Sizing Criteria for Inclined Plate Settlers

Theory, Current TCEQ Rules, and Full-Scale Operating Data

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Agenda

• Background and Technical Information
• Advantages
• Sizing Criteria
• Uprating: Missouri City Case Study
BACKGROUND INFORMATION
FOR PLATE SETTLERS
What are plate settlers?

- For clarification/sedimentation
- A.k.a. lamella clarifiers
- Flexibility in type of basin
How Plates Work

• Large settling area in small volume
Sludge Collection

• Many options: existing clarifier, chain and flight, sludge scraper, hose vacuum...

• Hoseless vacuum is a low-maintenance option
Plate settlers are rapidly gaining popularity

• Installations in Texas:
  – MRI – 8
  – JMS – 5
  – Parkson – (Waiting)
ADVANTAGES OF PLATE SETTLERS
Advantages of Plate Settlers

- Plates require less space than conventional clarifiers
- Often less costly overall

<table>
<thead>
<tr>
<th>Footprint</th>
<th>Water Quality</th>
<th>Coagulant Usage</th>
<th>O&amp;M</th>
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</thead>
</table>

- Solids-Contact / Sludge Blanket Conventional Clarifiers
  - ~3x the area of plate settlers

- Straight-flow / Up-flow Conventional Clarifiers
  - ~5x the area of plate settlers
# Advantages of Plate Settlers

- Plates typically boost settled water quality

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[Image of a plate settler with water flowing through]
Advantages of Plate Settlers

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- Plates typically allow modest reduction in coagulant dosage
Advantages of Plate Settlers

- O&M is straightforward
  - Only moving parts are in sludge collection mechanism
  - Hosing down typically needed monthly
SIZING CRITERIA
From settling theory, capacity is proportional to horizontal surface area.

Capacity = Loading Rate \times \text{Horizontal Surface Area}

\text{gpm} \quad \text{gpm/sf} \quad \text{sf}
But horizontal surface area is **not** the same as footprint.
For plate settlers, capacity is based on **Surface Loading Rate (SLR)**

- Calculated over *horizontally projected area*
- Typically 0.3 gpm/sf
TCEQ currently grants capacity based on **Surface Overflow Rate (SOR)**

- Calculated over *footprint* of equipment (including troughs and support equipment)
- 3.0 gpm/sf  (vs. 1.0 gpm/sf per TAC 290)
Available pilot data appears to support higher loading rates

Missouri City pilot study approach:

- Initial SLR of 0.3 gpm/sf; later 0.6 gpm/sf (using efficiency multiplier of 90%)
Missouri City Pilot Study Results

- Increased SLR did not increase settled water turbidity.

![Bar chart showing average turbidity (NTU) for raw water and settled water at different surface loading rates (SLR).]

<table>
<thead>
<tr>
<th>Surface Loading Rate (SLR)</th>
<th>Average Turbidity (NTU)</th>
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<tbody>
<tr>
<td>0.3 gpm/sf</td>
<td>334 NTU</td>
</tr>
<tr>
<td>0.6 gpm/sf</td>
<td>103 NTU, 100 NTU, 1.31 NTU</td>
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UPRATING IS AN OPTION: MISSOURI CITY CASE STUDY
Missouri City Surface Water Treatment Plant
## Typical Turbidity

<table>
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<tr>
<th>Month</th>
<th>Raw Water</th>
<th>Settled Water</th>
</tr>
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<tbody>
<tr>
<td>April 2013</td>
<td>33</td>
<td>0.70</td>
</tr>
<tr>
<td>May 2013</td>
<td>33</td>
<td>0.72</td>
</tr>
<tr>
<td>June 2013</td>
<td>43</td>
<td>0.75</td>
</tr>
<tr>
<td>July 2013</td>
<td>33</td>
<td>0.84</td>
</tr>
</tbody>
</table>
Draft full-scale challenge test protocol has been submitted to TCEQ
Proposed Goal: 0.6 gpm/sf while maintaining turbidity below 3.0 NTU 95% of time

- If approved, Missouri City plate settler capacity will **double** (11 mgd to 22 mgd)
• Plate settlers offer multiple advantages

• Sizing is based on Surface Loading Rate (SLR)
  – However, TCEQ grants capacity based on Surface Overflow Rate (SOR)

• Uprating is an option, like Missouri City case
Thank you for attending

QUESTIONS, COMMENTS