CALRECYCLE ORGANICS INITIATIVE

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Questions answered today

- What does implementation of SB1383 mean for air district facility permitting efforts?
- What are some potential considerations to address VOC emissions?

What does this mean for air district permitting efforts?

Permitting issues and considerations

- Number of advanced technology facilities to permit?
  - Covered aerated static pile compost
  - In-vessel digestion (anaerobic digestion/WWTPs)
- Number of VOC offsets needed?
  - Movement of organic materials
  - Emission factors
  - NSR thresholds/facility sizes
  - Emission reduction credits
  - Essential public service designation
- What other permitting issues exist?
  - $PM_{2.5}/PM_{10}$
  - Toxic air contaminants
  - Odors

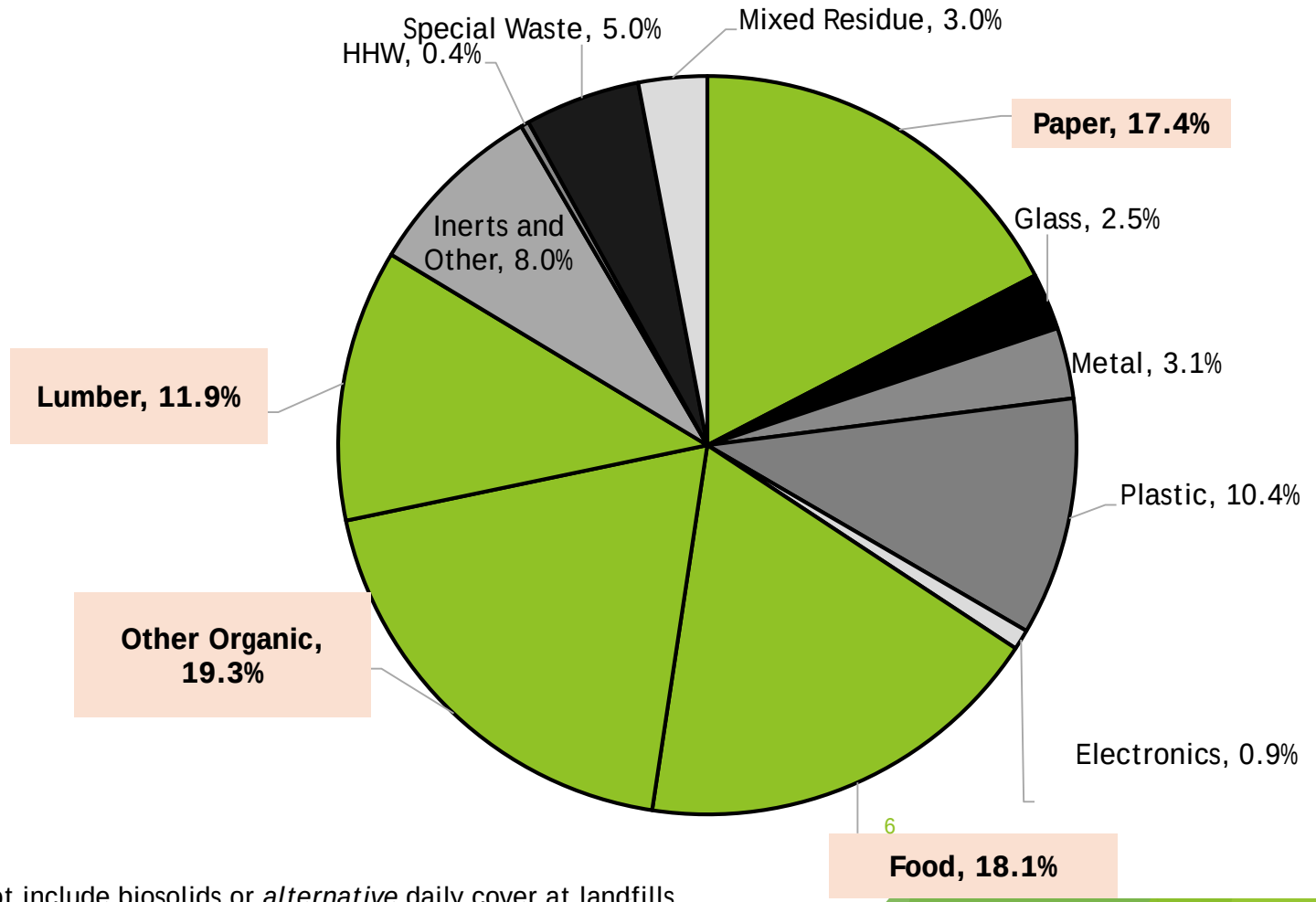
SB 1383 proposed landfill diversion regulation draft definition

Organic Waste:

"Organic Waste" means solid wastes containing material originated from living organisms and their metabolic waste products, including but not limited to food, green waste, landscape and pruning waste, applicable textiles and carpets, wood, lumber, fiber, manure, biosolids, digestate and sludges.

2014 disposal stream

- Organic waste >20 million tons disposed of at landfills
  - 2/3^{rds} of the total 2014 waste stream



*From CalRecycle's Waste Characterization Study (2015). Does not include biosolids or *alternative* daily cover at landfills.

Organic waste disposal analysis

- Based on CalRecycle's 2014 Waste Characterization Study disposal rates
  - Projected population/disposal growth to 2025 by air district
- Organic materials capable of being composted or going to anaerobic digestion facilities
  - Food recovery – 2.5% rescued; 25% to composting; 75% to in-vessel
  - Yard waste – 100% to composting
  - Manure – 50% to composting; 50% to in-vessel
  - Digestate from anaerobic facilities to composting
- Need to divert approximately 4 million tpy to anaerobic digestion and over 5 million tpy to compost

How many additional total statewide compost and anaerobic digestion facilities needed?

- About 90 compost facilities (60,000 tpy throughput)
- Roughly 50 anaerobic digestion facilities (75,000 tpy throughput)

Possible movement of materials across air district boundaries scenario

Departing County (Air District)	Receiving County (Air District)				
Northern California	San Joaquin (SJVUAPCD)	Stanislaus (SJVUAPCD)	Merced (SJVUAPCD)		Stay in County
Contra Costa (BAAQMD)	25%	-	-		75%
Alameda (BAAQMD)	25%	25%	-		50%
Santa Clara (BAAQMD)	-	25%	25%		50%
Southern California	Kern (Eastern Kern APCD)	San Bernardino (Mojave Desert AQMD)	Riverside (Mojave Desert AQMD)	Imperial (Imperial APCD)	Stay in County
Los Angeles (SCAQMD/Antelope Valley)	25%	25%	25%		25%
Orange (SCAQMD)	10%	25%	25%	10%	30%
SDUAPCD (SDUAPCD)	-	-	25%	25%	50%

Compost facilities needed by air district – Two possible scenarios

Number of additional compost facilities needed keeping organic waste within air district boundaries

Number of additional compost facilities needed moving organic waste across air district boundaries

Air District	Within air district boundaries scenario		Across air district boundaries scenario	
	Organic material diverted (tpy)	Number of additional facilities needed	Organic material diverted (tpy)	Number of additional facilities needed
Bay Area	885,000	15	727,000	12
Imperial	43,000	1	201,000	3
Mojave Desert	35,000	1	138,000	2
Sacramento Metro	226,000	4	226,000	4
San Diego	593,000	10	390,000	6
San Joaquin Valley	283,000	5	701,000	12
South Coast	2,620,000	44	2,290,000	38
Ventura	145,000	3	145,000	3
All other air districts	466,000	8	485,000	8
Grand total	5,296,000	89	5,303,000	88

How many VOC offsets might be needed?

- Understanding each air district's unique air quality issues
  - Ozone attainment status
  - NSR offset threshold for VOCs
  - How each air district draws boundaries around these stationary source and determines emission factors
  - ERC banks and availability within those banks
- Do sufficient emissions reduction credits exist?

Which emissions factor (EF) should be used?

- Potential to emit (PTE) for 60,000 tpy throughput
  - SJVAPCD - 23.5 tpy VOC emissions actual permitted facility
  - SCAQMD - 35 tpy VOC emissions based on 75% control of emissions
  - BAAQMD - 56 tpy VOC emissions based on actual permitted facility
- What affects the EF behind the PTE?
  - Material type
  - Where the boundary around the facility is drawn
  - How many data points are gathered to derive the EF
- Should digestate be included in EF?
  - Assume digestate doesn't add to compost VOC emissions

Where do these EFs come from?

Baseline (uncontrolled) EF

- Generally accepted EF(s)* vs. operator specific
  - SCAQMD, SJVAPCD, ARB (EI) have published EFs
- Feedstock composition (green, food, biosolids, manure)
- Variability (EF range among accepted tests 0.85 to 10 lb-VOC/ton)
- NSR implications
  - BACT most likely will be triggered
    - ~120 to 190 ton uncontrolled windrow(s) in active phase > 25 lb-VOC/day
    - BACT technology and control % (What is the class/category? What is the achieved-in-practice performance standard?)
  - Offsets?
- Title V applicability (fugitive vs. non-fugitive)

*https://www.arb.ca.gov/ei/areasrc/Composting%20Emissions%20Inventory%20Methodology%20Final%20Combined.pdf

Source testing

- Compliance demonstration
  - BACT or rule performance standard (% Reduction over baseline)
  - Offsets <-> Throughput
- Testing considerations
  - Cost: ~$30,000 to $100,000+
  - Minimum ~ 3 piles different ages: 2 active phase; 1 curing phase (= 3 points on the “curve”)
  - Pile age selection? VOC emission rate correlates with pile temperature.
  - With less testing, more of the curve is formed by linear interpolation.
  - Ammonia emissions lag VOC in the cycle (i.e. peaks are not coincident).
  - Frequency?
    - Seasonal variation
    - Stand alone or cumulative average?

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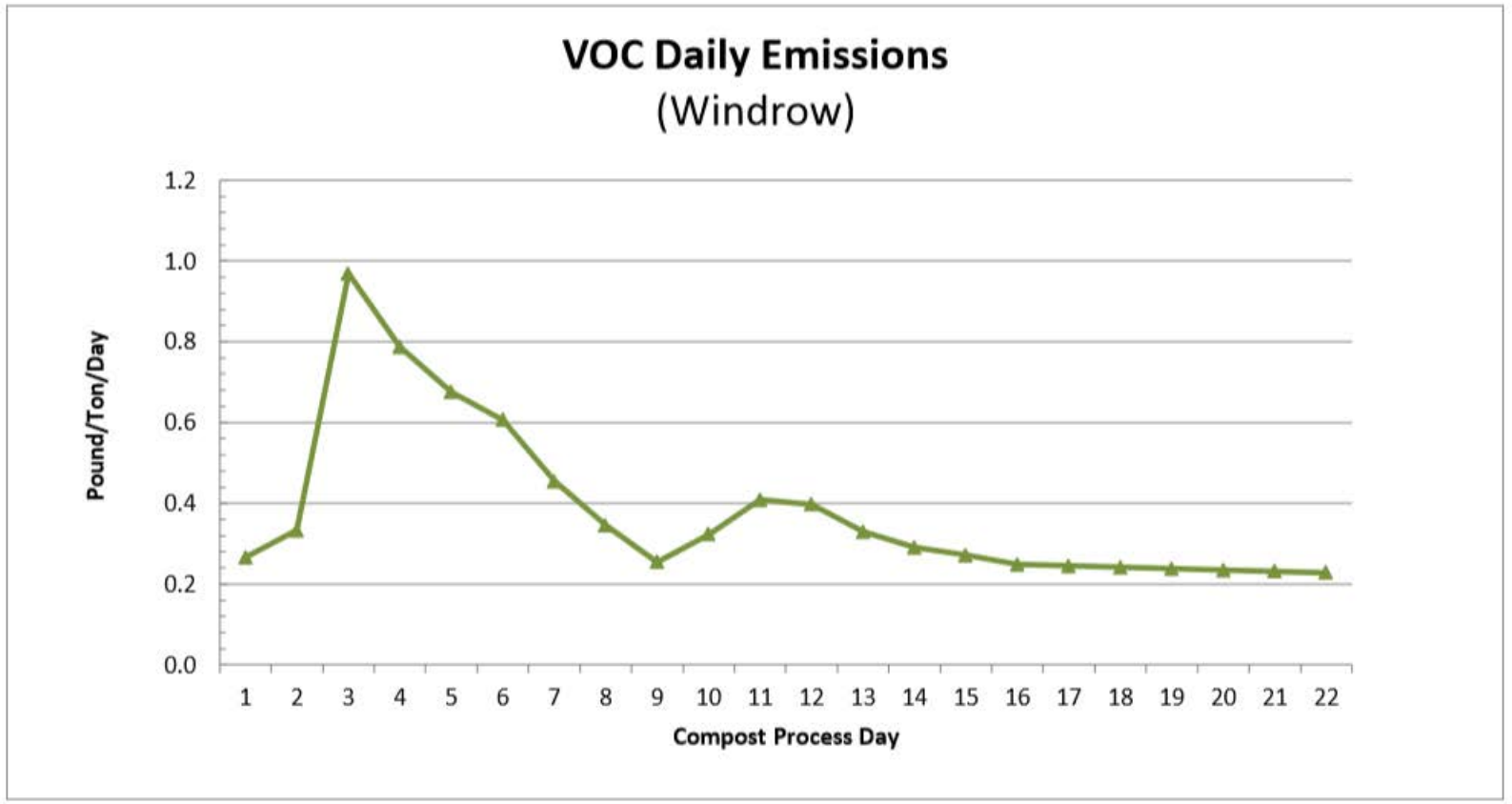
EF= area under the curve

$$EF\left(\frac{lb-VOC}{ton}\right)=\frac{Flux\left(\frac{mass}{area\cdot time}\right)\times Pile\ Surface\ Area}{Pile\ Volume\times Pile\ Density}\times time$$



Plot from 2013 TAP Study for Solar Powered ASP (SJVAPCD)

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Potential BMPs to minimize VOC emissions

- Compost pile monitoring options
  - Process variables (e.g. oxygen, moisture, C:N ratio) - conduct stability tests
  - Feedstock type and throughput – keep records
  - Integrity of cover(s) – visual inspection; VOC portable analyzer – possible utility for "leak" detection, but not emissions
  - Olfactory (HSC sec. 41705, 1st of two, subdivisions (a)-(c)) – odor nuisance enforcement not delegated to air districts, but strong odors can indicate anaerobic conditions, old feedstock stockpiles, poor management, malfunctioning equipment
- Other pile monitoring options

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In which air districts will offsets be triggered for VOCs?

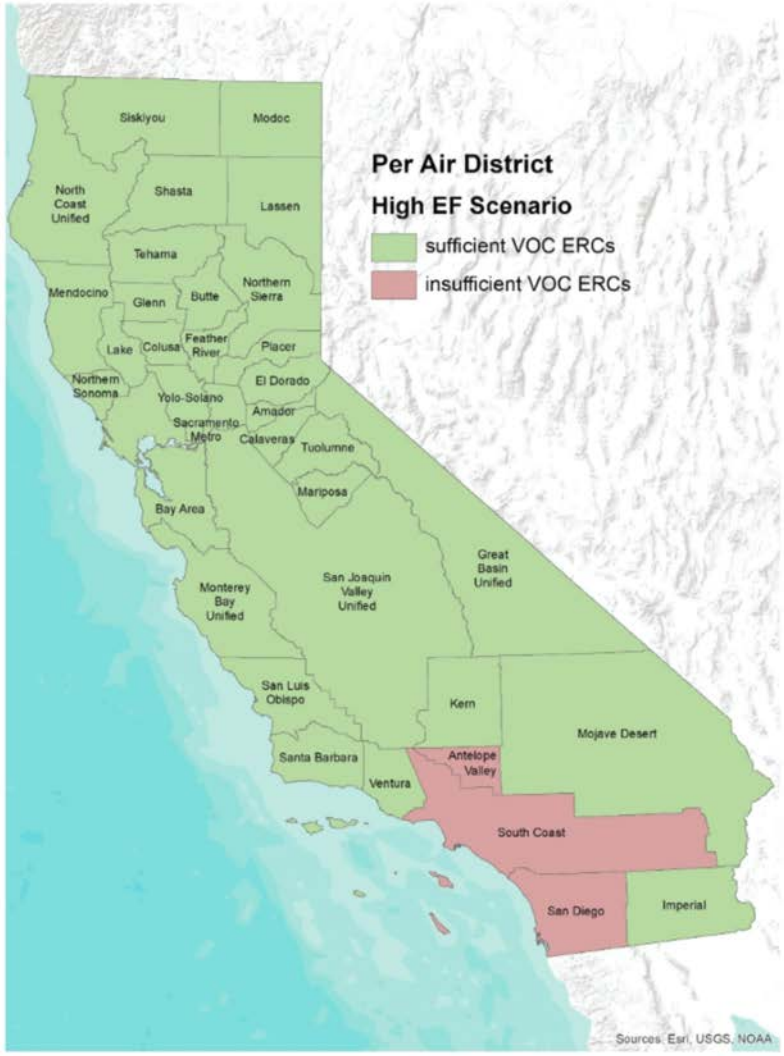
High Compost Emissions Factor Scenario Including Organic Waste Movement Across Air District Boundaries

Low Compost Emissions Factor Scenario Including Organic Waste Movement Across Air District Boundaries

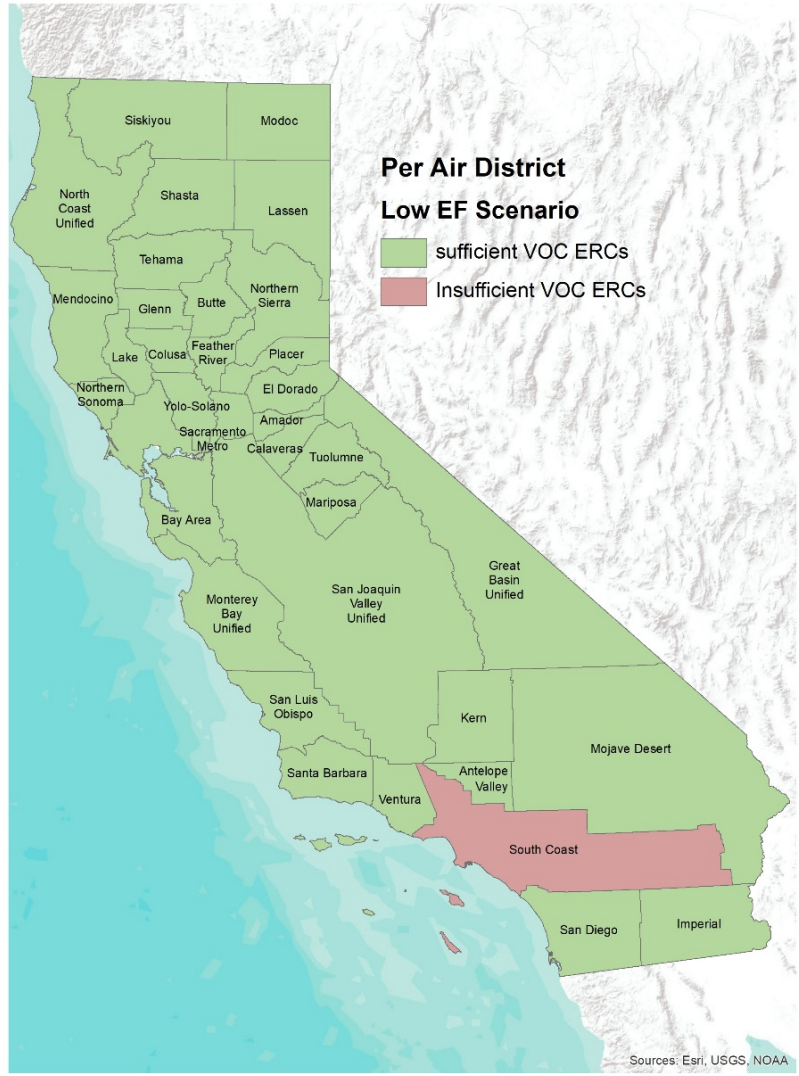
Air Districts	Air District New Compost Facility Survey Results (Distributed by Yolo-Solano Spring 2017)	
	VOC offset threshold/major source threshold (tpy)	Total VOC ERCs in the general bank (tons)
Antelope Valley	25	0.16
Bay Area	10	3147
Butte	25 or 40	85.6
Feather River	25 or 100	273.8 Non-Fed; 69.8155 Fed
Lake County	~25	No offset program
Mojave Desert	25 or 40	105.24 All Fed
Monterey Bay	~25	94.206
No. Sonoma	N/A	0
Placer County	25	120
Sacramento Metro	25	Community/ Military: 494; Private ERCs: 318
San Diego	25 or 50	281.54
San Joaquin Valley	10	5000
San Luis Obispo	25	55.4
Santa Barbara	25	106
Shasta	25	360.5
South Coast	4 (10, 25, 100)	98.89
Ventura	15	593.8
Yolo-Solano	25	196.3

Do sufficient ERCs exist to permit additional compost facilities?

High Compost Emissions Factor Scenario Including Organic Waste Movement Across Air District Boundaries

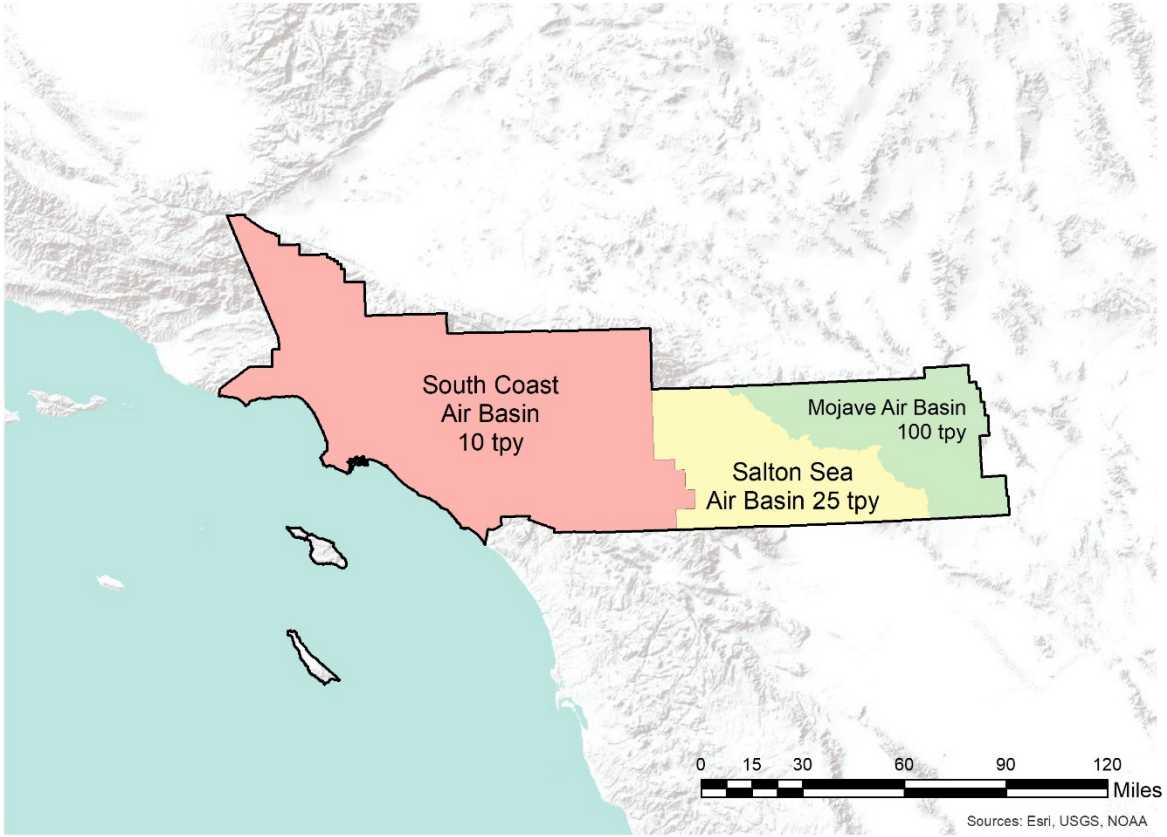


Low Compost Emissions Factor Scenario Including Organic Waste Movement Across Air District Boundaries



SCAQMD air basins example

- 38 - 44 compost facilities
- 560 – 1650 VOC tpy emitted (exempt digestate emissions)
- 99 ERCs available in basin
- Rule 1133 caveats
  - Size matters (>5000 tpy)
  - Materials matter (food waste)
  - Fugitive versus equipment emissions



Main results

- The majority of air districts should have sufficient VOC ERCs or not need VOC ERCs to meet SB 1383
- Smaller throughput facilities may not need VOC offsets
- Where the boundaries are drawn around a facility matters
- Where a facility is located in an air district may be important
- ERCs appear to exist, but are they readily available for purchase, and do other industries need them too?

What are some potential considerations to address VOC emissions?

Potential considerations to permit facilities

- Improving air quality through compost application
- Essential public service designation may be useful in certain circumstances
- Compost VOC biogenic low ozone reactivity
  - May not be effective at reducing ozone levels
- Consider regional air quality approach
  - Shifting emissions from landfills to compost facilities
  - Landfill VOC emission credits (biogenic vs. anthropogenic)
  - Accounting for windrow to ASP conversion

Achieving SB 1383's landfill diversion goal can improve air quality

- Compost and mulch application as a part of a systems approach to natural working lands management can reduce criteria air pollutant emissions
  - PM_{10} ($PM_{2.5}$) emissions from degraded soils
  - VOC emissions by reducing need for pesticide application
  - NOx emissions by reducing need for synthetic fertilizer application
  - Reduce emissions associated with irrigation by decreasing irrigated water (~30%) needs
- Reduce GHG emissions directly and indirectly
  - Reduce methane emissions from landfills
  - Sequester carbon in roots and surrounding soil through increasing soil organic matter and enhancing plant growth from compost addition

Essential public service designation

- Compost facilities would become similar to landfills and WWTPs (since the waste can't go to landfills anymore, it needs to go somewhere).
  - 21 out of 35 air districts have EPS definitions
  - 12 include landfills (2, only if publicly-owned and operated)
  - 17 include WWTPs (12, only if publicly-owned and operated)
- Not universally useful
- May open up access to small community ERC banks
- May give some leeway by creating a higher threshold for emissions

Air Districts	Air District New Compost Facility Survey Results (Distributed by Yolo-Solano)			
	Total VOC ERCs in the general bank (tons)	ERC bank for EPS?	Size ERC VOC EPS bank (tpy)	Compost eligible for EPS ERC Bank?
Antelope Valley	0.16	No	N/A	N/A
Bay Area	3147	No	195	No
Butte	85.6	Yes	60	No
Feather River	273.8 Non-Fed 69.8155 Fed	Yes	14.48	No
Lake County	No offset program			
Mojave Desert	105.24 All Fed	No		
Monterey Bay	94.206	Yes	43.69	Yes
No. Sonoma	0	No	n/a	n/a
Placer County	120	Yes	32	No
Sacramento Metro	Community/ Military: 494; Private ERCs: 318	Yes	20.3	No
San Diego	281.54	No	N/A	N/A
San Joaquin Valley	5000	No	N/A	N/A
San Luis Obispo	55.4	Yes	31.9	APCO discretion
Santa Barbara	106	No	n/a	n/a
Shasta	360.5	No	n/a	n/a
South Coast	98.89	Yes	22.8	No
Ventura	593.8	Yes	198	No
Yolo-Solano	196.3	Yes	17.1	No

Volatile Organic Compound	MIR	% VOC Emissions
Acetone	0.36	0.47%
Camphor	0.49	1.18%
Isopropyl alcohol	0.61	42.31%
Undecane	0.61	0.20%
Methyl alcohol	0.67	12.79%
Acetic acid	0.68	5.94%
Methyl butylacetate	1.09	0.14%
Methyl propionic acid	1.2	0.26%
Propionic acid	1.22	0.53%
Ethyl alcohol	1.53	18.16%
Butanoic acid	1.82	1.35%
2 Butanol	2.4	0.39%
Naphthalene	3.34	0.50%
Pinene Isomers	3.52	0.60%
3 Methyl butanoic acid	4.23	0.28%
Alpha pinene	4.51	1.36%
Camphene	4.51	0.24%
Limonene	4.55	2.27%
Terpineol	4.63	0.35%
Isovaleraldhyde	4.97	0.15%
1 Methyl, 3-1-methyl ethyl benzene	5.49	0.23%
2 Methyl 1-propene	6.29	0.41%
Acetaldehyde	6.54	0.14%
Propene	11.66	0.22%
2 Butene	14.24	0.17%
Others	N.A.	9.36%
		100%

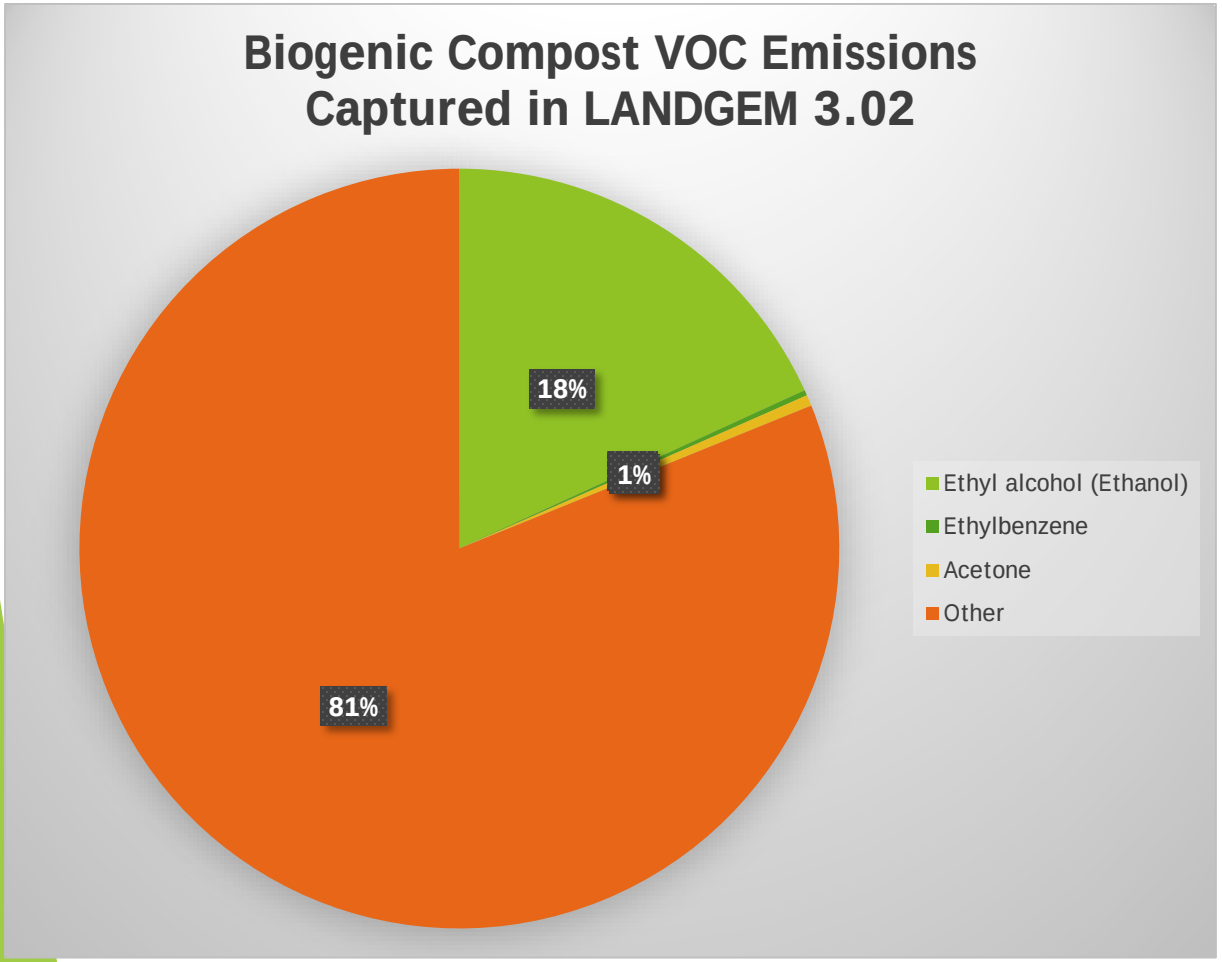
Biogenic VOC reactivity varies

- 90 percent of VOCs emitted in first week of composting (Kumar et al., 2011) and can be well controlled through CASP systems
- About 82% of compost emissions have MIR < 1.53
- Non-aerated degradation (landfills?) of organic materials emit more highly reactive monoterpene VOCs (Burger et al., 2015) in the 4 – 5 MIR range
- VOC emissions not controlled from active face landfills
- By permitting advanced technology compost facilities we should be reducing VOC emissions

Regional air quality approach

- Do regional emissions modeling
  - Movement of the same material from one place to another
  - Not entirely “new” emissions
  - Create credits for landfill emissions reductions for new compost facilities to use?
- Landfill LANDGEM issues
  - CalPoly SLO study looking at GHG/VOC emissions

LANDGEM emissions measured versus natural degradation of organic materials



- Anthropogenic versus biogenic VOC emissions measured
  - CFCs, BTEX, etc.
- Different timeframe from organic material VOC emissions
  - Emissions accounted for once steady-state achieved
  - Intermediate cover (two plus years after most emissions from organic materials have occurred)
- Non-aerated degradation of organic materials emits more highly reactive VOCs (Burger at al., 2015)

Summary

- Not an easy lift
- Each air district has unique air quality challenges
  - Many considerations (VOCs, offsets, ERCs)
- Research may be needed to better define new approaches
  - Emission factors
  - Quantify VOCs further for regional modeling approach

Working together

- CAPCOA white paper
- CalRecycle and ARB want to work with air districts by
  - Providing technical assistance
  - Supporting efforts to meet air quality goals
  - Developing materials and information to support district air quality permitting activities
  - Other assistance needed to help facilitate the permitting of organic materials management facilities
  - Regional modeling

Contact us!

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