California Environmental Protection Agency
Department of Pesticide Regulation

Chloropicrin Mitigation Measures

January 16, 2015

Pesticide Registration and Evaluation Committee

Email questions during meeting to:
preccomments@cdpr.ca.gov

Outline

- Background – uses, risks, current requirements
- Development of additional DPR measures
- DPR mitigation measures
  - Buffer zone distances – factors, tables, minimums, credits
  - Emergency preparedness and response
  - Notice of intent
  - Maximum acreage and overlapping buffers
  - Buffer zone duration and tarp cutting interval
  - Tree hole restrictions
  - Fumigation time restrictions
  - Combination products
- Summary and concluding remarks

Background: uses

- Chloropicrin is applied to fields prior to planting for weeds, diseases, nematodes, and insects that are difficult to control

- Chloropicrin is injected into the soil with a tractor or applied through drip irrigation, and usually covered with a tarp

Verticillium damage in strawberries

Tractor shank injection fumigation

Drip Fumigation

From Ajwa

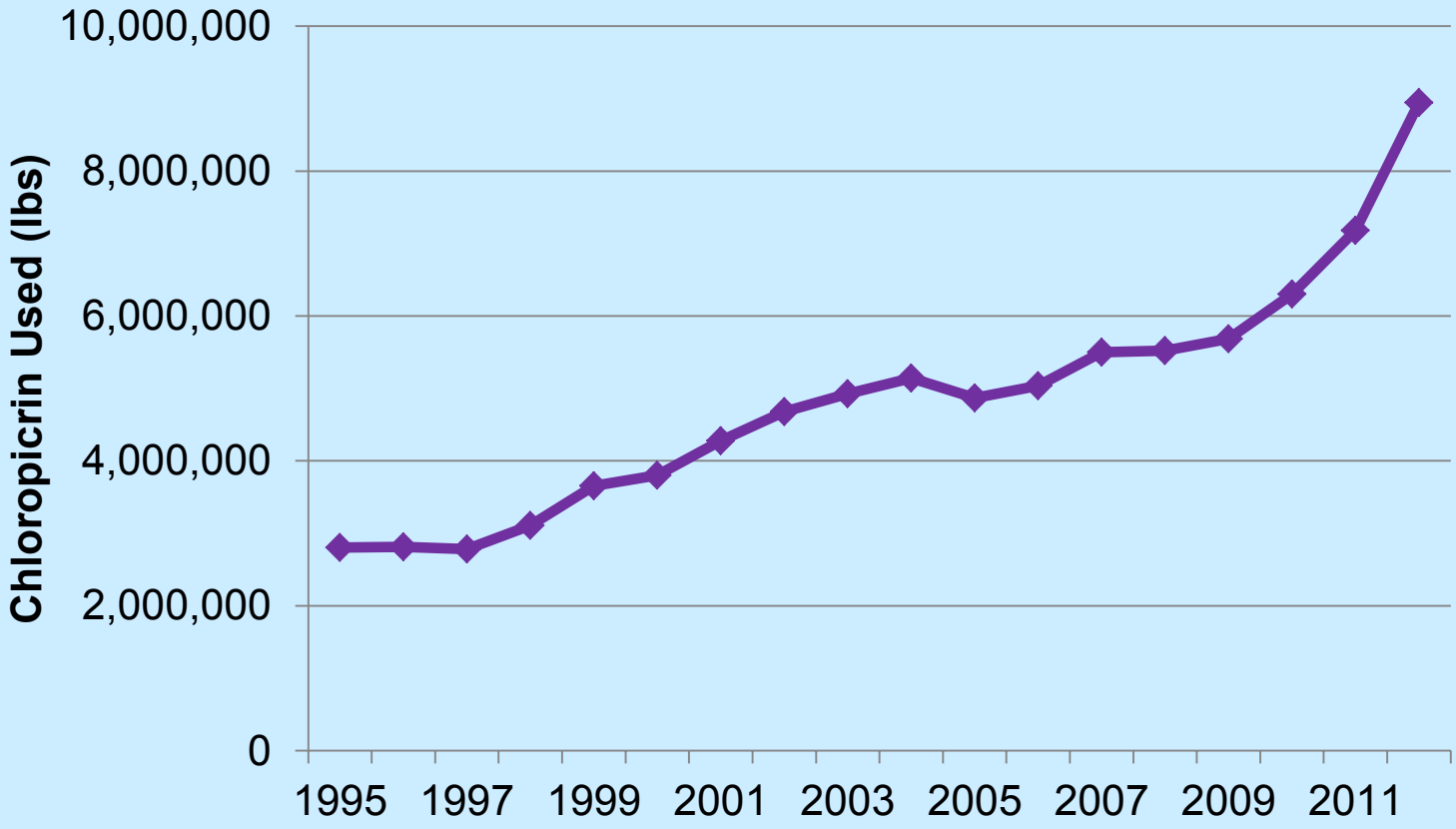
Background: product types

- Most chloropicrin is applied using products that also contain methyl bromide (MB) or 1,3-dichloropropene (1,3-D)

Product Type	2010-2012 Yearly Average		
	Pounds	Acres	Applications
MB/chloropicrin (e.g., Tri-Con, Terr-O-Gas)	35%	46%	53%
1,3-D/chloropicrin (e.g., Inline, Pic-Clor)	44%	39%	37%
Chloropicrin only (e.g., Tri-Clor)	21%	15%	10%
TOTAL	7,488,172 lbs	61,617 ac	2,766 apps

Background: use trend

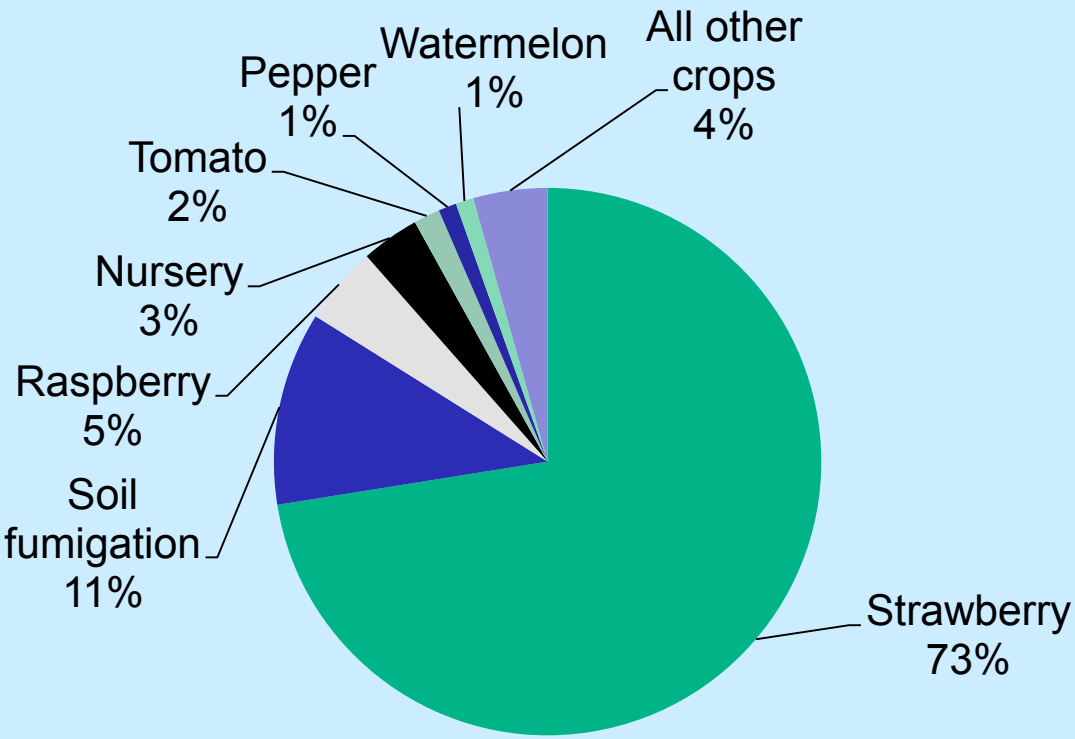
- Chloropicrin use has increased due to increased acreage planted and phaseout of methyl bromide that began in 1995



Background: crops treated

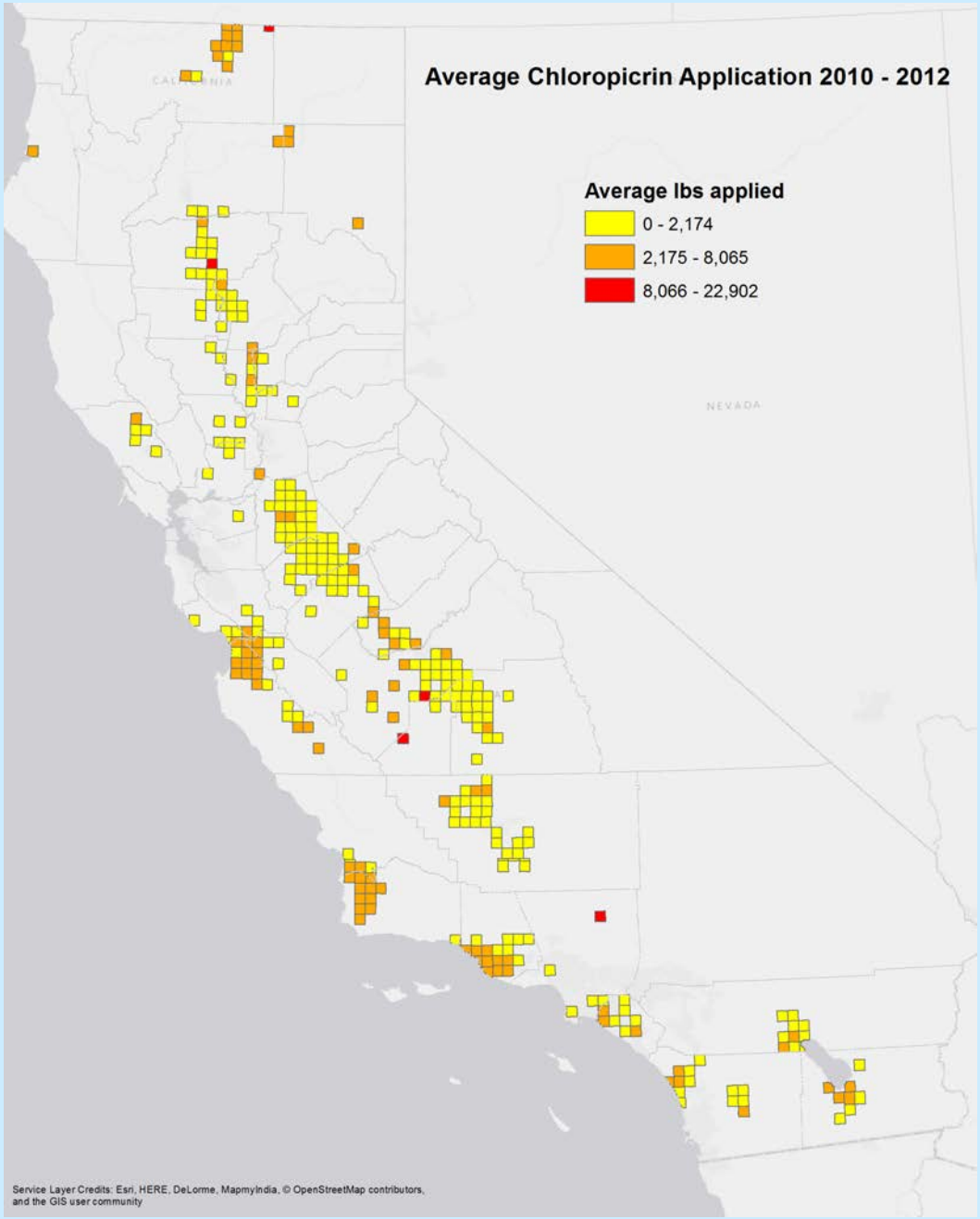
- Chloropicrin is primarily used to fumigate soil prior to planting strawberries, nursery crops, raspberries, tomatoes, peppers, and melons

2010-2012 Use (percent of pounds)



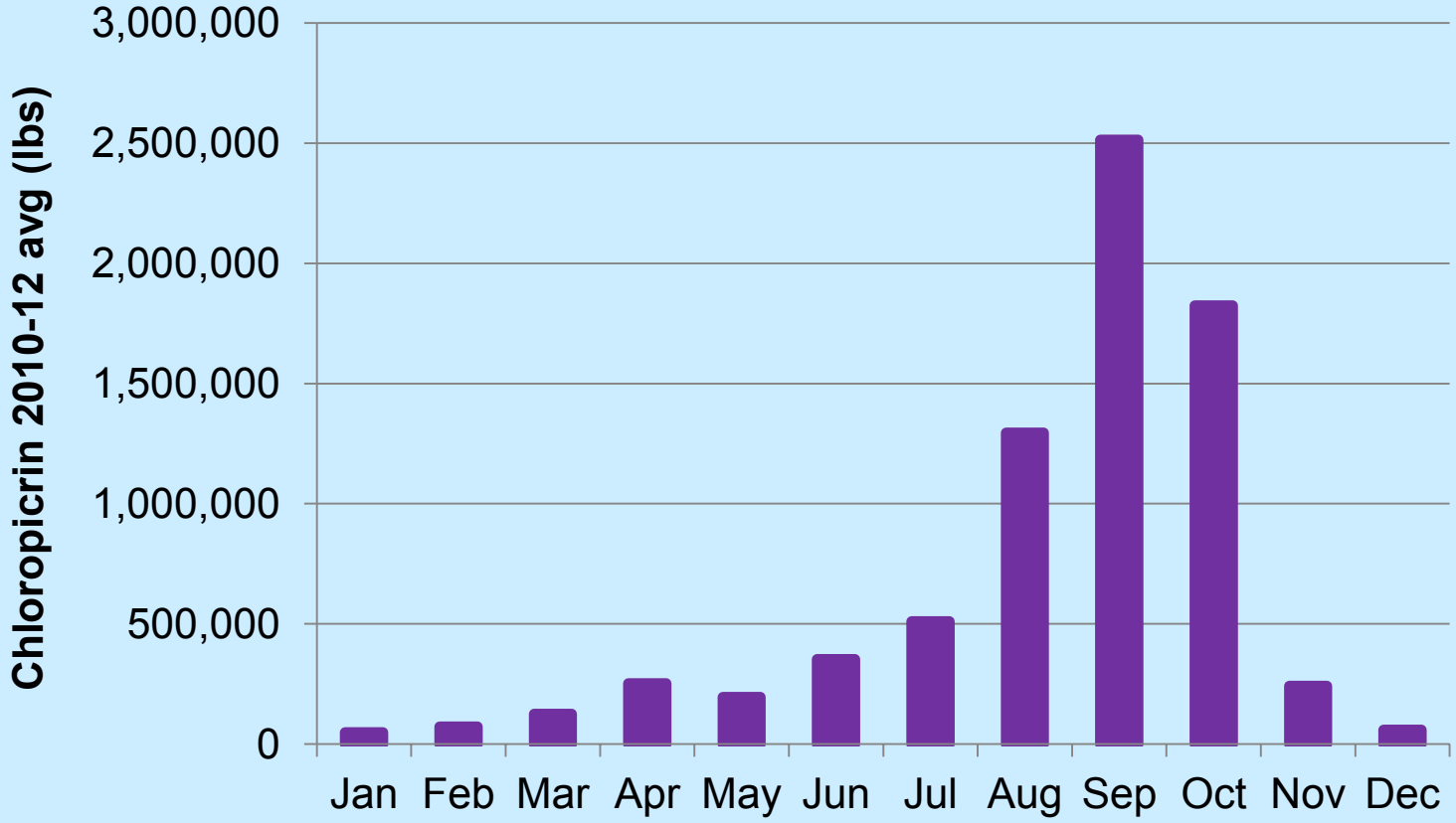
Background: locations of applications

- 6 counties account for 89% of pounds used (2010-12)
  - Ventura (30%)
  - Monterey (26%)
  - Santa Barbara (14%)
  - Santa Cruz (7%)
  - Siskiyou (7%)
  - San Luis Obispo (5%)



Background: period of applications

- 75% of chloropicrin is applied during August – October



Background: potential health risks

- As required by federal and state laws, EPA and DPR evaluated potential health hazards
  - Toxicology data evaluated
  - Exposure data (air concentrations) evaluated
  - Eye and respiratory irritation are most sensitive potential toxic effects
  - 33 CA illness episodes were investigated by county agricultural commissioners and DPR during 2001-2011
- EPA revised label requirements in 2011 and 2012 based on its assessment of risks and other factors
- DPR has developed additional mitigation measures based on its assessment of risks and other factors

Background: current use requirements

- **EPA label and other requirements**
  - Phase 1 revisions (Jan 2011): handler protections
  - → Phase 2 revisions (Dec 2012): bystander and resident protections
- **DPR regulations**: chloropicrin is a restricted material
  - Applications must be made or supervised by certified applicator
  - A permit must be obtained from county agricultural commissioner
- **County permit conditions**: agricultural commissioners have implemented additional restrictions that vary from county to county
- The most stringent requirements must be followed, whether specified by labels, regulations, or permit conditions

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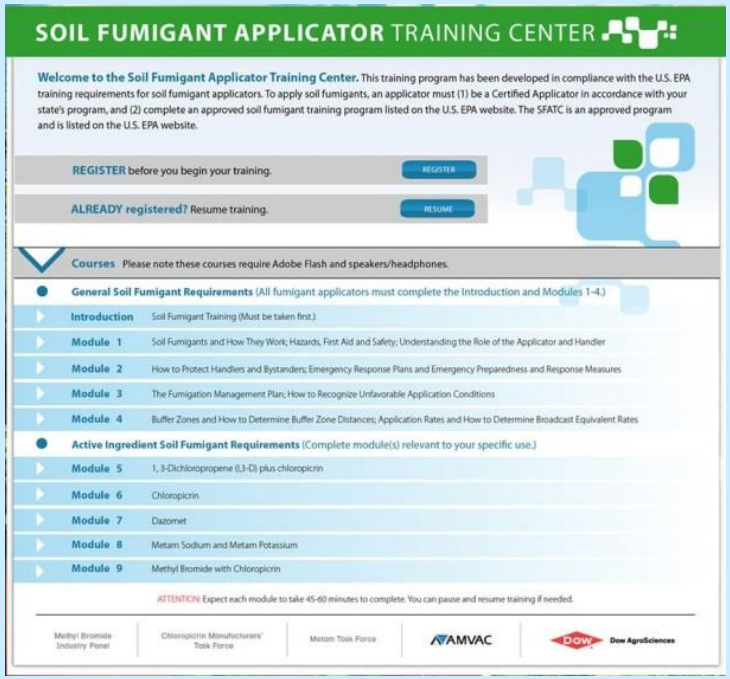
Background: EPA Phase 2 label revisions and other requirements

- Certified applicator training
- Community outreach
- Information for first responders
- Emergency response plan
- Buffer zones and related requirements

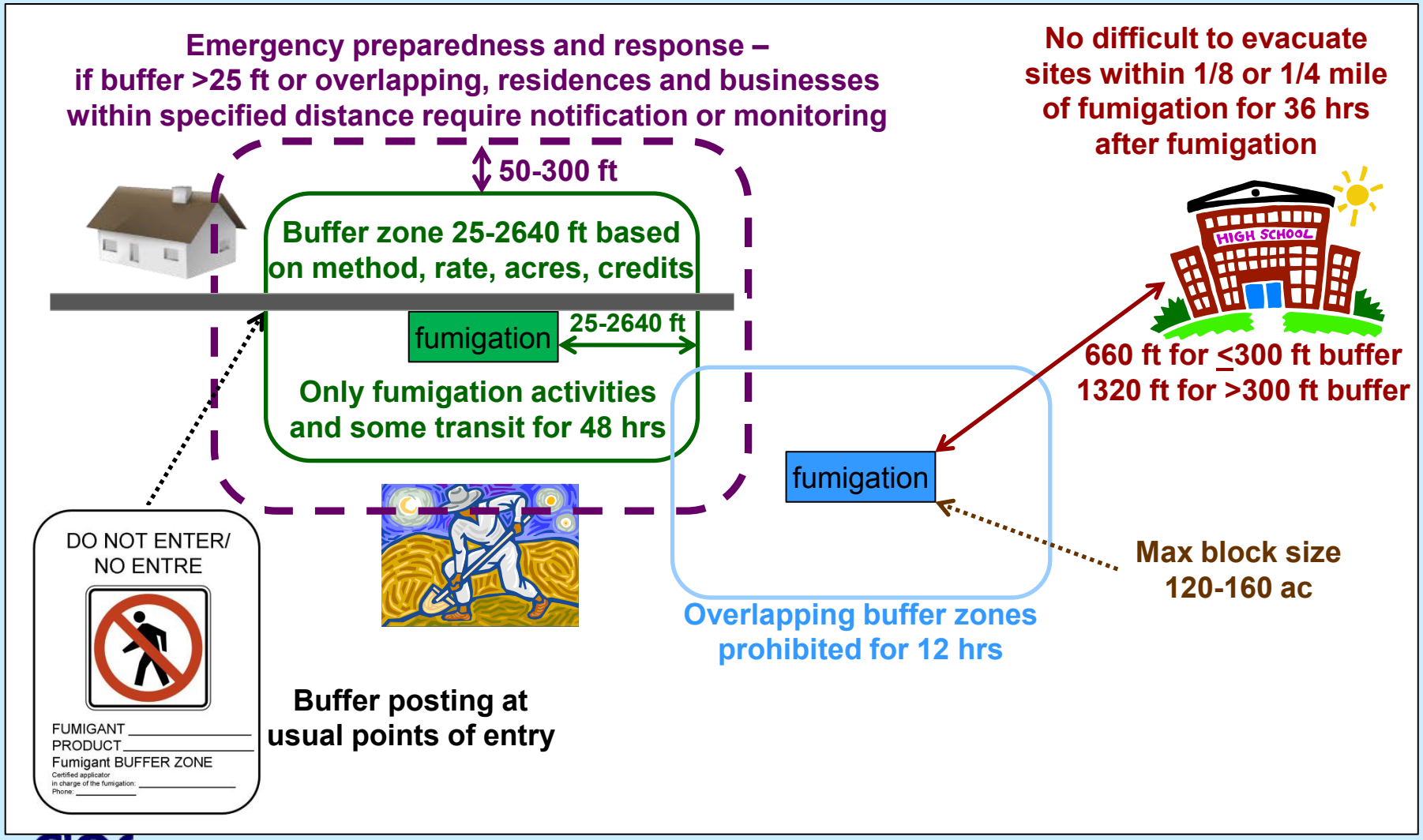


FIELD FUMIGATION EMERGENCY RESPONDER GUIDE: CHLOROPICRIN

THIS GUIDE IS FOR VAPOR EXPOSURES TO AIRBORNE EMISSIONS OF CHLOROPICRIN FOLLOWING SOIL INJECTION TO AGRICULTURAL FIELDS. CHLOROPICRIN MAY BE APPLIED ALONE OR IN COMBINATION WITH METHYL BROMIDE, 1,3-DICHLOROPROPENE, IODOMETHANE, OR DIMETHYL DISULFIDE. SEE FIELD POSTING FOR ACTUAL PRODUCT APPLIED. SEE EMERGENCY RESPONDER GUIDE FOR EACH CHEMICAL APPLIED. SEE PESTICIDE LABEL FOR EXPOSURE TO LIQUID OR SPILLS.

POTENTIAL HAZARDS	
HEALTH	Chloropicrin behaves as a mild irritant at concentrations between 75 ppb and 150 ppb and is usually detected through odor and eye sensation, within 5 minutes of exposure. At concentrations of about 75 ppb, eye sensation (prickliness or pinching) can be felt in about 20 minutes. Symptoms are temporary and reversible at concentrations up to 150 ppb. At levels above 150 ppb headache, nausea and vomiting may occur. At levels above 580 ppb for 8 hours or 2000 ppb for 10 minutes, life-threatening effects including pulmonary edema or death can occur The OSHA 8-hour TWA is 100 ppb. The NIOSH IDLH is 2000 ppb. Chloropicrin has been shown to not cause cancer in animal studies following long-term inhalation. Laboratory testing showed that at inhalation exposures below levels which produced permanent respiratory injury, birth defects or decrement in reproductive function did not occur. Chloropicrin is not expected to accumulate in human tissue.
CHEMICAL PROPERTIES	Chloropicrin is injected into the soil as a liquid where it becomes a vapor. Vapors are heavier than air, and will collect in low areas. Chloropicrin is volatile and concentrations may increase under still or low wind conditions. Vapors are not flammable or explosive.
PUBLIC SAFETY	

Background: label requirements for buffer zones and related restrictions



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Development of additional DPR measures

- In Dec 2010 DPR issued a risk management directive to mitigate acute exposure, with a target concentration of no greater than 73 ppb as an 8-hr average for residents and bystanders
- DPR released a mitigation proposal for public comment and peer review in May 2013
- Final mitigation measures include revisions based on comments and corrections to data errors
  - Mitigation measures apply to use as an active ingredient in soil fumigations (products with >2% chloropicrin)
  - Mitigation measures apply to products containing chloropicrin alone, with 1,3-dichloropropene, and with methyl bromide

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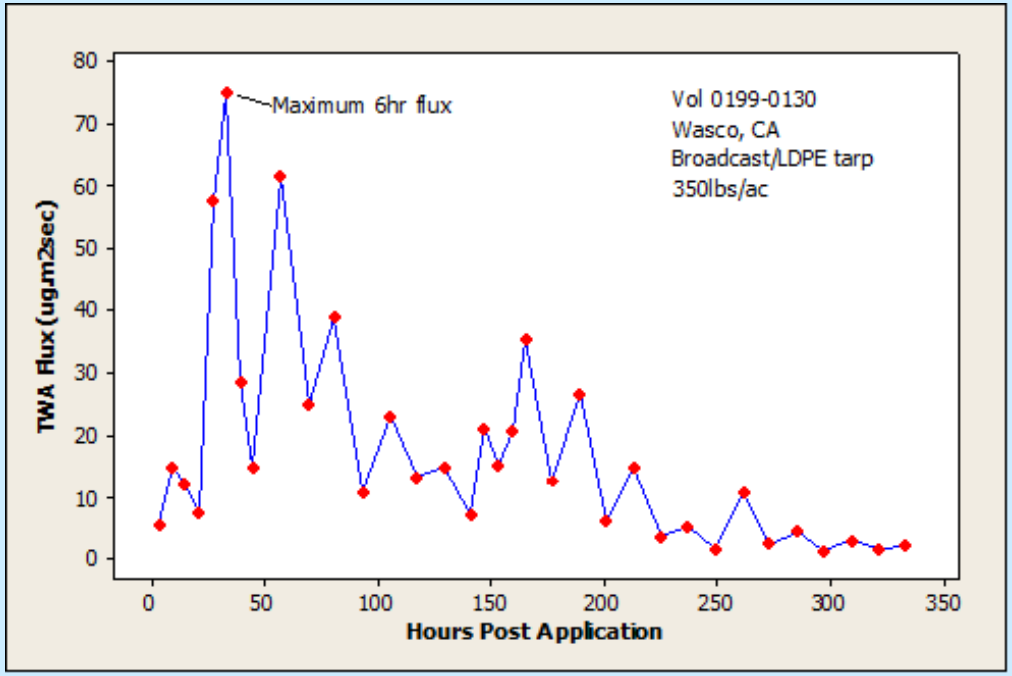
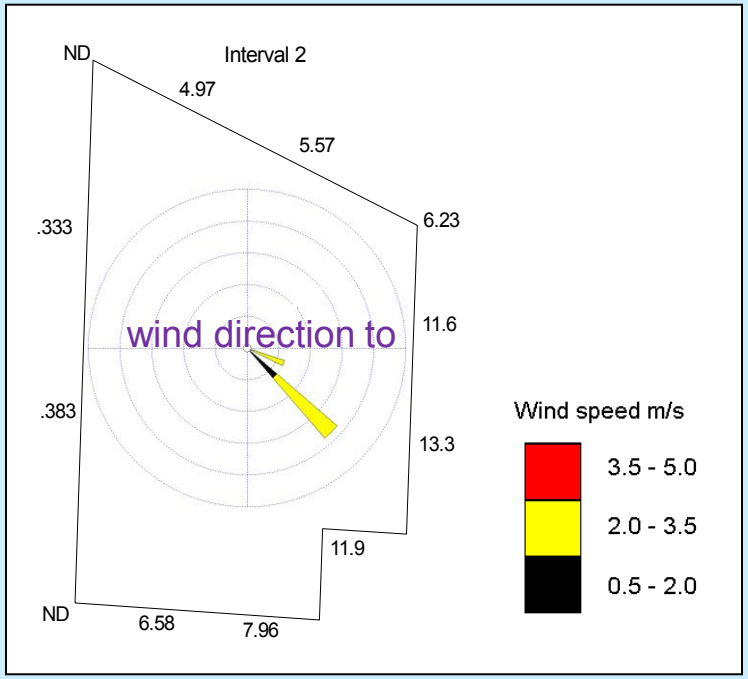
Development of additional DPR measures: air monitoring

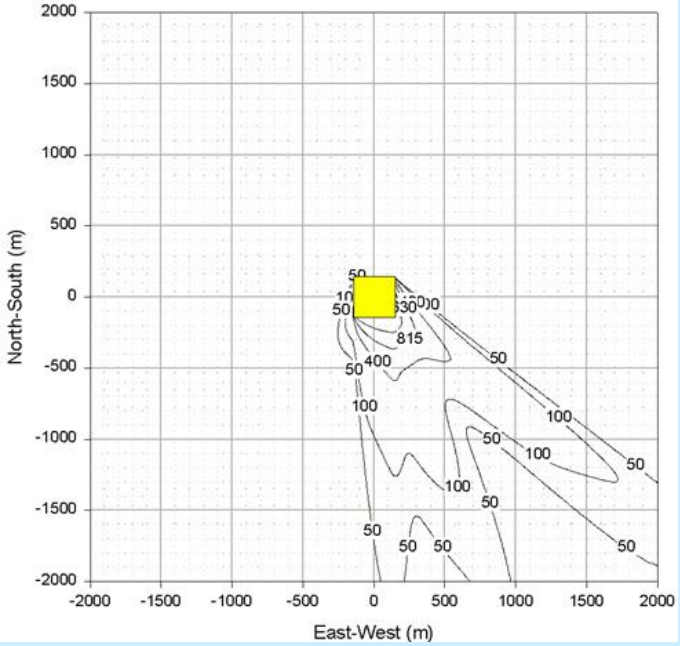
- DPR used monitoring data from 28 chloropicrin field fumigations
  - Air concentrations vary with location, time, fumigation method, application rate, acres, and weather
  - Measured air concentrations are used to estimate emissions (flux)





Development of additional DPR measures: computer modeling

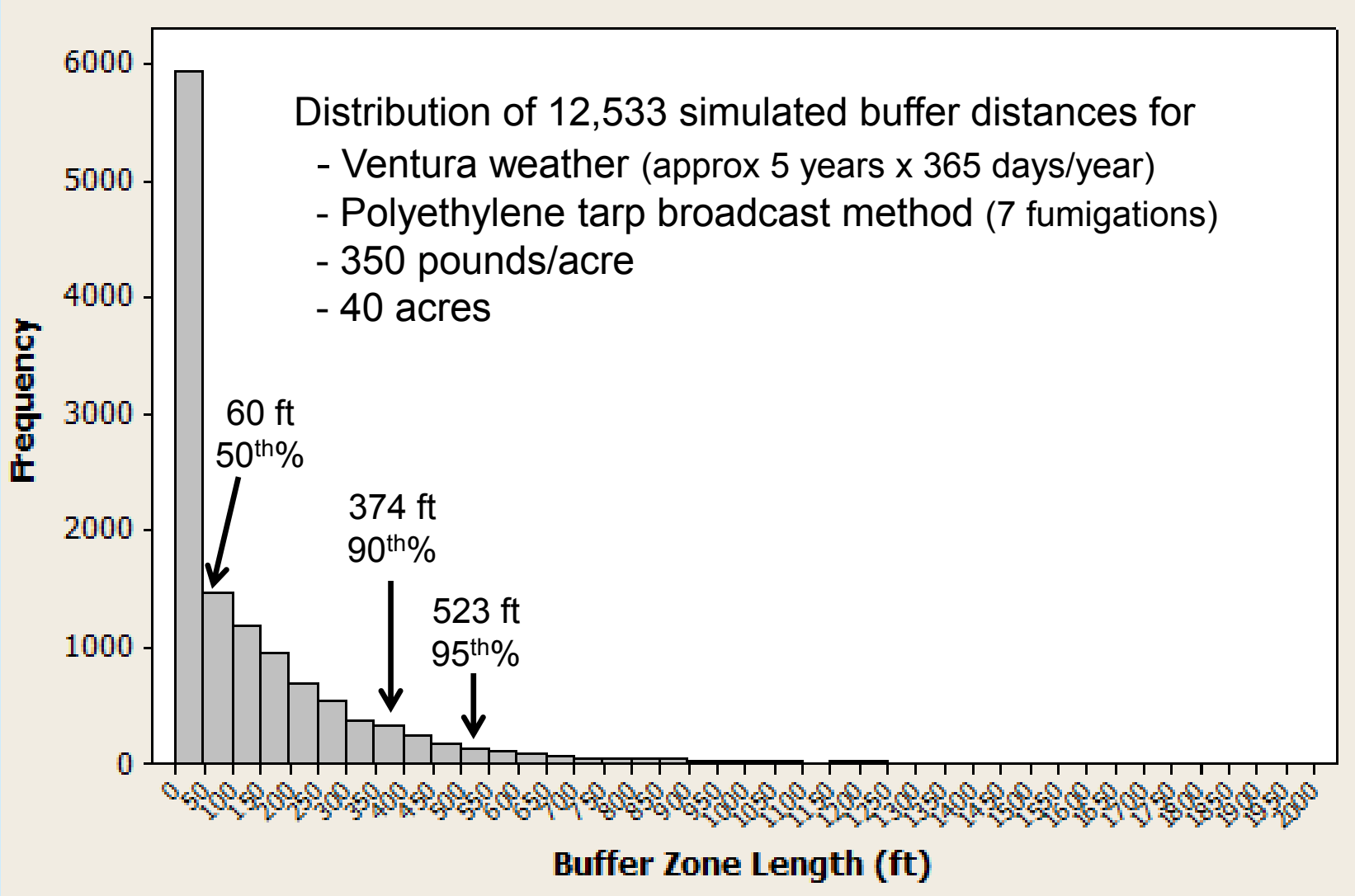
- DPR supplemented monitoring data with computer modeling to estimate air concentrations based on emissions and weather data
  - Emissions from 28 fumigations – change from proposal
  - 5 yrs of historical weather from 5 stations – change from proposal
- Emissions and weather data used for proposal had errors; corrections resulted in smaller buffers
- DPR simulated approximately 250,000 fumigations to estimate distances to 73 ppb regulatory target concentration



Development of additional DPR measures: buffer zones

- Labels only allow fumigation activities and transit in buffer
- DPR buffer zone size is the maximum distance from the fumigated area to the 73 ppb regulatory target concentration
- Several thousand computer simulations show distance ranges from 0 to 4700+ feet
- DPR selected 95th percentile from distribution of buffer distances
  - DPR estimates that air concentrations for 95% of the fumigations will be no more than 73 ppb at downwind edge of buffer
  - This is consistent with DPR mitigation for other fumigants

Development of additional DPR measures: example distribution of simulated buffer zones



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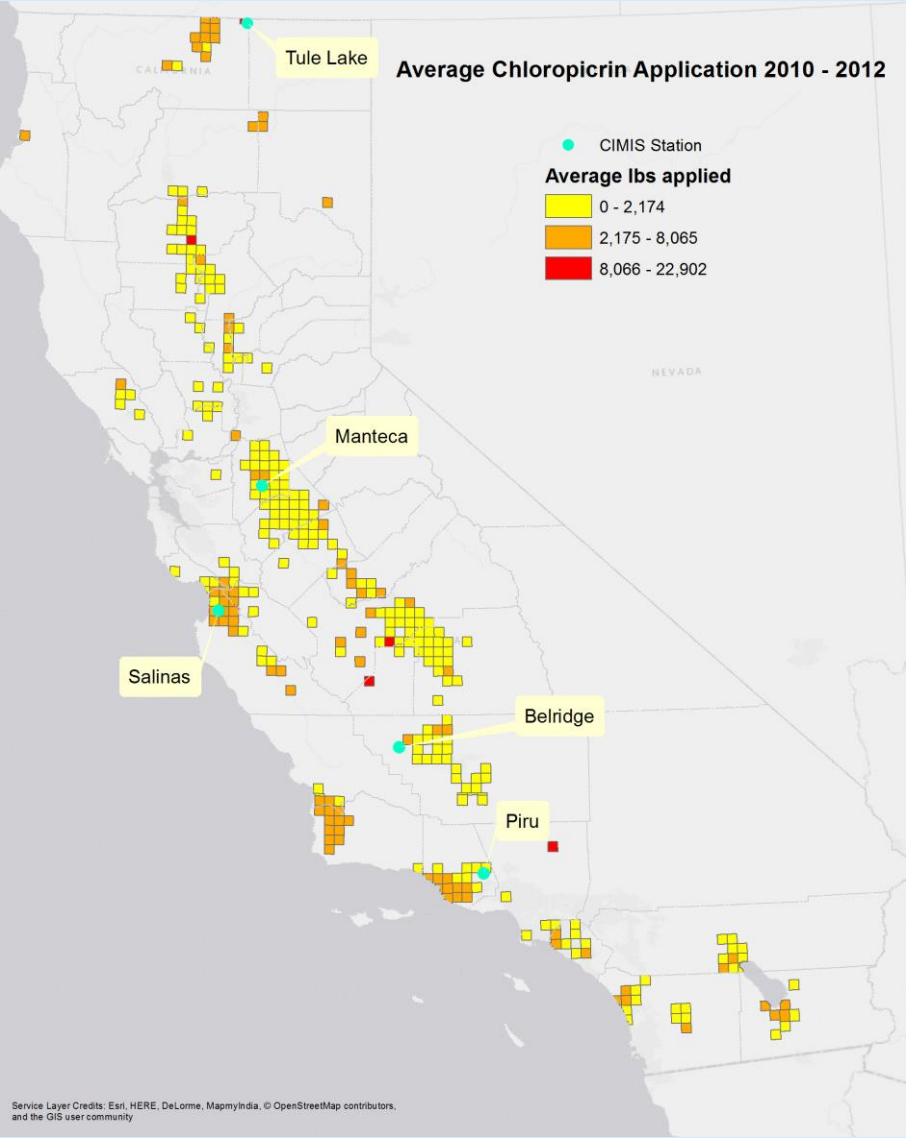
Buffer zone distances: determined from four factors

1. Region: coastal and inland – change from proposal
2. Fumigation method – change from proposal
   - Tarp type
     - TIF (totally impermeable film assigned 60% buffer credit)
     - Non-TIF (standard polyethylene, 20% buffer credit, 40% buffer credit)
     - Untarped
   - Field type
     - Broadcast (fumigation of entire flat field)
     - Strip (fumigation of orchard or vineyard rows)
     - Bed (fumigation of pre-formed beds)
   - Equipment type
     - Tractor shank injection (shallow or deep)
     - Drip application
3. Application rate
4. Acres

Buffer zone distances: regions – change from proposal

- DPR evaluated buffers using weather data from 5 stations in high use areas
- Coastal buffers are based on Piru (Ventura Co) weather; Salinas had smaller buffers
- Inland buffers are based on Manteca (San Joaquin Co)
  - No single location had consistently larger buffers
  - Tule Lake had more calm days, more uncertainty
  - Belridge area had lower use



Buffer zone distances: 12 fumigation methods – change from proposal

1. TIF tarp broadcast injection
2. TIF tarp bed injection
3. TIF tarp strip deep injection
4. TIF tarp drip

5. Non-TIF tarp broadcast injection
6. Non-TIF tarp bed injection
7. Non-TIF tarp strip injection
8. Non-TIF tarp drip

9. Untarped broadcast shallow injection
10. Untarped broadcast deep injection
11. Untarped bed injection
12. Untarped drip

Buffer zone distances: buffer tables

- 18 buffer tables – change from proposal
  - 6 fumigation methods x 2 regions (coast and inland) = 12
  - 6 fumigation methods default to label buffers
- Each table specifies buffer distances that vary with
  - Application rate (broadcast-equivalent for bed, strip, drip)
  - Acres
- Label buffers differ from DPR buffers due to differences in computer modeling inputs
- Labels prohibit applications with buffer zones >2640 ft (1/2 mi)

From Ajwa

Buffer zone distances: example buffer zones for untarped broadcast deep injection

DPR coastal buffers

Application Rate	5 ac	10 ac	40 ac
100 lbs/ac	100 ft	215 ft	702 ft
200 lbs/ac	488 ft	780 ft	2032 ft
350 lbs/ac	976 ft	1536 ft	~~3786 ft~~

DPR inland buffers

Application Rate	5 ac	10 ac	40 ac
100 lbs/ac	100 ft	129 ft	462 ft
200 lbs/ac	350 ft	572 ft	1455 ft
350 lbs/ac	749 ft	1182 ft	~~2910 ft~~

Label buffers

Application Rate	5 ac	10 ac	40 ac
100 lbs/ac	30 ft	118 ft	405 ft
200 lbs/ac	272 ft	446 ft	1106 ft
350 lbs/ac	525 ft	820 ft	1990 ft

Orange values indicate minimum distance
Purple values indicate >2640 ft not allowed

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Buffer distances: comparison to label buffers

Application Method	Coastal Buffers	Inland Buffers
1. TIF broadcast	DPR same as label	DPR same as label
2. TIF bed	DPR same as label	DPR same as label
3. TIF strip deep	DPR same as label	DPR same as label
4. TIF drip	DPR same as label	DPR same as label
5. Non-TIF broadcast	DPR same as label	DPR same as label
6. Non-TIF bed	DPR 4x – 8x larger	DPR 3x – 6x larger
7. Non-TIF strip	DPR 2.5x – 3.5x larger	DPR 2x – 3x larger
8. Non-TIF drip	DPR 1x – 2.5x larger	DPR 1x – 2x larger
9. Untarped shallow	DPR 1.5x – 2x larger	DPR 1.1x – 1.5x larger
10. Untarped deep	DPR 1.5x – 2x larger	DPR 1.1x – 1.5x larger
11. Untarped bed	DPR 2x – 4x larger	DPR 2x – 3x larger
12. Untarped drip	DPR same as label	DPR same as label

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Buffer zone distances: minimum buffer

- DPR and EPA modeling shows concentrations <73 ppb at field edge in some cases, but uncertainty in the modeling

- Minimum buffer zones – change from proposal
  - Labels: 25 ft
  - DPR TIF: 25 ft
  - DPR Non-TIF ≤6 ac: 60 ft
  - DPR Non-TIF >6 ac: 100 ft
  - DPR Untarped: 100 ft

Buffer zone distances: reduction credits

- Labels reduce buffer distances up to 80% using 11 possible "credits" for conditions and practices with lower emissions
- DPR only allows 1 credit: 60% credit for TIF tarps
- Tarps assigned 60% credit require EPA and DPR approval – change from proposal
- Additional DPR evaluation of other credits is in progress

Condition or Practice	Label % Reduction
Low perm tarp	20, 40, or 60
Soil OC 1-3%	10, 20, or 30
Clay >27%	10
Soil temp <50° F	10
Symmetry	10
Thiosulfate	15
Water seal	15

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Emergency preparedness and response: triggers

- Labels: measures are not required if buffer zone is 25 feet
- Labels: certified applicator must provide response information for neighbors OR conduct sensory monitoring if:

Buffer zone is:	**AND there are residences or businesses within:**
>25 ft but ≤100 ft	50 ft from edge of buffer zone
>100 ft but ≤200 ft	100 ft from edge of buffer zone
>200 ft but ≤300 ft	200 ft from edge of buffer zone
>300 ft or overlapping buffers	300 ft from edge of buffer zone

Emergency preparedness and response: response information for neighbors

- For this option, labels require certified applicator to provide
  - Location of fumigation (application block)
  - Fumigant product applied
  - Contact information for certified applicator and property owner
  - Time period application is planned (1-4 weeks prior to application)
  - Early signs and symptoms, what to do if exposed
  - How to find additional information about fumigants
  - Persons must be notified again if application doesn't occur during specified time period
- Additional DPR measure: response information must be provided in English and Spanish

Emergency preparedness and response: sensory monitoring

- For this option, labels require certified applicator or handler to
  - Monitor at least 8 times while buffer is in effect (48 hrs), including
    - 1 hr before sunset
    - During the night
    - 1 hr before sunrise
    - During daylight hours
  - Implement emergency response plan if sensory irritation occurs
- More restrictive DPR measures
  - Monitor at edge of buffer zone
  - Monitor at least two locations in direction of residences, businesses, and downwind; monitor all sides of buffer if calm wind
  - Person monitoring must have full olfactory capabilities

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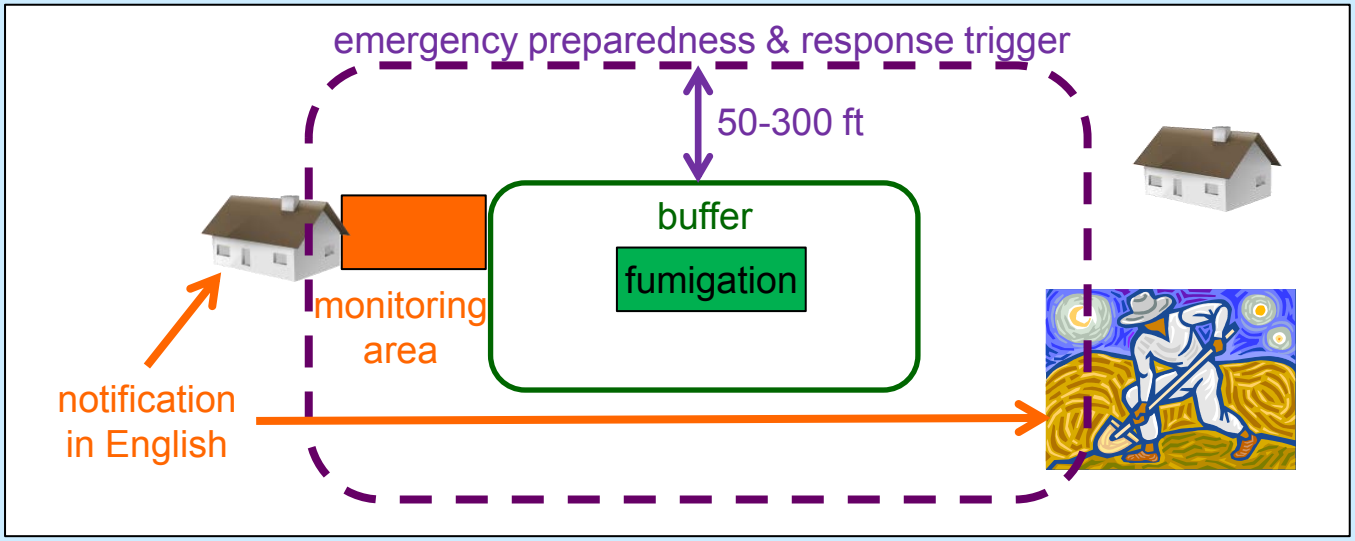
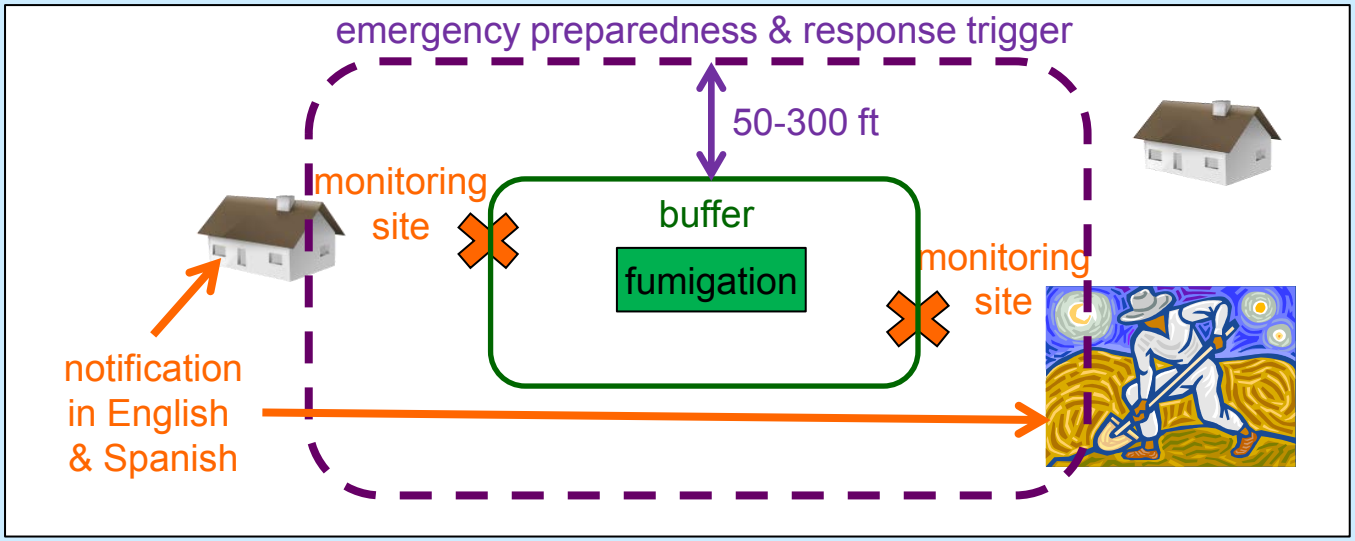
Emergency preparedness and response: notification OR monitoring

Label



DPR mitigation



Emergency response plan

- Labels: plan must include
  - Evacuation routes
  - Contact information
  - Phone locations
  - Procedures/responsibilities
- Additional DPR measure: ag commissioner must be notified immediately – change from proposal

Notice of intent (NOI) submitted to agricultural commissioner

- Current regulations require NOI to be submitted at least 24 hrs prior to application
- Additional requirements for chloropicrin
  - Submit NOI at least 48 hrs prior to application, and specify start time
  - Application starts within 12 hrs of specified time, or resubmit

Notice of Intent To Apply Restricted Materials

(8463-323913)

County	Nursery	Sec.	Twn.	Rng.	Base	Method	Property Operator	Applicator Name and Address
Monterey	No	11	14S	02E	M	Ground 1143	Harvest Moon Ag Services	TriCal PO Box 1327 Hollister 95024 Applicator ID: 30596

Permit No.	Site ID	Planted Area
2700944	05	418 Acres

Location	Block ID
STROBEL RANCH	050005

Est. Application Time	Est. Treatment Area	Commodity
2014-11-14 05:00:00	25 Acres	STRAWBERRY

Chem No	Product Applied	Rate	Dilution	Pest
	NOI TriCal, Inc. Tri-Con 50/50 (11220-10) (49.70% - Chloropicrin)	350 Lb / Acre	0 Ga	Verticillium

Re-Entry Interval	Pre-Harvest Interval	Applied / Supervised By
7 Days	0 Days	Abbie Wiseman

Environmental Changes / Comments
| Restrictions: Avoid Drift -- Certified Applicator Required -- Notice of Intent Required -- Posting Required -- Toxic To Birds

Submitted By	Date/Time	PCA Name & License
Abigail Wiseman	2014-11-11 20:44:35	Abigail Wiseman 121891

Received By	Box #	Date	Approved or Declined

Treatment Area

Adjacent Crops, Schools, Dwellings, Etc.

Converted From REC-2346119

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Shared With - Trical, Inc. - Hollister,Richard Pozzi

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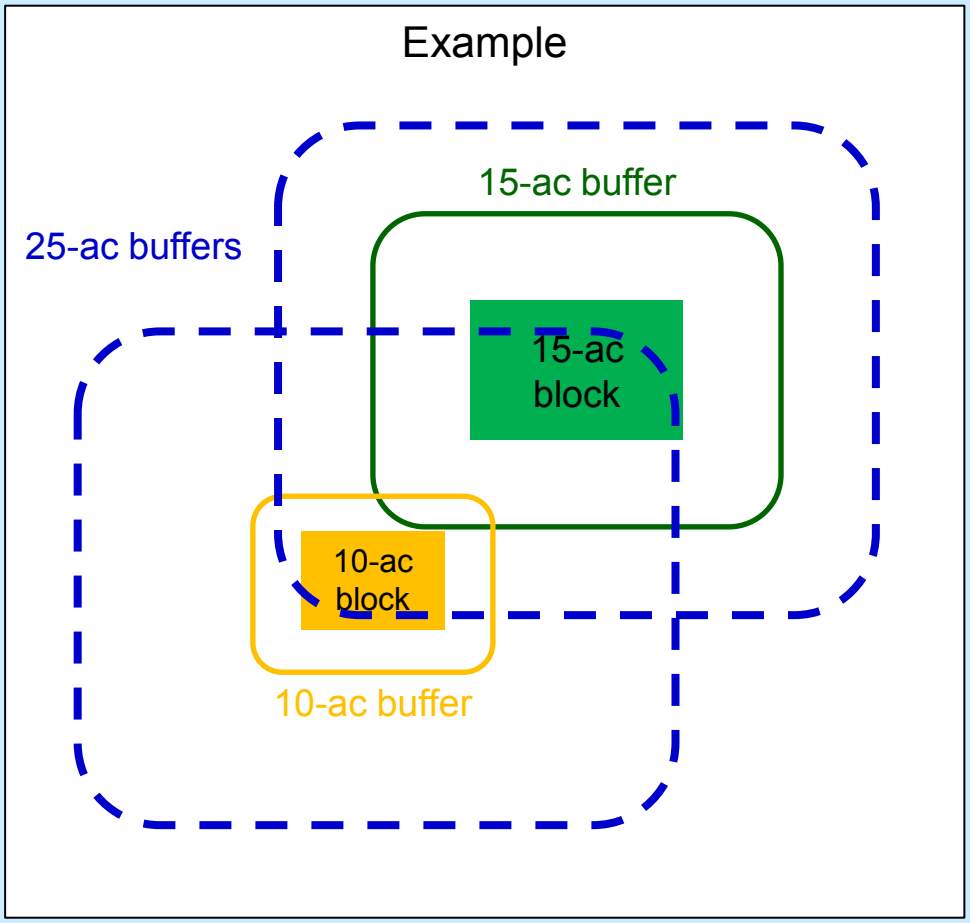
Maximum acreage

- Maximum fumigated acreage in 24 hrs at one site
  - Label drip: 120 ac
  - Label other methods: 160 ac

  - DPR non-TIF/untarped: 40 ac
  - DPR TIF: 60 ac – change from proposal

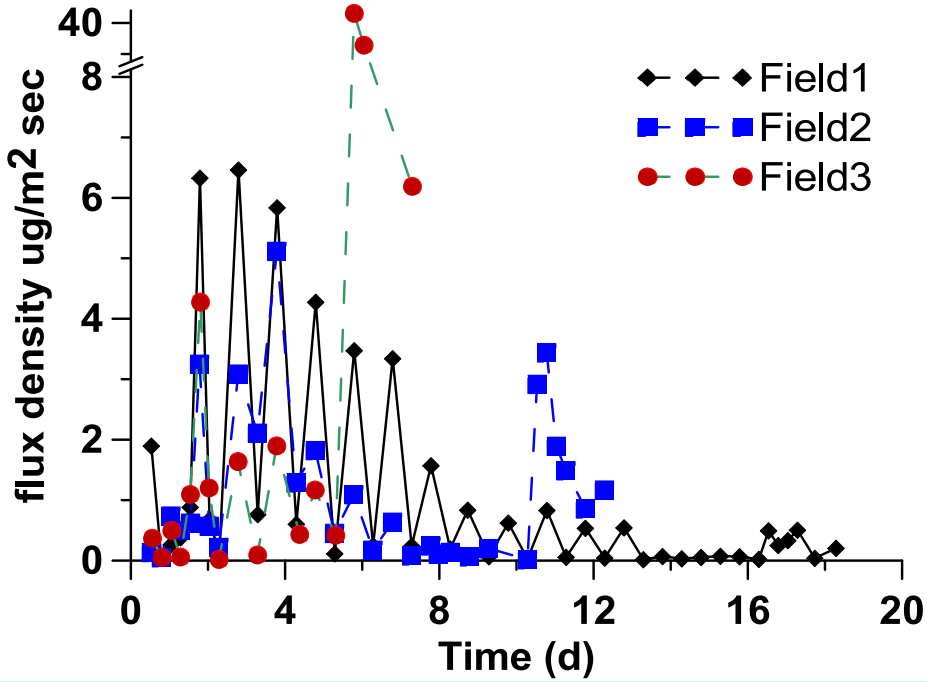
Overlapping buffers

- Labels: overlapping buffers are prohibited for 12 hours
- Additional DPR measures
  - Acreage is combined to determine buffer if overlap during first 36 hrs
  - Combined acreage can't exceed 40 acres
  - TIF acreage excluded – change from proposal



Buffer duration and tarp cutting interval

- Buffer expires 48 hours after application (labels and DPR)
- DPR minimum tarp cutting interval is 9 days from end of application for tarps with any buffer credit; labels require 5 days



Tree hole restrictions

- Labels
  - Buffer zone 25 ft
  - Maximum application rate = 1 lb/hole, 435 lbs/ac

- Additional DPR measures: limits on number of holes and acreage at each site in 24 hrs – change from proposal

Maximum Holes/Acre	Maximum Acres
50	40
75	10
100	5
200	1

Fumigation time restrictions – change from proposal

- Labels have no restrictions on fumigation time
- All other factors being equal, higher air concentrations occur at night due to inversions and more stable atmosphere
- To help avoid peak flux at night for non-TIF and untarped fumigations
  - Applications must start no sooner than 1 hr after sunrise
  - Applications must end no later than 3 hrs before sunset
- TIF fumigations have no time restrictions

Combination products

- 1,3-D/chloropicrin products
  - Buffers are based on chloropicrin
  - 1,3-D products also require 100 ft distance to occupied structure
- Methyl bromide/chloropicrin products – DPR regulations still apply
  - Depending on fumigation method, chloropicrin will usually control buffer distances when present at 33% – 43% or greater
  - More stringent minimum methyl bromide buffers will not change, regardless of mixture
  - TIF tarps are allowed with methyl bromide, but no buffer distance reduction and 40 ac maximum
  - Tree hole fumigations are limited to 1 ac

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Summary comparison of requirements

Requirement	Labels	DPR
Max buffer distance	TIF: 290 ft Non-TIF: 725 ft Untarped: 1990 ft	TIF: label distances Non-TIF: 1x – 8x of label Untarped: 1x – 6x of label
Min buffer distance	25 ft	25–100 ft
Buffer credits	11 credits	Only DPR-approved 60% TIF tarp
Emergency prepare & response	Notify in English OR monitor 1 location	Notify in English & Spanish OR monitor 2+ locations; ag comm notified immediately
Notice of intent	None	48 hrs
Max acres	120–160 acre block	TIF 60 ac; other methods 40 ac
Overlapping buffers	Prohibit overlapping buffers for 12 hrs	Non-TIF & untarped buffer based on combined acres during 36 hrs
Min tarp time	5 days	9 days for 20%, 40%, 60% tarps
Tree hole limits	None	50–200 holes/ac, 40 ac max
Fumigation time limits	None	Non-TIF & untarped start 1 hr after sunrise, end 3 hrs before sunset

Concluding remarks

- Next steps
  - Interim permit conditions
  - Regulations or label changes
- The mitigation document, responses to comments, and other information are available on DPR's website:
  - www.cdpr.ca.gov
  - "LATEST NEWS AND INFORMATION" section