SOURCE EMISSION MONITORING

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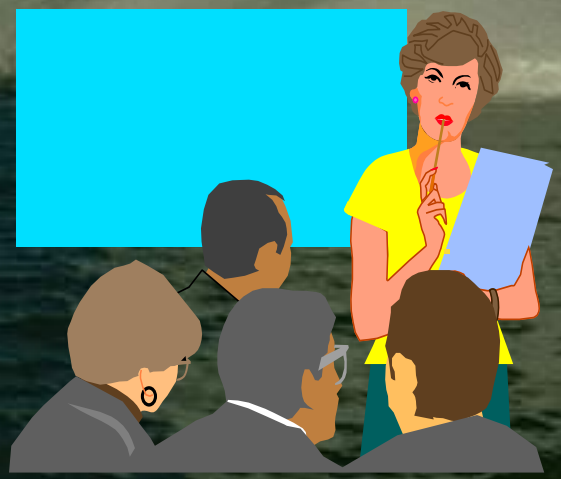


SOURCE EMISSION MONITORING

- SEM means experimental study of flue gas Temperature, Molecular weight, Moisture, Flow rate and concentration of Particulate Matter and Gaseous Pollutants by way of collecting representative sample from the source.

- Representative sample means drawing suitable size of flue gas from the parent stream that is flowing through stack without altering its characteristics at the point of sampling.

Objectives of SEM

- Operators to have the record of emission levels with respect to process variations and also to optimize the process conditions.
- Maintenance personnel to study the performance of PCD and find the scope for further improvement.
- Designing personnel to get the basic data for which PCD is to be designed and also to analyse the performance after installation.

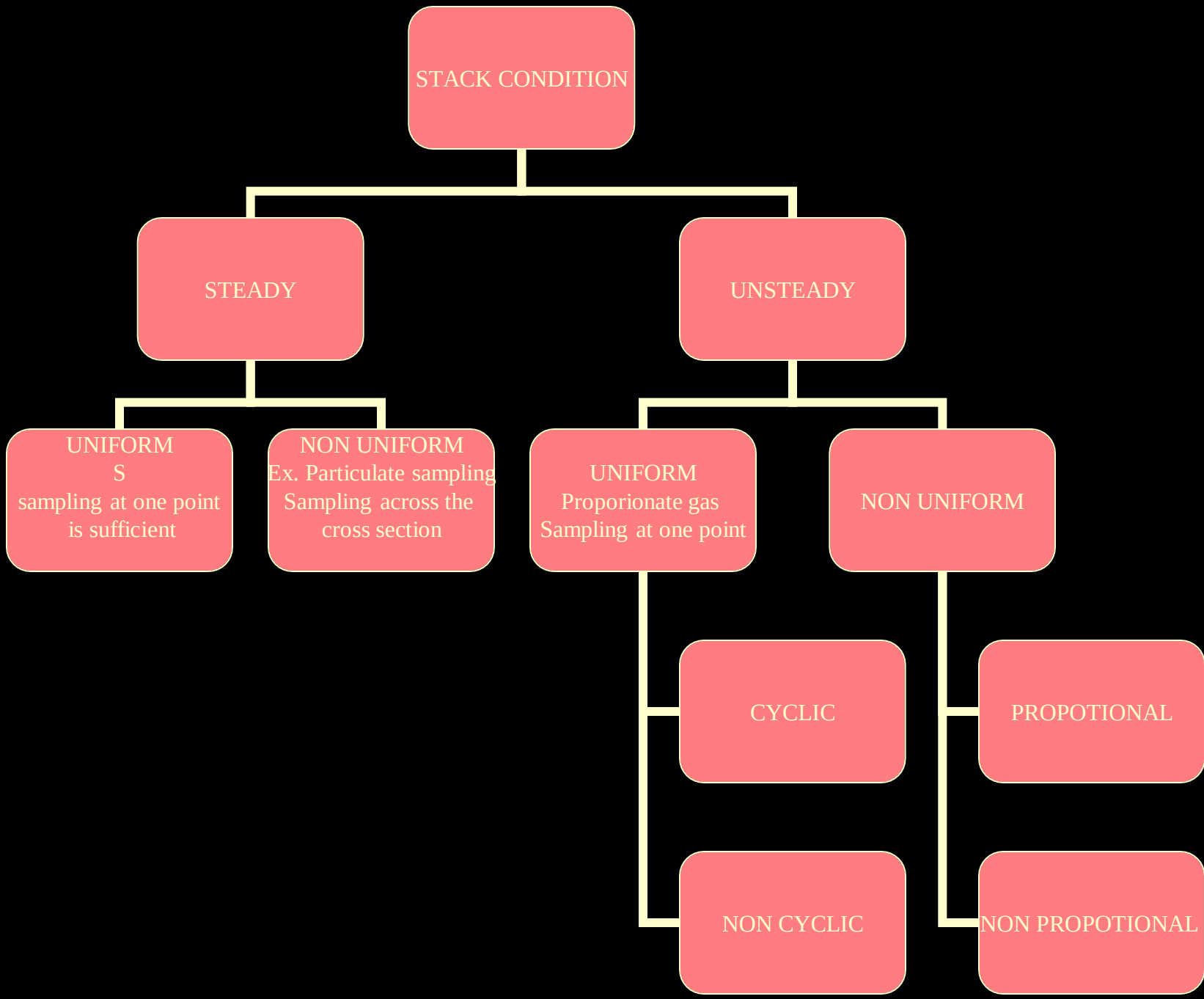
- Environment Authority to implement the regulatory standards, Performance evaluation of Control System and compliance verification.

- To carry out the Research and Mathematical modelling.

- To develop emission factors.

PLAN

- Process study
- Emission Study (Steady & Uniform, Steady & non uniform, Unsteady & Uniform, unsteady & non uniform). Accordingly plan the monitoring.
- Location.
- Number of Traverse Points.


STACK CONDITION
STEADY
UNSTEADY
UNIFORM
S
sampling at one point is sufficient
NON UNIFORM
Ex. Particulate sampling
Sampling across the cross section
UNIFORM
Proporionate gas
Sampling at one point
NON UNIFORM
CYCLIC
NON CYCLIC
PROPOTIONAL
NON PROPOTIONAL

prepreparation for monitoring

- Selection of Pitot tube (Standard or S type)
- Selection of Thimble
- Taking tare weight of thimble after pre conditioning at 10^{o}C more than the temperature of the stack to be monitored.
- Preparation of suitable absorption solution for gaseous pollutants.
- General check up of SMK.

Road map of Monitoring

- Ambient Temperature
- Stack Diameter
- Porthole length
- Stack Temperature
- Composition of Gas so as to find out the Molecular weight
- Moisture measurement
- Calculation of Traverse points and markings.

- Measurement of velocity Head, ie., presssure difference between the impact and static end of the Pitot tube.
- Measurement of Static Pressure.
- Calculation of velocity
- Calculation Isokinetic sampling rate
- Set up of sampling train.
- Isokinetic Sampling
- Calculation of volume of sample collected and applying Temperature, Pressure and Moisture correction so as to get the volume of the sample at normal conditions.
- Calculation of PM concentration and Pollution Load.

Why Traverse Points

- Dust particles are non spherical in shape and having wide size distribution varying from 0.3 micron to more than 100 micron in size. Therefore not distributed uniformly through out the cross section of the stack or Duct. It is necessary to monitor through out the cross section so as to get reliable data. More the points, more is the accuracy.

Traverse Points selection

- The Cross section of the stack is equally divided into as many as smaller domains, like in case of integrated sampling, so as to get the reliable results. The center of such small domain is called Traverse Points.
- Sampling location is not at idle location or even the location is at idle location but the velocity profile of the flue gas stream is not

- following the normal parabolic path, the number of TPs may be increased in four folds of the percentage of the violation.
- As a ready reckoner
- D/s. 8 7.3 6.7 6.0 5.3 4.7 4.0 3.3 2.6 2.0
- U/s. 2 1.8 1.7 1.5 1.3 1.2 1.0 0.8 0.6 0.5
- TPs 12 16 20 24 28 32 36 40 44 48

Rationalisation of Traverse Points

- ID < 0.3 = 4
- 0.3 < ID < 0.6 = 8
- 0.6 < ID < 1.2 = 12
- 1.2 < ID < 2.4 = 20

ID > 2.4 = 32

Selection of Pitot tube

- When the particulate matter concentration is expected to be low, a standard Pitot tube may be used. The advantage is that static pressure can be measured using static pipe.
- When the particulate matter concentration is more and is likely to choke the openings of the pitot tube, a “S” type or Staubscheibe pitot tube may be used. The disadvantage is that Static pressure can not be measured.

Selection of Inclined Monometer

- When the velocity is greater than 3 m/s, Inclined Monometer with 0.1 mm of WG calibration can be used.
- When the velocity is less than 2 m/s, an ultrasensitive micro manometer where 0.025 mm of WG or a thermoanemometer of hot wire type can be read.

Measurement of Differential Pressure

- The pitot tube shall be marked for TP_S. The impact tube shall be facing the upstream. The opening, which has free flow than another one is the impact tube.
- A straight tube shall be used to measure the static pressure, in case of S type Pitot tube.

Velocity calculation

- From the differential pressure, stack temperature, Molecular weight of the flue gas and absolute stack pressure, velocity is calculated from the basic equation i.e.,
- $V = C * SQRT(2g\Delta p/\rho)$ or
- $V = 128.994*Cp*SQRT(\Delta p*Ts/Ps*MW)$
- Diff Pres. = Manometer reading, mm H_2O
- Specific gravity of fluid * manometer inclination angle
- Abs. Stack Press = Atm. Press ± Stat. Press

ISO - KINETIC SAMPLING

- The particles of different size have different mass. Particles with different mass have different momentum. To collect a representative sample, the sampling velocity should be same as that of the gas at the traverse point so that the polydisperse particles enter into the sampling nozzle with out any change in the particle size distribution.

Selection of Thimble

- Cellulose thimble : Temp upto 100^{o}C.
- GF thimble : Temp upto 250^{o}C. Sensitive to Fluorides.
- Allundum thimbles Temp upto 250^{o}C.
- SS thimbles stuffed with Glasswool. Temp upto 150^{o}C.
- SS thimbles stuffed with ceramic/quartz wool : Temp upto 150^{o}C. Not suitable for Heavy Metal monitoring.
- When the collected PM is further analysed for HM, Titanium thimbles are used.

- Isokinetic Sampling rate shall be calculated as FRiso = V * NA * Ta / Ts * 6
- Sampling time may be determined in such way that the particulate matter collection shall be 300 mg or 1000 lts.
- Volume of gas sampled, V = SR * ST
- Vol.of gas sampled, at normal conditions, Nm3 = V * 298/Tg * (Pa-Pv)/760 * (100-M%)/100
- PM, normalised to 12% CO2 = PM * 12/CO2 measured, in case of boiler emissions or
- 6 % O2 correction = PM * (0.15/21-O2 mea)/100

Thank You
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