California Environmental Protection Agency
Department of Pesticide Regulation

Volatile Organic Compound Emissions from Pesticides:

Options for Reducing Non-Fumigant Emissions

September 2011

Overview

- State implementation plan
- Emission estimates and effect of fumigant regulations
- Evaluation of non-fumigant emissions
- Non-fumigant reduction options and issues

State implementation plan

- As required by Clean Air Act, the state implementation plan (SIP) describes measures to reduce VOCs and NOx to achieve ozone standard
- SIP (pending EPA approval) requires DPR to
  - Develop and maintain an emission inventory to track pesticide VOC emissions
  - Reduce pesticide emissions by specified amounts during May-Oct peak ozone season – San Joaquin Valley pesticide emission limit of 18.1 tons/day
  - Require low-emitting fumigation methods
  - Implement restrictions on non-fumigant pesticides by 2014

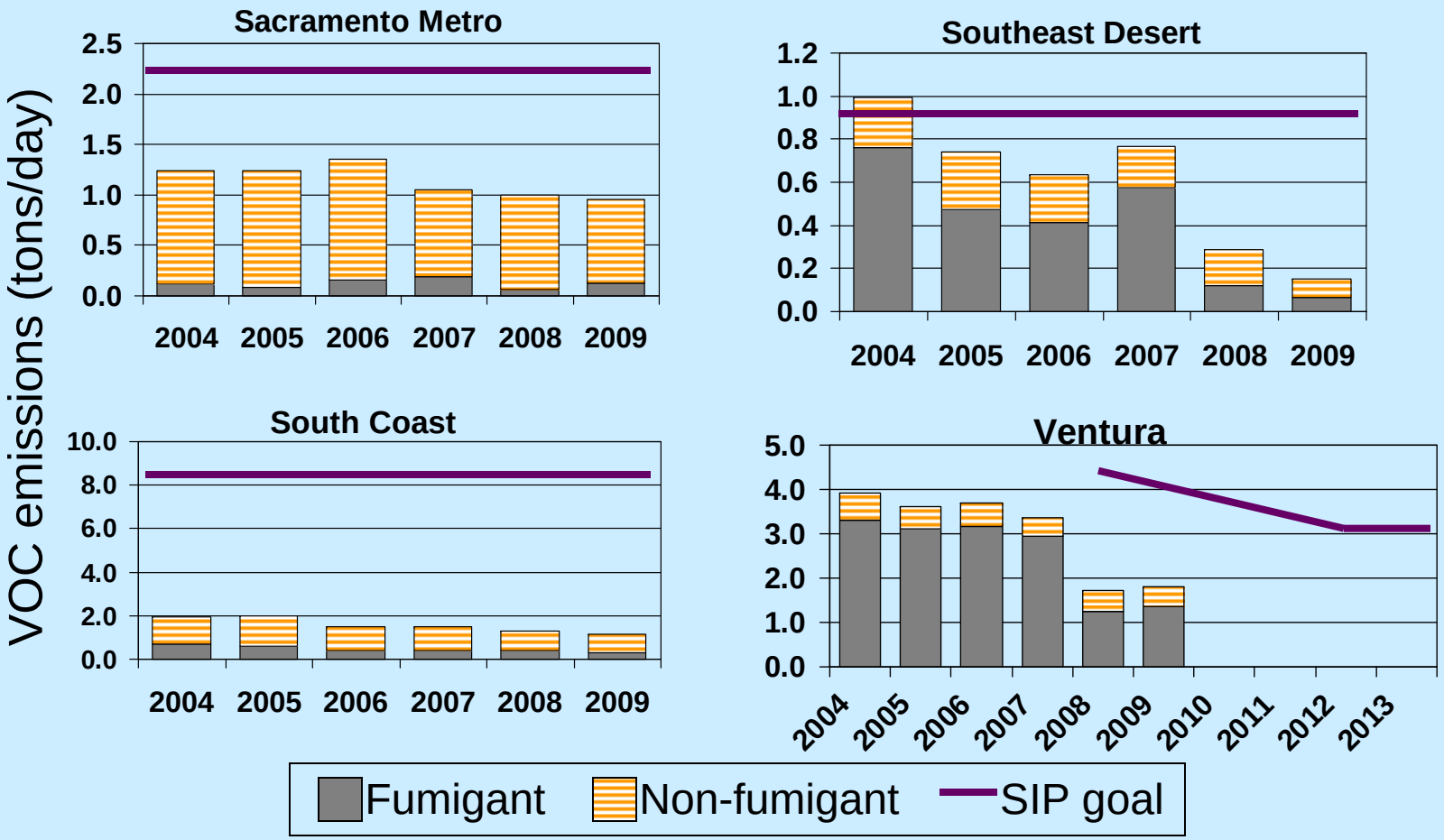
Method for estimating pesticide VOC emissions

- VOC emission from a pesticide product is calculated by multiplying:
  - Amount of product applied (from pesticide use reports)
  - VOC fraction in product (emission potential, EP), determined by thermogravimetric analysis (TGA) and other methods
- Fumigants are adjusted by an additional factor to account for emissions under field conditions
  - Emission rating varies with fumigant and application method

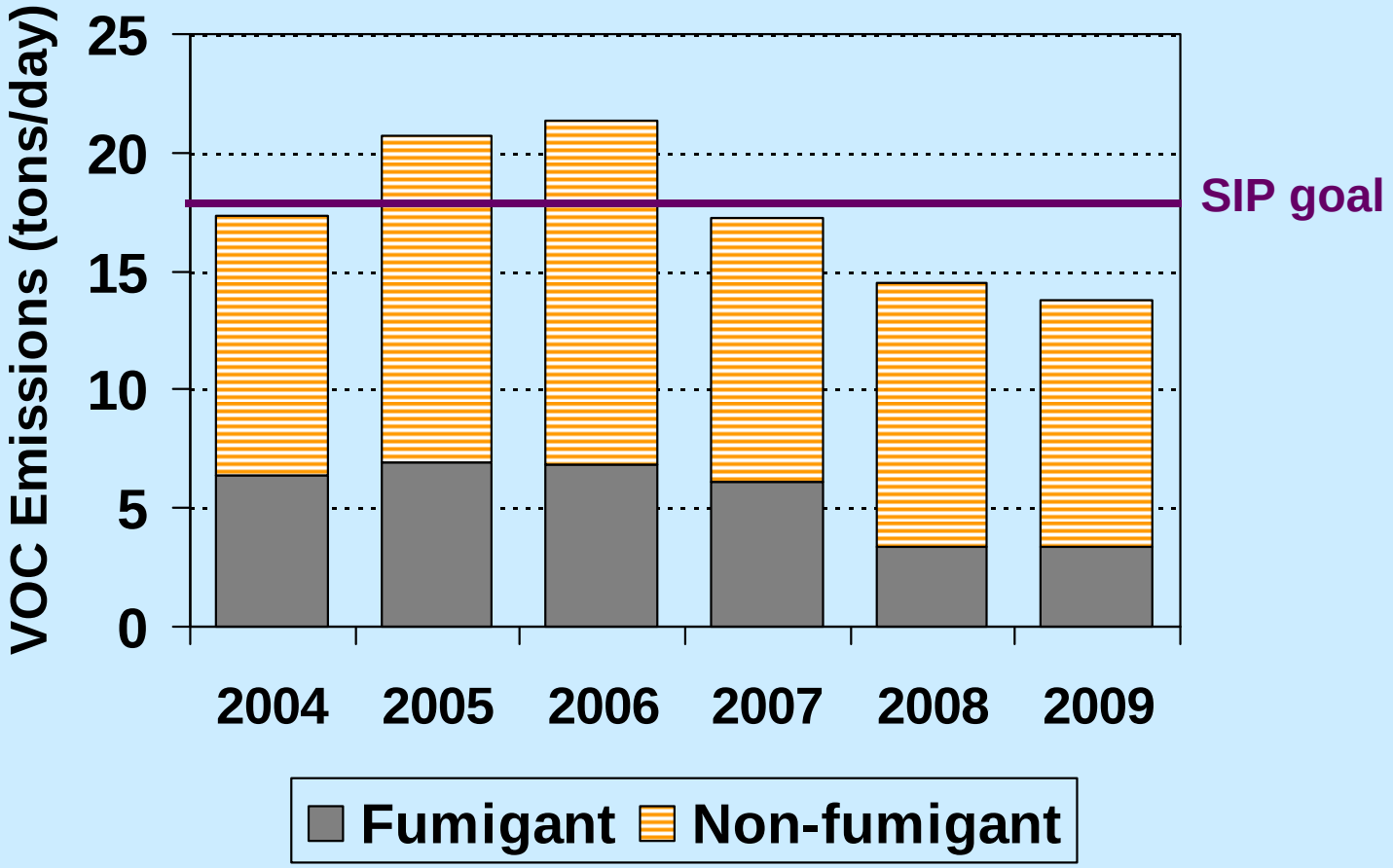
Pesticide VOC inventory

- Most pesticide VOC emissions from
  - Fumigants
  - Emulsifiable concentrate products (active and inert ingredients)
- Four nonattainment areas should consistently achieve SIP goals
  - Sacramento Metro
  - South Coast
  - Southeast Desert
  - Ventura
- San Joaquin Valley does not always achieve SIP goal

Pesticide VOC emission inventory



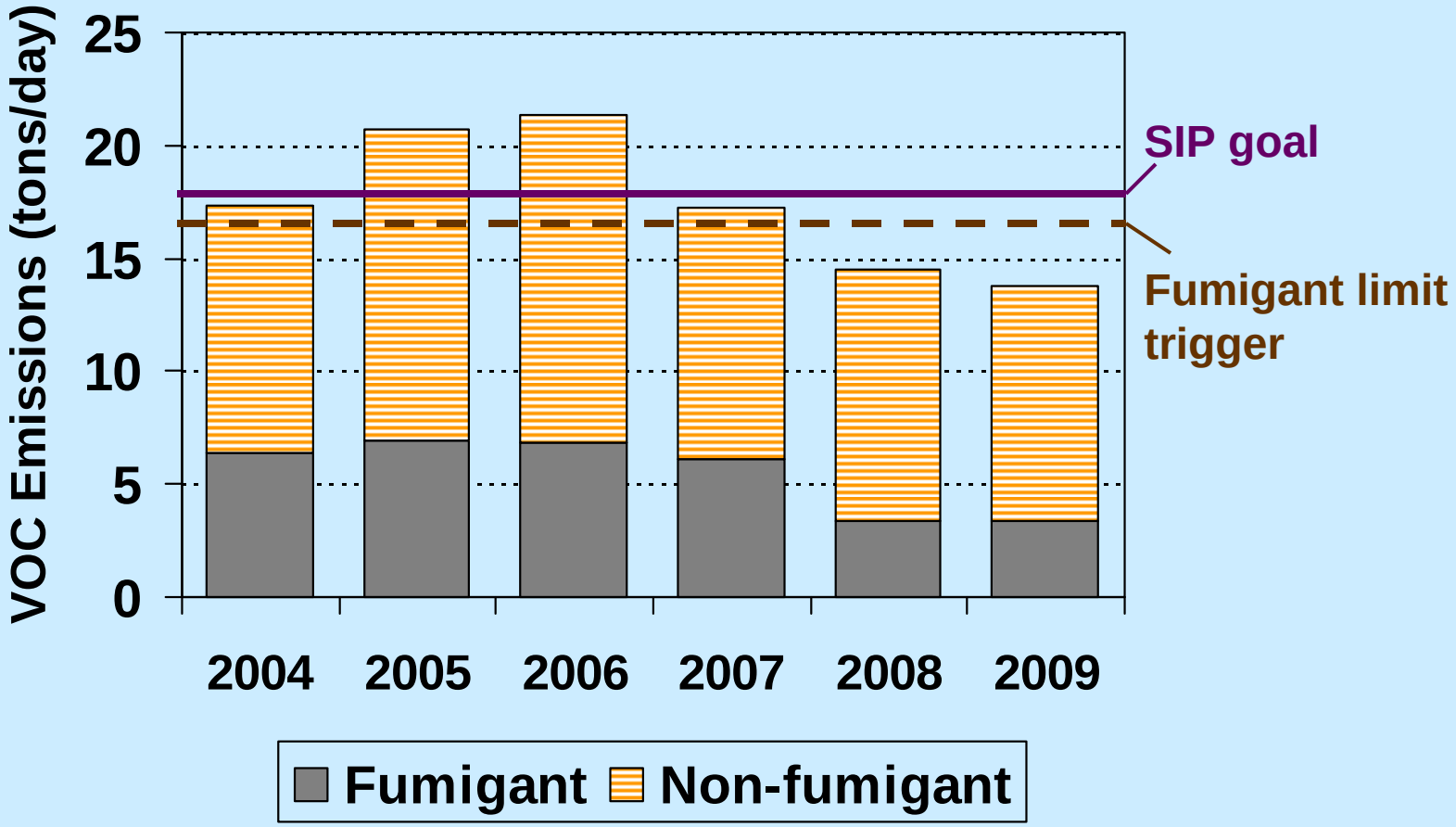
Pesticide VOC emission inventory for San Joaquin Valley



Emission changes due to fumigant regulations

- Reductions beginning in 2008 primarily due to fumigant regulations
- Fumigant regulations implemented in 2008 require
  - Low-emission fumigation methods
  - Fumigant limit and allowances in Ventura
  - Possible fumigant allowances program in other areas

Pesticide VOC emission inventory for San Joaquin Valley



Need for non-fumigant reductions

- SIP requirement – “DPR will implement restrictions to reduce VOC emissions from non-fumigant pesticides by 2014.”
- Maintain San Joaquin Valley SIP emission limit goal (18.1 tons/day)
- Avoid fumigant limit

Reevaluation of non-fumigants

- Most non-fumigant VOC emissions due to certain liquid products (emulsifiable concentrates)
- Reevaluation initiated in 2005, revised in Feb 2010
- Assess reformulation of inert ingredients in products with highest VOC contribution
  - Abamectin products (e.g. Agri-Mek)
  - Chlorpyrifos products (e.g. Lorsban)
  - Dimethoate products (e.g. Cygon)
  - Gibberellins products (e.g. Gibgro)
  - Oxyfluorfen products (e.g. Goal)
  - Permethrin products
  - Trifluralin products (e.g. Treflan)

Proposed to focus VOC reductions on chlorpyrifos and oxyfluorfen products

- Two largest non-fumigant contributors in SJV
- Liquid “low-VOC” products available
- Use of low-VOC products likely ensures needed reductions and fumigant allowances not triggered
- Use of low-VOC products likely has lower agricultural impact, compared to other major non-fumigants

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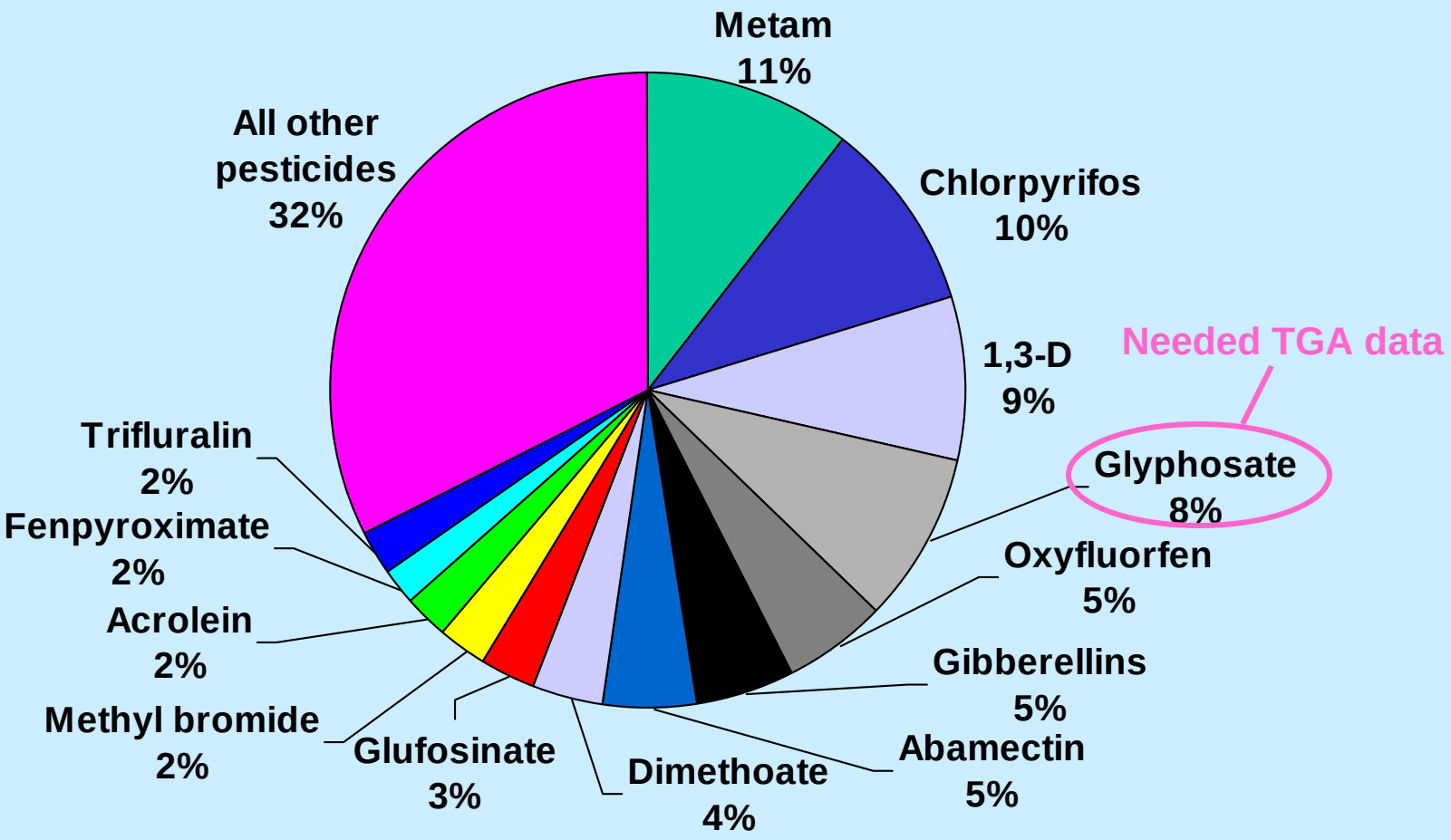
Top VOC pesticides for San Joaquin Valley, May-Oct 2009



Chlorpyrifos and oxyfluorfen SJV emissions, May-Oct 2009

Commodity	Chlorpyrifos (lbs)	Oxyfluorfen (lbs)	Total (lbs)
Almond	152,511	149,291	291,802
Walnut	82,255	19,448	101,703
Orange	87,843	797	88,640
Alfalfa	69,852	12	69,864
Cotton	45,470	9,611	55,351
Grape (all)	11,687	23,149	34,836
All other crops	44,214	52,042	96,255
TOTAL	484,101	250,354	738,451

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Availability of low-VOC alternatives

Pesticide	Liquid w/ Same AI?	Solid w/ Same AI?*	Liquid w/ Alternative AI?*
Abamectin	Yes	Yes	Yes
Chlorpyrifos	Yes	Yes	Yes
Dimethoate	No	Yes	Yes
Gibberellins	No	Yes	No
Oxyfluorfen	Yes	No	Yes
Permethrin	No	Yes	??
Trifluralin	No	Yes	??

*Solid formulations and alternative active ingredients may not be effective in all cases

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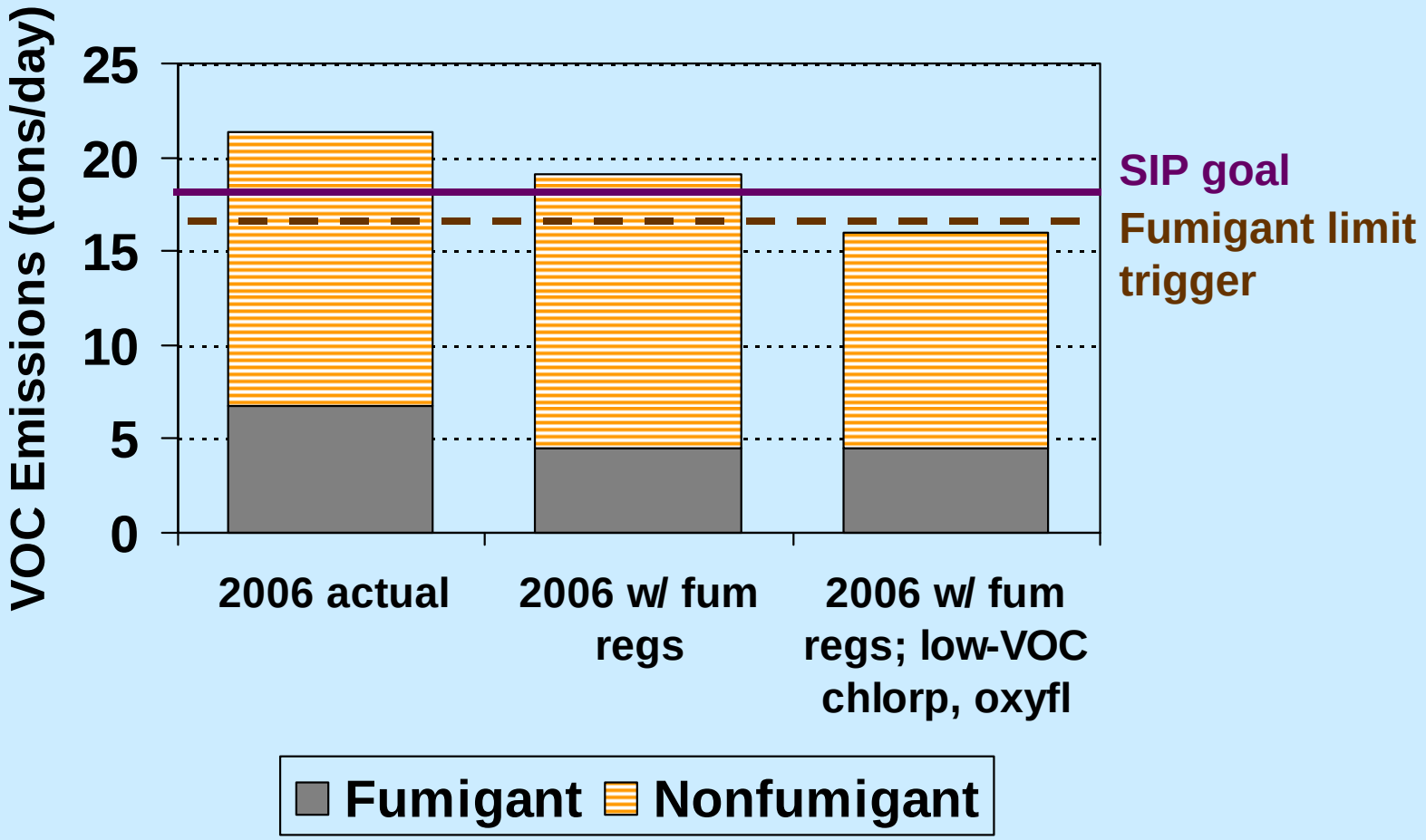
Projected SJV pesticide emissions with fumigant regs and low-VOC products



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Approximate cost of low-VOC alternatives

Pesticide	Alfalfa	Almonds	Citrus	Cotton	Grapes	Walnuts
Abamectin*	Low use	$36/ac	Low use	-$61/ac	?	-$36/ac
Chlorpyrifos	$0.02/ac	$11/ac	$16/ac	$28/ac	$7/ac	$4/ac
Dimethoate	$14/ac	No use	$38/ac	?	Low use	No use
Gibberellins	No use	No use	-$1/ac	No use	$150/ac	No use
Oxyfluorfen	No use	$0.1/ac	$5/ac	-$17/ac	-$8/ac	$5/ac

*Recently registered low-VOC products not evaluated

Approximate cost of low-VOC alternatives

Pesticide	Alfalfa	Almonds	Citrus	Cotton	Grapes	Walnuts
Abamectin*	Low use	52%	Low use	-49%	?	-35%
Chlorpyrifos	<0.1%	33%	22%	107%	20%	9%
Dimethoate	40%	No use	104%	?	Low use	No use
Gibberellins	No use	No use	-2%	No use	68%	No use
Oxyfluorfen	No use	0.8%	10%	-30%	-17%	32%

*Recently registered low-VOC products not evaluated

Updated impact evaluation

- UC analysis indicates low-VOC chlorpyrifos and oxyfluorfen products less effective in some cases
- Need exceptions to high-VOC prohibition
- May need to include other pesticides to ensure SIP goal met and fumigant limit not triggered
  - Abamectin – UC evaluating new low-VOC product
  - Gibberellins – may need additional cost information

Regulatory options

- Establish VOC product emission limit based on current product with lowest emissions
- Type of product emission limit
  - EP limit, or
  - “VOC emission rate” limit (EP x application rate)
- Select affected active ingredients

Options for enforcing a product emission limit

- 4½ options
- All options require regulations
- All options prohibit products exceeding emission limit, with exceptions
- Some options likely achieve more VOC reduction than needed, others tailor the reduction to the SIP goal
- Different options place most of the burden and workload on different groups

Enforcing an emission limit: Option 1 – deny/cancel registrations

- Deny/cancel registrations of certain high-VOC products, with exceptions
- Requirements statewide, year-round
- Likely achieves more VOC reduction than needed
- Fumigant limit trigger unchanged
- Compliance and enforcement is high, if few exceptions
- Workload/burden is relatively high for growers and applicators, low for ag commissioners

Enforcing an emission limit: Option 2 – prohibit use

- Prohibit use of certain high-VOC products, with exceptions
- Requirements statewide or SJV, year-round or May-Oct
- Likely achieves more VOC reduction than needed
- Fumigant limit trigger unchanged
- Extensive outreach needed to ensure compliance
- Workload/burden is relatively high for grower and applicators, low for ag commissioners (if limited outreach)

Enforcing an emission limit: Option 3 – add restricted materials

- Designate additional pesticides as restricted materials, with permit conditions as needed
- Requirements statewide or SJV, year-round or May-Oct
- Achieves needed VOC reduction
- Fumigant limit trigger uncertain
- Maximum flexibility for restrictions
- Compliance and enforcement is high
- Workload/burden is relatively low for most growers and applicators, high for ag commissioners
- Some growers will use restricted materials for first time

Enforcing an emission limit: Option 4 – change fumigant limit trigger

- Replace/amend fumigant limit trigger with trigger prohibiting use of certain non-fumigant high-VOC products, with exceptions
- Annual emission inventory report used to determine if high-VOC prohibition is triggered, and which active ingredients are affected
  - Example: Fall 2013 inventory report would use 2012 PUR to determine if high-VOC prohibition triggered for May-Oct 2014
- If triggered, requirements only in SJV, May-Oct
- Achieves needed VOC reduction
- 2 possible methods to ensure compliance

Enforcing an emission limit: Option 4a – "authorizations" for use

- If high-VOC prohibition triggered, use of high-VOC products would require an "authorization" issued by ag commissioner
- Likely similar to permitting process, but no local evaluation or conditions (yes/no for authorization)
- Regulations would describe the situations for which an ag commissioner could issue an authorization
- DPR would provide fact sheet that explains requirements and lists allowed exceptions to high-VOC prohibition
- No authorization required for low-VOC products
- Workload/burden is relatively low for growers and applicators, possibly high for ag commissioners

Enforcing an emission limit: Option 4b – dealer requirements

- If high-VOC prohibition triggered, compliance through dealer sales requirement
- DPR would notify dealers of requirements and provide a form that explains allowed exceptions to high-VOC prohibition
- As a condition of sale, purchaser must read the form and certify that a high-VOC product is needed for an allowed use
- No requirements for sale of low-VOC products
- Similar to current clopyralid regulations
- Workload/burden is relatively low for growers and applicators, low for ag commissioners, possibly high for dealers

Summary of options for proposed regulations

- List of active ingredients affected and product emission limits
  - Chlorpyrifos and oxyfluorfen, possibly others
  - Possibly identify affected active ingredients in annual report
- Method to determine product emission
  - Revise regulations describing method for determining product VOC emissions, and include TGA method
  - Assume product is high-VOC without TGA data

Summary of options for proposed regulations

- Restrictions on products exceeding emission limit
  - Prohibit affected high-VOC products
    - San Joaquin Valley (possibly statewide)
    - May-Oct (possibly year-round)
  - Describe exceptions and process to add
    - Exceptions due to efficacy for specific crops/pests
    - Exceptions due to other adverse effects
    - Other exceptions?
- Enforcement of restrictions on high-VOC products
  - Registration requirements or sales/use requirements
  - Possibly revise fumigant limit trigger

Next steps

- **Summer-Fall 2011:** Stakeholder meetings and informal comments
- **Winter-Spring 2012:** Prepare draft regulations
- **Summer 2012:** Notice proposed regulations for formal public comment
- **Summer 2013:** Regulations in effect
- **May 2014:** Earliest possible prohibition of high-VOC products

Additional information and comments

- DPR web site
  - www.cdpr.ca.gov
  - Click on “Air” under Quick Finder
  - Click on “Volatile Organic Compound Emissions”
- Send comments to
  - Randy Segawa
  - 916-324-4137
  - rsegawa@cdpr.ca.gov