Air Pollution Control Technology

Stack Emission Monitoring

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Question

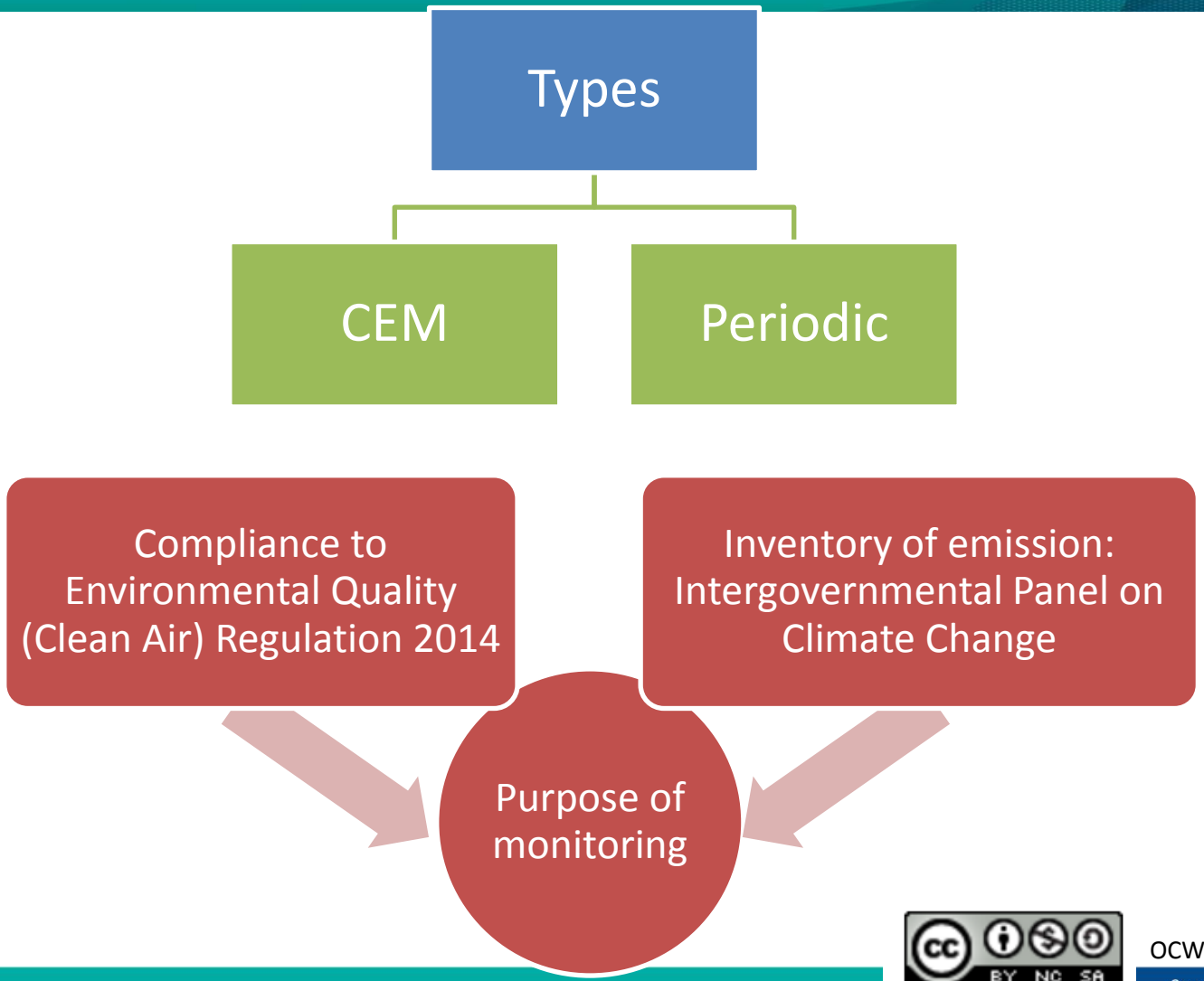
Follow the instruction

- Form a group with 6 members in a group.
- Find one process operation from any factory or premise either Malaysia or International situation. (Semiconductor/ food processing/ wood process/ welding/ chemical processing etc.)
- Identify the raw material use in the process.
- Identify the process operation / production line that occur in the premise.
- Justify the air pollution control device that having in the factory or premise.
- List the reference use in this assignment.
- Label the diagram of flow process / process operation

Chapter Description

- Aims
  - ….
  - ….
- Expected Outcomes
  - Students are able to discuss the stack emission monitoring
  - Students are able to select instrumentation for stack emission monitoring
- References

Introduction



Regulation

- Performance monitoring
- Maintenance record
- Opacity
- Limit values and technical standard
- Hazardous substance
- Periodic monitoring
- CEM
- Emission declaration

Stack Emission Monitoring

A stack emissions test involves the determination of:

- Pollutant mass or volume concentration;
- Reference quantity; avoid dilution effects, reference quantities are used to modify an emission result to a standardized format
- Mass flowrate or a volumetric flowrate.

These determinations are covered by two basic types of site activity:

  - Sample collection
  - Direct measurement

Criteria for sample collection and direct measurement

The following are general criteria that should be met in all cases:

- The stack gas which is sampled/measured should be representative of the stack gas as a whole.
- The technique employed,
- The measurement system is leak-tight
- Neither loss of pollutant nor addition of interfering contaminant.
- That any supporting measurements that are required such as volumetric flowrate, oxygen and moisture are conducted using suitable techniques and are simultaneous

The factors that are critical to stack tests using sample collection are:

- The volume corrected to standard conditions of temperature and pressure
- The volume of gas sampled is sufficient
- Particulates and droplets are sampled isokinetically;
- The sample trap is recovered with the necessary care, uniquely labelled, appropriately stored
- impingers traps are utilised that there is sufficient contact time.
- “equipment blank”

The factors that are critical to stack tests using portable equipment monitoring are:

- The range of the analyser is appropriate to the purpose of the measurement.
- Calibration before and after measurement
- The analyser is suited to the environment in which it is being operated.
- A non-specific detection system cannot be used to measure the levels of a specific chemical substance in an emission unless that substance is the sole component of the

Standard Method

- American Society for Testing and Materials (ASTM)
  - Verein Deustcher Ingenieure (VDI)
  - British Standards Institution (BSI)
  - Association Francaise de Normalisation (AFNOR)
  - Deutsches Institute fur Normung (DIN)
  - United States Environmental Protection Agency (US EPA)

Selection of Sampling Site and Minimum Number of Traverse Point

- (a) Select the sampling site =

  - at least **eight stack of duct diameters downstream** and

  - **two diameters upstream from any flow disturbance**

- When (a) is not accessible, choose a convenient sampling location and use **Table 1.3 and Figure 1.3** to determine the minimum required number of traverse location to the nearest upstream and downstream disturbance.

Table 1.3 : Minimum required number of traverse points for sampling sites which meet specified criteria

Inside diameter of stack or duct (m)	Number of points
I.D. ≤ 0.3	4
0.3 ≤ I.D. ≤ .6	8
0.6 ≤ I.D. ≤ 1.2	12
1.2 ≤ I.D. ≤ 2.4	20
2.4 ≤ I.D. ≤ 5	32

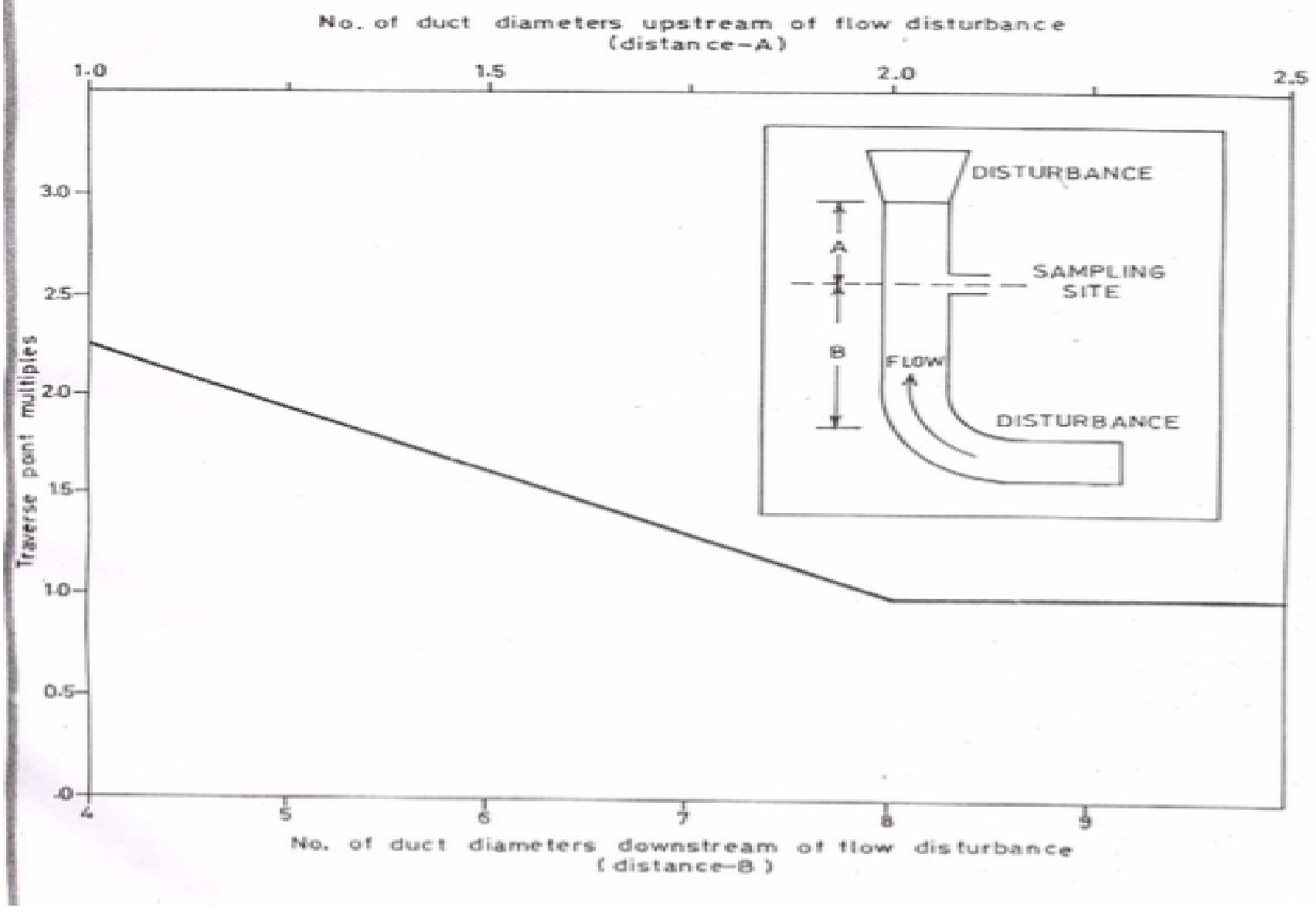
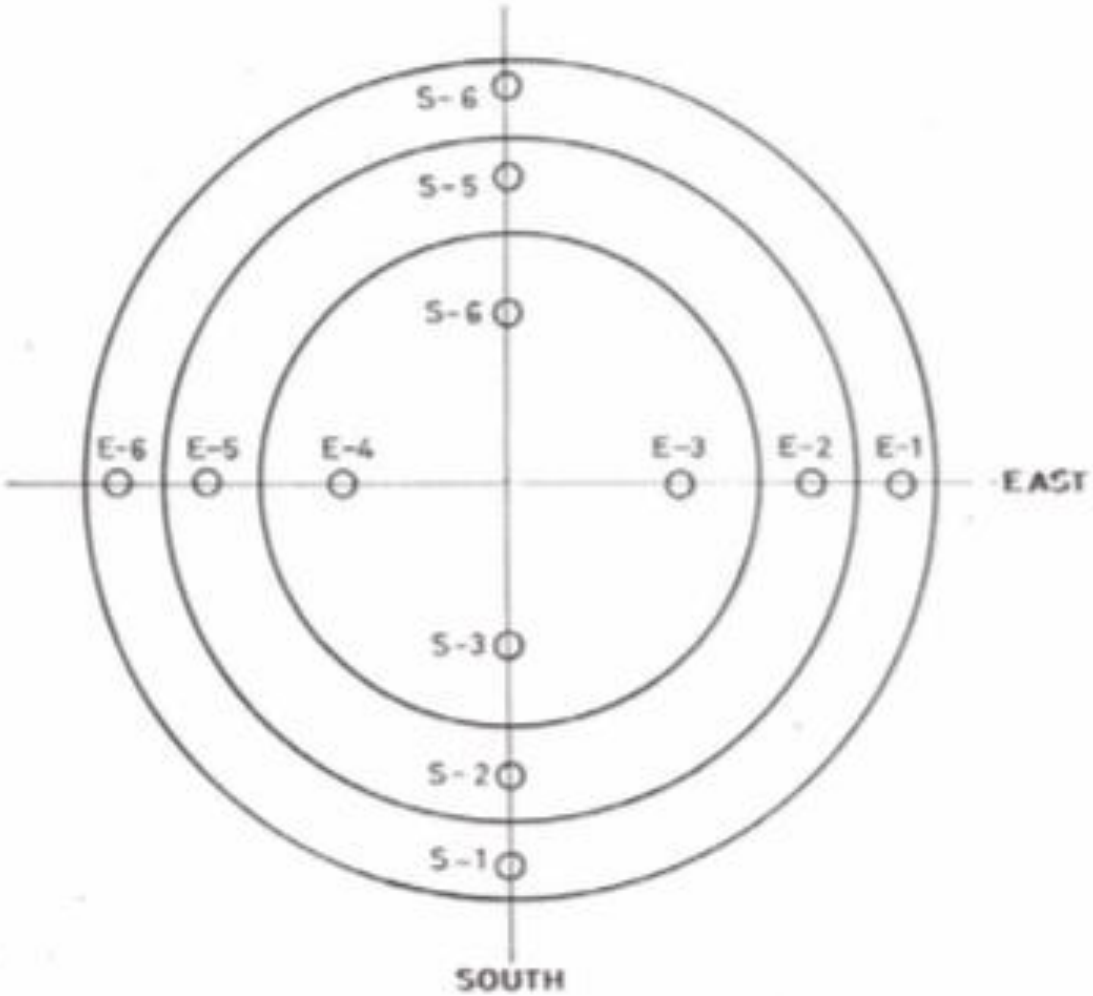


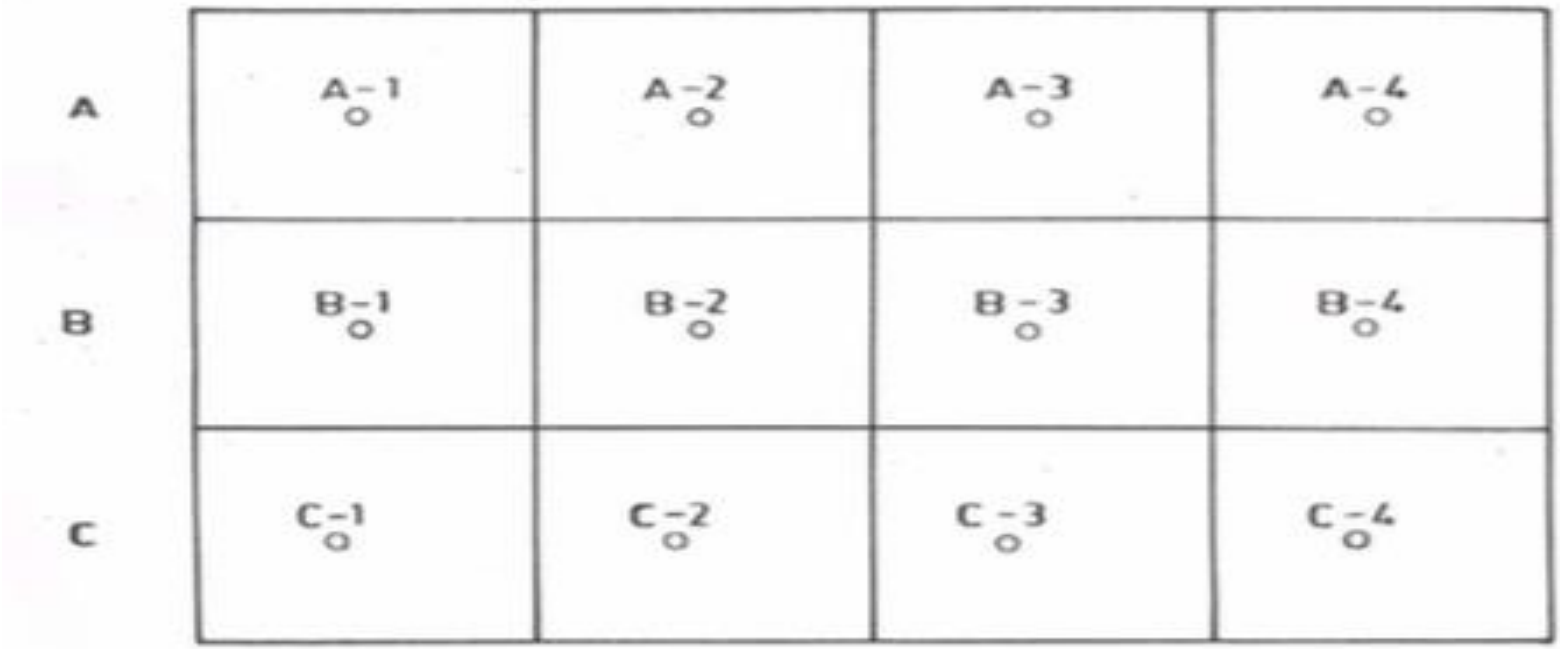
FIGURE 1.3 Travers point multiples to determine minimum number of traverse points requirement when a < 2 dia or b < 8 dia

- First, measure the distance from the chosen sampling location to the nearest upstream and downstream disturbance.
- Then, from **Figure 1.3** determine the corresponding sample points multiples for both distances and select the greater of these.
- Multiply it by the number obtained from Table 1.3.
- The result of this calculation is the minimum number of traverse points required.
- Under no condition shall sampling points be selected within 3 cm of the stack wall.

Circular



Rectangular



Location of sampling port

- To ensure laminar flow,
- = at atleast 8 times chimney diameter down stream and 2 times up stream from any flow disturbance.
- = a rectangular cross section the equivalent diameter (De) shall be calculated by using following equation to determine up stream, down stream distances.

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

Where L =Length in m, W= width in m.

Number of sampling port

- The pitot tubes commercially available in the country generally do not **exceed 2 meter in length**
- Inserted pitot tube through the sampling port (hole) for stacks with diameter less than 2m. Minimum two (mutually orthogonal) sampling ports are required in a circular chimney
- For stacks having diameter between 2 and 4 meters, two mutually orthogonal sampling ports are to be increased to

Dimensions of sampling port

Sampling port : a standard flanged pipe **of 0.10 m inside diameter** (ID) **with 0.15 m bolt circle diameter**. An easily removable blind flange should be provided to close the port when not in use.

Port Installation: Flanged pipe used as port should be installed with the interior stack wall. Port should extend outward from the **exterior stack wall not less than 50 mm and not more than 200** mm only when additional length is required for gate valve installation.

Ports should be installed at a height between **0.90 and 1.2 m above** the floor of the working platform.

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