L-19
Visibility and Minimum or safe stack height

Air Pollution and Control
(Elective -I)

What is Visibility?

- The sky is many times engulfed in a brownish-yellow or greyish-white haze due to air pollution. **Such haze can reduce visibility from miles (kilometres) to yards (meters).** Mountains or buildings once in plain sight can suddenly be blocked from view.

- Air pollution that reduces visibility is often called haze or smog. The term smog originally meant a mixture of smoke and fog in the air, but today it refers to any mixture of air pollutants that can be seen. Smog typically starts in cities or areas with many people, but because it travels with the wind, it can appear in rural areas as well.

- One consequence of smog over any given area is that it can change the area's climate. Certain dark particles, such as carbon, absorb solar radiation and scatter sunlight, helping produce the characteristic haze that fills the skies over the world's megacities. This haze reduces the amount of the Sun's energy reaching the Earth's surface, sometimes by as much as 35 percent.

- A reduction in sunlight may not be the only thing air pollution inhibits. Some research has supported the idea that certain air particles are altering rainfall patterns as well.

Visibility

- Pollution absorbs and scatters light resulting in sunsets or brown clouds

Visibility

Clear Day
Excellent Visibility

Visibility in few km

Hazy Day
Poor Visibility

Visibility hardly few m

Stack height

1) As per emission regulations (July 1984) part I published by the Central Board for Prevention and Control of Water Pollution, New Delhi, the chimney height is to be calculated according to the formula:

$$H = 74(Q)^{0.27} \qquad (3.14)$$

where

Q = particulate matter emission in tonnes per hour

H = height of chimney in metres

2) The height of the chimney for effective dispersion of SO_2 is to be calculated as per the formula $H = 14(Q)^{0.3}$ (as given in Sec. 19.5 under guidelines for minimum stack height)

where,

Q = SO_2 emission in kg/h

H = Height of chimney in metres

3) Mi stack height should be at least

- **So, select max of above three values as stack height**

Problem on stack height
(Rao and Rao pp34-35)

A factory uses 2,00,000 litres of furnace oil (specific density 0.97) per month. If for one million litres of oil used per year, the particulate matter emitted is 3.0 tonnes per year, SO_2 emitted is 59.7 tonnes per year, NO_x emitted is 7.5 tonnes per year, hydrocarbons emitted are 0.37 tonnes per year, and carbon monoxide emitted is 0.52 tonnes per year, calculate the height of the chimney required to be provided for safe dispersion of the pollutants.

Solution

The particulate emission is equal to 3.0 tonnes per million litres of oil per year. Consumption of oil is equal to

$$2,00,000 \times 12 = 24,00,000 \text{ l/year}$$

$$= 2.4 \text{ million l/year}$$

Therefore,

$$\text{Total particulate emission} = 2.4 \times 3.0 = 7.2 \text{ tonnes per year.}$$

$$= \frac{7.2}{300 \times 24} \text{ tonnes per hour (assuming 300 working days and 24 hours per day).}$$

Now,

$$H = 74\left(\frac{7.2}{300 \times 24}\right)^{0{\cdot}27}$$

$$= 11.47 \text{ m}$$

SO_2 emission rate

Q in the example $= 59.7 \times 2.4 = 144$ tonnes per year

$= 20$ kg/h

Therefore $H = 14(20)^{0.3} = 34.4$ m

So, adopt a height of 34.4 metres.

(Since the emission of SO_2 is much more than that of NO_x, CO, and Hydrocarbons, the calculation of stack height is done based on SO_2 emission data only).

Objective Questions

Q1. On a hazy day visibility will be _____.

Q2. The minimum stack height should be ___m.

Q3. Stack height based on SO2 emission rate is given by _____.

Q4. Stack height based on SPM emission rate is given by _____.

Q5. haze can reduces visibility from ____ to ___.

Theory Questions

Q1.What is visibility?

Q2. Write procedure for fixing minimum stack height.