

Stationary Source Control Equipment

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Stationary Source Control Equipment

- ◆ Particulate
- ◆ SO_x
- ◆ VOC
- ◆ CO
- ◆ NO_x

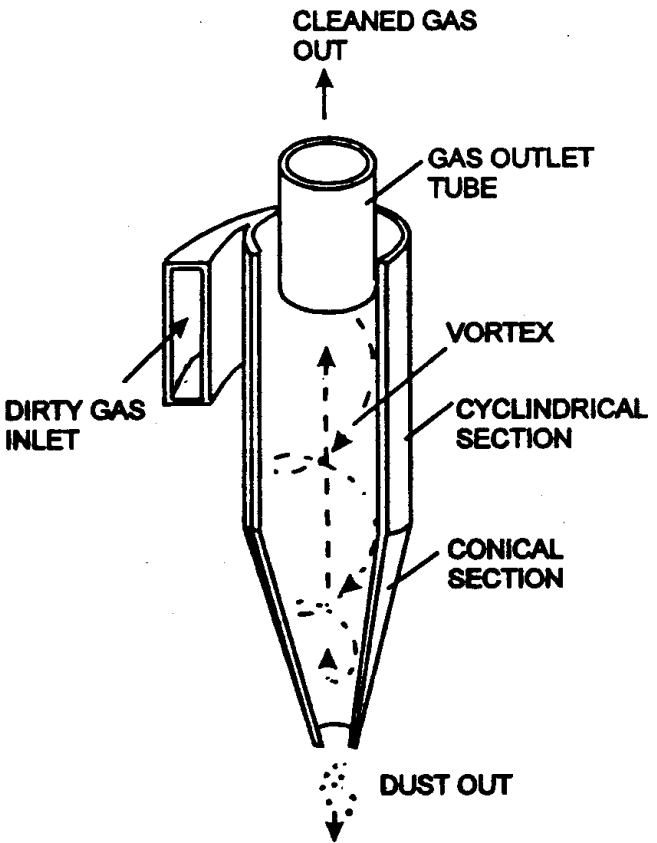


PM Control

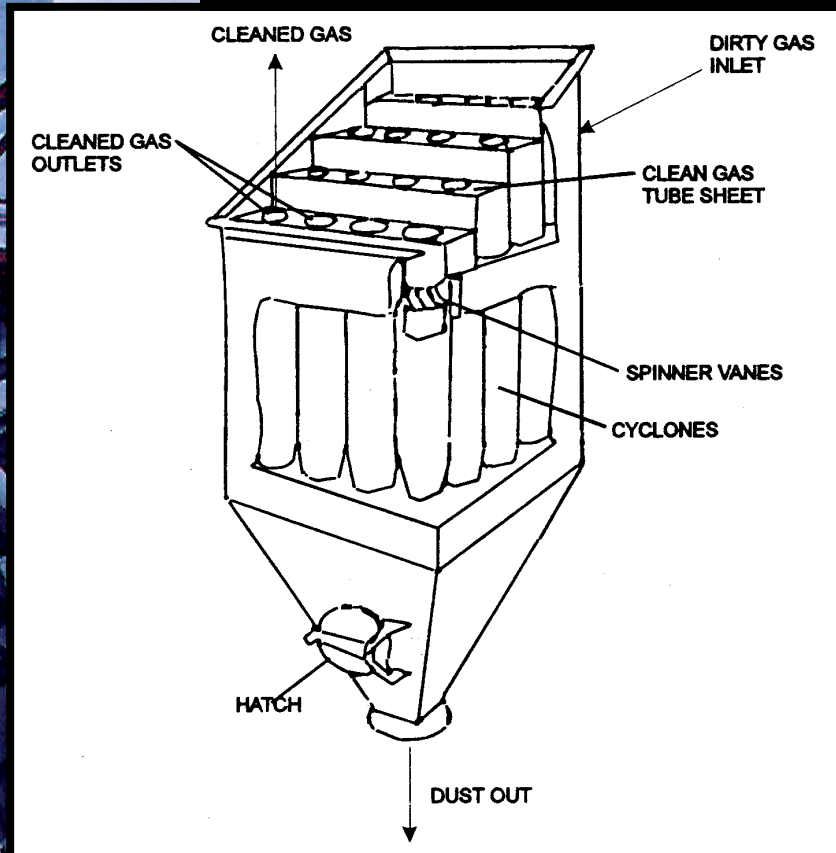
A photograph of a winter forest. The scene is filled with snow-covered evergreen trees. In the foreground, two large, thick tree trunks with reddish-brown bark stand prominently. The ground is covered in a layer of snow, and a wooden fence is visible in the distance. The overall atmosphere is serene and cold.

- ◆ Cyclones
- ◆ Baghouses
- ◆ ESPs
- ◆ Scrubbers
- ◆ Particulate Filters

Cyclones



Multi-Cyclone



Mac2flo

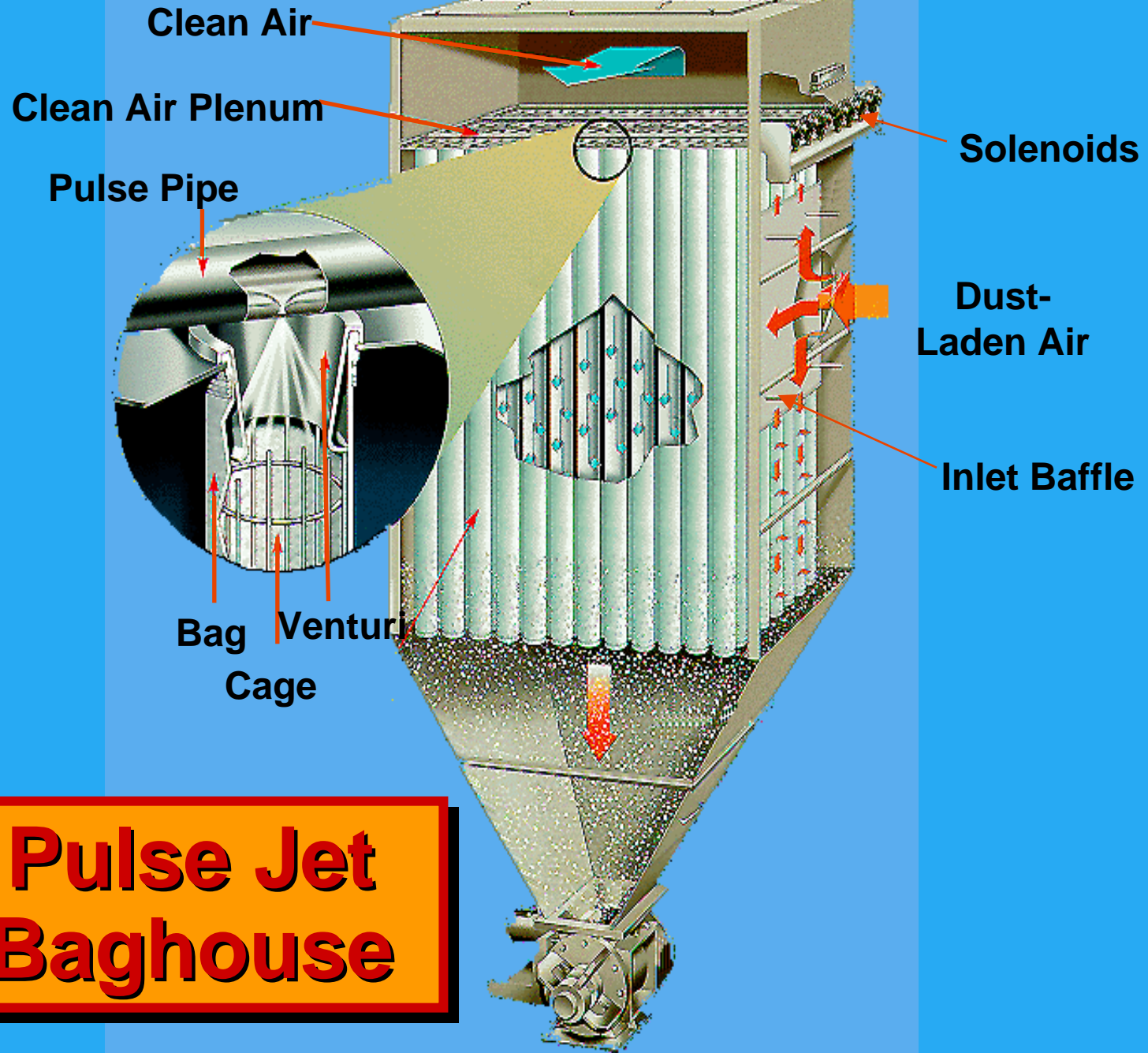
↑
GREEN
BREAK

MAC

Baghouse

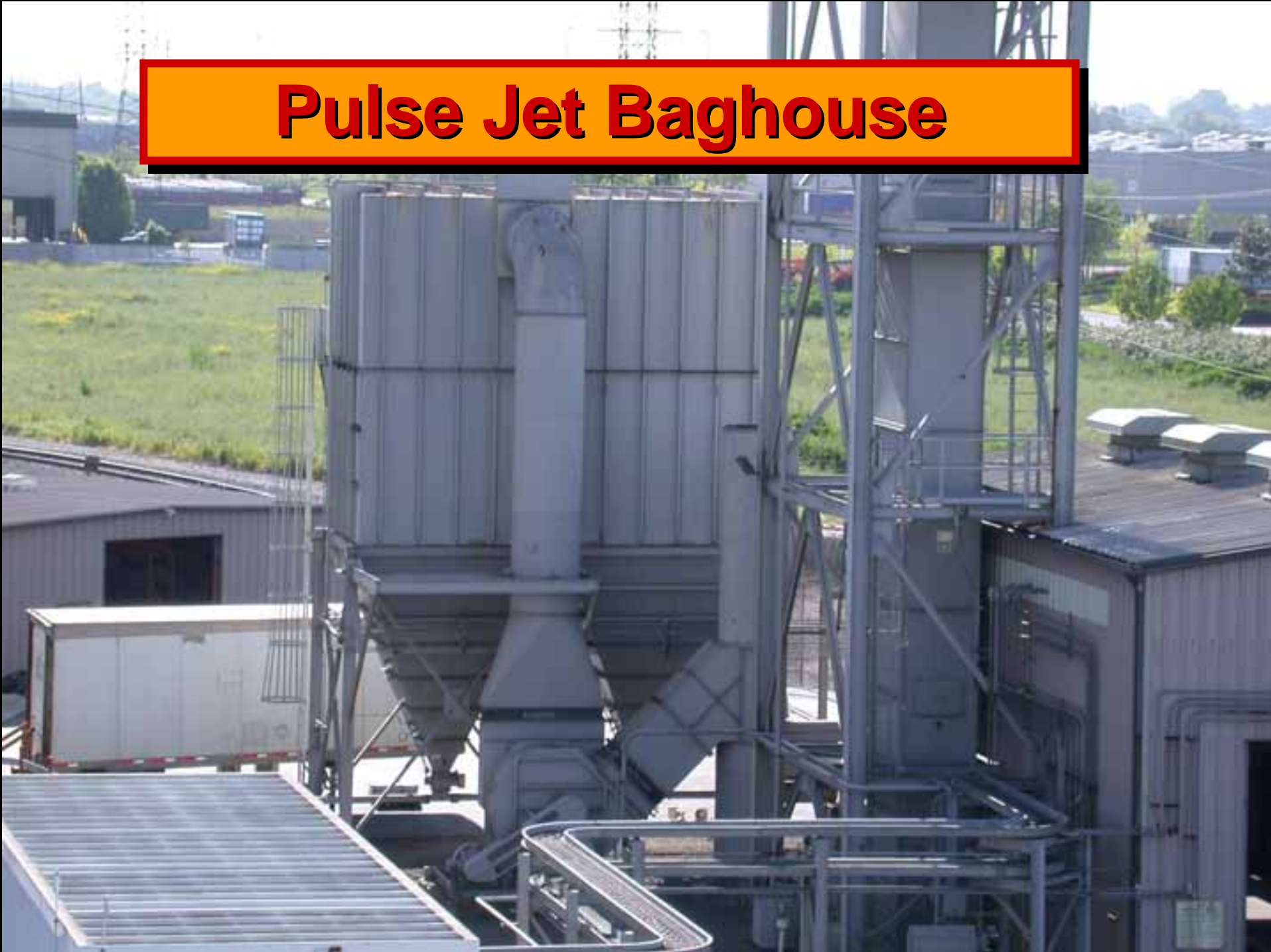
A large, multi-story industrial baghouse structure, painted blue, stands in an outdoor industrial setting. A tall, silver, corrugated metal duct extends vertically from the base of the structure. Several workers wearing hard hats and work clothes are gathered around the base of the baghouse, some looking towards the camera. The background shows other industrial buildings and a clear sky.

Baghouse



Pulse Jet Baghouse

Pulse Jet Baghouse



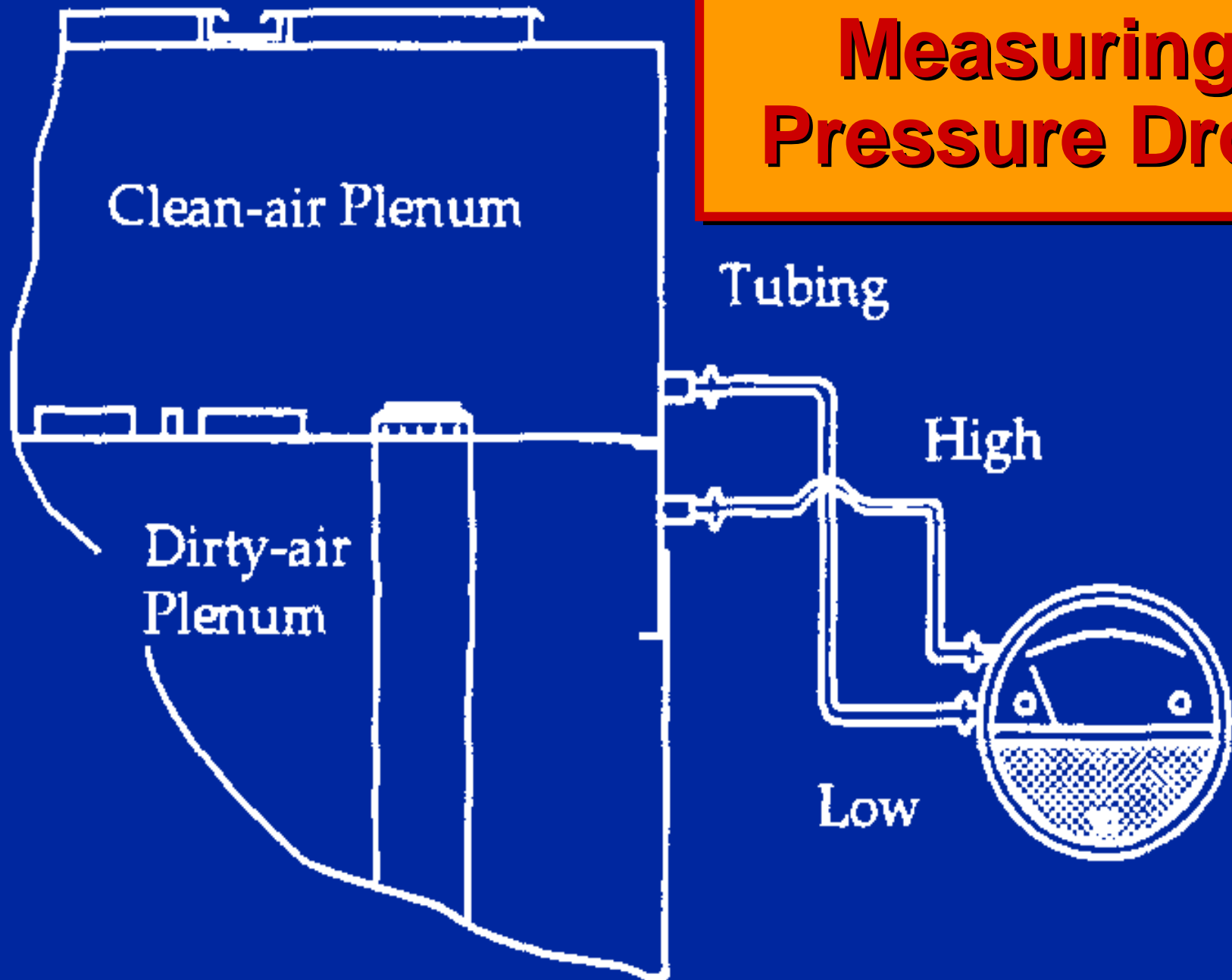
Inside a Pulse Jet Baghouse



Pulse Jet Bag



Measuring Pressure Drop



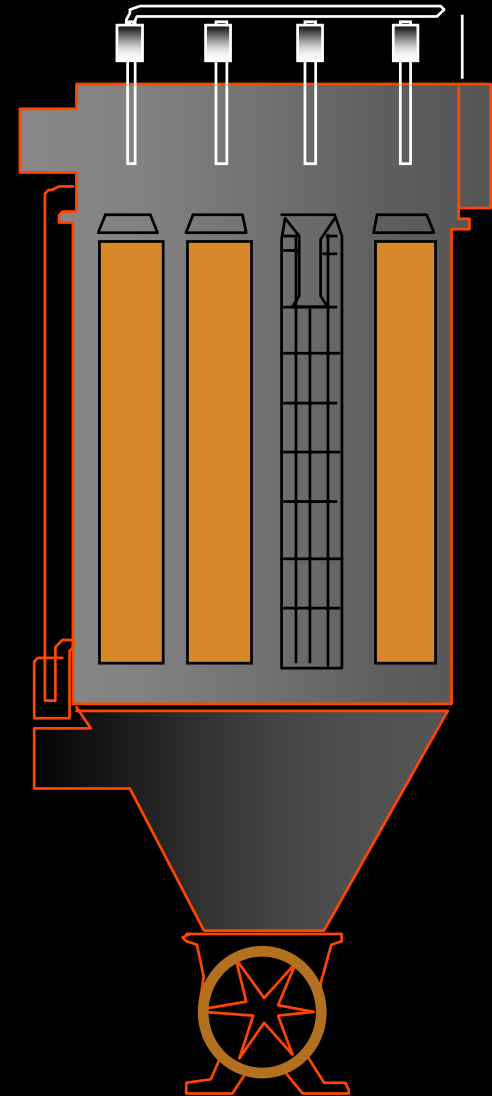


0 TO 1.0 INCHES OF H₂O

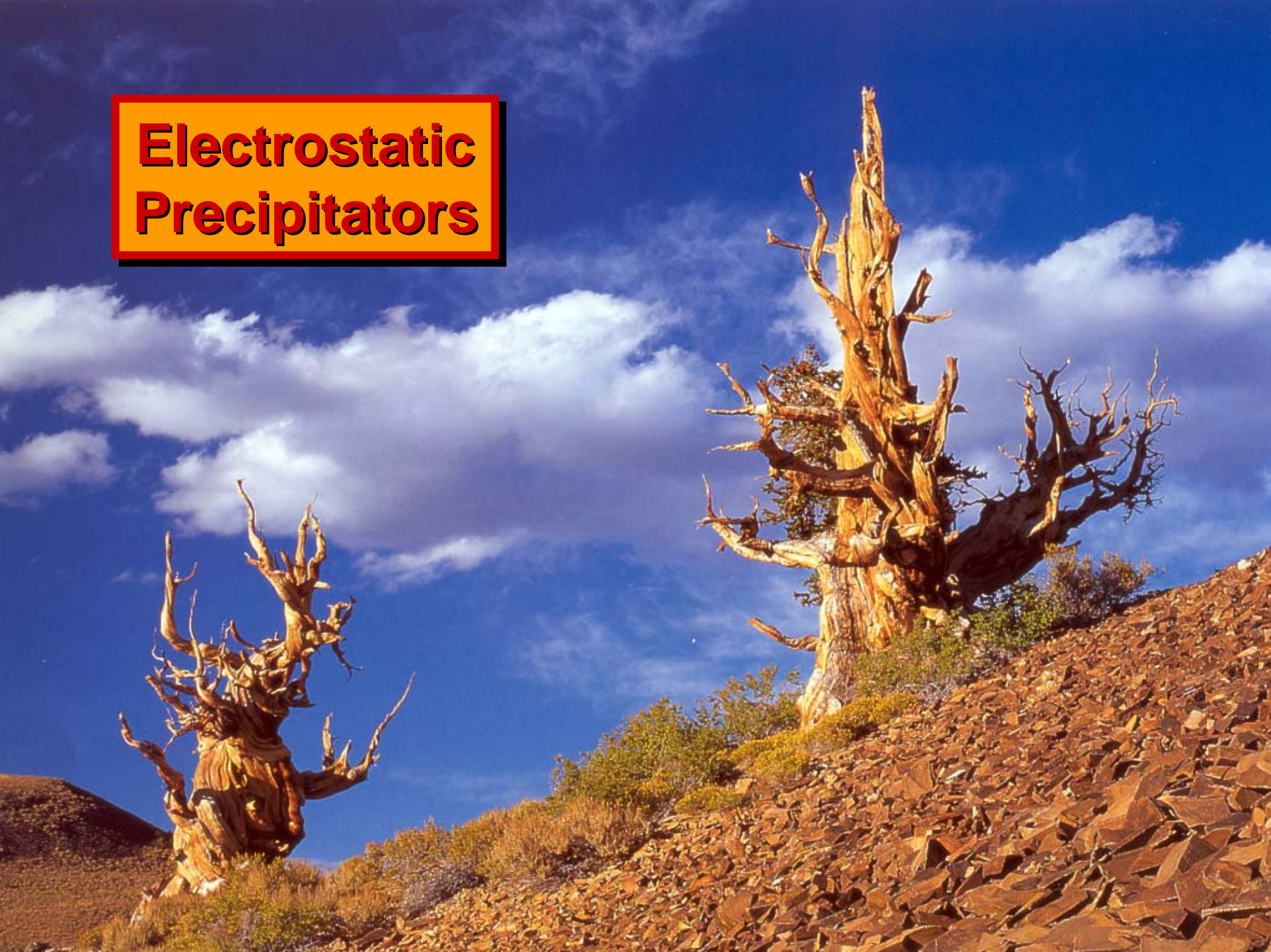
**Magnehelic
Guage**

Baghouse Design Considerations

- ◆ Pressure Drop
- ◆ Air-To-Cloth Ratio
- ◆ Collection Efficiency
- ◆ Fabric Type
- ◆ Cleaning
- ◆ Temperature Control
- ◆ Bag Spacing
- ◆ Compartment Design
- ◆ Space and Cost



Electrostatic Precipitators

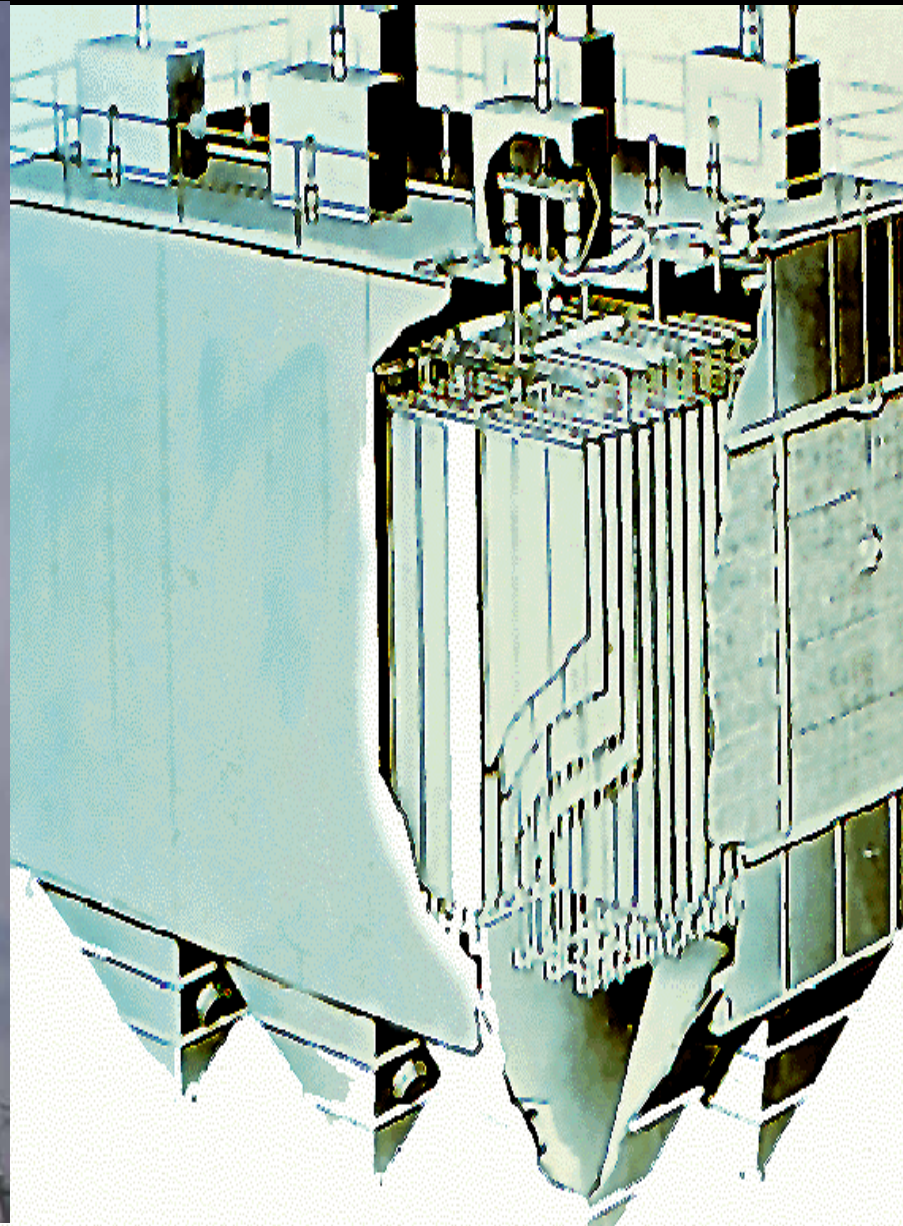


Bio Mass Power Plant

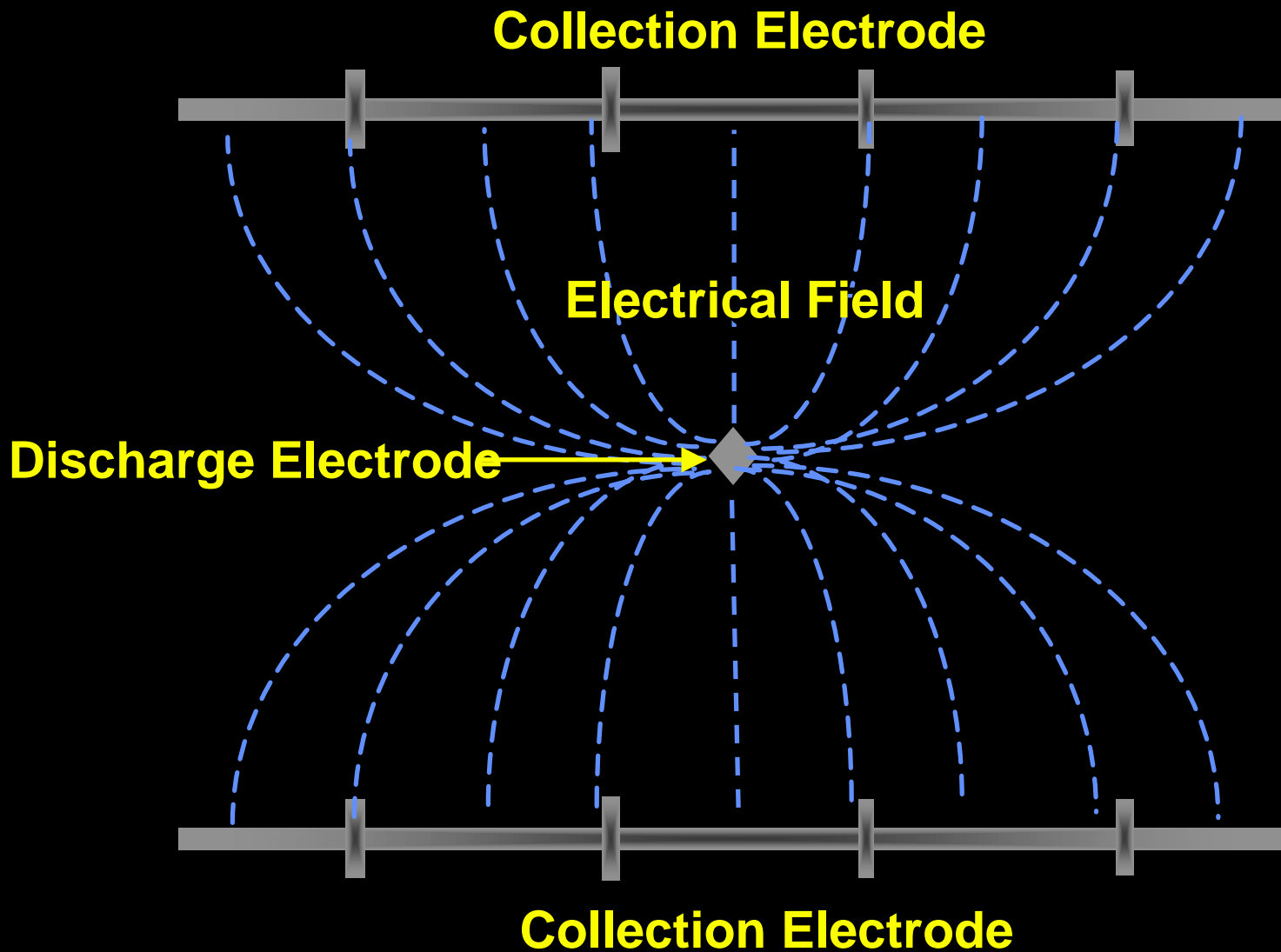


Electrostatic Precipitator

Electrostatic Precipitator



Electrical Field Generation



ESPs: Design Factors Affecting Performance

- ◆ **Specific Collection Area**
- ◆ **Aspect Ratio**
- ◆ **Collection Plate Spacing**
- ◆ **Sectionalization**
- ◆ **Power Requirements/Spark Rate**

A scenic landscape featuring a mountain peak reflected in a calm pool of water. The mountain is rocky and covered with sparse vegetation. The water is still, creating a clear reflection of the mountain and the sky. The foreground is a sandy or gravelly shore. The sky is bright with some clouds. The overall scene is peaceful and natural.

Diesel Particulate Filters

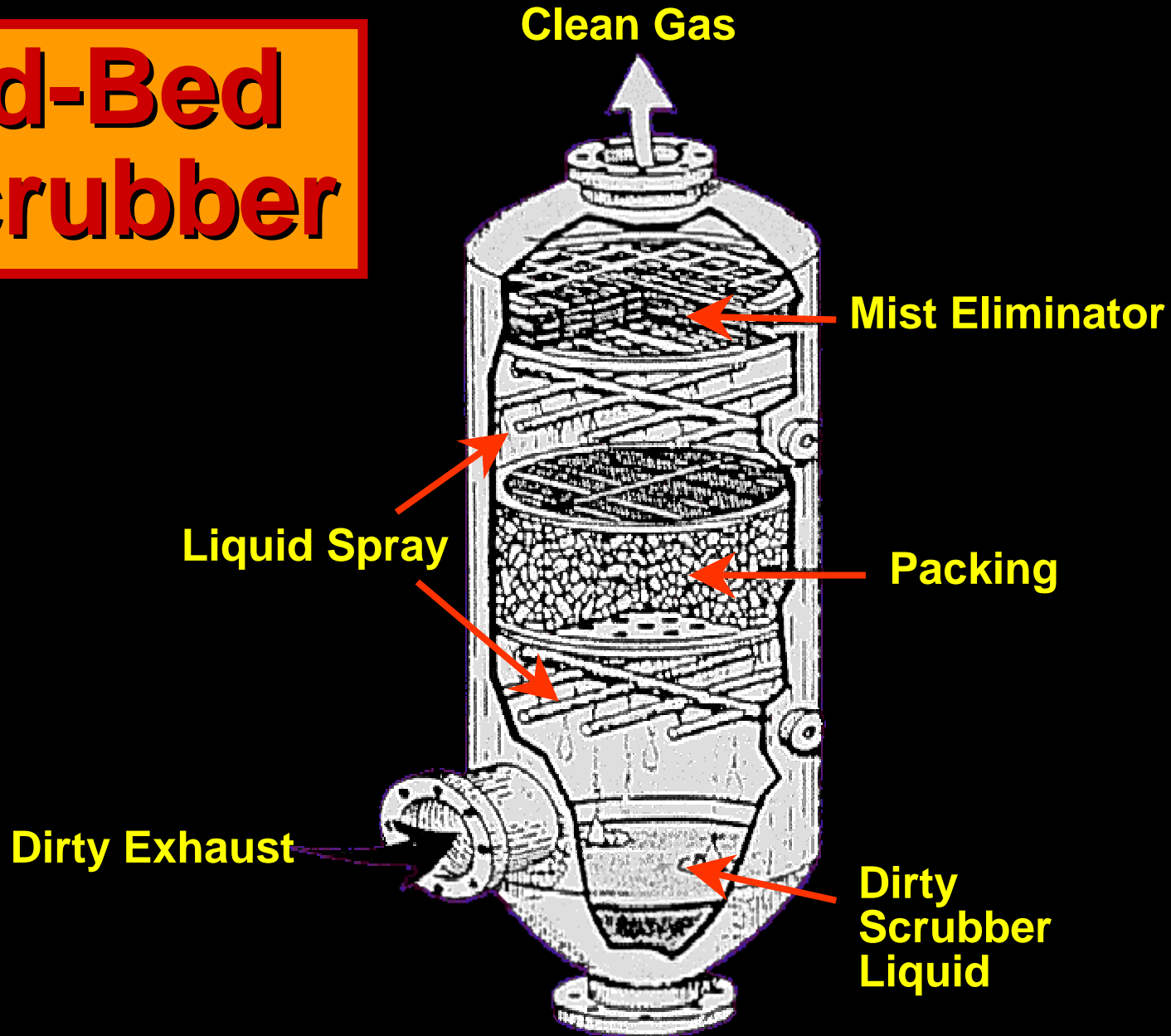


Diesel Particulate Filter (DPF)

A scenic landscape featuring a meadow with patches of green and yellow grass, a calm lake reflecting the sky and mountains, and several large, dark rocks in the foreground. In the background, there are rugged, rocky mountains under a blue sky with scattered white clouds. A text box with a red border and a yellow background is overlaid on the left side of the image.

PM Scrubbers

Packed-Bed Wet Scrubber

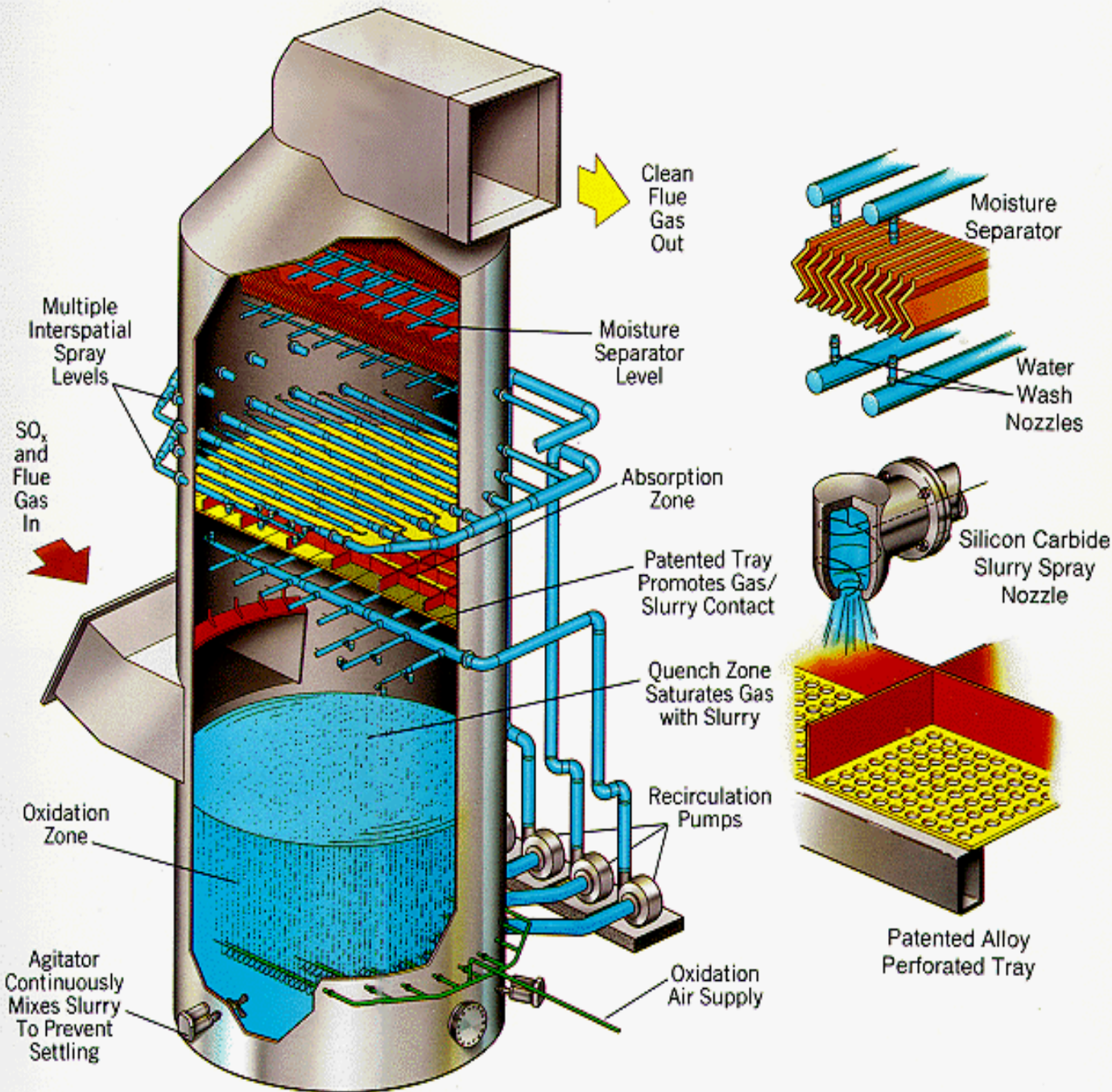




Packed-Bed Wet Scrubber

SOx Control

Wet FGD



Five FGD Scrubber Modules on Utility Boiler



VOC Control

- ◆ **Transfer Efficiency**
- ◆ **Containment**
- ◆ **Condensation**
- ◆ **Absorption**
- ◆ **Adsorption**
- ◆ **Oxidation**



**High Volume Low Pressure (HVLP)
Spray Gun**

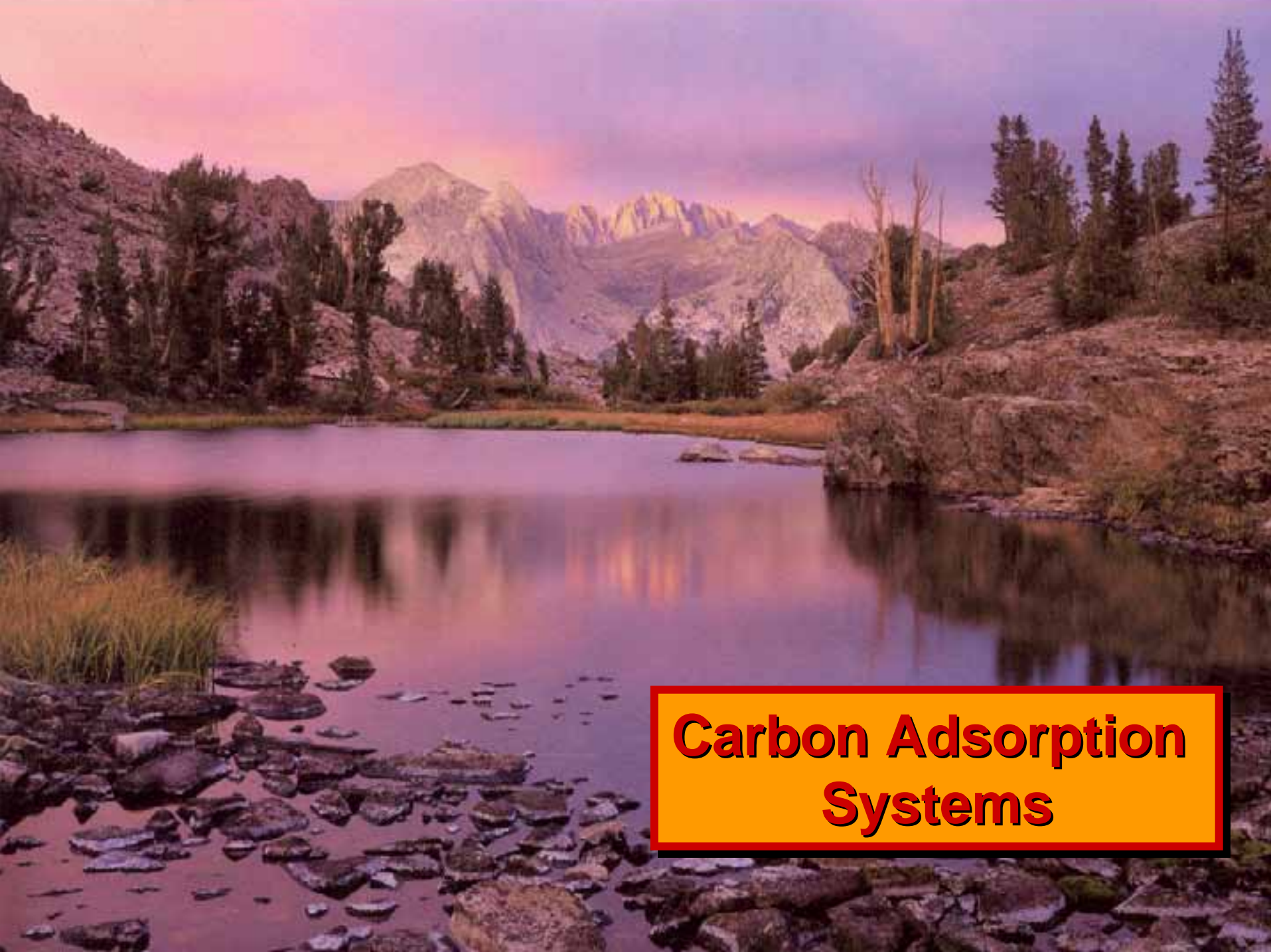


Controlled Spraying

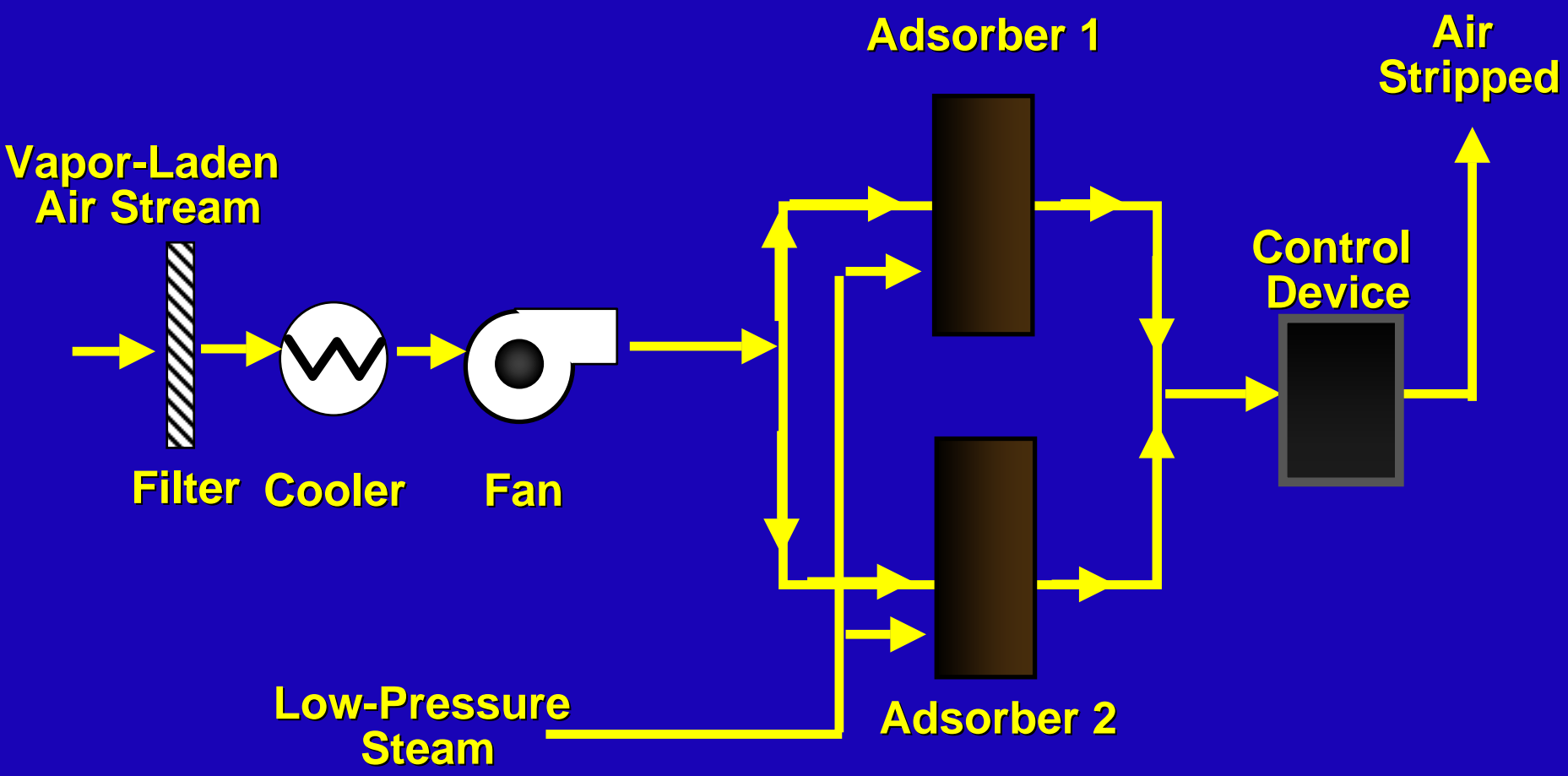
Reduces VOC emissions
Increases transfer efficiency
Low fluid tip pressure
Employee gun handling training



Gel Coat Application in a Spray Booth



Carbon Adsorption Systems



Carbon Adsorption System

**Carbon
Adsorbers
at a Soil
Remediation
Site**



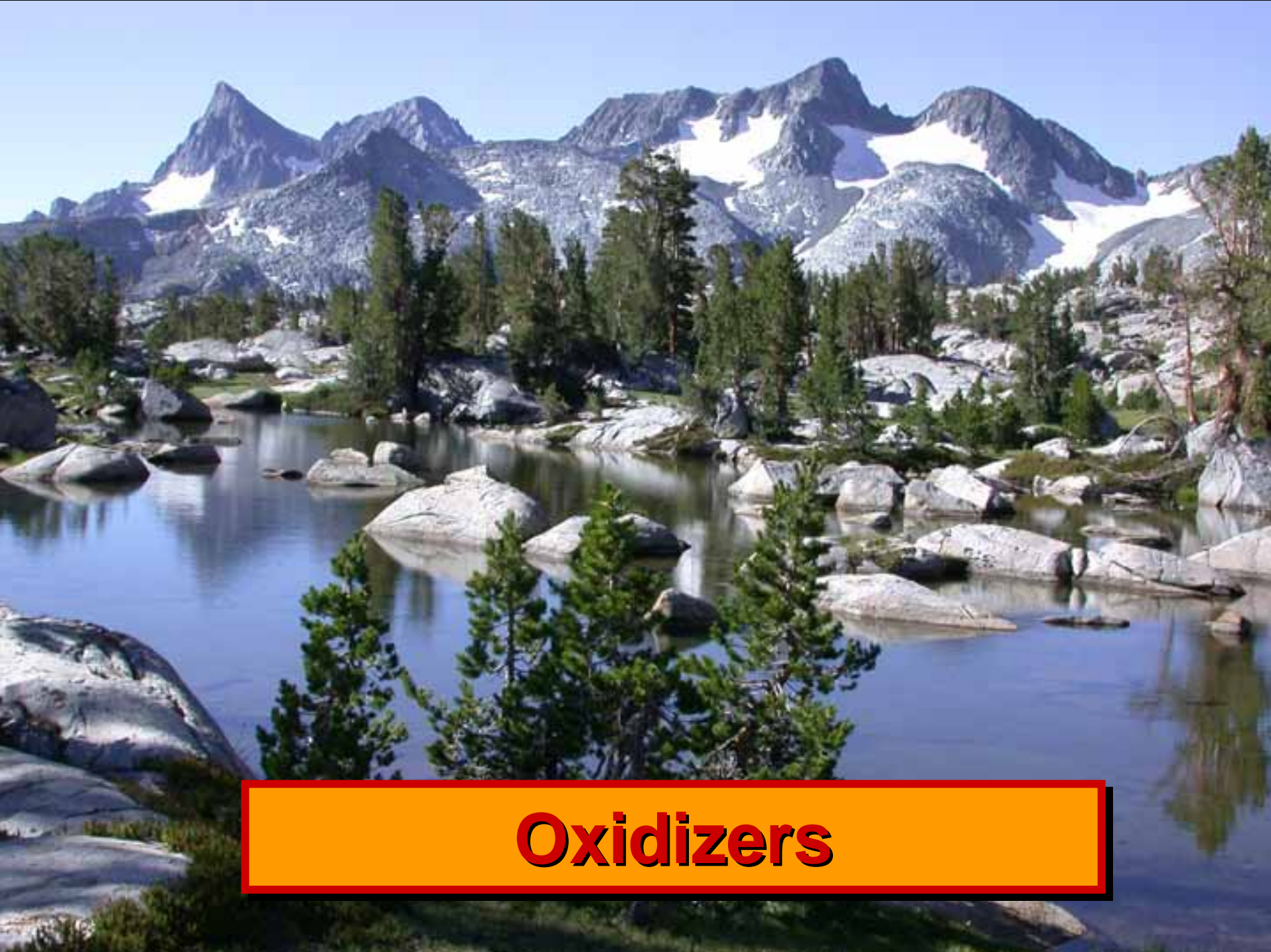


Combustion Sources

Flare at Landfill

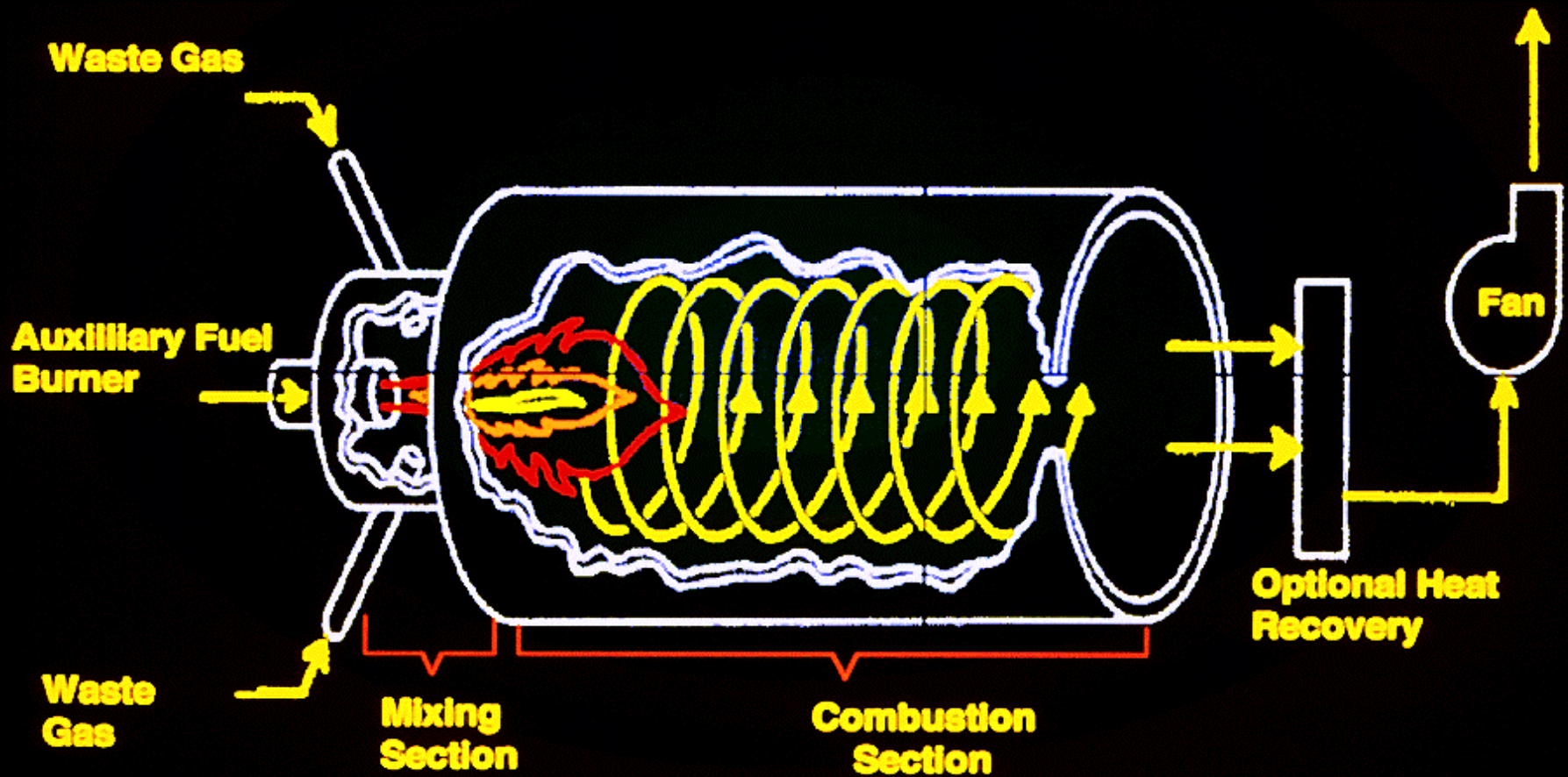


Combustion of VOCs



Oxidizers

Thermal Oxidizer/Afterburner



Thermal Incinerator





Venting to Oxidizer



NO_x Control

- ◆ **Thermodynamic realities**
- ◆ **Low-NO_x combustion techniques**
- ◆ **Ammonia injection (SCR & SNCR)**
- ◆ **Catalytic controls**

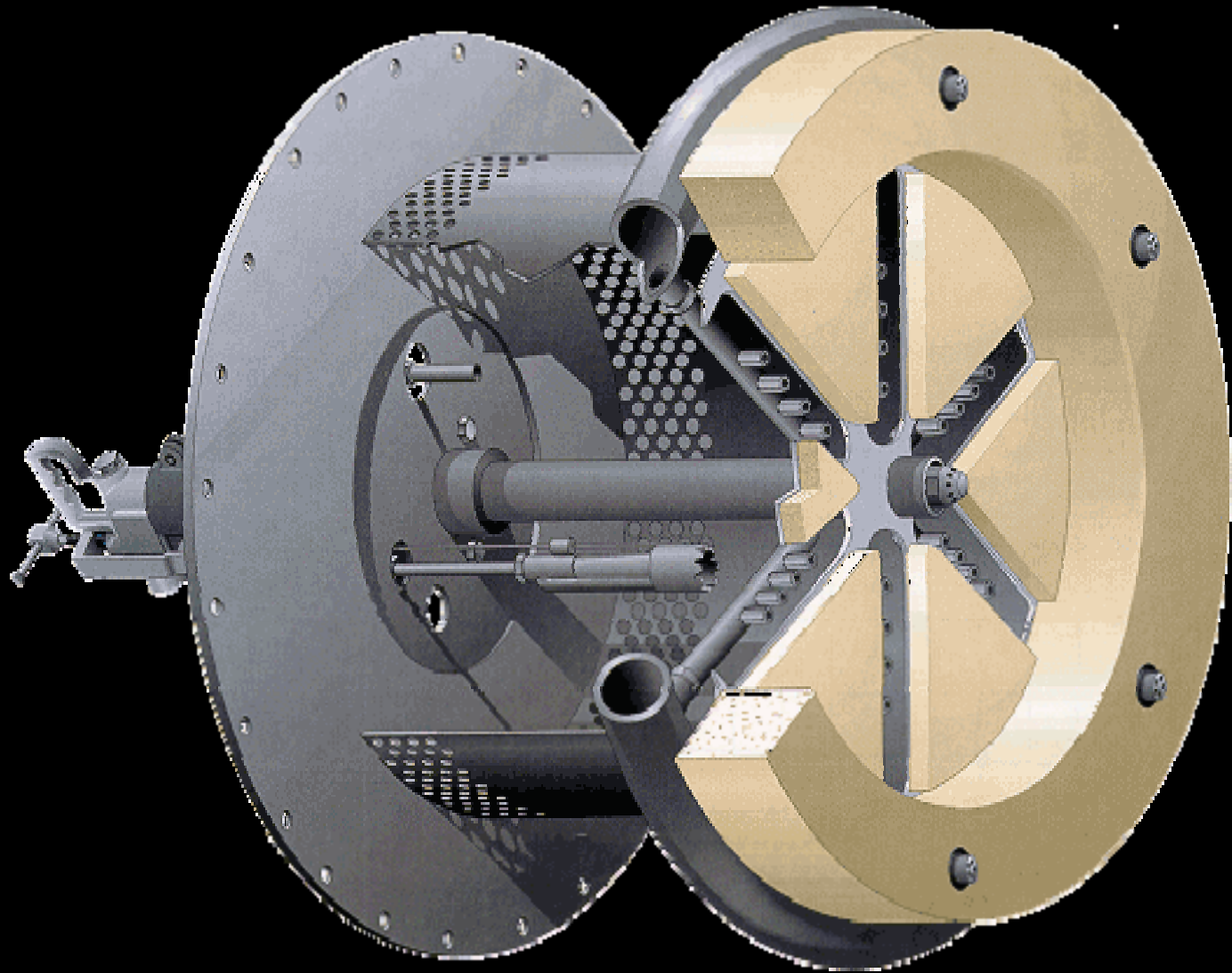


Thermal NOx
Fuel-bound NOx
Prompt NOx



NOx Creation

Low-NOx Burner with Staged Fuel





Flue Gas Recirculation





Gas Turbine Power Plant Controls

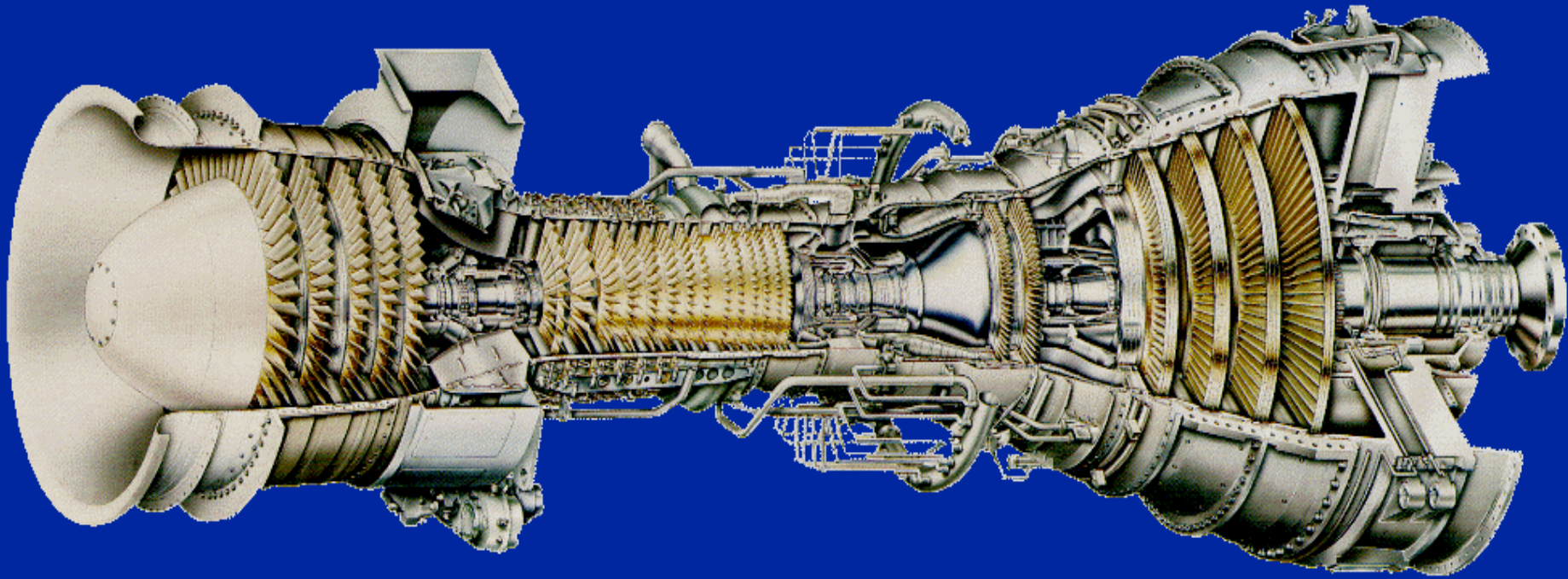
Gas Turbine Power Plant





**Typical Power
Plant**

GE LM6000 Gas Turbine



Steam/Water Injection

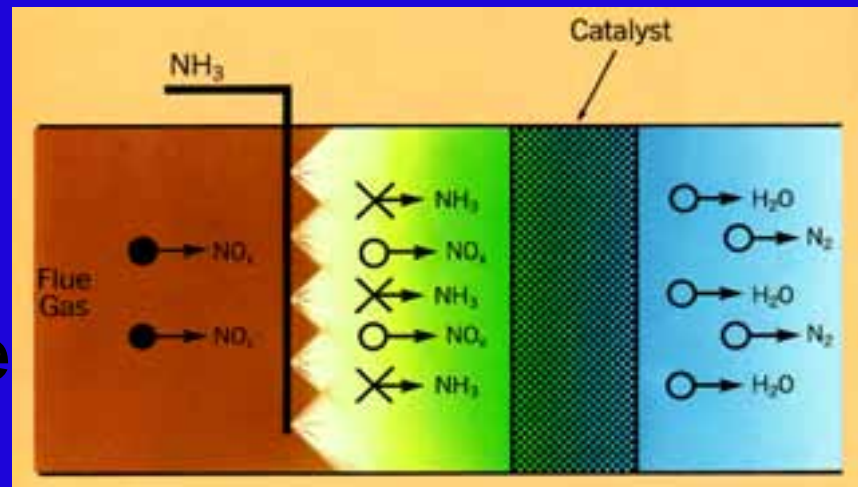




SCR

Selective Catalytic Reduction (SCR)

- ◆ NO_x control thru ammonia (NH₃) injection
- ◆ $4\text{NO} + 4\text{NH}_3 + \text{O}_2 \Rightarrow 4\text{N}_2 + 6\text{H}_2\text{O}$
- ◆ $2\text{NO}_2 + 4\text{NH}_3 + \text{O}_2 \Rightarrow 3\text{N}_2 + 6\text{H}_2\text{O}$
- ◆ 65-90% control
- ◆ Problems
 - ◆ Expensive
 - ◆ High maintenance
 - ◆ Ammonia “slip”
 - ◆ Catalyst replacement & disposal



NH₃ Manifold





**Small Boiler
with SCR**



Utility Boiler with SCR



**Gas Fired
I.C. Engine
Controls**

Gas Fired I.C. Engines





Three-Way Catalyst



The End