



A Compost Air Emissions Primer

EPA Headquarters, Room 550

April 7, 2009



This Presentation

- 1. VOCs, NOx, ozone and GHGs**
- 2. Composting emission studies**
- 3. Efforts to regulate compost emissions**
- 4. Federal Clean Air Act permitting**
- 5. Compost and climate change**

What are Volatile Organic Compounds (VOCs)?

- **Defined by vaporizing under normal atmospheric conditions**
- **Some harmful, some not**
- **Man-made and naturally occurring**
- **Up to 10x higher indoors than out**
- **Reactive with other gases**

Where do VOCs come from?

Man made

(anthropogenic)

- Refineries and factories
- Fuel loading/unloading
- Paints and varnishes
- Solvents and cleaners
- Pesticides/fertilizers
- Plywood/particle board
- *Compost piles???*

Natural

(biogenic)

- Trees and forests
- Grass and shrub lands
- Agricultural crops
- Manure and silage
- The ocean!
- *Compost piles???*

Biogenic VOCs



The famous haze over Australia's Blue Mountains is caused by VOCs emitted by the "Blue Gum" or common eucalyptus tree.

What is NO_x (NO & NO₂)?

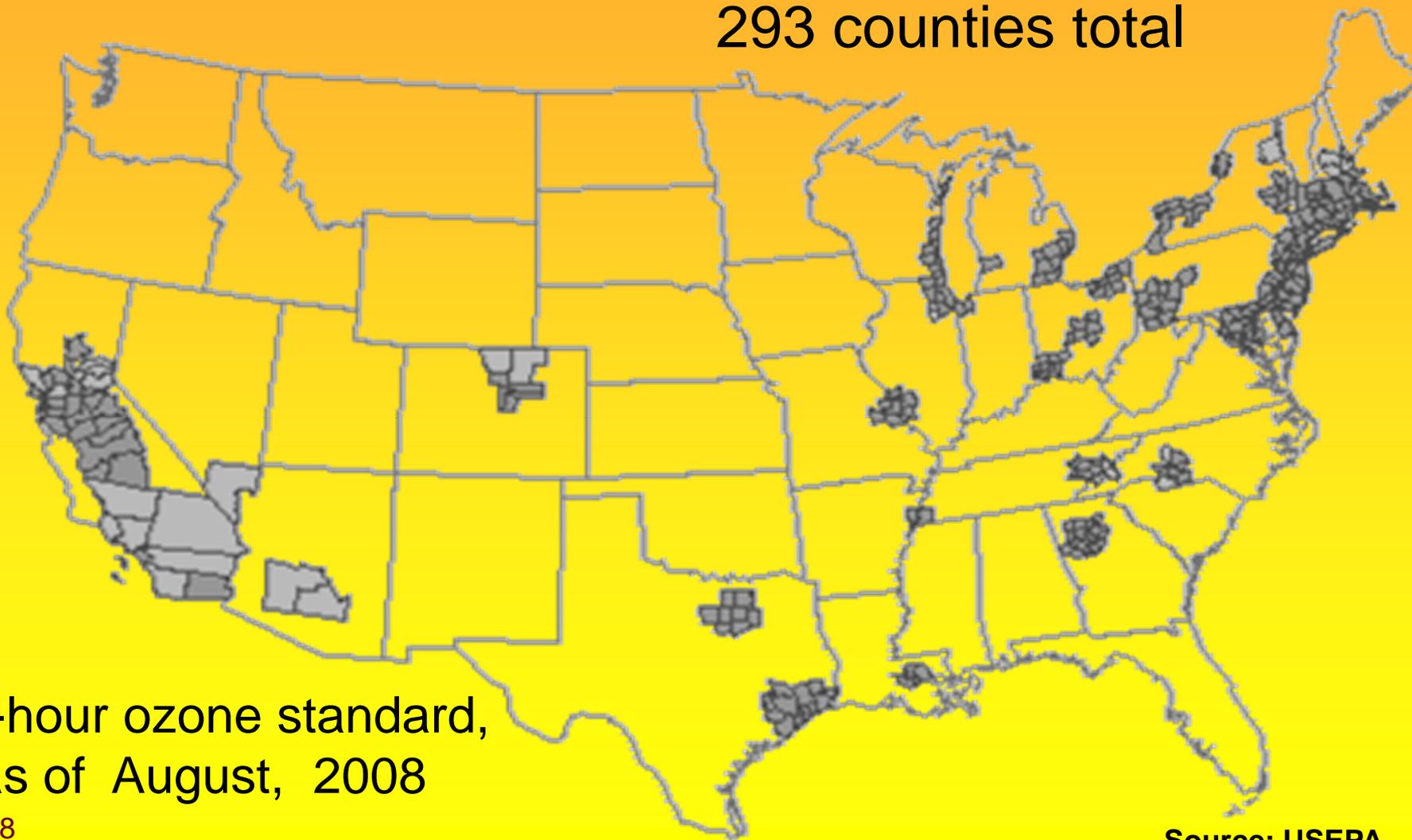
- **By-product of high-temperature combustion (engines, boilers)**
- **Forms acid rain components when mixed with atmospheric moisture**
- **React with VOCs and sunlight to create “photochemical smog”**

What is Ozone (O₃)?

- **Reacts with many chemicals**
- **Forms toxic compounds**
- **Inflames and damages lung lining**
- **Increases asthma, allergies**
- **Interferes with photosynthesis**
- **Reduces crop yields**

Ozone non-attainment areas in the USA

293 counties total



8-hour ozone standard,
as of August, 2008

Greenhouse Gases

- Carbon dioxide (CO₂): GHG Factor 1
- Methane (CH₄): GHG Factor 21
- Nitrous oxide (N₂O): GHG Factor 296
- Natural and man-made sources
- Will be trapped and traded in future
- Compost-GHG balance being debated now

Composting emissions studies



How many VOCs can you count here?

Emissions Measurement Gear

Portable
gas
analyzer



USEPA Surface Isolation
Flux Chamber assembly



Tunable
diode
laser



2001 SCAQMD Studies

Inland Empire Composting, Colton CA

- **First studies on green waste piles**
- **Measured VOCs, methane, ammonia**
- **Two sampling days**
- **Enormous tipping, grind and fines piles responsible for about 90% of total facility emissions**

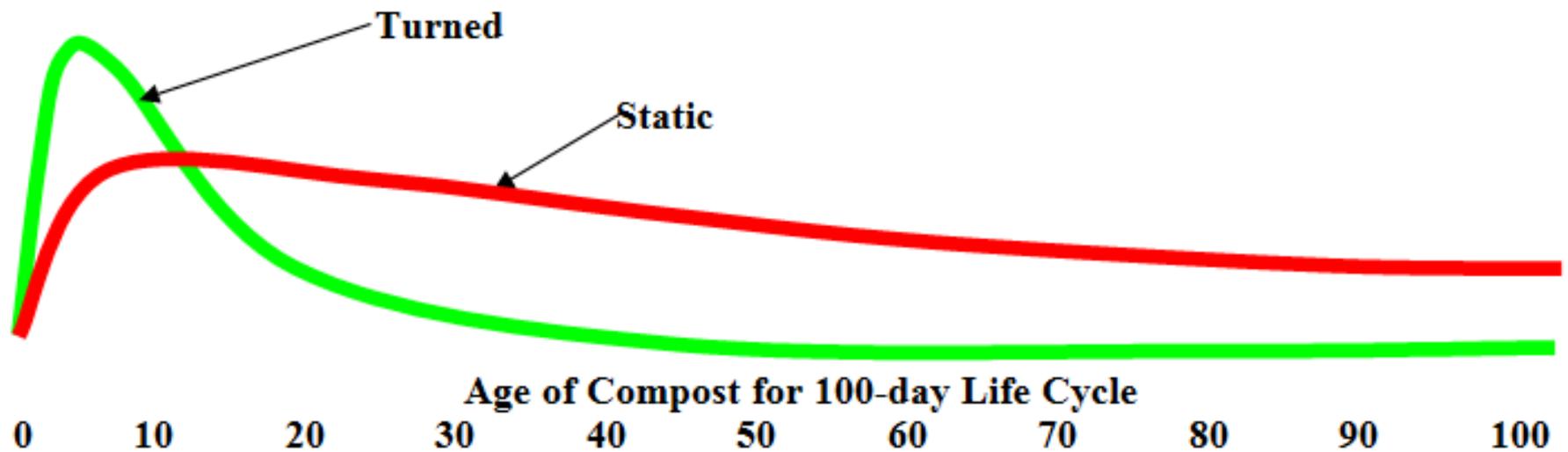
2002 CIWMB Emissions Study

Tierra Verde Industries, Irvine CA

- **High C:N ratio windrow emitted less VOC than low C:N ratio windrow**
- **Turned pile emitted more VOC than static pile, but matured faster**
- **Ammonia not a concern for greenwaste composting**

Hypothetical compost pile emissions: turned vs. static

Conceptual Plot – Hypothetical Emissions for Static vs. Turned Windrows



2006 CIWMB Emissions Study

City of Modesto Compost Facility

- **Measure life-cycle (60 days) VOC emissions for greenwaste and 15% food waste windrows**
- **Test two potential emissions-reducing best-management practices (BMPs)**
 - Additives: one feeds microbes; other forms crust on windrow (Cost: \$1.50 per ton)
 - Pseudo-biofilter: Cover “active” windrows with a layer of finished compost (60 cents per ton)



Putting on the “pseudo-biofilter” compost cap



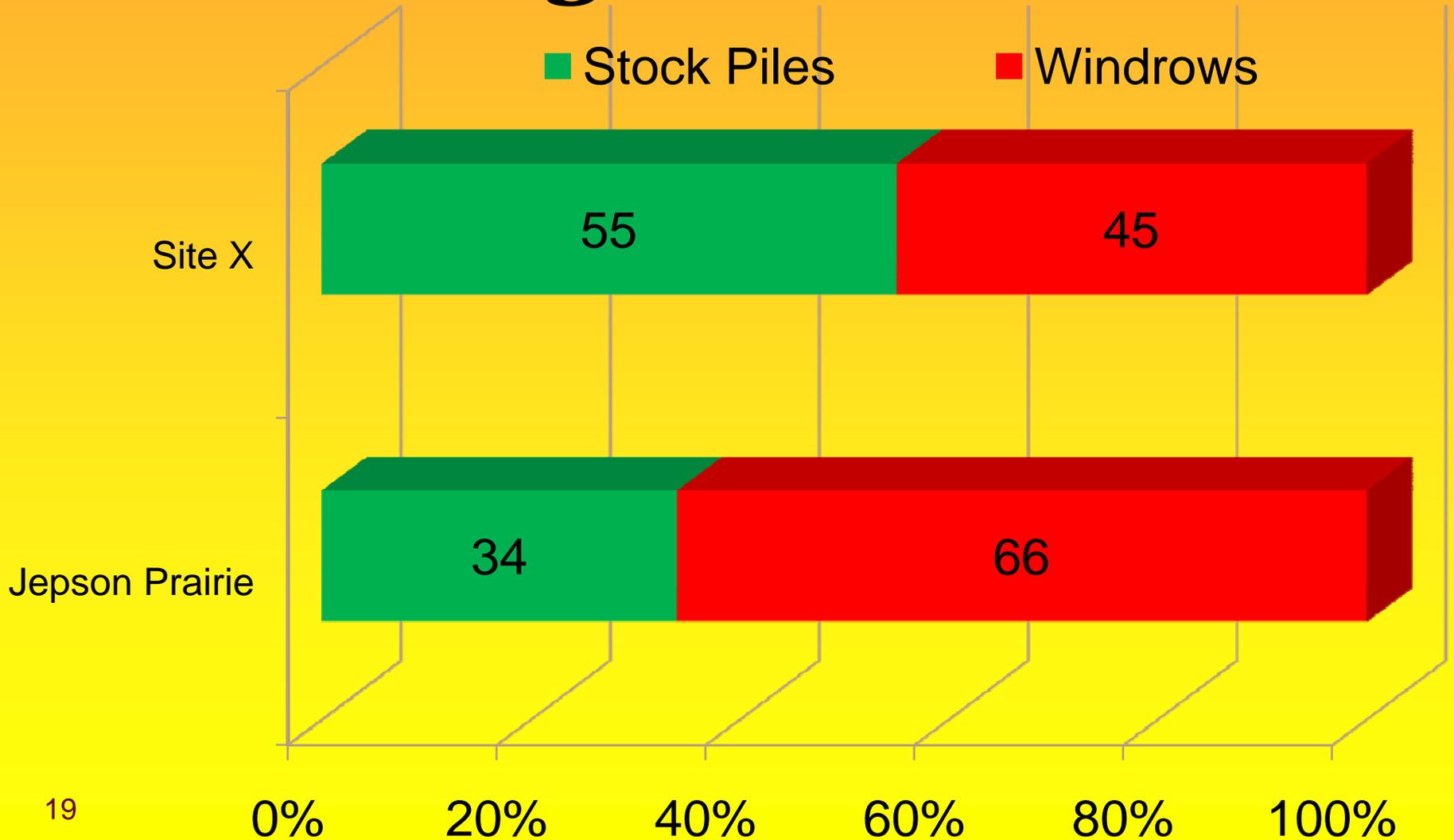
Modesto study conclusions

- Most VOCs emitted during first two weeks
- Most VOC emissions vent through top of windrows as opposed to middle or sides
- “Pseudo-biofilter” compost cap reduced VOC emissions up to 75% for first two weeks.
- “Pseudo-biofilter” compost cap about 5x more effective than additives.
- Food waste roughly doubled VOC emissions compared to green waste.

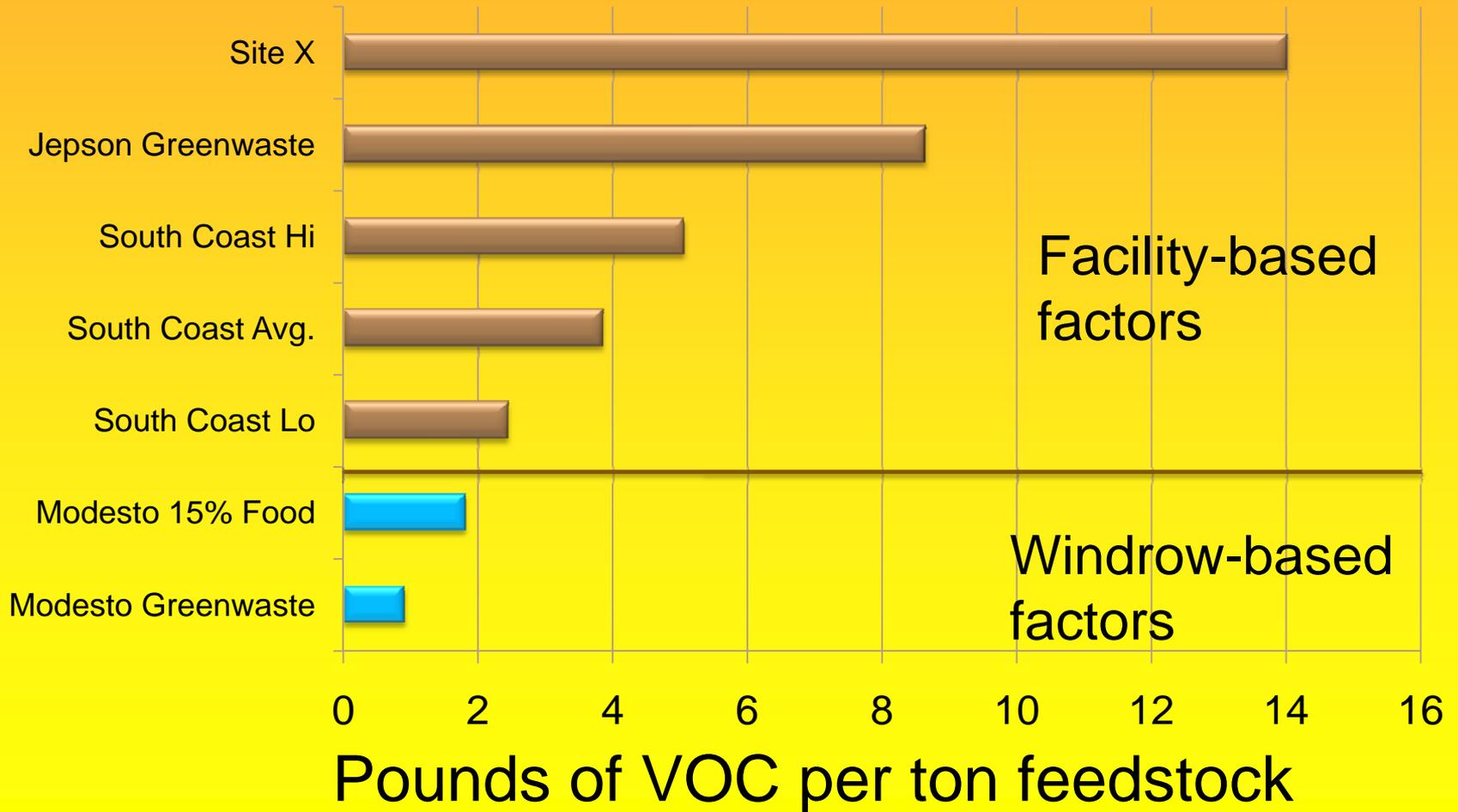
Recent private-facility studies

- **Facility-based emission factors counting stockpiles and windrows**
- **Much higher emissions factors than either CIWMB or SCAQMD**
- **Two sites, both handle some food**
- **Potential mitigation systems using tarps tested on food waste**

Stockpile emissions significant



Wide range of greenwaste emissions factors



Efforts to regulate compost emissions



Compost piles, not just equipment, are the focus of air quality regulators

California AQMD regulations

- **Local air quality districts enforce federal Clean Air Act & their own rules**
- **Los Angeles, Mojave, San Joaquin Valley all have compost regulations**
- **Biosolids co-composters were first**
- **San Joaquin now working on regulations for greenwaste composters**
- **Los Angeles and Bay Area may follow**

San Joaquin Valley: The Latest

- **December, 2008:** District puts proposed green waste compost rule on hold for 18 months to undertake field research.
- **January, 2009:** District issues request for proposals to study emissions reductions from controlling compost pile temperature, moisture, pH, oxygen, porosity.
- **March, 2009:** Study contract awarded to San Diego State University, work should begin in May.
- **Spring, 2009:** District plans to begin issuing “in house” air permits for existing compost operations.

The Backstory

- **Very low thresholds in bad-air basins for federal “major source” polluter status**
- **San Joaquin Valley APCD intends to push composters into federal Title 5 and Title 1 permitting regimes**
- **Composters treated similar to landfills, oil refineries, chemical factories, etc.**

What is Title V?

- **Federal permit program, authorized by Clean Air Act, implemented locally**
- **Monitoring, record-keeping and reporting requirements**
- **Fees to apply, renew, etc.**
- **Must report all deviations from permit conditions**
- **USEPA can inspect, issue fines**

What is Title I?

- Also authorized by federal Clean Air Act
- Known as “New Source Review”
- Requires facility to adopt “best available control technology” (BACT)
- Even after attaining BACT, facilities required to purchase VOC offsets for all emissions above threshold
- VOC offsets run up to \$50,000 per ton in SJV; many are owned by oil companies

Fugitive emissions?

- **Fugitive emissions cannot “reasonably” be passed through a “stack, chimney, vent or functionally equivalent opening”**
- **Fugitive emissions generally do NOT count toward a facility’s potential Title I or Title V emissions threshold**
- **USEPA guidance but no case law**
- **CIWMB position: Compost emissions are fugitive**

Compost & climate change

- **Composting can reduce methane emissions from landfills and GHG impacts from agriculture**
- **California must reduce GHG 25% by 2020; plan adopted Dec., 2008**
- **National carbon-trading plan imminent?**
- **Composting GHG balance not yet known**
- **CIWMB conducting life-cycle analysis**

Increasing compost use...



...may decrease use of less sustainable methods.



Thanks for listening

Bob Horowitz

California Integrated Waste Management Board

rhorowit@ciwmb.ca.gov

916-341-6523

CIWMB Web Site

www.ciwmb.ca.gov/Organics/Threats/Emissions/