The Effect of Air Pollutant & Control Device Characteristics on Emission Rates

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Effects on Controlled Emissions

- Pollutant Characteristics
- Type of Control Device
- Design of Control Device

Most Pollutants are Heterogeneous

- CO is a gas and consists of one compound
- NO_x is both NO & NO_2
- Hg may be Metallic, an Oxide, Combined with Chlorine or in an Organic Compound

- Solids may vary in many ways and also contain additional pollutants

Variations in Particulate

- Mean Particle Size
- Size Distribution
- Particle Shapes
- Density

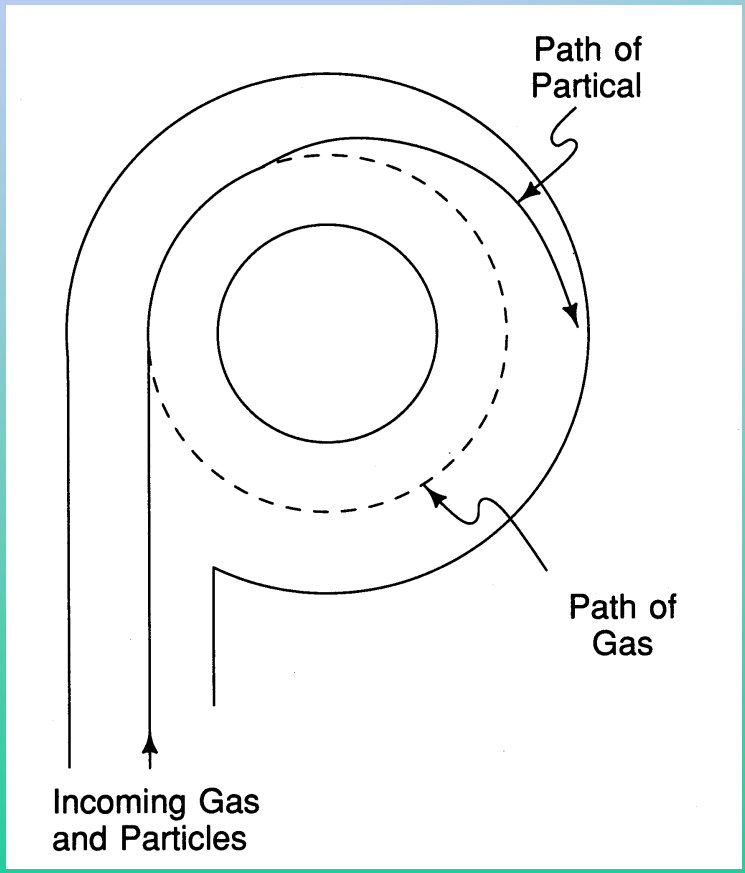
These determine Aerodynamic Diameter

Additional Particulate Properties

- Adhesion
- Cohesion
- Surface Electrical Conductivity

These also determine Control Device Collection and Operability

Inside Cyclone Collector

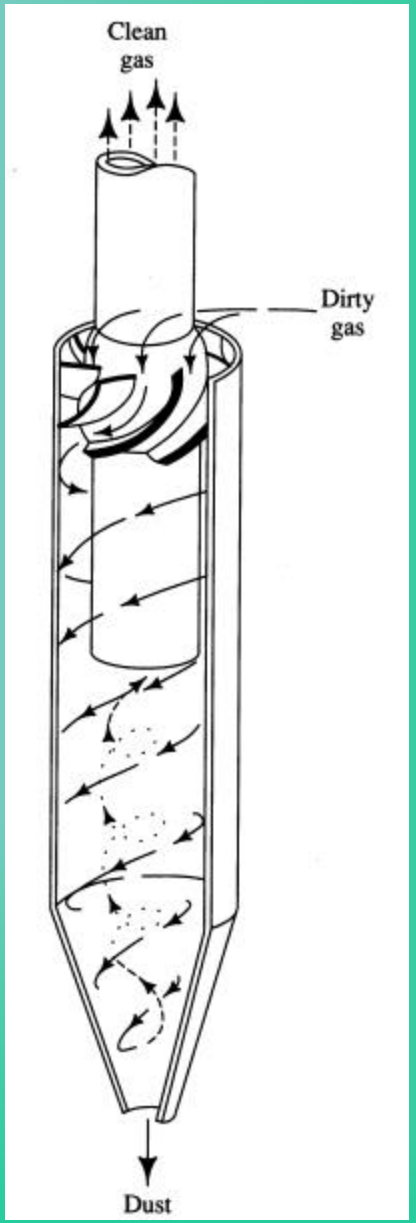


- Gas turns in Cyclone
- Inertia causes dust movement away from gas flow towards the wall
- Separation increases with Particle Size

Dust Cyclone

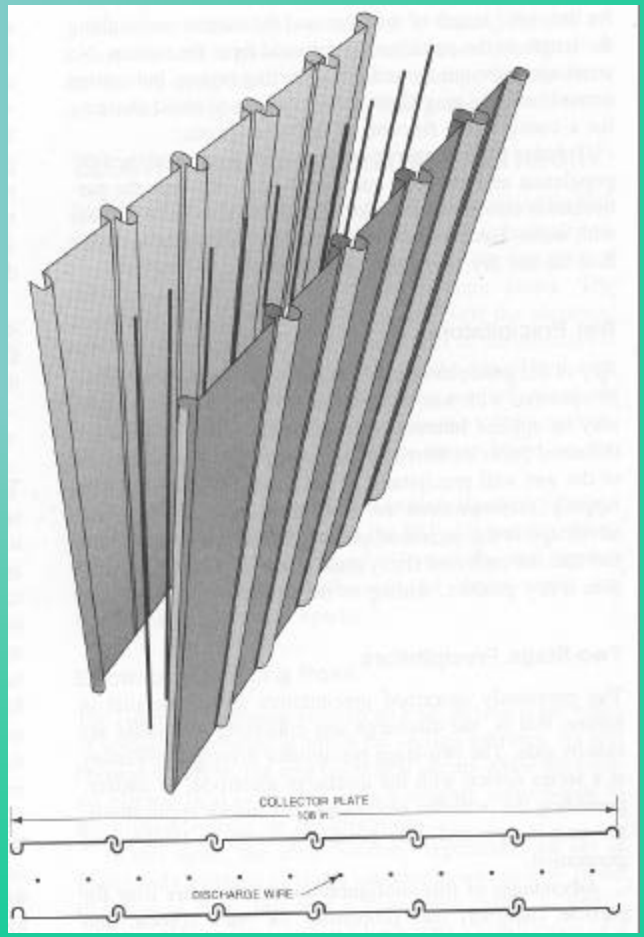
- Used for Larger Particulate
- Some units capture PM_{10}

- Note opportunity to release (re-entrain) Particulate from Walls



Electrostatic Precipitator (ESP)

- Discharge Wires are Midway between Collection Plates
- Ridges in Plates Protect Dust Collected on Plates from Re-entrainment into Gas Flow Stream



Fabric Filter

- Pulsejet Type
- “online cleaning”
- Existing Dust Cake on bags filters dust in gas

- Emissions depend on type of Bag Media and condition of Filter Bags

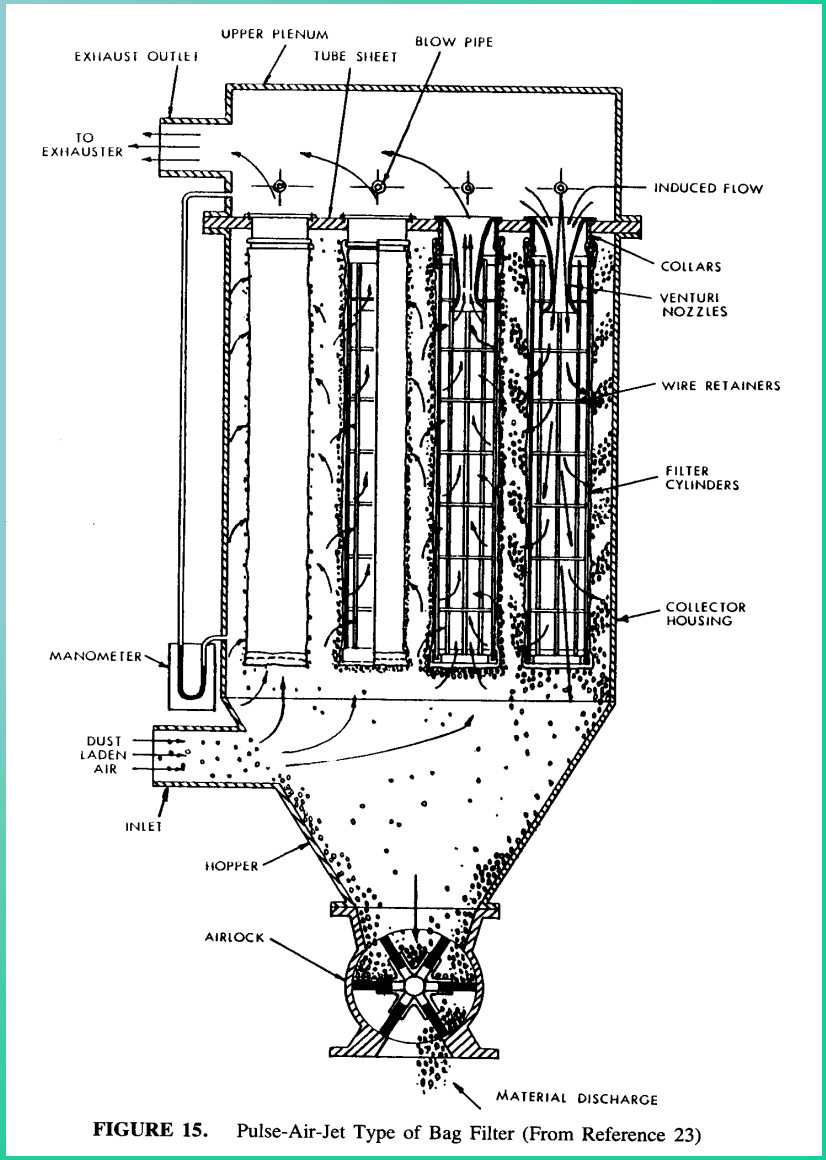
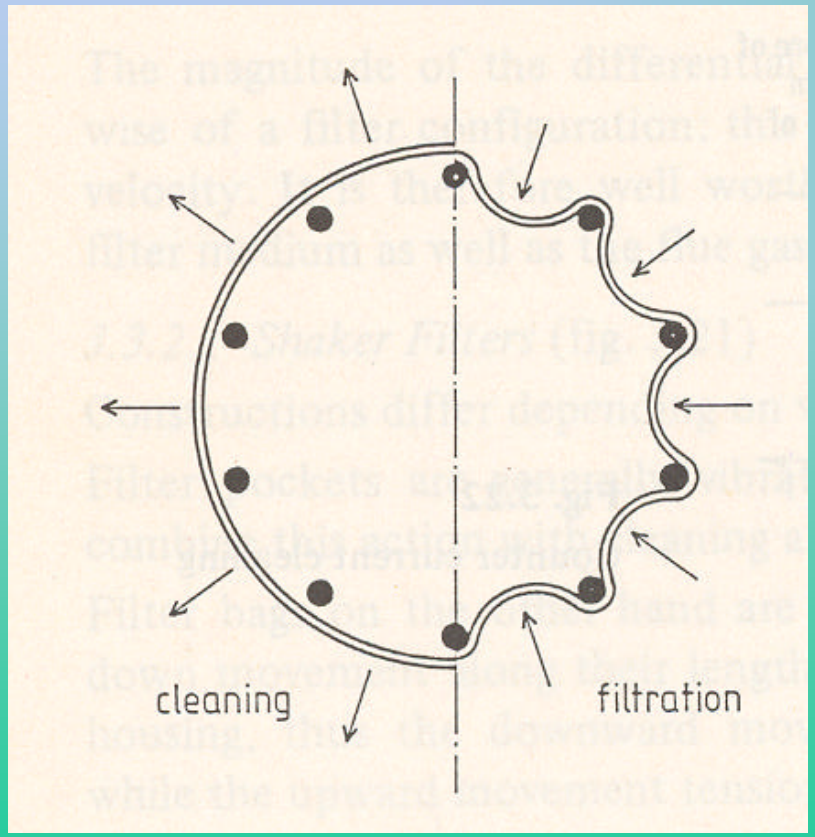


FIGURE 15. Pulse-Air-Jet Type of Bag Filter (From Reference 23)

Bag Cleaning Motion

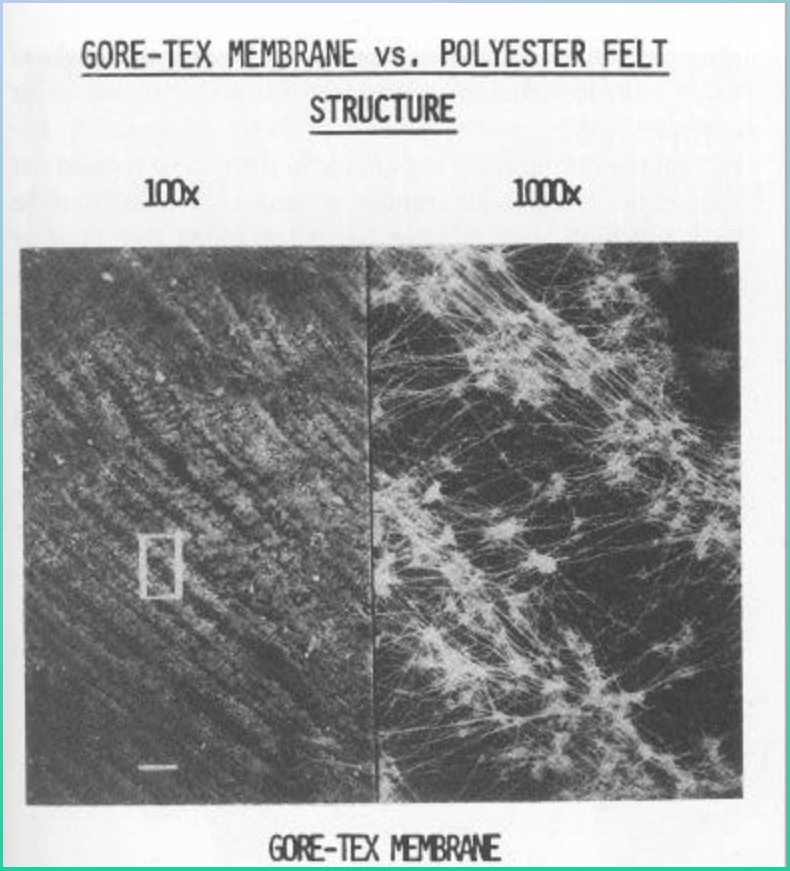


- Filtration example shows Bag collecting Dust
- Cleaning example shows Bag inflated by Compressed Air Pulse
- Aggressive Pulsing will damage Bag

Felt Filter Media

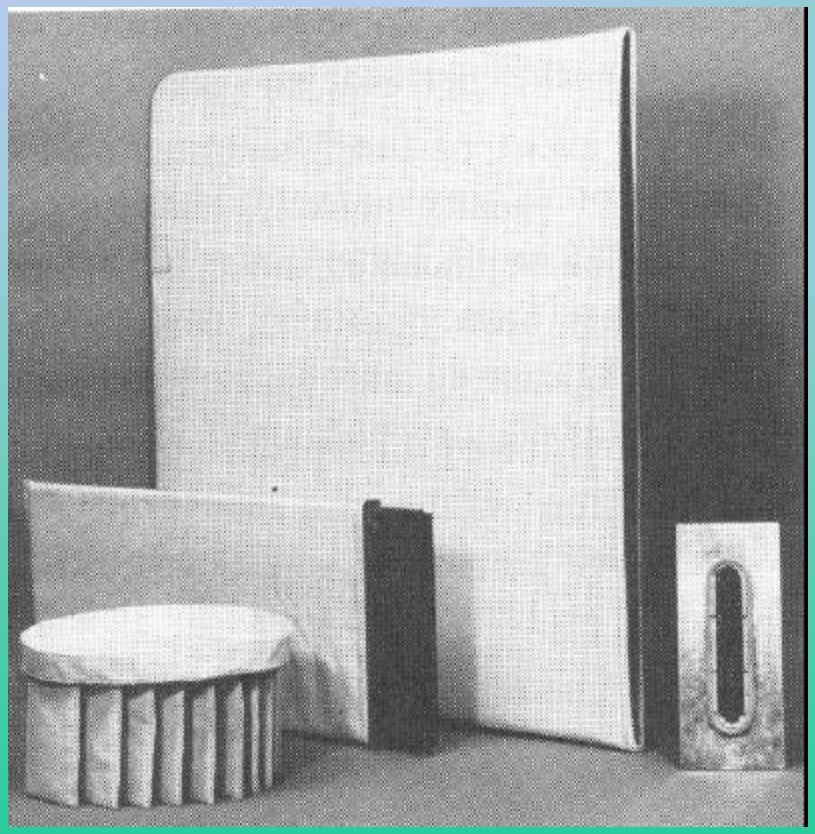
- Filament Structure is Random, producing Media without large Holes
- Synthetic fiber produces long, round filaments

Expanded PTFE Membrane



- Notice fine structure of Surface Membrane
- Membrane acts as a Filter, both, just after Bag Cleaning and from Sieving during normal Operation
- Very effective Dust Removal

Sample Filter Bags



- Types shown presently used in Small Collectors
- Modern Cartridge Filters are not shown

Typical Control Efficiencies

- General graphs based on different Coal Fired Electric Utility Units
- Inlet Dust Loadings are similar, providing a basis to describe efficiency for Fabric Filters

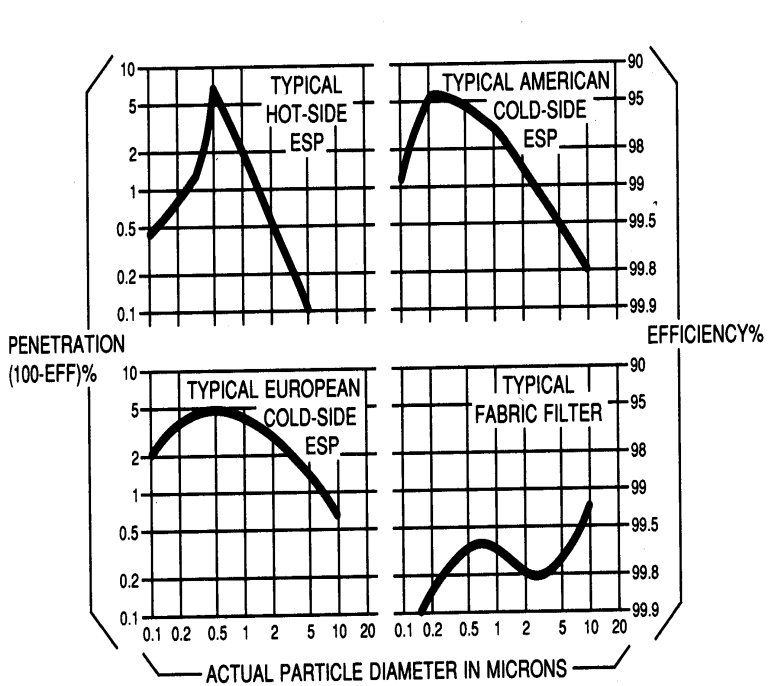


FIGURE 2. Typical Fractional Efficiencies For Existing Collectors (From *Electric Power Research Institute Economics of Fabric Filters vs. Precipitators*, Denver, CO June 1978)

Particulate Emission Trends

- Graph is for MSW Incineration
- Initially all controls shown were ESP
- Most Fabric Filters shown follow an SDA
- Only Filterable Dust is shown

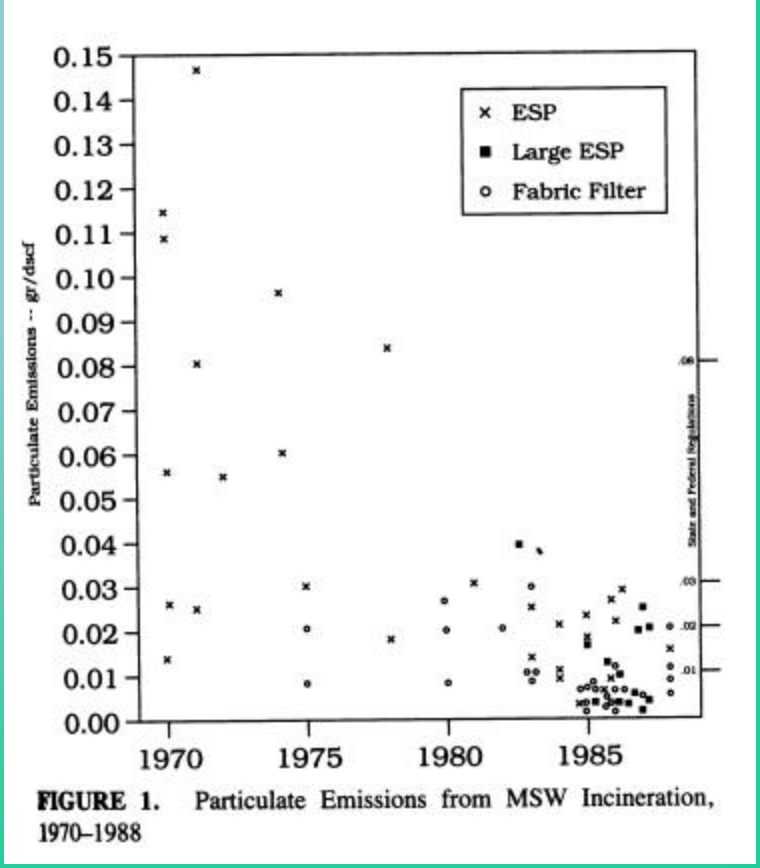


FIGURE 1. Particulate Emissions from MSW Incineration, 1970–1988