


Spotsylvania County's Expanded Biosolids Composting Facility Uses Advances in Aerated Static Pile Technology

by

Todd O. Williams, P.E., BCEE

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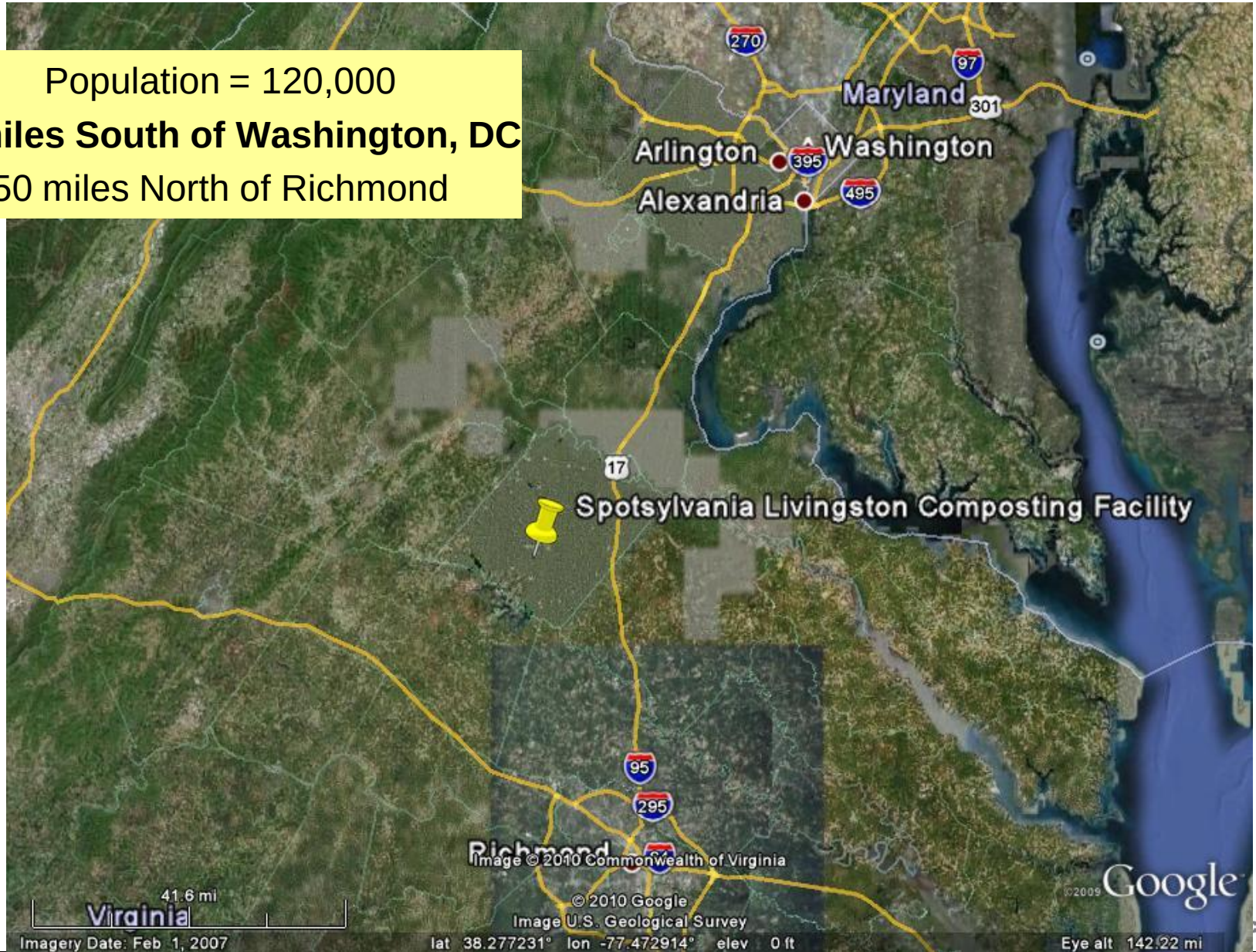
- Co-Authors
  - Ed Petrovitch, Spotsylvania County
  - Doug Crooks, Spotsylvania County
  - Ben Loveday, Spotsylvania County
  - Chris Easter, CH2M HILL
  - Mohidur Rahman, CH2M HILL

Spotsylvania County, Virginia

Population = 120,000

50 miles South of Washington, DC

50 miles North of Richmond



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SPOTSYLVANIA COUNTY, COMPOSTING OVERVIEW of OLD FACILITIES

- Covered Aerated Static Pile Composting
- Demonstration Initiated in 2001
- Full Scale Implemented in 2003
- Belt Filter Dewatered Undigested Solids
- Average 16% Cake Solids
- Capacity = 27 Wet Tons per Day
- Ground Brush is Primary Bulking Agent
- Capital Cost of Original Facilities ~ $2M

WWTP RESIDUALS CAKE

OLD BULKING AGENT STORAGE

OLD MOBILE BATCH MIXER

OLD ASP AND BUILDING

OLD AERATION SYSTEM

OLD AERATION

- Positive Aeration Only
- Above Ground HDPE Pipe
- Cycling Timers

SCREENING WITH TROMMEL

COMPOSTING FACILITY EXPANSION NEED

- Composted Dewatered Solids From Massaponax WWTP Only
  - 240 tons/week (12,800 tons annually)
- Landfilled Solids From FMC WWTP
  - 120 tons/week
- Old Facility was Operating at Capacity
- Needed to Expand to Manage Solids Production Through 2025
  - Planned Capacity of 560 tons per week or 29,250 tons WWTP Solids per year

SPOTSYLVANIA COMPOSTING FACILITY EXPANSION FEATURES

- Incorporates Existing Structures and Equipment
- Incorporates Significantly Upgraded Process Controls
- Includes Odor Control
- Capacity is 80 TPD of Dewatered Solids, 7 days per week
- Capital Cost of Expanded Facilities = $15.5M

EXPANDED COMPOST FACILITY KEY ISSUE: ODOR CONTROL QUESTIONS

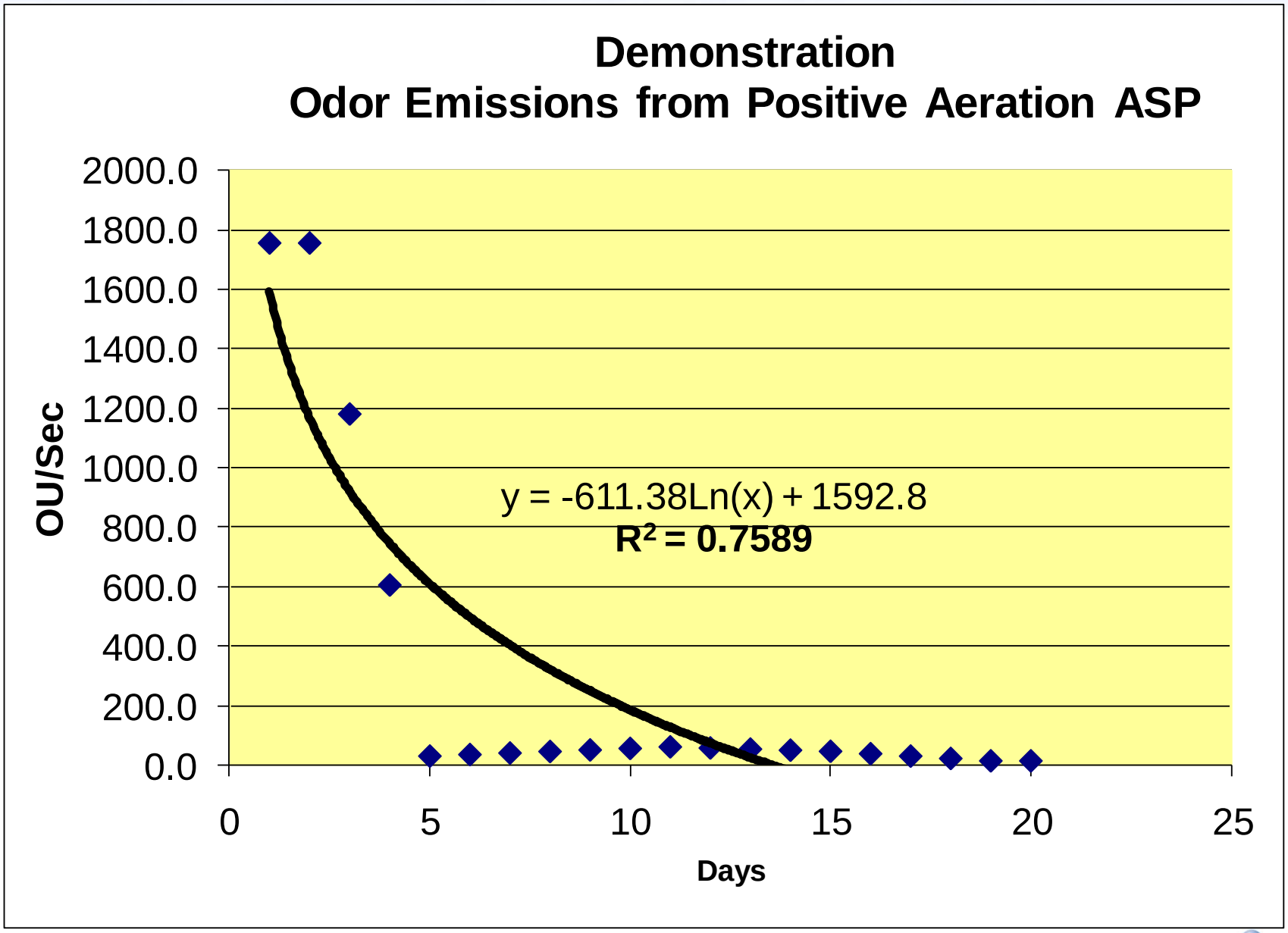
- What degree of odor control would be required?
- Should the facility be enclosed?
- How should odor control vs. capital cost be balanced to achieve the level of odor control needed without expending excessive engineering and capital costs?
- The first step was to perform odor sampling of two design approaches and then to model the performance expected

ODOR SAMPLING/TESTING

- Open Hood with Evacuated Chamber Sampler for Positive Aeration
- Flux Chamber with Sweep Air and Evacuated Chamber Sampler for Negative Aeration

ODOR SAMPLING

- Sampled Compost Piles in Positive Aeration Mode
  - Fans On, Fans Off
- Sampled Compost Piles in Negative Aeration Mode
- Sampled Compost Pile Exhaust
- Sampled Cure Piles in Positive Aeration Mode
  - Fans On, Fans Off
- Measured System Airflows
- Sampled Mix Building
- Calculated System Emission Factors
- Developed Odor Model with ISCST3 Using Local Meteorological Data (2006)


Demonstration
Odor Emissions from Positive Aeration ASP
OU/Sec
2000.0
1800.0
1600.0
1400.0
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
y = -611.38Ln(x) + 1592.8
R² = 0.7589
0
5
10
15
20
25
Days

ODOR EMISSION ESTIMATE

Proposed Expansion Configuration

	Positive Aeration Emissions		Negative Aeration Emissions		% Capture Compared to Positive Aeration Mode
	OU/Sec	% of Total	OU/Sec	% of Total	
Compost	6,850	**77**	200	9	**97**
Curing	2,040	**23**	2,040	91	0
Total	**8,890**	100	**2,240**	100	**75**

Odor Emissions W/O Biofiltration

TOTAL = 8890 OU/Sec

6850 OU/Sec

2040 OU/Sec

Composting

Curing

Odor Emissions With Biofiltration

TOTAL = 2905 OU/Sec

200 OU/Sec

Composting

2040 OU/Sec

Curing

665 OU/Sec

6650 OU/Sec

Biofiltration

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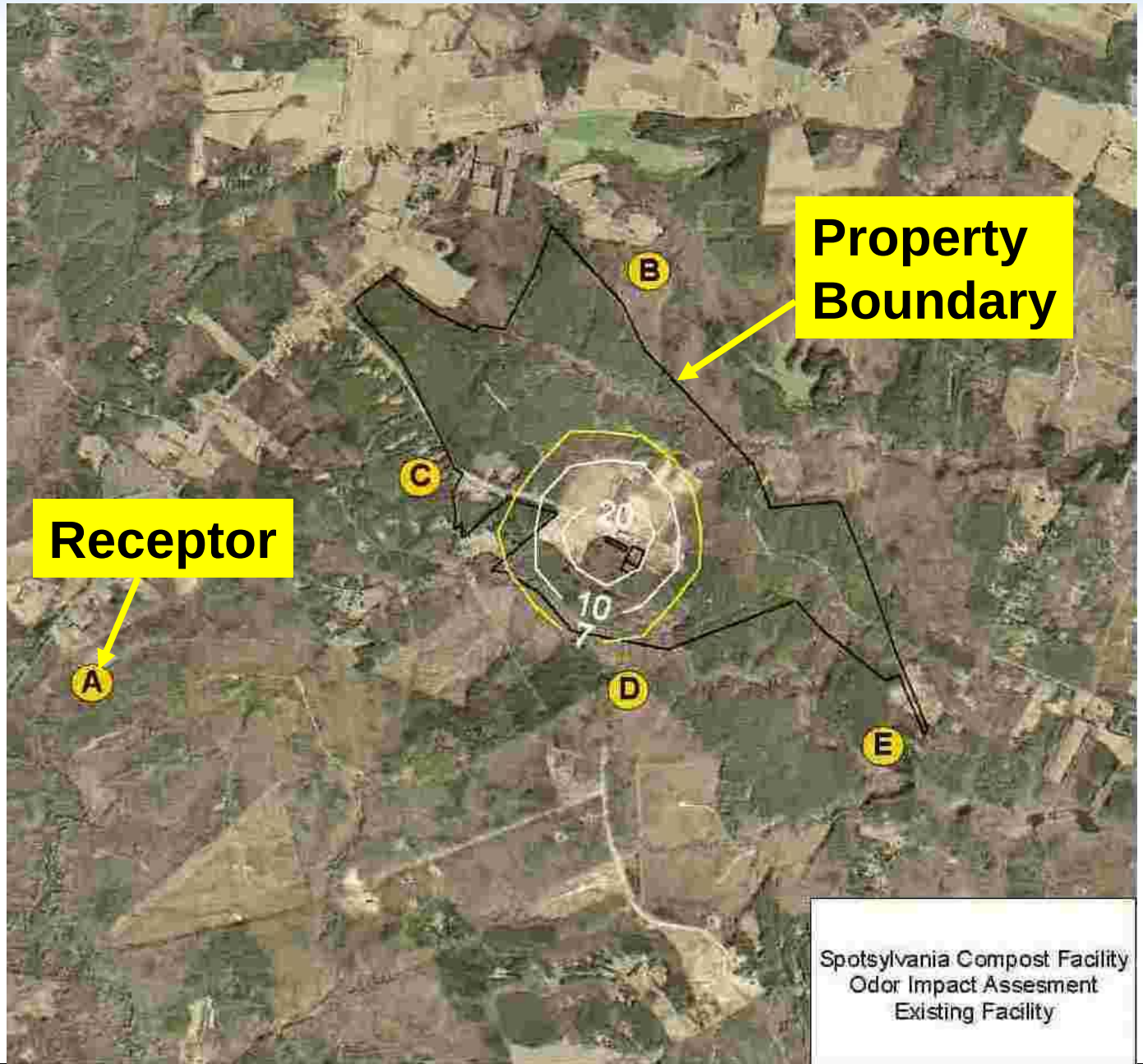
DEMONSTRATION RESULTS

- Based on these results, it appeared that the original facility could be expanded by 3 times the capacity without further odor impact using continuous negative aeration and odor treatment with biofilters
- Odor modeling was performed to validate this hypothesis

COMPOSTING FACILITY EXPANSION ODOR MODELING

- ASP Compost Facility Expansion
- Compare Existing Conditions to Future Conditions
  - Phase II Expansion to 3X Current Capacity
  - Phase III Expansion to 6X Current Capacity
- Goal of 7 D/T at Offsite Receptor Locations
- Emission Points Included
  - Biofilters
  - Compost & Mixing Building Up Blast Fans
  - Curing Piles

Odors From Old Operation at 6.67 DT/day with No Biofilters



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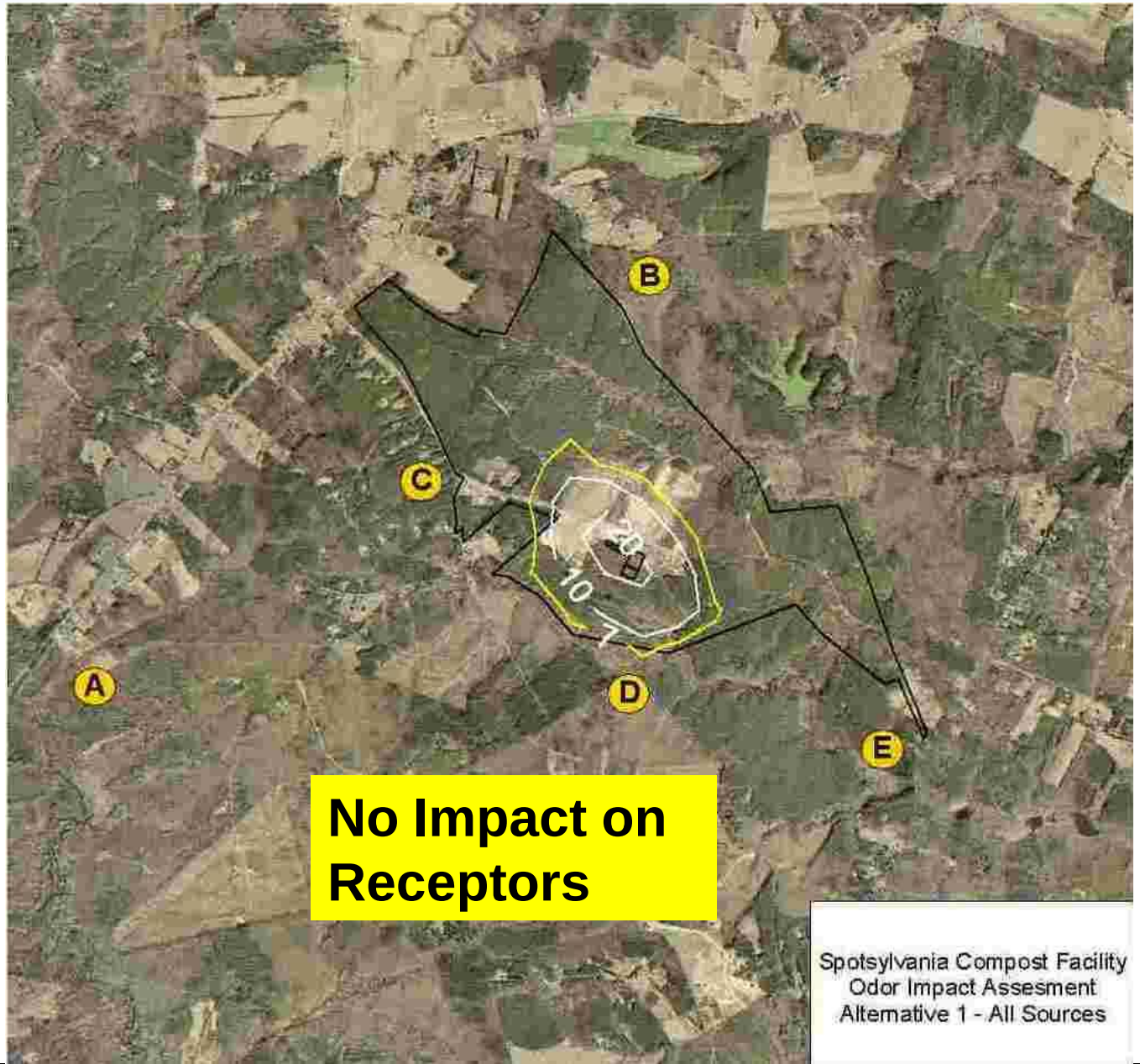
Predicted Phase II Expansion Odors at 18 DT/Day with Biofilters



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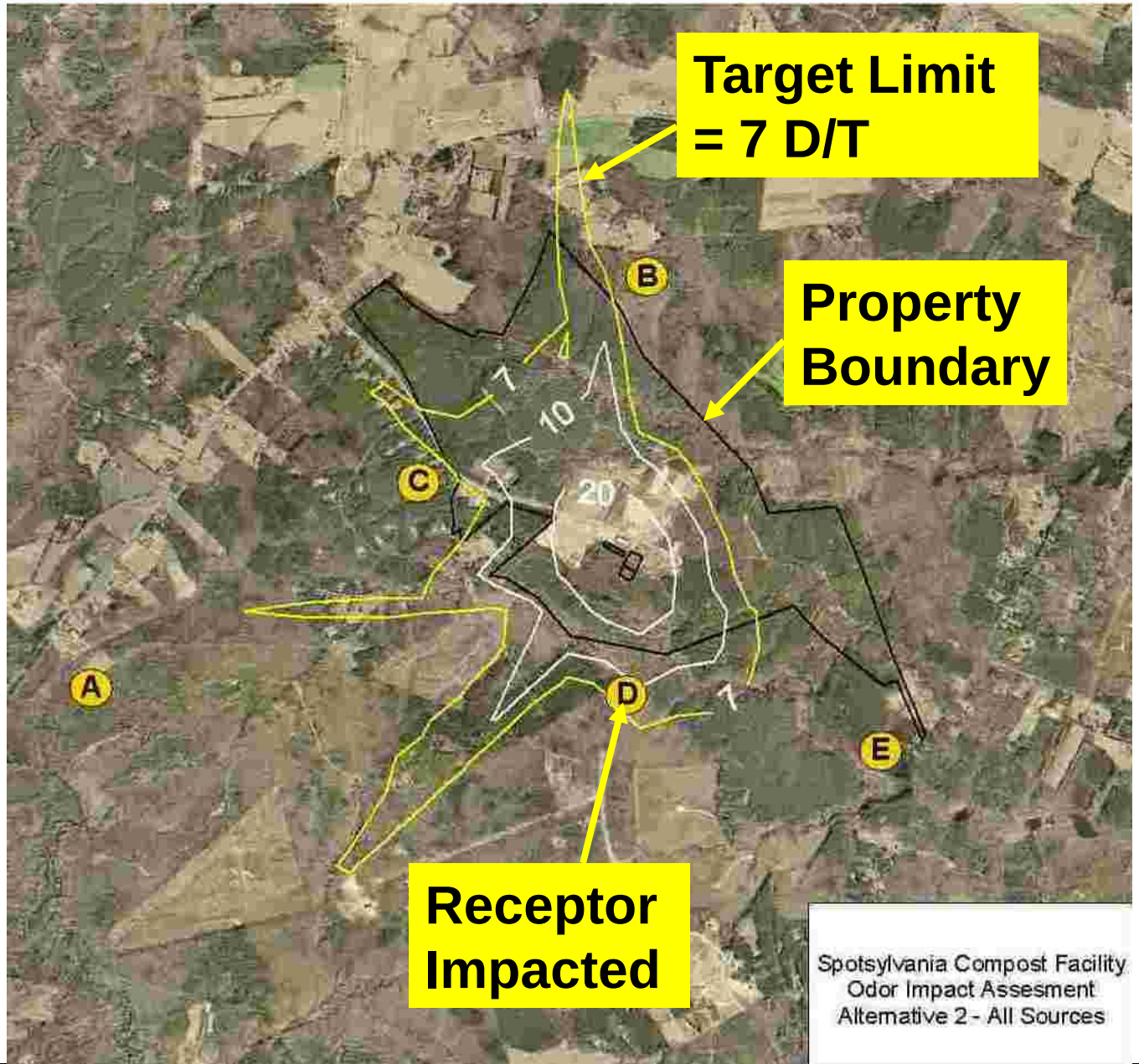
Predicted Phase III Expansion Odors at 36 DT/day with Biofilters



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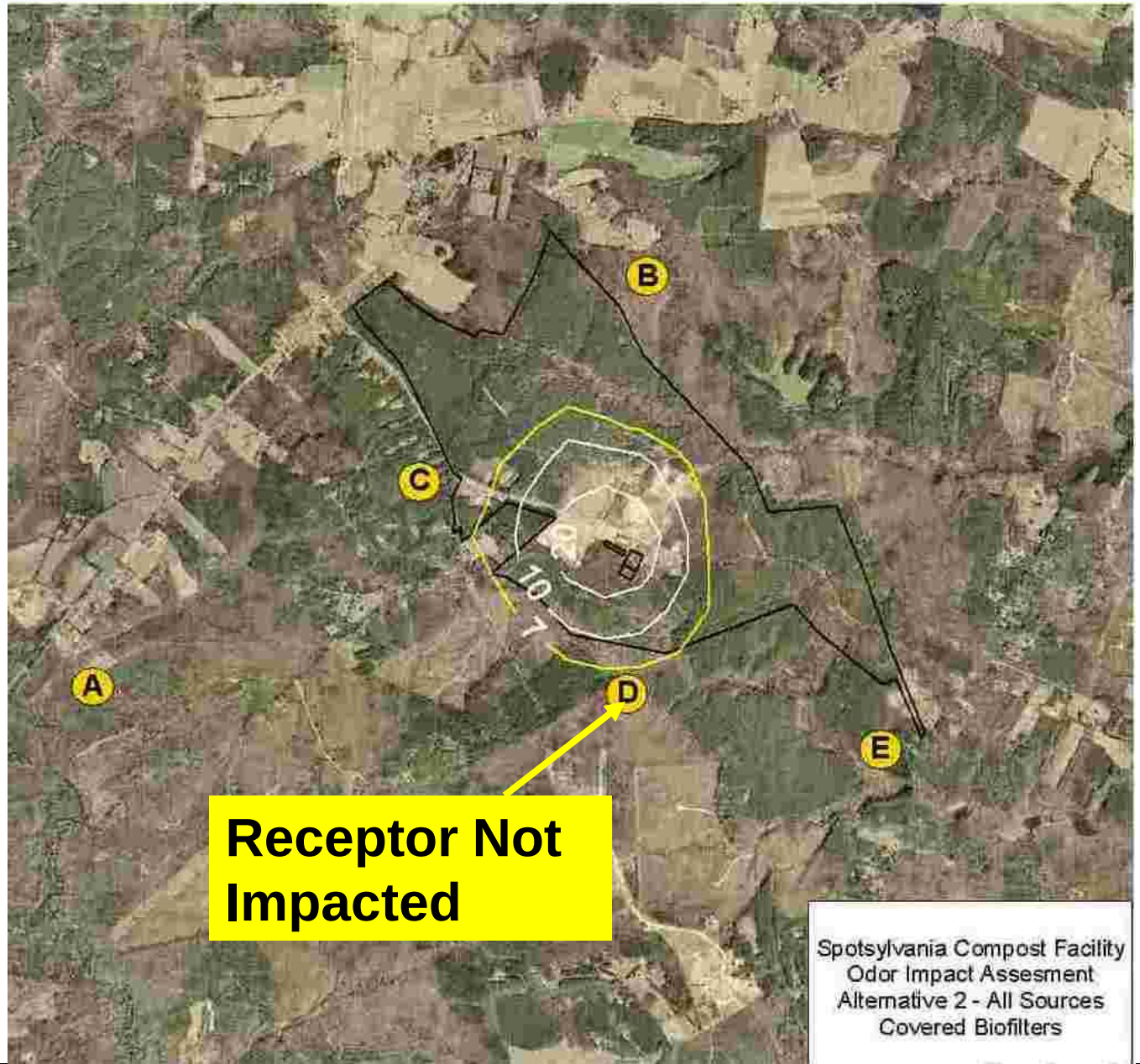
Phase III Expansion with Biofilters and Enhanced Dispersion



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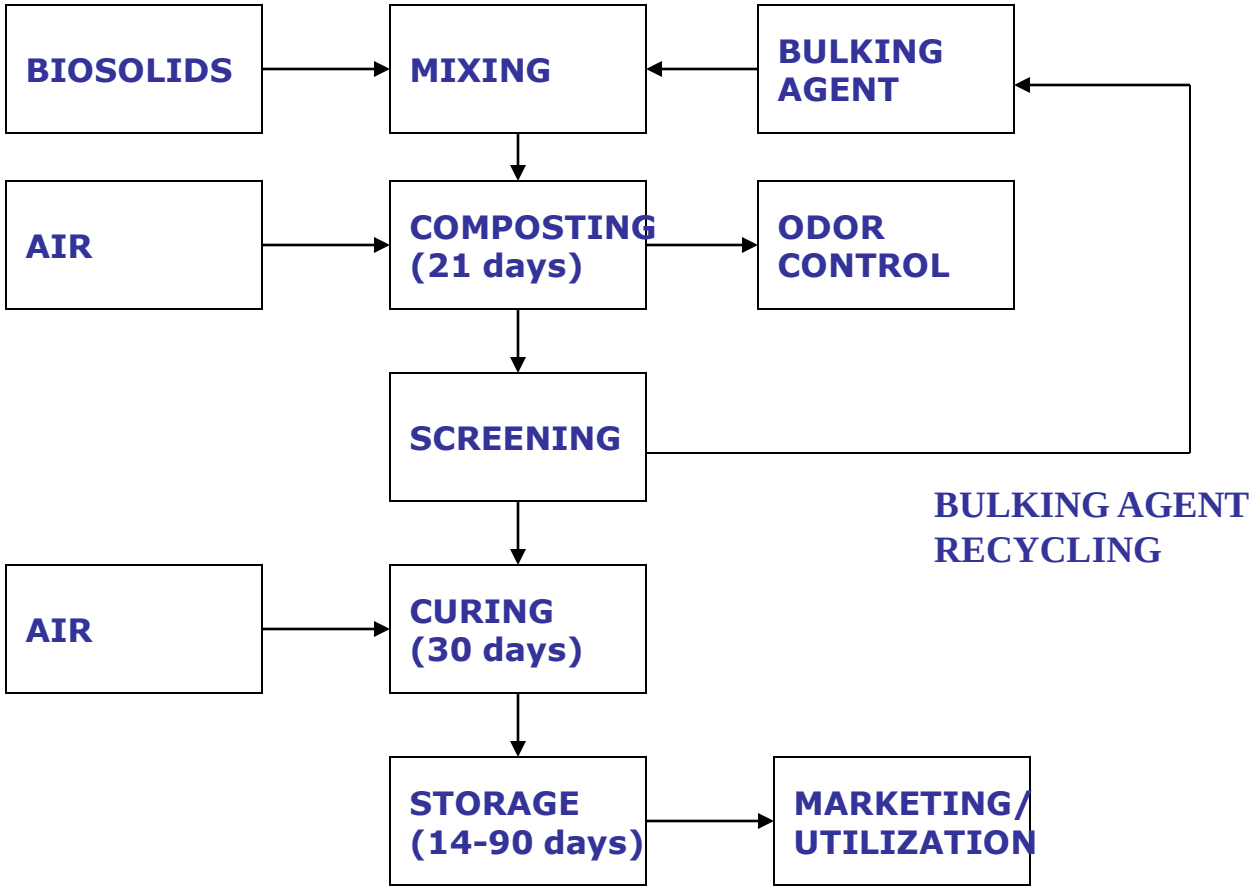
COMPOSTING FACILITY EXPANSION ODOR MODELING RESULTS

- Expansion Meets Target Odor Limit of 7 D/T at all Offsite Receptor Locations
- Phase III Expansion will Require Covering the Biofilters and Adding Up Blast Dispersion Fans to Achieve Target Odor Limit at all Offsite Receptor Locations

COMPOSTING FACILITY EXPANSION KEY DESIGN CRITERIA

- 18 DTPD (112.5 WTPD) capacity, 5 days per week
- 16%TS cake solids on average
- Mixing 4 hours per day, 5 days per week
- In-ground composting aeration system
- Continuous negative aeration during composting
- Odor control with maintenance redundancy
- Positive aeration during curing

SPOTSYLVANIA COMPOSTING PROCESS FLOW DIAGRAM



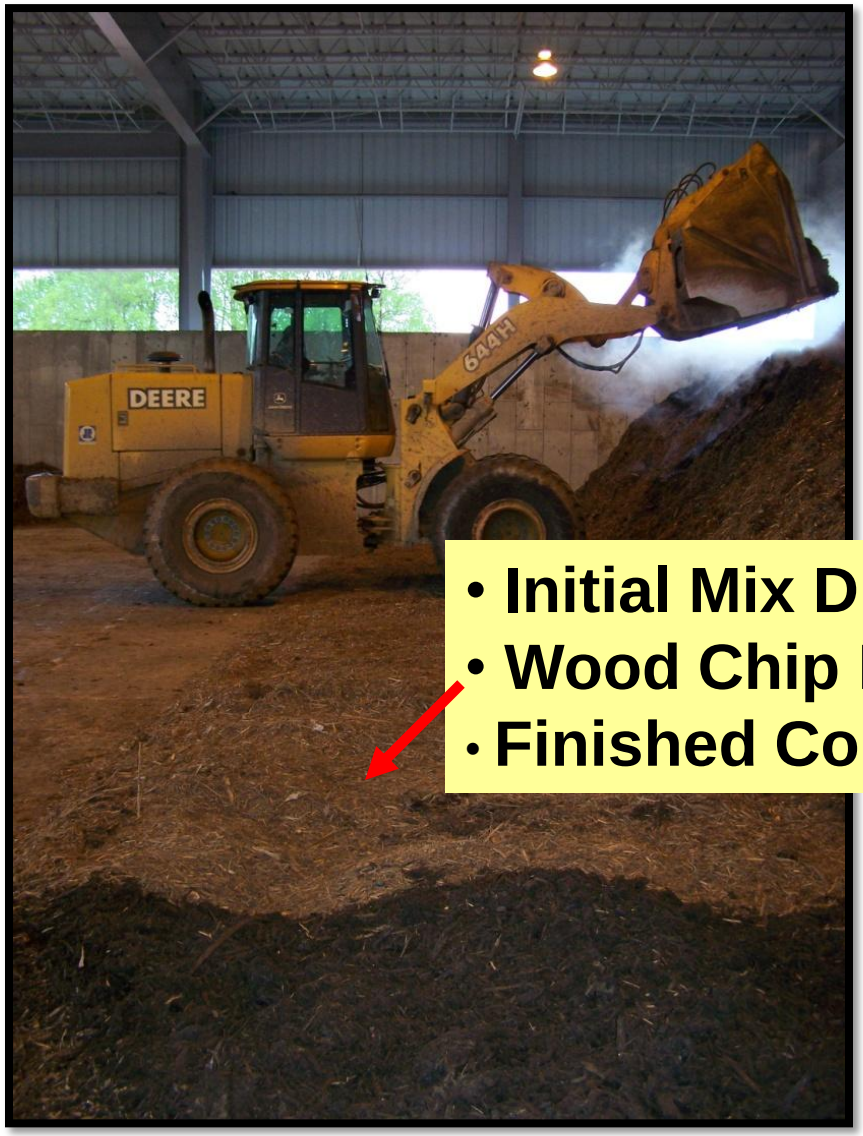
SPOTSYLVANIA COMPOSTING EXPANDED FACILITY

NEW BULKING AGENT STORAGE

MIXING WITH BATCH MIXERS

- Two 22 CY Mixers
- Weigh Scale Operation
- 30+ TPH Solids Capacity

PILE BUILDING



- Initial Mix Discharge
- Wood Chip Base
- Finished Compost Cover

COMPOST AERATION SYSTEM

- Negative Aeration Only
- Eighteen 1500 CFM Aeration Stations
- 5,000 cfh/dry ton capacity
- Continuous Aeration with Temperature Feedback and VFD Fan Control

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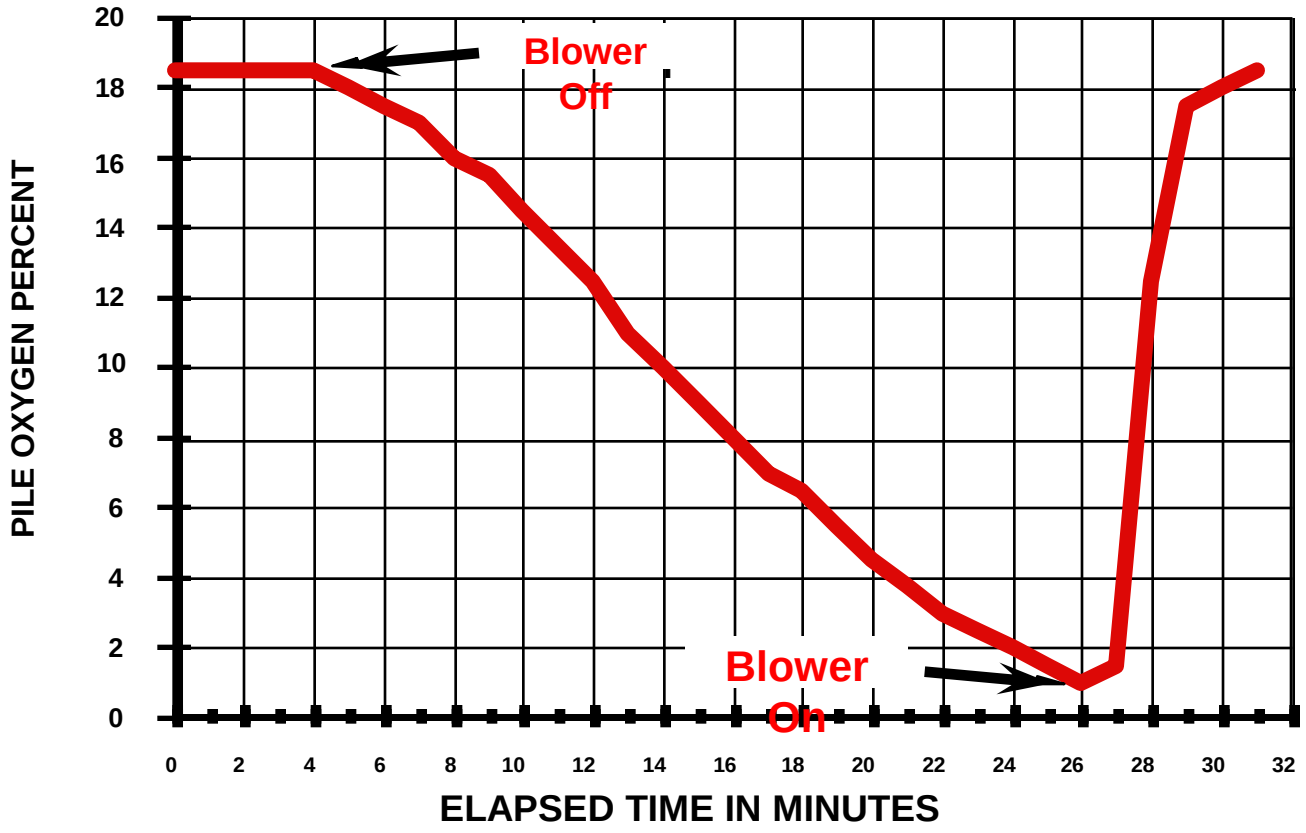
Why Continuous Aeration?

Active Compost Pile – Oxygen Depletion and Regeneration

Source: Murray and Thompson 1990's



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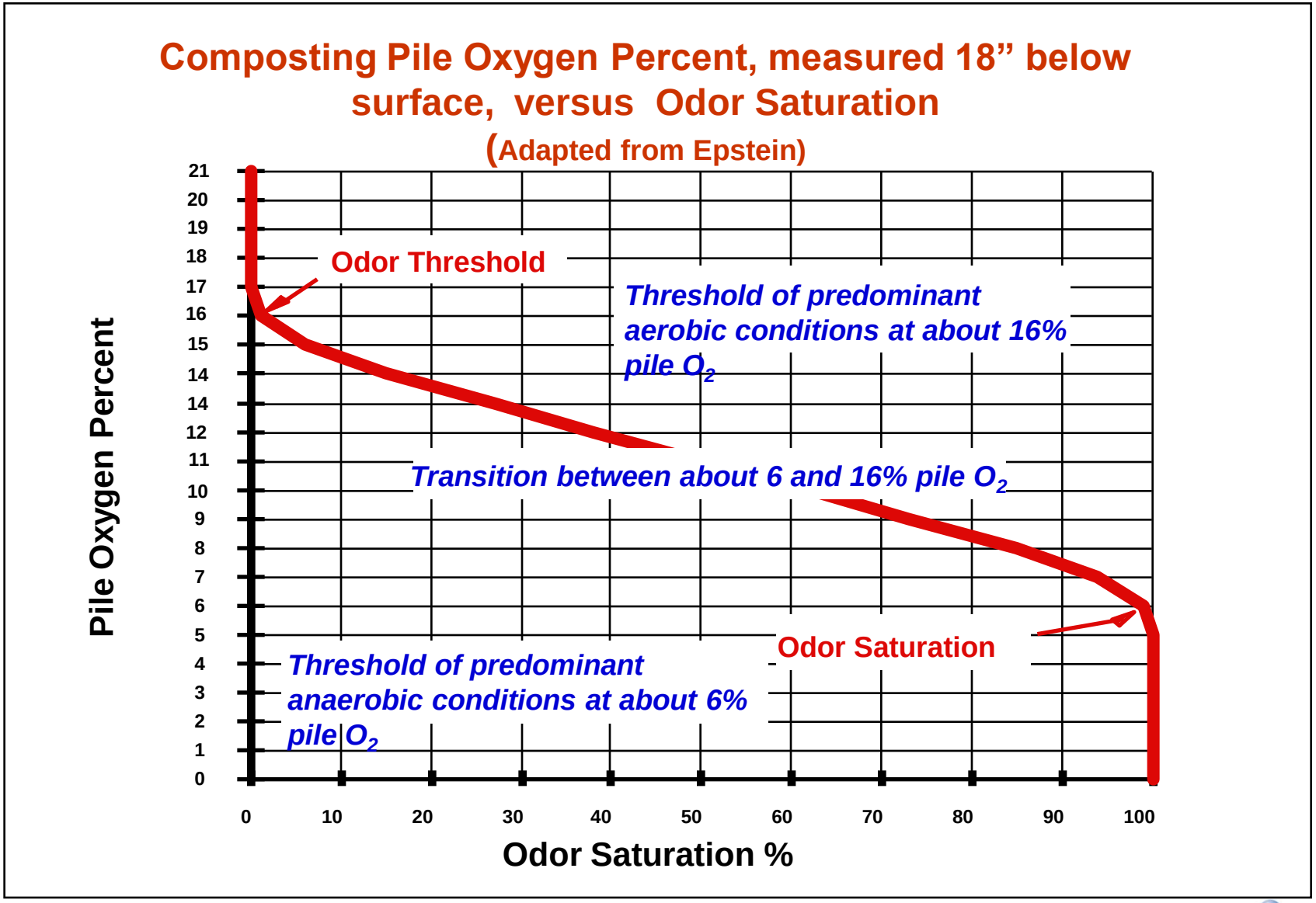
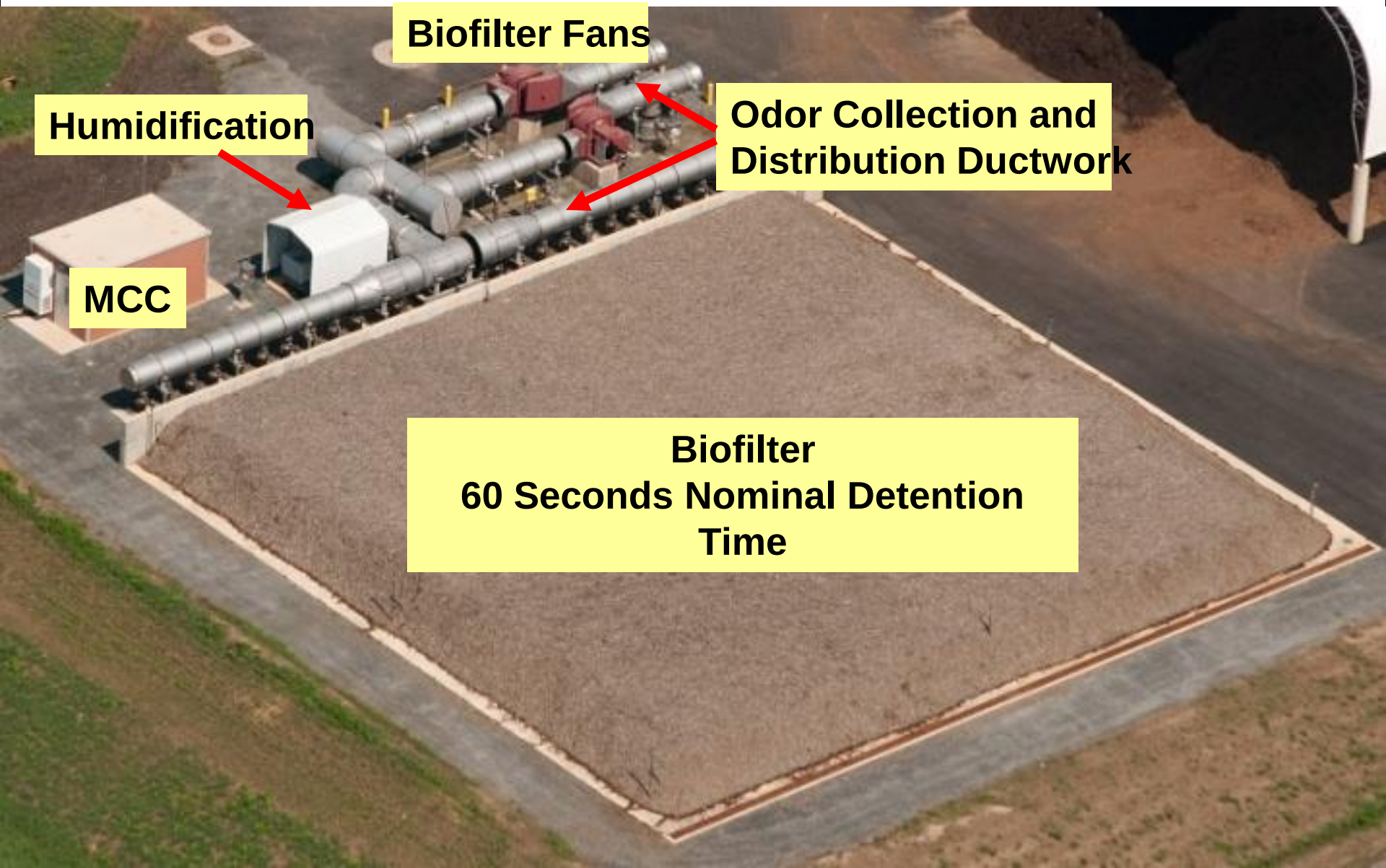
Pile Oxygen vs. Sulfur and VFA Odors



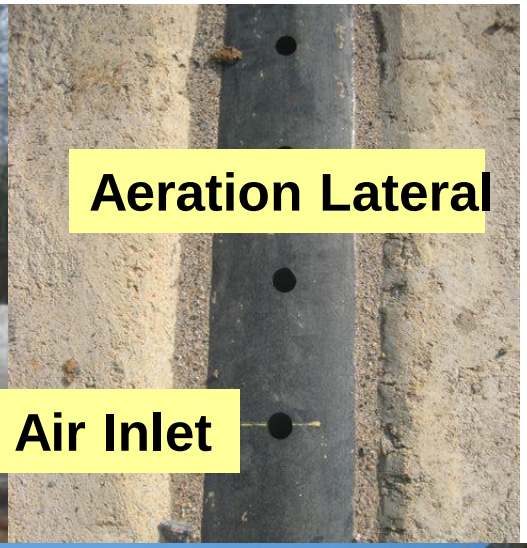
IN-FLOOR AERATION SYSTEM

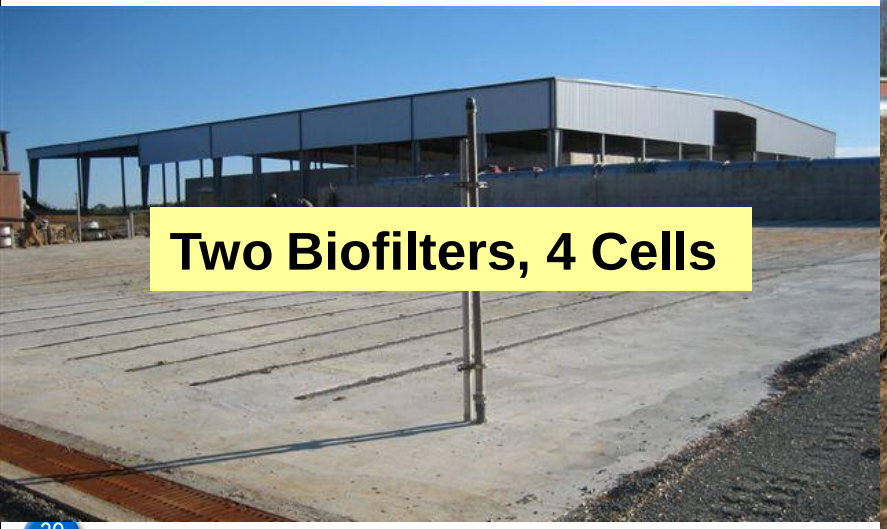
- Below Ground HDPE Piping to Fans
- HDPE Risers with Flush Mounted Grates
- Engineered Spacing Aeration Grate System
- 1872 Aeration Grates

BIOFILTRATION SYSTEM



BIOFILTRATION SYSTEM





COMPOSTING FACILITY EXPANSION BIOFILTER ODOR SAMPLING RESULTS

4/26/2010	Dilution to Threshold (D/T)			
	Detection		Recognition	
Biofilter Inlet	3400		2000	
Biofilter Outlet	370	190	210	110
Odor Removal %	**89**	**94**	**90**	**95**

High Loading Rate **Low Loading Rate**

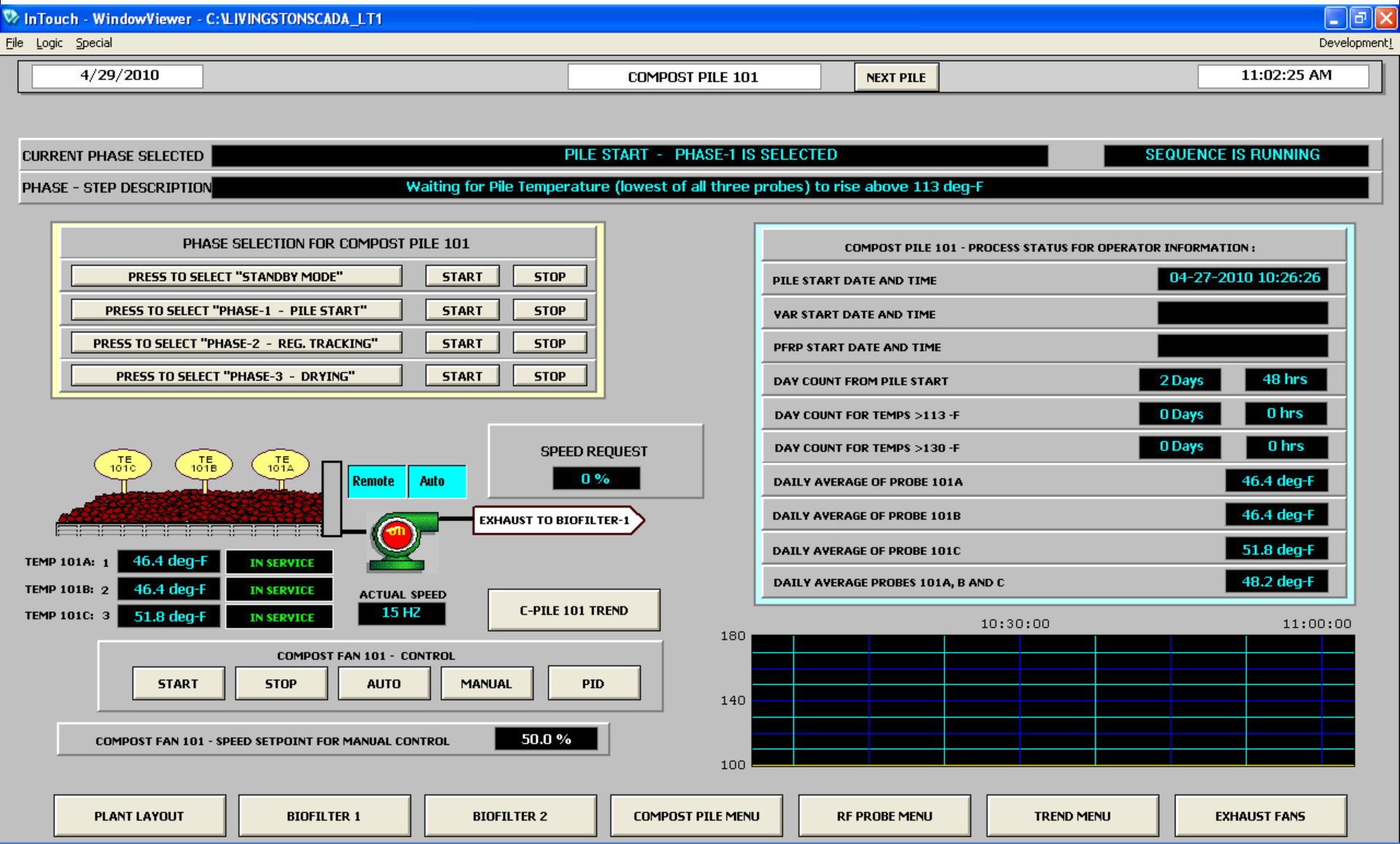
COMPOSTING FACILITY EXPANSION ODOR MODELING RESULTS

- Modeling Confirmed Testing Results/Predictions
- Because No Offsite Impact, Enclosure is not needed
- Air Handling and Biofilter Size is Less than 60% of that Required for a Totally Enclosed Facility
- Realized Savings of $3M in Capital Due To
  - Smaller Biofilter
  - Smaller Blowers and Ducting
  - Lower Building Cost due to savings in
    - Building Walls
    - Building Insulation
    - Corrosion Coatings
    - Sprinkler System
- Realized 30% Reduction in Electricity Costs in O&M
- AND….Less Offsite Odor Impact Than If Enclosed
  - Due to Limits of Biofilter Emission Concentration
  - Smaller Footprint, Lower Biofilter Mass Emission Rate

PROCESS CONTROL

- 3 Wireless Temperature Probes/Pile
- Feed Back to SCADA System to Control Blower and Generate Operating Records

Supervisory Control And Data Acquisition

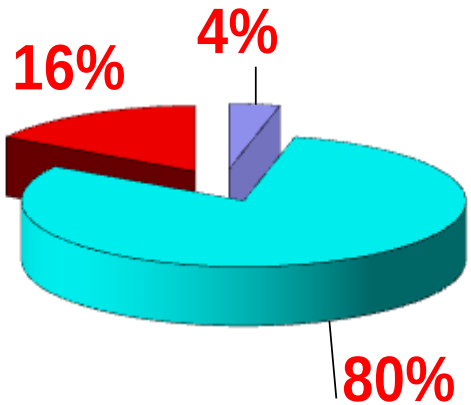


SPOTSYLVANIA COUNTY COMPOST MARKETING

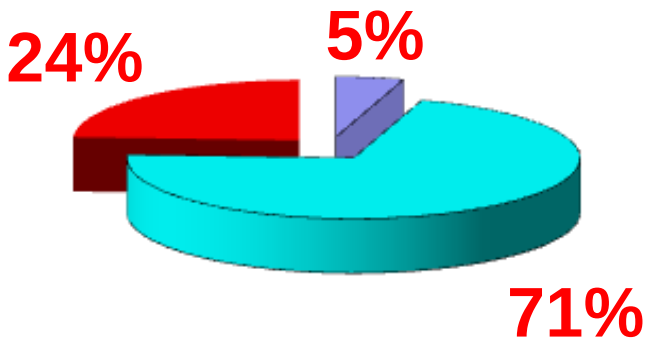
- Done Using In-House Staff
- Quality Product – USCC STA Approved
- Registered as Fertilizer with Virginia Dept. of Agriculture
- Compost Produced is Widely Accepted
- Principal Users Are Landscapers, Soil Blenders, and General Public
- Principal Use is in Landscaping

SPOTSYLVANIA COUNTY HISTORICAL COMPOST SALES

VOLUME (CY)



REVENUE



Nursery Landscaping Residential

SPOTSYLVANIA COMPOSTING FACILITY CAPITAL COSTS

Buildings/Facility/Engineering (2008)	$15,500,000
Moving Stock (2007)	$500,000
Original Facility Buildings/Improvements (2002-2006)	$1,000,000
Total	$17,000,000

SPOTSYLVANIA COMPOSTING FACILITY
2010 O&M COSTS FIRST 6 MONTHS OPERATION

Labor	$134,700
Utilities (Electric)	$27,200
Fuel	$23,300
Maintenance	$9,000
Miscellaneous	$25,800
Subtotal	$220,000
Biosolids Tonnage Processed	5840
Cost Per Ton Biosolids Processed	$37.70/ton
Compost Revenues	$66,200
Cost Per Ton Biosolids Processed After Product Sales	$26.30/ton

SPOTSYLVANIA COMPOSTING
PRELIMINARY ECONOMICS at CAPACITY

Capital Cost	$17,000,000
Annual Depreciation	$1,106,000
Projected Annual O&M	$1,033,700
Subtotal	$2,139,700
Projected Annual Compost Revenues	$253,600
Total Annual Cost	$1,886,100
Projected Annual Tonnage Processed	29,250
Cost Per Wet Ton Processed	
Annualized Capital	$37.81
O&M	$26.67
Total Cost per Ton Biosolids	$64.48

Amortized at 4.5%
Original Facilities - 20 year life; New Facilities - 30 year life
Moving Stock - 8 year life

SPOTSYLVANIA COUNTY COMPOSTING FACILITY EXPANSION CONCLUSIONS

- Total Enclosure is Not Needed for ASP Odor Control
- Emissions Modeling Used to Verify Expected Odor Impacts
- This Proactive Design Approach Saved Capital Costs, Reduced O&M Costs, Saved Space and More Effectively Achieves Odor Impact Goals Than a Totally Enclosed Operation
- Process Controls Design And Operation Details are Key to Providing a Successful Operation without Odor Problems
- Compost Product is Excellent and Material is Sold Out
- Economics are very favorable to alternatives

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QUESTIONS?

Todd O. Williams, P.E., BCEE

todd.williams@ch2m.com