Aggregate Plants

Course Overview: Aggregate Plants
- Introduction
- Emissions and Health Impacts
- Aggregate Industry
- Aggregate Process
- Engineering Evaluation
- Inspection Procedures

Let's Talk Rock
Emissions and Health Impacts

Who?

How?

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)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxic Organic Gases (TOG)</td>
<td>0.22</td>
</tr>
<tr>
<td>Reactive Organic Gases (ROG)</td>
<td>0.15</td>
</tr>
<tr>
<td>Carbon Monoxide (CO&lt;sub&gt;2&lt;/sub&gt;)</td>
<td>0.05</td>
</tr>
<tr>
<td>Oxides of Nitrogen (NOx)</td>
<td>0.10</td>
</tr>
<tr>
<td>Oxides of Sulfur (SOx)</td>
<td>0.01</td>
</tr>
<tr>
<td>Total Particulate Matter (PM)</td>
<td>25.19</td>
</tr>
<tr>
<td>Particulate Matter PM10</td>
<td>11.73</td>
</tr>
<tr>
<td>Particulate Matter PM2.5</td>
<td>4.46</td>
</tr>
</tbody>
</table>
How Small is PM?

Hair cross section (60 μm)

- Human Hair (60 μm diameter)
- \( PM_{2.5} \)
  - (10 μm)
  - (2.5 μm)

<table>
<thead>
<tr>
<th>PM Size (μm)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 Microns and larger</td>
<td>Alveoli</td>
</tr>
<tr>
<td>7 to 11 Microns</td>
<td>Skin</td>
</tr>
<tr>
<td>4.7 to 7 Microns</td>
<td>Pharynx</td>
</tr>
<tr>
<td>3.3 to 4.7 Microns</td>
<td>Trachea</td>
</tr>
<tr>
<td>2.1 to 3.3 Microns</td>
<td>Primary bronchus</td>
</tr>
<tr>
<td>1.1 to 2.1 Microns</td>
<td>Secondary bronchi</td>
</tr>
<tr>
<td>0.65 to 1.1 Microns</td>
<td>Bronchioles</td>
</tr>
<tr>
<td>0.43 to 0.65 Microns</td>
<td></td>
</tr>
</tbody>
</table>

Health Effects of PM

The Filial have been damaged from particulate exposure
246: HMA, Aggregate & Concrete Batching

Emissions/Health Impacts

Asbestos

Emissions/Health Impacts

X-ray of a lung exposed to asbestos

Result:

Mesothilaoma

Health Effects of PM/PM2.5

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

Concerns???

Concerns???
Let's Discuss Aggregate Processing

Perception

Let's Discuss Aggregate Processing
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.
Sand and Aggregate are:
- Loose mineral and rock particles
- Transported by water and erosion

Key Differences:
- Aggregate...passes through 2 inch screen
- Sand...passes through 1/4 inch opening (retained on a 200 mesh per square inch screen)
Lack of Controls??

Emission Sources

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

Process & Controls

Emissions are measured by knowing

- How much aggregate is processed over time?
- How much moisture is in the material being processed?
- The control efficiency of the air pollution control device...

Resulting in:

- Total Emissions (mass based...pounds/day or tons/year)
General equation from EPA AP-42 is:

\[ E = A \times EF \times (1 - \frac{ER}{100}) \]

where:
- \( E \) = emissions
- \( A \) = activity rate
- \( EF \) = emission factor
- \( ER \) = % overall emission reduction efficiency

Calculating Emissions

Aggregate Mining

- Two General Types:
  - Sand and Gravel & Crushed Stone

Aggregate Mining

Sand & Gravel Mining
Aggregates Mining

Crushed Stone Mining

- Drilling
- Blasting

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
• **Aggregate Mining**

• **Process/Control, Crushing, Screening & Transfer Points**

• **Materials Handling**
  - Feeders/Conveyors
    - Primary
    - Secondary
  - Crushers
    - Primary
    - Secondary
    - Tertiary
Feeders

Feeders are used to:

• Absorb the impact from dumping large quarried stone
• Feed the plant with a controlled, steady stream of raw material Used to handle muddy or sticky material
• They are located ahead of large, stationary primary crushers

Application of Feeders

<table>
<thead>
<tr>
<th>DUTY</th>
<th>RECOMMENDED TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck dumping or direct loading by Drop, Shovel or Dragline</td>
<td>Super Heavy-Duty Apron Feeder with manganese flights</td>
</tr>
<tr>
<td>Maximum lamp size not to exceed 75 percent of feeder width</td>
<td></td>
</tr>
<tr>
<td>Under hopper in pit, handling non-abrasive material. Maximum lamp size not to exceed 75 percent of feeder width</td>
<td>Heavy-Duty Apron Feeder</td>
</tr>
<tr>
<td>Under hopper in pit, handling non-abrasive material. Maximum lamp size not to exceed 75 percent of feeder width</td>
<td>Vibrating Feeder or Grizzly Feeder</td>
</tr>
<tr>
<td>Under high-speed belt conveyor</td>
<td>Belt Feeder</td>
</tr>
<tr>
<td>Under Large Primary Crushers</td>
<td>Heavy-Duty Apron Feeder</td>
</tr>
</tbody>
</table>

Feeders & Conveyors

• Primary
  - Apron
  - Grizzly/Belt

Vibrating Feeders: 36” to 72” width, 12” to 36” length

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Apron Feeders

Apron feeders are used where:

- Extremely rugged machines handling large feed are required
- Used to handle muddy or sticky material
- They are located ahead of large, stationary primary crushers

Vibrating Feeder & Vibrating Grizzly Feeders

These feeders are used where:

- Used where a compact feeder with variable speed control is required
- Vibrating Grizzly feeder is similar plus grizzly bars for separating fines the crushed feed
- They help bypass fines around the primary crushers increasing production & reduces crusher liner wear.

Vibrating Grizzly Feeders

- Grizzly
  - Vibrating Grizzly
  - Step deck Grizzly
Vibrating Grizzly Feeders

Reduces crusher liner wear

Grizzly Feeder

Grizzly Feeder
Belt feeders are used:

- Under a hopper or trap with 6” maximum feed size
- They have an infinite variable speed control for optimum plant feed rate
Vibrating Pan

Primary Conveyor

Wobble Feeder

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

Conveyors

Conveyors
Crushing

- Fracture Mechanisms
- Crushing Equipment
- Factors Influencing Crushed Product

Fracture Mechanisms

Particle Breaking:
1. Abrasion
2. Cleavage
3. Shatter

Primary or Jaw Crusher

Jaw Crusher
Jaw Crusher

3" – 8" size rock

Jaw Crusher

No Spray bars

Spray bars to reduce emissions
Grinding Mill or Ball Mill

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

Media are rods or balls

Rods are for coarse-like manufactured sand or cement klinker

Screening Operations
Screening Operations

Screening Operations
Point Emissions

- Point emissions originate from stacks
  - Control Devices
  - Where aggregate is dried
- Stack emissions
  - Moisture
  - Gases
  - PM/PM10/PM2.5
  - All of the above
Stockpiling

Could be a potential source of fugitive dust emissions.

Screening, Storage & Loadout Operations

Storage & Loadout Operations
Air Pollution Control Measures

- Preventative Measures
  - Passive Enclosures
  - Wet/Chemical Suppression
  - Paved Surface/Cleaning

- Dry Collection Systems
  - baghouse
  - cyclone

Process & Control Measures

Control
Moving conveyors or trucks (Passive control is wind screens)

Operations
Crushing (active control is water)
Transfer (active control is water)

Air Pollution & Control Measures

- 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
• Minimizing drop height
• Paved surfaces cleaning
• Work practices
• Housekeeping

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Baghouses are regulated in terms of:
- Grains/cubic foot or air emitted (gr./dscf)
- Pounds/Ton of Aggregate produced
- Opacity

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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
- PERP Equipment
- Washing equipment
- Rotary Scrubber
- Wet Classifiers
- Pumps
- Grinding Mills

Inspection Objectives

Determine compliance with:
- District regulations & permit conditions
- Fugitive dust
- Visible emissions
- Oxides of nitrogen (for fuel burning equipment)
- Control devices

Pre-Inspection

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

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

Pre - Entry & Entry

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

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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
Non - Compliance

A NTC/NOV is issued when the permit is not:
1. Current or no permit
2. Posted properly
3. Or conditions on permit are not followed
4. Blatant disregard

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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.

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Safety