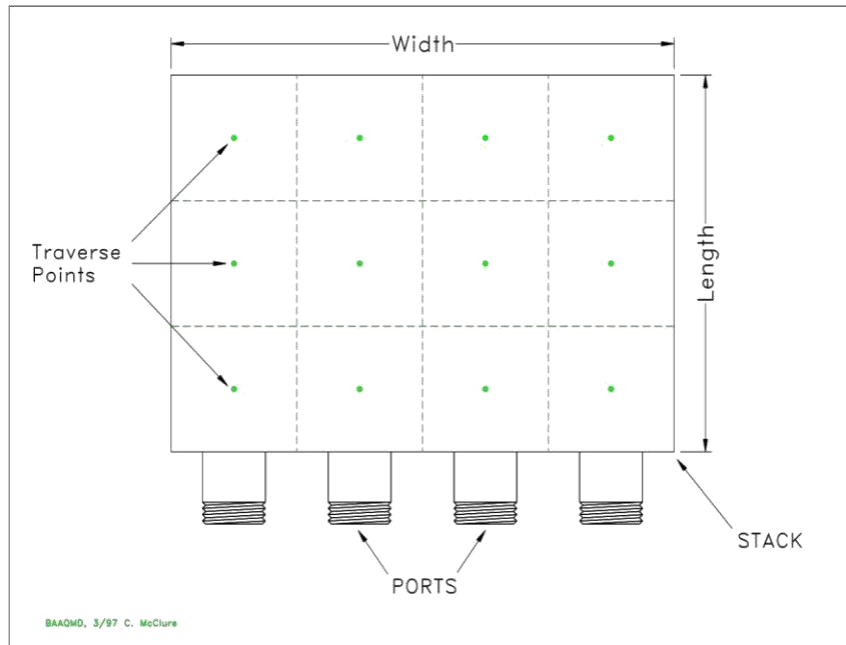
Example of port location for a round stack requiring four ports

In the case of rectangular stacks, an equivalent diameter will be calculated, and a cross section layout (matrix layout) applied. The cross section layout is specified in the Method 1 (EPA Method 1-Sample and Velocity Traverses for Stationary Sources). Locate the number of ports required by the cross section layout on the widest of the two stack sides. Contact the facility manager to provide assistance in determining the correct cross section layout (matrix layout) for rectangular port placement. See Figure 2.

## 3 Work Platform

### 1.2. Size

For a round stack with two-port installation the platform must serve that quarter of the stack and extend at least 900mm beyond each port. It must be at least 1200mm wide. For a circular stack with four-port installation the platform must serve the full circumference of the stack and be at least 1500mm wide. For a rectangular stack the platform must serve the side containing the ports. It must be at least 1200mm wide and extend across the full width of the stack.



3.1 **Figure 2**  
 Example of port location for a rectangular stack with a 4X3 traverse point

**matrix 4.2. Construction**

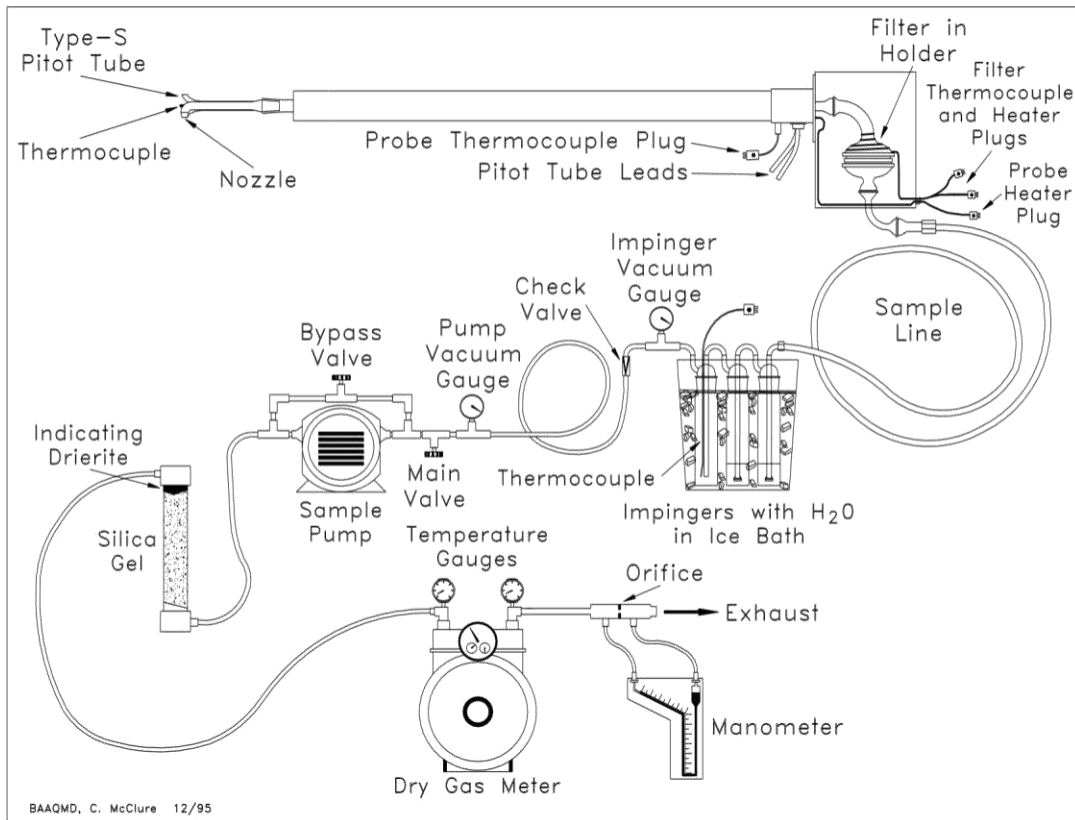
Safe and easy access to the work platform must be provided by stairway, caged ladder, or other suitable means. The platform must have a guardrail and toeboard. It must be able to support 500Kg live load. All construction must conform to the OSHA, 2007 requirements. Platforms more than 21m high require a swinging arm and pulley to assist the lifting of test apparatus.

**2.0. Clearances**

Insertion of a long stack sampling probe with filter assembly on its end is a difficult task. See Figure 3 for a diagram of the sampling probe and equipment. There must be a clearance zone, with no obstructions, around each port extending 300mm above, 600mm below, and 600mm on each side of the port. The zone must extend outward from the end of the port at least one stack diameter plus 900mm. Guardrails that enter the clearance zone must be equipped with removable sections or chains.

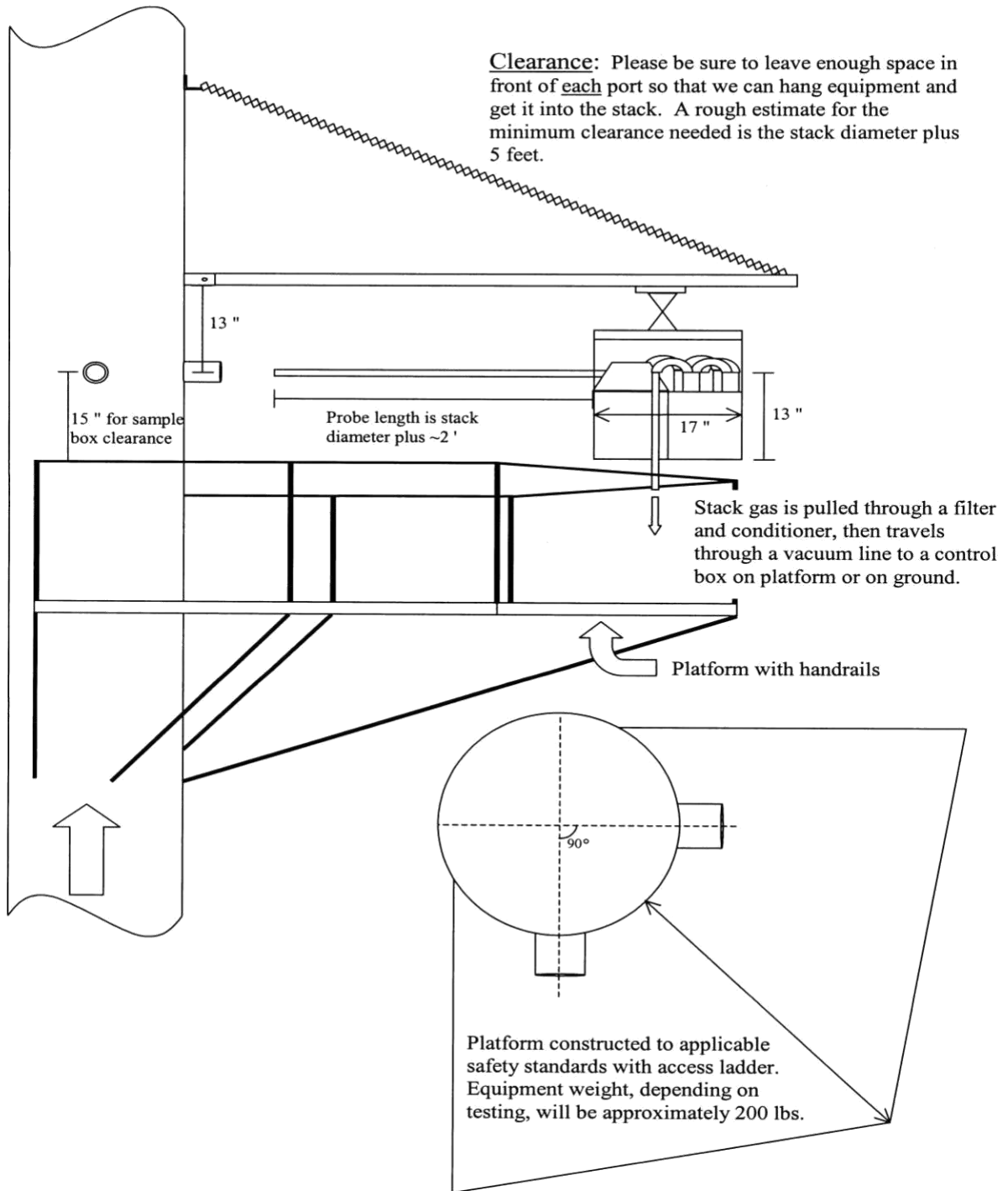
Conducting PM<sub>10</sub> or PM<sub>2.5</sub> sampling requires site-specific clearances and probe support devices, i.e. a support rail system/bracket. See Figure 4. Contact the Facility Manager for site-specific guidance.

## Particulate Sampling Probe and Equipment



3.2 Figure 3 Particulate Sampling Probe and Equipment

## Typical Stack Sampling Access Requirements



**Figure 4: Typical Stack Sampling Access Requirements**

## 4 Power Supply

Sampling platforms over 21m high require two electrical outlets, each capable of supplying 230/115-volt, 15-ampere, 60 cycle AC. Sampling platforms less than 21m high require that two electrical outlets, each capable of supplying 115-volt, 15-ampere, 60 cycle AC be located within 15m of the sampling site.

## 5 Additional Requirements

Additional requirements may be specified for situations with special needs such as flow pattern adjustment, hoist equipment, or variations in the number and location of sampling ports.

Mark the Pitot tube at the points to be sampled accordingly as explained above. Mark with tape, asbestos rope or other suitable material compatible with flue gas conditions the required length of Pitot for each of the points.

**Table 1 Required Number of Traverse Point for Sampling Sites**  
(Clause 5.3)

SI No.	Range of Stack Diameter m	Total No. of Traverse	Number of Traverse	
			Plane 1	Plane 2
(1)	(2)	(3)	(4)	(5)
i)	ID up to 0.3	4	4	–
ii)	ID>0.3 up to 0.6	8	8	–
iii)	ID>0.6 up to 1.2	12	12	–
iv)	ID>1.2 up to 2.4	20	10	10
v)	ID>2.4 up to 5.0	32	16	16
vi)	ID > 5.0	52	26	26

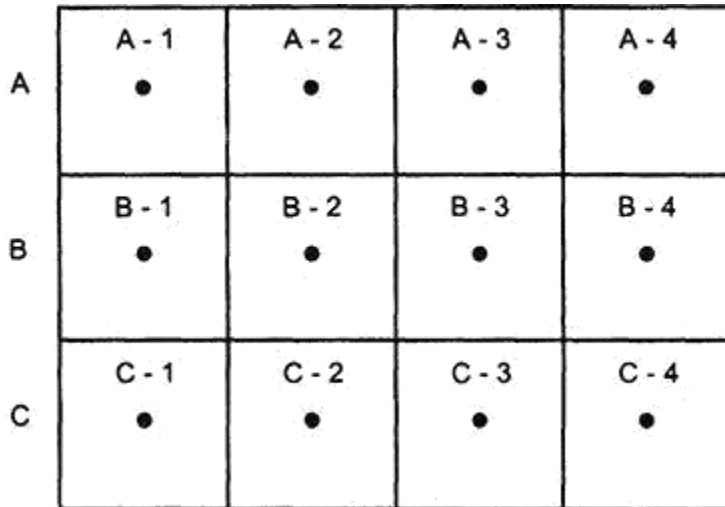
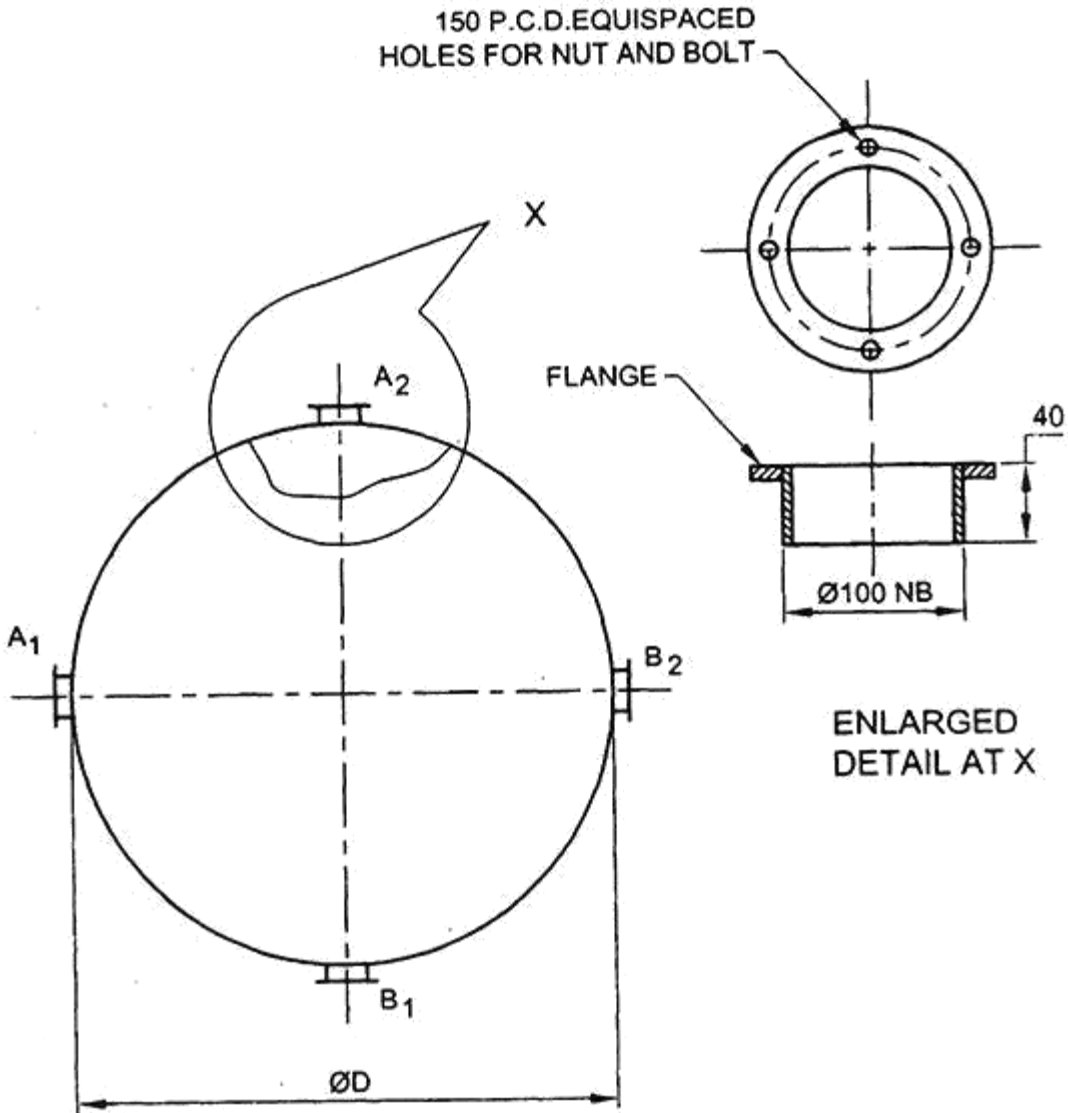


Fig. 3 Diagrammatic Representation of Equal Rectangular Sub-Areas for a Rectangular Duct





- 1) A<sub>1</sub>, A<sub>2</sub> When D < 2000
- 2) A<sub>1</sub>, A<sub>2</sub>, B<sub>1</sub>, B<sub>2</sub> When D < 2000

All dimensions in millimetres.

Fig. 4 Sampling Port

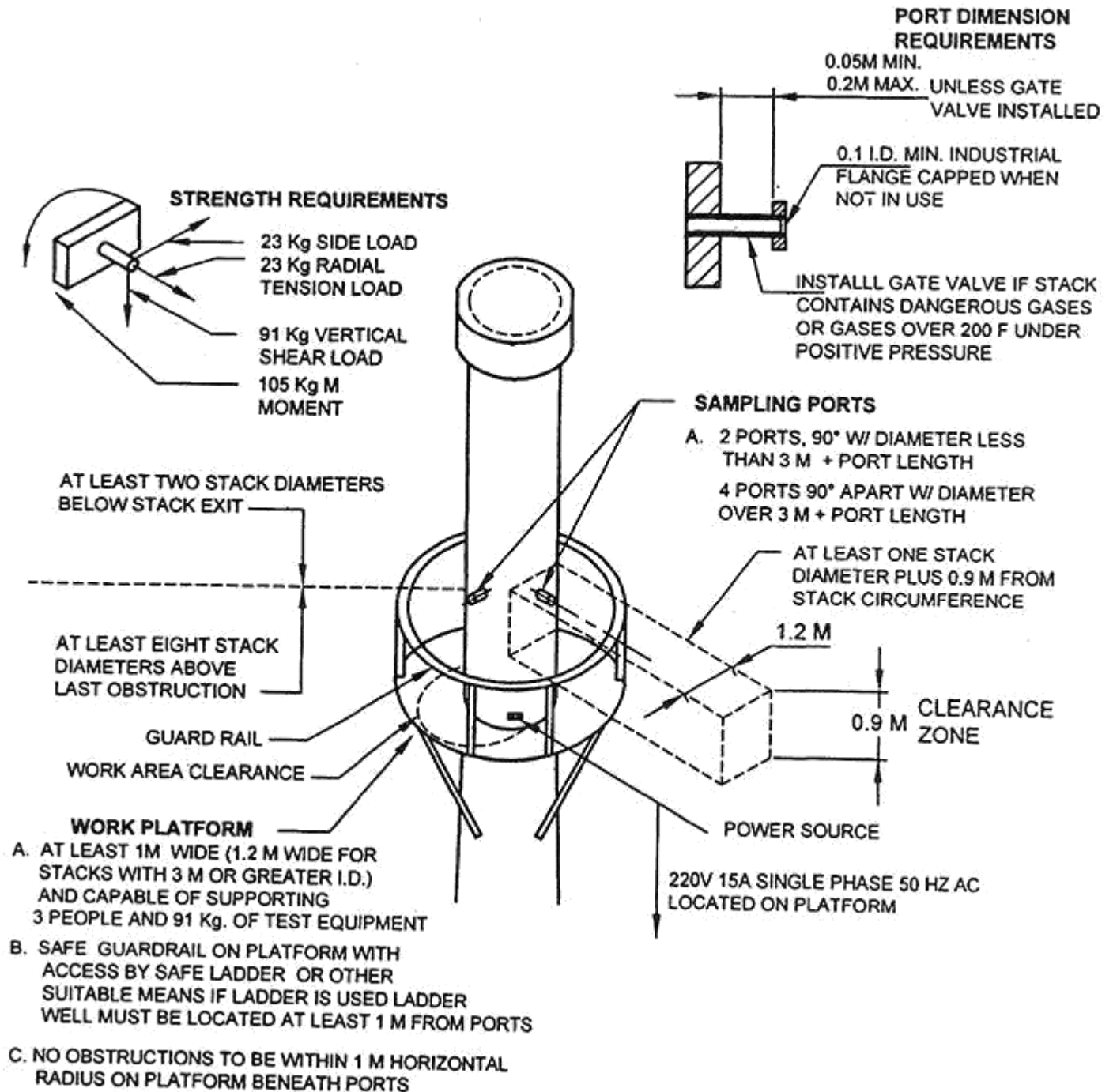


Fig. 5 Typical Sampling Provision

## 6.0 Guidance for Small Stacks/Ducts $\leq 0.1\text{m}$

### 6.1 Selection of Measurement Site for Particulate Measurements—Steady or Unsteady Flow.

- Select a particulate measurement site located preferably at least eight equivalent

stack or duct diameters downstream and 10 equivalent diameters upstream from any flow disturbances such as bends, expansions, or contractions in the stack, or from a visible flame.

- b) Locate the velocity measurement site eight equivalent diameters downstream of the particulate measurement site
- c) If such locations are not available, select an alternative particulate measurement location at least two equivalent stack or duct diameters downstream and two and one-half diameters upstream from any flow disturbance.
- d) Then, locate the velocity measurement site two equivalent diameters downstream from the particulate measurement site. For a rectangular cross-section; refer to 1.1 equation for calculating equivalent diameters.

**Annex 5: List of laboratories designated by NEMA to carry out air quality measurements: Available on the NEMA website- [www.nema.go.ke](http://www.nema.go.ke); gazetted designated laboratories**

sn	Laboratory	Email & Mobile Contact.	Scope Measurement					
			Stack Emission		Ambient Air Quality		Indoor Air Quality	
			PM	Gase s	PM	Gase s	PM	Gase s
1	SGS Kenya Limited P.O. Box 72118-00200, <b>NAIROBI</b>	<a href="mailto:enquiries.kenya@sgs.com">enquiries.kenya@sgs.com</a> Landline +254 02 2733690/99 Tel: 0709633400, 0733637142	Yes	Yes	Yes	Yes	Yes	Yes
2	Ecoscience Engineering Services	0713566825/0711632342/ Ecoscience.engineering@gmail.com or info@ecoscience and engineering.co.ke	Yes	Yes	Yes	Yes	Yes	Yes
3	Eurolab Services Limited P.O Box 5050-00200 <b>NAIROBI</b>	<a href="mailto:info@eurolabltd.com">info@eurolabltd.com</a> <a href="mailto:eurolablimited@gmail.com">eurolablimited@gmail.com</a> 0722241766,0752435126	Yes	Yes	Yes	Yes	Yes	Yes
4	Labworks P.O.Box 9648 - 00100, <b>NAIROBI</b>	<a href="mailto:info@labworksea.com">info@labworksea.com</a> Tel: 0726209641	Yes	Yes	Yes	Yes	No	No
5	Polucon Services P.O. Box 99344 - 80100, <b>MOMBASA</b>	<a href="mailto:Polucon@polucon.com">Polucon@polucon.com</a> Tel: 0722229944	Yes	Yes	Yes	Yes	No	No
6	CSI International Ltd. P.O.Box 47846 - 00100, <b>NAIROBI</b>	<a href="mailto:info@csiinternationalke.co.ke">info@csiinternationalke.co.ke</a> Tel:0712603528/0723479111/0705204610	Yes	Yes	Yes	Yes	No	No
7	Ecoserv Laboratory, P.O.Box 1303 - 00100, <b>NAIROBI</b>	<a href="mailto:gachanja@ecoservkenya.com">gachanja@ecoservkenya.com</a> Tel: 0722882879	Yes	Yes	Yes	Yes	No	No
8	Instrumentation Engineers(EA) Limited P.O Box 18986-00500, <b>NAIROBI</b>	<a href="mailto:info@instrumentation-engineers.com">info@instrumentation-engineers.com</a> Tel: 0722357991/+254-20-2108606	No	Yes	No	No	No	No

sn	Laboratory	Email & Mobile Contact.	Scope Measurement					
			Stack Emission		Ambient Air Quality		Indoor Air Quality	
9	Kenya Bureau of Standards P.O.Box 54974-00200, <b>NAIROBI</b>	<i>info@kebs.org</i> <i>Tel: 0722203137</i>	No	Yes	Yes	No	No	No
10	Institute of Nuclear Science & Technology P.O.Box 3097 - 00100, <b>NAIROBI</b>	<a href="mailto:inst@uonbi.ac.ke"><i>inst@uonbi.ac.ke</i></a> <i>Tel: 020-318262</i>	No	No	Yes	No	No	No

**Key:**

- (i) **PM: Particulate Matter/Dust**
- (ii) **Yes: Capacity exists to measure the indicated parameters**
- (iii) **No: No capacity to measure the indicated parameters**
- (iv) **Equipment Inventory available for verification**

**THIRTEENTH SCHEDULE**

**FEES**

The fees chargeable under these Regulations shall be as specified hereafter.

- (a) Application for:
  - (i) Emission License for listed emitting facility: - *KShs.5, 000/=*
  - (ii) Emission License for other emitting facility than (i) above: - *KShs.5,000/=*
  - (iii) Variation of emission license: *KShs.3,000/=*
  - (iv) Transfer of emission license: - *KShs.3,000/=*
  
- (b) Annual License fee for Emission into the atmosphere
  - (i) Facility listed in 6<sup>th</sup> schedule under category I :- *KShs.50,000/=*
  - (ii) Facility listed in 6<sup>th</sup> schedule under category II :- *KShs.30,000/=*
  - (iii) Polluting facility not in 6<sup>th</sup> Schedule other than ( i) and (ii) above :- *KShs.20,000/=*
  
- (c) Inspection of emission monitoring records/emission license register: - *KShs.200/=*
  
- (d) Variation of emission License is 10% of the Annual License fee

The above fees are payable to the NEMA Revenue Account:

Details:

Account No. **1102298158**

Bank Name: **KCB,**

Branch: **KICC Branch,**

## **Annex 7: List of Controlled Areas**

### **SIXTH SCHEDULE**

#### **LIST OF CONTROLLED AREAS**

- a) Residential areas, Hospitals,
- b) National Parks,
- c) Reserves and Sanctuaries,
- d) Conservation areas,
- e) Central Business Districts
- f) Any other area declared by the Authority from time to time

**Annex 8 : Emission Limits for Controlled and Non-Controlled Facilities**

6 r16,72

**THIRD SCHEDULE**

**EMISSION LIMITS FOR CONTROLLED AND NON-CONTROLLED FACILITIES**

Air Pollutant	Industry	Sulphur Dioxide (SO <sub>2</sub> ) (mg/Nm <sup>3</sup> )		Nitrogen Dioxide (NO <sub>2</sub> ) (mg/Nm <sup>3</sup> )		Nitrogen Oxides (NO <sub>x</sub> ) (mg/Nm <sup>3</sup> )		Carbon Monoxide (CO) (mg/Nm <sup>3</sup> )		Volatile Organic Compounds (VOC) (mg/Nm <sup>3</sup> )		Particulate Matter (PM <sub>10</sub> ) (mg/Nm <sup>3</sup> )		Particulate Matter (PM <sub>2.5</sub> ) (mg/Nm <sup>3</sup> )		
		NDA	DA	NDA	DA	NDA	DA	NDA	DA	NDA	DA	NDA	DA	NDA	DA	
Aluminium recycling plants		10-30											20		*	*
Asphalt mixing batch plants	< 100 t: g/kg			200		460		*	*	20						
	100 to 300 t: g/kg															
	300 to 500 t: g/kg															
	> 500 t: g/kg															
Boilers	*	50		*		*		*	*	*	*					*
Cement plants		50		400		1500		*	500	300						0.5ng/Nm <sup>3</sup>
Ceramics manufacture		400				180-250 ppm										



Industry	Air Pollutant	Unit	Emission factor (kg/Nm <sup>3</sup> )	DA	NDA	SO <sub>2</sub> (mg/Nm <sup>3</sup> )	NO <sub>x</sub> (mg/Nm <sup>3</sup> )	CO (mg/Nm <sup>3</sup> )	H <sub>2</sub> O (%)							
Coke & coal plants		*			*		*		*	*	*	*	*			
Dairy			50													
Fertilizer plant			50		*		500				20	30		50		
Iron Foundry			50		560				*	*				5		
Brass bronze Foundry			50		20 - 50											
Glass Manufacture			20-50		Oil fired: 1,800		1000 - 2000							50	5	
					Gas fired: 700											
Galvanizing operations		*	50													
Incinerators		*	< 10 t:		500		Existing: 130-600 ppm		*		*					2.0 - 3
			4g/kg to 30 t:													
			10g/kg to 50 t:													
			10g/kg													

Air Pollutant	Industry	Openly		3(mg/N x)m		3(mg/N x)m		2%		0		DA		DA		DA		DA		DA	
		NDA	DA	NDA	DA	NDA	DA	NDA	DA	NDA	DA	NDA	DA	NDA	DA	NDA	DA	NDA	DA	NDA	DA
		> 50 t:				New															0.1-5
		17.5 g/kg				: 60-400 ppm															-
	Municipal waste	100				300			*	*											TEQ/N
	Medical waste	20 (PM <sub>2.5</sub> )		500		300			*	*	*		*								*
	Industrial waste	* 50		150		460			*	*	*	*	*	*							*
	Kraft pulp mills	100-150		500		600			*	*	20	15	*	*							*
	Lead Recycling plants	20 (PM <sub>2.5</sub> )		400																	50 (B & R Furnace)

Air Pollutant	Industry	Opacity	10 (mg/Nm <sup>3</sup> )	3 (mg/Nx)m	3 (mg/Nx)m	2%	0	DA								
			NDA	DA	NDA	DA	NDA		DA							
																10 Pot Furnace)
	Mineral Processing	50														
	Mining & Quarry	20%	400													
	Non-ferrous secondary smelters	50		20	*			*	*	*	*					
	Non-ferrous secondary smelters	*	< 10 t: 7.5 g/kg (PM <sub>2.5</sub> )	800	*			*	*	20	15				*	

Air Pollutant	Industry	Quantity		3(mg/N x) m)	3(mg/N x) m)	3(mg/N x) m)	2%	0										
		10 (mg/ Nm)	30 (mg/ Nm)															
		NDA	DA	ND	DA	ND	DA											
		10 to 30 t: 22.5 g/kg (PM <sub>2.5</sub> )																
		30 to 50 t: 37.5g/kg (PM <sub>2.5</sub> )																
		> 50 t: 52.5 g/kg (PM <sub>2.5</sub> )																
Paint and varnish manufacturing		50 (PM <sub>2.5</sub> )								20	15	10						
Pesticides formulation		20 (PM <sub>2.5</sub> )								20		5						
Pesticide manufacturing		20								20								

Air Pollutant	Industry	Openly	3(mg/10 Nm)	3(mg/N x)m	3(mg/N x)m	2%	0		D A						
		NDA	DA	NDA	DA	NDA			D A						
Petroleum Refineries	50		Sulphur recovery: 150	460						20	152				
Pharmaceuticals manufacturing plants	20		Combustion units: 500							80		10			
Printing industry										20		10			
Steel mills	* Existing- 240 (PM <sub>2.5</sub> )		500	200				*							
	* New- 120 (PM <sub>2.5</sub> )			180											

Air Pollutant	Industry	3(m g/N m)	10	3(m g/N m)	x)	3(mg/ Nm)	x)	2%	0					
		N D A D A ND A		DA ND A										D A
Sulphuric acid Plants	50		SO <sub>2</sub> : 2 kg/t acid											
			SO <sub>3</sub> : 0.15 kg/t acid											
			< 100 t: 3.75 g/kg											
			100 to 300 t: 10.5 g/kg											

Air Pollutant	Industry	3(m g/N m)		3(m g/N m)		3(mg/ Nm)		0	
		10	x)	x)	2%				
		NDA	DA NDA	DA NDA					DA
			300 to 500 t: 34.5g/kg	> 500 t: 48 g/kg					
Sugar Manufacture		(< 8.7 mw input boiler) : 150 (>8.7 mw input boiler) : 100	2000	Liquid fuels : 460 ppm Solid fuels : 750 ppm					
Soda Manufacture	ash	50							*
Tanneries		50	1000	1500				20	15
Textiles		50					20		
Geothermal Power plants			*	*				*	

Air Pollutant	Industry	Openly		3(mg/N x)m		3(mg/N x)m		3(mg/N x)m		2%		0	
		NDA	DA	ND A	DA	ND A	DA						
Thermal Power Plants													
Small combustion facilities(3MWth – 50NMWth)Reciprocating internal Combustion Engine (RICE)													
Engine (Gas)		N/A		N/A		200(SI)		1,600(CI)					
Liquid	KS1515	50		Use 1.5% sulphur fuel (SF)*		Bore ø<400mm: 1460		Bore ø≥400mm: 1,850					
Turbine													
Natural Gas													



Air Pollutant						0									
Industry						2%									
	<	N/A	N/A	42ppm(El ectric Gen erati on)( EG)											
15MWth to < 50MWth		N/A	N/A	25ppm											
Other fuels															
3MWth to 15MWth	<	N/A	0.5 %S F	96ppm(E G)											

Industry	Air Pollutant	Year	Particulates (mg/Nm <sup>3</sup> )	Sulphur dioxide (mg/Nm <sup>3</sup> )	(SO <sub>2</sub> ) (mg/Nm <sup>3</sup> )	NO <sub>x</sub> (mg/Nm <sup>3</sup> )	(NO <sub>x</sub> ) (mg/Nm <sup>3</sup> )	O <sub>2</sub> %	Carbon monoxide (mg/Nm <sup>3</sup> )	Carbon dioxide (mg/Nm <sup>3</sup> )	Hydrogen Sulphide (mg/Nm <sup>3</sup> )	Hydrogen Chloride (mg/Nm <sup>3</sup> )	Hydrogen Fluoride (mg/Nm <sup>3</sup> )	Lead (mg/Nm <sup>3</sup> )	Dioxins/Furans
			NDA	DA	NDA	DA	NDA	DA							
	15MWth to < 50MWth		N/A	0.5 % SF or lower		74ppm									
	Boiler														
	Gas		N/A	N/A		320									
	Liquid		50 or 150 *	200		460									
	Solid		50 or 150 *	200		650									
	Combustion Technology/Fuel														
	RICE														
	Natural Gas		N/A	N/A	N/A	200(SI) 400(DF)	200(SI) 400(DF) /CI)	15%							

Industry	y	Particulate/Desulfurization 10 <sup>3</sup> (mg/Nm <sup>3</sup> )		Sulphur dioxide	(SO <sub>x</sub> ) <sup>3</sup> (mg/Nm <sup>3</sup> )		Nitrogen oxides	(NO <sub>x</sub> ) <sup>3</sup> (mg/Nm <sup>3</sup> )	O <sub>2</sub> %	Carbon monoxide(mg/Nm <sup>3</sup> )	Carbon dioxide(mg/Nm <sup>3</sup> )	Hydrogen Sulphide(mg/Nm <sup>3</sup> )	Hydrogen Chloride	Hydrogen Fluoride(mg/Nm <sup>3</sup> )	Lead(mg/Nm <sup>3</sup> )	Dioxins/Furans
		NDA	DA	NDA	DA	NDA	DA									
Liquid fuels(>=50MWth to < 300MWth)		50	30	1,170 or <2%SF	0.5	1,460(CI, Bore ø<400mm) 1,850(CI, Bore ø≥400mm) 2,000(D F)		400	15%							
Liquid fuels(plant≥300MWth)		50	30	585 or ≤1%SF	0.2	740*		400	15%							

Industry	Air Pollutant	Opacity	Particulate (Dust)		Sulphur oxide		Nitrogen oxides		CO <sub>2</sub> %	Carbon monoxide:(mg/Nm)	Carbon dioxide:(mg/Nm)	Hydrocarbons:(mg/Nm)	Hydrogen Sulphide:(mg/Nm)	Hydrogen Chloride	Hydrogen Fluoride:(mg/Nm)	Lead <sub>3</sub> (mg/Nm)	Dioxins/Furans
			P <sub>10</sub>	P <sub>2.5</sub>	(SO <sub>2</sub> ) <sub>3</sub>	(NO <sub>x</sub> ) <sub>3</sub>											
			NDA	DA	NDA	DA	NDA	DA									
	Biofuels/Gaseous fuels other than Natural Gas		50	30	N/A	N/A	30% > Natural Gas & Liquid Fuels										
	Combustion Turbine																
	Natural Gas (All turbine types of unit> 50MWth)		N/A	N/A	N/A	N/A	51	25									
	Fuels other than Natural Gas(unit> 50MWth)		50	30	Use 1% SF	Use 0.5% SF											
	Boiler																
	Natural Gas		N/A	N/A	N/A	N/A	240	240	3%								
	Other Gaseous fuels		50	30	400	400	240	240	3%								

Air Pollutant	Industry	NDA		DA		NDA		DA		2%							
		(mg/Nm <sup>3</sup> )	(mg/Nm <sup>3</sup> )	(mg/Nm <sup>3</sup> )	(mg/Nm <sup>3</sup> )	(mg/Nm <sup>3</sup> )	(mg/Nm <sup>3</sup> )	(mg/Nm <sup>3</sup> )	(mg/Nm <sup>3</sup> )								
Liquid Fuels(Plant >=50MWth to < 600MWth)		50	30	900 - 1500	400	400	200	3%									
Liquid Fuels(>=600MWth)		50	30	200 - 850	200	400	200	3%									
Solid Fuels>=50MWth to < 600MWth)		50	30	900 - 1500	400	510	200	6%									
Solid Fuels(>=600MWth)		50	30	200 - 850	200	1,100 upto volatile matter of fuel < 10%	200	6%									
Waste water treatment plants						NH <sub>3</sub> (100 - 400)					4000	5000					

And any other parameter as may be prescribed by the Authority from time to time

**Legend**

SF: Suphur Fuel

\* 1.5-3.0% only justified by project specific considerations i.e. add secondary treatment to meet levels of 1.5% Sulphur

\*\* dependent on water availability for injection

CI: Compression Ignition

SI: Spark Ignition

DF: Dual Fuel

DA: Degraded Area

NDA: Non-degraded Area

The chimney or stack should have a minimum height of 10 metres above ground level and clear the highest of the building by not less than 3 metres for all roofs. The topography and height of adjacent buildings within 50 metres radius should be taken into account.

Toxic Equivalent (TEQ) is the sum of the toxic equivalent factors (TEF) of a mixture congeners contained in a compound. The compound 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) was assigned a TEF of 1 after being identified, by International Association of Radiology and Cancer (IARC) and World Health Organisation (WHO), as the most toxic of all compounds, and as carcinogenic to humans, based mainly on studies of cases involving accidental or occupational heavy exposure. Therefore the TEF is a weighting factor.

*g - gram*

*µg- microgram*

*kg – kilogram (1,000g)*

*mg - milligram*

*µg<sub>3</sub>- microgram*

*m – cubic metre*

*ppm – Parts per million*

*t – tonne*

7

## Annex 9: Acceptable Emission Control Technologies

### SEVENTH SCHEDULE

#### Acceptable Emission Control Technologies

##### List of Acceptable Emission Control Technologies

	Air Pollutants	Emission Control technologies	Remarks
1.	Particulate Matter	Mechanical collectors ( <a href="#">dust cyclones</a> , multicyclones)	
		<a href="#">Electrostatic precipitators</a>	
		Fabric filters (baghouses)	
		<a href="#">Particulate scrubbers</a>	
2.	Nitrogen Oxides (Nox) *	<a href="#">Low NOx burners</a>	
		<a href="#">Selective catalytic reduction (SCR)</a>	
		<a href="#">Selective non-catalytic reduction (SNCR)</a>	
		<a href="#">NOx scrubbers</a>	
		<a href="#">Exhaust gas recirculation</a>	
		<a href="#">Catalytic converter</a>	
3.	Volatile Organic Compounds (VOC), hydrocarbons	Adsorption systems, such as <a href="#">activated carbon</a>	
		<a href="#">Flares</a>	
		<a href="#">Thermal oxidizers</a>	
		Catalytic oxidizers	
		<a href="#">Biofilters</a>	
		<a href="#">Absorption (scrubbing)</a>	
		Cryogenic condensers	

	<b>Air Pollutants</b>	<b>Emission Control technologies</b>	<b>Remarks</b>
4.	Sulphur Oxides (SO <sub>x</sub> )	<a href="#">Wet scrubbers</a>	
		<a href="#">Dry scrubbers</a>	
		<a href="#">Flue gas desulphurization</a>	
5.	Carbon Oxides	<a href="#">Thermal oxidizers</a>	
6.	Hydrogen Sulphides	<a href="#">Absorption (scrubbing)</a>	
7.	Hydrogen Chloride	Dry Scrubbers, Adsorption systems, such as <a href="#">activated carbon</a>	
8.	Dioxins & Furans	Cyclone	
		Electrostatic precipitator	
		Bag filter	
		Wet scrubber	
		Quenching & subsequent wet scrubber	
		Catalytic oxidation (selective catalytic reaction)	
		Catalytic bag filter	
		Dry absorption in resins (carbon Particles dispersed in a polymer matrix)	
		Entrained flow reactor with added activated carbon or coke/lime or limestone solutions and subsequent fabric filter	



	<b>Air Pollutants</b>	<b>Emission Control technologies</b>	<b>Remarks</b>
		Fixed bed or circulating fluidized bed reactor, adsorption with activated carbon or open hearth coke	
9.	Metals (Hg, Pb, )	Sorbent Injection Technology	
		Electro-Catalytic Oxidation (ECO)	
		K-Fuel	
10.	Any other technology approved by the Authority from time to time		

7.1.1.1.1.1.1

7.1.1.1.1.1.2 \* Notes

Best Available Technology (BAT) for this category of equipment will consist of combustion modification technology including either:

- (a) low NO burner technology with low excess air
- (b) Air if technically feasible; or
- (c) flue gas re-circulation with low excess air.