American Academy of Environmental Engineers and Scientists Technical Webinar:

Tulare Lake Compost
Attaining Sustainability in a Nonattainment Area

June 4, 2020
Speakers

Carl Wm. Glass, P.E.
Carl is a Mechanical Engineer in the Reuse and Compliance Section with the Sanitation Districts. For the past 34 years he has been working on programs that apply technical engineering principles to resource recovery operations. He received a B.S in mechanical engineering from the University of Delaware and an M.S. in environmental engineering from Loyola Marymount University. Carl will discuss operational challenges and innovations at TLC.

Brian Polson
Brian is an Environmental Engineer in the Air Quality Engineering Section with the Sanitation Districts. For the past 5 years he has been evaluating regulations and audits to ensure compliance. He received a B.S in chemical engineering from the University of California Irvine and an M.S. in environmental engineering from California State University Fullerton. Brian will discuss air quality challenges and findings at TLC.

Larry Wong, P.E.
Larry is a Civil Engineer in the Wastewater Research Section with the Sanitation Districts. For the past 12 years he has been working on research programs that help develop practical solutions for the public sector. He received a B.S in civil engineering from the University of California Berkeley and an M.S. in civil engineering from the University of California Los Angeles. Larry will discuss research challenges and strategies at TLC.
Who are the Los Angeles County Sanitation Districts?

- 24 independent special districts
- Serving about 5.6 million people
- Approximately 850 square miles
- Encompassing 78 cities and unincorporated areas of the county
OUR MISSION

To protect public health and the environment through innovative and cost-effective wastewater and solid waste management and, in doing so, convert waste into resources such as recycled water, energy, and recycled materials.
Topics to be Discussed Today

• Unique opportunity and vision at Tulare Lake Compost

• Challenges in meeting air quality regulations

• Research and results

• Meeting air quality and throughput objectives
Need to Manage Biosolids

<table>
<thead>
<tr>
<th>Facility</th>
<th>Flow Rate</th>
<th>Annual Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>JWPCP</td>
<td>260 MGD</td>
<td>~440,000 WTPY</td>
</tr>
<tr>
<td>Valencia WRP</td>
<td>14 MGD</td>
<td>~26,000 WTPY</td>
</tr>
<tr>
<td>Lancaster WRP</td>
<td>14 MGD</td>
<td>~13,000 WTPY</td>
</tr>
<tr>
<td>Palmdale WRP</td>
<td>10 MGD</td>
<td>~9,000 WTPY</td>
</tr>
</tbody>
</table>

- 488,000 tons per year
- 1,300 tons per day
- 50x/day
Biosolids Management Circa 1990

- Landfill 80%
- Composting 20%
Biosolids Options Start to Dwindle Circa 2000

• Puente Hills Landfill closure
• Onsite operations ended
• Land application bans
Districts Needed a Solution

- Reliable
- Fully owned and operated
- Ability to handle full production
- Environmentally responsible
- Waste into resource
Central Valley Option

• Lots of available land
• One of the largest agricultural regions in the country
• Abundance of agricultural wood waste
• Huge demand for fertilizers and soil amendments
Tulare Lake Compost

Access Road

Utica Ave.

Kettleman City

Compost Facility

200 miles from JWPCP
Composting turns biosolids into a valuable soil conditioner

Biosolids + Bulking Agents and Moisture + Elevated Temperatures → Compost

\[ \begin{align*}
\uparrow \text{Soil health} \\
\uparrow \text{Crop yield} \\
\downarrow \text{Irrigation} \\
\downarrow \text{Evaporation} \\
\downarrow \text{Fertilizers}
\end{align*} \]
EPA Definition of Class A Exceptional Quality Compost

• Biosolids treated beyond what occurs at the treatment plant
• PFRP – Process to Further Reduce Pathogens
  • Maintaining a temperature of 131°F for 3 days further kills pathogens
• VAR – Vector Attraction Reduction
  • 14 days at 104°F reduces the vector attraction potential
  • Vectors are animals or insects that can carry disease, such as rats, flies, mosquitos, etc.
Air Emissions
Challenges to Bring TLC Up To Full Permitted Capacity
Air Quality Concerns

8-Hour Ozone Nonattainment Areas (2015 Standard)

Tulare Lake Compost

Nonattainment areas are indicated by color. When only a portion of a county is shown in color, it indicates that only that part of the county is within a nonattainment area boundary.
Composting Emissions

Volatile Organic Compounds (VOCs)

Ammonia

Facility emissions cap for VOCs and ammonia (pounds/year)
Positively Aerated Static Pile
Aerated Static Pile with Engineered Cover

- Weather Resistant
- Oxygen Sensor
- CO₂ Temperature Sensor
- Odors / Volatile Compounds
- Moisture
- Heat
- Bacteria
- Anchor System

Air

Anchor System
Synthetic Fabric Cover System
## Synthetic Fabric Cover System Emission Results

<table>
<thead>
<tr>
<th></th>
<th>Cedar Grove Pilot Study</th>
<th>September 2016 Compliance Test</th>
<th>February 2017 Compliance Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOC EF (lb/ton)</td>
<td>0.2</td>
<td>2.6</td>
<td>0.75</td>
</tr>
<tr>
<td>Biosolids Throughput (tons/year)</td>
<td>500,000</td>
<td>39,000</td>
<td>135,000</td>
</tr>
</tbody>
</table>

- **January 2007**: Initial setup and testing of the synthetic fabric cover system.
- **September 2016**: Compliance test showing improved performance.
- **February 2017**: Further tests with consistent results.
Synthetic Fabric Cover Conclusion

Climatic conditions of high temperatures and low humidity inhibited cover performance.

- Polyester
  - Impermeable
  - Breathable
  - Membrane
  - Rain water impermeable
  - Air and steam permeable
  - Example of breathable impermeable membrane
  - Water and odor components re-condensation
Alternative Composting Method

• Extended Aerated Static Pile (eASP) with finished compost biofilter cover
Potential Benefits of eASP

• Low VOC and ammonia emissions
• Biofilter cover made from recycled compost
• Operational cost savings
  • Adapts to windy and hot environment
  • Low material handling
  • Increased capacity within existing footprint
  • Easy to adjust the composting process
• Demonstrated in-practice and recognized as Best Available Control Technology for commercial biosolids composting facilities
Windrow Construction
vs
eASP Design and Construction
Supervisory Control and Data Acquisition
Research and Results
Challenges to Bring TLC Up To Maximum Capacity
Research and Results

• Early trial and error – eASP #1-4  (in-house testing)
• Emissions compliance test – eASP #5-6  (3rd party testing)
• Optimization results – eASP #7-12  (in-house testing)
There are Two Major Compliance Requirements

Emissions (Air Permit)

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Emission Factor Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>NH₃</td>
<td>&lt;1.79 lbs-NH₃ / ton mix</td>
</tr>
<tr>
<td>VOC</td>
<td>&lt;0.20 lbs-VOC / ton mix</td>
</tr>
</tbody>
</table>

Compost Core Temperature (EPA 503)

- PFRP: ≥131°F
- VAR: ≥104°F
- 3 days
- 14 days
## eASP #1: Learning to Build, Operate, and Test

### Biofilter Cover Cross-Section

<table>
<thead>
<tr>
<th>Test</th>
<th>Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emission Factor (lbs / ton mix)</td>
<td>Operations</td>
</tr>
<tr>
<td>NH₃</td>
<td>VOC</td>
</tr>
<tr>
<td>eASP #1</td>
<td>0.10</td>
</tr>
<tr>
<td>Target</td>
<td>&lt;1.79</td>
</tr>
</tbody>
</table>
**eASP #2: Implemented Major Changes to Improve Emissions**

Block wall retains heat and prevents air intrusion

<table>
<thead>
<tr>
<th>Test</th>
<th>Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>eASP #2</td>
<td>Emission Factor (lbs/ton mix)</td>
</tr>
<tr>
<td></td>
<td>NH₃</td>
</tr>
<tr>
<td>Target</td>
<td>&lt;1.79</td>
</tr>
<tr>
<td>eASP #2</td>
<td>0.04</td>
</tr>
</tbody>
</table>

*Screened* Finished Compost

*Unscreened* Finished Compost

Biofilter Cover Cross-Section
eASPs #3-4: Adjusting Aeration Scheme to Achieve Temperature Compliance Quicker

More starting air appears to speed up meeting PFRP

More starting air appears to increase early core temp.

<table>
<thead>
<tr>
<th>eASP</th>
<th>Starting Air</th>
<th>Days to Pass PFRP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Timing</td>
<td>Blower Setting</td>
</tr>
<tr>
<td>2</td>
<td>After Build</td>
<td>50%</td>
</tr>
<tr>
<td>3</td>
<td>During Build</td>
<td>100%</td>
</tr>
<tr>
<td>4</td>
<td>During Build</td>
<td>100%</td>
</tr>
</tbody>
</table>
Early Results Recap for eASPs #1-4

<table>
<thead>
<tr>
<th>Test</th>
<th>Compliance</th>
<th></th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Emissions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NH\textsubscript{3}</td>
<td>VOC</td>
<td>Core Temp</td>
</tr>
<tr>
<td>eASP #1</td>
<td>0.10</td>
<td>1.6</td>
<td>1 failed</td>
</tr>
<tr>
<td>eASP #2</td>
<td>0.04</td>
<td>0.05</td>
<td>1 slow to heat up</td>
</tr>
<tr>
<td>eASP #3 / 4</td>
<td>-</td>
<td>0.20</td>
<td>All passed</td>
</tr>
<tr>
<td>Target</td>
<td>&lt;1.79</td>
<td>&lt;0.20</td>
<td></td>
</tr>
</tbody>
</table>
**eASP #5-6: Verify eASP Emissions for SJVAPCD Compliance Test**

<table>
<thead>
<tr>
<th>Test</th>
<th>Emissions</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>NH₃</td>
<td>0.03</td>
<td>0.12</td>
</tr>
<tr>
<td>eASP #5 / 6</td>
<td>All passed</td>
<td></td>
</tr>
<tr>
<td>Target</td>
<td>&lt;1.79</td>
<td>&lt;0.20</td>
</tr>
</tbody>
</table>
eASP #7–8 Simplified Aeration

- Rerouted (above-ground) air header
- Expected lateral air migration from existing headers
- Existing (below-ground) air headers

Cross-section of eASP
eASP #9 – Full Pad

Week #1

3 rows

Week #2

2 rows

Week #3

2 rows
## Completed Optimization Results

<table>
<thead>
<tr>
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<tbody>
<tr>
<td></td>
<td>Emissions</td>
</tr>
<tr>
<td></td>
<td>VOC (lbs/ton)</td>
</tr>
<tr>
<td>eASP #7 – air headers</td>
<td>-</td>
</tr>
<tr>
<td>eASP #8 – air headers</td>
<td>1.35</td>
</tr>
<tr>
<td>eASP #9 – full pad</td>
<td>-</td>
</tr>
<tr>
<td>Target</td>
<td>&lt;0.20</td>
</tr>
</tbody>
</table>

How did emissions go awry?
Prime Suspects

Too Dry

Too Thin
eASP #10 – Control Pile

- Full thickness biofilter cover
- Increased irrigation
- Existing air headers
# Completed Optimization Results Recap

<table>
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<tr>
<td></td>
<td>Emissions</td>
</tr>
<tr>
<td></td>
<td>VOC (lbs / ton)</td>
</tr>
<tr>
<td>eASP #7 – simplified aeration</td>
<td></td>
</tr>
<tr>
<td>eASP #8 – simplified aeration</td>
<td>1.35</td>
</tr>
<tr>
<td>eASP #9 – full pad</td>
<td></td>
</tr>
<tr>
<td>eASP #10 – control</td>
<td>0.08</td>
</tr>
<tr>
<td>Target</td>
<td>&lt;0.20</td>
</tr>
</tbody>
</table>
**eASP Irrigation and Leachate Production**

**Current Work eASPs #11-12:** Optimize irrigation program to minimize both emissions and leachate generation
Preliminary Results – Relationship Between Irrigation/Leachate Generation/Emissions

eASP Leachate Generation and VOC EF vs. Irrigation Rate
(eASPs 10 through 12)
Summary of Achievements

- Fully owned and operated management solution for full production of Sanitation Districts biosolids

- Understanding the air quality challenges of composting the central valley

- Adaptation of existing infrastructure for alternative composting system

- Proved eASP technology at TLC to maximize throughput
QUESTIONS?

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