This document is an instructional module package designed in the objective format for use by an instructor familiar with pre-treatment unit operation. Included are objectives, instructor guide, student handouts and transparency masters. The module considers design, operation, maintenance, and safety of common methods of grit removal, screening, grinding, flotation and pre-aeration. (Author/RH)
PRE-TREATMENT
Training Module 2.102.2.77

Prepared for the,
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Des Moines, Iowa 50319

by
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September, 1977
The mention of trade names, or use of manufacturers technical bulletins, diagrams depicting specific equipment, or the commercial product in this module is for illustration purposes, and does not constitute endorsement or recommendation for use by Kirkwood Community College nor by the Iowa Department of Environmental Quality.
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<tr>
<th>Module No:</th>
<th>Module Title:</th>
<th>Submodule Title:</th>
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<tr>
<td></td>
<td>Preliminary Treatment</td>
<td>1. Grit Removal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Screening/Comminutors</td>
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<tr>
<td></td>
<td></td>
<td>3. Flotation</td>
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<td></td>
<td></td>
<td>4. Preaeration</td>
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</table>

**Approx. Time:**

<table>
<thead>
<tr>
<th>1. Grit Removal</th>
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<tr>
<td>2. Screening/Comminutors</td>
</tr>
<tr>
<td>3. Flotation</td>
</tr>
<tr>
<td>4. Preaeration</td>
</tr>
</tbody>
</table>

**Overall Objectives:**

Upon completion the student will be able to:

1. Identify method and equipment used in grit removal.
2. Identify methods of dewatering.
3. Identify parts of a bar screen.
4. Identify parts of a comminuter.
5. Identify process of flotation and purpose.
6. Identify process of preaeration and purpose.

**Instructional Aids:**

Handouts, Overheads
Suggested: Plant O & M Guide

**Instructional Approach:**

Discussion, Lecture
Optional: Field trip and demonstration

**References:**

1. WPCF MOP #8
2. Wastewater Engineering, Metcalf and Eddy Inc.
3. WPCF MOP #11
4. Operation of Wastewater Treatment Plants, Sacramento
5. Manufacturer's literature

**Class Assignments:**

Read handouts
Label diagrams
Participate in discussions
Instructor Notes:

Instructor:
This entire module has been researched from many sources. Please note the sources and become familiar with them.

1. Handouts
Most handouts are of a dual nature. These may be copied on a transparency and used as an overhead.

2. The field trip mentioned is optional. Recommended if the specific process/equipment mentioned is in the nearby area.

3. Student may supply O & M manufacturers information for further resource material in the workshop.

4. The instructor is expected to add personal experiences, changes and deletions to the module based on personal experience.

5. Disposal methods mentioned in the last part of this module are only a few of the techniques available. These techniques will be the most common. Suggestion on this section will be to have students check out local ordinances covering this area.

Instructor Outline:

Objective:
The student will be able to recognize the importance of pretreatment in wastewater. The properly operated and maintained preliminary portion of the treatment process will be the key to a well operated biological process by not overloading with excess materials.

Handouts of equipment and process equipment are examples or guides. Instructor should get recent literature from appropriate manufacturers.
LIST OF HANDOUTS

1. Screening Equipment
2. Link Belt Screen/Grinder Service Instruction
3. Comminuter
4. Grinder Maintenance
5. Barminuter
6. Fine Screens Operation Parts Maintenance
7. Fine Screen Side View

Preaeration
1. Circulation Pattern of Aeration Tanks
2. Pre-aeration/Primary Unit CretaWay

Flotation
1. DAF System - Also can be used to describe vacuum system
2. Side view of DAF
3. Same
4. Flotation Units - Advantages/Disadvantages

Manufacturers
1. List of Manufacturers

Disposal Methods
1. Methods
<table>
<thead>
<tr>
<th>Module No:</th>
<th>Module Title:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preliminary Treatment</td>
</tr>
<tr>
<td>Submodule Title:</td>
<td>Grit Removal</td>
</tr>
<tr>
<td>Approx. Time:</td>
<td>1 hour</td>
</tr>
<tr>
<td>Topic:</td>
<td>Introduction</td>
</tr>
</tbody>
</table>

**Objectives:**

Upon completion of this module the student will be able to:

1. Discuss purpose for grit removal.
2. List the characteristics of grit.
3. Describe where a grit chamber should be placed (written).

**Instructional Aids:**

- AV

**Instructional Approach:**

- Lecture
- Discussion

**References:**

1. WPCF MOP #11
2. WPCF MOP #8

**Class Assignments:**

- Review class notes
<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Damage to mechanical equipment pipes and valves reduce digester cleaning frequency.</td>
<td><strong>A. Introduction to Grit Removal:</strong></td>
</tr>
<tr>
<td>2. Egg shells, coffee grounds street wash (sand) and other abrasive sources.</td>
<td>1. Why remove grit</td>
</tr>
<tr>
<td>3. Heavy suspended mineral matter present in wastewater.</td>
<td>2. Where does grit come from</td>
</tr>
<tr>
<td>4. Characteristics</td>
<td>3. Define</td>
</tr>
<tr>
<td>b. Subsiding velocities greater than organic matter</td>
<td>a. Non-putrescible</td>
</tr>
<tr>
<td>5. Ahead of all mechanical equipment e.g. screen, grit chamber, comminuter.</td>
<td>5. Placement of units</td>
</tr>
</tbody>
</table>
6. a. Gravity

Weight of particle causes removal or deposition. The redirection of velocity to 1 FPS ± FPS. An increase or decrease of this velocity will create non-settling of grit, organic deposition respectively.

Normal expected removal size of particle is measured by its specific gravity (S.G.). Comparison of grit S.G. is that of silica sand, 2.65.
<table>
<thead>
<tr>
<th>Module No:</th>
<th>Module Title: Preliminary Treatment</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Submodule Title: Grit Removal</td>
</tr>
<tr>
<td>Approx. Time:</td>
<td>Topic: Removal Processes</td>
</tr>
<tr>
<td>1½ hour</td>
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</tbody>
</table>

**Objectives:**

Upon completion of this module the participant will be able to:

1. Identify the types of grit removal processes.
2. Describe how grit is removed from chamber.

**Instructional Aids:**

Handout 1
Handout 2
Both can be overheads

**Instructional Approach:**

Lecture
Discussion

**References:**

1. WPCF MOP #8
2. Operation of Wastewater Treatment Plants, Sacramento
3. Manufacturers guide

**Class Assignments:**

Participate in class discussion.
1. a. Necessary to have two parallel systems in order to allow for cleaning one and collecting grit in the other.

Handout - Schematic of Manual System - #1

This system is cleaned by means of hard work. Shovel the grit out and deposit the grit in a landfill or other approved location.

Handout - Mechanical System #3
b. Buckets or scrapers are used to pick up the grit from under the water flow and bring the material deposited on the channel bottom back against the direction of flow to elutriate (wash out organics) the grit. The electriated grit is now removed from the flow by a dewatering device. (Discuss later).

The system is usually placed on a timer to control collection.

1. Cleaning methods
   a. Manual
   b. Mechanical
STOP GATES
Insert when cleaning to prevent backflow

FLOW

GRIT SETTLING AREA

CENTER WALL

SLIDE GATES
WEIRS (WHEN USED)

GRIT SETTLING AREA
PAGES 10 AND 11 REMOVED PRIOR TO BEING SHIPPED TO EDRS FOR FILMING DUE TO MARGINAL LEGIBILITY OF ORIGINAL.

BEST COPY AVAILABLE.
AERATED GRIT HOPPER

- AIR SUPPLY
- WATER LEVEL
- FLOW PATTERN
- DIFFUSER
- GRIT DEPOSITING IN HOPPER
<table>
<thead>
<tr>
<th>Module No:</th>
<th>Module Title:</th>
<th>Submodule Title:</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Preliminary Treatment</td>
<td>Grit Removal</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Approx. Time:</th>
<th>Topic:</th>
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</thead>
<tbody>
<tr>
<td>1.5 hrs</td>
<td>Flow Factors</td>
</tr>
</tbody>
</table>

**Objectives:**

The participant will be able to:

1. List/describe the factors effecting settling
2. Measure flow through a rectangular grit chamber

**Instructional Aids:**

- Blackboard

**Instructional Approach:**

- Lecture
- Discussion

**References:**

- WPCF MOP #8
- WPCF MOP #11

**Class Assignments:**

- Participate in class discussion
## Flow Factors

### Instructor Outline:

2. **Design flow control**

3. **Factors affecting flow/settling**
   - a. Scour
   - b. Turbulence
   - c. Coalescence of particles

4. **Method of Determining Flow Velocity**

### Instructor Notes:

2. Flow factor of 1.0 to 1.25 FPS maximum critical control flow by means of effluent weir.

3. a. Bottom scour of deposited material will reduce the effectiveness of removal.
   - b. Turbulence - Reduction of this problem is by designing a transition zone to slow down flow to 1.0 fps.
   - c. Coalescence of particles is not a major factor because of the shallow depth of the channel. Short detention times and the nature of the material. Indication of this would be excessive organics embedded in the grit.

4. A piece of wood whose length is 2/3 the depth of the channel. Weight it to float vertically with 2-3" of the board above the surface. Pick two points in the channel and time the float.

Use formula:

\[ r = \frac{d}{t} \]

- \( r \) = Flow velocity
- \( d \) = Distance
- \( t \) = Time
<table>
<thead>
<tr>
<th>Module No:</th>
<th>Module Title:</th>
<th>Submodule Title:</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Preliminary Treatment</td>
<td>Grit Removal</td>
</tr>
<tr>
<td>Approx. Time:</td>
<td>45 min.</td>
<td>Topic: Grit Sources</td>
</tr>
</tbody>
</table>

**Objectives:**

The student will be able to:

List 7 of the 11 listed in the lecture

**Instructional Aids:**

- Handout 4

**Instructional Approach:**

- Lecture
- Discussion

**References:**

- WPCF MOP #8
- WPCF MOP #11
- Operation of Wastewater Treatment Plants - Sacramento

**Class Assignments:**

- Participate in discussion
- Review notes and handouts
3. Quantities of grit removed in each system are similar with the quality of grit higher in the aerated system.

Sources of grit are:

a. Type of street surface
b. Relative area served
c. Climate conditions
d. Types of catch basins
e. Maintenance of catch basins
f. Sewer grades
g. Storm water diverted to system
h. Construction and condition of sewer
i. Ground and ground water characteristics
j. Industrial wastes
k. Relative use of household grinders
Sources of Grit

a.
b.
c.d.
e.
f.
g.
h.
i.
j.
k.
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<th>Module No:</th>
<th>Module Title:</th>
<th>Submodule Title:</th>
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<tr>
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<td>Preliminary Treatment</td>
<td>Grit Removal</td>
</tr>
<tr>
<td>Approx. Time:</td>
<td>Topic:</td>
<td>Mechanical Equipment</td>
</tr>
<tr>
<td>1/2 hour</td>
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</table>

**Objectives:**
The student will be able to:
1. Label schematic of unit principal parts.

**Instructional Aids:**
Handout 2
Handout 3

**Instructional Approach:**
Lecture
Discussion

**References:**
Manufacturers brochure

**Class Assignments:**
Review handout
Participate in discussion
<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handout of Grit Equipment From Link Belt</td>
<td>Mechanical equipment – nomenclature</td>
</tr>
<tr>
<td></td>
<td>a. Electric motor</td>
</tr>
<tr>
<td></td>
<td>b. Longitudinal flights</td>
</tr>
<tr>
<td></td>
<td>c. Cross flights</td>
</tr>
<tr>
<td></td>
<td>d. Drive mechanisms</td>
</tr>
<tr>
<td></td>
<td>e. Sprockets</td>
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<td></td>
<td>f. Chains</td>
</tr>
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<td>Module No:</td>
<td>Module Title:</td>
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<td>Preliminary Treatment</td>
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<td></td>
<td>Submodule Title:</td>
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<tr>
<td></td>
<td>Grit Removal</td>
</tr>
<tr>
<td>Approx. Time:</td>
<td>Topic:</td>
</tr>
<tr>
<td>1½ hours</td>
<td>Start up of Manually/Mechanically Cleaned Units</td>
</tr>
</tbody>
</table>

**Objectives:**

The student will be able to:

1. Describe the operations for starting either manual or mechanical cleaning equipment.
2. Describe the abnormal characteristics ascribed to this process.

**Instructional Aids:**

None

**Instructional Approach:**

- Lecture
- Discussions

**References:**

- WPCF MOP#8
- Manufacturers material
- Several O & M Manuals of typical distillations Operating Wastewater Treatment Plants - Sacramento

**Class Assignments:**

- Participate in class discussions
4. Start up
   a. Manually and mechanically cleaned start the same
      1. Open influent gate slowly.
      2. Open effluent gate when flow reaches it.
      3. Protect mechanical equipment by placing the gear in operation as wastewater starts to cover the longitudinal collectors.
      4. Start all peripheral equipment
   5. Normal operation - mechanically cleaned
      a. Longitudinal collectors set to operate at slow speed to prevent bottom scour and allow for elutriation
      b. Determine collection for removal rates at selected flow rates.
      c. Inspect equipment regularly (3 x's per a min.) to determine:
         Grit removal quantities need for repair preventive maintenance.
         If additional channel is required.
   6. Manually cleaned - normal operation
      a. Measure grit level by draining unit of wastewater daily. Do only at low flow period.
      b. When grit level reaches given quantity take channel out of service and place alternate into service.
      c. Keep sluice gates clean and
<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>d. Do not allow grit to stay in channel as organics will putrify and odors and decay will start. Remember H₂S will attack concrete walls of channels.</td>
</tr>
<tr>
<td></td>
<td>7. Abnormal operation</td>
</tr>
<tr>
<td></td>
<td>a. Rainfall - Infiltration to sewer</td>
</tr>
<tr>
<td></td>
<td>b. Flooding - Infiltration to sewer and plant.</td>
</tr>
<tr>
<td></td>
<td>c. Freezing to channel walls sluice gates and other appurtenances.</td>
</tr>
<tr>
<td>Module No:</td>
<td>Module Title: Preliminary Treatment</td>
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</tr>
<tr>
<td></td>
<td>Submodule Title: Grit Removal</td>
</tr>
<tr>
<td></td>
<td>Topic: Maintenance of Equipment</td>
</tr>
</tbody>
</table>

Objectives:
The student will be able to:
1. Prepare a simple maintenance program for the unit.

Instructional Aids:
Handout 3 (optional)

Instructional Approach:
Lecture

References:
Manufacturer's brochure
Plant O & M Manuals
WPCE 'MOP #11
Operations of Wastewater Treatment Plants - Sacramento

Class Assignments:
Participate in class discussions
Module No: [Blank]

Instructor Notes: [Blank]

Instructor Outline:

9. Maintenance Equipment
   a. Electrical motors
      1. Bearing R & R as needed
      2. R & R defective motor
   b. Longitudinal flights
      1. Straighten if bent
      2. Clean of rags - improve collection
      3. Tighten/replace bolts on collector
   c. Cross flights - Follow b
   d. Drive mechanisms
      1. Oil or grease as per mfg. guide
      2. Check for wear in gears
      3. Replace oil as required
   e. Sprockets
      1. Check for chips
      2. Grease to prevent wear damage
      3. Check key way
   5. Chains
      a. Grease frequently
      b. Check, repair and replace broken or loose links
      c. Check for proper alignment on sprocket.
<table>
<thead>
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<th>Module Title:</th>
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<td>Grit Removal</td>
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<tr>
<td>Approx. Time:</td>
<td>Topic:</td>
</tr>
<tr>
<td>15 minutes</td>
<td>Safety</td>
</tr>
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</table>

**Objectives:**

The student will:

1. Demonstrate the proper safe procedures for work around the unit.

**Instructional Aids:**

Plant tour

**Instructional Approach:**

Plant tour

**References:**

WPCF MOP#8

**Class Assignments:**

- Plant tour
10. Safety Procedures
   a. Keep walkways free of grease, salts, and equipment.
   b. If a deep channel, follow safety precautions for entering deep channels.
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<tr>
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<tbody>
<tr>
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<tr>
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<td>Grit Removal</td>
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<table>
<thead>
<tr>
<th>Approx. Time:</th>
<th>Topic:</th>
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</thead>
<tbody>
<tr>
<td>½ hour</td>
<td>Aerated Units</td>
</tr>
</tbody>
</table>

**Objectives:**
The student will:
1. Draw and label schematic plan of an aerated unit

**Instructional Aids:**
Handout 2
Handout 4

**Instructional Approach:**
Lecture
Discussion

**References:**
WPCT MOP #8
WPCF MOP #11
Operation of Wastewater Treatment Plants - Sacramento

**Class Assignments:**
Participation in discussion
Review handout
1. A detention time of approximately 3 min. in the unit is at maximum flow. The locating of the air diffuser is on the same side as the grit hopper about 18-24 inches above the hopper.

Velocity of rolling air is the factor in quantity of grit removed. The greater the velocity the less grit removed.

Wastewater will be introduced to the flow in the unit in the direction of the flow.

Grit is removed by means of drag buckets or tubular conveyors.

Approximately 3.0 CFM/ft. of length of chamber for shallow installations 8-15 ft.

Handout of System
<table>
<thead>
<tr>
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<th>Module Title:</th>
<th>Preliminary Treatments</th>
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</thead>
<tbody>
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<td></td>
<td>Submodule Title:</td>
<td>Grit Removal - Aerated</td>
</tr>
<tr>
<td>Approx. Time:</td>
<td>Topic:</td>
<td>Normal Operation - Abnormal Operation</td>
</tr>
</tbody>
</table>

**Objectives:**

The student will be able to:

1. List procedures of start-up of unit.
2. List three factors of abnormal operation

**Instructional Aids:**

Handout 4
Handout 2

**Instructional Approach:**

Lecture
Discussion

**References:**

MOP #8
Operation of Wastewater Plants - Sacramento Wastewater Engineering - Metcalf & Eddy

**Class Assignments:**

Participation in discussion
Review handouts
<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A. Normal Operation</td>
</tr>
<tr>
<td></td>
<td>Open influent gate</td>
</tr>
<tr>
<td></td>
<td>Allow flow to cover diffuser by 3 ft.</td>
</tr>
<tr>
<td></td>
<td>Turn on air supply system</td>
</tr>
<tr>
<td></td>
<td>Removal of grit from unit will be based on quantity in system</td>
</tr>
<tr>
<td></td>
<td>Keep record to determine rate of removal</td>
</tr>
<tr>
<td></td>
<td>B. Abnormal Operation</td>
</tr>
<tr>
<td></td>
<td>High grit quantity due to storm or infiltration.</td>
</tr>
<tr>
<td></td>
<td>Remove grit more frequently from unit</td>
</tr>
<tr>
<td></td>
<td>Rolling action not as visible.</td>
</tr>
<tr>
<td></td>
<td>Clean diffuser plate</td>
</tr>
<tr>
<td></td>
<td>Odorous grit</td>
</tr>
<tr>
<td></td>
<td>Remove more frequently</td>
</tr>
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<td></td>
<td>Check air flow to the unit</td>
</tr>
<tr>
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<td>Test for organic levels</td>
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<tr>
<td>Module No:</td>
<td>Module Title:</td>
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<td>Preliminary Treatment</td>
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<table>
<thead>
<tr>
<th>Submodule Title:</th>
<th>Topic:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grit Removal - Aerated</td>
<td>Parts of Unit</td>
</tr>
</tbody>
</table>

**Objectives:**

The student will be able to:

1. List parts common to the unit.

**Instructional Aids:**


**Instructional Approach:**

Lecture

**References:**

- Plant O & M Manuals
- Manufacturer's brochures

**Class Assignments:**

Participate in class discussions
<table>
<thead>
<tr>
<th>Instructor Notes</th>
<th>Instructor Outline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blower supplies the air to the system</td>
<td>C. Main parts</td>
</tr>
<tr>
<td>Diffuser creates the rolling action in the unit</td>
<td>Blower</td>
</tr>
<tr>
<td>Diffuser</td>
<td></td>
</tr>
<tr>
<td>Grit collection</td>
<td></td>
</tr>
<tr>
<td>Drive</td>
<td></td>
</tr>
<tr>
<td>Flights</td>
<td></td>
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<tr>
<td>Sprockets</td>
<td></td>
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<td>Module No:</td>
<td>Module Title:</td>
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</tr>
<tr>
<td></td>
<td>Preliminary Treatment</td>
</tr>
</tbody>
</table>

**Approx. Time:** 15 minutes

**Objectives:**
The student will be able to:
1. Develop a maintenance plan for their own unit.

**Instructional Aids:**

**Instructional Approach:**
Lecture

**References:**
- Plant O & M Manuals

**Class Assignments:**
Participate in discussions.
D. Maintenance

Clean diffuser every six months

For blower follow manufacturer's guide

Grease grit upper sprocket and drive unit weekly
<table>
<thead>
<tr>
<th>Module No:</th>
<th>Module Title:</th>
<th>Submodule Title:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preliminary Treatment</td>
<td>Grit Removal - Aerated</td>
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</table>

<table>
<thead>
<tr>
<th>Approx. Time:</th>
<th>15 minutes</th>
</tr>
</thead>
</table>

**Topic:** Safety

**Objectives:**

The student will be able to:

1. Use safe practices around aerated units.

**Instructional Aids:**

**Instructional Approach:**

Lecture  
Discussion

**References:**

UPCF MOP#8  
Operation of Wastewater Treatment Plants - Sacramento

**Class Assignments:**

Participate in discussion
<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
</table>

**E. Safety**

- Prevent flips and falls. A dangerous area due to the rapid air movement.
- Depth of unit requires draining of tank to repair unit.
- Clean unit thoroughly before entering.
**Module No:**

**Module Title:**
Preliminary Treatment

**Submodule Title:**
Grit Removal - Dewatering

**Topic:**
Devices

**Approx. Time:**
½ hour.

**Objectives:**
The student will be able to:

1. List main parts of the unit (screw).
2. Name both methods of dewatering.

**Instructional Aids:**
Handouts 5 and 6

**Instructional Approach:**
Lecture
Discussion

**References:**
Manufacturer's brochures
Plant O & M Manual

**Class Assignments:**
Participate in discussion.
### Instructor Outline:

<table>
<thead>
<tr>
<th>Handout 5</th>
</tr>
</thead>
</table>

#### I. Dewatering devices (classifiers)

**A. Methods of classification**

1. Screw
2. Cyclone
   
1. Screw
   
   **a. Main parts**
   
   - Screw pump
   - Submerged bearing
   - Trough
   - Reducer
   - Motor

   **b. Maintenance**

   - Screw pump: requires minimal attention as a single part.
   - Submerged bearing: is to be greased daily to prevent grit becoming inbedded in bearing.
   - Trough wear to this is due to misalignment of the pump unit itself.
   - Reducer: grease weekly.
   - Replace oil in unit yearly.
   - Motor: check for wear or strange noise from bearing.
<table>
<thead>
<tr>
<th>Module No:</th>
<th>Module Title: Preliminary Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Submodule Title: Grit Removal - Dewatering</td>
</tr>
<tr>
<td>Approx. Time:</td>
<td>45 minutes</td>
</tr>
<tr>
<td>Topic:</td>
<td>Normal Operation/Abnormal Operation</td>
</tr>
</tbody>
</table>

**Objectives:**

The student will be able to:

1. Distinguish between normal and abnormal operation.

**Instructional Aids:**

**Instructional Approach:**

- Lecture
- Discussion

**References:**

- Plant O & M Manuals
- Manufacturers brochures

**Class Assignments:**

- Participate in discussion
### Normal Operation/Abnormal Operation

#### Instructor Outline:

<table>
<thead>
<tr>
<th>B. Normal operation</th>
<th>C. Abnormal operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grit pump and mixing device to stir up grit into solution &quot;on.&quot;</td>
<td>Excessive grit over weir. Decrease water flow into unit.</td>
</tr>
<tr>
<td>Turn on screw and check for free turning.</td>
<td>Screw pump bound tight. Reverse direction.</td>
</tr>
<tr>
<td>Test to see if grit does not go over weir.</td>
<td>Flood trough with water.</td>
</tr>
<tr>
<td>Prevent odors.</td>
<td>Odors from unit. Flush and clean unit thoroughly.</td>
</tr>
<tr>
<td>Follow specific procedures of manufacturer.</td>
<td></td>
</tr>
</tbody>
</table>

#### Instructor Notes:

- Follow specific procedures of manufacturer.
AUX. WASH WATER
(USUALLY WASTEWATER)

MOTOR

SCREW-TYPE IMPELLER

GRI T FEED

WATER AND ORGANICS OUTLET

CONVEYOR

GRIT WASH WATER

TO HOPPER, TRUCK, ETC.

SCREW CONVEYOR
<table>
<thead>
<tr>
<th>Module No:</th>
<th>Module Title:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preliminary Treatment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Submodule Title:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grit Removal Dewatering</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Approx. Time:</th>
<th>Topic:</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 minutes</td>
<td>Safety</td>
</tr>
</tbody>
</table>

**Objectives:**

The student will be able to:

1. Work safely around screw separators

**Instructional Aids:**

**Instructional Approach:**

Lecture Discussion

**References:**

Plant O & M Manuals

**Class Assignments:**

Participate in discussion
<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td>Keep hands and feet out of unit while in operation.</td>
</tr>
<tr>
<td></td>
<td>Do not drop large foreign matter into pump trough.</td>
</tr>
<tr>
<td></td>
<td>To work on unit, tag out and lock switch before starting.</td>
</tr>
<tr>
<td>Module No:</td>
<td>Module Title:</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------</td>
</tr>
<tr>
<td></td>
<td>Preliminary Treatment</td>
</tr>
</tbody>
</table>

### Approx. Time: 15 minutes

### Objectives:
The student will be able to:
1. List on a schematic the main parts of the unit.

### Instructional Aids:
Handout 7

### Instructional Approach:
- Lecture
- Discussion

### References:
- Manufacturers brochures
- Plant O & M manuals

### Class Assignments:
Participate in discussion
<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclone</td>
<td>Cyclone</td>
</tr>
<tr>
<td>Main parts</td>
<td>Main parts</td>
</tr>
<tr>
<td>Grit pump</td>
<td>Grit pump</td>
</tr>
<tr>
<td>Apex valve</td>
<td>Apex valve</td>
</tr>
<tr>
<td>Feed chamber</td>
<td>Feed chamber</td>
</tr>
<tr>
<td>Rubber lines</td>
<td>Rubber lines</td>
</tr>
<tr>
<td>Vortex finder</td>
<td>Vortex finder</td>
</tr>
<tr>
<td>Belt drive</td>
<td>Belt drive</td>
</tr>
<tr>
<td>Module No:</td>
<td>Module Title:</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------</td>
</tr>
<tr>
<td></td>
<td>Preliminary Treatment</td>
</tr>
</tbody>
</table>

**Approx. Time:**

1/2 hour

**Topic:**

Maintenance

**Objectives:**

The student will be able to:

1. List procedures for maintenance of unit

**Instructional Aids:**

- Plant Manuals
- Manufacturers brochures

**Instructional Approach:**

Lecture

**References:**

- Plant Manuals
- Manufacturers brochures

**Class Assignments:**

Participate in discussion
<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline</th>
</tr>
</thead>
</table>

**Maintenance**

- Lock out switch and tag.
- Check belt for wear or glazing weekly. Adjust, tighten as needed.
- Apex valve. Check for wear weekly.
- Rubber lining. Replace only if wear is excessive. See manufacturer's handbook. Overhaul yearly.
MAJOR COMPONENTS
Cyclone Separator Unit

Overflow Connection
Feed Chamber
Cone Section
Tailpiece
Vortex Finder
Feed Connection
Rubber Liner
Apex Valve
<table>
<thead>
<tr>
<th>Module No:</th>
<th>Module Title:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preliminary Treatment</td>
</tr>
<tr>
<td>Submodule Title:</td>
<td>Grit Removal</td>
</tr>
<tr>
<td>Approx. Time:</td>
<td>½ hour</td>
</tr>
<tr>
<td>Topic:</td>
<td>Normal/Abnormal Operation</td>
</tr>
</tbody>
</table>

**Objectives:**

The student will be able to:

1. Recognize the difference in normal and abnormal operation by labelling a list.

**Instructional Aids:**

**Instructional Approach:**

Lecture  
Discussion

**References:**

Plant O & M Manuals

**Class Assignments:**

Participate in discussion
<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal Operation,</td>
</tr>
<tr>
<td></td>
<td>Feed to unit is constant and steady.</td>
</tr>
<tr>
<td></td>
<td>Adjust apex valve to allow for largest grit quantity and least organics.</td>
</tr>
<tr>
<td></td>
<td>Allow unit to run until all flow from the holding tank is exhausted.</td>
</tr>
<tr>
<td></td>
<td>Run unit only if appreciable volume of grit is to be removed.</td>
</tr>
<tr>
<td></td>
<td>Abnormal Operation</td>
</tr>
<tr>
<td></td>
<td>Excessive organics. Adjust apex valve.</td>
</tr>
<tr>
<td></td>
<td>No grit. Adjust apex valve, clean unit.</td>
</tr>
<tr>
<td></td>
<td>Excessive noise. Check for wear.</td>
</tr>
<tr>
<td></td>
<td>Increasing/decreasing feed pressure will allow for correct grit separation.</td>
</tr>
<tr>
<td>Module No:</td>
<td>Module Title:</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------</td>
</tr>
<tr>
<td></td>
<td>Preliminary Treatment</td>
</tr>
<tr>
<td>Approx. Time:</td>
<td>Submodule Title:</td>
</tr>
<tr>
<td>10 minutes</td>
<td>Grit Removal</td>
</tr>
<tr>
<td>Topic:</td>
<td></td>
</tr>
<tr>
<td>Safety</td>
<td></td>
</tr>
</tbody>
</table>

Objectives:
The student will be able to:
1. Employ proper safety techniques around this unit.

Instructional Aids:

Instructional Approach:
- Lecture
- Discussion

References:
- Plant O & M Manuals
- Manufacturers brochure

Class Assignments:
- Participate in discussions
<table>
<thead>
<tr>
<th>Module No:</th>
<th>Topic:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Safety</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Safety. Handout of unit.</td>
</tr>
<tr>
<td></td>
<td>Noise may require ear protection.</td>
</tr>
</tbody>
</table>
### Module No:

<table>
<thead>
<tr>
<th>Module Title:</th>
<th>Preliminary Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submodule Title:</td>
<td>Screening/Comminution</td>
</tr>
<tr>
<td>Approx. Time:</td>
<td>7 hours</td>
</tr>
<tr>
<td>Topic:</td>
<td></td>
</tr>
</tbody>
</table>

### Overall Objectives:

Upon completion of this module the participant will be able to:

1. Describe the various methods used to screen and comminute wastewater, identify equipment used, and relate the importance of this procedure.
2. Describe the process of
   a. Screening
   b. Comminution
3. Identify equipment used in
   a. Screening
   b. Comminution

### Instructional Aids:

- Handouts
- Overheads

### Instructional Approach:

- Lecture
- Discussion

### References:

1. Operation of Wastewater Treatment Plants, Sacramento
2. WPCF MOP #11
3. Wastewater Engineering, Metcalf and Eddy
4. Various Equipment Manufacturer's Material
5. Aeration in Wastewater Treatment Plants, WPCF MOP #5

### Class Assignments:

- Read handouts
- Prepare handouts
- Participation discussions
<table>
<thead>
<tr>
<th>Module No.</th>
<th>Module Title: Preliminary Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Submodule Title: Screening/Comminution</td>
</tr>
</tbody>
</table>

**Approx. Time:** 15 minutes

**Topic:** Introduction

**Objectives:**
Upon completion of this module the participant will be able to:
1. Describe the purpose of screening and comminution.

**Instructional Aids:**
None

**Instructional Approach:**
Lecture

**References:**
1. WPCF MOP #11
2. Wastewater Engineering
3. Operation of Wastewater Treatment Plants, Sacramento

**Class Assignments:**
Participate in discussion
<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. 1. To remove the larger materials that may cause extensive damage or necessitate repair to equipment. This may also mean in the case of comminution, the reduction in size of larger suspended matter, e.g. cloth, fibers, garbage, fecal matter. Heavy inorganics are removed - metal objects.</td>
<td>I. Introduction</td>
</tr>
<tr>
<td></td>
<td>a. Purpose</td>
</tr>
</tbody>
</table>
Module Title: Preliminary Treatment

Submodule Title: Screening/Comminution

Approx Time: 1 hour

Topic: Equipment

Objectives:

Upon completion of this module the participant will be able to:

1. List equipment used to screen or comminute wastewater.
2. List clear openings of screen equipment.

Instructional Aids:

Handout 1

Instructional Approach:

Lecture Discussion

References:

1. WPCF MOP #11
2. Operation of Wastewater Treatment Plants, Sacramento

Class Assignments:
### Instructor Notes:

<table>
<thead>
<tr>
<th>II.</th>
<th>1. 3/4&quot; - 6&quot; clear openings vertically or angularly placed in flow of wastewater.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>Manually cleaned daily.</td>
</tr>
<tr>
<td>B.</td>
<td>Cleaned by a timer, a flow differential control removal rates are at an average 0.7% of solids. Manually cleaned units average openings for coarse bar - 2&quot;. Fine bar - 3/4&quot;. Mechanically cleaned coarse bar - 3&quot;. Fine bar - 3/4&quot;. Coarse bars trap logs, timbers, stumps etc. Usually are found in larger flow plants with combined sewer systems.</td>
</tr>
</tbody>
</table>

---

### Instructor Outline:

II. Equipment (Handout)

1. Bar racks
   A. Manually cleaned
   B. Mechanically cleaned

2. Comminuters
   A. Comminuters
   B. Grinders
   C. Barminuter

3. Screening devices
   A. Fine
II. 1. a. Maintenance of mechanically cleaned unit

A. Lubricate foot shaft weekly

B. Lubricate wiper rollers frequently to maintain free movement.

C. Shear pin on upper sprocket drive to be replaced if broken. This device protects unit from major breakdowns.

D. Lubricate upper chain and drive unit weekly.
SCREENING EQUIPMENT
BAR RACKS
mechanically cleaned
manually cleaned
COMMINUTERS
grinders
barminuters
FINE SCREENS
THRU-CLEAN BAR SCREEN

Service Instructions

This manual contains complete instructions for the installation, operation and service of Link-Belt Thru-Clean bar screens. The life and economical operation of the machine is dependent, to a great extent, on the care taken during installation and the subsequent lubrication and service.

PREPARATION OF SITE

Before installing screen in channel, check channel width, depth, etc., against the dimensions on Link-Belt general arrangement drawing. Make sure that the foundation bolts for locating foot shaft, screen bars, chain guides, bar spacer, screen housing and all other components are located in the channel walls and floor in accordance with dimensions shown on general arrangement drawing.

INSTALLATION

1. Placing safety collars on shaft and slide them in toward center of shaft.
2. Mount sprockets, one on each end of shaft with long hubs in toward safety collars. Be sure that sprockets rotate freely on shaft.
3. Mount one bearing on each end of the shaft with hubs toward sprockets.
4. Move all parts back far enough from the shaft ends to clear anchor bolts in channel wall.
5. Lower shaft into channel, making sure that the topped
holes in each end of shaft and clearance hole in bearing hub are in an upward position.
6. Slide bearings out to ends of shaft and over anchor bolts in channel wall after shaft is in position.
7. Put the two pipe nipples used for lubrication system through the clearance holes in the bearings and into threaded holes in foot shaft.

Foot sprockets
1. Place foot sprockets on their proper centers, as shown on foundation and general arrangement drawings, and center in the channel.
2. Fasten safety collars to keep sprockets in position.
3. Move bearings toward sprockets so that sprockets will rotate freely with a minimum amount of clearance.
4. Force bearing setscrews tight against shaft.
5. On anchor bolts nearest wall, turn nuts finger-tight against bearings. Tighten nuts on other side of bearings, making sure that shaft is centered in channel, level with and at right angles to channel wall.

Foot shaft assembly is now ready for grouting.

Bar rack
Bar rack is next assembled in the channel. The bar rack will be in one piece or in sections depending on width of screen. Wooden block spacers are bonded between the bar racks to protect and support them during shipment and assembly. Remove these blocks after racks are attached to the chains.
1. Place bar rack on anchor bolts located in the channel floor. Be sure that bar rack is lined up vertically, and center it with sprockets on foot shaft.
2. Check the distance between foot sprockets and bar rack assembly using general arrangement drawing.
3. Secure bar rack in place using anchor bolts; grout if necessary.

Head section
1. Bolt head section housing panels together and set them in position over channel opening.
2. Temporarily bolt head section housing tight to foundation.
3. Check clearance with center plate as shown on general arrangement drawing. Deflector plate must pivot freely so that it will always return to its proper position.

Side plates
1. Locate and space two side plates in position against the channel walls, one on each side, using dimensions shown on general arrangement drawing.
2. Secure plates in position, grout to suit.

Slack chain supports
Bolt slack chain supports to channel wall under sprockets. Maintain ½” from outside diameter of sprockets to support surface.

Chain guides
Bolt chain guides to channel walls, maintaining 5-11/16” front center line of head and foot shaft. The ends should clear the sprockets by ½”.

Bar rack spacer
1. Place spacer supports on anchor bolts
2. Bolt spacer assembly to supports
3. Adjust spacer so that it is parallel with foot shaft in both directions. Spacer must also be centered so that spacer teeth are centrally located between bars in bar rack. Spacer must pivot freely so that it will always return to correct position.
4. Grout behind spacer supports as required.
5. Attach lubrication tubing for the foot shaft bearings to channel walls.
1. Assemble sprockets, takeups and safety collars on head shaft.

2. Bolt head shaft in position, and line it up with foot shaft. Head shaft should be parallel to the foot shaft in both planes. Alignment is obtained by shifting head shaft housing and head shaft bearings.

3. Line up head sprockets with the foot sprockets.

**Chains**

1. Assemble rake carrying chains around head and foot sprockets with rake attachments and chain assemblies as shown on general arrangement drawing.

2. Attach rakes as shown on general arrangement drawing.

3. Tighten chains, by moving the takeup bearing adjusting screws. Rotate both screws the same number of turns so the head shaft remains parallel to the foot shaft. When chains are pulled taut, back off on the adjusting screws to provide a small amount of slack.

4. Secure takeup screws with locknuts. Mount drive sprockets and drive machinery on head section housing. After machinery is properly aligned install wiper blade in wiper guides.

**OPERATION**

If current is available for the drive motor, jog screen through one complete cycle to be sure all parts clear. Check bar spacers and deflector plate to see that they return to proper positions after rakes have passed. Check and adjust wiper so that it rolls free in the guides.

Operate screen through several cycles. If all parts function properly, and a shredder is included with the installation, install it in accordance with instructions attached to it, and bolt trough, chutes, etc., in position.

If permanent current is available, connect motor so that screen can be operated for a short time. If a fluid drive is used, connect the motor for the higher voltage and operate it on the lower voltage. This is done far torque control reasons.

Lubricate all parts and then operate screen for a short run-in period. During the run-in period, recheck all parts to make sure they function correctly.

Pay particular attention to the operation of the rolling wiper. Check the horizontal end-play; if it appears excessive, add more washers to the flange side of the rollers.

If, during operation, the rake chains move away from the wiper, allowing the wiper to fall free for a distance after it leaves the rake, take up on the rake chains and move the chain guides closer to the back of the chains.

The screen can be operated manually or by the use of a timer.

If an automatic timer is used to control the operation of the screen, set it to operate the screen at intervals sufficiently long and properly spaced to suit local conditions. The screen should operate often enough to keep the screen bars reasonably free of screenings, etc. The minimum recommended operating cycle is 10 minutes' operation every 2 hours.

See attached instruction sheets for setting and maintaining the timer.

**LUBRICATION AND MAINTENANCE**

Lubricate the foot shaft at least once a week and more often if sand in sewage is excessive.

Lubricate the pivoted spacer and deflector plate as often as necessary to keep them pivoting freely. Lubricate wiper rollers as often as required to keep them rolling freely in the guides.

All gear drives, shredders, and chain drives must be lubricated in accordance with instructions attached to them.

Thru-Clean bar screens can be equipped with shear pin hubs for overload protection. If a pin breaks, replace it by removing the chain guard, taking out the broken pieces of pin, replinishing the holes and inserting a new pin. Shear pin breakage can usually be traced to some foreign object jammed in the screen or screen mechanism. Be sure the cause of jamming is corrected before installing a new pin and again operating screen.
Unit-Slat Thru-Clean Bar Screen

Fig. 627
<table>
<thead>
<tr>
<th>Module No:</th>
<th>Module Title: Preliminary Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Submodule Title: Screening/Comminution</td>
</tr>
<tr>
<td>Approx. Time:</td>
<td>Topic: Comminution Maintenance</td>
</tr>
<tr>
<td>1 1/2 hours</td>
<td></td>
</tr>
</tbody>
</table>

**Objectives:**
Upon completion of this module the participant will be able to:
1. Label parts of a comminuter.
2. List startup and shut down procedures.
3. List preventive maintenance procedures.

**Instructional Aids:**
Handout #3

**Instructional Approach:**
Lecture
Discussion

**References:**
1. WPCF MOP #11
2. Operation of Wastewater Treatment Plants, Sacramento

**Class Assignments:**
Participate in class discussion
<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. <strong>Comminuters</strong></td>
<td>II. 2. A. <strong>Parts of a comminutor</strong></td>
</tr>
<tr>
<td>A. <strong>Comminuters</strong></td>
<td>a. <strong>Motor</strong></td>
</tr>
<tr>
<td>1. <strong>Flow through</strong></td>
<td>b. <strong>Shaft</strong></td>
</tr>
<tr>
<td>2. <strong>In channel</strong></td>
<td>c. <strong>Bearing</strong></td>
</tr>
</tbody>
</table>

Reduce size of offending materials by allowing the flow to pass through a settled screen and the trapped materials to be cut into smaller pumpable sizes.

<table>
<thead>
<tr>
<th>a. <strong>Handout parts</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>b. <strong>Shaft wear caused at packing (bearings) and alignment settings connects motor to drum.</strong></td>
</tr>
<tr>
<td>c. <strong>Bearing requires lubrication as it rotates shaft from stress and allows drum to rotate in alignment.</strong></td>
</tr>
<tr>
<td>d. <strong>Drum rotates on shaft. Contains cutter blades and teeth.</strong></td>
</tr>
<tr>
<td>e. <strong>Cutters, shredders and combs located on drum and base. Fixed combs trap material to be cut and as drum rotates the cutters and shredders are brought in contact.</strong></td>
</tr>
<tr>
<td>f. <strong>Base</strong></td>
</tr>
</tbody>
</table>
### Instructor Notes:

- with the combs and the reduction of material takes place.
- Base supports the weight and is bolted to the concrete channel.

### Instructor Outline:

#### II. 2. B. Start up and shut down

1. Once unit is started it is only shut down for repair or preventive maintenance.
2. Clear unit of major obstructions.
3. Turn on power.
4. Shut down procedure in reverse.

#### II. 2. C. Preventive maintenance

1. Visually check drum 3'x's daily.
2. Remove major obstructions.
3. Cutter mechanisms have a life of 5 years. Replace following manufacturer's recommendations.
<table>
<thead>
<tr>
<th>Module No:</th>
<th>Module Title: Preliminary Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Submodule Title: Screening/Communion</td>
</tr>
<tr>
<td>Approx. Time:</td>
<td>½ hour</td>
</tr>
<tr>
<td>Topic:</td>
<td>Safety</td>
</tr>
</tbody>
</table>

**Objectives:**

Upon completion of this module, the participant will be able to:

1. Demonstrate safe procedures around the comminuter.

**Instructional Aids:**

None

**Instructional Approach:**

Lecture

**References:**

1. WPCF MOP #11
2. Operation of Wastewater Treatment Plants, Sacramento

**Class Assignments:**

Participate in discussion
<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students with this unit are to add to the safety steps. This will encourage class discussion.</td>
<td>II. 2. A. Safety</td>
</tr>
<tr>
<td></td>
<td>1. Do not put hand into flow while unit is operating.</td>
</tr>
<tr>
<td></td>
<td>2. Do not repair unit until it is totally isolated electrically and drained of water.</td>
</tr>
<tr>
<td>Module No:</td>
<td>Module Title:</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------</td>
</tr>
<tr>
<td></td>
<td>Preliminary Treatment</td>
</tr>
</tbody>
</table>

**Approx. Time:** 45 minutes

**Topic:** Grinders

**Objectives:**
Upon completion of this module the participant will be able to:
1. Identify the difference between a comminuter and a grinder.

**Instructional Aids:**
Refer to handout 2, page 5 & 6

**Instructional Approach:**
Lecture
Discussion

**References:**
1. Manufacturer's Guide
2. WPCF MOP #11

**Class Assignments:**
Participate in discussion
Read handout
II. 2. B. Grinders

Located out of flow only with screenings collected and passed through the unit and ground screenings returned to the flow. High speed as opposed to the slower speed of comminuters. Infrequent operation.

Parts
Motor
Rotating drum
Cutters

N.B. This is a high speed unit. Care must be taken in safety in feeding of screens material.
<table>
<thead>
<tr>
<th>Module No:</th>
<th>Module Title:</th>
<th>Submodule Title:</th>
<th>Topic:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preliminary Treatment</td>
<td>Screening/comminution</td>
<td>Start up/Shut down</td>
</tr>
<tr>
<td>Approx. Time:</td>
<td>½ hour</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Objectives:**

Upon completion of this module the participant will be able to:

1. Demonstrate the proper start up and shut-down of the grinder.

**Instructional Aids:**

- Running grinder at an installation
- Handout 2

**Instructional Approach:**

- Lecture
- Demonstration

**References:**

1. WPCF MOP #11
   - Manufacturer's Guide

**Class Assignments:**

- Read handout
- Participate in discussion
- Demonstrate grinder operation
<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>II. B: Start up and shut down</td>
</tr>
<tr>
<td></td>
<td>1. Turn switch on and allow motor to come to full operating speed.</td>
</tr>
<tr>
<td></td>
<td>2. Unit may require outside source of water turn on as you start unit (kitchen grinder).</td>
</tr>
<tr>
<td></td>
<td>3. Feed screenings to unit in piecemeal fashion to allow for proper grinding. Do not jam or overfill. Do not put metal or plastic into unit.</td>
</tr>
<tr>
<td></td>
<td>4. Stop unit by switch.</td>
</tr>
<tr>
<td></td>
<td>5. After complete stop let water flush unit for a few minutes before closing valve.</td>
</tr>
<tr>
<td>Module No:</td>
<td>Module Title:</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------</td>
</tr>
<tr>
<td></td>
<td>Preliminary Treatment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Submodule Title:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screening/commination</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Approx. Time:</th>
</tr>
</thead>
<tbody>
<tr>
<td>½ hour</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topic:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grinder Maintenance</td>
</tr>
</tbody>
</table>

**Objectives:**

Upon completion of this module, the participant will be able to:

1. List procedures for maintaining unit.

**Instructional Aids:**

- Handout 4

**Instructional Approach:**

- Lecture
- Discussion

**References:**

1. Manufacturer's Guide
2. Plant O & M Manuals

**Class Assignments:**

- Participate in discussion
- Fill out handout
### Topic: Grinder Maintenance

#### Instructor Outline:

<table>
<thead>
<tr>
<th>II. D. Maintenance and preventive maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Grease bearings weekly.</td>
</tr>
<tr>
<td>2. Check water flow into unit weekly.</td>
</tr>
<tr>
<td>3. Clean out grinder after each operation.</td>
</tr>
<tr>
<td>4. Cutter blades replace as per manufacturer's suggestions.</td>
</tr>
</tbody>
</table>

#### Instructor Notes:
Handout 4

Grinder Maintenance

1.

2.

3.

4.
<table>
<thead>
<tr>
<th>Module No:</th>
<th>Module Title: Preliminary Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Submodule Title: Screening/commihiution</td>
</tr>
<tr>
<td>Approx. Time:</td>
<td>45 minutes</td>
</tr>
<tr>
<td>Topic:</td>
<td>Barminuter</td>
</tr>
</tbody>
</table>

**Objectives:**
Upon completion of this module the participant will be able to:
1. Label parts on a drawing.

**Instructional Aids:**
Handout 5

**Instructional Approach:**
Lecture
Discussion

**References:**
1. Operation of Wastewater Treatment Plants; Sacramento.
2. Manufacturer's Guide

**Class Assignments:**
Participate in class discussion
Label handout
### Module No:  
#### Topic:  
**Barminuter**

<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>II. 2. C.</strong></td>
<td><strong>II. 2. C. Barminuter</strong></td>
</tr>
<tr>
<td>Placed in stream flow</td>
<td>Trade mark of Chicago Pump Parts</td>
</tr>
<tr>
<td>1. Counter weight offsets the heavy motor and unit weight allowing free travel of unit.</td>
<td>1. Counter weights</td>
</tr>
<tr>
<td>2. Motor &quot;rides&quot; on the entire system and is located on front upstream side of unit.</td>
<td>2. Motor</td>
</tr>
<tr>
<td>3. Cutting assembly rotating drum with blade the shred entrapped material on the screen.</td>
<td>3. Cutting assemble</td>
</tr>
<tr>
<td>4. Screen performs function of both a fine screen and cutting surface for the cutting drum.</td>
<td>4. Screen</td>
</tr>
<tr>
<td>Module No:</td>
<td>Module Title: Preliminary Treatment</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td></td>
<td>submodule Title: Screening/Comm Min</td>
</tr>
<tr>
<td>Approx. Time:</td>
<td>45 minutes</td>
</tr>
<tr>
<td>Topic:</td>
<td>Start up/Shut down Maintenance - Abnormal Operation</td>
</tr>
</tbody>
</table>

**Objectives:**

Upon completion of this module the participant will be able to:

1. Identify preventive maintenance procedures.
2. List possible problems of abnormal operation.

**Instructional Aids:**

None

**Instructional Approach:**

Lecture
Discussion

**References:**

1. Operating Wastewater Treatment Plants, Sacramento.
2. Manufacturer's Guide

**Class Assignments:**

Participate in discussion
<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
<tbody>
<tr>
<td>II. 2. C.</td>
<td></td>
</tr>
<tr>
<td>1. Material blocked screen cause head difference, cause activation of the unit.</td>
<td>Start up and shut down</td>
</tr>
<tr>
<td></td>
<td>1. Timed or &quot;dam buildup&quot; activated.</td>
</tr>
<tr>
<td></td>
<td>2. Automatically turns on and off.</td>
</tr>
<tr>
<td></td>
<td>Equipped with a manual override.</td>
</tr>
<tr>
<td></td>
<td>Preventive maintenance</td>
</tr>
<tr>
<td></td>
<td>1. Check oil levels.</td>
</tr>
<tr>
<td></td>
<td>2. Add grease to unit as specified by manufacturer</td>
</tr>
<tr>
<td></td>
<td>3. Check 3 x's daily to prevent damage.</td>
</tr>
<tr>
<td></td>
<td>Remove major blockages immediately.</td>
</tr>
<tr>
<td>Abnormal routine</td>
<td></td>
</tr>
<tr>
<td>1. Will not start, reset switch on power supply is defective.</td>
<td></td>
</tr>
<tr>
<td>2. Reverses too frequently on mid cycle; blockage in screen, misalignment of cutters, plugged reverse spring.</td>
<td></td>
</tr>
<tr>
<td>Module No:</td>
<td>Module Title: Preliminary Treatment</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td></td>
<td>Submodule Title: Screening/Communion</td>
</tr>
<tr>
<td>Approx. Time:</td>
<td>Topic: Safety</td>
</tr>
<tr>
<td>20 Min:</td>
<td></td>
</tr>
</tbody>
</table>

**Objectives:**
Upon completion of this module the participant will be able to:

1. Perform safely around this unit.

**Instructional Aids:**
None

**Instructional Approach:**
- Lecture
- Discussion

**References:**
1. Operation of Wastewater Treatment Plants, Sacramento
2. Manufacturer's Guide

**Class Assignments:**
Participate in discussion
II. 2. C. Safety

1. Do not drop objects into unit.

2. Encase of jam, shut unit off completely.

3. On this unit do not work alone. Parts are too heavy for one person to handle.

4. If located in deep channel, wear harness.
<table>
<thead>
<tr>
<th>Module No:</th>
<th>Preliminary Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submodule Title:</td>
<td>Screening/Communion</td>
</tr>
<tr>
<td>Approx. Time:</td>
<td>1-1/2 hours</td>
</tr>
<tr>
<td>Topic:</td>
<td>Fine Screens</td>
</tr>
</tbody>
</table>

**Objectives:**

Upon completion of this module the participant will be able to:

1. Describe written operation of the unit discussed.
2. List parts of unit.
3. List maintenance procedures.

**Instructional Aids:**

Handout 6 & 7

**Instructional Approach:**

Lecture
Discussion

**References:**

1. WPCF MOP #11
2. Suspended Solids Removal, USEPA

**Class Assignments:**
<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
<tbody>
<tr>
<td>III. Mechanically cleaned by waterjet nozzles. Perforated bronze, stainless steel plate or drum. Removes smaller particles. Size of openings are usually less than 3/16&quot;.</td>
<td>III. Fine Screens</td>
</tr>
</tbody>
</table>

Handout

1. Operation

Screen travels into the water flow; submerge on the downstream side and leaves flow on upstream side. Trapped solids are settled off by means of a spray nozzle. Not a practical device for wastewater as they get clogged easily and require extensive cleaning. Better application is the effluent polish to remove minute particles.

Excellent results are obtained in water treatment plants.

2. Parts List

   a. Drum
   b. Screen material
   c. Chain sprocket
   d. Chain
   e. Reducer
   f. Motor
   g. Jet spray assembly

3. Maintenance

   a. Grease drum bearing weekly.
   b. Replace screen material if torn or punctured.
   c. Grease upper sprocket monthly.
   d. Check for worn links and replace monthly.
   e. Grease reducer bearing weekly.
   f. Check motor for wear (bearings).
Instructor Notes

Instructor Outline:

4. Normal operation
   a. Turn on drum. Drive unit to run continuously in flow
   b. Check for problems
   c. Open channel gate
   d. Flow to be constant so as to submerge 1/3 of drum.
   e. Water spray can now be turned on to wash off screen.
   f. Check unit thoroughly every hour to prevent damming or binding of unit.

5. Abnormal operation
   a. Blinding - water pressure too low in nozzles.
   b. Unit vibrates noisily - excessive water flow in channel

6. Safety
   a. Tag and lock out unit
   b. Do not allow large objects to hit screen
   c. Do not walk on screen.
   d. Work with two people. Minimum due to bulky parts. Awkward to handle.
TYPICAL MICROSCREEN UNIT, CROSS SECTION
<table>
<thead>
<tr>
<th>Module No:</th>
<th>Module Title:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preliminary Treatment.</td>
</tr>
<tr>
<td>Approx. Time:</td>
<td>Submodule Title: Submodule Topic:</td>
</tr>
<tr>
<td>1 hour</td>
<td>Preaeration</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Objectives:</td>
<td>Upon completion of this module the participant will be able to:</td>
</tr>
<tr>
<td></td>
<td>1. Identify preaeration equipment.</td>
</tr>
<tr>
<td></td>
<td>2. Label schematic of process equipment.</td>
</tr>
<tr>
<td></td>
<td>3. List corrective action for abnormal operation.</td>
</tr>
</tbody>
</table>

**Instructional Aids:**
- Handouts
- Overheads

**Instructional Approach:**
- Lecture
- Discussion

**References:**
1. WPCE MOP #B
2. Wastewater Engineering, Metcalf and Eddy
3. Manufacturer's Guide

**Class Assignments:**
- Read handouts
- Participate in discussions
### Module Title: Preliminary Treatment

#### Submodule Title: Preaeration

#### Topic: Introduction

**Approx. Time:** 1 hour

**Objectives:**

Upon completion of this module, the participant will be able to:

1. Identify
   - a. Diffused
   - b. Mechanical

2. List operations parameters processes.

**Instructional Aids:**

- Handout 1

**Instructional Approach:**

- Lecture
- Discussion

**References:**

1. WPCF MOP #11
2. Operation of Wastewater Treatment Plants
3. WPCF MOP #8

**Class Assignments:**

- Read handout
- Participate in discussion
Module No:  | Topic: Preaeration  
---|---
Instructor Notes:  
- Freshen sewage  
- Control odors  
- Improve settling  
- Improves grease removal  
- Grit removal  
- Uniform distribution of suspended and floating solids  
- Increase BOD removals  

Instructor Outline:  
I. Introduction  
1. Diffused  
2. Mechanical  

Handout 1  
1. Compressed air or air from a blower-pump are used to disperse air to the unit. The air discharge point is through a sparger similar to the fish tank bubbler systems.

Handout 2  
2. Massive surface and/or draft tube mixers are used to aerate liquid. DO measurement needed to measure freshness of wastewater.

A. Operation parameters  
1. Retention time 10 - 45 min.  
2. Tank depth 15 ft.  
3. Air requirements 0.1 - 0.4 cu. ft./gal. of wastewater  
4. Minimal deposition of solids is allowed  
5. DO measured by using DO meter.
<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
</table>

**B. Main parts**

1. Diffuser
2. Blower

**C. Safety**

1. Railing around the unit to be secure.
2. Do not work on unit unless unit is drained.
3. Keep area free of grease, wastewater, oil, to pincant clips and balls.
CIRCULATION PATTERN OF AERATION TANK
<table>
<thead>
<tr>
<th>Module No:</th>
<th>Module Title:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preliminary Treatment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Submodule Title:</th>
<th>Approx. Time:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flotation/Grease Separation</td>
<td>3 hours</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topic:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objectives:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upon completion of this module the participant will be able to:</td>
</tr>
<tr>
<td>1. Identify need and purpose for flotation.</td>
</tr>
<tr>
<td>2. Identify types of flotation units.</td>
</tr>
<tr>
<td>3. Outline steps of operation of flotation units.</td>
</tr>
<tr>
<td>4. List 2 advantages/disadvantages of flotation.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Instructional Aids:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handouts</td>
</tr>
<tr>
<td>Overheads</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Instructional Approach:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
</tr>
<tr>
<td>Discussion</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>References:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. WPCF MOP #8</td>
</tr>
<tr>
<td>2. Manufacturer's Guide</td>
</tr>
<tr>
<td>3. Plant O &amp; M Manuals</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Class Assignments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read handouts</td>
</tr>
<tr>
<td>Participate in discussion</td>
</tr>
<tr>
<td>Module No:</td>
</tr>
<tr>
<td>------------</td>
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<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Approx. Time:</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Objectives:
Upon completion of this module the participant will be able to:
1. Identify the need and purpose of flotation.
2. List types of flotation units.

Instructional Aids:
Handouts 1, 2 & 3

Instructional Approach:
Lecture & Discussion

References:
1. WPCF MOP #8
2. Manufacturer's Guide

Class Assignments:
Participate in discussion
<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handouts 1, 2, 3</td>
<td>I. Need and purpose</td>
</tr>
<tr>
<td></td>
<td>To convert finely divided solids (grease) to floating matter in a shorter period of time and ease of operations.</td>
</tr>
<tr>
<td></td>
<td>II. Position of equipment</td>
</tr>
<tr>
<td></td>
<td>A. Ahead of primary settling</td>
</tr>
<tr>
<td></td>
<td>II. Types</td>
</tr>
<tr>
<td></td>
<td>A. Pressure flotation</td>
</tr>
<tr>
<td></td>
<td>B. Vacuum flotation</td>
</tr>
<tr>
<td></td>
<td>C. Flotation</td>
</tr>
</tbody>
</table>
Dissolved air flotation system
INTERNAL FLOW DIAGRAM
H-R TYPE FLOTATION UNIT
Dissolved air flotation unit
Module No:  
Module Title:  
Preliminary Treatment  
Submodule Title:  
Flotation/Grease Separation  
Approx. Time:  
1 hour  
Topic:  
Operation  
Objectives:
Upon completion of this module the participant will be able to:
1. Write out procedure of operations to float solids.
2. Identify parts of unit process.

Instructional Aids:
Handout 1, 2, 3
This handout can be used for vacuum method by changing retention tank to vacuum tank.

Instructional Approach:
Lecture  
Discussion  

References:
1. WPCF MOP #8  
2. Manufacturer's Guide  
3. Suspended Solids Removal, USEPA

Class Assignments:
Read handout  
Participate in discussion
**Module No:**

<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handout of unit</td>
<td>I. A. 1. Unit equipment</td>
</tr>
<tr>
<td></td>
<td>Refer to handout for listing.</td>
</tr>
<tr>
<td></td>
<td>2. Flotation tank</td>
</tr>
<tr>
<td></td>
<td>a. Flow enters at bottom</td>
</tr>
<tr>
<td></td>
<td>b. Scrapers move flotted scum to hopper</td>
</tr>
<tr>
<td></td>
<td>c. Scum to treatment/disposal</td>
</tr>
<tr>
<td></td>
<td>3. Vacuum flotation</td>
</tr>
<tr>
<td></td>
<td>a. Saturate wastewater with air (aerate)</td>
</tr>
<tr>
<td></td>
<td>b. Apply partial vacuum in enclosed tank (9 in. mercury).</td>
</tr>
<tr>
<td></td>
<td>c. Gas dissolved in tank liquid is released; minute bubbles attach to solids causing floating of solids.</td>
</tr>
<tr>
<td></td>
<td>II. C. Flotation</td>
</tr>
<tr>
<td></td>
<td>This unit is similar to the primary basin on settling unit. Allows scum to rise at its own rate. Period of retention in the unit is decreased over primary clarification to reduce the quantity of sludge/ash deposition.</td>
</tr>
<tr>
<td></td>
<td>III. Operation</td>
</tr>
<tr>
<td></td>
<td>A. Pressure flotation</td>
</tr>
<tr>
<td></td>
<td>Pressurize the sewage to 1 atm and release the entire contents to the atmosphere. Dissolved gas in the liquid are released as fine bubbles adhering to the minute solid particles and cause the particle to float.</td>
</tr>
<tr>
<td></td>
<td>Equate to a soda pop bottle w/compressed CO₂. When opened, the bubbles rise to the surface.</td>
</tr>
<tr>
<td>Module No:</td>
<td>Module Title:</td>
</tr>
<tr>
<td>----------------</td>
<td>---------------</td>
</tr>
<tr>
<td></td>
<td>Preliminary Treatment</td>
</tr>
</tbody>
</table>

**Approx. Time:** 1 hour

**Objectives:**

Upon completion of this module, the participant will be able to:

1. List three (3) advantages/disadvantages.

**Instructional Aids:**

Handout 4 (over)

**Instructional Approach:**

Lecture

Discussion

**References:**

1. WPCF MOP #8
2. Manufacturer's Guide

**Class Assignments:**

Read handouts
Participate in discussion
## Advantages/Disadvantages

### I. Advantages

1. 50% removal of soluble material (grease).
2. 35% removal of suspended solids.
3. 17–35% BOD reduction.
4. High overflow rates, low detention periods. Reduced size of equipment.
5. Odor and nuisances minimized.
6. Thicker scum/sludge.

### II. Disadvantages

1. Higher operating costs (pressure and vacuum).
2. High power costs (pressure).
3. Airtight structures necessary (vacuum).
4. Highly skilled maintenance required.
Handout 4

FLOTATION UNITS.

Advantages:
1.
2.
3.
4.
5.
6.

Disadvantages:
1.
2.
3.
4.
III. Maintenance

1. Grease chain and sprocket monthly.

2. Maintain oil levels in gear boxes.

3. Clean enclosed tanks (pressure and vacuum) regularly depending on the type of scum and its adherence to tank.

4. Check valves and pipes for leaks.

5. Check motors and vacuum/pressure systems for wear monthly.

IV. Abnormal Operation

Skimmer not removing total quantity of scum

Replace wiper rubber
Adjust wiper rubber

Effluent solids are high
Reduce load to unit
<table>
<thead>
<tr>
<th>Instructor Notes:</th>
<th>Instructor Outline:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Floats sludge too thin - flight speed too high</td>
</tr>
<tr>
<td></td>
<td>Unit overloaded - low dissolved air</td>
</tr>
<tr>
<td></td>
<td>V. Safety</td>
</tr>
<tr>
<td></td>
<td>Keep unit floor area clear and clean of any material (oil, grease, sludge, water).</td>
</tr>
<tr>
<td></td>
<td>Do not climb on unit. Use provided access areas.</td>
</tr>
<tr>
<td></td>
<td>Keep hands and clothing free of moving parts.</td>
</tr>
</tbody>
</table>
### Module Title:
Preliminary Treatment

### Submodule Title:
Manufacturers

### Approx. Time:
½ hour

### Objectives:
Upon completion of this module the participant will be able to:

1. List several major equipment manufacturers.

### Instructional Aids:
Handout 1

### Instructional Approach:
Lecture
Discussion

### References:
1. Manufacturer's Listing

### Class Assignments:
- Do handout
- Participate in class discussion
<table>
<thead>
<tr>
<th>Module No:</th>
<th>Topic:</th>
<th>Preliminary Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Instructor Notes:</td>
<td>Instructor Outline:</td>
</tr>
<tr>
<td></td>
<td>Handout 1</td>
<td>I. Manufacturers of all process equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mention of particular manufacturer does not constitute endorsement.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. FMC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Chicago pump</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Rex</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Envirotech</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Dorr-Oliver</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Wemco</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. Worthington</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8. Jeffrey</td>
</tr>
</tbody>
</table>
Handout 1
MANUFACTURERS OF EQUIPMENT

1.
2.
3.
4.
5.
6.
7.
8.
Module No:  
Module Title: Preliminary Treatment  
Submodule Title: Disposal of Materials  
Topic:

Approx. Time:  
\( \frac{1}{2} \) hour

Objectives:
Upon completion of this module the participant will be able to:

1. List the methods of disposal.

Instructional Aids:
Handout 1

Instructional Approach:
Lecture  
Discussion

References:
1. Operation of Wastewater Treatment Plants  
   Operation of Wastewater Treatment Plants
2. WPCF MOP #8

Class Assignments:
Do handout  
Participate in class discussion
### Instructor Notes:

- Handout 1

### Instructor Outline:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. Disposal of Materials</strong></td>
<td></td>
</tr>
<tr>
<td>All materials collected in each process mentioned can be disposed of in the manner listed below. Check with the local Public Health Dept. Codes for approval.</td>
<td></td>
</tr>
<tr>
<td>1. Land disposal - burying</td>
<td></td>
</tr>
<tr>
<td>2. Digestion followed by burying or incineration</td>
<td></td>
</tr>
<tr>
<td>3. Incineration followed by land disposal</td>
<td></td>
</tr>
</tbody>
</table>
Handout 1

DISPOSAL METHODS

1.

2.

3.
The participant will score 70% or more on the test provided below.

Preliminary Treatment Evaluation

1. What is the velocity of wastewater in a grit chamber?
   A. 0.2 - 0.9 FPM
   B. 0.75 - 1.25 PSI
   C. 10 FPS
   D. 1 FPS

2. Grit is
   A. Sand
   B. Egg shells
   C. Coffee grounds
   D. All of these

3. Types of cleaning methods for a grit chamber are

4. Grit is removed from the flow by
   A. Trucks
   B. Screens
   C. Aeration
   D. Gravity

5. Dewatering devices are for
   A. Dewatering water
   B. Separating grit from water
   C. Increasing plant costs
   D. Increasing plant efficiency

6. Screw classifiers need the submerged bearing greased daily because
   A. The grit will wear out bearings
   B. Plant personnel should support the lubrication companies
   C. Because it’s there
   D. Prevent the screw from falling out
Module No.: Module Title:  

Submodule Title:  

EVALUATION  

Objectives:

7. The ________ determines the quantity and quality of grit from a cyclone.

8. The purpose of screening is ________
   A. Remove larger objects from the flow
   B. Prevent damage to expensive equipment
   C. Keep bugs out
   D. None of these
   E. All of these

9. The clear openings of a bar screen are from ________
   A. 2 - 12 feet
   B. 3/4 inches to 3 inches
   C. 2 - 3 inches
   D. All of these
   E. None of these

10. Label diagram of comminuter supplied by the instructor.

   Motor   Drum   Base   Cutters

11. A comminuter and a grinder are different because ________
   A. The grinder is a grinder
   B. A comminuter is above the flow
   C. A grinder cuts the screens above the flow and a comminuter in the flow
   D. All of the above
Approx. Time:  

EVALUATION  

Objectives:  

12. Preaeration is for  
   A. Freshening sewage  
   B. Odor control  
   C. Improves grit removal  
   E. All of these  

13. Retention time in this unit is  
   A. 2 hours  
   B. 10 days  
   C. 10 - 45 minutes  

14. There are three types of flotation units, fill in the one missing.  
   Pressure  
   Flotation  

15. The principle of flotation is similar to a ______ bottle opened.  

16. List two advantages of flotation  
   A.  
   B.  

17. List two disadvantages of flotation  
   A.  
   B.  

**Module No:** EVALUATION

**Instructor Notes:**

Answers for test on preliminary treatment.

1. D
2. D
3. Manual mechanical
4. C, D
5. B
6. A
7. Apex valve
8. A, B
9. B
10. see note 10
11. C
12. E
13. C
14. Vacuum
15. Soda pop
16. A.
   B.
   See note on question answers.
17. A.
   B.
   See note on question answers

**Instructor Outline:**

10. Diagram supplies by instructor.
   Use Handout 3 comminuter
16. A. 50% removal of soluble material
   B. 35% removal of Suspended Materials
   C. 17% - 35% BOD reduction
   D. High overflow rates
   E. Odor and nuisance minimized
   F. Thicker sludge and scum
17. A. Higher operating costs
   B. High power costs
   C. Airtight structures necessary
   D. Highly skilled maintenance required