



# **Hot Mix Asphalt (HMA) Facilities**

# Overview

- ➡ Introduction
- ➡ Emissions
- ➡ Process
- ➡ Control
- ➡ Permit Requirements
- ➡ Inspection Procedures

# Introduction

## Industry Background

### ➡ Hot Mix Asphalt (HMA) facilities

- ✓ Stationary
- ✓ Some transportable

### ➡ HMA is combination of

- ✓ Hot aggregate,
- ✓ Hot liquid asphalt binder
- ✓ Filler

### ➡ Recycled Hot Mix (RHM) is HMA with

- ✓ Crumb rubber (rubberized asphalt concrete)
- ✓ Reclaimed asphalt



# Introduction

## Industry Background

➡ Two basic processes

✓ Batch

✓ Continuous mix

➡ Batch change recipe based on customers order

➡ Continuous mix one recipe at a time stored for up to 7 days in insulated silo



# Introduction

## Permit Process Requirements

- ➡ District issues an “Authority to Construct”
- ➡ Inspection conducted
  - ✓ Usually includes a source test
- ➡ All conditions met “Permit to Operate” is issued



# Emissions and Effects



**HMA facilities emit pollutants such as PM, CO, NO<sub>x</sub>, SO<sub>x</sub>, VOCs and other toxic substances**

**NO<sub>x</sub> and VOCs are Ozone (O<sub>3</sub>) precursors each reacts with sunlight to form O<sub>3</sub>**

# HMA Emissions in CA

(OVER 125 Facilities)

<b>Typical HMA Pollutants</b>	<b>Emissions (tons/yr)</b>
<b>PM (total for all size categories)</b>	<b>1500</b>
<b>PM10</b>	<b>700</b>
<b>PM2.5</b>	<b>400</b>
<b>CO</b>	<b>800</b>
<b>NOx</b>	<b>450</b>
<b>Total Organic Compounds</b>	<b>200</b>
<b>Reactive Organic Gas</b>	<b>200</b>
<b>SOx</b>	<b>100</b>
<b>VOCs</b>	<b>200</b>

# Emissions

## Criteria and Precursor Pollutants

➡ Created during production, storage, and transport of HMA

➡ PM from aggregate





# Emissions

## Criteria and Precursor Pollutants (cont.)

- ➡ PM, CO, NO<sub>x</sub>, VOCs, and SO<sub>x</sub> from fuel combustion and storage of asphalt binder and HMA
- ➡ Blue Smoke (VOCs) from production and loading



# NSPS – Standards of Performance HMA Facilities

(40 CFR Part 60 Subpart I)

## Applies to HMA Facilities Comprised of:

- ✓ Dryers
- ✓ Screening, Handling, Storing and Weighing Hot Aggregate Systems
- ✓ Loading, Transferring, and Storing Mineral Filler Systems
- ✓ Mixing HMA Systems
- ✓ Loading, Transfer, and Storage for APC Systems

## Applies to HMA Facilities that:

Commence Construction or Modification after June 11, 1973

## Particulate Matter Standard

- ✓ No discharge in excess of 90 mg/dscm (0.04 gr/dscf)
- ✓ Not to exceed 20 % Opacity or Greater

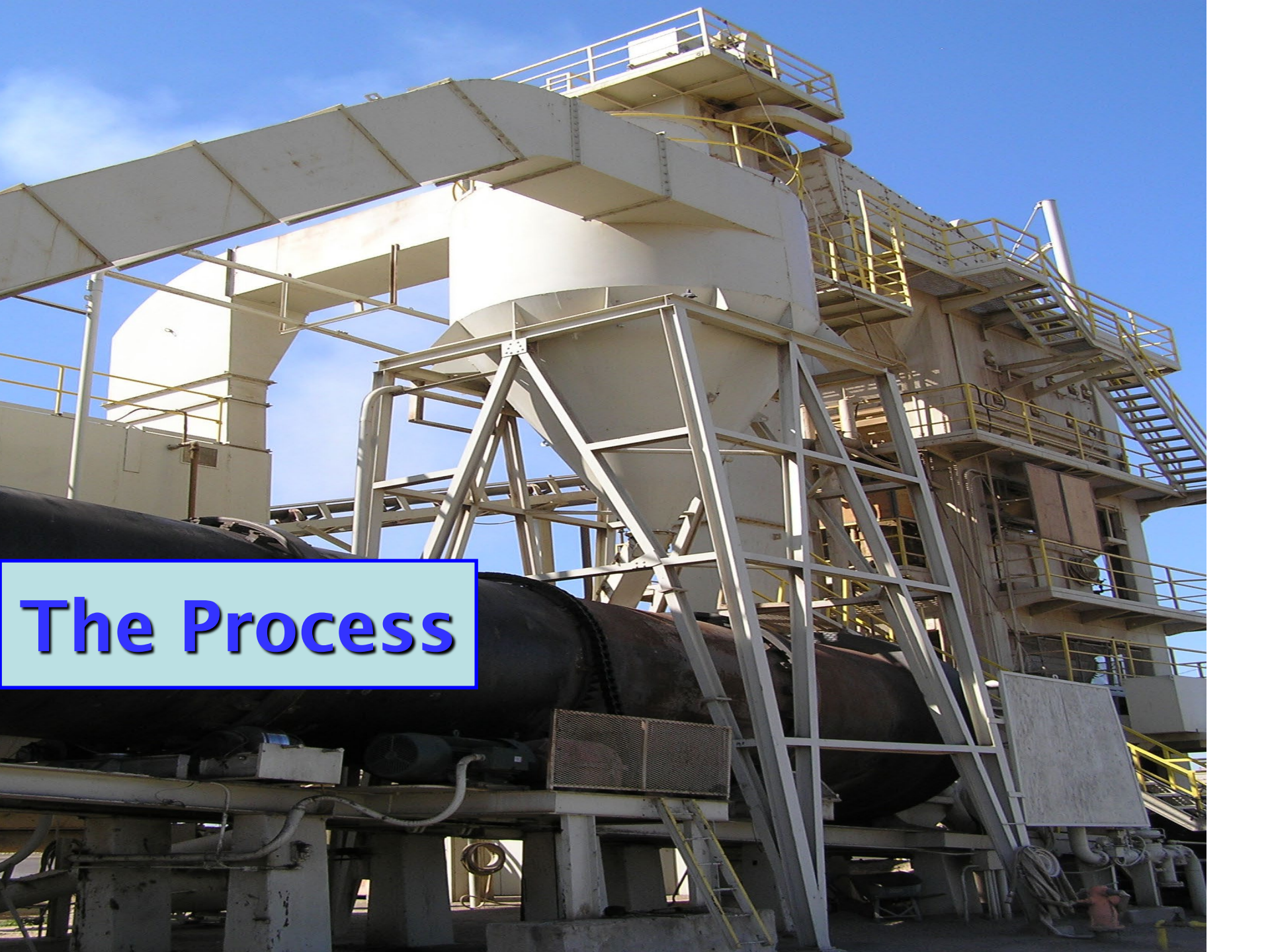
# NSPS – Standard of Performance for Nonmetallic Mineral Processing Plants

(40 CFR Part 60 Subpart 000)

**HMA Facilities are also Regulated Under  
Subpart 000 for Crushers & Grinding Mills**

## **Process/Control**

- ✓ **How much aggregate is processed**
- ✓ **Moisture content of the processed material**
- ✓ **Control efficiency of the air pollution control equipment**
- ✓ **Opacity**



# The Process

# Process

## Composition of HMA

- ➡ Binder
- ➡ Filler
- ➡ Aggregate



# Process

## Binder Composition



### Binder Terms

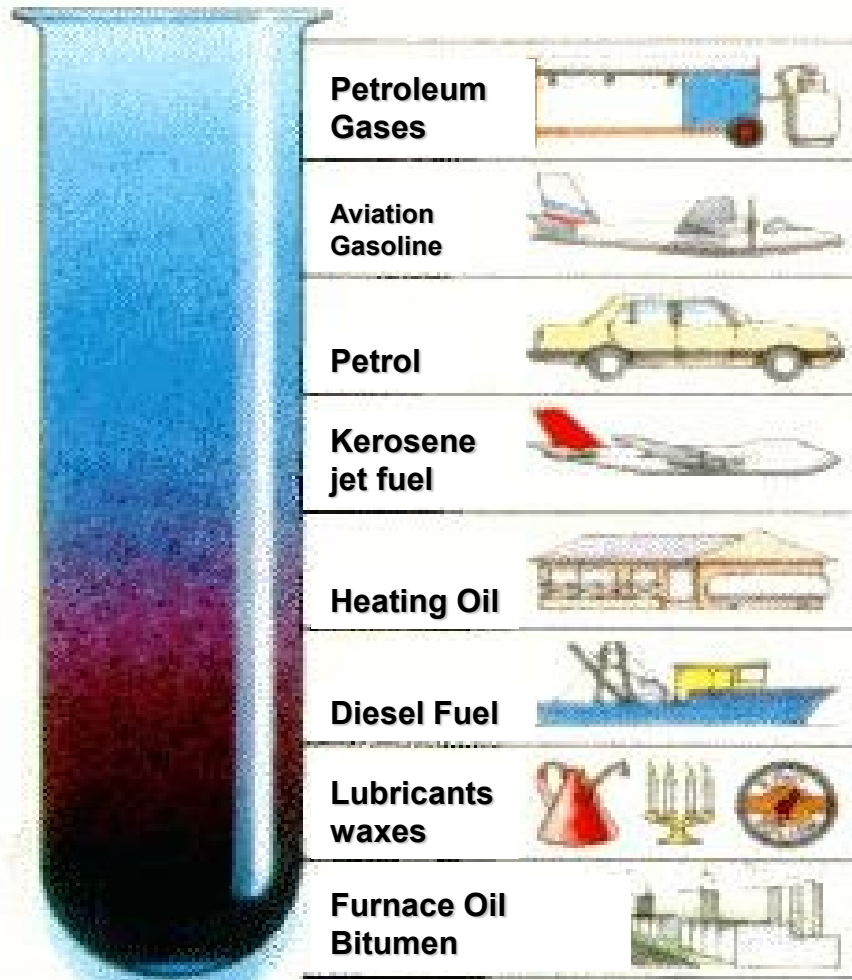
#### ➡ Asphalt Binder

- ✓ Includes asphalt cement and any material added to modify properties

#### ➡ Bitumen

- ✓ Class of dark colored (solid, semi solid, or viscous)

# Process Binder Composition



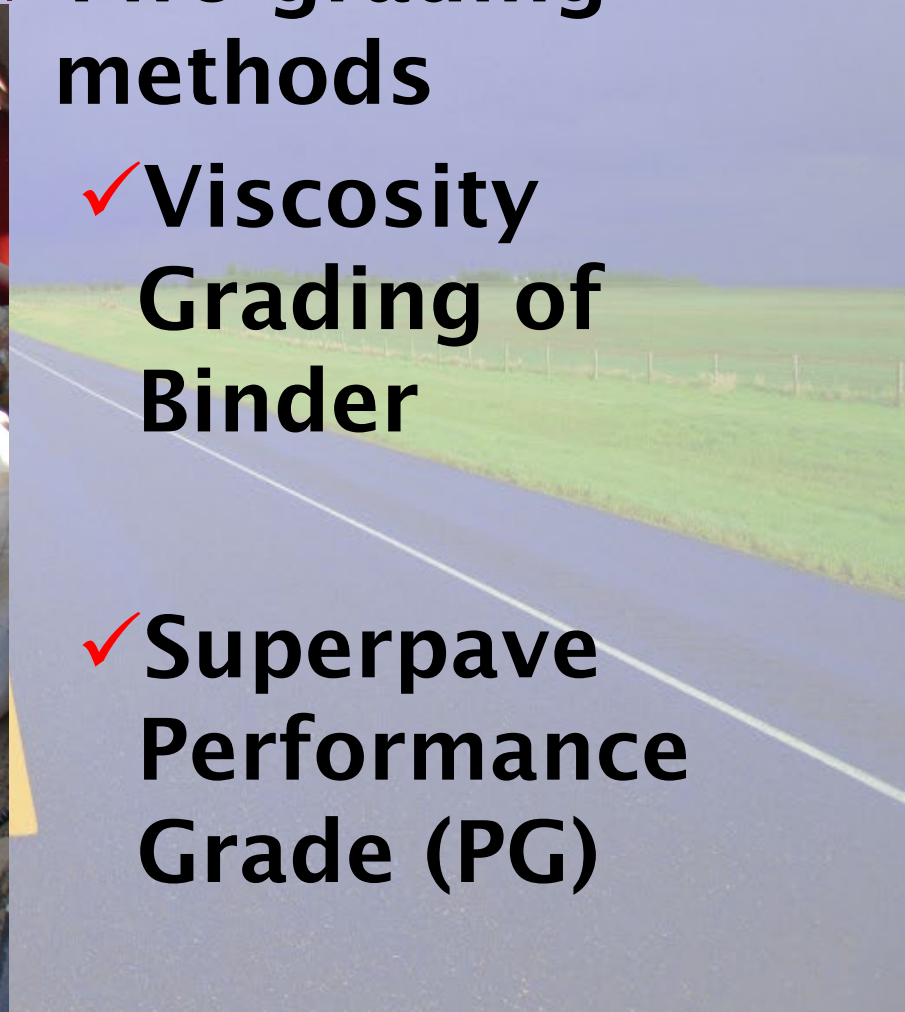
**Crude  
Petroleum  
Distillation  
Fractions**

# Process Asphalt Grading

➡ Two grading methods

✓ Viscosity  
Grading of  
Binder

✓ Superpave  
Performance  
Grade (PG)





# Process

## Viscosity Grading of Binder

➡ Viscosity test developed during the early part of the 20<sup>th</sup> century.

✓ AC

- Tests viscosity of binder to characterize viscosity as supplied (simulating condition before used)

✓ AR

- Tests viscosity of binder aged in a rolling thin-film oven (simulating HMA production)

# Process

## Viscosity Grading of Binder (cont'd.)

### ➤ PG (Superpave Performance Grade)

- ✓ Test developed in 1980-1990
- ✓ Based on performance of binder in relation to climate
- ✓ Temperature range is 115 to 180 F
- ✓ Address rutting, fatigue cracking, and thermal cracking



# Process

## Conventional HMA Binder

- ➡ Solid at room temperature
- ➡ 250 and 325 F from point of origin to the final destination
- ➡ Softening binder adds VOCs by
  1. Adding softer grade asphalt
  2. Adding lighter petroleum oils



# Process

## Typical Alternative Asphalt Binder

- ➡ Reclaimed asphalt pavement (RAP)
- ➡ Used tires (crumb rubber)
- ➡ Proprietary polymers
- ➡ Anti-stripping agents (hydrated lime)
- ➡ Recycled baghouse dust



**Figure 2.16: RAP in Aggregate-Sized Chunks**

# Process

## Polymer Modified Binders

- ➡ proprietary blends added to bitumen
- ➡ Formula varies depending on desired result of end product



# Process

## Filler

- ➡ **Dust added to asphalt binder and aggregate to improve adhesion**



# Process

**RECIPE FOR HOT MIX ASPHALT**

# Process



## Hydrated Lime

- ➡ Caltrans requires a lime-slurry-marination (LSM) where climate promotes stripping
- ➡ Requires that mixture be stockpiled for 24 hours before use “marinated”



# Process

## Hydrated Lime

➡ **Anti-stripping agent:**

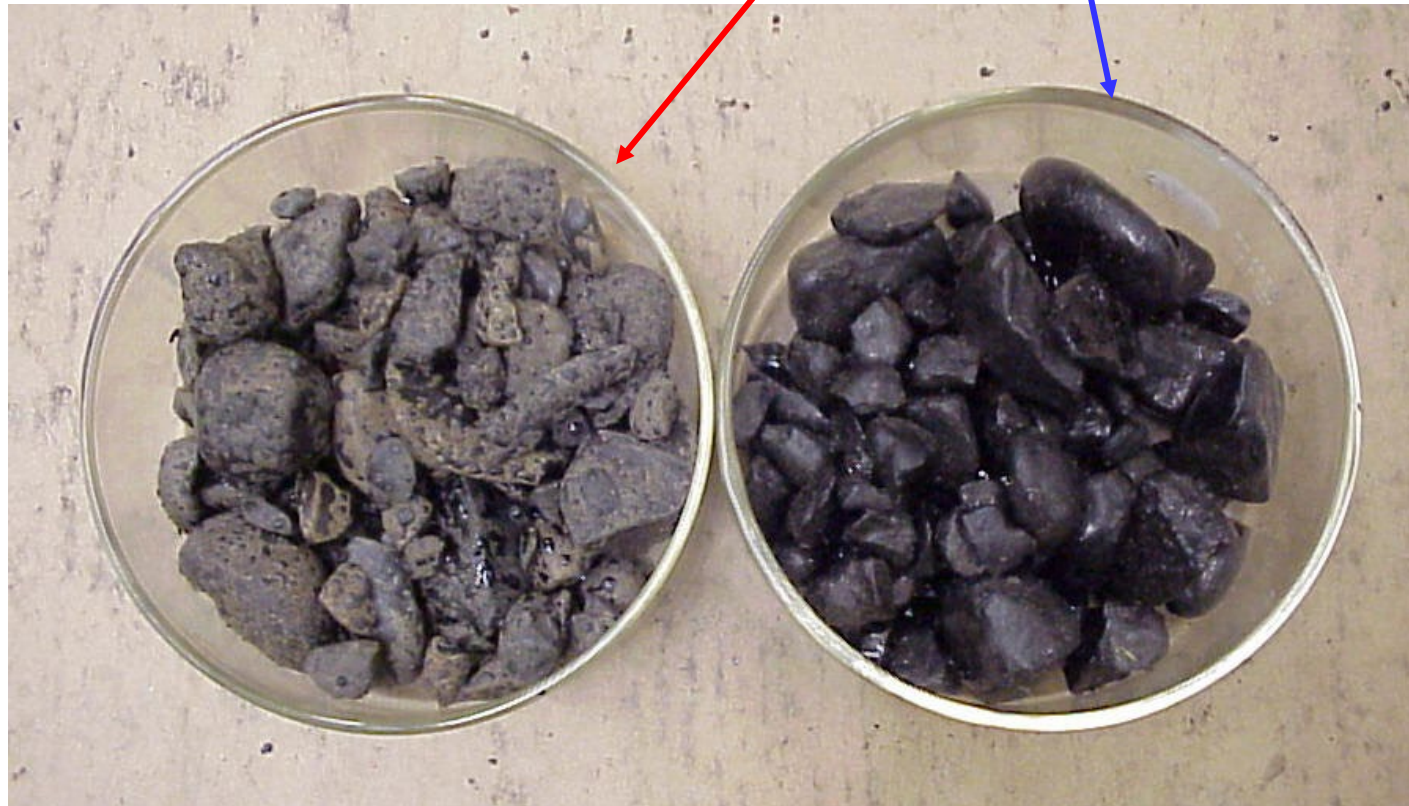
- 1. Added dry with binder**
- 2. Added dry to wet or dry aggregate and “marinated” for several days**
- 3. Added as lime slurry for immediate use or “marinated”**



# Process

## Anit-stripping Agents

Illustration of binder with anti-stripping agent and without anti-stripping agent



# Process

## Alternative Binders

- ➡ Kept at temperatures higher than conventional binder
- ➡ Two types
  1. Polymer-modified asphalt cement
  2. Crumb rubber modified



# Process



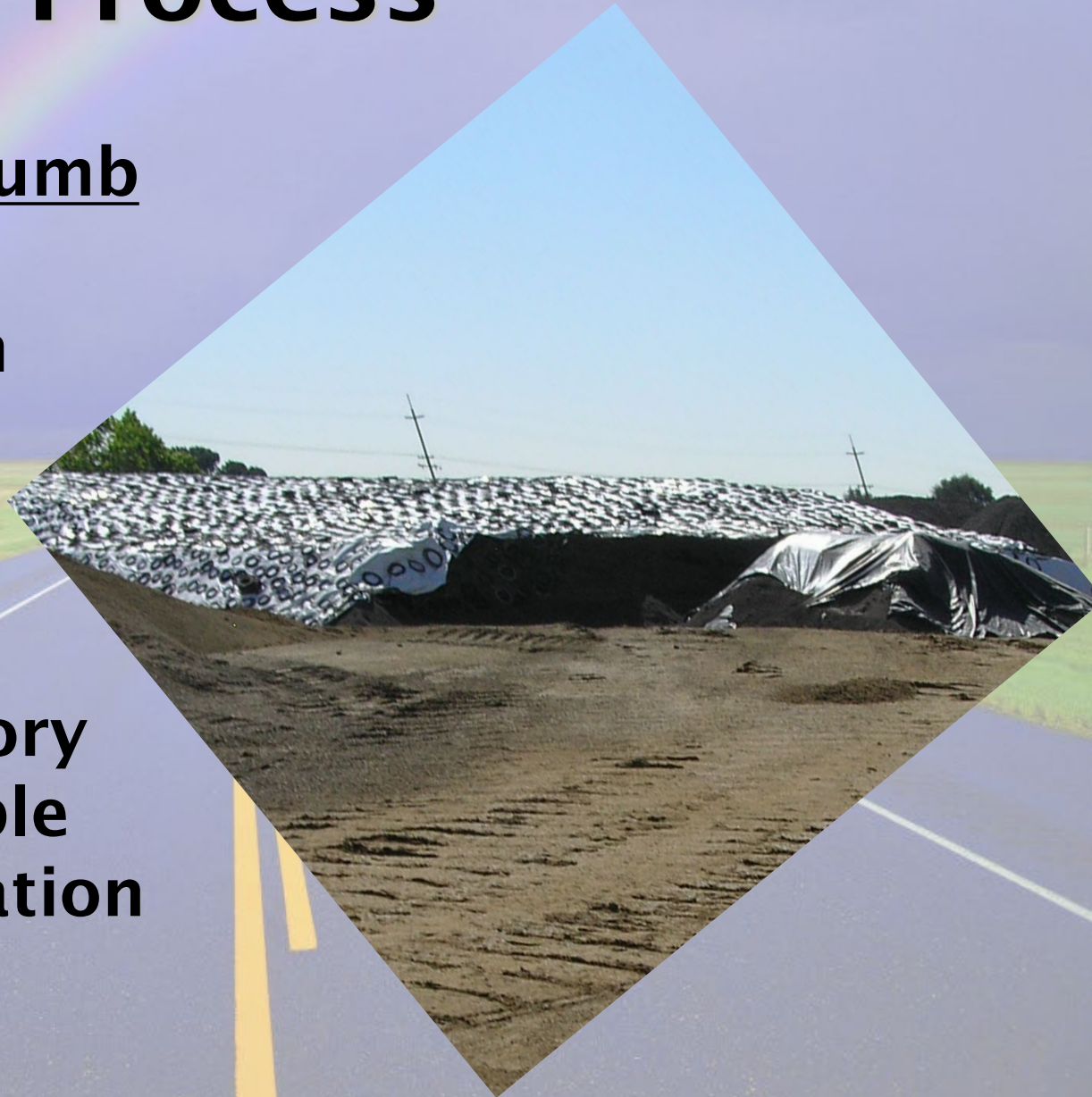
## Crumb Rubber

- ➡ Added to binder to make crumb rubber modified (CRM)
- ➡ 75% scrap tire and 25% virgin rubber
- ➡ Non-hazardous hydrocarbon polymer
- ➡ Rubber-modified asphalt concrete (RAC)

# Process

## Advantages of Crumb Rubber

- ➡ Waste reduction
- ➡ Less water
- ➡ Quiet
- ➡ Lasts Longer
- ➡ BUT No regulatory relief from visible emission evaluation (VEE)



# Process

**RECIPE FOR RAC**

# Process

## Reclaimed Asphalt Pavement

- ➡ RAP is
  - ✓ Top layer of asphalt pavement removed
- ➡ Developed because of energy, economic, and environmental concerns
- ➡ RAP could be 30% of mix
- ➡ Increases asphalt lifetime
- ➡ May increase generation of Blue Smoke



# Process

## RAP

- ➡ Production temp of virgin aggregate is 500-800 F
- ➡ RAP is heated through conductive heat transfer
- ➡ RHM is 350 F



RAP Port



# Process

**RECIPE FOR RECYCLED HOT MIX**

# Process

- ➡ Warm Mix Asphalt
- ➡ Advantages
  - ✓ Lower Production temp. 220 to 275 F
  - ✓ Less energy
  - ✓ Reduced cracking
- ➡ Disadvantages
  - ✓ Further testing to ensure QA/QC
  - ✓ Rutting
  - ✓ Workability
  - ✓ Longer setting=traffic delays



# Process HMA Facility Types

▣ Batch

▣ Continuous Mix

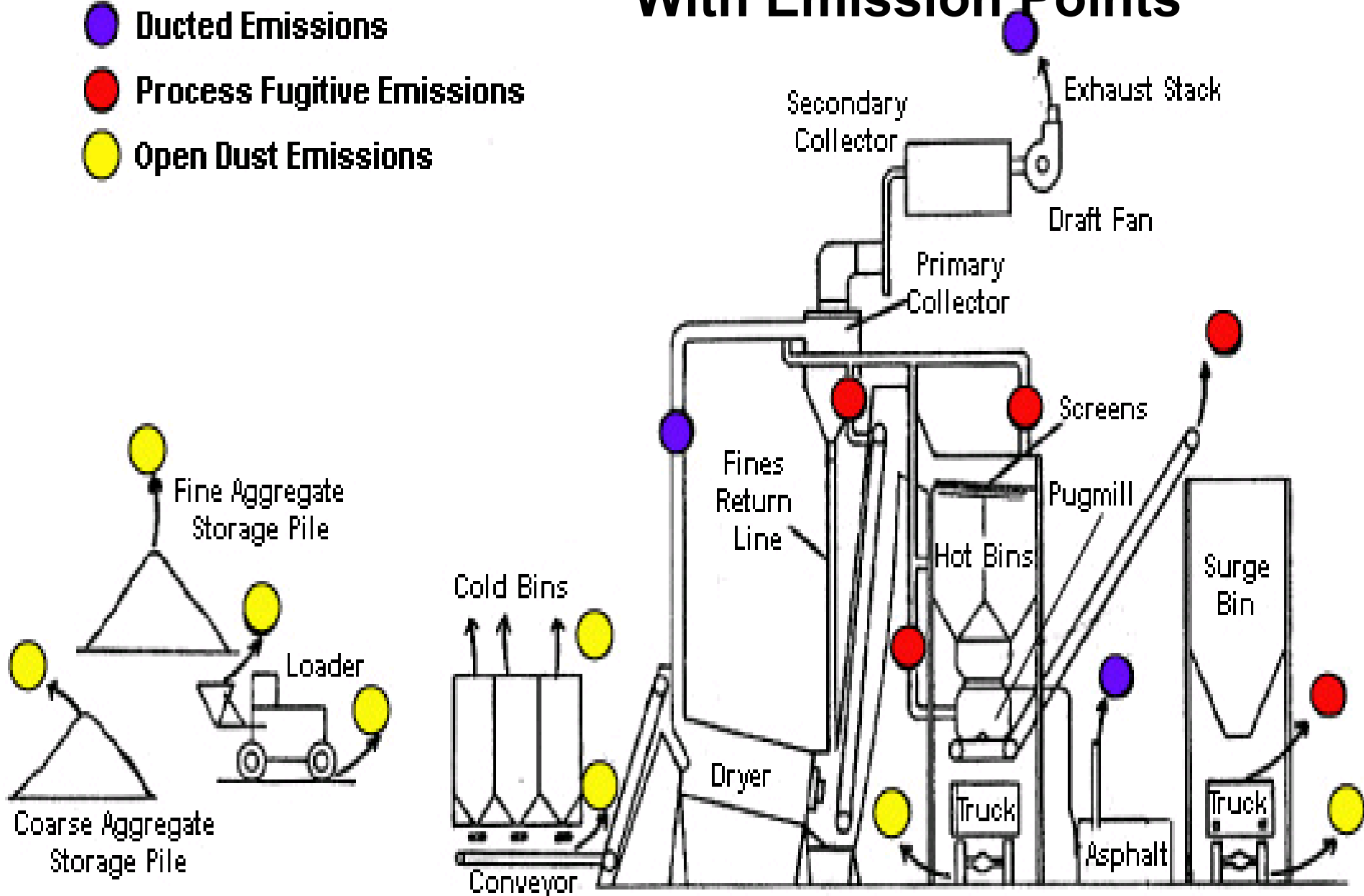
# Process Batch Mix



## LEGEND

- Emission Points
- Ducted Emissions
- Process Fugitive Emissions
- Open Dust Emissions

# HMA Batch Mix Process With Emission Points



# Process Batch Facility

## ➡ Aggregate

- ✓ Stored in cold bins
- ✓ Moved by conveyor
- ✓ Sorted and weighted
- ✓ Dropped into dryer
- ✓ Elevated to top of batch tower and
- ✓ Separated

# Process Cold Bins Aggregate Stockpiles



# Process Cold Bins





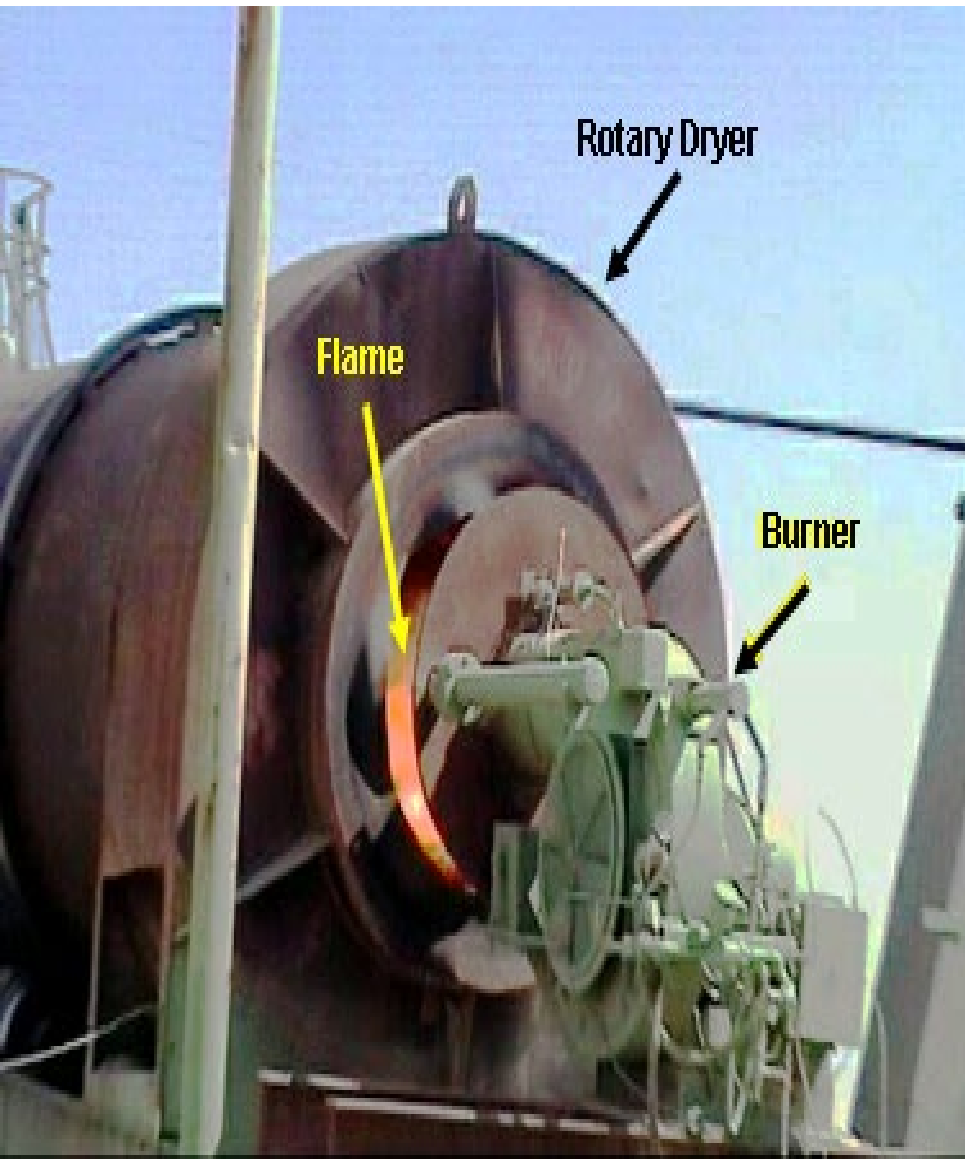
# Process Cold Bins and Conveyors



# Batch Process Aggregate Dryer

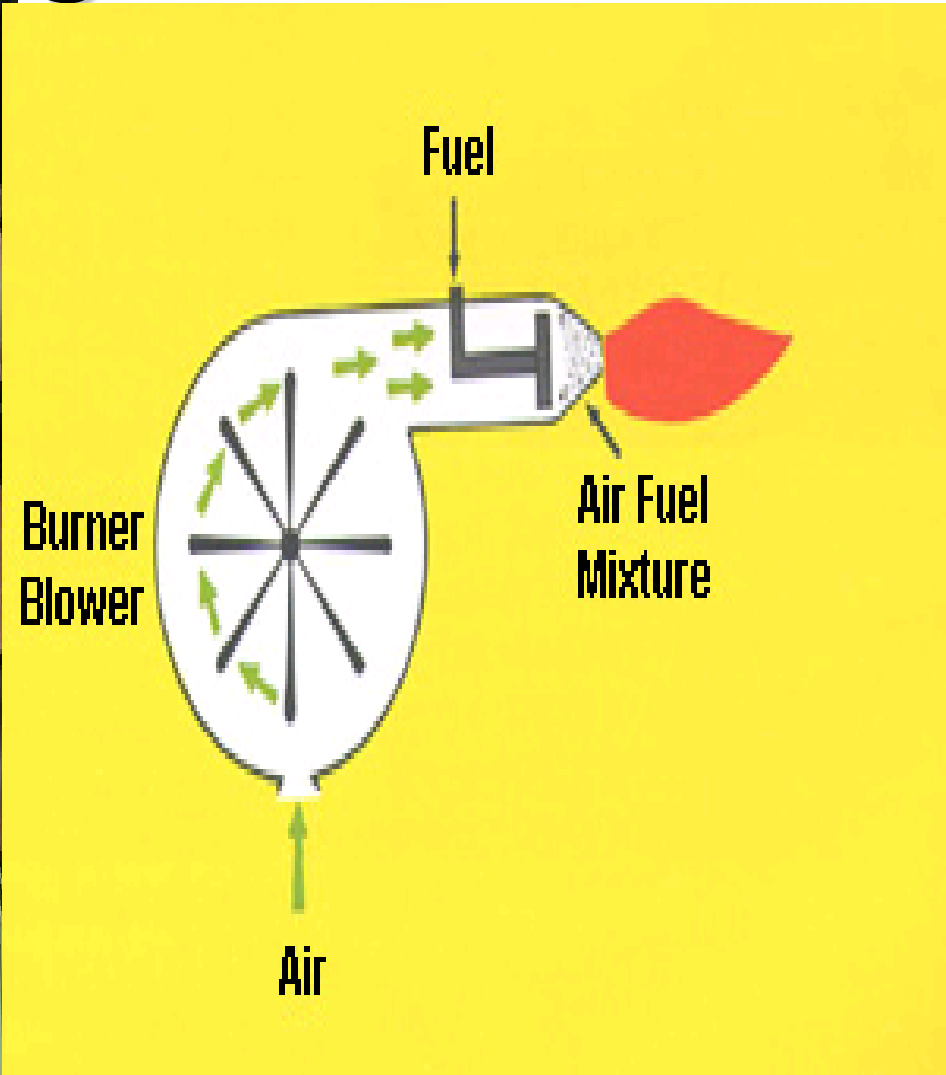
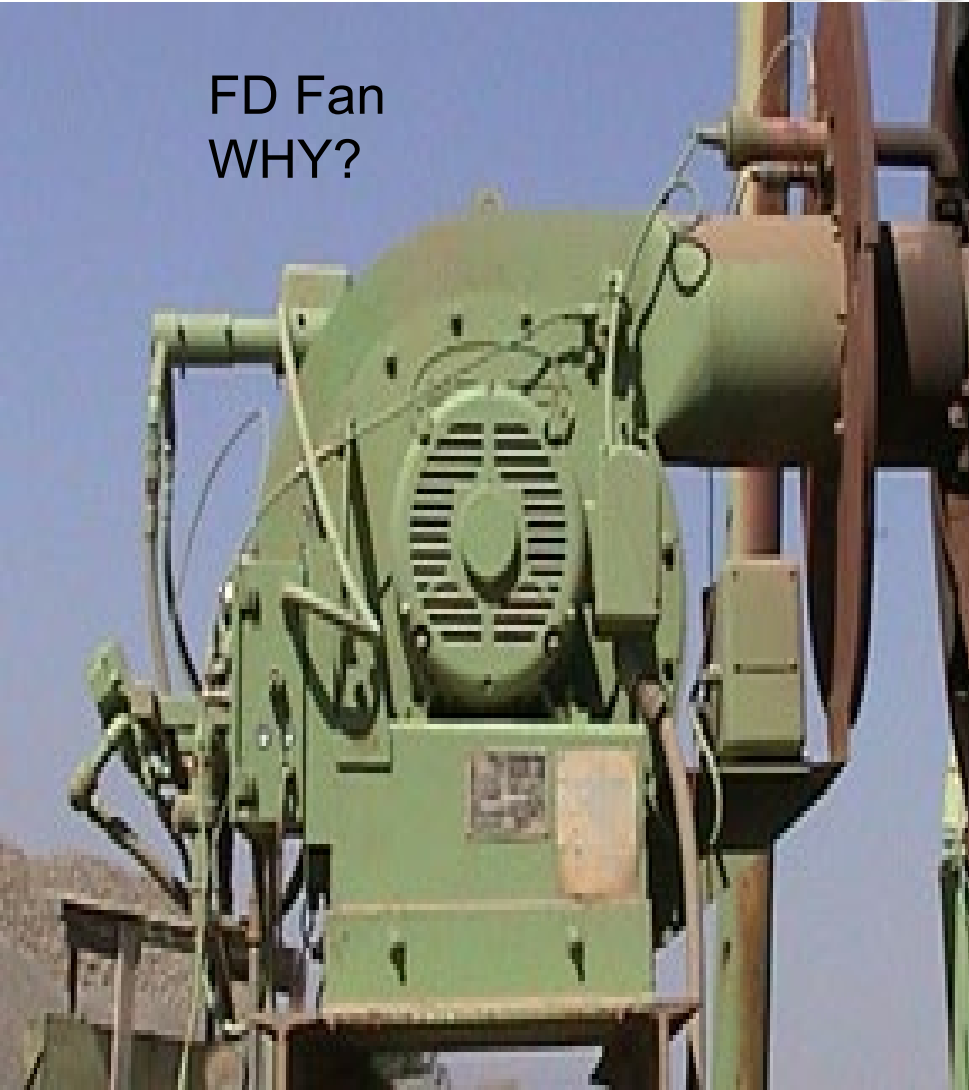


# Batch Process Rotary Dryer

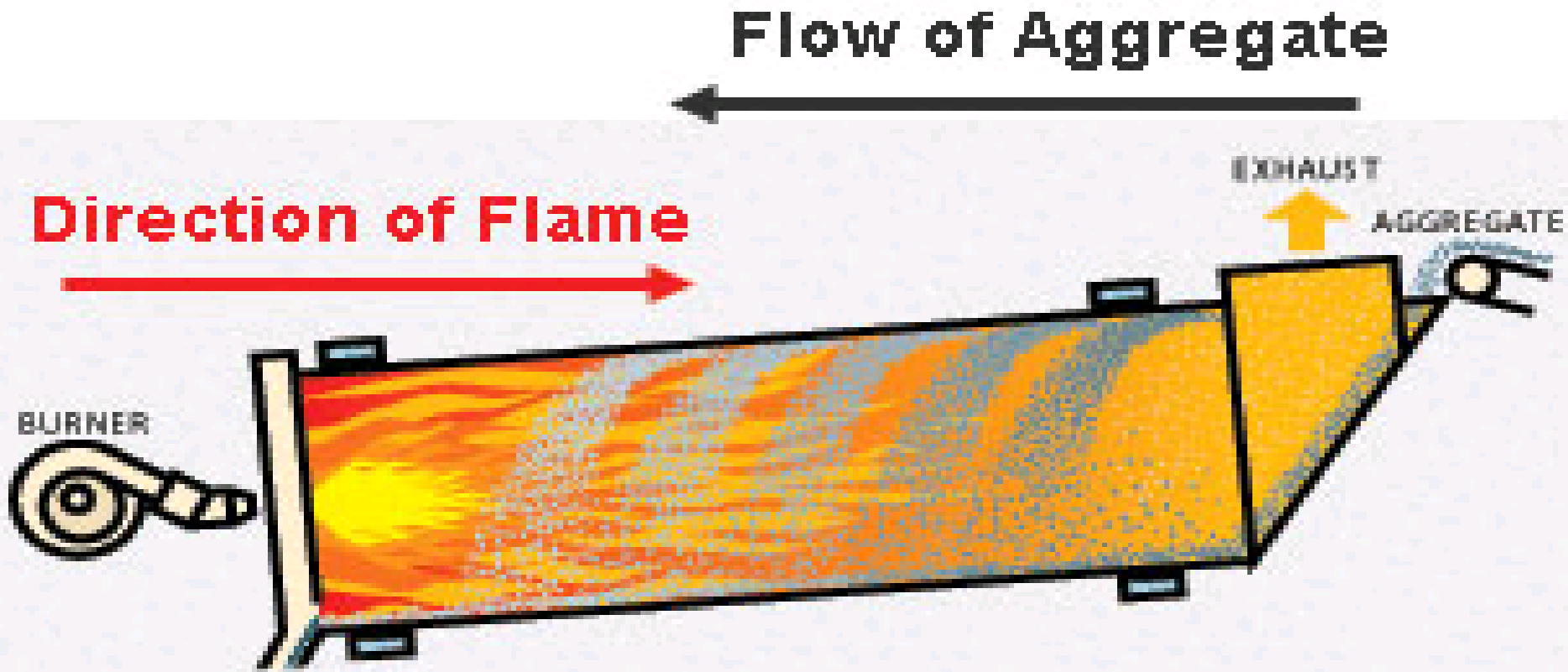


# Process Combustion and Basic Burner Design

FD Fan  
WHY?



# Batch Process Rotary Dryer Counterflow Design



**COUNTERFLOW DESIGN**

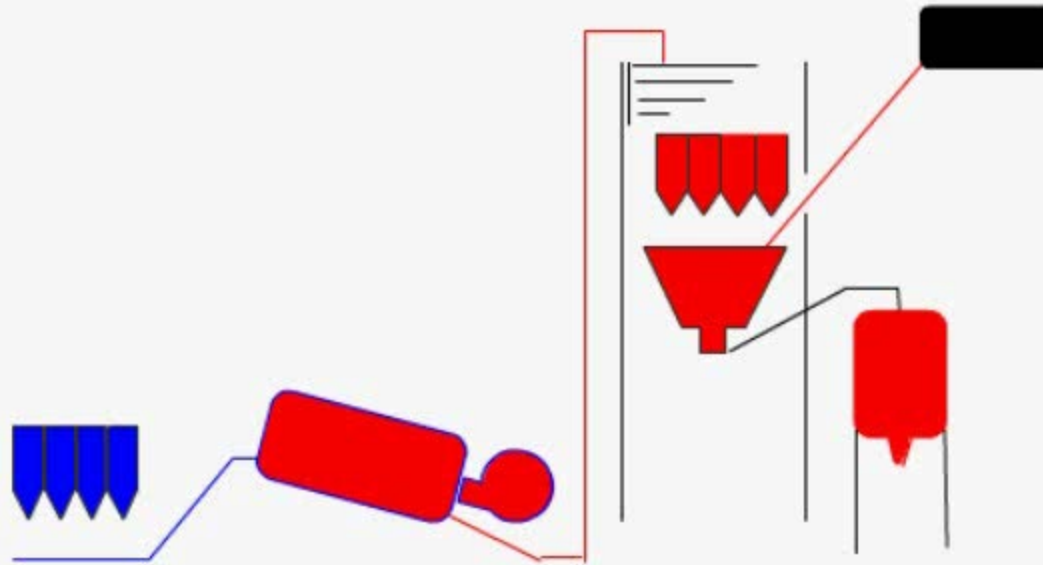
# Batch Process

(cont'd)

- ➡ Hot aggregate dropped from elevator to vibrating screens, sorted by size
- ➡ Weighed, and dropped into pugmill for mixing with
- ➡ Hot liquid asphalt binder and filler until coated
- ➡ Dropped into truck for delivery

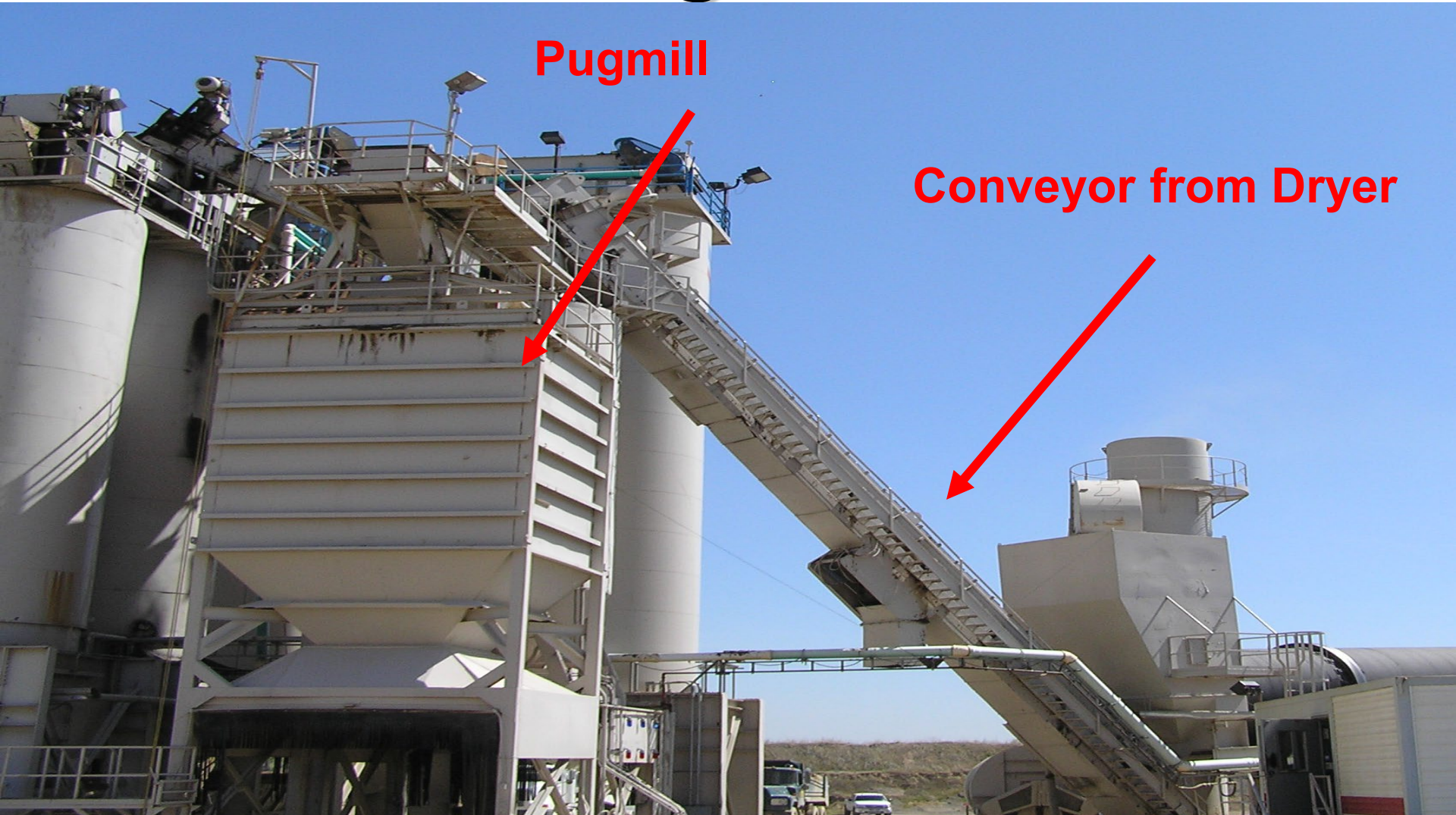
# Process

## BATCH FACILITY FLOW CHART



# Batch Process

## Hot Aggregate Conveyor to Pugmill



**Pugmill**

**Conveyor from Dryer**



**Covered Conveyor**





# Batch Process View of Pugmills



**Hot Aggregate  
Conveyor**

**HMA Drop**





3

2

HOT PLANT  
CB  
CHANNEL 20

**DRIVERS**  
DO NOT WEAR  
OILY GLOVES  
— WHEN —  
CLIMBING LADDERS  
TURNING VALVES  
STARTING PUMPS

# Batch Mix Process without Pugmill

- ➡ Newer design
- ➡ All ingredients are mixed together in the drum and sent to silos
- ➡ Better controls

# Batch Process Rotary Dryer/Mixer Combined



# View of Batch Operated Double Drum Mixer Down for Maintenance





# Inside View of Double Drum Mixer



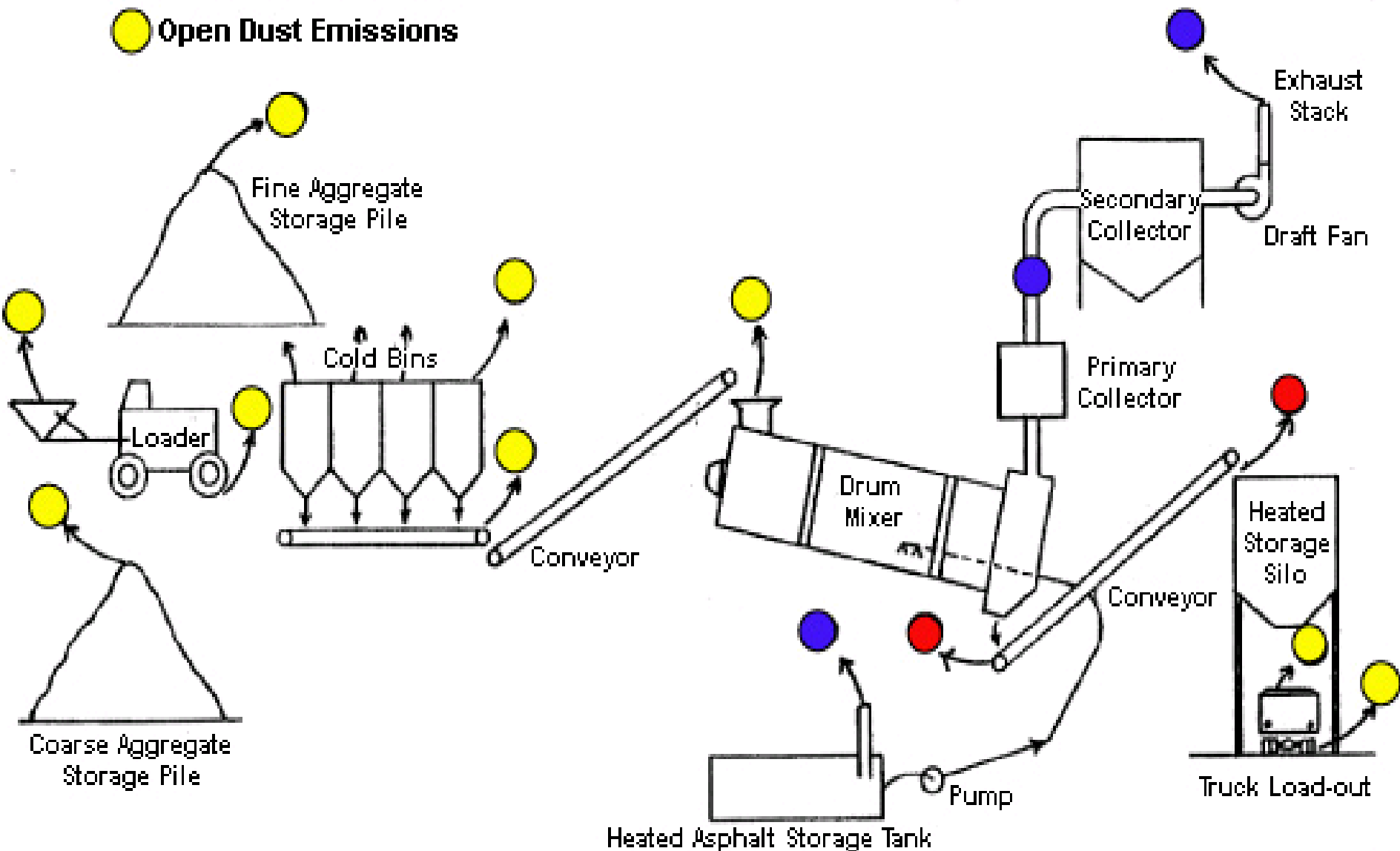
# Continuous Mix Process



**LEGEND**

- Emission Points
- Ducted Emissions
- Process Fugitive Emissions
- Open Dust Emissions

# HMA Continuous Mix Process With Emission Points





# **Process**

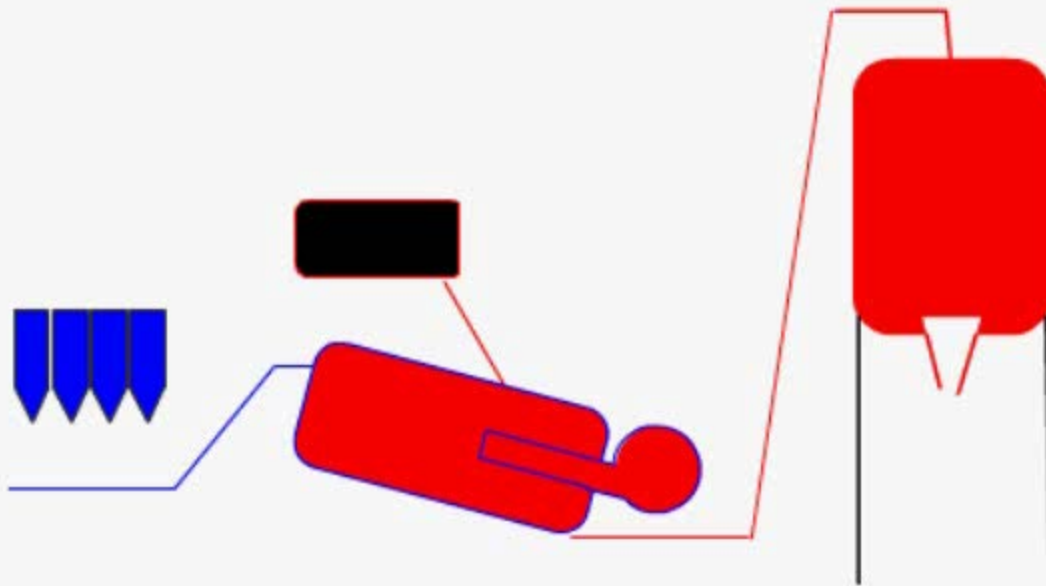
## **Continuous Mix Facility**

### **Characteristics**

- 1. HMA is continuously produced**
- 2. No batch towers to segregate hot aggregate**
- 3. Insulated heated storage silos are used instead of surge bins to store HMA**
- 4. Production is horizontal verses vertical**

# Process

## CONTINUOUS MIX FACILITY FLOW CHART



# Process HMA Drum Design



# Process Drum Design

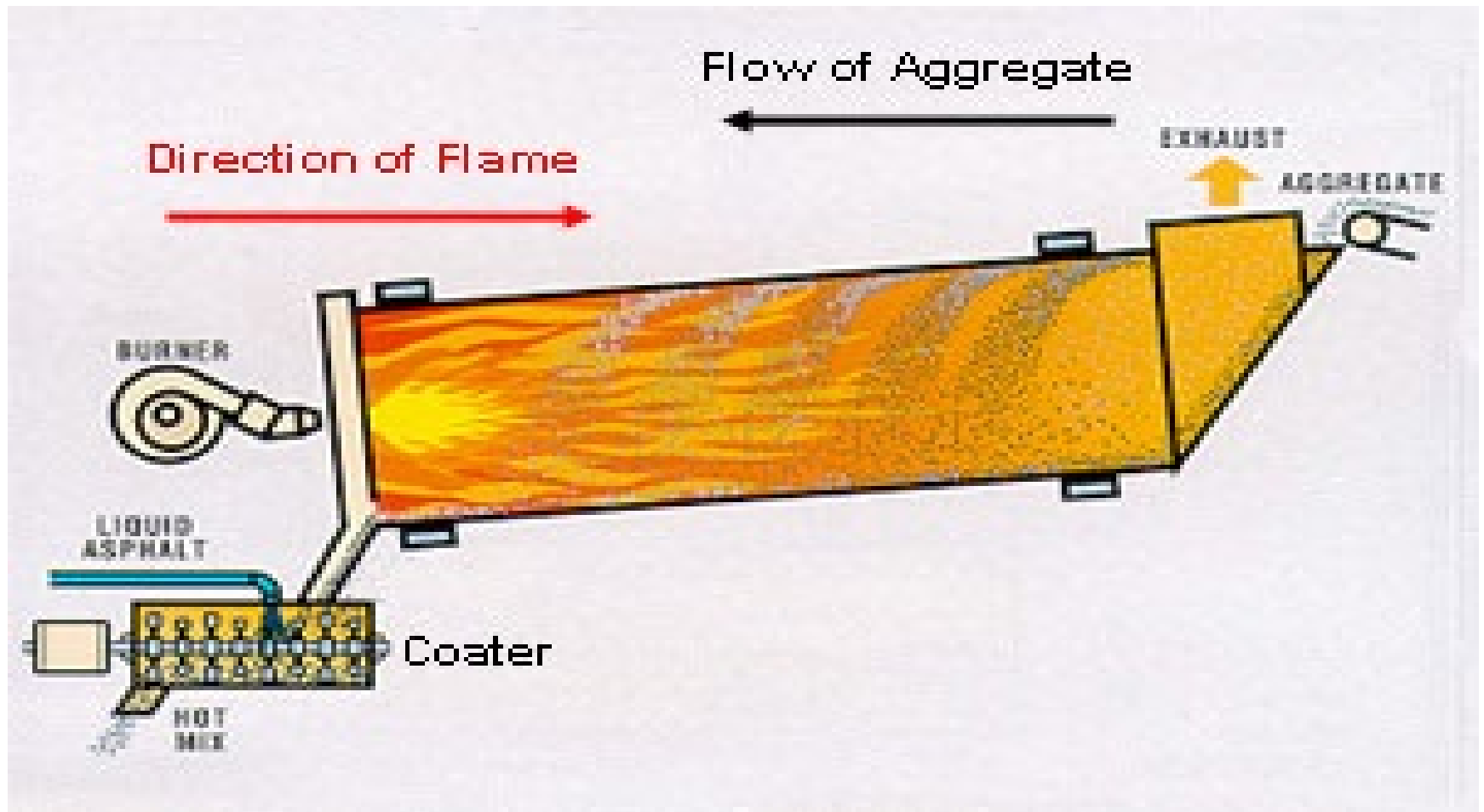
## ➡ 4 general designs

- ✓ Counter Flow Dryer Coater
- ✓ Parallel Flow Drum Mixer
- ✓ Double Barrel Drum Mixer
- ✓ Triple-Drum<sup>tm</sup> Mixer

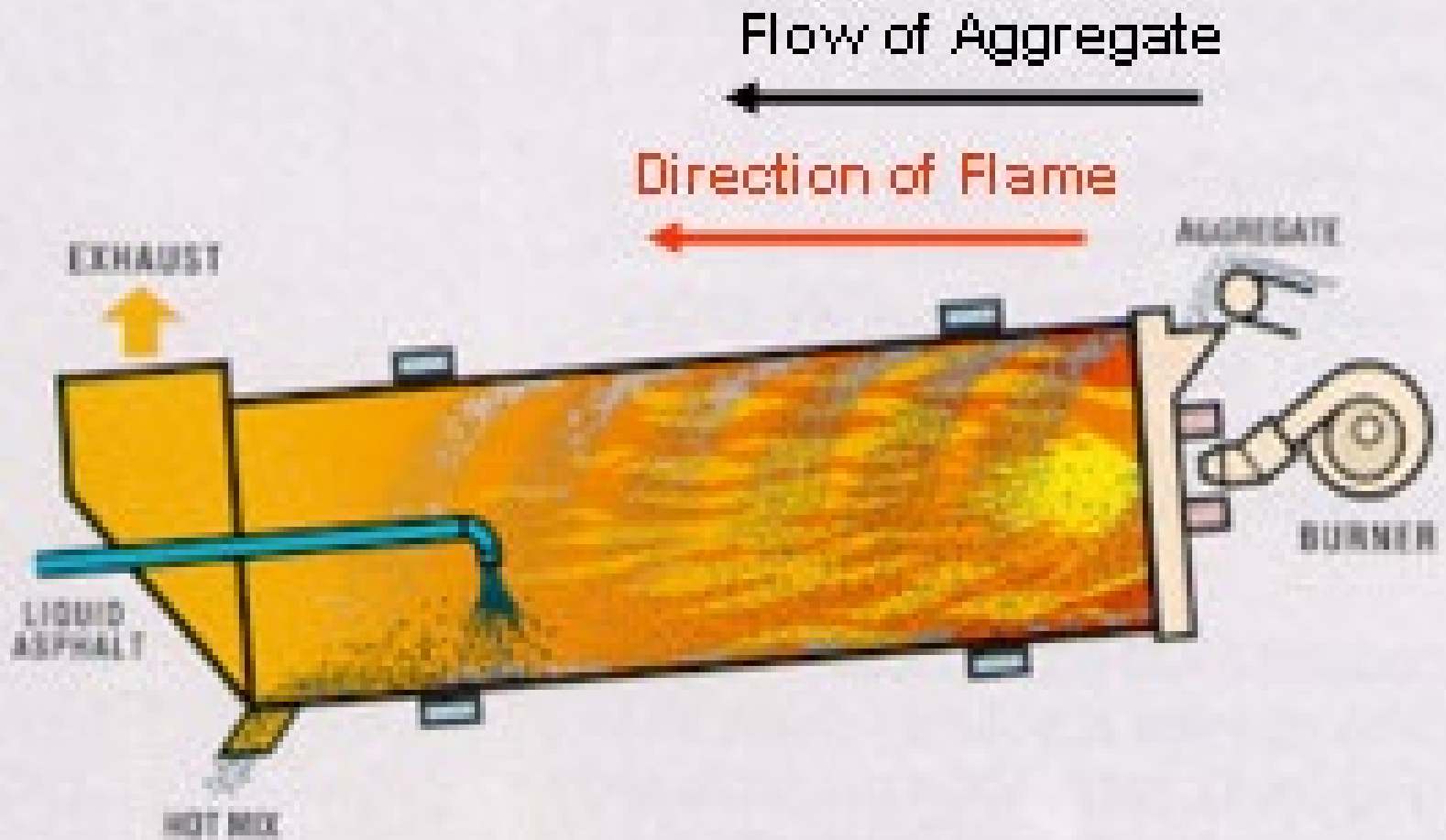
## ➡ Drum mixers two zones:

- ✓ primary for aggregate drying and heating
- ✓ secondary for mixing heated aggregate with binder and filler

# Counterflow Dryer and Coater

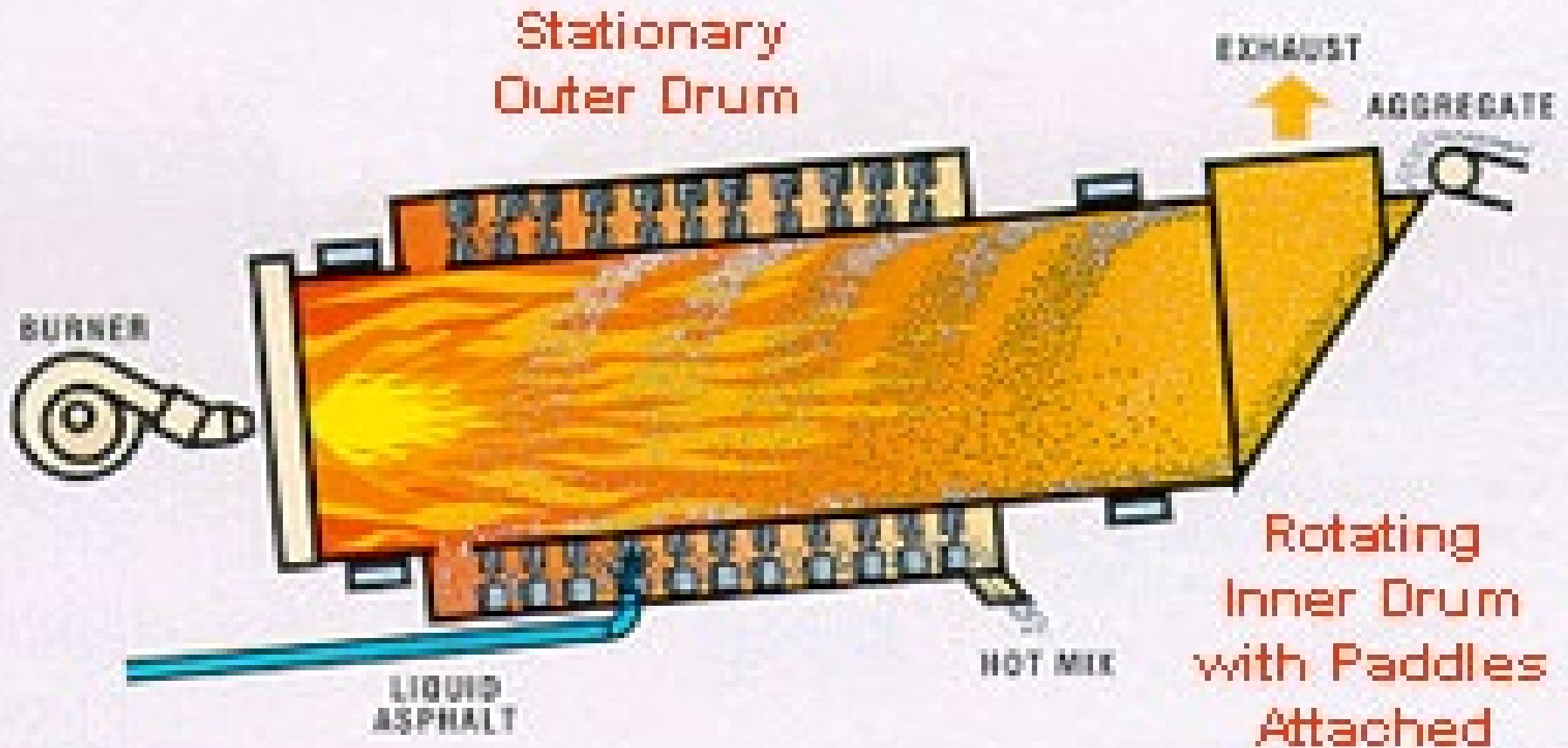






## PARALLEL FLOW DESIGN

# Double Barrel Drum Mixer



# Inside View of Double Drum Dryer Section



# Inside View of Double Drum Mixer Section





Dense material flow provides efficient drying of virgin aggregates.

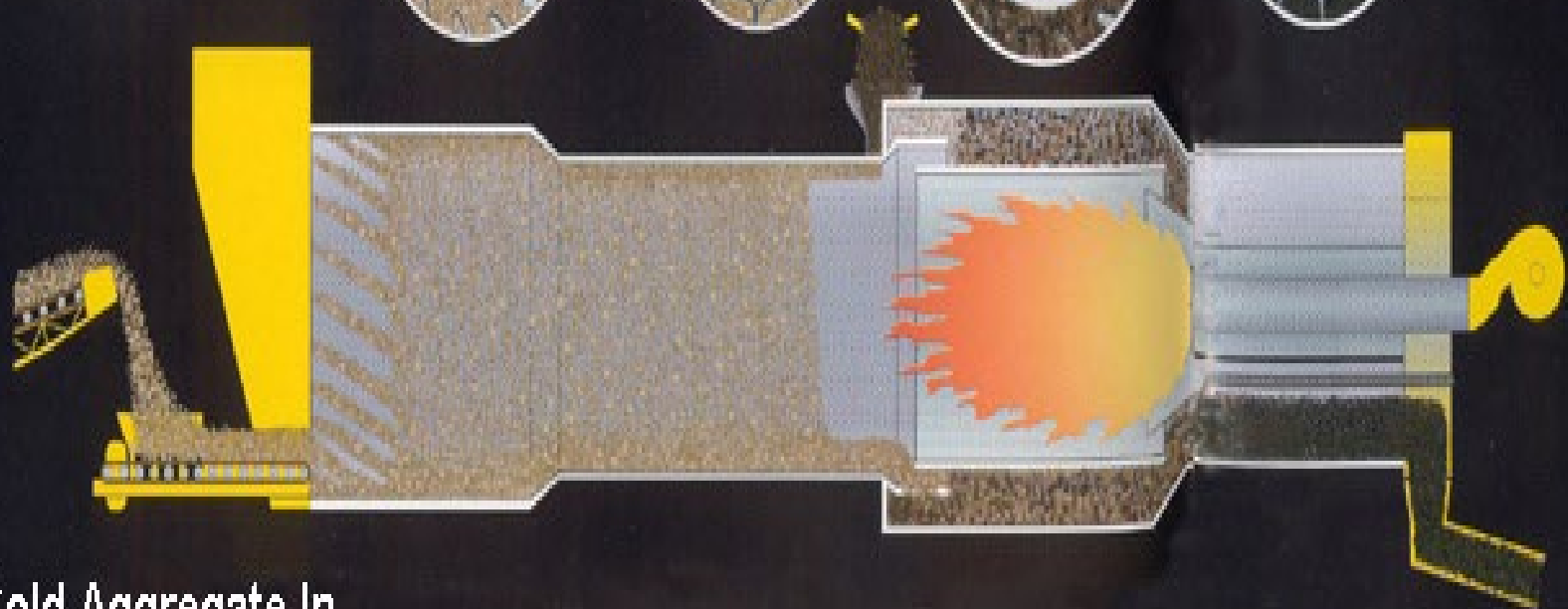
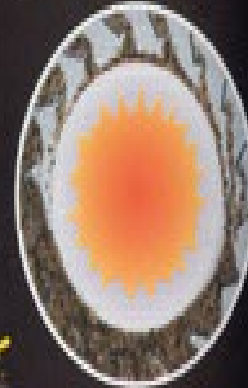
Insulator flights hold heat and transfer aggregates to combustion zone.

Radiating combustion zone efficiently dries even high percentage, high moisture RAP mixes.

Adjustable mixing zone retains material flow for perfect blending.

## TRIPLE-DRUM™

Hot Mix Asphalt Production and Recycling System



Cold Aggregate In

Hot Mix Asphalt Out

# Triple-Drum



**Triple-Drum Mixer**

# Process Asphalt Binder Storage



**WARNING**

**CHECK WITH ASPHALT PLANT BEFORE UNLOADING**

**RIVERS**

**DO NOT WEAR GLOVES**

**WHEN CLIMBING LADDERS TURNING VALVES STARTING PUMPS**

WARNING: CHROMIUM VI IN THE STATE OF CALIFORNIA IS KNOWN TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HAZARDS ARE PRESENT IN YOUR WORK AREA.

86-251

86-252

AR 8000 AR 4000

AR 4000

REAR COMPARTMENT

FRONT COMPARTMENT

**DANGER 240 VOLTS**





# Underground Asphalt Storage Tanks



# Emission Controls



# Control Aggregate



- ➡ Wind-blown dust
- ➡ Fugitive dust
- ➡ Common Control methods



# Process

## Cold Bin Dust Collection System









Keep hands clear  
of moving  
machinery

CAUTION  
Do not touch moving parts  
or machinery. Do not touch  
moving parts or machinery.  
Do not touch moving parts  
or machinery. Do not touch  
moving parts or machinery.

Louisville



# Dust Suppression?





# Emission Control Hot Aggregate Handling



# Emission Control

## Hot Aggregate Handling

**Hot Aggregate  
Being Discarded  
onto Pile**

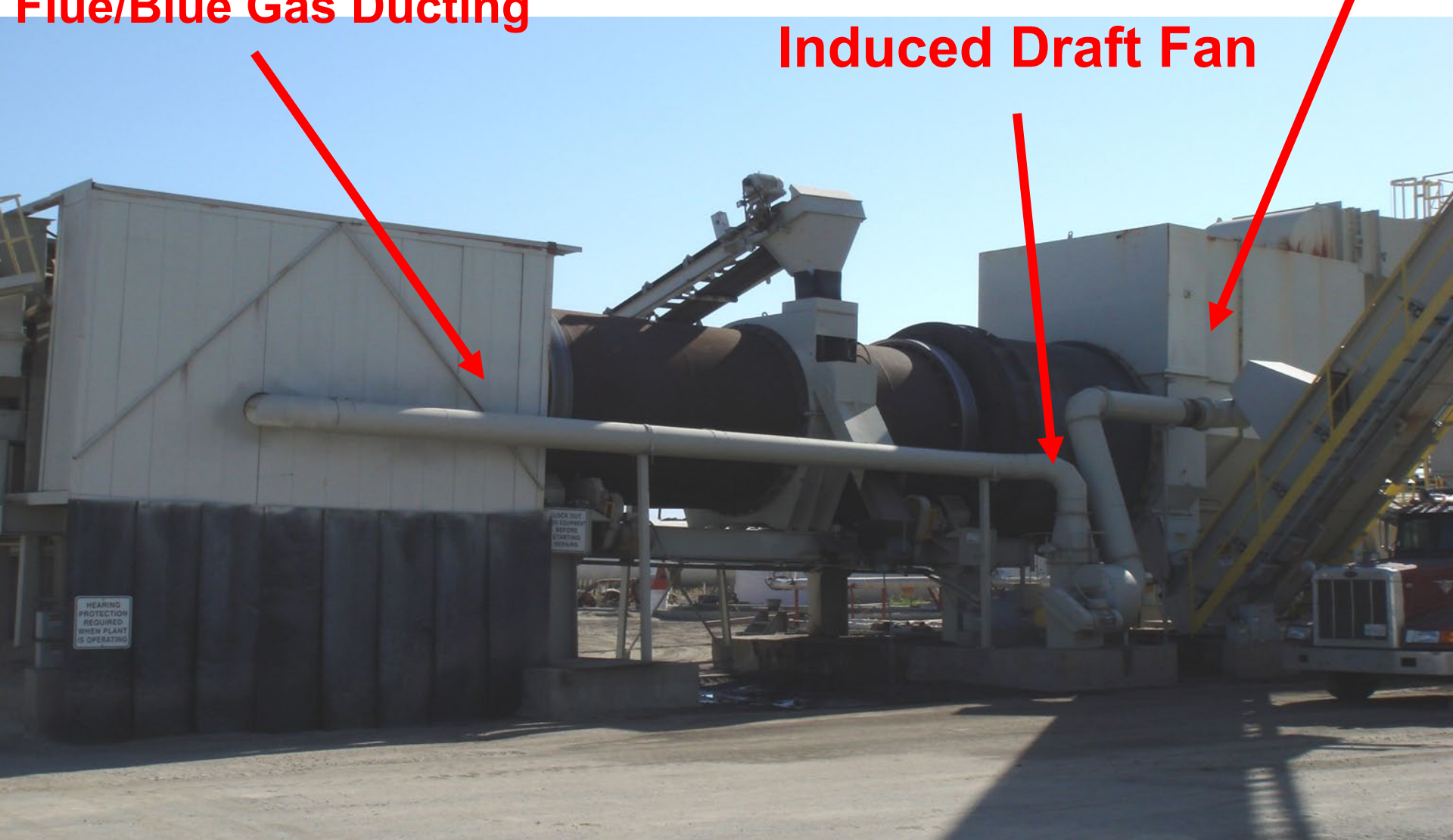


# Emission Control Flue Gas Recirculation

Blue Smoke

Flue/Blue Gas Ducting

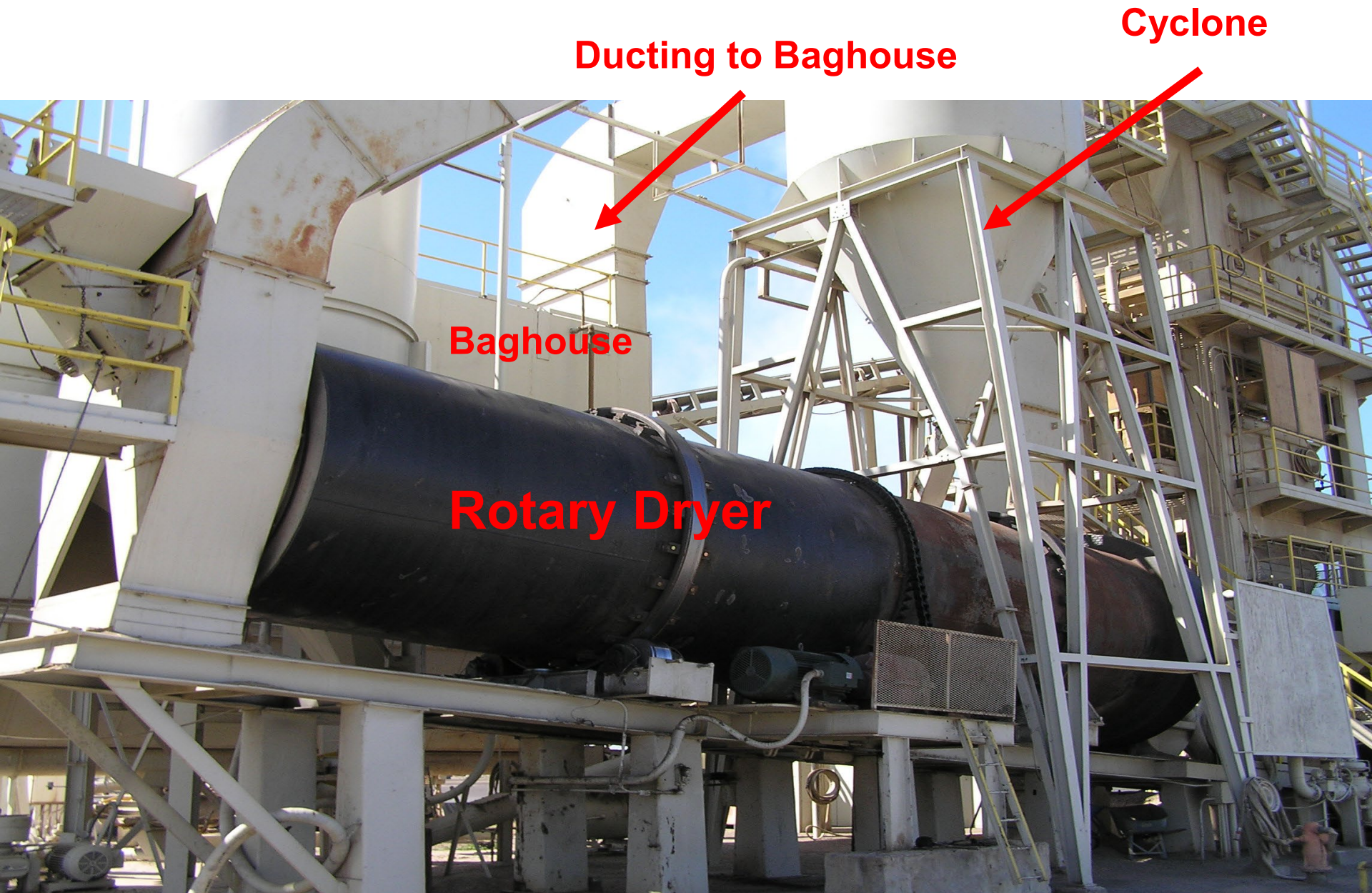
Induced Draft Fan



HEARING PROTECTION REQUIRED WHEN PLANT IS OPERATING

LOCK OUT TAG OUT BEFORE MAINTENANCE

# Emission Control



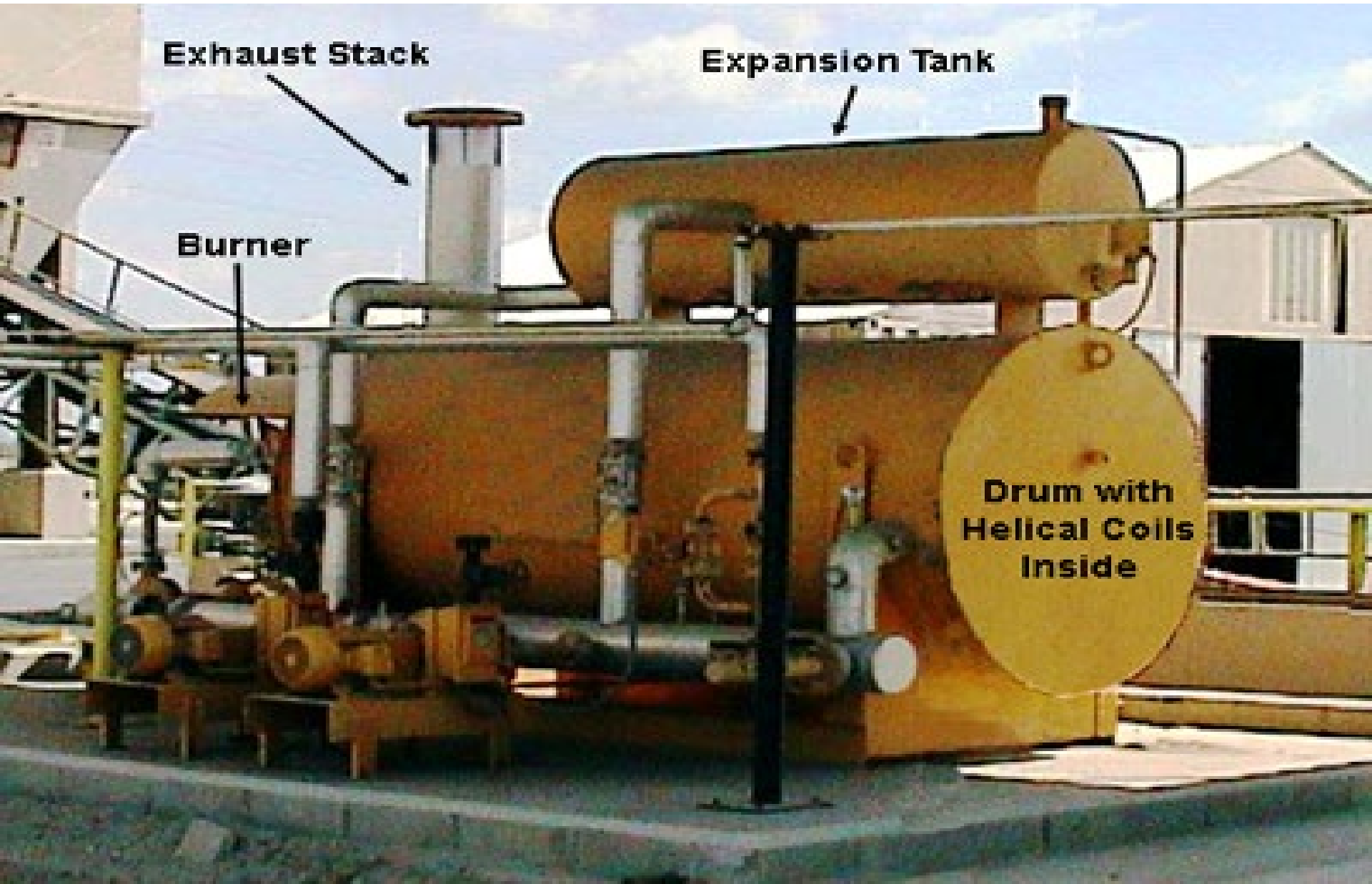
Ducting to Baghouse

Cyclone

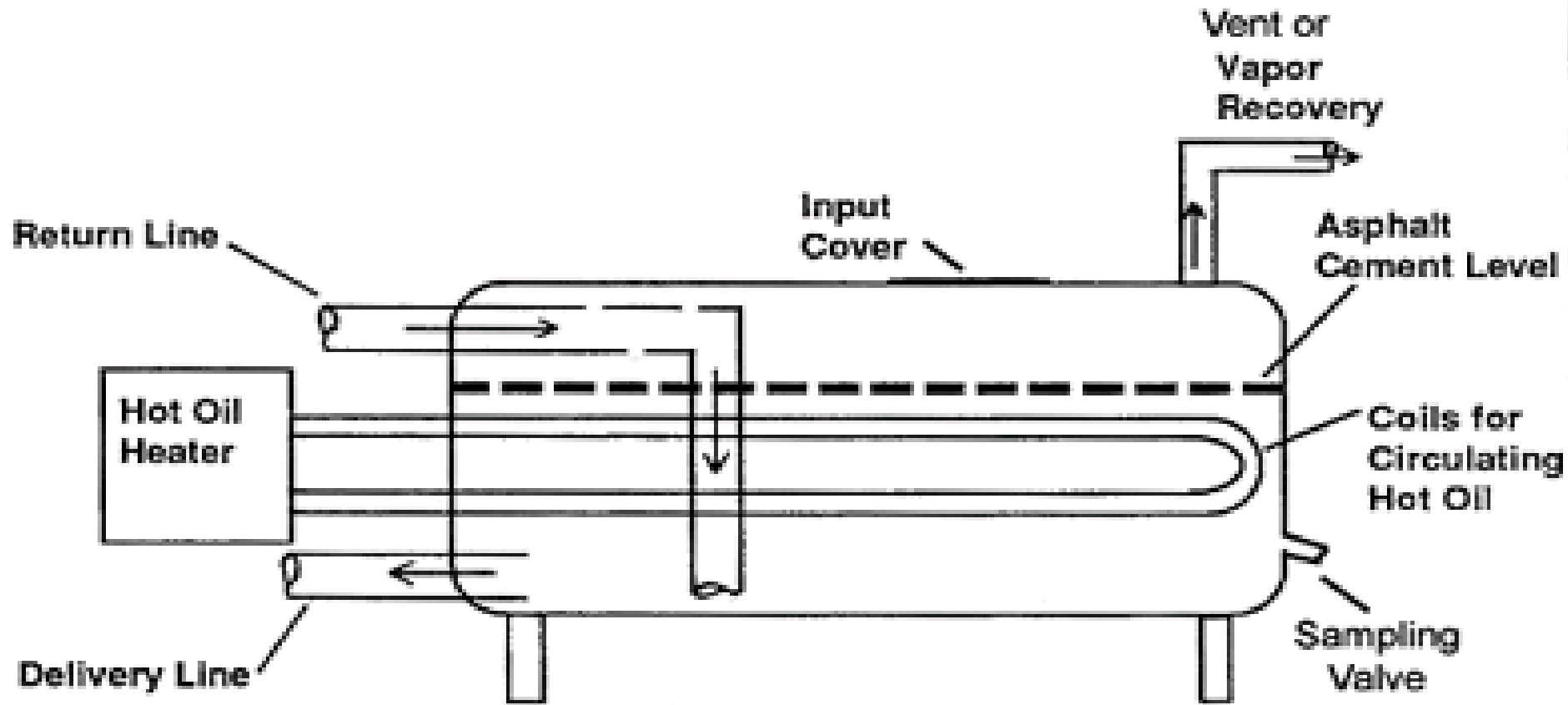
Baghouse

Rotary Dryer

# Small Binder Storage Tank



# Hot Oil Heater Coils



# Process Underground Storage Tanks

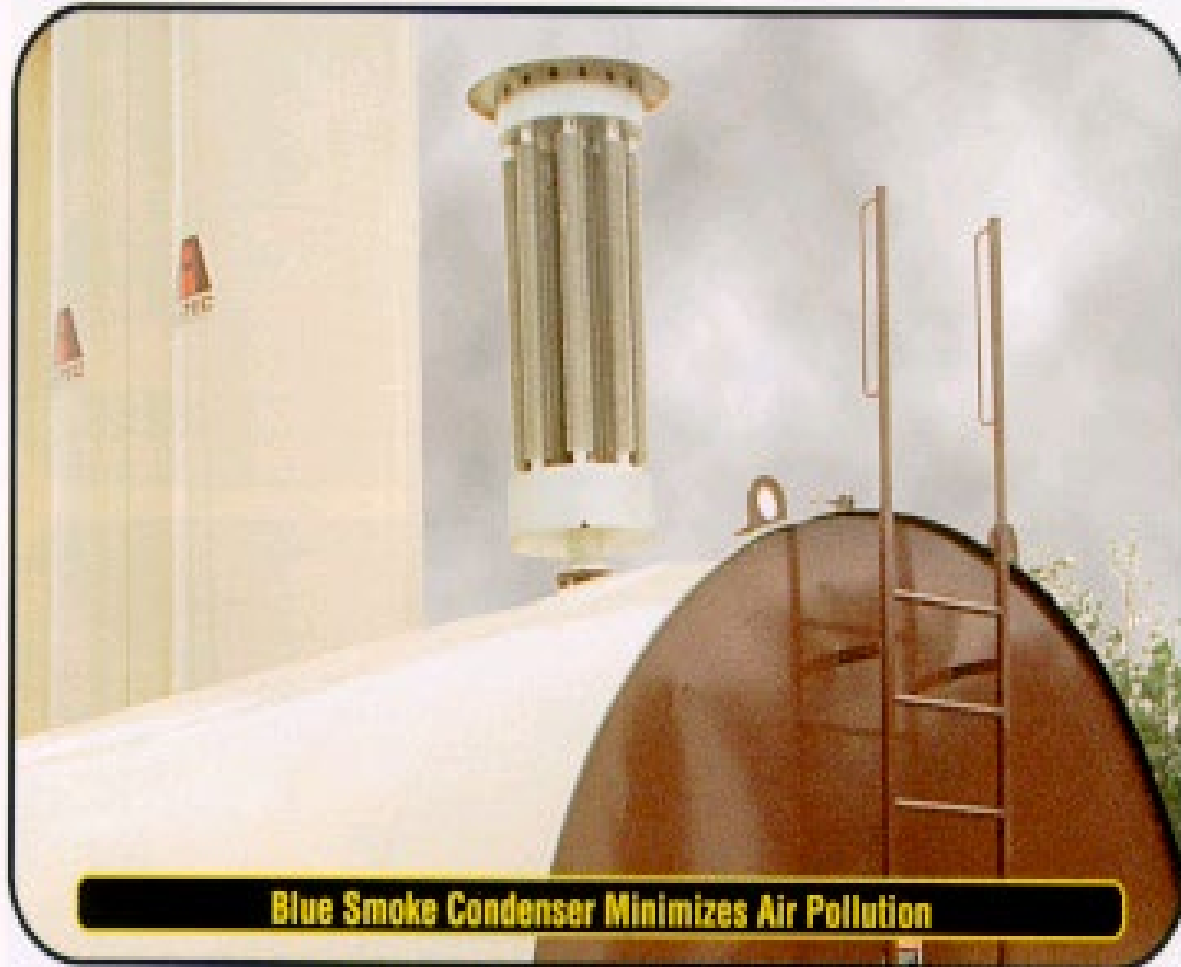




**Uncontrolled RAC  
Binder Storage Tank**

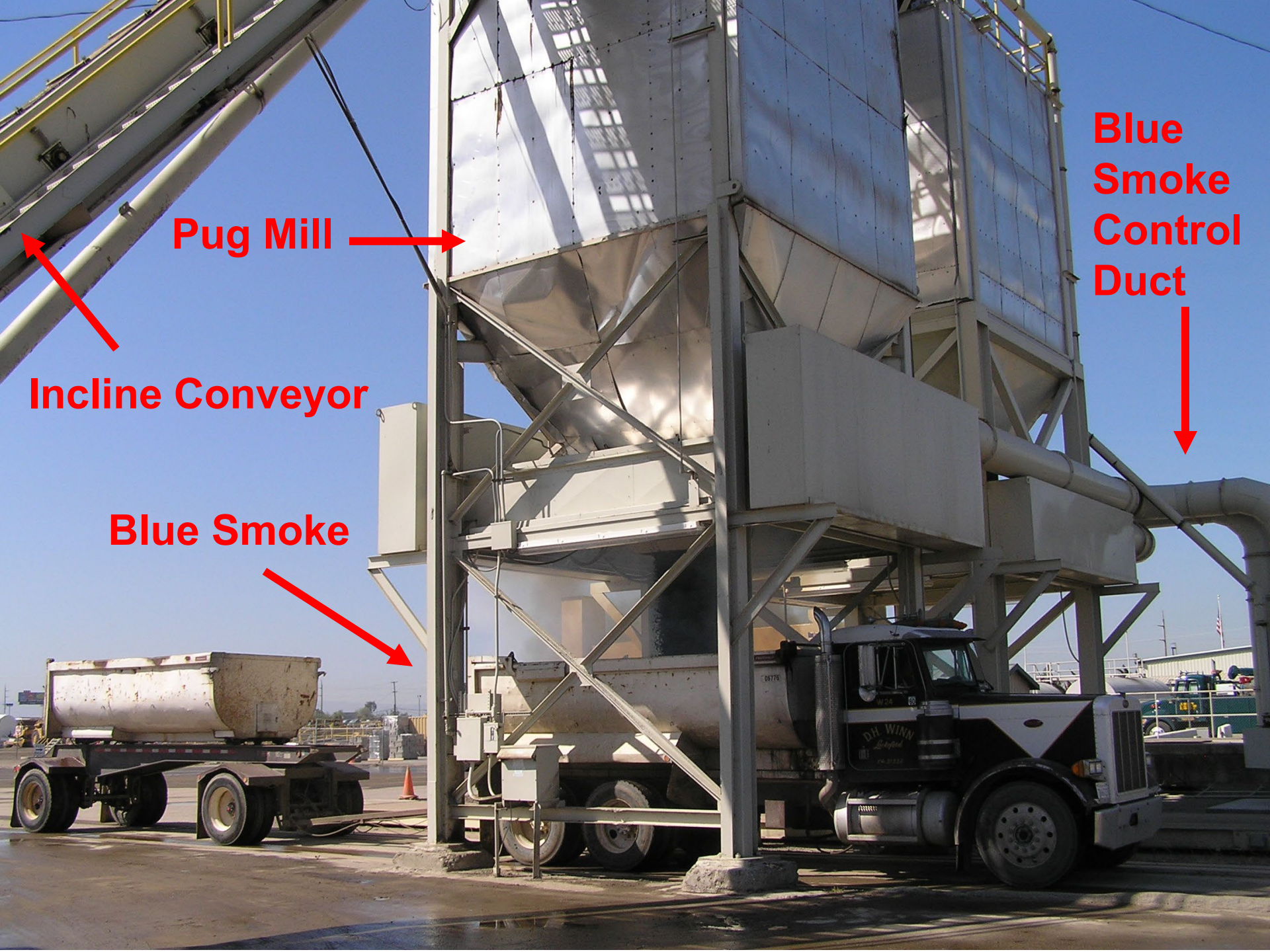


# Controlled Binder Storage Tank Vent Condenser



# Dust Silo





**Pug Mill** →

**Incline Conveyor**

**Blue Smoke** →

**Blue  
Smoke  
Control  
Duct** ↓

# Control Draft Air



# Control Draft Air

- ➡ **Draft air passes through ducting due to pressure differential**
- ➡ **Draft air affects**
  - 1. Combustion efficiency**
  - 2. How a system develops leaks**
  - 3. Control effectiveness**

# Control

## Types of Draft Air

➡ 4 Type

1. Forced Draft Air

✓ Air that is pushed resulting in positive pressure

2. Induced Draft

✓ Air is pulled by a fan resulting in negative pressure

# Control Draft Air (cont'd)

## 3. Natural Draft Air

- ✓ Difference in temp between flue gases and the ambient air.

## 4. Balanced Draft

- ✓ Forced draft fan pushes combustion air into combustion chamber.

# Control

**FORCED DRAFT**



# Control

**INDUCED DRAFT**



# Control

**NATURAL DRAFT**



# Leak in a Rotary Dryer



**Source of Leak**



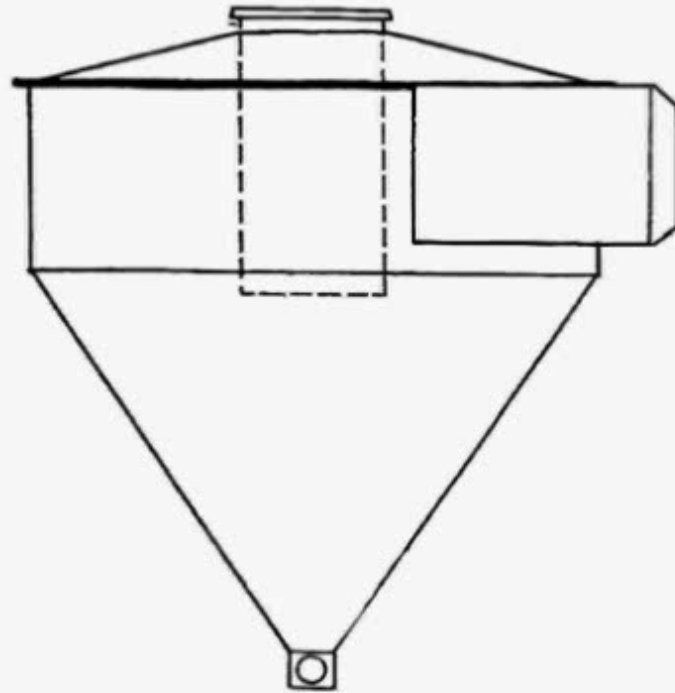
# Control Drum/Dryer Emission

- ➡ Drum/Dryer produce large amounts of PM
- ➡ Two control devices
  - ✓ Primary for large particles and
  - ✓ Secondary for small particles
- ➡ Combined efficiency is 99% or greater
- ➡ Ask for manufacturer or facility guarantee

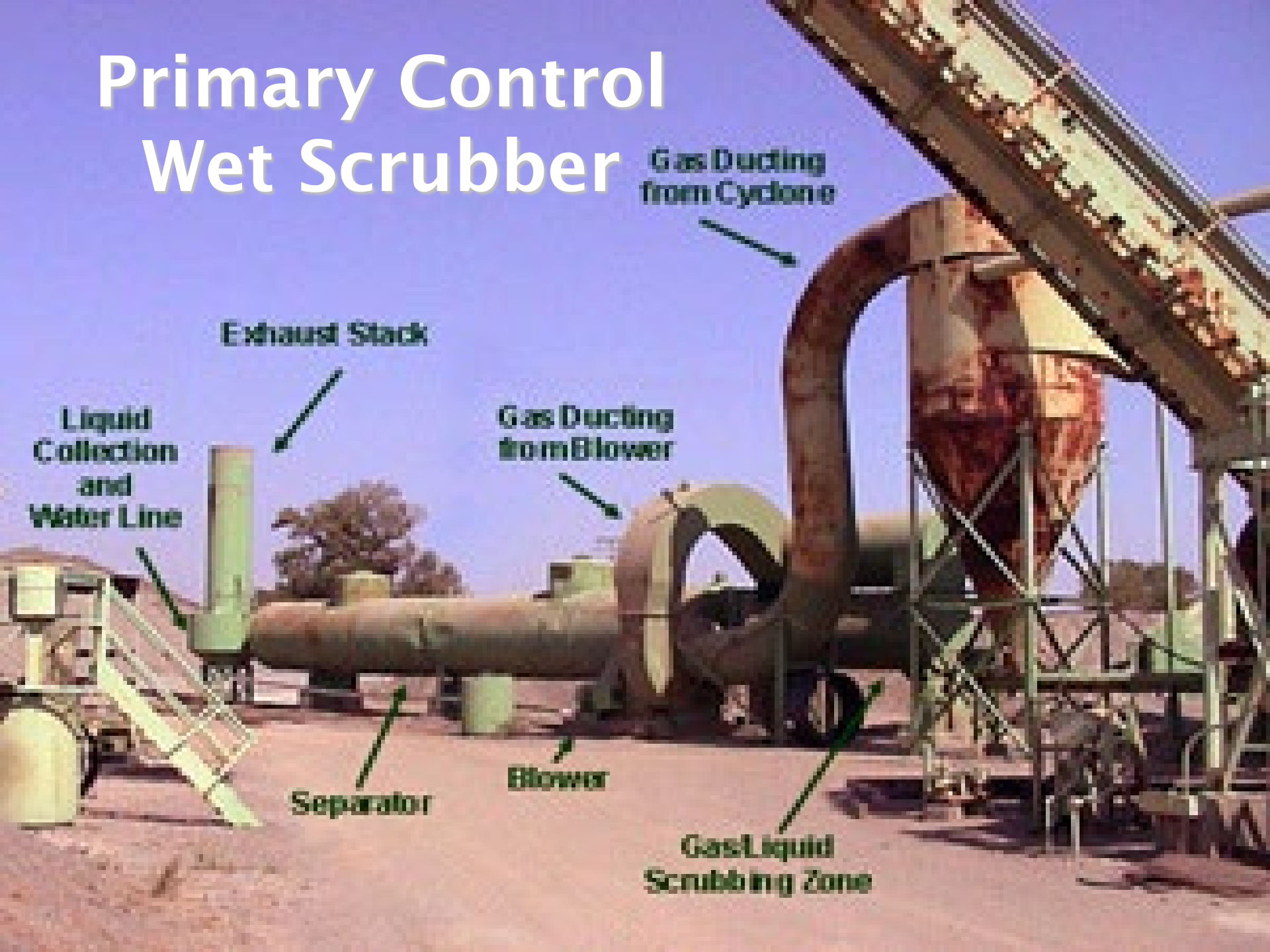
# Primary Controls Cyclone



# Primary Control Cyclone



# Primary Control Wet Scrubber



Gas Ducting  
from Cyclone

Exhaust Stack

Liquid  
Collection  
and  
Water Line

Gas Ducting  
from Blower

Separator

Blower

Gas Liquid  
Scrubbing Zone



# Wet Scrubber?



# Process/Control Wet Scrubber

- ➡ Used to control stack emissions
  - ✓ Must meet the emission requirements specified in Subpart 000
  - ✓ Continuous emissions pressure monitor
    - $\pm 250$  pascals  $\pm 1$  inch water gauge pressure
  - ✓ Continuous measurement of scrubbing liquid flow rate to scrubber

# Control Techniques

## Wet Scrubber

### ➡ General description

- ✓ Particles get trapped in liquids
  - Inertial impaction and diffusion
- ✓ Liquids must contact particles and dirty liquids must be removed from exhaust gas

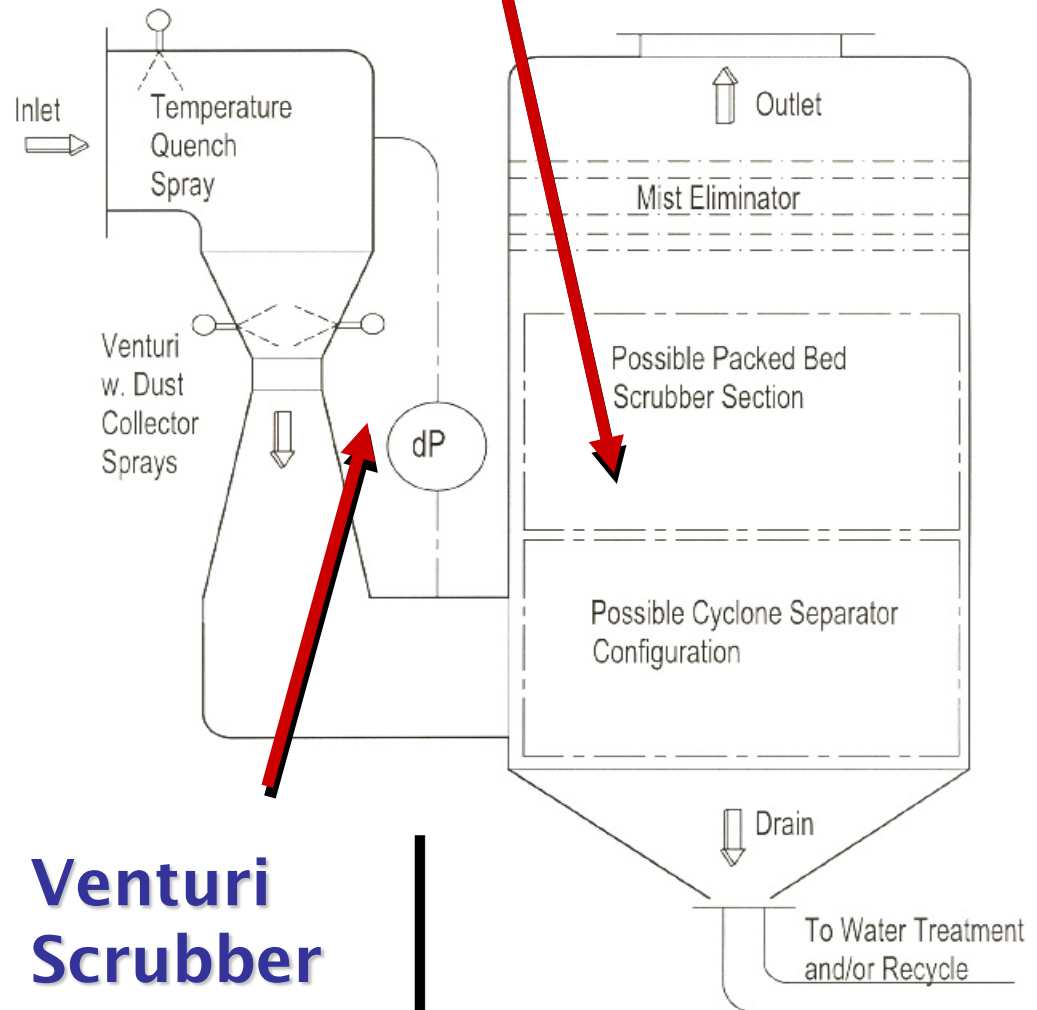
# Particle Scrubbers

- ➡ Initial quench – use clean water
- ➡ Water drops and particles must contact (impact)
  - ✓ Requires water flow and mixing energy
- ➡ Dirty water collection
- ➡ Water treatment & recirculation

# Packed Bed Scrubber

## Wet Scrubber Operation

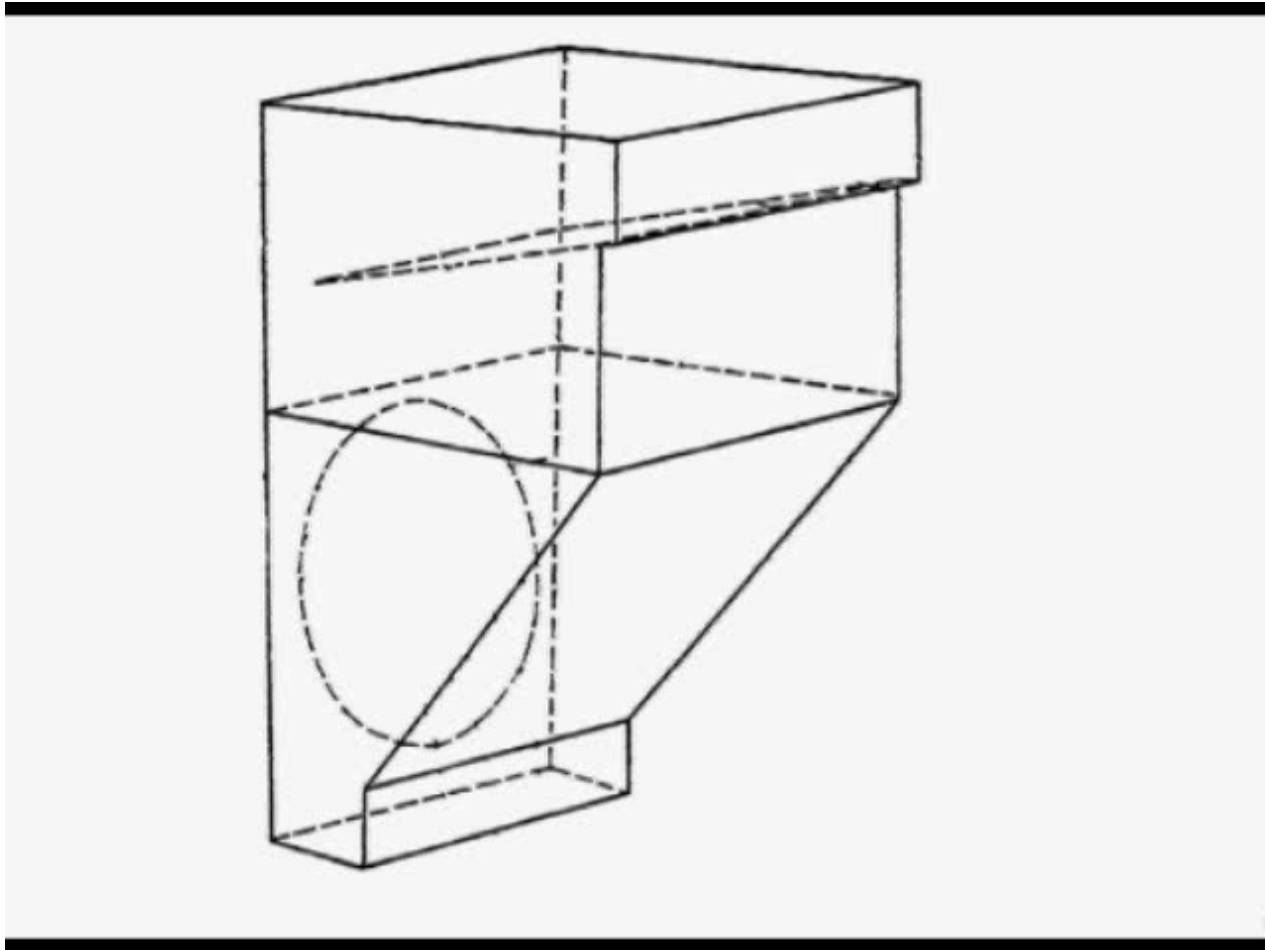
- ▶ Particles collected by impaction
- ▶ Gasses collected by diffusion & absorption



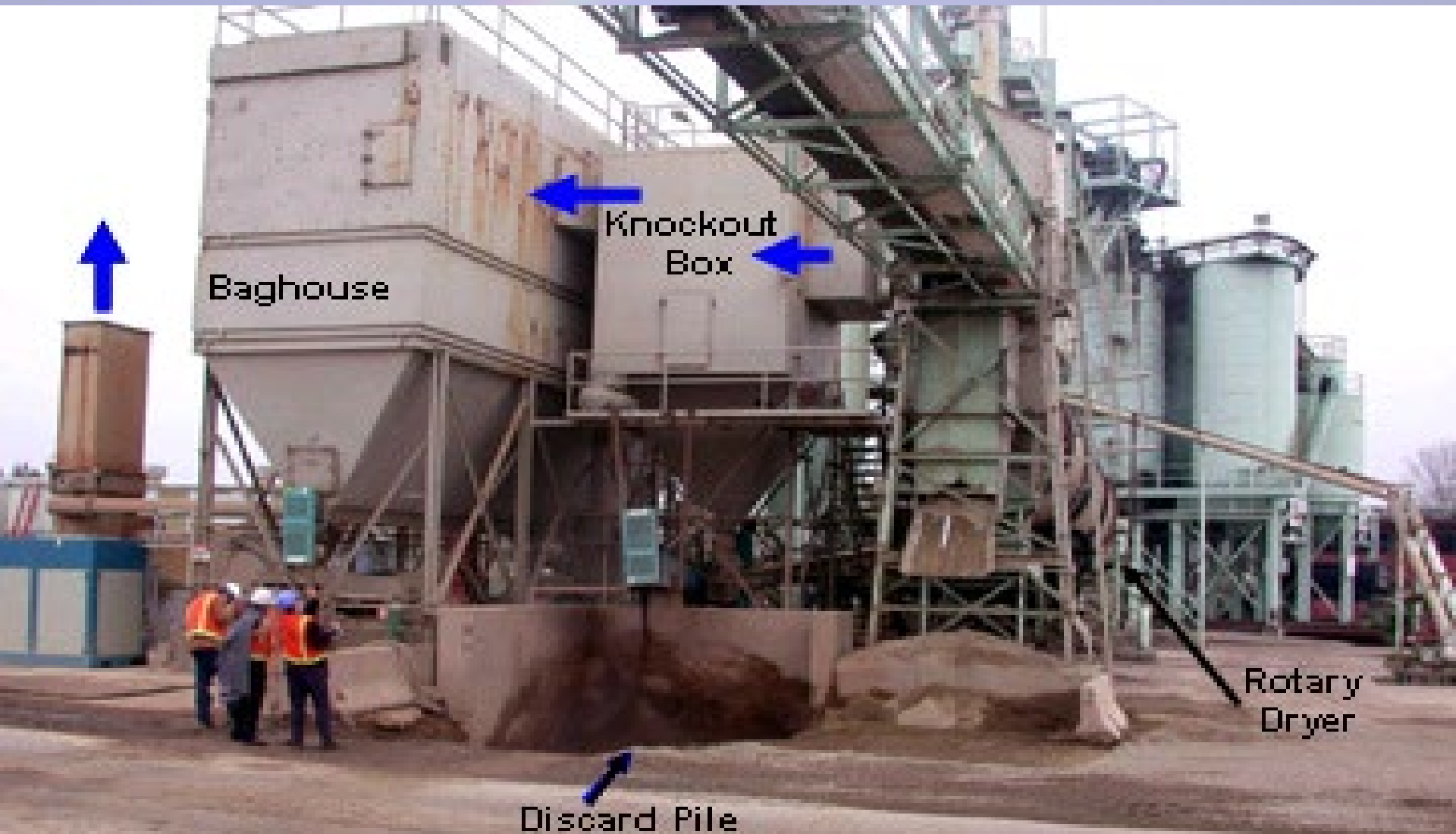
# Scrubber Liquor



# Primary Control Knock Out Box



# Primary Controls Knock-out Box





# Secondary Control Baghouse

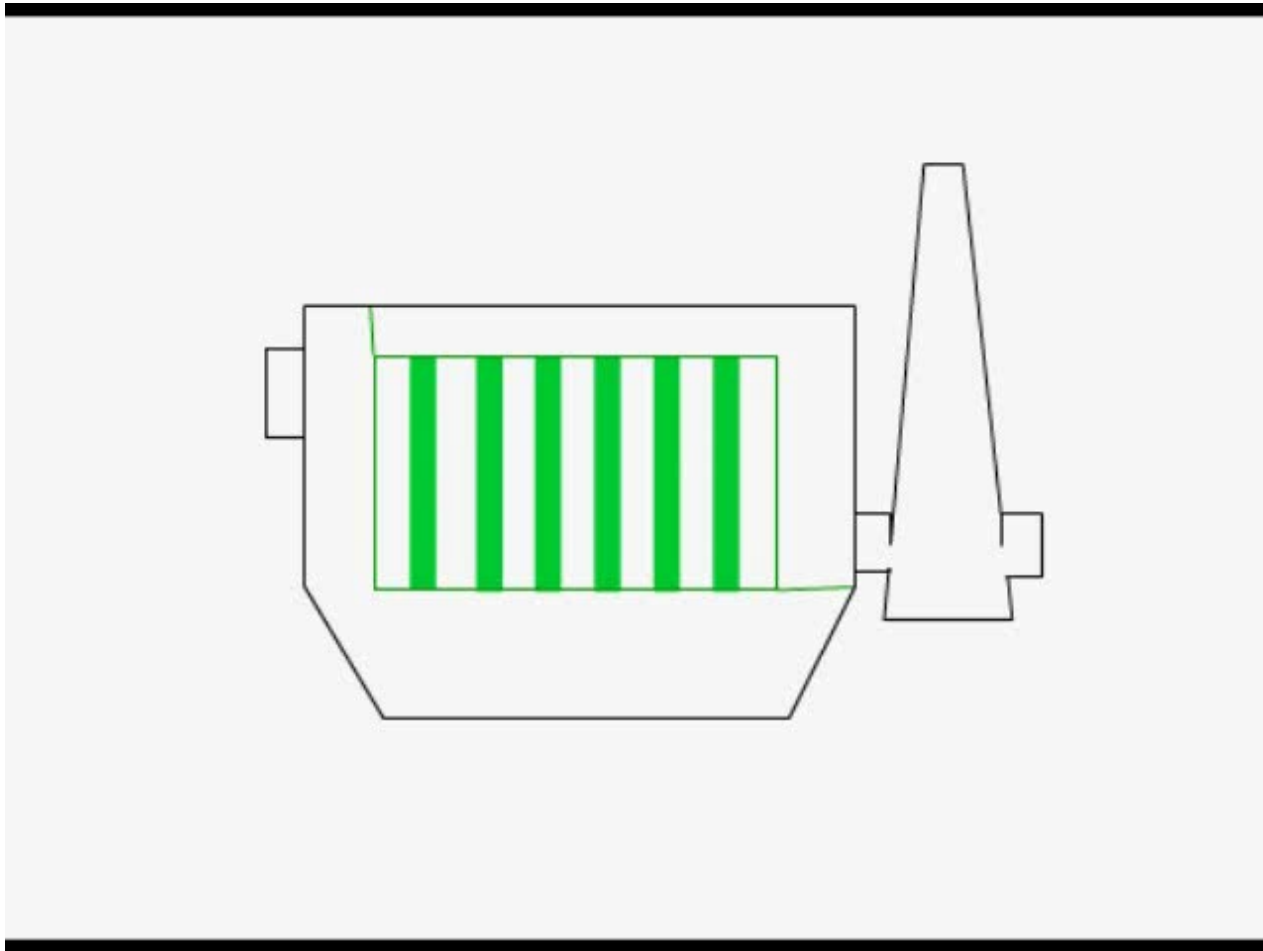


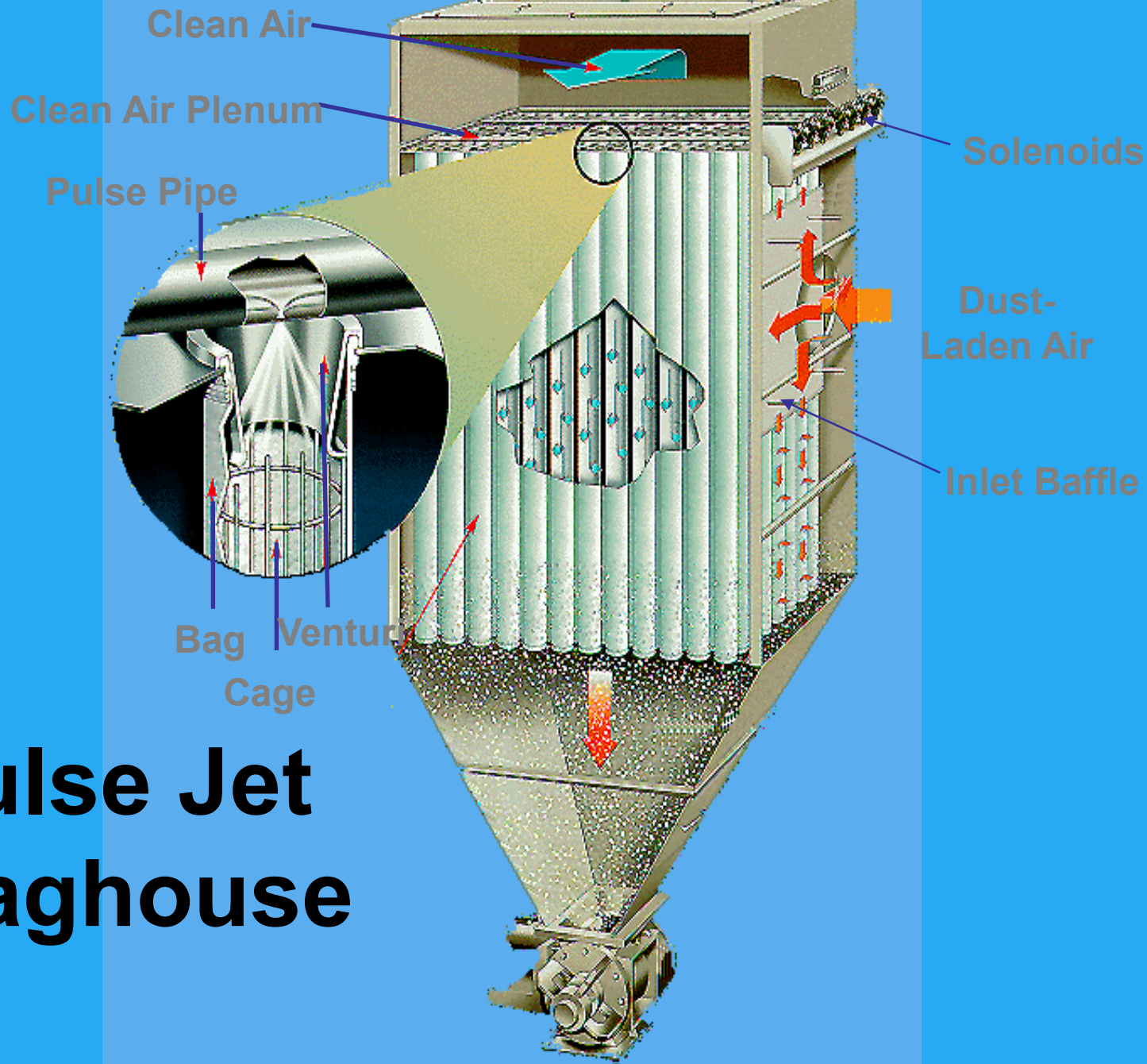


# Secondary Control Baghouses

- ➡ **General description**
  - ✓ **Particles trapped on filter media, then removed**
  - ✓ **Either interior or exterior filtration systems**
  - ✓ **Up to 99.9% efficiency**
  - ✓ **Fabric filters are big vacuum cleaners with a cleaning mechanism**

# Secondary Control Baghouse





# Pulse Jet Baghouse

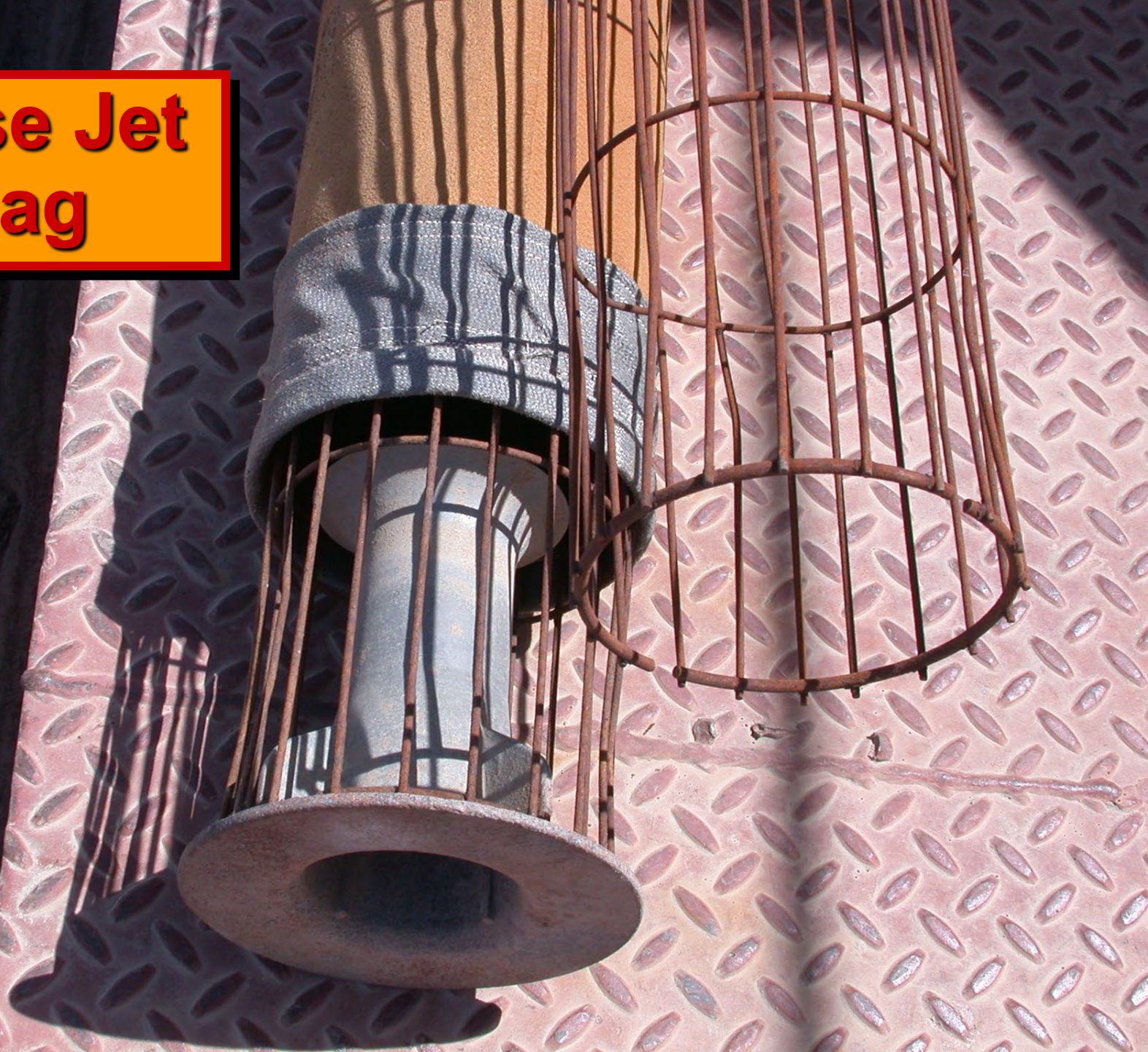
# Secondary Control Pulse Jet Baghouse



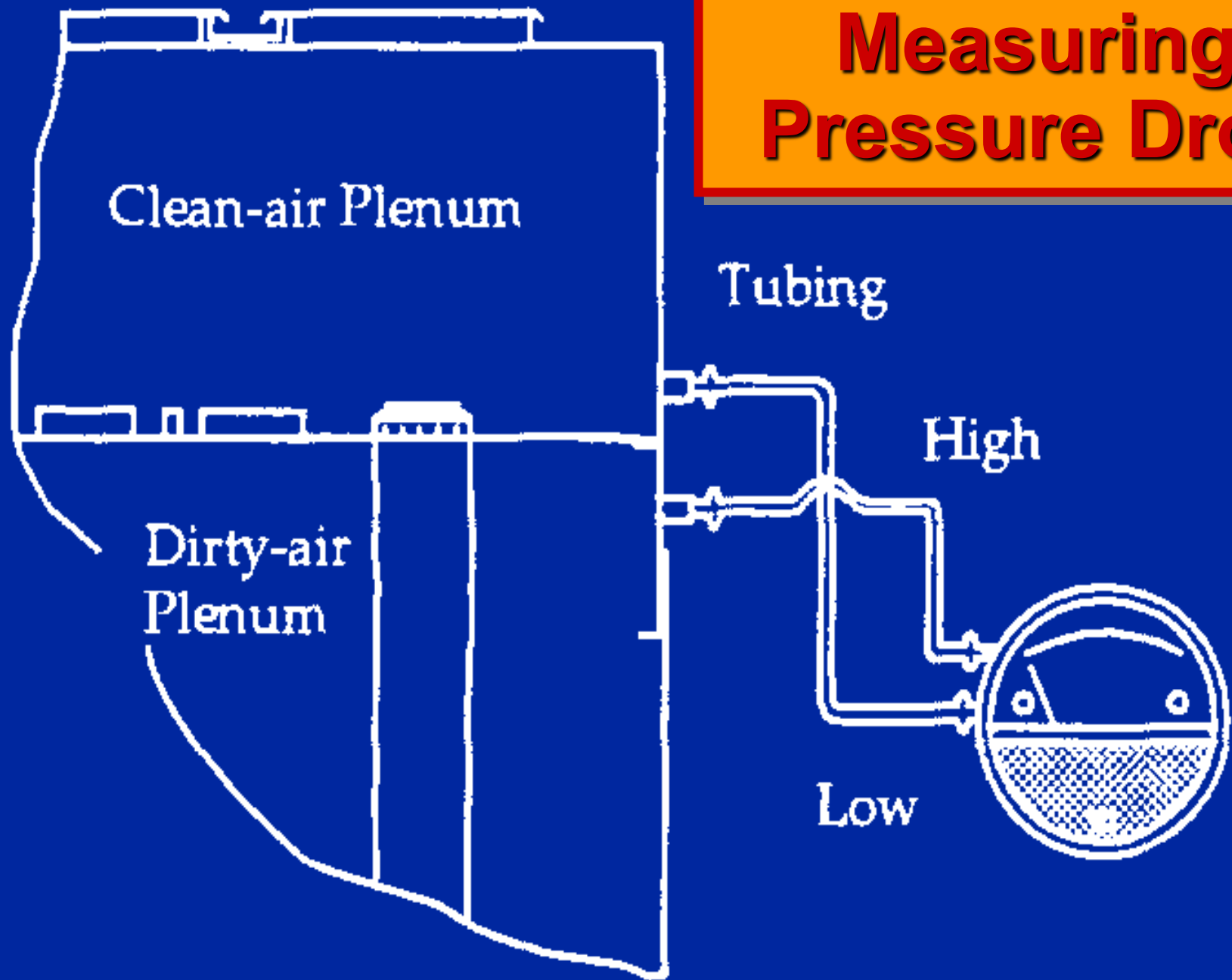
# Secondary Control Inside a Pulse Jet Baghouse



# Pulse Jet Bag



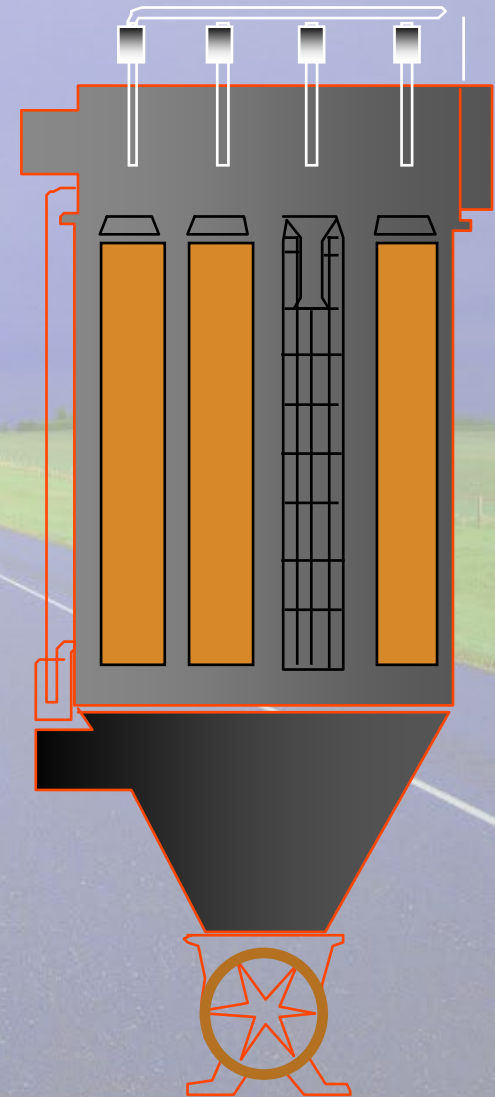
# Measuring Pressure Drop





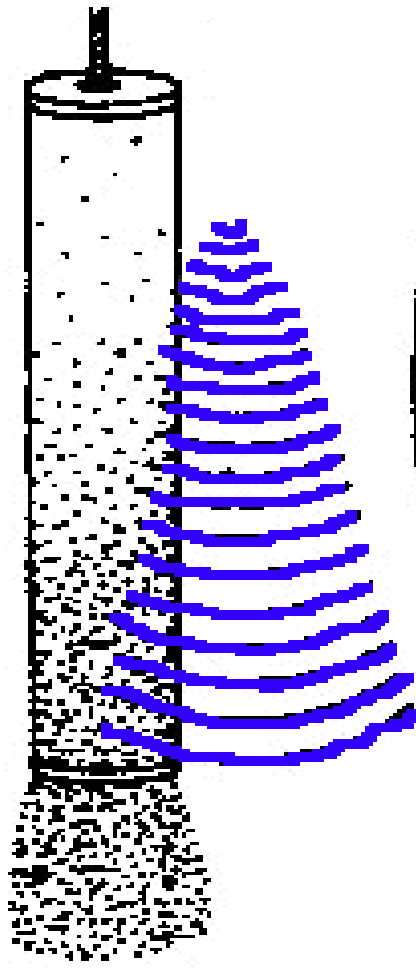
# Baghouse Design Considerations

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

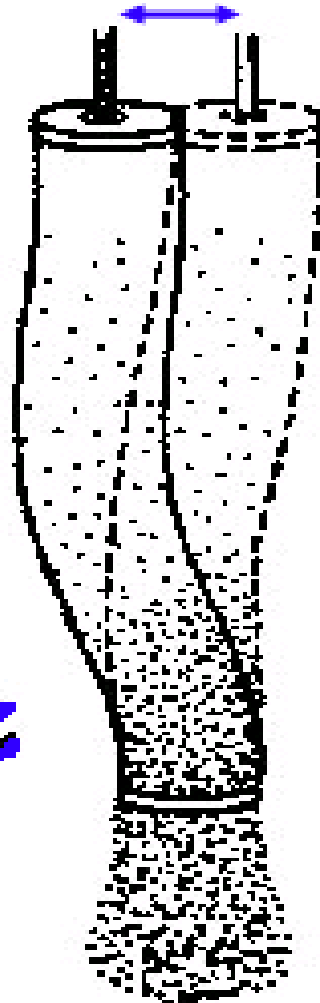


# Secondary Control Shaker Method

Sonic Vibration



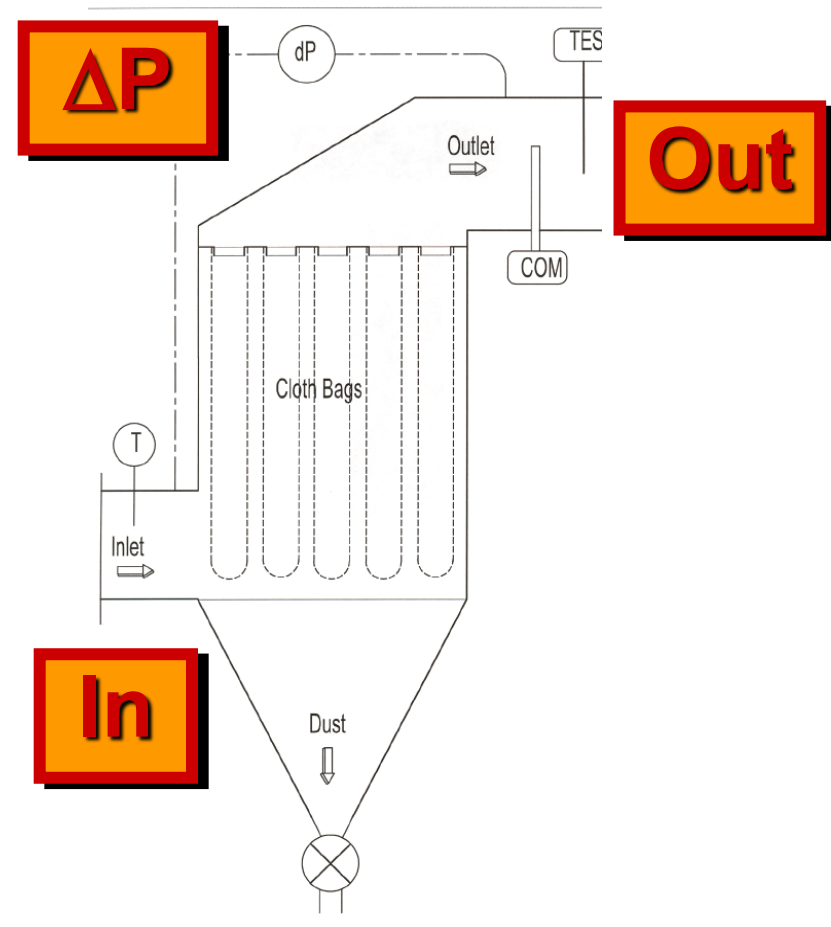
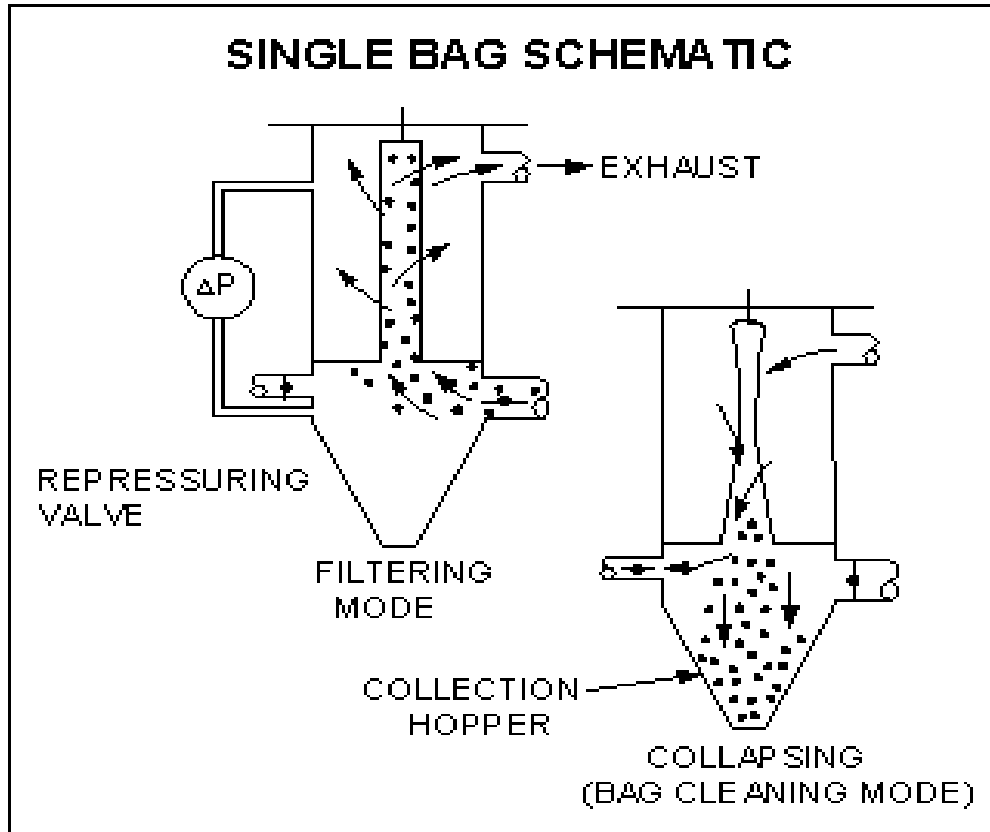
Horizontal



Vertical



# Secondary Control PM Control Techniques – Fabric Filter



# Secondary Control PM Control Techniques - Fabric Filter

## ▣ Factors affecting efficiency

### ✓ Filter media

- Abrasion
- High temperature
- Chemical attack

### ✓ Gas flow

### ✓ Broken or worn-out bags

# Secondary Control PM Control Techniques - Fabric Filter

## ➡ Factors affecting efficiency (continued)

- ✓ Cleaning system failure
- ✓ Leaks
- ✓ Re-entrainment
- ✓ Damper or discharge equipment malfunction
- ✓ Corrosion

# Secondary Control PM Control Techniques - Fabric Filter

- ▶ Performance indicators
  - ✓ Outlet PM concentration
  - ✓ Bag leak detectors
  - ✓ Outlet opacity
  - ✓ Pressure differential
  - ✓ Inlet temperature
  - ✓ Temperature differential

# Secondary Control PM Control Techniques - Fabric Filter

- ➡ **Performance indicators (cont'd)**
  - ✓ **Exhaust gas flow rate**
  - ✓ **Cleaning mechanism operation**
  - ✓ **Fan current**
  - ✓ **Inspections and maintenance**

# Secondary Control Bag House Monitoring

- ➡ Normal bag house emissions are very low.
  - ✓ Opacity sensors Continuous Opacity Monitor (COM) aren't very good below 1-2%, so they don't detect initial problems.
  - ✓ Opacity will show a major particulate emissions increase.
  - ✓ COM or Method 9 may be OK for loose emission limits.



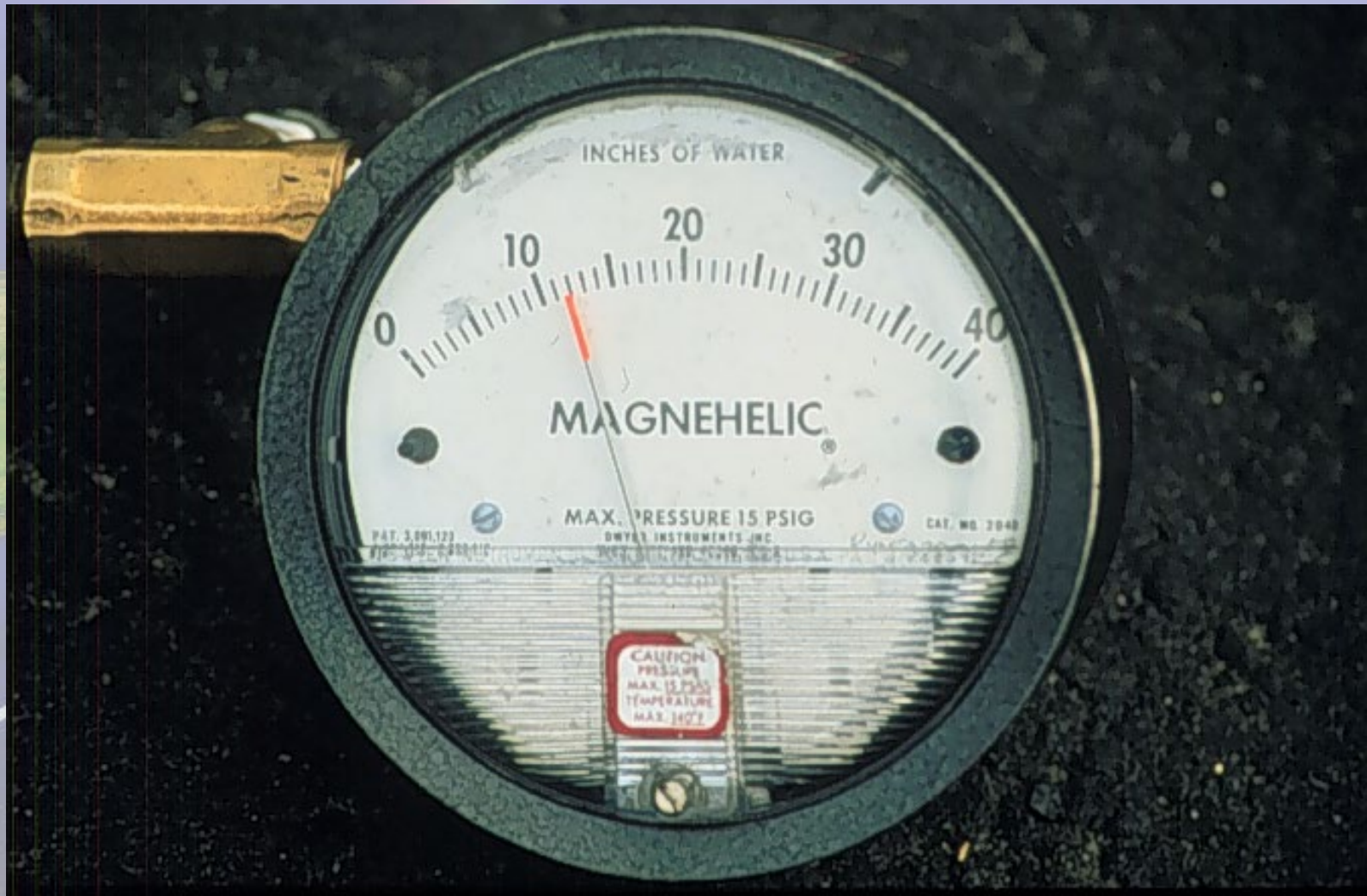
# Inspection Procedures Instrumentation

➡ What types of instruments are being used to monitor for permit conditions?

- ✓ Magnehelic Gauge
- ✓ Triboelectric Monitor

# Inspection Procedures

## Magnehelic Gauge



GAUGES SHOULD READ BETWEEN  
2" & 5" STATIC PRESSURE  
CALL ENGINEERING IF  
LIMITS ARE NOT MET. EXT.#2825



Inspection  
Procedures

What's  
wrong  
with this  
picture?

# Baghouse Monitoring Triboelectric Sensor (TES)

- ➡ **TESs are a newer technology**
  - ✓ **Primary use in cement, coal fired power plants, and food manufacturing**
  - ✓ **US EPA encourages use of TESs as CAM (compliance assistance monitoring, 40 CFR 64) or**
  - ✓ **As a performance indicator in lieu of a source test**
- ➡ **Districts are adopting TES as BACT or compliance measurement tool**

# Baghouse Monitoring Triboelectric Sensor

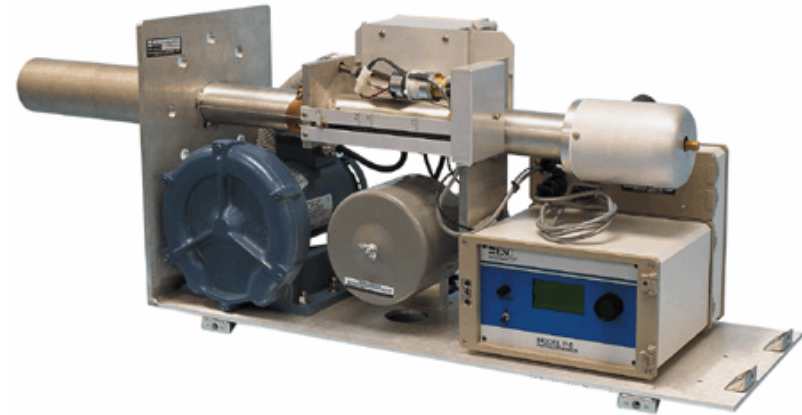
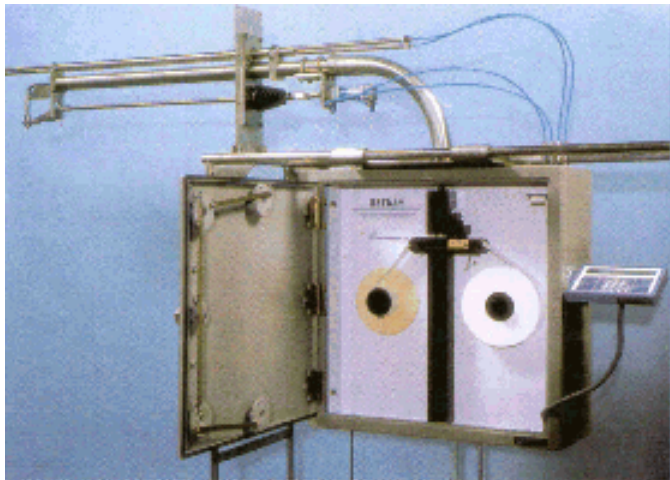
- ➡ **Triboelectric sensors (TES) work well at very low particle concentrations (very sensitive).**
- ➡ **TES detects micro amp current from particles hitting a metal probe.**
- ➡ **TES is simple and inexpensive.**
- ➡ **TES is an effective monitor when a small to moderate increase in emissions is of concern.**

# Baghouse Monitoring Triboelectric Sensor

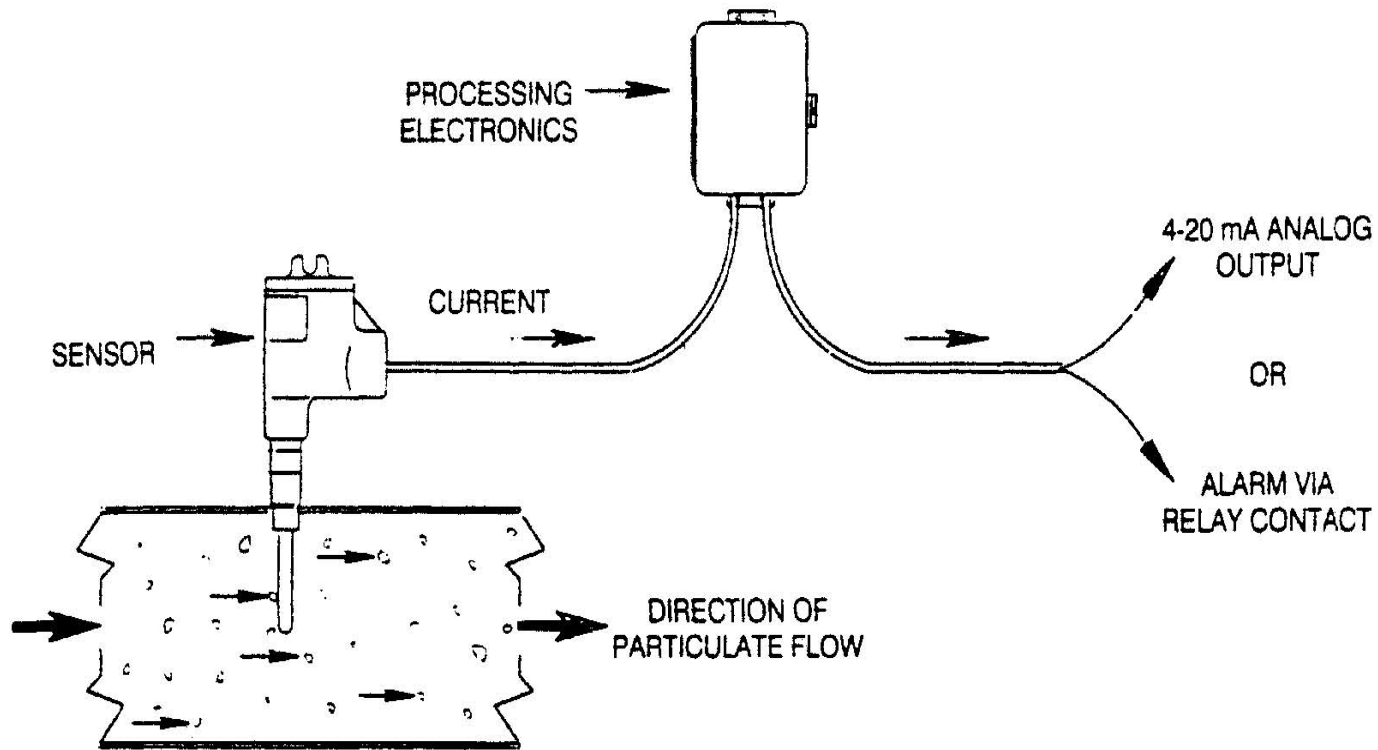
- ▶ Operates on the principle of electric conductivity
  - ✓ Triboelectric Principle: When 2 solids contact an electrical charge is transferred between the 2
  - ✓ Current generated is proportional to the particulate mass flow rate
  - ✓ Instrument tuned to produce continuous analog output and/or an alarm at a specific signal level

# Control Devices

## PM CEMS/TES Devices

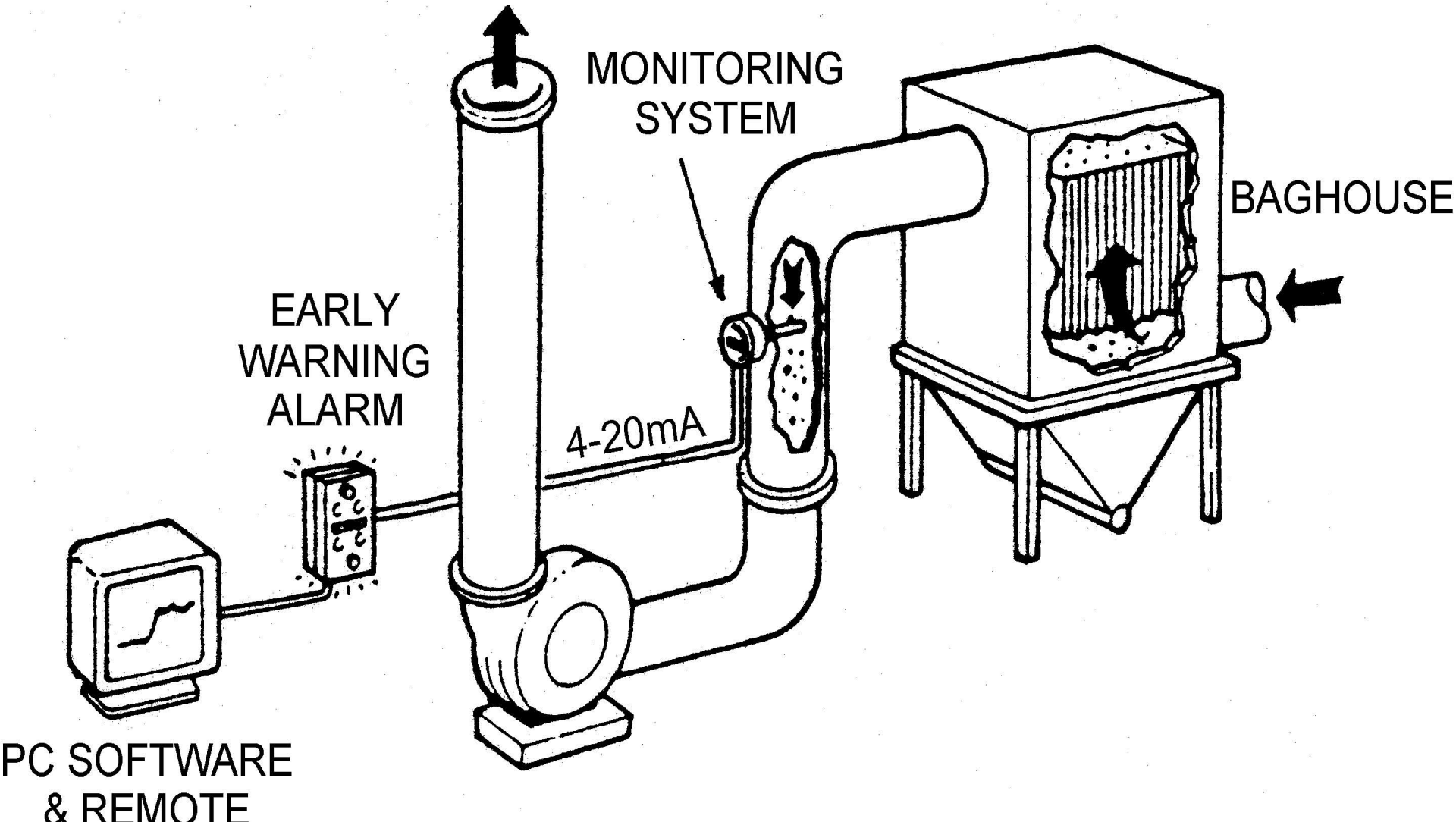


# Control Device Triboelectric Sensor Schematic





# Triboelectric Sensor Installation for a Negative Pressure Monitoring System



# Monitoring Device

## Triboelectric Sensor

- ➡ **TES works well at low particulate concentrations**
- ➡ **Detects micro amp current from particles hitting a metal probe**
- ➡ **Simple and inexpensive**
- ➡ **Effective monitor when a small to moderate increase in emissions is of concern**

# Baghouse Monitoring Device Triboelectric Sensor

- ➡ Establish baseline
- ➡ Monitor detects gradual or instantaneous increases in the signal from baseline
- ➡ Baseline emissions can be as low as 0.1 mg/dscm (0.00005 gr/dscf)

# Inspection Procedures

## Fans/Blowers

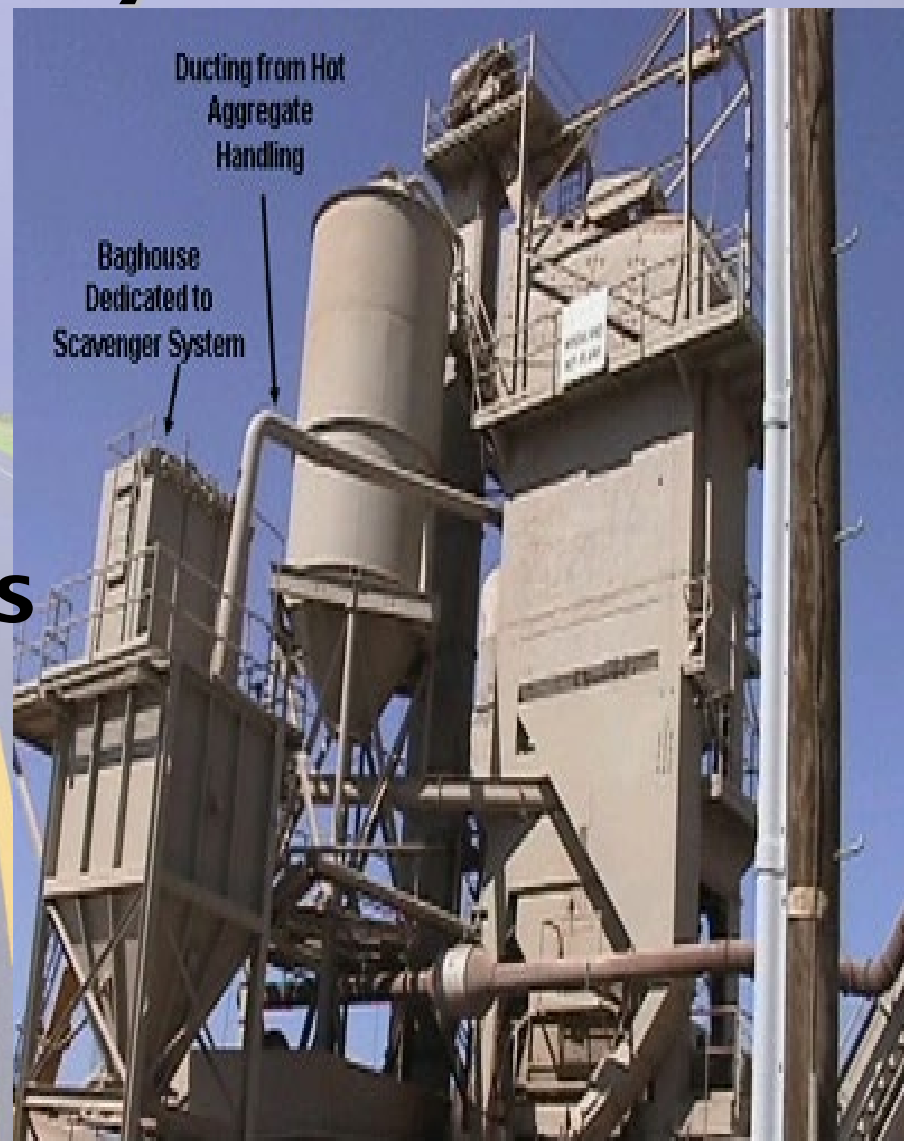


▶ Horsepower

▶ Number of Engines

# Control Scavenger System

- ➡ Collects fugitive emissions from:
  - ✓ Hot aggregate elevator
  - ✓ Vibrating screens
  - ✓ Hot bins



# Control

## Asphalt Binder Storage

- ➡ **May or may not be controlled**
- ➡ **Controls include**
  - ✓ **Condensers,**
  - ✓ **Vapor recovery system (similar to gas station)**
    - **Vapors returned to refinery for incineration**
- ➡ **Delivery truck lines are flushed with non-hazardous cleaners**

# Control Asphalt Binder Storage







# Control Blue Smoke



# Control Blue Smoke



➡ An aerosol of condensed organic particles adsorbed to dust or water particles

# Control Blue Smoke

- ➡ **Some organic compounds begin to**
  - 1. vaporize at 300 F**
  - 2. Condense in ambient air**
  - 3. Adsorb to dust and water particles**
- ➡ **To form visible emissions**
- ➡ **Visible emissions are formed until the air becomes saturated**



**Blue Smoke  
Emission Points**

# Control

## Blue Smoke Emissions Points

- ➡ Drop points of HMA from pugmill
- ➡ On top of surge bins/silos
- ➡ At the base of surge bins/silos
- ➡ Drag slat conveyors
- ➡ Truck load out
  
- ➡ Challenge to capture and control
- ➡ Primary reason for complaints
- ➡ Perception !!

# Blue Smoke Collection System



Blue  
Smoke  
Collection  
System  
to Dryer



Induction Fan of  
Blue Smoke  
Collection  
System



**Blue Smoke Control Device??**

3/1/2022

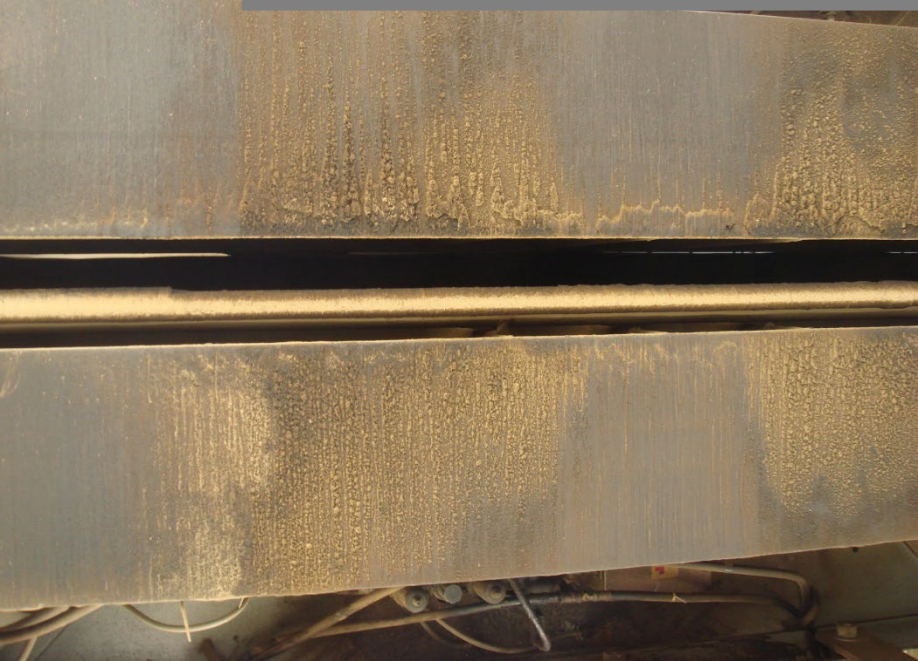


**Blue Smoke  
Controls**





# Truck Load Out & Blue Smoke Controls





**Silo/Truck Load Out & Blue Smoke Controls??**



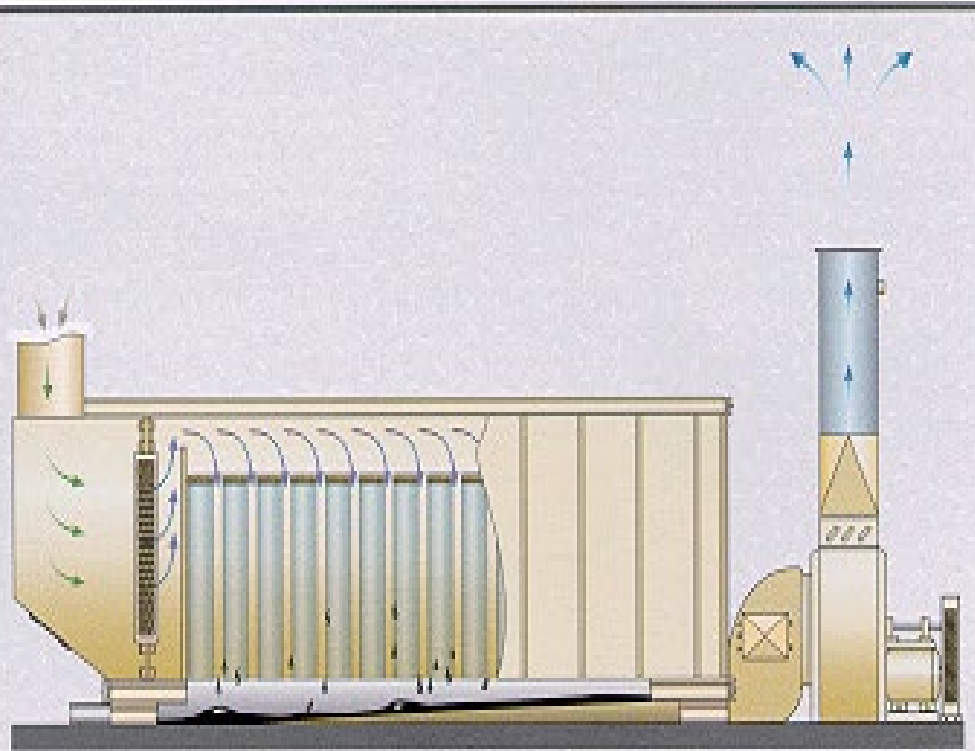
## Blue Smoke Controls





**Blue Smoke Control Device**

# Fiberbed Filtration



FIBERBED MIST COLLECTOR



**Fiberbed Filtration**



# Control of Blue Smoke Truck Entrance



HAVE YOU  
CHECKED  
YOUR GATES  
?

NOTICE  
ALL TRUCK DRIVE  
YOU ARE RESPONSIBLE  
FOR GROSS WEIGHT  
AXLE DISTRIBUTION &  
PROPER TIRE CAPACITY  
OF ALL LOADS HAULED  
FROM THIS PLANT  
INDUSTRIAL ASPHALT  
ACCEPTS NO RESPONSIBILITY  
FOR OVERLOADS OF ANY  
NATURE

STAY IN  
VEHICLE WHILE  
LOADING

HARD HAT  
REQUIRED AT ALL  
TIMES WHEN OUT-  
SIDE OF VEHICLES

# Control Blue Smoke Enclosed Load Out



**DUCTWORK TO ELECTROSTATIC PRECIPITATOR**



# Control

## Side View of HMA Drop with ESP/Smog Hog for Blue Smoke



# Control Ducting to ESP/Smog Hog



# Two-Stage ESP

**Collector Cells (to collect particles)**

**Ionizer (to charge particles)**

**Pre-Filter**

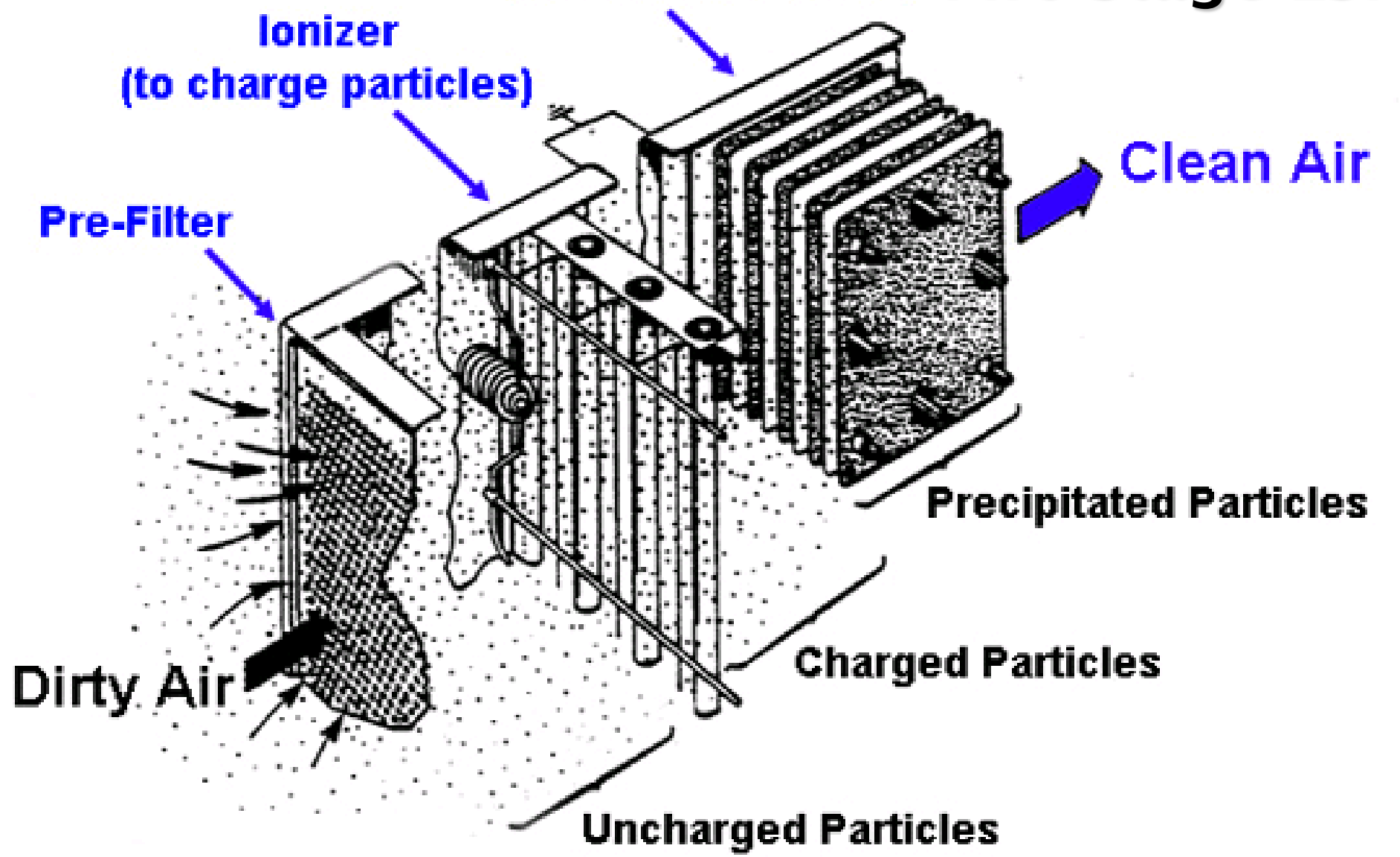
**Clean Air**

**Dirty Air**

**Precipitated Particles**

**Charged Particles**

**Uncharged Particles**



# Controls Innovations in HMA Production

➡ Four areas where the technology has improved

- ✓ burner design,
- ✓ fuels,
- ✓ dryer/drum design, and
- ✓ blue smoke controls

# Controls

## Triple-Drum Mixer



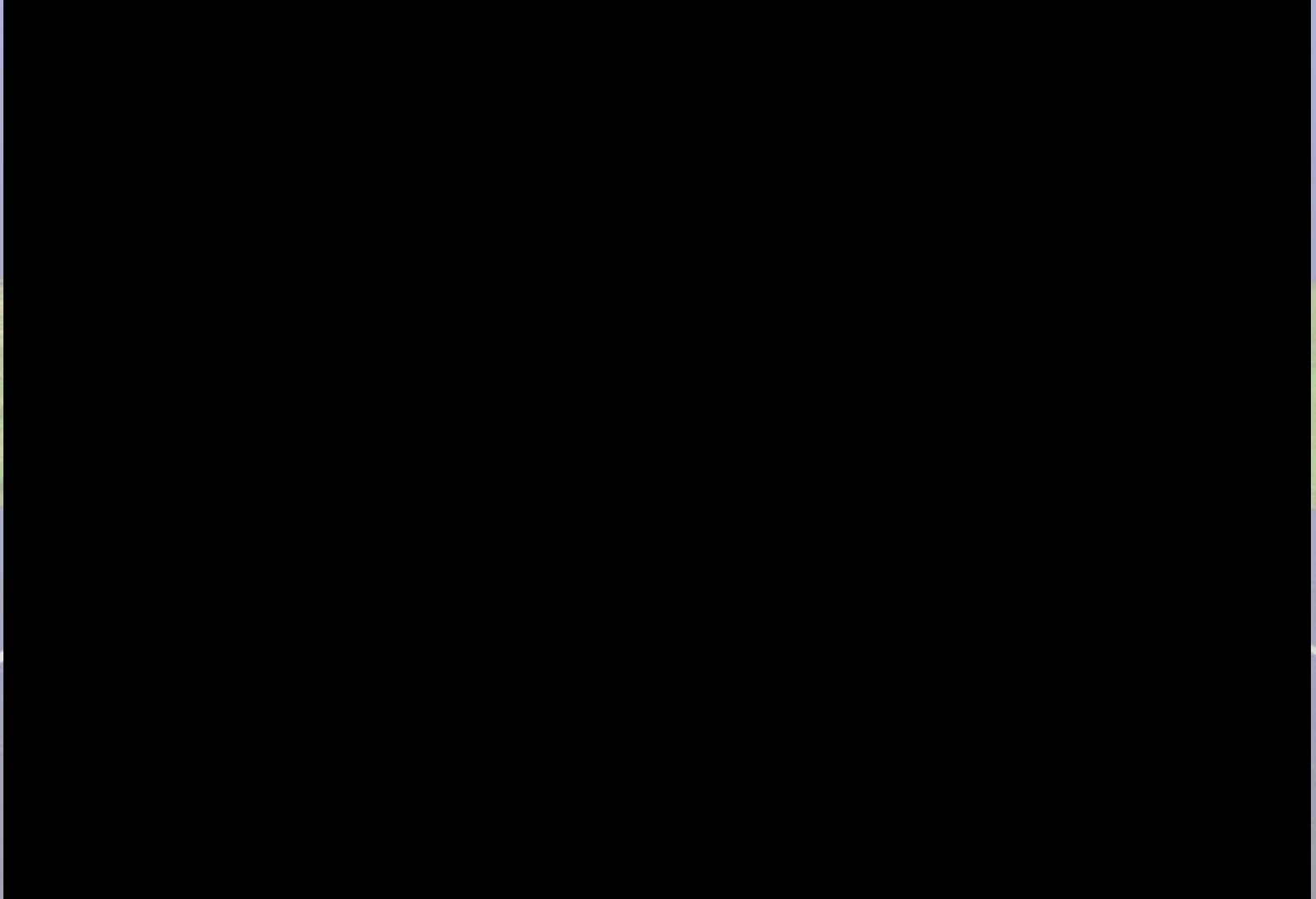
**Triple-Drum Mixer**

# ASPHALT SEAL COAT AND PAVING

## Reading a Moving Plume



# Moving Source



# Permit Conditions



## ➡ Emission Controls

- ✓ Emission Limits
- ✓ Process Limits
- ✓ Emission Rate Limits
- ✓ Requirements to Minimize Emissions
- ✓ Source Test
- ✓ CAM (gauges on baghouse)



# Permit Conditions (cont'd)



## ➡ Fuel Requirements

- ✓ Type
- ✓ Nitrogen or Sulfur content
- ✓ Amount of fuel
- ✓ Type of backup fuel
- ✓ Method of measurement
- ✓ Recordkeeping of fuels purchased and used

# Permit Conditions (cont'd)



## ➡ Visible Emissions Limits

- ✓ NSR lists are 20% or No. 1 on Ringleman
- ✓ Sources permitted before NSR maybe 40% or No. 2 on Ringleman

# Process/Control

## Dry Collection Systems



➡ **Baghouses are regulated in terms of**

- ✓ **Source Test Requirements and Methods**
- ✓ **Visual Test Method?**



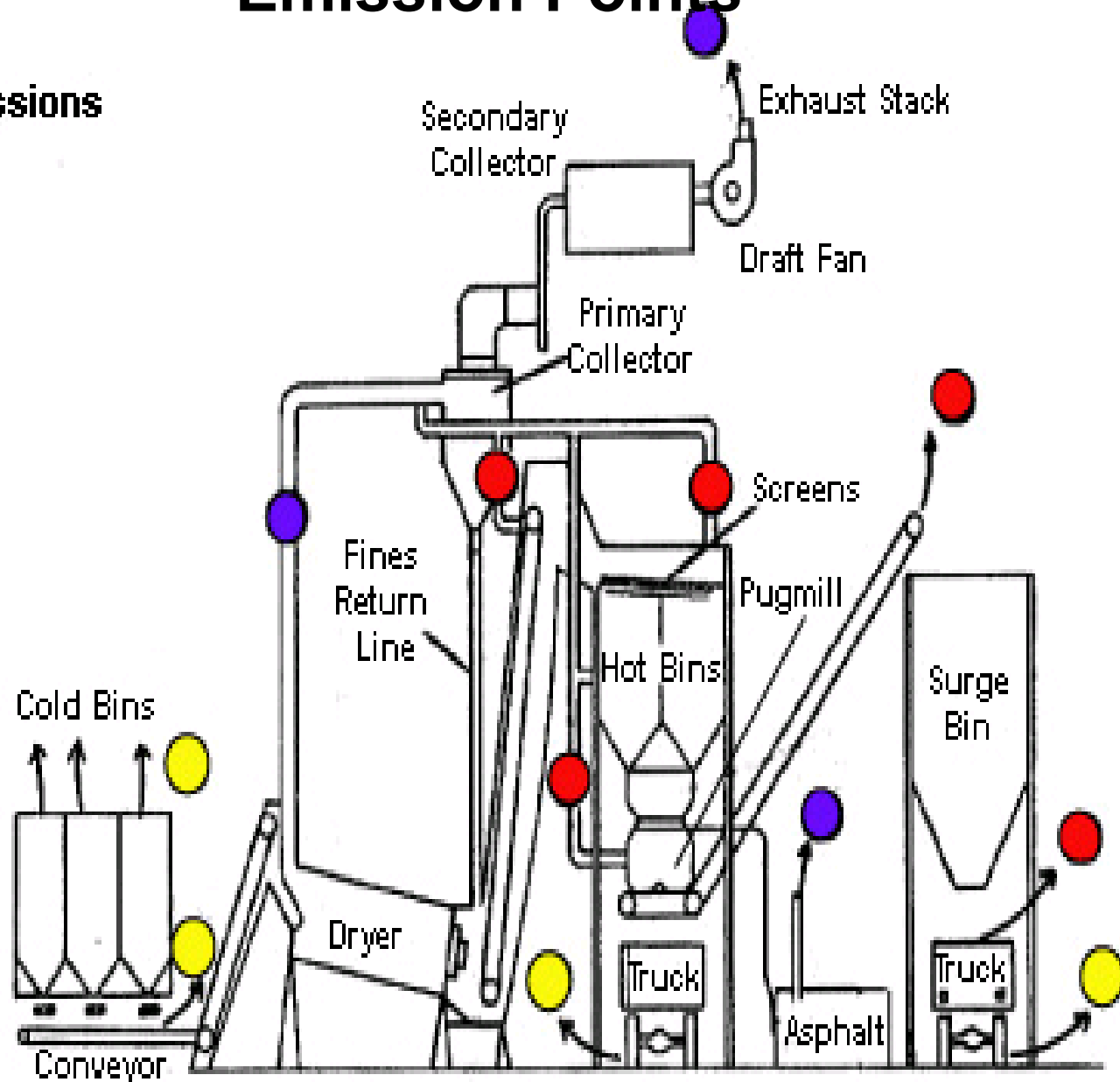
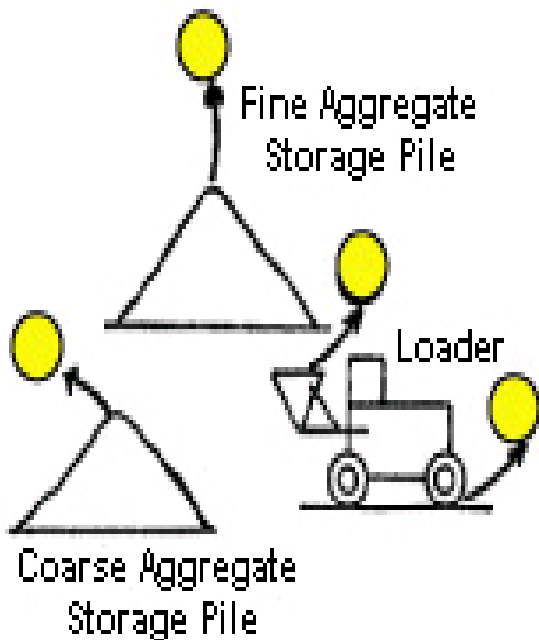
# Permitting/Inspection HMA Source Test



# LEGEND

- Emission Points
- Ducted Emissions
- Process Fugitive Emissions
- Open Dust Emissions

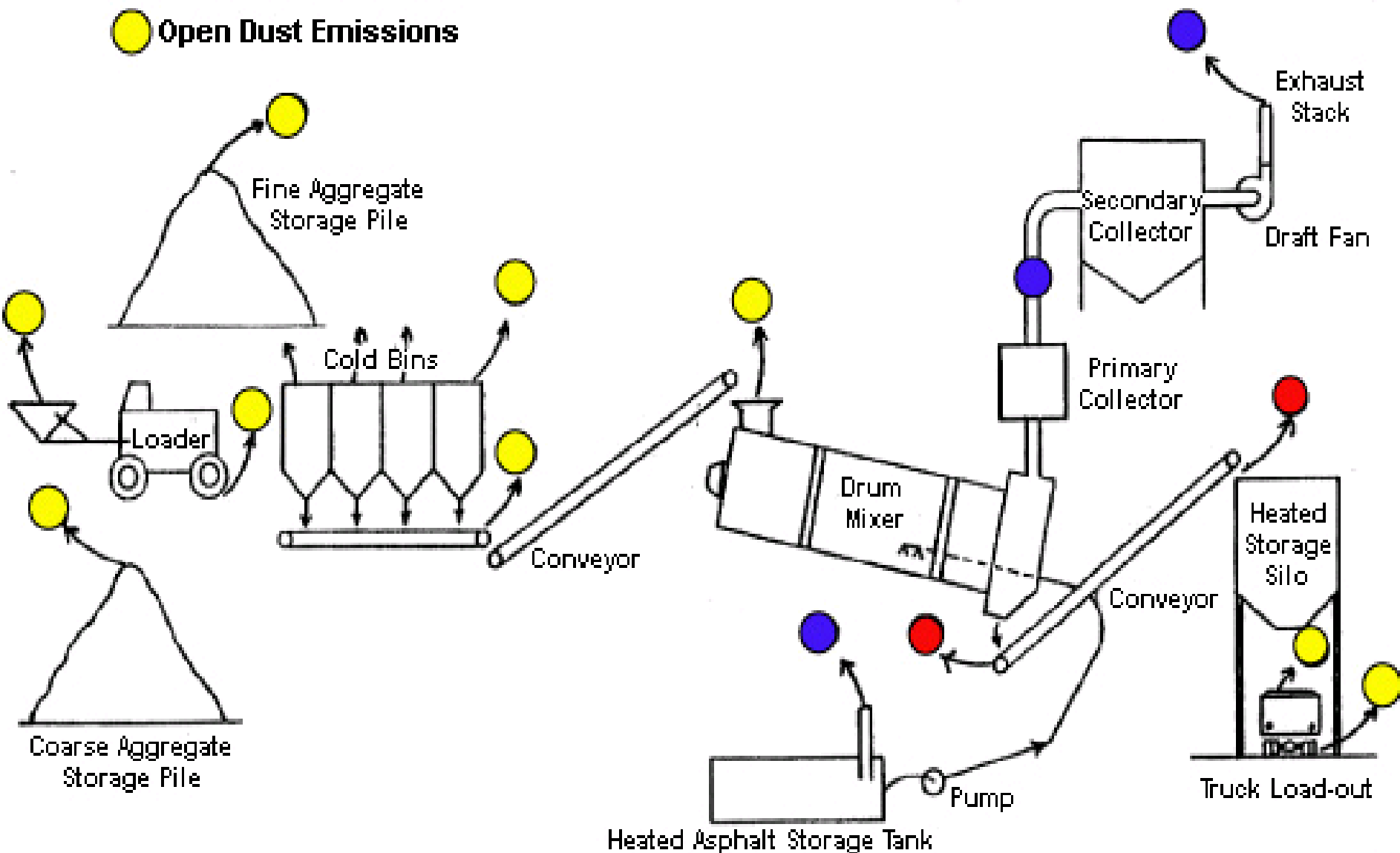
# HMA Batch Mix Process Emission Points



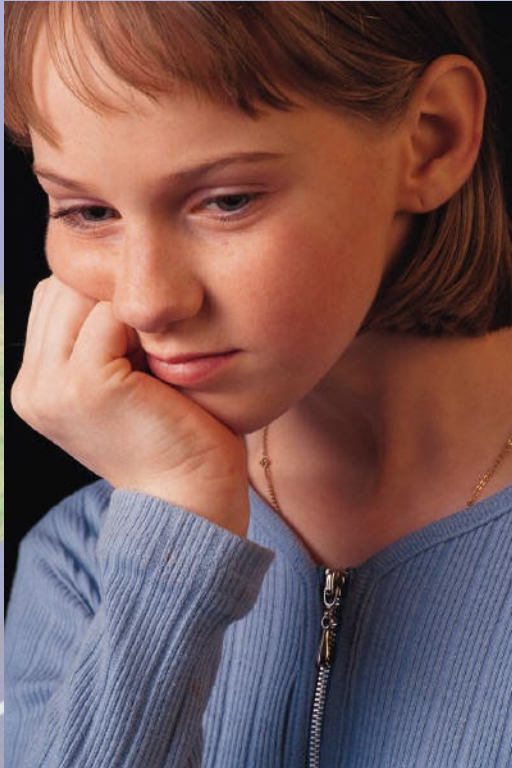
# LEGEND

- Emission Points
- Ducted Emissions
- Process Fugitive Emissions
- Open Dust Emissions

# HMA Continuous Mix Process Emission Points



# Permit/Inspection Objectives



- Determine compliance with  
Local rules, State laws,  
Federal regulations  
& permit conditions**
- **Fugitive emissions**
- **Stack emissions**
- **Visible emission tests**
- **Oxides of nitrogen (for  
fuel burning equipment)**