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PARTICULATE CONTROL TECHNIQUES: Control of particulates at source can be accomplished in several ways, for example through raw material changes, operational changes, modifications, or replacement of processes equipment. When source correction cannot achieve the desired goal of air pollution control, effluent gas cleaning techniques are employed. Particulate discharged is reduced by the application of control equipment. Equipment for the control of particulate matter is designed to remove solid and liquid particles from the gas stream. The choice of collection device depends upon number of factors like quantity of gas to be treated, nature and concentration of the particulate, the physical and chemical characteristics of particulates, temperature, pressure, and humidity of gaseous medium.

The main objectives of using control equipment are as follows:

1. Prevention of nuisance and physical damage to property.

2. Elimination of health hazards to plant personnel and to the general population

3. Recovery of valuable waste products

4. Minimization of economic losses through the reduction of plant maintenance

5. Improvement of product quality.

PARTICULATE CONTROL DEVICES: The removal of particulate matter from gas stream is an essential step for air pollution control.

Gravity Settling Chamber: Gravity settling chamber is the simplest type of equipment used for the collection of particulate matter. It requires manual cleaning at regular interval. It consists of a long chamber through which the contaminated gas passes slowly, allowing time for the particulate matter to settle under the force of gravity. They are used to remove large particles (greater than 50μm). They offer low-pressure drop and requires little maintenance but their efficiencies are quite low for fine particles. They are widely used for the removal of large solid particulates. These devices are normally used as pre-cleaners prior to passing the gas through high efficiency collection devices. They are, sometimes used as first step in dust control in the process industries, particularly for smelters and metallurgical processes.

Fabric Filter Fabric: Filters consists of yarns made from stranded fibers of a natural spun staple or a synthetic continuous monofilament. They are usually formed in cylindrical tubes and hung in multiple rows to provide large surface area for gas passage known as baghouse. A baghouse is a house full of bags. The bags are usually made of cotton, wool, synthetic, or glass fibers, and there may be hundreds of bags within one structure. The fabric filtration is a well-known and practiced method for separating dry particles from a stream of gases (usually air or

combustion gases). The dusty gas flows into and through the fabric, leaving the dust on the inside of the bag, while the cleaned gas exits through the bag to the other side and then out the baghouse. There are many different types of fabrics, different sizes of bags, different ways of flowing the gases through the bags, and different ways of cleaning the bags within the baghouse. The extended operation of a baghouse requires that the bags should be cleaned regularly.

Cyclone (Centrifugal) Separators: Cyclone separators or cyclones are devices that employ a centrifugal force generated by a spinning gas stream to separate particles from the carrier gas. Entrance of flow into cyclone can be axial or tangential through inlet section, which can be in different shapes for each cyclone. Their simple design, low maintenance costs, and adaptability to a wide range of operating conditions such as sizes and flow rates make cyclones one of the most widely used particle removal devices. Small cyclones are used to collect particles in the field of air pollution control for ambient sampling, while large cyclones are used to remove particles from industrial gas streams. Cyclones are particularly well suited for high temperature and pressure conditions because of their rugged design and flexible component materials. They are used widely for control of gas-borne particulates in such industrial operations as cement manufacture, feed and grain processing, food and beverage processing, paper and textile industries and wood working industries.

Electrostatic Precipitators (ESP): The Electrostatic precipitator (ESP) or electro-filtration is the most effective and widely used devices for controlling particulate emissions at different installations ranging from power plant, cement factories, pulp and paper mills to oil refineries. They can also be used for air cleaning in public buildings, theatres, railway, cars, etc. Particles are electrically charged and attracted to collector surfaces.

The process of electrostatic precipitation involves the following:

1. The ionization of contaminated particles laden air flowing between electrodes

2. The migration and collection of the particles on oppositely charged plates

3. Knocking out particles off the plates and into hoppers

4. The removal of the material from the hoppers.

The air flows freely through the ESP, but the particles are left behind on the plates. The collected material is periodically knocked off or washed off the plates, and is collected in the bottom. The ESP is unique among air pollution control devices in that the forces of collection act only on the particles and not on the entire air stream. This phenomenon typically results in high collection efficiency with a very low air pressure drop. Electrostatic Precipitators can be either single-stage or two-stage in design. ESP can also be classified, as dry precipitators and wet precipitators, depending upon the mode of operation is a dry process or a wet one.

Wet Collectors (Scrubbers) : In air pollution control technology, the term scrubber means a device for collecting fine particles on liquid drops. Wet scrubbers are devices, which utilizes a liquid to assist in the removal of particulates from the carrier gas stream. Mostly, water is used as the scrubbing liquid. In a wet collector, the dust is agglomerated with water and then separated from the gas together with the water. Wet scrubbers involve four major steps in collecting particles. The first of these is transport. The particles must be moved to the vicinity of the water droplets that are usually 10 to 1000 times larger. The step is collision. The particle must collide with the droplet. The third step is adhesion. Last step is precipitation, or removal of the droplet containing the dust particle. There are different types of wet scrubbers such as spray towers, venturi-scrubbers, cyclone scrubbers, packed scrubbers and mechanical scrubbers