
California
Air Resources Board
Aggregate Plants

Overview

- Introduction
- Emissions and Health Impacts
- Aggregate Industry
- Aggregate Process
- Engineering Evaluation
- Inspection Procedures

Introduction

Great Wall of China

Introduction

Let's Talk Rock

Emissions and Health Impacts

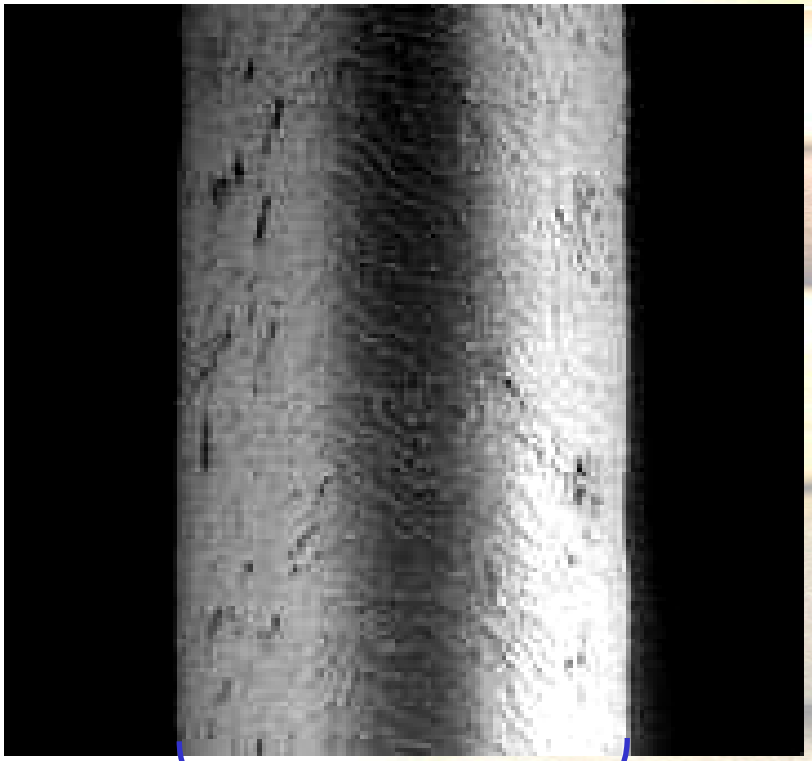
Emissions from Nonmetallic Mining

- Particulate matter
  - PM
  - PM10
  - PM2.5
- Gases
  - Toxic
  - Reactive
  - CO
  - NOx
  - SOx
- Asbestos & Heavy Metals

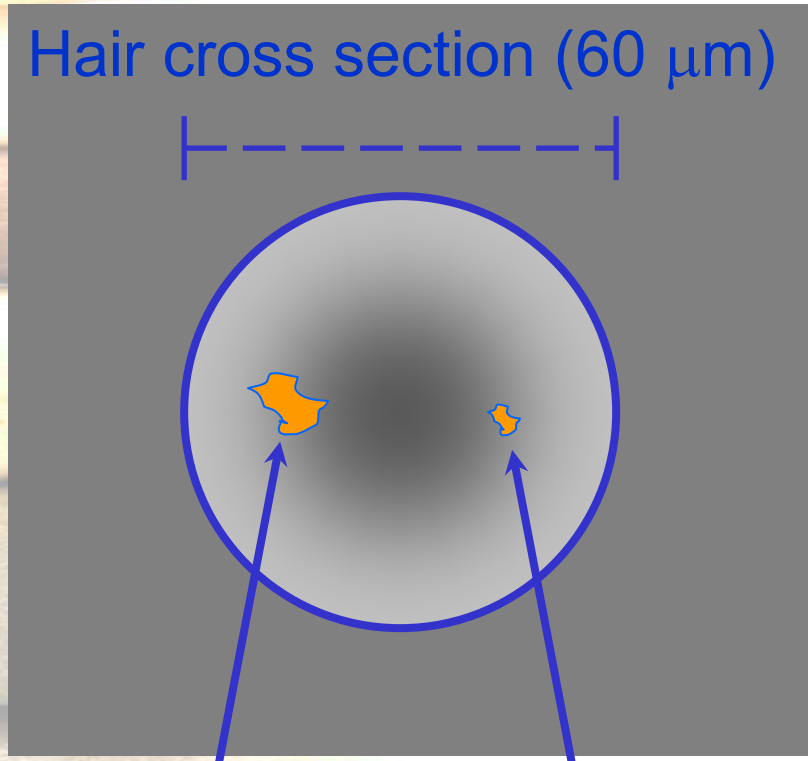
Emissions from Nonmetallic Mining in California (tons/day)

Toxic Organic Gases (TOG)	0.22
Reactive Organic Gases (ROG)	0.15
Carbon Monoxide (CO_2)	0.05
Oxides of Nitrogen (NOx)	0.10
Oxides of Sulfur (SOx)	0.01
Total Particulate Matter (PM)	25.19
Particulate Matter PM10	11.73
Particulate Matter PM2.5	4.46

How Small is PM?

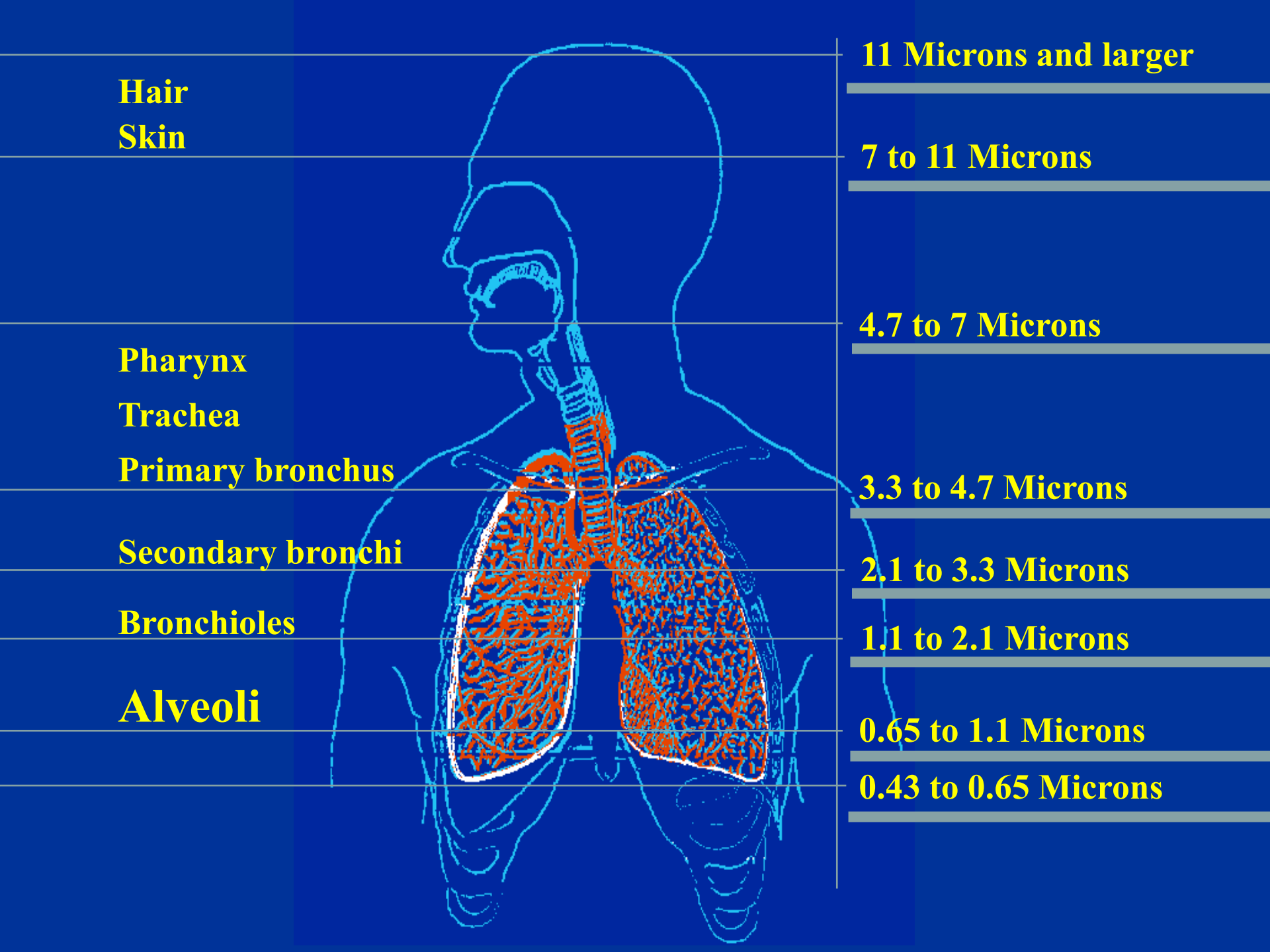


Human Hair
(60 μm diameter)



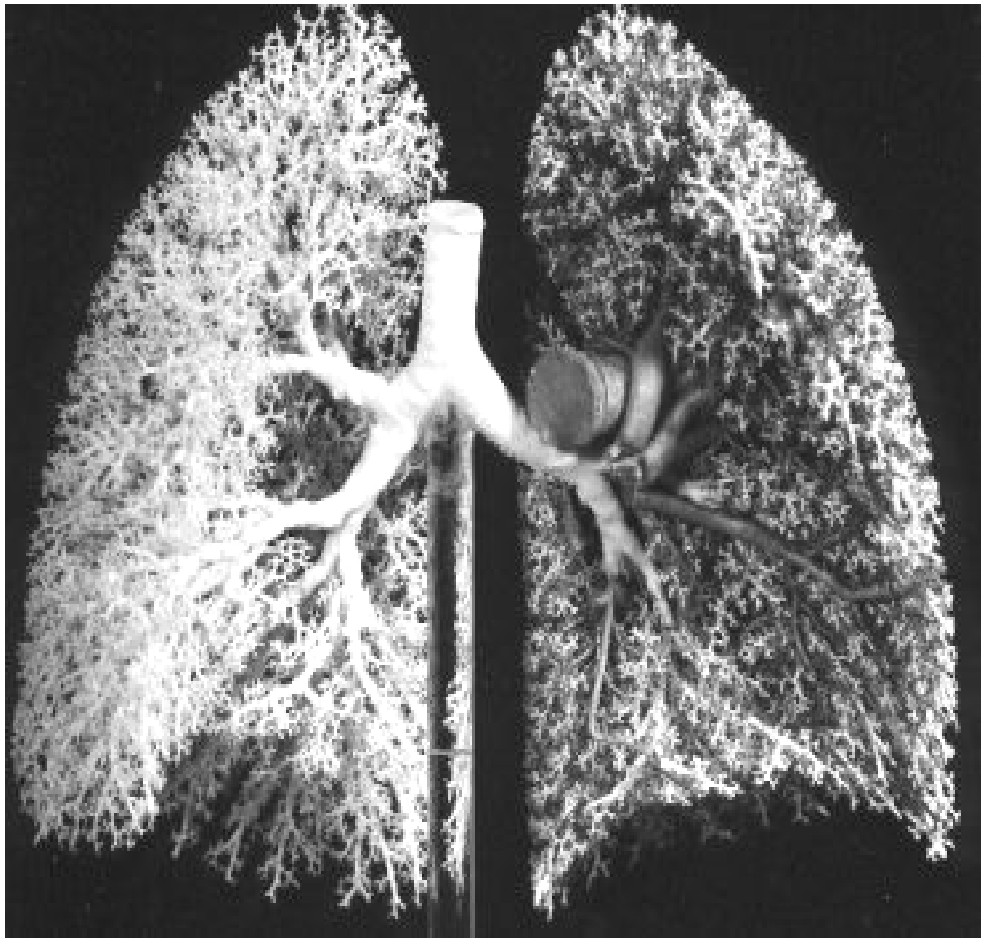
PM_{10}
(10 μm)

$PM_{2.5}$
(2.5 μm)


Hair
Skin
Pharynx
Trachea
Primary bronchus
Secondary bronchi
Bronchioles
Alveoli
11 Microns and larger
7 to 11 Microns
4.7 to 7 Microns
3.3 to 4.7 Microns
2.1 to 3.3 Microns
1.1 to 2.1 Microns
0.65 to 1.1 Microns
0.43 to 0.65 Microns

Health Effects of PM

The Filial have been damaged from particulate exposure



Emissions/Health Impacts

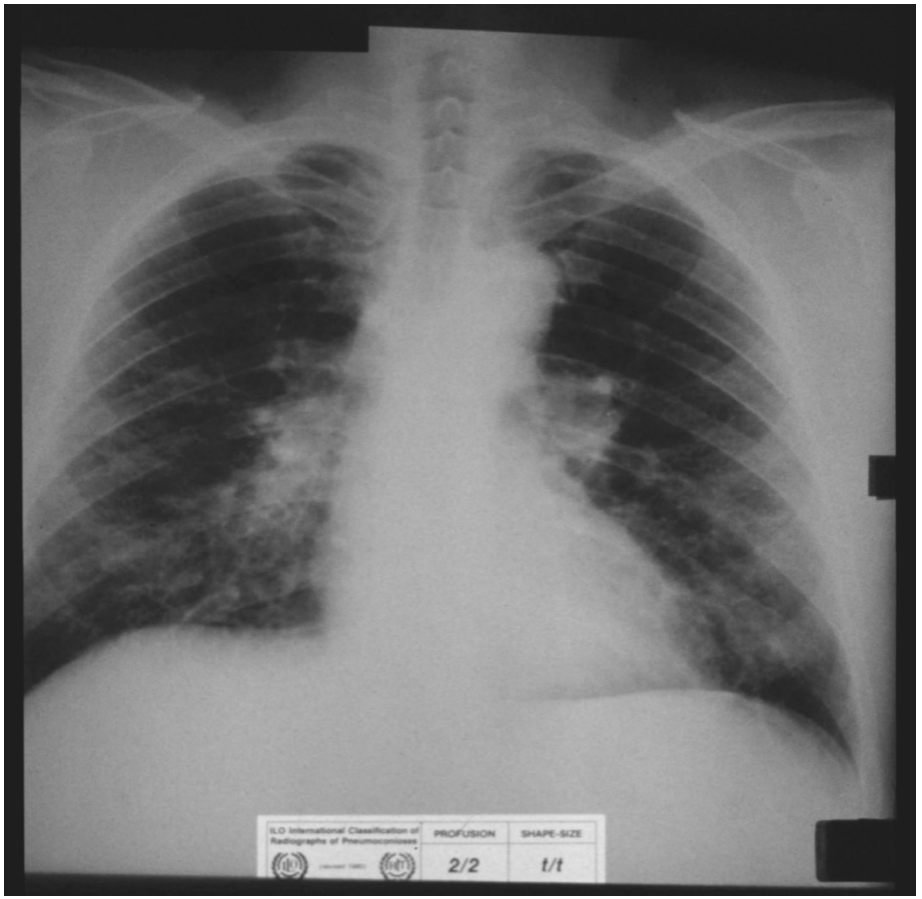
Asbestos

Emissions/Health Impacts

X-ray of a lung exposed to asbestos

Result:

Mesothilaoma

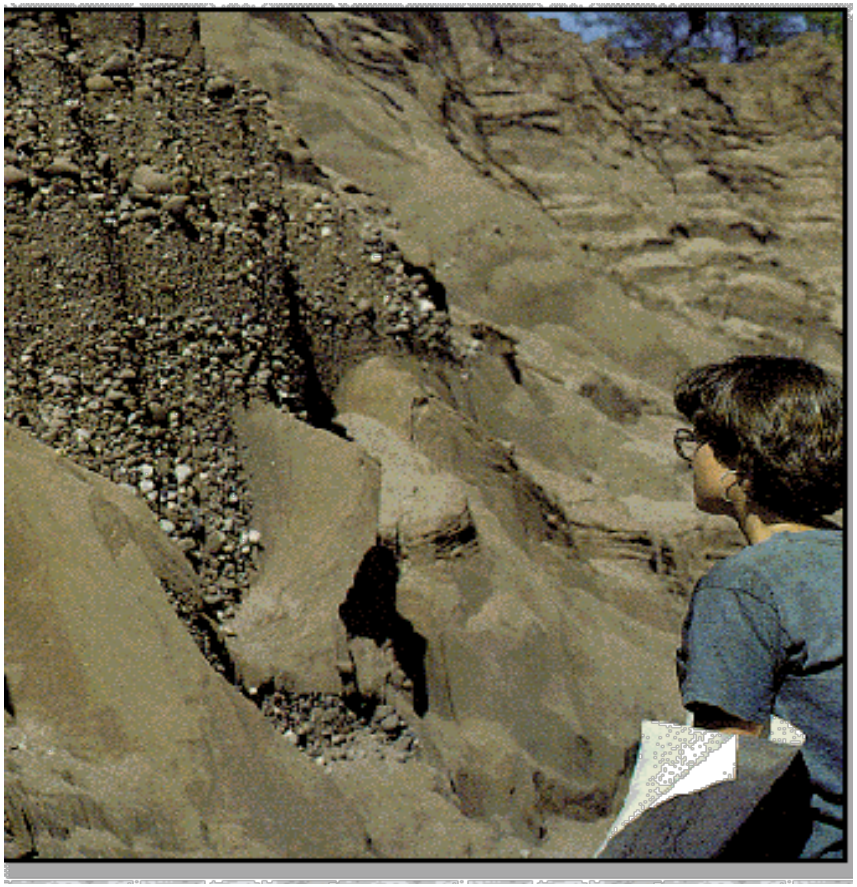


Health Effects of PM

- Aggravated asthma
- Respiratory Distress
- Decreased Lung Function
- Chronic Bronchitis

Aggregate Industry

Aggregate Industry



Definition of Natural Aggregate:

A material composed of rock fragment (sand, gravel, and crushed stone) that may be used in its natural state or crushed, washed and sized.

Aggregate Industry

Sand and Aggregate are:

- Loose mineral and rock particles
- Transported by water and erosion

Key Differences:

- Aggregate…passes through 2 inch screen
- Sand…passes through1/4 inch opening (retained on a 200 mesh per sq inch screen)

Aggregate Industry Types

Natural

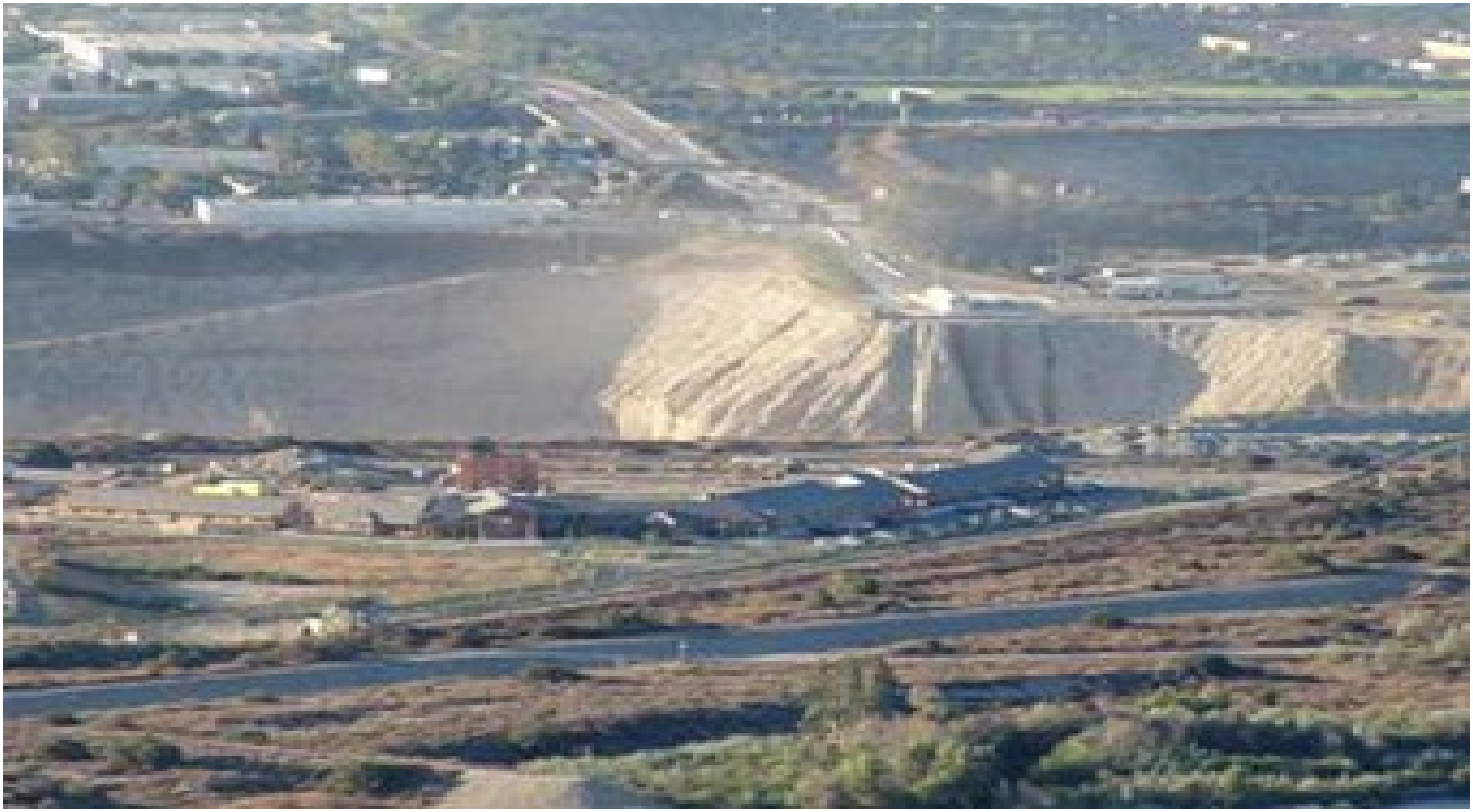
Crushed by Mechanical Means

Aggregate Industry In California

- $3.5 billion industry
- Approximately 1,055 non-fuel mineral mines
- Employs 10,400 people

Aggregate Process and Control

Emissions



Process/Control

Emission Sources

- **Plant Generated Dust**
  - Drilling
  - Crushing
  - Conveying
  - Screening
  - Stockpiling
- **Fugitive Dust**
  - Geologic material suspended by
    - Wind
    - Human activity

Process/Control

Emissions are measured by knowing

- How much aggregate is processed over time
- How much moisture is in the material being processed, and
- The control efficiency of the air pollution control procedures…

Giving you:

- Total Emissions

Calculating Emissions

General equation from AP-42 is:

$$E = A \times EF \times (1-ER/100)$$

where:

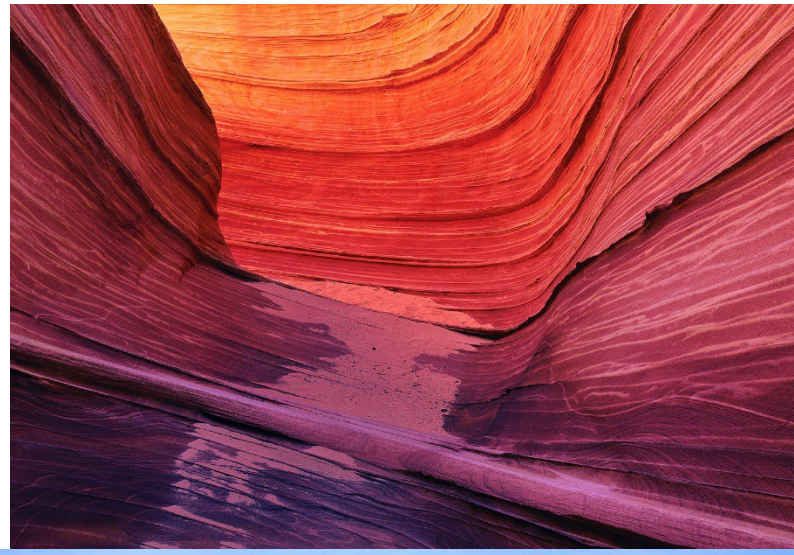
- E=emissions
- A=activity rate
- EF=emission factor
- ER=% overall emission reduction efficiency

Aggregate Plant

Aggregate Mining

Mining

- Two General Types
  - Sand and Gravel
  - Crushed Stone



Sand and Gravel Mining Equipment

- Front-End Loader

- Ripper

Dragline

Crushed Stone Mining

- Drilling

- Blasting

Mining Operations

Explosives

Primary Rock Crusher

Material Dumping from Trucks

Transportable Screening

Impact Crusher

Process

FROM THE MINE

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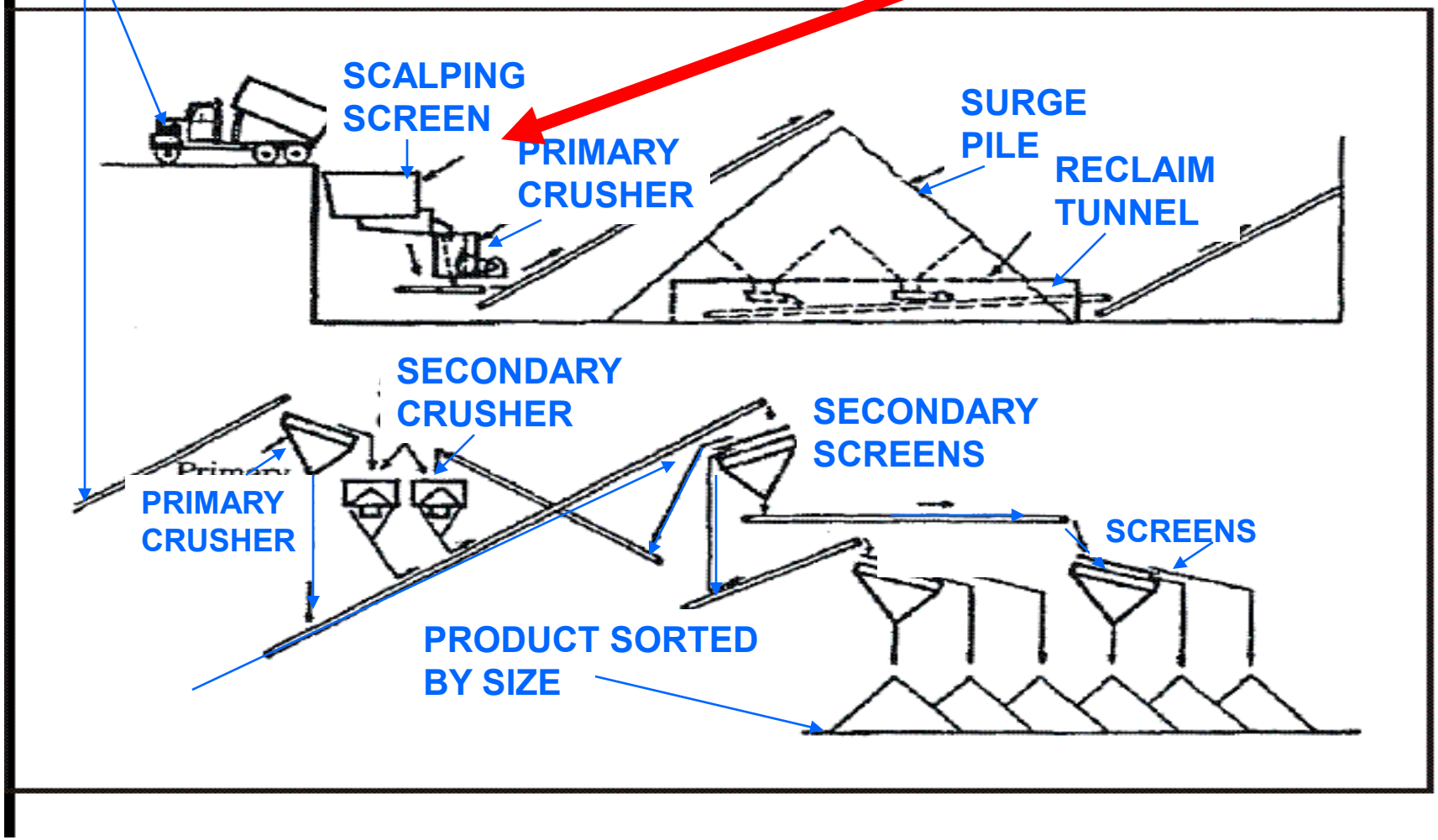
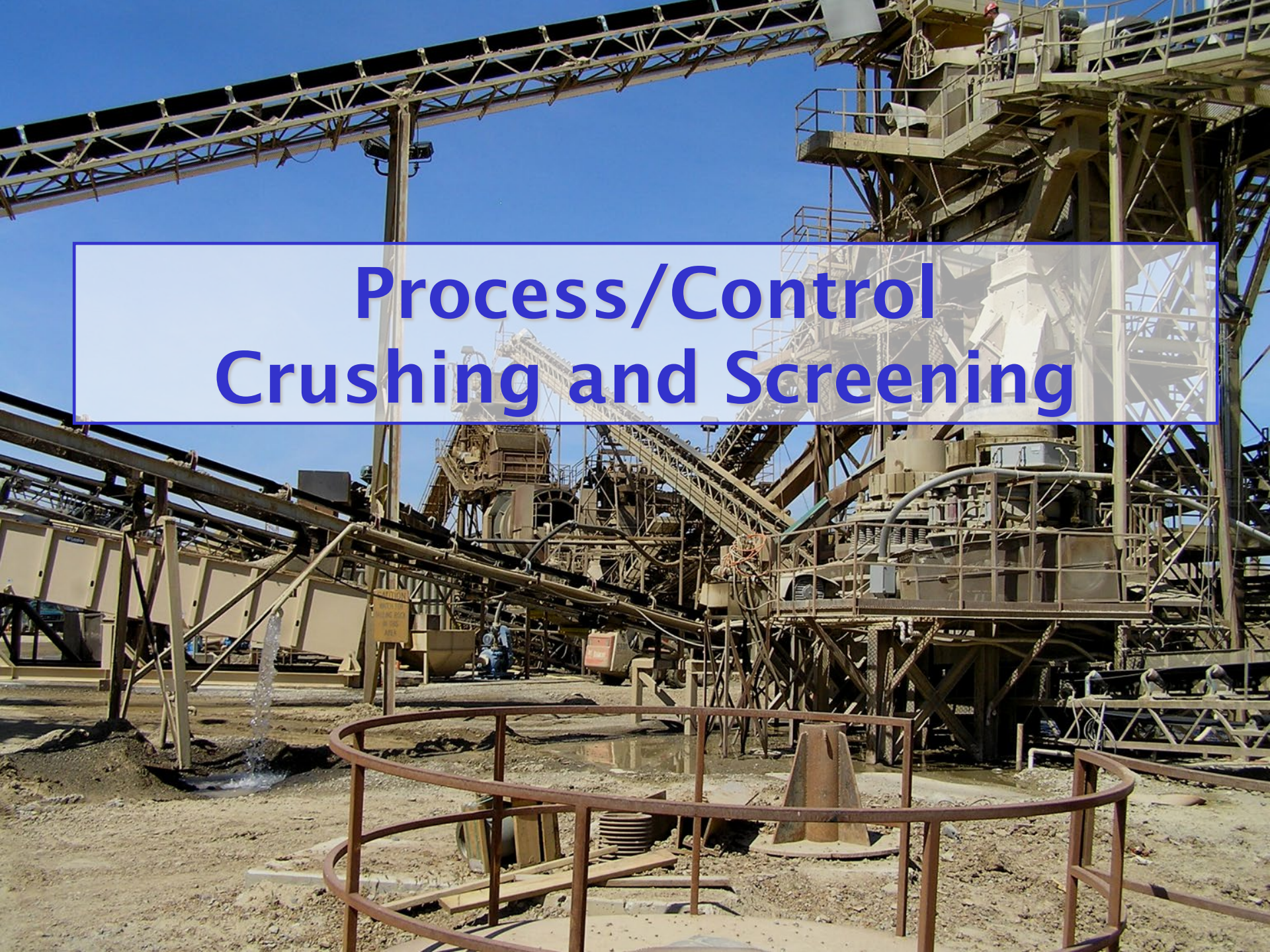


Process/Control

Transfer Points

Haul Roads



Process/Control
Crushing and Screening

Materials Handling

- Feeders
  - Primary
  - Secondary
- Crushers
  - Primary
  - Secondary
  - Tertiary

Feeders

- Primary
  - Apron

  - Reciprocating Plate

Feeders

- Grizzly
  - Vibrating Grizzly
  - Stepdeck Grizzly

Vibrating Pan

Reciprocating Plate

Grizzly

Primary Conveyor

Wobble Feeder

- Combined feeder and scalper
- Effective in handling clay or fine sticky feed material

Washing

Washing

Secondary Wash

Troughs

Secondary Feeders

Feeders

Conveyors

Conveyor Belt Feeders

- Conveyor Belt

- Belt feeder with adjustable feed gate

Conveyors


S-PACK

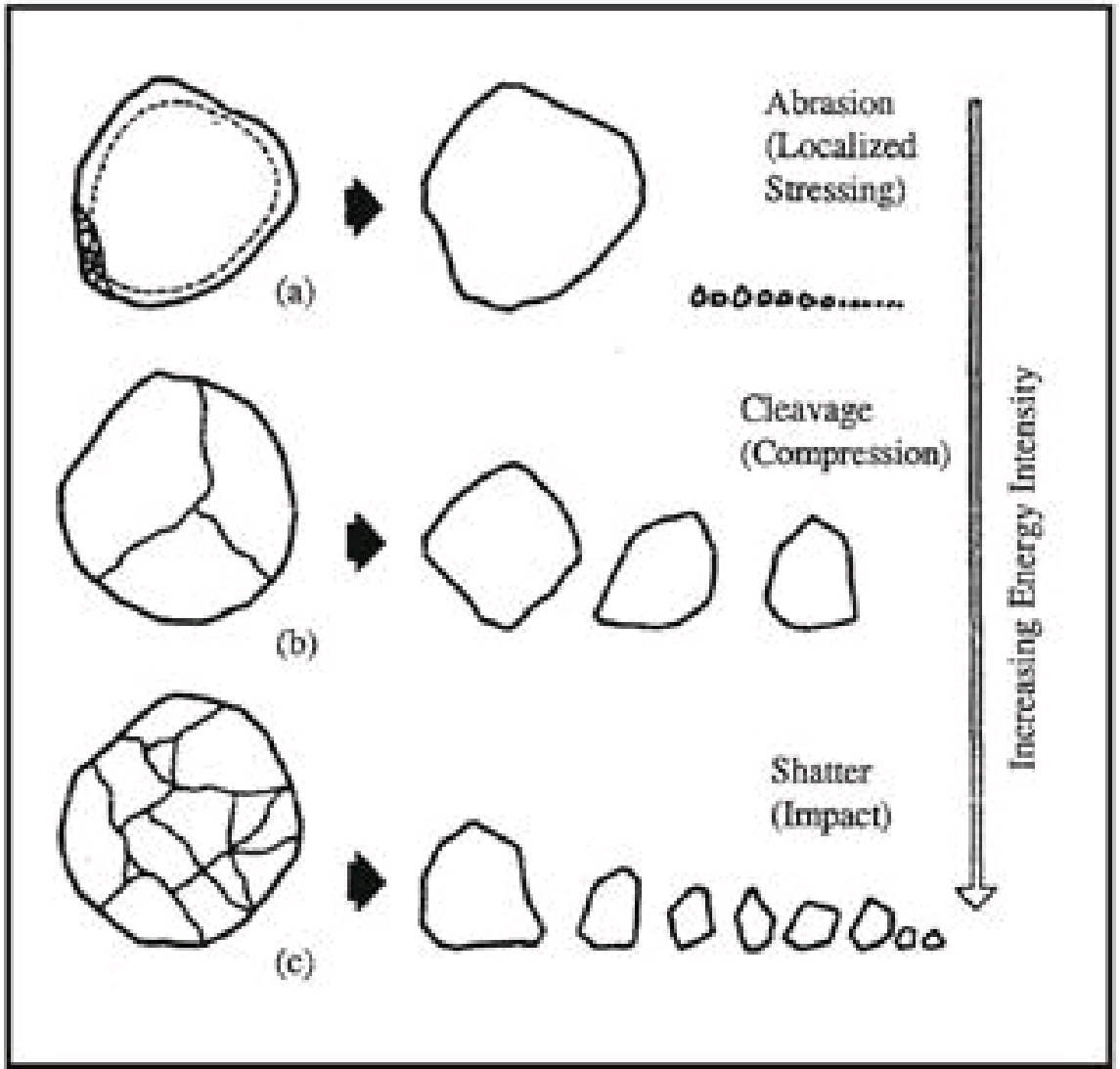
Crushing

- Fracture Mechanisms
- Crushing Equipment
- Factors Influencing Crushed Product

Fracture Mechanisms

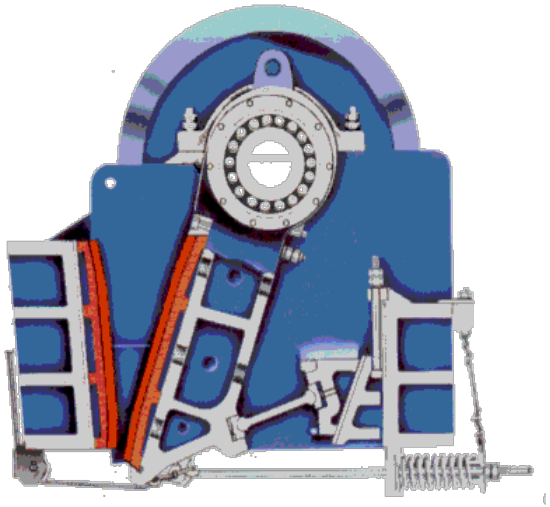
Particle Breaking:

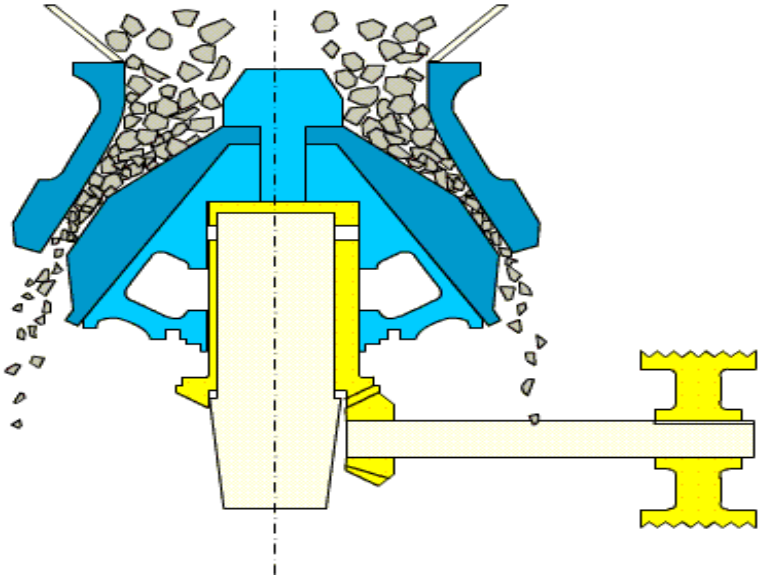
1. Abrasion
2. Cleavage
3. Shatter




Cone Crusher

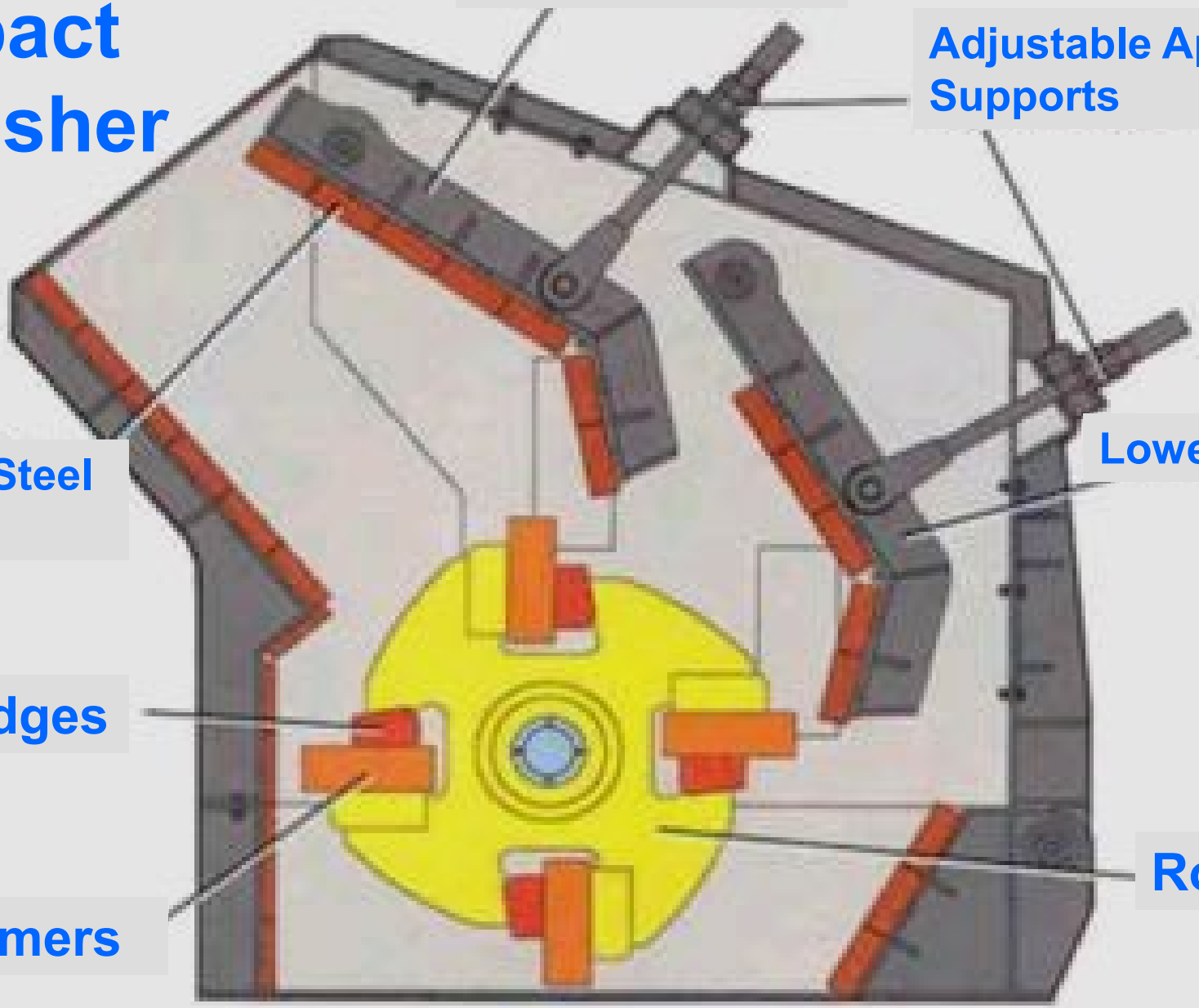
Diagrams of Cone Crusher





Process/Control

Impact Crusher



Primary Crusher

Jaw

Secondary Crusher

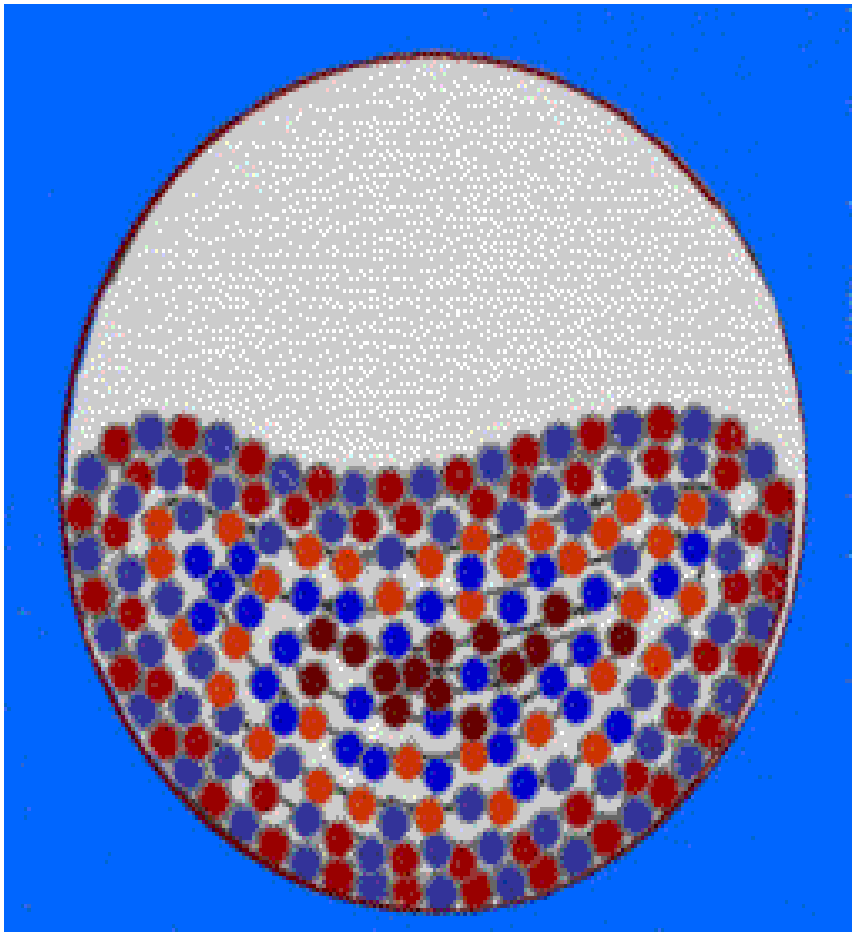
- Impact Crusher

Tertiary Crushers

Hammer Mill

Grinding Mills

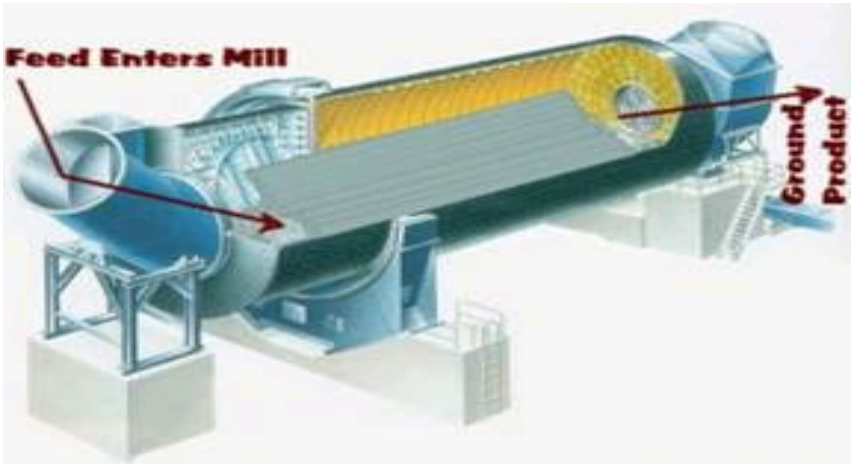
- Dry ball mills most popular, due to economics
- Used for finer material separation



Grinding Mills

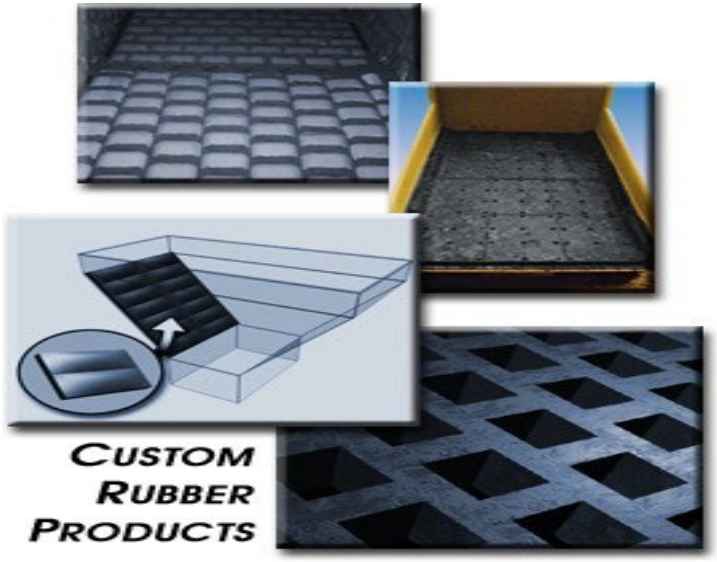
- Media are rods or balls

- Rods are for coarse-like manufactured sand

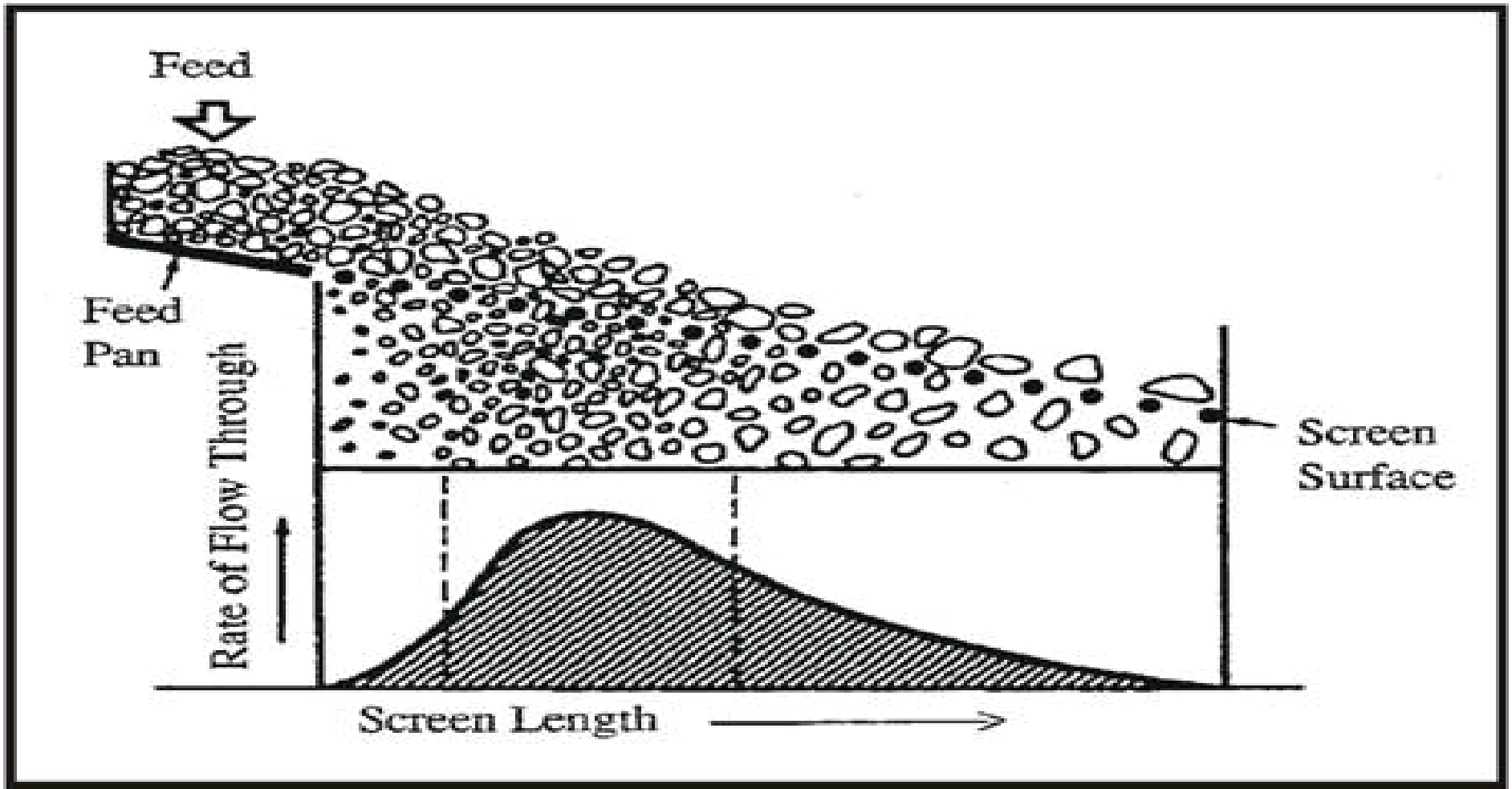


Screening

- Screening material

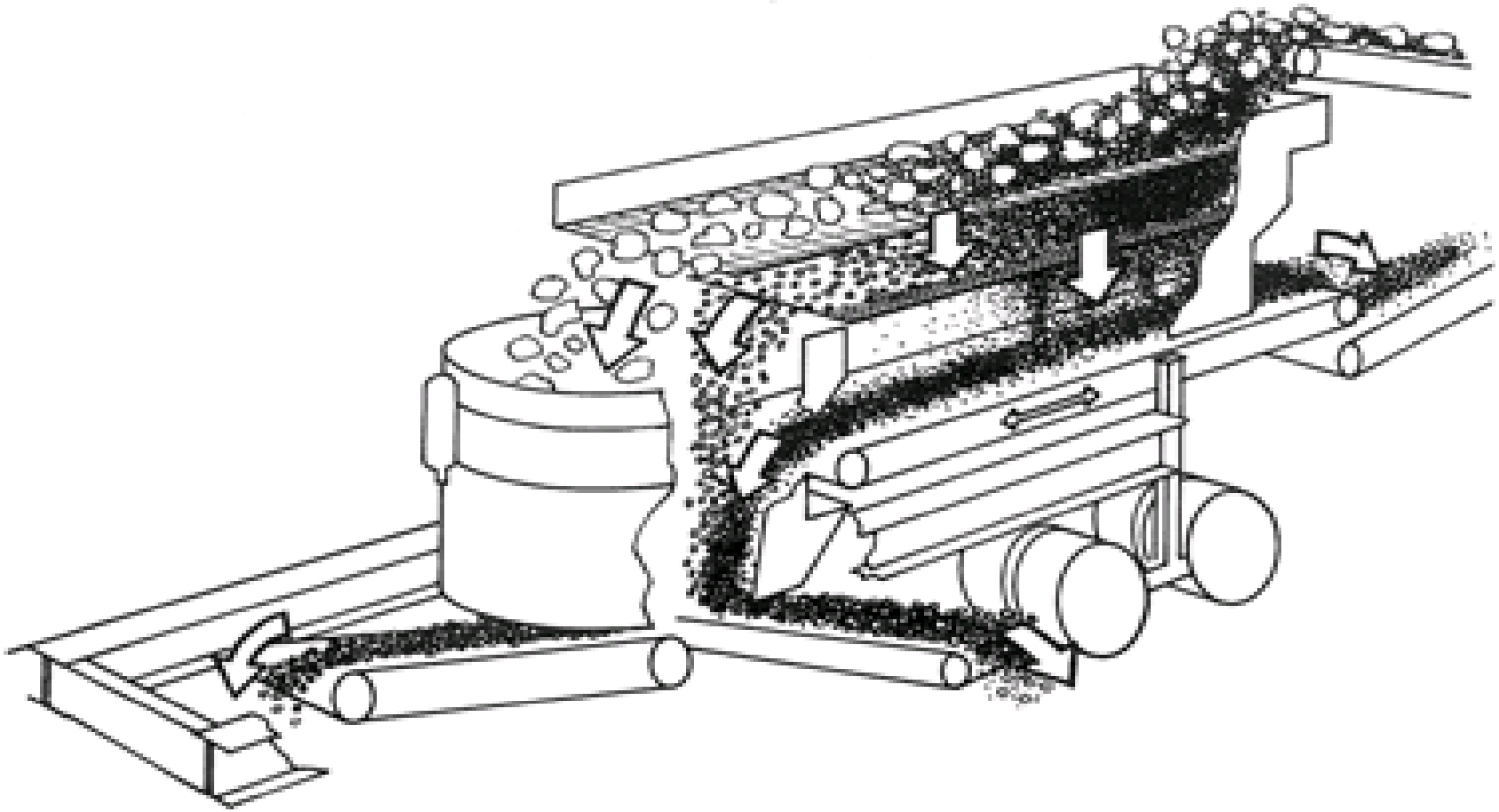


Screening Surface



Portable 3-Deck Screen

Chutes and Hoppers Operation



Screening

FROM THE MINE

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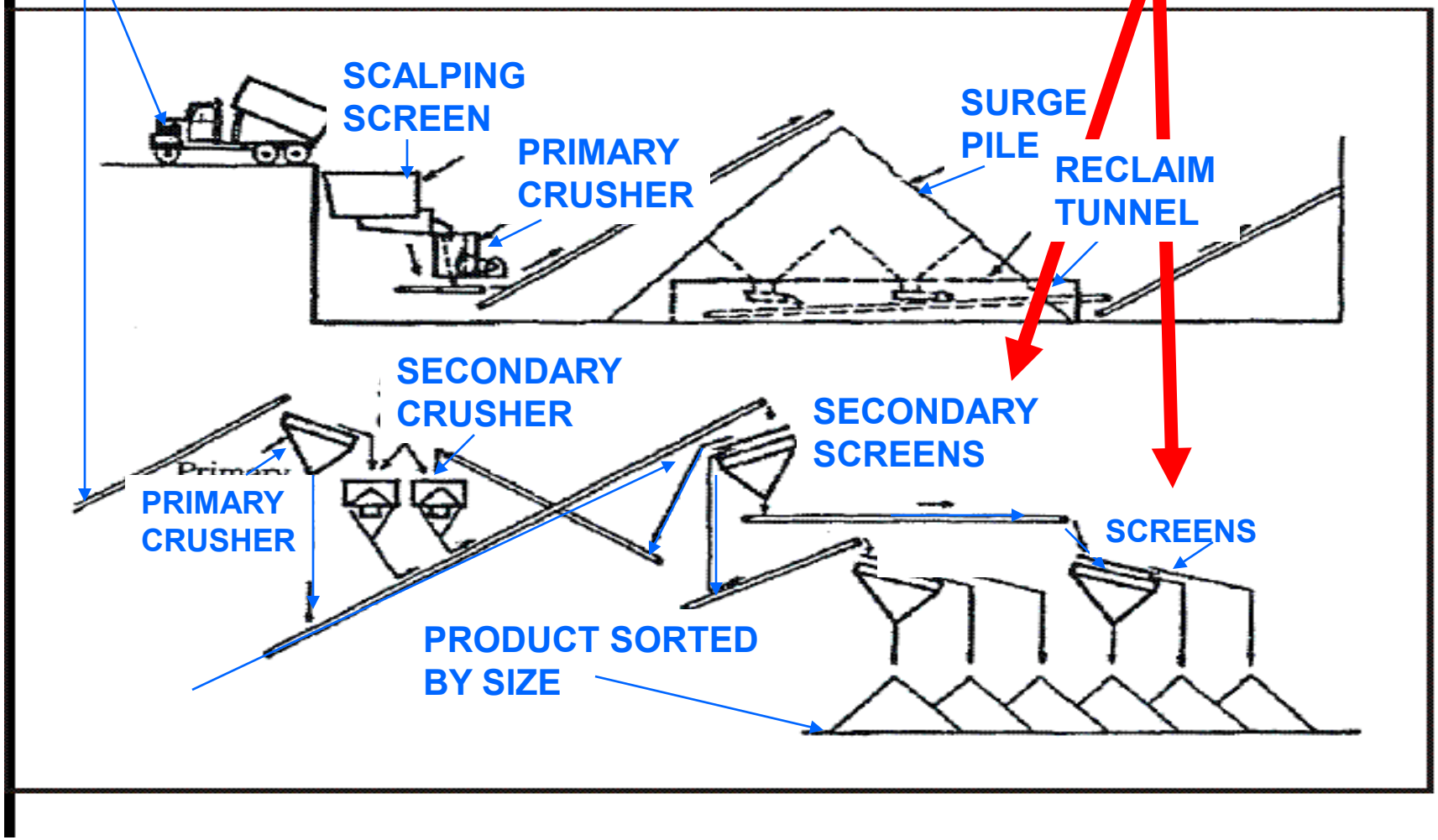


Point Emissions

- Point emissions originate from stacks
  - Control Devices
  - Where aggregate is dried
- Stack emissions
  - Water
  - Gases
  - Dirt particles
  - All Above

Fugitive Dust from Storage Bins and Aggregate Piles

Excavation

- Light charge blast
- Draglines, front-end loaders, suction dredge pumps

Heavy Metals

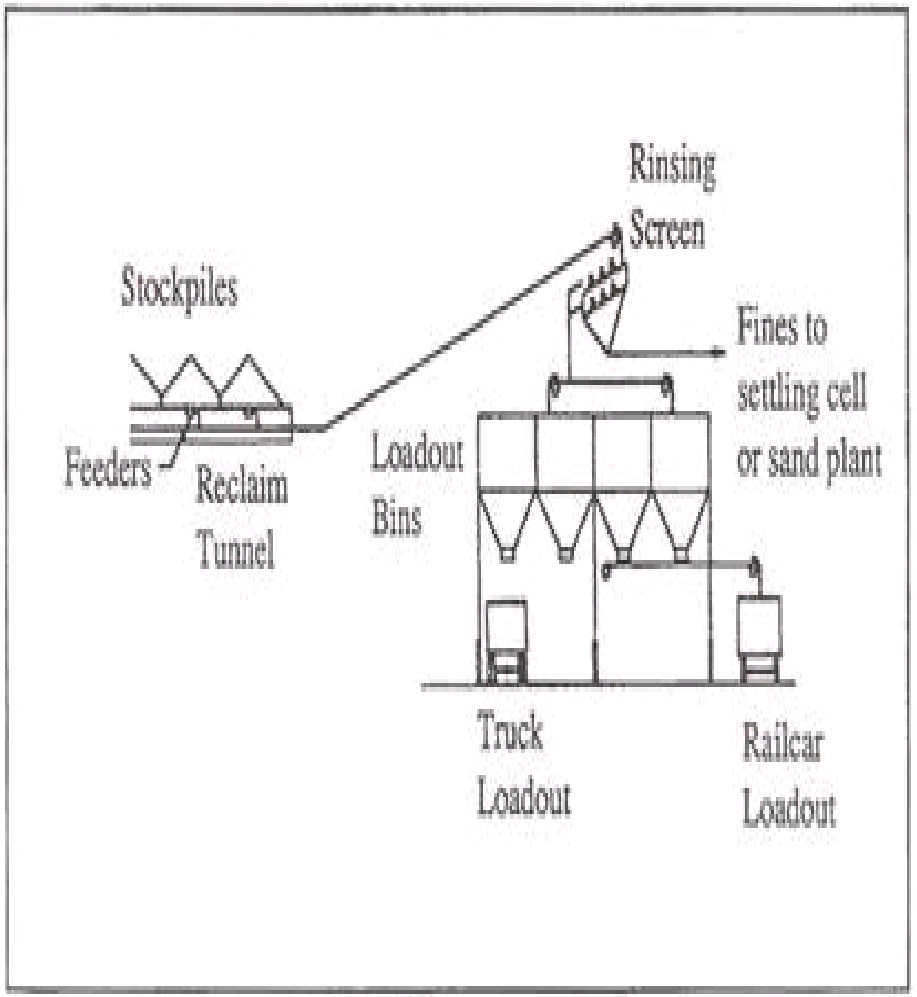
- Associated with quartz or volcanic deposits
- Metals include nickel, cadmium and antimony
- Become airborne during blasting or crushing
- Questionable sources should be sampled for presence of heavy metals

Impact Crusher

Stockpiling

Storage Bins

Loadout

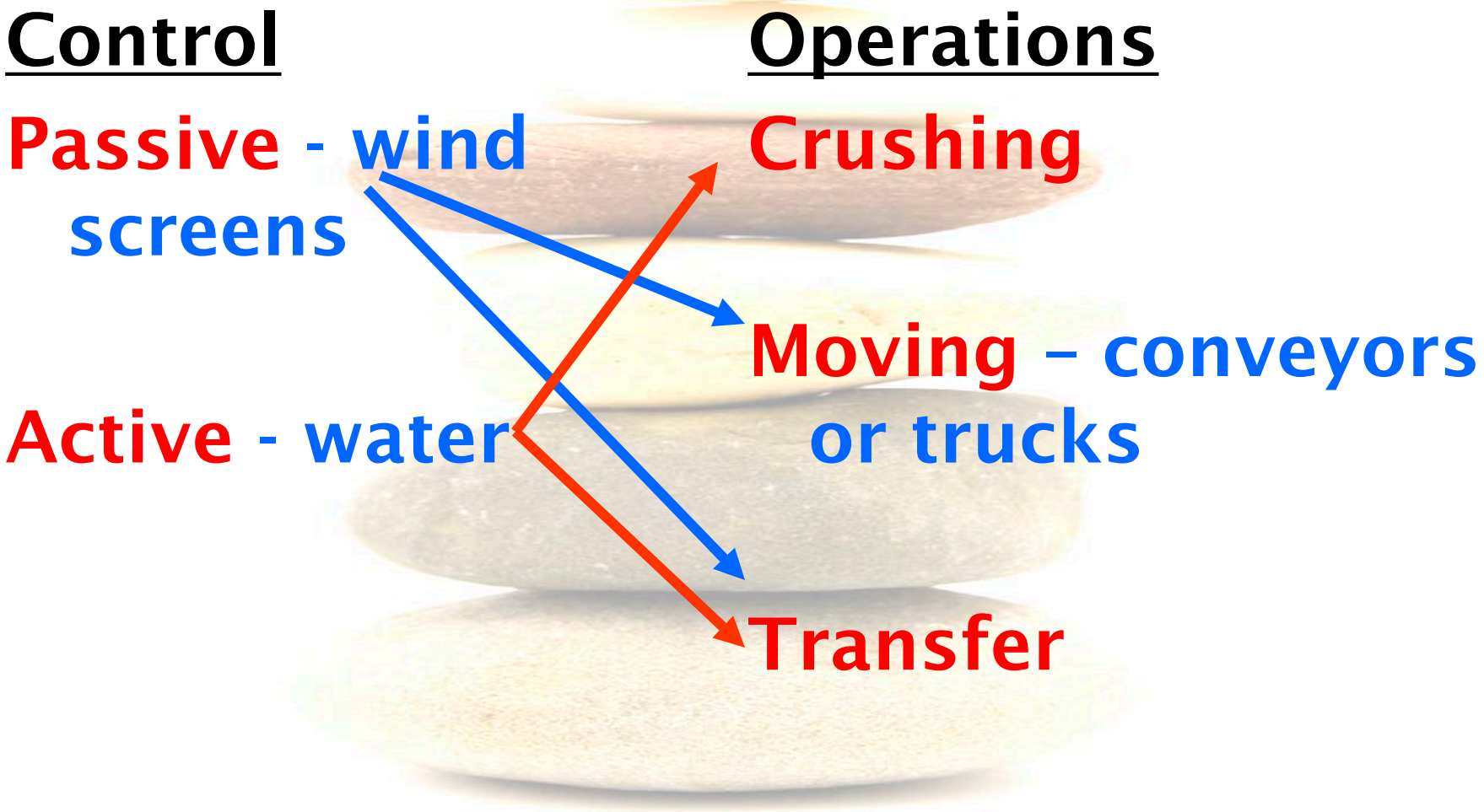

Rinsing
Screen
Stockpiles
Fines to
settling cell
or sand plant
Feeders
Reclaim
Tunnel
Loadout
Bins
Truck
Loadout
Railcar
Loadout

Measuring

Air Pollution Control Measures

- Preventative Measures
  - Passive Enclosures
  - Wet Suppression
  - Paved Surface Cleaning
- Dry Collection Systems
  - baghouse
  - cyclone

Process/Control



Air Pollution Control Methods
(continued)

- Water sprays
- Maintaining good housekeeping
- Covers
- Enclosure or cover at transfer points and screening operations
- Exhausting air to air pollution control systems

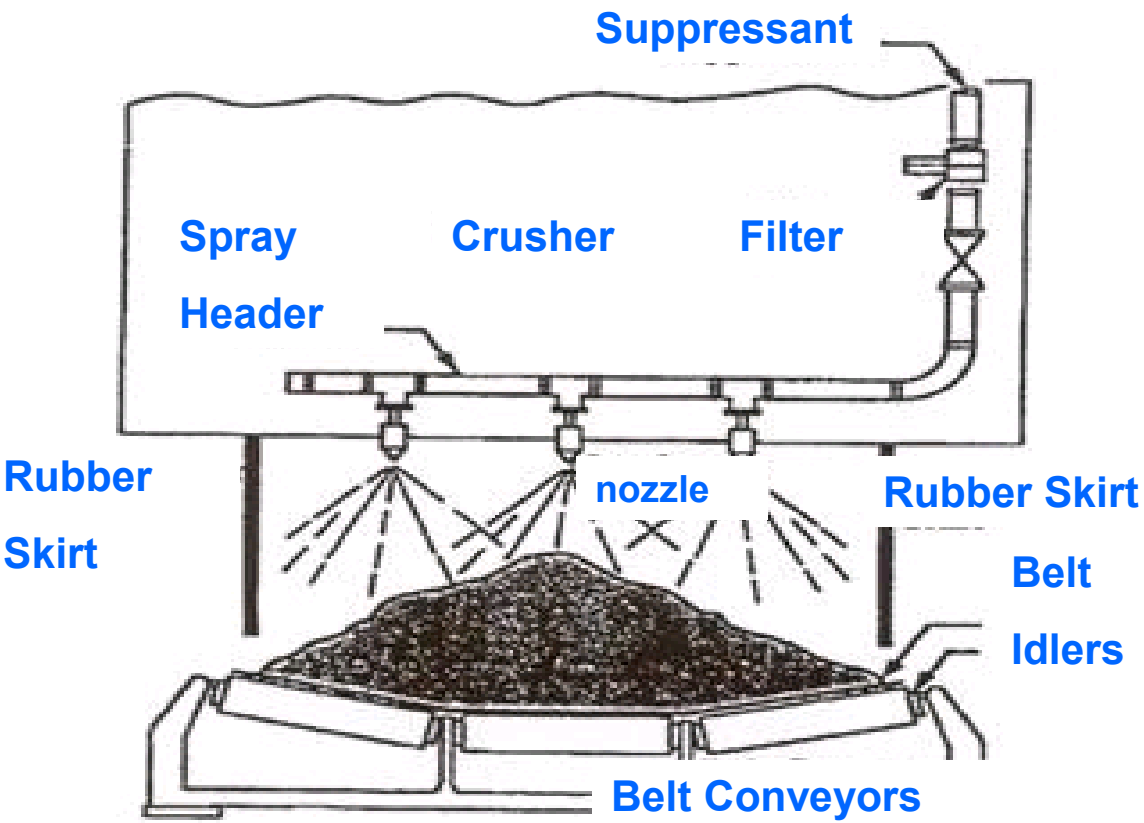
Preventative Measures

- Passive enclosures
- Wet suppression
- Stabilization of unpaved surfaces
- Paved surfaces cleaning
- Work practices
- Housekeeping

Preventative Measures

Process/Control

Preventative Measures




C-7

Dry Collection Systems

Baghouses are regulated in terms of:

- **Grains/cubic foot or air emitted (gr./dscf)**
- **Pounds/Ton of Aggregate produced**
- **Opacity**

Combination Systems

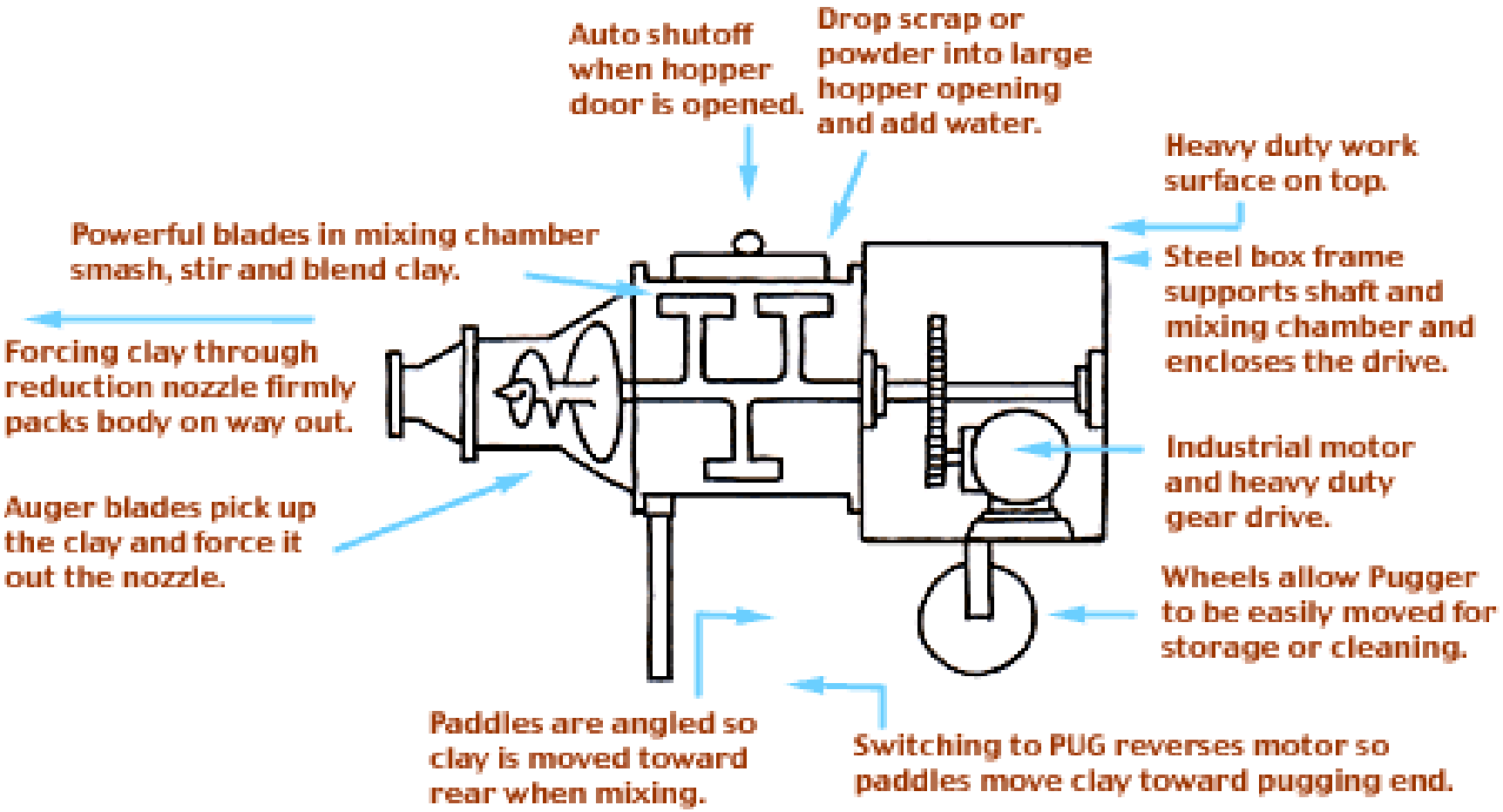
- Dry collection and wet suppression
  - When fine particulates have an economic value in addition to meeting air pollution control laws
  - Due to screen blinding
  - Due to plant location or local pollution control codes, which is not economically feasible

Other Processing Equipment

- Rock Breaker
- Magnets
- Metal Detectors
- Pugmills
- Washing equipment
- Rotary Scrubber
- Wet Classifiers
- Pumps
- Grinding Mills

Specialty Equipment

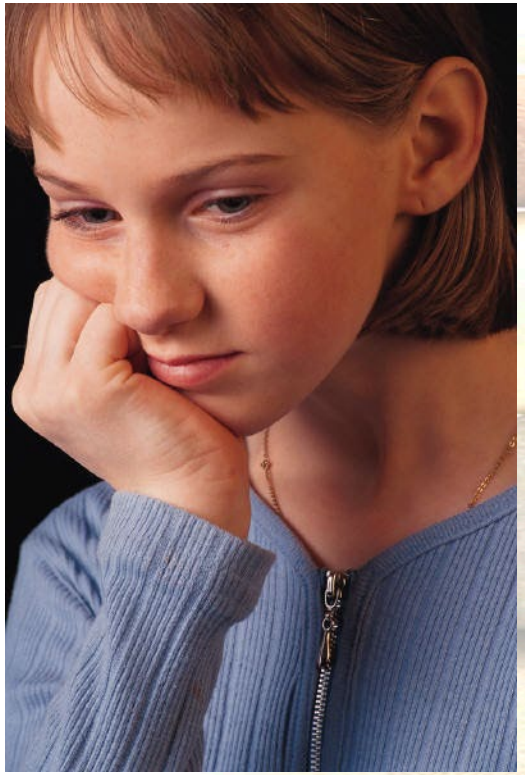
Specialty Equipment Designed to Blend Clay



Specialty Equipment
Wet Classifiers & Pumps

Ball Mill

Inspection Objectives



Determine compliance with District regulations & permit conditions

- Fugitive dust
- Visible emissions
- Oxides of nitrogen (for fuel burning equipment)

Pre-Inspection File Review

1. Permit application
2. Approved permit
3. Equipment
4. Permit condition for each unit
5. Previous inspection reports
6. NOV
7. Enforcement action
8. Complaints
9. Variance history
10. Abatement orders
11. Date of last source test

Pre-Inspection

- Regulation Review
- Equipment Check
  - Safety goggle and earplugs
  - Safety shoes, hard hat, and gloves
  - ID and business cards

Pre-Entry and Entry

- Observe the site
  - Note odors or visible emissions
  - Size and layout
- ID potential problem areas
- Enter through normal public access
- Introduce yourself, ask to see contact listed in file, & present business card

Pre-Inspection Meeting

- State purpose of inspection and identify equipment to be inspected
- Obtain:
  - company name, ownership, address, contact name
  - operating schedule, date of last source test, fuel usage
- Discuss any outstanding business
- Date of last breakdown
- Status of:
  - dust suppression equipment
  - Air pollution control equipment
  - Monitoring and recording devices
- Check Permit

Permit Inspection Questions

An NOV is issued when the permit is not:

1. current
2. posted properly
3. or conditions on permit are not followed

Post Inspection

- Make compliance determination
- Inform site of inspection (NOVs, and advise on areas of concern
- Document pending NOVs due to additional info request etc.

Unstable Stockpiles and Warning Signs