P.O. Box 33
Bridgeport, PA 19405
(610) 272-0567
www.EnvoGuard.com

December 21, 2005

Product Demonstration:

Carboxx-HMA – City Bio-Solids Division - Southeastern Pennsylvania

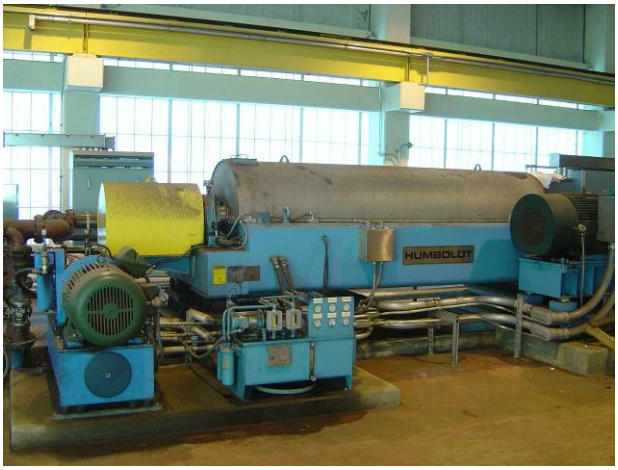
Objective:

The purpose of this demonstration is to quantify reductions of known odor causing compounds over the course of a 27 day time period. This document discusses the size and scope of the bio-solids operation, describes application procedures, and analyzes data collected during the demonstration period. The main objective of the 27 day demonstration is to achieve reductions in odor causing compounds and decrease odor complaints, making transportation of the bio-solids possible.

City Bio-Solids Division Operation:

The demonstration was performed at a city Bio-Solids Division (BSD) with influent volumes of ≈ 100, 000 gallons of municipal waste per day. This waste is sent to one of twelve 2 million gallon anaerobic digesters during a 9 minute period every half hour. The residence time in the digesters is approximately 20 days, during which waste is circulated and methane harvested.

Following the digester process, effluent is sent to one of ten high speed (500gpm) centrifuge systems, where effluent is reduced to a cake containing 30% solids. The BSD runs 16 hours a day and produces 800 tons of Bio-Solid cake per day.



The Bio-Solid cake is conveyed to pad sites during two 8 hour shifts per day. The first shift mixes 400 tons of Bio-Solid cake with 200 tons of wood chips for composting. This compost mix is put on concrete pads in 40' x 20' x 100' rows, covered with fresh wood chips, and left undisturbed for 7 days. The completed compost is then collected and moved to a common area for transport and use as fill material.

The second shift deposits un-amended Bio-Solid cake in similar rows to be left undisturbed for a period of 7 days. This material is then moved to a central collection site for removal to land application areas.

During the first 4 days after Bio-Solids have been centrifuged, there is a spike of odorous compound release due to incomplete reversion of methyl compound to methane.

Methods:

To quantify reductions in release of odor causing compounds, samples were sent to Bucknell University for Gas Chromatograph testing.

1. **Product Application:**

   Carboxx-HMA was applied during a 3 hour period to the material for one full row of both Bio-Solid cake and Compost mix at a rate of 3.4 ppm. Using a high pressure spray system the product was misted over the Bio-Solids prior to their transportation to the pad site. This allowed complete surface area contact along with some mixing as the Bio-Solids were transported and placed in rows.

2. **Sampling:**

   Samples were taken by BSD personnel and sent refrigerated the same day to Bucknell University.

   Samples were collected from:

   - Untreated Bio-Solid cake
   - Treated Bio-Solid cake
   - Untreated Compost mix
   - Treated Compost mix

3. Testing:

Bucknell University personnel placed equal weights of each sample into two capped testing containers. These eight containers were then sampled once a day by drawing a fixed volume of air from the trapped airspace in each container. Each sample was analyzed via Gas Chromatograph. The odor constituents analyzed were:

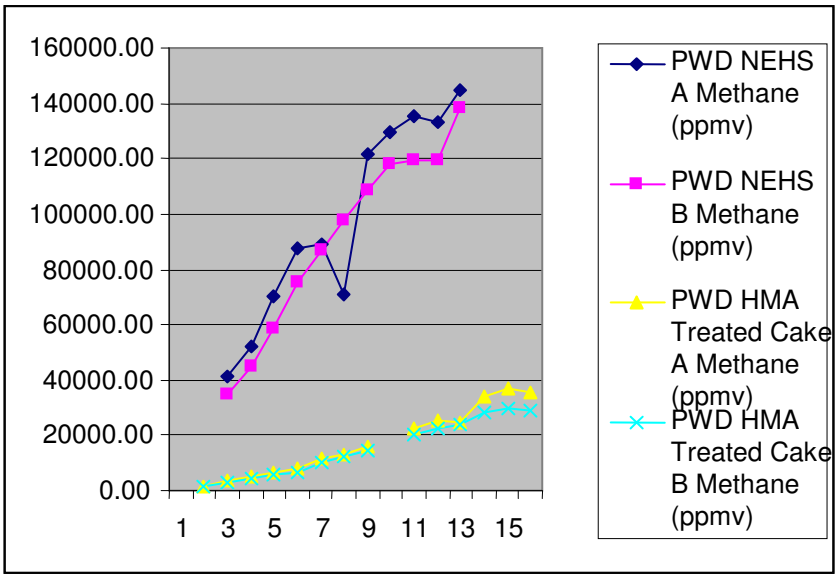
- Methane
- Hydrogen Sulfide
- Methyl Mercaptan
- Dimethyl Sulfide
- Dimethyl Disulfide

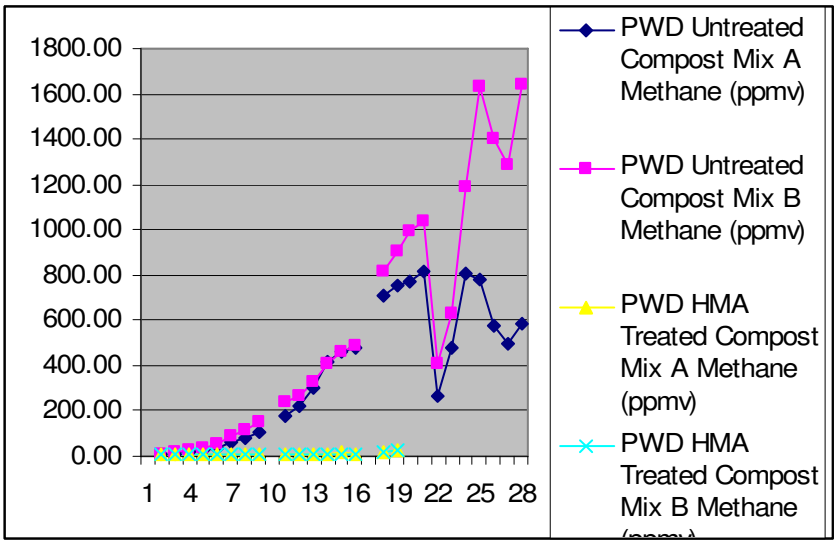
This procedure was repeated daily for 27 days.

Note: To reduce costs, individual odor constituent tests were ceased when results recorded zero for three days in a row.

Results:

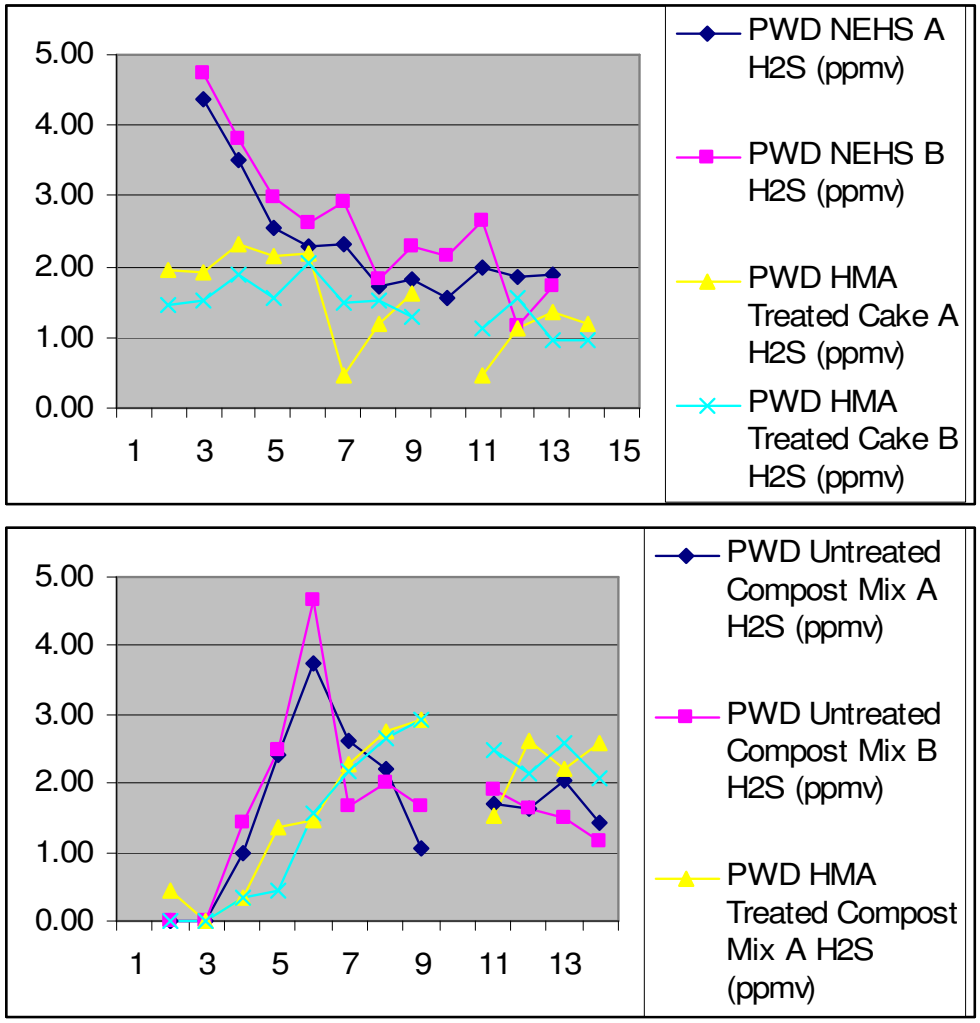
Methane:





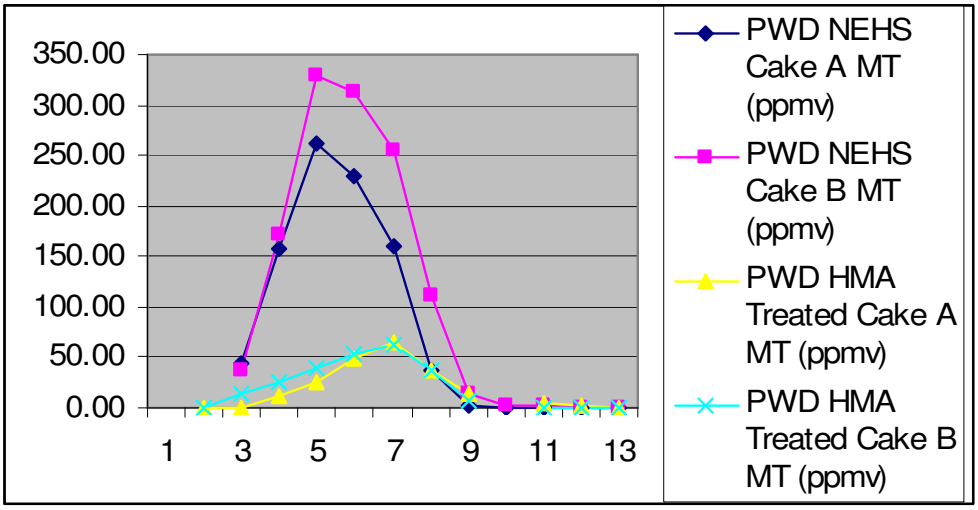
- Methane production during the demonstration was reduced by an average of:
  - **82% from Bio-Solid cake**
  - **97.5% from Compost mix**

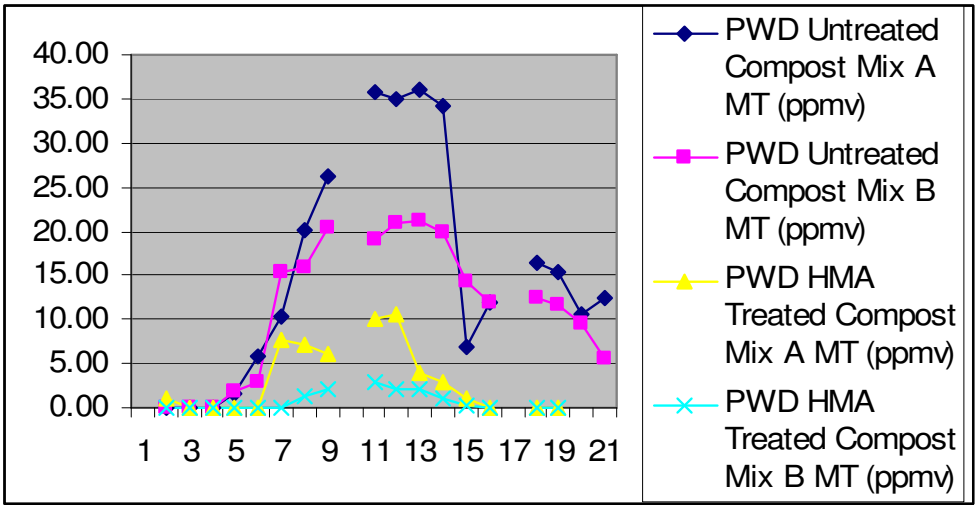
Hydrogen Sulfide:



- Hydrogen Sulfide production during the demonstration was reduced by an average of:
  - **41.5 % from the Bio-Solid Cake**
  - **Change in the curve eliminating H2S spike from Compost mix**

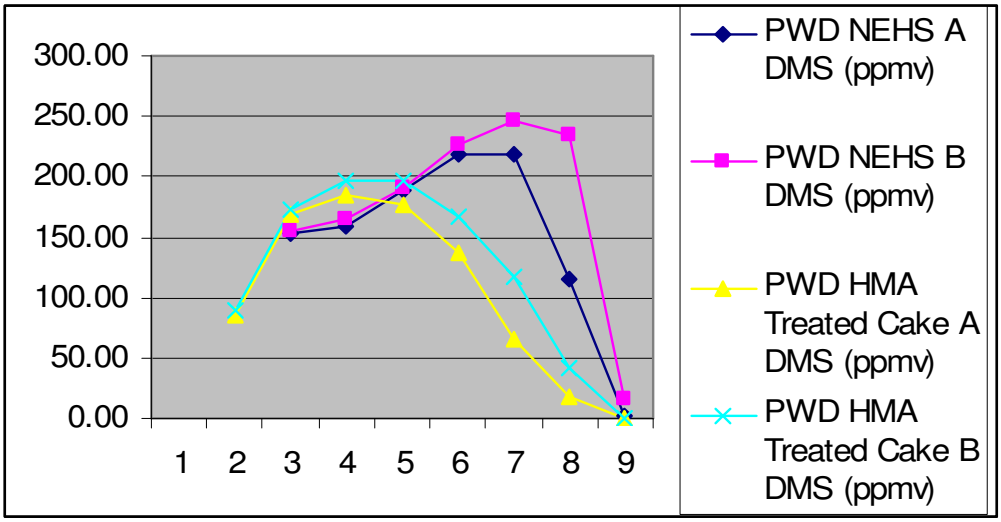
Methyl Mercaptan:

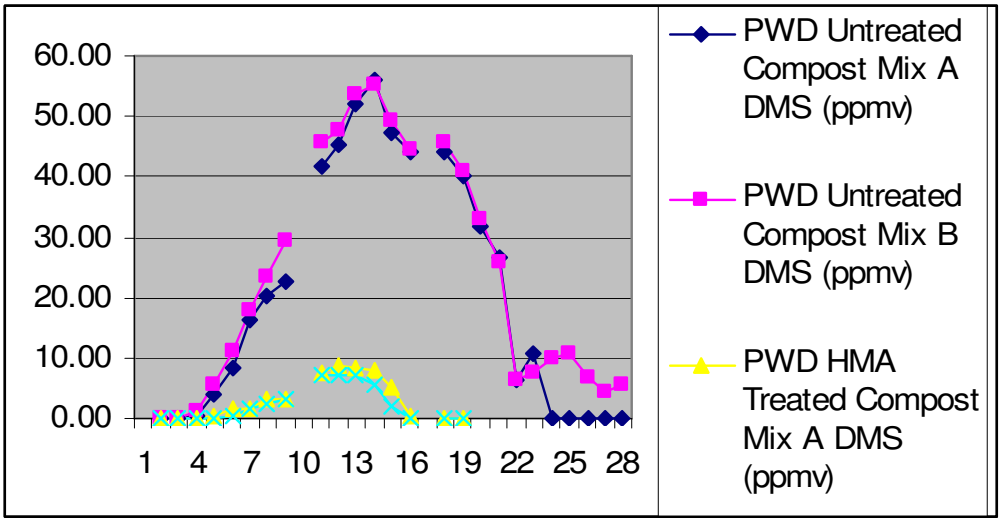




- Methyl Mercaptan production during the demonstration was reduced by an average of:
  - **78.8% from the Bio-Solid cake**
  - **87% from the Compost mix**

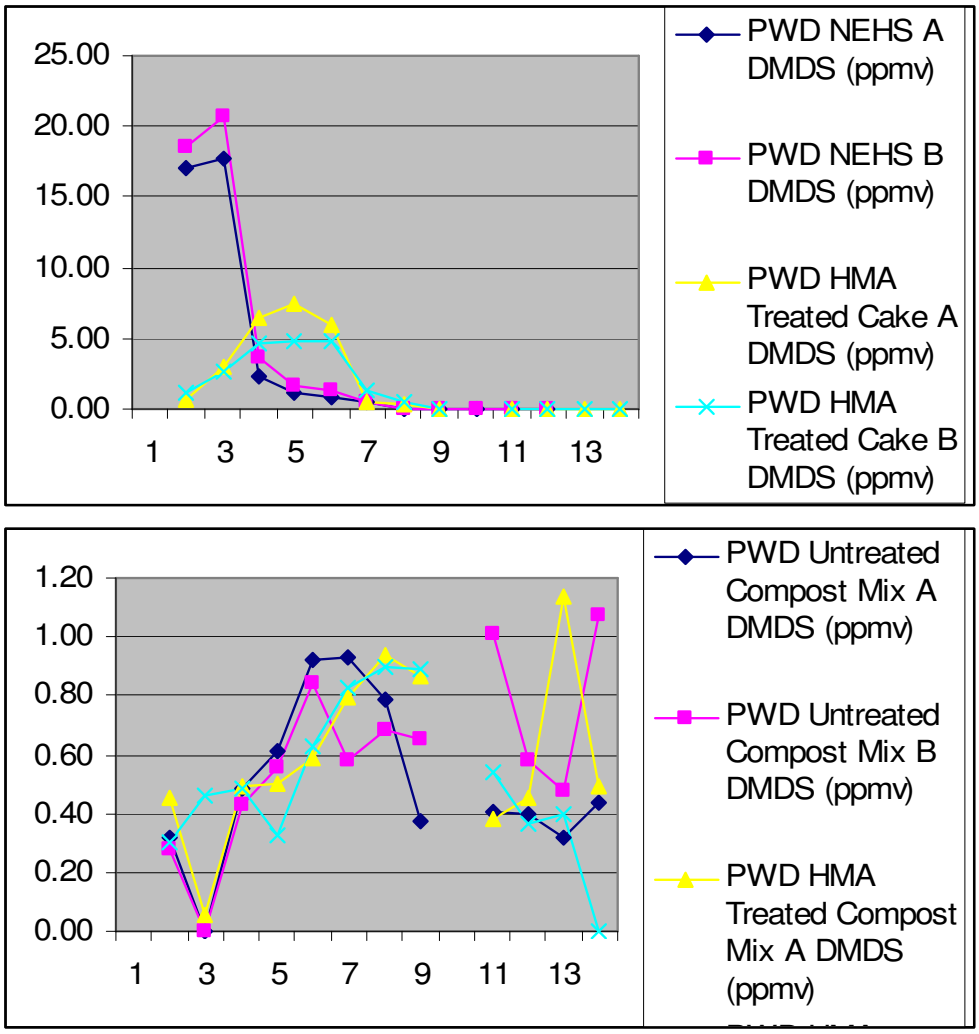
Dimethyl Sulfide:





- Dimethyl Sulfide production during the demonstration was reduced by an average of:
  - **20.5% from the Bio-Solid cake**
  - **92.3% from the Compost mix**

Dimethyl Disulfide:



- Dimethyl Disulfide production during the demonstration was reduced by an average of:
  - **48.8% from the Bio-Solid cake**
  - **No significant relationship in the Compost mix**

Conclusions:

Based on the results from testing conducted by Bucknell University, Carboxx-HMA treatment has been demonstrated effective in significantly reducing odor constituent release from both Bio-Solid cake and Bio-Solid Compost mix. At the recommended feed rate and application protocols, Carboxx-HMA is also cost effective and user friendly.