



Department of Pesticide Regulation



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MEMORANDUM

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HSM-10011

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[Original signed by S. Edmiston]

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SUBJECT: EVALUATION OF CHLOROPICRIN PRIORITY ILLNESS EPISODES
RELATIVE TO COUNTY PERMIT CONDITIONS, PESTICIDE USE, AND
U.S.EPA'S MITIGATION MEASURES

This memo summarizes information on priority investigations of illness episodes that followed exposure to chloropicrin used as an agricultural fumigant. It is intended to provide context for label updates and mitigation proposals.

Chloropicrin Characteristics:

Chloropicrin has a low threshold for irritation; if exposure continues for an hour, most people experience eye irritation at a concentration of 100 ppb, or about seven tenths of a milligram per cubic meter. Typical applications use 150 to 200 pounds of chloropicrin per acre, which corresponds to 17 to 22 grams per square meter. If chloropicrin vapor escaped into still air with a boundary at, for example, 100 meters above ground, escape of one half of one percent of the chloropicrin would raise the concentration in the whole 100-meter column above a perceptible level. Put another way, the amounts of chloropicrin applied are sufficient to contaminate a column of air the size of the treated field and roughly 15 miles long.

Chloropicrin use has more than doubled as growers seek alternatives to methyl bromide. In the early 1990s, growers used somewhat more than two million pounds annually. The total exceeded three million pounds for the first time in 1998, four million in 2001, and five million in 2004. While some usage is reported in almost all California counties, the heaviest use occurs in Monterey County, followed by Ventura, Santa Barbara, and Santa Cruz. These four counties account for 70% of the chloropicrin applied in California from 1992 through 2007.

Illness Data:

A search of the Pesticide Illness Surveillance database (1992 – 2007) identified 23 priority episodes in which people developed symptoms following exposure to chloropicrin in agricultural use. Just four of these episodes occurred before the year 2000. Review of priority logs identified five additional episodes that occurred in 2008 and 2009, for a total of 28 potentially relevant episodes. The episodes that occurred in 2009 are still under investigation, but this report includes preliminary information from their 15-day reports.

Five episodes were excluded from this analysis because they concerned effects on applicators, which are not addressed by current permit conditions or suggested interim mitigation measures. Three other episodes involved people whose concerns are unlikely to be addressed by any feasible regulation: those who expressed conviction that fumigation would harm them. Accordingly, we segregated those episodes in which the affected people had made such statements. Twenty episodes remain for analysis of factors that contributed to their occurrence. These episodes are described individually in Appendix C, table 9.

The 17 fully investigated episodes affected a total of 699 individuals, and ranged from six to 324 affected people per episode. Distance from the fumigated field was not available for each affected person, but ranged from 30 feet to nearly three miles.

Pesticide Use Circumstances:

Of the 20 episodes under analysis, eight involved use of chloropicrin alone, seven chloropicrin with methyl bromide, and five chloropicrin with 1,3-dichloropropene. Three of the episodes affected agricultural workers; the other 17 affected people who lived or worked near fumigated fields. They occurred in nine counties: five in Monterey, four in Ventura, two each in Merced, Santa Barbara, San Bernardino, and San Joaquin, and one each in Kern, Orange, and San Luis Obispo. The three episodes that affected field workers occurred in Monterey, Santa Barbara, and San Luis Obispo Counties.

The event counts for Monterey, Ventura, Santa Barbara, and Orange Counties are directly proportional to their chloropicrin use rates. The absence of incidents in Santa Cruz County is intriguing and warrants further investigation. San Diego and Siskiyou Counties also record more chloropicrin use than the other counties where exposures occurred. This analysis cannot identify causes for the absence of mishaps in counties with substantial amounts of fumigant use, particularly as Santa Cruz and Siskiyou Counties have not implemented permit conditions, and San Diego requirements are minimal. It would be helpful to investigate whether fumigant use in these counties occurs in areas with favorable climatic conditions, or whether land use patterns isolate fields subject to fumigation from occupied structures.

County	Percent of Total Agricultural Chloropicrin Usage	Number of Chloropicrin Drift Episodes
MONTEREY	29.3	5
VENTURA	20.3	4
SANTA CRUZ	11.8	0
SANTA BARBARA	9.1	2
ORANGE	4.1	1
SAN DIEGO	3.6	0
SISKIYOU	3	0
MERCED	2	2
SAN LUIS OBISPO	1.8	1
3 other counties	4.9	0
KERN	1.5	1
SAN JOAQUIN	1.3	2
8 other counties	5.4	0
SAN BERNARDINO	0.2	2

Intended Crop:

Nearly half of the recorded agricultural chloropicrin applications have been identified as for strawberries, and the next most frequent category is “soil fumigation/pre-plant”, which does not exclude planting strawberries. So it is not necessarily disproportionate that strawberries were the intended crop in at least 15 of the 20 episodes analyzed. It does suggest, however, that mitigation regulations will have to consider the needs and practices of strawberry growers.

Application Methods:

Application equipment was not specified in one of the preliminary reports on episodes that remain under investigation. Of the 19 episodes with known application equipment, six involved drip irrigation systems; in five of these the beds were tarped, and the sixth may have been (pending investigation.) In 13 episodes, the fumigant was incorporated into the soil mechanically (for instance by shank injection), including three applications performed without tarps.

Application Method	Fumigant Containment Method			
	Compaction	Tarp	Tarp AND Water	UNKNOWN
DRIP	0	3	2	1
INJECTION	2	7	3	1
UNKNOWN	0	0	0	1

For chloropicrin used alone, application rates ranged from 80 to 200 pounds of product (94 to 99% chloropicrin) per acre. In combination with other fumigants, the amount of chloropicrin applied ranged from 40 to 140 pounds/acre. Application rate was not available for one episode still under investigation. Treated acreage ranged from 4 to 49 acres, and was not available for two of the three priority episodes still being investigated.

Fumigant Containment:

Applications were followed by irrigation in five of the 20 episodes. In one episode, three sets of irrigation were initiated in response to complaints or observations of escaping fumigant vapor. In two drip irrigation episodes, we noted that irrigation was delayed by one to three hours while workers flushed lines and changed over the system to supply water to sprinklers.

Anecdotal reports in two investigations provide evidence for the efficacy of both irrigation and compaction for confining fumigant vapors. In one, fire fighters noted that the problem was alleviated when a worker turned on sprinklers. Another episode ended when the treated field was compacted. It appears, however, that no method now in use reliably prevents fumigant from escaping the soil sufficiently to reach perceptible concentrations in still air. One episode demonstrated the potential for perceptible contamination levels to develop as long as two days after soil incorporation of the fumigant. Confining a fumigant with such a low odor/irritation threshold poses a formidable challenge to any mechanism.

Violations:

Violations of label instructions or permit conditions were identified in ten of the seventeen fully investigated episodes. In three of these, the violations were clearly unrelated to the exposure (for instance, the pest control business was late delivering their notice of completion to the grower.) In the other seven, the violations contributed something to exposure, but available information does not demonstrate that compliance would have avoided exposure. In particular, fumigators made errors related to buffer zones in four episodes, but the affected people were not within the required buffer zone. The investigators did not ever describe the location of unaffected people outside the buffer area. The available investigations do not document the distance from the application that provided adequate protection.

The best documented episode occurred in 2005 in Monterey County. In that episode, a grower applied chloropicrin through drip irrigation to strawberry beds; and that evening vapor drifted into a residential neighborhood of Salinas. The investigation found evidence that irrigation lines were not flushed adequately before supplying water to sprinklers intended to seal the vapor in the ground. Investigators also canvassed residential areas near the sites from which people had placed emergency calls. From this, we learned that people more than two miles from the application site had credible symptoms of exposure. When we modeled air levels, though, we found that the use of contaminated water contributed little to the air concentration. Most of the

chloropicrin that moved offsite appeared to have entered the air via normal diffusion from the treated field.

Other Factors:

In eight episodes, investigators recorded opinions that climatic conditions, typically atmospheric inversions, appeared to have played a critical role in allowing the problem to develop. Several investigations provided records from the California Irrigation Management Information System. This system maintains a network of more than 120 automated weather stations, and provides hourly measures of air and ground temperatures and wind speed and direction along with other values more specifically related to evapotranspiration. We noticed that problems typically occurred when wind speed dropped below about three miles per hour.

Four investigations identified potential contributing factors not addressed by existing or proposed regulation: The two San Bernardino County investigations noted the soil type, Tujunga loamy sand, which is characterized by the soil conservation service as a rapidly permeable soil. Two other incidents involved fumigation of fields that sloped towards the people who were affected.

Applications that Aroused Opposition:

By contrast to the episodes discussed above, county agricultural commissioners (CACs) closely monitored three applications that neighbors had tried to block. These applications complied fully with all requirements, and gave rise to complaints that differed from those reported by people unaware or unconcerned about impending fumigations. Most obviously, in these episodes, adverse effects reports came from people who had expressed prior concerns about the application. These people lived at scattered sites among a larger number of residents who did not volunteer information on any effects. The effects they attributed to exposure also differed from those reported in areas where residents had not contested the fumigation. In the latter situation, more than 90% of affected people reported eye irritation, and more than 40% had no other complaint. Among people who had opposed fumigation, only 20% reported any eye effects, and all attributed systemic and/or respiratory effects to the exposure. Most of these effects were evaluated as possibly related, since there was no specific evidence to the contrary.

County Permit Conditions for Use of Chloropicrin:

Eleven counties developed permit conditions for use of chloropicrin as a soil fumigant, and revised the conditions as events demonstrated their incompleteness. Conditions addressed factors including air temperature, soil moisture, confinement mechanisms, distance to occupied structures, and participation by trained applicators. Episodes continued to occur in spite of each of these restrictions. No county conditions approached the pending label revisions in level of detail (see Appendix B).

EPA's Proposed Mitigation Measures for Chloropicrin:

In May 2009, U.S. EPA issued final new safety measures for chloropicrin to increase protections for agricultural workers and bystanders. These protections will be implemented over the next two years by way of product label amendments. During the review of chloropicrin, U.S. EPA identified potential human health risk associated with its use as it has the potential to move off-site. U.S. EPA is concerned with inhalation exposure to handlers, bystanders, and workers. To reduce inhalations exposures and to address associated risks of concern, U.S. EPA is requiring a number of mitigation measures (see Appendix A).

U.S. EPA has determined that most of the mitigation measures will be implemented over a two year period starting in the 2010 use season. The more challenging mitigation measures including fumigant management plans, community outreach, and in particular, buffer zones, will not be imposed until the 2011 use season, allowing time for outreach and training.

Several of the mitigation measures U.S. EPA has determined necessary to prevent off site-movement of chloropicrin appear to be consistent with measures implemented by county agricultural commissioners via restricted materials permit conditions. However, the requirement to obtain and document site specific conditions, in particular, climatic conditions, have not yet been imposed in any county. By 2011, Fumigant Management Plans will require Good Agricultural Practices be followed including documenting weather conditions, the day of and the 48-hour period following applications; and the specific prohibition of making applications if an inversion is forecast to persist more than 18 consecutive hours for the 48 hours after start of an application. As discussed above, in several of the priority incidents reviewed, climatic inversions were indicated as a likely cause of the off site movement of the fumigant. U.S. EPA believes accurate weather forecast information is readily available to comply with these mitigation measures.

Although the label changes address a number of important factors, the buffer zone formulas caused some concern. The reviewed incidents demonstrate that, under some circumstances, a concentrated plume of fumigant can travel a considerable distance. Priority incidents 29- and 30-SBD-06 provide examples: In these incidents, chloropicrin-treated fields were covered with tarps identified as "high density" and had water applied over the tarps three or four times. This would have qualified them for substantial reductions in required buffer zones, possibly down to the 25-foot minimum. In the recorded events, however, people were affected as far as 320 feet away from the edge of a field.

Conclusions:

In the one episode for which we were able to do modeling, predicted air levels agreed well with exposure reports. This gives us some confidence in the validity of basing regulations on predictions derived from flux measurements and wind speed. Other episodes' observations also

suggest that atmospheric conditions, particularly atmospheric inversions and low wind speed, are the essential determinants of fumigant concentration in the air that passes over fumigated fields.

It may be important to refine the air level models to represent the effects of variables such as soil type on the fumigant's tendency to enter the atmosphere. We also need more complete data on the effects of application conditions such as pattern (specifically, whether more or less chloropicrin escapes when applicators leave strips of untreated and untarped ground between treated beds), and the performance of different barrier materials under realistic use conditions.

We can make only tentative conclusions about the effectiveness of the expected label changes, since the episode investigations did not provide all the information required to evaluate the changes' performance. These episodes do provide evidence, though, that some of the recommended barrier mechanisms may be less effective in practice than in theory. To develop evidence of the scope of regulations needed, investigators will have to collect more information. In particular, investigators should be trained to seek a boundary beyond which people were not affected. This would estimate the buffer area needed to protect health under the application conditions that existed.

Recommendations:

Specific details that should be captured in future investigations

- Details on the application method, equipment used etc.
 - Date and time applications begin and end
 - Total area treated and area treated per day if application spans more than one day
 - Application rate
 - Application equipment; we need very specific information
 - Depth of injection or drip system
 - Use of compaction to contain fumigant; need specifics on method used
 - Date and time water seals applied
 - Inches of water applied
 - Exact specifications on the type of barrier material, since this is a major factor under the new federal label language
- Climatic conditions
 - In the same way that we expect CACs to request medical releases in priority investigations, we should also expect them to collect relevant CIMIS data and available measures of atmospheric stability so that we can evaluate their relevance to off site movement and identify safe conditions for fumigation.
- Site specific details, soil type, topography
 - Soil type

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- Soil condition
 - Adequacy of preparation (moisture, clods, debris)
 - Evidence that applicators gave appropriate consideration to the condition of the field
- Relevant topographic features (slope, obstructions, etc.)
- Post-application monitoring
 - Frequency
 - Methods (observation, measurements)
 - Results of all monitoring
- In interviewing affected people, CACs should try to determine the boundaries of the area within which people were affected. That requires canvassing the affected neighborhoods.

To assist CACs in this effort, DPR should design a form on which to collect the information outlined above, identify the circumstances in which the form is to be used, and train CACs in its use.

Additional factors that should be investigated for their impact on flux:

- Effect of gaps in barrier fabric between treated beds or strips
- Delay in beginning irrigation (time to purge chemigation lines and pressurize sprinklers)

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Appendix A
CHLOROPICRIN MITIGATION

	DPR, CACs current	USEPA pending	Comments
<u>Restricted Materials Permit</u>	Yes	Yes	
<u>Notice of Intent</u>	Yes – varies by county, from 24 to 96 hrs prior to application	Notification of application to State if State wants info.* <ul style="list-style-type: none"> • Location of application block • Fumigant Reg No. • Responsible parties • Time period fumigation to occur 	<i>*This is covered in the FMP and</i>
<u>Good Agricultural Practices that must be followed*</u>			<i>*The measurements and documentation to ensure GAPs are achieved must be recorded in the FMP and/or post application report</i>
Tarps & Tarp Plan		Tarps must be installed immediately after fumigant is applied to soil. Written tarp plan must include: <ul style="list-style-type: none"> • schedule & procedures for repair • perforation schedule & procedures • removal 	
Weather Conditions		<ul style="list-style-type: none"> • Forecast for day of application and the 48-hour period following must be checked. • Wind at site must be 2 mph at 	

	DPR, CACs current	USEPA pending	Comments
		<p>start or forecasted to be 5 mph during application</p> <ul style="list-style-type: none"> Do not apply if inversion forecast to persist more than 18 consecutive hours for the 48 hours after start of application. 	
Soil Preparation		<ul style="list-style-type: none"> Generally free of clods golf ball size or larger Tilled 5 – 8 inches deep Field trash managed Trash pulled by shanks to ends of field must be covered w/ tarp or soil before next pass 	
Soil Temperature		<ul style="list-style-type: none"> 90 F maximum temperature at depth of injection If air temp above 100 F in any of 3 days prior to application soil temp shall be recorded 	
Soil Sealing		<ul style="list-style-type: none"> <u>Broadcast untarped</u> – mix soil 3-5 inches to eliminate chisel or plow and compact traces then compact w/ cultipacker, ring roller or roller in combination w/ tillage equip. <u>Bedded</u> – disrupt chisel trace w/ press sealer, bed shaper, cultipacker or re-shaping beds immediately following injection. 	

	DPR, CACs current	USEPA pending	Comments
		<ul style="list-style-type: none"> • <u>Tarped</u> - prior to tarping minimize/disrupt chisel traces 	
Soil Moisture		Measure soil moisture no more than 48 prior to application, soil must be moist 9 inches below surface. Measure moisture via: <ul style="list-style-type: none"> • USDA feel method • Tensiometer 	
Application Depth		Tarped – Broadcast & Bedded <ul style="list-style-type: none"> • Injection points must be a minimum of 8 inches from nearest final soil/air interface Untarped – Bedded <ul style="list-style-type: none"> • Injection points must be a minimum of 12 inches from nearest final soil/air interface Untarped – Broadcast <ul style="list-style-type: none"> • Injection points must be a minimum of 10 inches from nearest final soil/air interface 	
		<i>*Additional miscellaneous requirements for prevention of end row spillage, calibration & maintenance for both mechanical and drip application equipment</i>	
<u>Fumigant Management Plan (FMP)</u>	Only if used in conjunction with MeBr	A site specific FMP is required for each application block (field or portion of field treated in any 24 hour period) & must include: <ul style="list-style-type: none"> • Block location address or GPS 	

	DPR, CACs current	USEPA pending	Comments
		<ul style="list-style-type: none"> • Name & address of operator • Map identifying all sensitive sites and location of posting signs for buffers zones. • Date of application window • Product information • Tarp information • Soil conditions • Weather conditions • Buffer zones • PPE • Emergency procedures • Posting procedures • Site-specific response & management <ul style="list-style-type: none"> ○ Monitoring BZ ○ Informing neighbors • Notification to State of fume • Communication between applicator, operator and others <ul style="list-style-type: none"> ○ Application timing details, PPE etc. • Authorized on-site personnel • Air monitoring plan (handlers) • Description and measurements of of GAPS • Hazard Communication • Record keeping – operator and PCO must keep & post FMP 	

	DPR, CACs current	USEPA pending	Comments
		<p>application summary for 2 yrs.</p> <ul style="list-style-type: none"> • Post-application summary must include: <ul style="list-style-type: none"> ○ Date, rate, size of block ○ Weather conditions during and 48 hrs after application ○ Soil temp ○ Tarp damage/repair ○ Tarp removal ○ Complaint details - personal info & control measure taken to mitigate ○ Equipment failure or other emergency ○ Details of elevated air concentrations mitigation measure taken, sensory irritation experienced • Date BZ sign removal • Deviations from FMP 	
<u>Buffer Zones (BZ)</u>	Refer to Appendix B for current county-specific Chloropicrin permit conditions		
Minimum distance		- 25 ft. minimum regardless of site-specific application parameters.	

	DPR, CACs current	USEPA pending	Comments
		- BZ distances must be based on look-up tables on product labels.	
Maximum distance		1/2 mile	
BZ proximity - Allow buffer overlap		No, unless 12 hours have elapsed between end of first application and start of second applications. - Emergency response measure apply if any occupied structure not within control of the fumigator within 300 feet of each buffer zone.	
Authorized entry to BZ		Only handlers who have been trained and equipped according to WPS and label requirements.	
Exemption for transit through BZ		Yes, vehicular and bicycle traffic on public and private roadways through the BZ is permitted. - Roadway means portion of a street or highway improved, designed or ordinarily used for vehicular travel, exclusive of the sidewalk or shoulder even if sidewalk or shoulder is used by persons riding bicycles. - Bus stops & similar locations not permitted within BZ.	
Include structures under control of owner/operator of application block		Yes, if not occupied and don't share common wall with occupied structure	

	DPR, CACs current	USEPA pending	Comments
Include areas not under the control of owner/operator of application block		BZ may not include residential areas (occupied structure or outdoor residential areas, such as lawns play areas) unless written agreement that they voluntarily vacate the BZ during BZ period.	
BZ cross into another ag property not in the control of owner/operator of the application block		No, unless <u>written</u> agreement that employees and other persons will stay out of buffer.	
Allow BZ to include right of way		No, unless area is not occupied during BZ period.	
Allow BZ to include other publicly owned and/or operated areas such as parks side walks, & playgrounds		No, unless area is not occupied during the BZ period, entry is prohibited and written permission is granted by appropriate authorities responsible for area.	
Posting buffer zones		Yes	
<u>Buffer Zone Reduction Credits</u>			
Credits for High Barrier Tarps		<ol style="list-style-type: none"> 1. 30% buffer credit for; Canslit Heatstrip Silver and Canslit Metalized high-barrier tarps 2. 60% buffer credit for; Olefinas Embossed VIF, Klerks VIF, Pliant Blockage, Bromostop (1.38 mil), Eval/Mitsui TIF (1.39 mil), Hytiblock7 Black (0.00125”), 	

	DPR, CACs current	USEPA pending	Comments
		XL Black Blockade (0.00124", Hytibar (1.5 mil), and IPM Clear VIF (1.38 mil) high barrier tarps	
Credits for High Barrier Tarps with Symmetry™ Application System		If Symmetry Application System (auto shut off) is used with the tarps specified above an additional credit of 10% is added so total buffer credit is: <ol style="list-style-type: none"> 1. 40% 2. 70% 	
Credits for Potassium Thiosulfate (KTS) and Tarps		If KTS is applied with ¼ to ½ inch of water over tarp specified above an additional credit of 15% is added so total buffer credit is: <ol style="list-style-type: none"> 1. 45% 2. 75% If KTS is used over any other tarp not specified the credit is 15%	<i>*what if KTS is applied when the Symmetry Application System is used.</i>
Credits for Water Seals		If ¼ to ½ inch of water is applied over a tarp specified above an additional credit of 15% is added so the total buffer credit is: <ol style="list-style-type: none"> 1. 45% 2. 75% If water seal is used with any other tarp not specified the credits is 15%	
Credits for Soil Type		10% if soil organic matter 1-2% 20% if soil organic matter 2-3%	

	DPR, CACs current	USEPA pending	Comments
		30% if soil organic matter >3% 10% if soil clay content >27%	
Credits for Soil Moisture		None	
Credits for Soil Temperature		10% if 50 ⁰ F or less at 3 inch depth	
Buffer Zone Credit Cap		80% max BZ reduction	
<u>Applications</u> <u>Restrictions for Difficult to Evacuate Sites</u>		Schools (preschool – grade 12), state licensed daycare, nursing homes, hospitals & prisons. <ul style="list-style-type: none"> • If BZ >300’ cannot use w/in 1/4 mile (1320 feet) of sites above unless not occupied during application and 36 hours following application. • If BZ ≤300’ cannot use w/in 1/8 mile (660 feet) of sites above unless not occupied during application and 36 hours following <u>the start of application</u>. 	
Posting of <u>Buffer Zone</u>		<ul style="list-style-type: none"> • Required, unless physical barrier prevents access to buffer zone. Can include sidewalks & bike trails • Posted before applications begins and remain posted until BZ period has expired 	

	DPR, CACs current	USEPA pending	Comments
		<ul style="list-style-type: none"> • Signs must be removed within 3 days after end of BZ period • <i>BZ period starts when fumigant is delivered to soil within application block and last for a minimum of 48 hours after fumigant has stopped being delivered to soil.</i> 	
<u>Posting of Treated Area</u>		<ul style="list-style-type: none"> • Posted for duration of REI • Signs must be removed within 3 days after REI 	<i>Two different kinds of signs</i>
<u>Emergency Preparedness and response</u>		<ul style="list-style-type: none"> • If BZ > 25ft or \leq 100ft and residents w/in 50 ft of BZ • If BZ > 100ft or \leq 200ft and residents w/in 100 ft of BZ • If BZ > 200ft or \leq 300ft and residents w/in 200 ft of BZ • If BZ > 300ft or BZ overlap and residents w/in 300ft of BZ <p>Then must follow:</p> <ol style="list-style-type: none"> 1. Fumigant site monitoring Or 2. Response information for neighbors <p>If BZ is 25ft then Emergency Preparedness and Response requirements not applicable</p>	

	DPR, CACs current	USEPA pending	Comments
Fumigation Site Monitoring		<p>From start of application until BZ period expires must:</p> <ul style="list-style-type: none"> • Monitor air between BZ and homes • Minimum of 8 samples: <ul style="list-style-type: none"> ○ Once 1hr before sunset ○ Once during night ○ Once 1hr after sunrise ○ Once during the day <p>Location & results to be recorded</p>	
Response Information for Neighbors		<p>Must ensure residents are provided the following at least 1 week before fumigation:</p> <ul style="list-style-type: none"> • Location of application block • Product information • Applicator contact info. • Early signs & symptoms of exposure & who to call • How to find additional info. <p>Information may include application dates that rang for no more than 4 weeks, otherwise must be redelivered.</p>	

APPENDIX B. Current County Specific Chloropicrin Permit Conditions

COUNTY	APPLICATION METHOD	APPLICATION METHOD SPECIFIC REQUIREMENTS	SEALING METHOD	TARP SPECS.	BUFFER ZONE TO			MAXIMUM ACRES TREATED PER 24 HOURS	POST APPLICATION WATER TREATMENT (YES/NO)	POST APP WATER TREATMENT (MINUTES)
					SCHOOLS IN SESSION	SENSITIVE AREAS	OCCUPIED STRUCTURES			
FRESNO	Broadcast or Bedded less than 12"		When application in within 1/2 mile of sensitive area - High barrier tarp, soil compaction <u>or</u> water seal		< 1/2 mile	< 1/2 mile	< 1/8 mile	10 acres within sensitive area or occupied structure	Yes	Applied by solid-set Sprinkler to maintain adequate moisture on top of soil
			When application is more than 1/2 mile from sensitive area - no specified sealing method		> 1/2 mile	> 1/2 mile	> 1/8 mile	40 acres max outside of sensitive area or occupied structure		
KERN	For 100% Chloropicrin Bed and Broadcast apps from May 1 = Oct 31				1/2 mile	1/4 mile	300 feet			
	For 100% Chloropicrin Chemigation (Drip System) apps from May 1 = Oct 31				1/2 mile	600 feet	300 feet			
	Bed/Row Shank		Press Sealer, Bed Shaper, or Cultipacker		1 mile	1/2 mile	500 feet	5 acres when applied at 200lbs/acre and when > 1/2 mile of school		
			Press Sealer, Bed Shaper, or Cultipacker <u>and</u> Water or Tarp Seal		1/2 mile	1/4 mile	300 feet			

COUNTY	APPLICATION METHOD	APPLICATION METHOD SPECIFIC REQUIREMENTS	SEALING METHOD	TARP SPECS.	BUFFER ZONE TO			MAXIMUM ACRES TREATED PER 24 HOURS	POST APPLICATION WATER TREATMENT (YES/NO)	POST APP WATER TREATMENT (MINUTES)
					SCHOOLS IN SESSION	SENSITIVE AREAS	OCCUPIED STRUCTURES			
	Broadcast, Flat Fume Shank		Disc and Cultipacker with injection 18" or deeper		1/2 mile	1/4 mile	300 feet			
			Disc and Cultipacker with injection 12" to 17"		1 mile	1/2 mile	500 feet			
			Disc and Cultipacker and Water Seal		1/2 mile	1/4 mile	300 feet			
			Tarp		1/2 mile	1/4 mile	300 feet			
	Drip		Tarp		1/4 mile	300 feet	100 feet			
			Buried Drip, Non-tarped		1/2 mile	600 feet	200 feet			
			Surface Drip, Non-tarped, Water Sealed		1/2 mile	600 feet	200 feet	60 acres when applied at 200 lbs 40 acres when applied at 300 lbs		
	Individual Vine and Tree Replants Less than One Contiguous Acre		Tarped, Seal injection point		1/2 mile	600 feet	200 feet			
			Non-tarped compaction of injection point		1/2 mile	1/4 mile	300 feet			
	KINGS	Bed/Row Shank		Press Sealer, Bed Shaper, or Cultipacker		1 mile	1/2 mile	500 feet	40	No
Broadcast, Flat Fume Shank			Disc and Cultipacker with injection 12" or deeper		1 mile	1/2 mile	500 feet	40	No	
Drip			Tarp		1/2 mile	1/4 mile	200 feet	40	No	
			Buried Drip, Non-tarped		1/2 mile	1/2 mile	500 feet		No	
			Surface Drip, Non-Tarped, Water Sealed		1/2 mile	1/2 mile	500 feet		Yes	Applied by solid-set sprinkler to maintain adequate moisture on top of soil
Tree Replant Want 18"		Tarped, Seal Injection Point		1/2 mile	1/8 mile	200 feet	40	No		

COUNTY	APPLICATION METHOD	APPLICATION METHOD SPECIFIC REQUIREMENTS	SEALING METHOD	TARP SPECS.	BUFFER ZONE TO			MAXIMUM ACRES TREATED PER 24 HOURS	POST APPLICATION WATER TREATMENT (YES/NO)	POST APP WATER TREATMENT (MINUTES)
					SCHOOLS IN SESSION	SENSITIVE AREAS	OCCUPIED STRUCTURES			
	injection depth and 1.5 lbs chlopicrin/100 ft. ²		Non-tarped Compaction of Injection Point		1/2 mile	1/4 mile	300 feet		No	
MADERA	Broadcast or Bedded less than 12"		When application is within 1/2 mile of sensitive area - High barrier tarp, soil compaction <u>or</u> water seal		< 1/2 mile	< 1/2 mile	< 1/8 mile	10 acres within sensitive area or occupied structure	Yes	Applied by solid-set sprinkler to maintain adequate moisture on top of soil
			Non-tarped Compaction of Injection Point		1/2 mile	1/4 mile	300 feet		No	
MERCED	For all applications, Shanks must be set to 12" or more		Applications within 1/2 mile of of any city limit shall be under full tarp							
			Applications between 1/2 and 1 mile from city limits or within 1/2 mile of of any rural housing developments shall be under full tarp or 15" or deeper.							
			Residents of all housing within 1/2 mile of any untarped application must be notified 24 hours prior to fumigations, advised of hazards and actions to take if exposed							

COUNTY	APPLICATION METHOD	APPLICATION METHOD SPECIFIC REQUIREMENTS	SEALING METHOD	TARP SPECS.	BUFFER ZONE TO			MAXIMUM ACRES TREATED PER 24 HOURS	POST APPLICATION WATER TREATMENT (YES/NO)	POST APP WATER TREATMENT (MINUTES)
					SCHOOLS IN SESSION	SENSITIVE AREAS	OCCUPIED STRUCTURES			
MONTEREY	Shank		Tarpaulin is required for all applications and kept in places for 48 hours following completion		When school is within 300 feet of the perimeter of the buffer zone, injections shall be completed 12 hours prior to start of school.	For application of 9 acres or less follow MeBr table 3 = 60 ft. For application 10 acres or more the buffer zone shall be 100 feet.		40		
ORANGE	Drip		Tarp 1.25 mil black must be used at sensitive sites		Applications adjacent to school shall be completed before school is in session	100	500 after 5 p.m.	10		
SAN DIEGO	Tarp/Shallow/Bed		Tarp					20		

COUNTY	APPLICATION METHOD	APPLICATION METHOD SPECIFIC REQUIREMENTS	SEALING METHOD	TARP SPECS.	BUFFER ZONE TO			MAXIMUM ACRES TREATED PER 24 HOURS	POST APPLICATION WATER TREATMENT (YES/NO)	POST APP WATER TREATMENT (MINUTES)
					SCHOOLS IN SESSION	SENSITIVE AREAS	OCCUPIED STRUCTURES			
VENTURA	Drip irrigation.	Concentrations of chloropicrin shall not exceed 1600 ppm at any time.	All drip applications must be covered with a tarp	None	None	None	100 feet. (previous conditions included the statement, "If within 500 feet of occupied structure, application must be completed by 2 p.m').	None	Only if odors detected. If so, water seal must be applied and CAC notified.	If daytime temperatures on the day of injection reach 80 °F, all applications shall be followed by at least one water seal t cool the tarps and reduce off gassing. Water seal must be repeated the next day if temperatures reach 80 °F.
SANTA BARBARA	Drip irrigation	No apps when temp >85 °F; must monitor wind and temp for first 12 hr following injection	All drip applications must be covered with a tarp		500 feet		100 feet		Yes if daytime temp on day of injection reach 80F, at least one water seal	
SANTA CRUZ	Tarp/Shallow Broadcast and Drip				300 feet					
SAN LUIS OBISPO										
SAN JOAQUIN										
SAN BERNARDINO										
IMPERIAL										

Appendix C: Summary Tables

Table 1. Summary of intended crops, Priority Episodes involving Chloropicrin (1992 – 2009)

INTENDED CROP	No. of Priority Episodes
Strawberries	15
Onions	1
Raspberries	1
Turf/Sod	1
Watermelons	1
Unknown	1
	20

Table 2. Intended Crops and Acres Treated, Priority Episodes involving Chloropicrin (1992 – 2009)

Priority Episode	Intended Crop	Acres Treated
62-MON-09	Unknown	Unknown
57-SLO-09	Strawberries	Unknown
48-VEN-09	Strawberries	12.5
23-SB-08	Strawberries	38
21-MON-08	Strawberries	10
62-MON-07	Strawberries	13
40-MER-06	Raspberries	12
30-SBD-06	Strawberries	4.5
29-SBD-06	Strawberries	4
46-SB-05	Strawberries	22.5
38-MON-05	Strawberries	13
36-VEN-05	Strawberries	13
36-KER-03	Onions	40.5
31-ORA-03	Strawberries	30
7-SJ-03	Watermelons	20.7
22-SJ-01	Turf/Sod	2.6
44-MON-00	Strawberries	15
43-VEN-95	Strawberries	26
51-VEN-92	Strawberries	49
29-MER-92	Strawberries	11.5

Table 3. Products used in Priority Episodes involving Chloropicrin (1992 – 2009)

Priority No.	Product	Active Ingredient(s)	Reg. No.	Label Rate	Application Rate
62-MON-09	Tri-chlor	Choropicrin only	58266-2-AA-11220	Unknown	200 pounds
57-SLO-09	PIC-CLOR 60 EC	Telone (1,3 - Dichloropropene) + Chloropicrin	8536-43-AA-11220	Unknown	Unknown
48-VEN-09	Tr-Chlor EC	Choropicrin only	58266-5-AA-11220	Unknown	200 pounds
23-SB-08	Telone C-35 CA	Telone (1,3 - Dichloropropene) + Chloropicrin	62719-302-ZA	Unknown	392 pounds
21-MON-08	Methyl Bromide Ameribrom Inc.	Methyl Bromide + Chloropicrin	8622-40	Unknown	300 pounds
62-MON-07	Terr-O Gas 57	Methyl Bromide + Chloropicrin	5785-28-AA	Unknown	275 pounds
40-MER-06	MBC-33	Methyl Bromide + Chloropicrin	8853-3-11220	350 Pounds	350 pounds
30-SBD-06	Tri-Chlor	Choropicrin only	58266-2-AA-11220	Unknown	150 pounds
29-SBD-06	Tri-Chlor	Choropicrin only	58266-2-AA-11220	Unknown	150 pounds
46-SB-05	INLINE	Telone (1,3 - Dichloropropene) + Chloropicrin	62719-00348-AA	Unknown	25 gallons
38-MON-05	Tri-Chlor EC	Choropicrin only	58266-5-A-11220	Unknown	Unknown
36-VEN-05	Inline	Telone (1,3 - Dichloropropene) + Chloropicrin	62719-348-AA	Unknown	25 gallons
36-KER-03	Metapicrin	Choropicrin only	8622-43-AA	Unknown	80 pounds
31-ORA-03	Tri-Chlor EC	Choropicrin only	58266-5-AA-11220	Unknown	200 pounds
7-SJ-03	Telone C35	Telone (1,3 - Dichloropropene) + Chloropicrin	62719-302-AA	Unknown	10.28 gallons
22-SJ-01	Tri-Con 75/25	Methyl Bromide + Chloropicrin	11220-08	Unknown	225- 264 pounds
	Pic-Brom 25	Methyl Bromide + Chloropicrin	8536-11	Unknown	225-264 pounds
44-MON-00	Terro-O Gas 57 (Great Lakes Chemical Corp)	Methyl Bromide + Chloropicrin	5785-28-AA	Unknown	325 pounds
43-VEN-95	Metapicrin/Ameribrom	Choropicrin only	8622-43-AA	Unknown	100 pounds
51-VEN-92	Tri-Con 67/33	Methyl Bromide + Chloropicrin	11220-07	355 pounds	360 pounds
29-MER-92	Ameribrom Methyl Bromide Chloropicrin	Methyl Bromide + Chloropicrin	8622-13-AA	Unknown	323 pounds

Table 4. Priority Episodes involving Chloropicrin (1992 – 2009)

Priority No.	Application Area	Application Method (General)	Application Method (Specific)	Application Depth (inches)	Fumigant Containment	Tarp Material	Tarp Thickness (mil)	Soil Compaction	Water Treatment/ Number of Treatments
7-SJ-03	Broadcast (Entire Field)	Injection	Plow	12	Unknown	Unknown	Unknown	Unknown	Unknown
22-SJ-01	Stripped	Injection	Shank	Unknown	Tarp	Unknown	Unknown	Not Applicable	None
21-MON-08	Broadcast (Entire Field)	Injection	Blades, Horizontal V-Shaped	Unknown	Tarp	Unknown	Unknown	Not Applicable	None
46-SB-05	Raised Beds	Drip	Drip, Buried	Unknown	Tarp	Unknown	Unknown	Not Applicable	None
40-MER-06	Broadcast (Entire Field)	Injection	Blades, Horizontal V-Shaped	Unknown	Tarp	High Barrier	Unknown	Not Applicable	None
62-MON-07	Broadcast (Entire Field)	Injection	Blades, Horizontal V-Shaped	Unknown	Tarp	Unknown	Unknown	Not Applicable	None
36-VEN-05	Raised Beds	Drip	Drip, Unspecified	Unknown	Tarp AND Water	Unknown	Unknown	Not Applicable	Sprinkler, Unknown
38-MON-05	Raised Beds	Drip	Drip, Unspecified	Unknown	Tarp AND Water	Unknown	Unknown	Not Applicable	Sprinkler, 1
44-MON-00	Broadcast (Entire Field)	Injection	Shank	Unknown	Tarp	Unknown	Unknown	Not Applicable	None
30-SBD-06	Raised Beds	Injection	Tractor-Mounted Shank	Unknown	Tarp AND Water	High Density	1.5	Not Applicable	Sprinkler, 4
29-SBD-06	Raised Beds	Injection	Tractor-Mounted Shank	Unknown	Tarp AND Water	High Density	1.5	Not Applicable	Sprinkler, 3
57-SLO-09	Unknown	Drip	Drip, Unspecified	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
29-MER-92	Unknown	Injection	Unknown	Unknown	Tarp	Unknown	1	Unknown	None
43-VEN-95	Raised Beds	Injection	Unknown	Unknown	Tarp AND Water	Unknown	1.5	Unknown	Sprinkler, Unknown
51-VEN-92	Broadcast (Entire Field)	Injection	Unknown	Unknown	Tarp	Armion Film	1	Not Applicable	None

Priority No.	Application Area	Application Method (General)	Application Method (Specific)	Application Depth (inches)	Fumigant Containment	Tarp Material	Tarp Thickness (mil)	Soil Compaction	Water Treatment/ Number of Treatments
36-KER-03	Broadcast (Entire Field)	Injection	Shanks	18	Compaction	Not Applicable	0	Weighted Board/ Ring Roller	None
62-MON-09	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unspecified
23-SB-08	Broadcast (Entire Field)	Injection	Shank	18	Compaction	Not Applicable	Not Applicable	Disc & Roller	None
48-VEN-09	Raised Beds	Drip	Drip, Unspecified	Unknown	Tarp	Unknown	Unknown	Not Applicable	Unspecified
31-ORA-03	Unknown	Drip	Drip, Buried	Unknown	Tarp	Unknown	Unknown	Not Applicable	None

Table 5. Summary, Priority Episodes involving Chloropicrin (1992 – 2009)

	No. of Priority Episodes
I. Area Treated	
Broadcast (Entire Field)	8
Raised Beds	7
Stripped	1
Unknown	4
	20
II. Application Method (General)	
1. Drip	
a. Buried	2
b. Unspecified	4
2. Injection	
a. Blades, Horizontal V-Shaped	3
b. Plow	1
c. Shank	4
d. Tractor-Mounted Shank	2
e. Unknown Injection Method	3
3. Unknown Method	1
	20
III. Fumigant Containment	
1. Compaction	2
2. Tarp	10
3. Tarp and Water	5
4. Unknown method	3
	20
IV. Tarp Material and thickness, if applicable	
1. Tarp (n=10)	
a. Armion Film, 1 mil thick	1
b. High Barrier, Unknown thickness	1
c. Unknown Material, 1 mil thick	1
d. Unknown Material, Unknown thickness	7
2. Tarp and Water (n=5)	
a. High Density, 1.5 mil thick	2
b. Unknown material, 1.5 mil thick	2
c. Unknown material, unknown thickness	1

Table 6. Pre-application evaluation and monitoring, Priority Episodes involving Chloropicrin (1992 – 2009)

Priority No.	Soil Temp Taken	Soil Temp	Soil Moisture Evaluated	Soil Preparation Evaluated	Field Management Evaluated	Monitoring Information Available
62-MON-09	Unknown	Unknown	Unknown	Unknown	Unknown	No
57-SLO-09	Unknown	Unknown	Unknown	Unknown	Unknown	No
48-VEN-09	Unknown	Unknown	Unknown	Unknown	Unknown	No
23-SB-08	Unknown	Unknown	Yes	Yes	Unknown	No
21-MON-08	Unknown	Unknown	Unknown	Unknown	Unknown	No
62-MON-07	Unknown	Unknown	Unknown	Unknown	Unknown	No
40-MER-06	Unknown	Unknown	Unknown	Unknown	Unknown	No
30-SBD-06	Unknown	Unknown	Unknown	Unknown	Unknown	No
29-SBD-06	Unknown	Unknown	Unknown	Unknown	Unknown	No
46-SB-05	Unknown	Unknown	Unknown	Unknown	Unknown	Yes
38-MON-05	Yes	63 °F	Unknown	Unknown	Unknown	No
36-VEN-05	Unknown	Unknown	Unknown	Unknown	Unknown	No
36-KER-03	Unknown	Unknown	Unknown	Unknown	Unknown	No
31-ORA-03	Unknown	Unknown	Unknown	Yes	Unknown	No
7-SJ-03	Unknown	Unknown	Unknown	Unknown	Unknown	Yes
22-SJ-01	Unknown	Unknown	Unknown	Unknown	Yes	No
44-MON-00	Unknown	Unknown	Unknown	Unknown	Unknown	No
43-VEN-95	Unknown	Unknown	Unknown	Unknown	Unknown	Yes
51-VEN-92	Unknown	Unknown	Unknown	Unknown	Unknown	No
29-MER-92	Unknown	Unknown	Unknown	Unknown	Unknown	No

Table 7. Summary of Pre-application evaluation and monitoring, Priority Episodes involving Chloropicrin (1992 – 2009)

	YES	NO	UNKNOWN	Total
Soil Temperature Taken	1	0	19	20
Soil Moisture Evaluated	1	0	19	20
Soil Preparation Evaluated	2	0	18	20
Field Management	1	0	19	20

Table 8. Compliance Notes

Priority No.	Compliance Notes
62-MON-09	Minimal report of permit conditions, nothing on climatic conditions, sprinkler use, or distance to affected residents. "Buffer zone" was 70 feet, residents must have been farther than that. Report does mention a series of non-compliances, none of which seems related to the problem: PCB late giving completion notice to grower, Exceeded NOI area (6.3 acres rather than 6 which increased required buffer zone from 60 to 70 feet (not violated)), tarps cut and removed prior to 48 hours required by permit.
57-SLO-09	
48-VEN-09	
23-SB-08	Buffer 300 ft at south end of field (opposite lettuce field where workers were affected) to protect a house. PERMIT CONDITIONS: Temperature less than 85 degrees; provide map showing acreage; no greenhouse use; NOI 48 hours prior; include application depth & type; and adjusted total pounds; post warning signs in advance; 7 day minimum REI; stop application if odor occurs; do not resume until corrected; buffer - 500 feet to schools, 300 to any other occupied structure; and accident response plan at site.
21-MON-08	Investigators Conclusions: 1) The application 2 days earlier was 67 feet from the property line therefore the OBZ extended 33 feet onto the nearby property. There were no signed OBZ agreements for any properties west of the site in the MeBr worksite plan. The grower violated 3CCR 6450.2(f)(3) requiring operator of the property to be fumigated to get permission from the neighboring properties for the OBZ to extend onto those properties. 2) The NOI for this application was for 11 acres but due to rain, only 10 acres were treated. IBZ = 40 feet and OBZ =100 feet. 3CCR 6450.1(b)(1) states a) that required notification zone is 300 feet from the perimeter of the OBZ, b) Operator of the property to be fumigated is to notify properties that contain schools, residences, hospitals, etc. at least 7 days before the NOI is submitted to the CAC office and c) the MeBr NOI must be submitted at least 48 hours before the proposed application. Ergo, notification is 9 days from proposed application. Submitted MeBr Worksite Plan did not include notifications to any properties or residences on the west side of the ranch. There were six properties with residences within 300 feet of the OBZ perimeter that were not notified (Four properties on the earlier application and two properties for this application).
62-MON-07	MB permit conditions in place (CCR 6447.3 (3)(B)1); OBZ= 100 ft.; IBZ = 40 ft.; CAC cited PCO for treating more than indicated acres on NOI (13, instead of 10 acres were treated). CAC noted that the increase in treated acreage would change IBZ from 40 to 50 ft., and OBZ from 100 to 190 ft. CAC concluded that conditions were ideal when fumigation began (53.1 °F, wind 6.3 mph SSE) but as the day progressed, conditions changed becoming exceedingly hot (peak at 89.1 °F at 1:00 p.m.) contributing to off-gassing. At about 5:00 p.m. wind began to decrease significantly. CIMIS records for STN 116 on 10/23/07: 5:00 p.m. (68.5 °F, Wind 3.6 SE), 6:00 p.m. (64.2 °F, Wind 1.6 SE).
40-MER-06	The CAC reported that pre-app. soil moisture was adequate, wind was calm and variable and evening temperature decreased while soil temperature increased.
30-SBD-06	Label does not require any buffer zone, just posting if within 300 feet of a sensitive area. PERMIT CONDITIONS: 30 feet to workers, 50 feet to resident property lines, sprinkler system available, tarp, inspector present, monitor every 4 hours, stop if problems develop.
29-SBD-06	PERMIT CONDITIONS: 30 feet to workers, 50 to resident property lines, sprinkler system available, tarp. Inspector present, monitor every 4 hours, stop if problems develop.

46-SB-05	<p>Permit conditions specify a 100 ft. buffer zone but people lived in a garage 72 feet from application site (they did not get sick). Illnesses reported from house 100 ft. northeast of application site. INSPECTOR RECOMMENDATIONS FOR PERMIT CONDITIONS: 1) buffer zone should start at property line, 2) notification and consent from home owners, 3) Inline application should not be applied if there is a possibility of an inversion. (last monitoring was at the end of application, no post application monitoring) 4) Inline application should not be applied if ambient t exceeds 85 °F. 5) water seal should be applied when ambient t is > 75 °F.</p>
38-MON-05	<p>Label at the time of application did not require any buffer zone, just posting if within 300 feet of sensitive areas. It was revised a year after this event, but still does not specify buffer zone. PERMIT CONDITIONS: NOI 48 hours prior, no more than 140 #/acre (?) at pre-app inspection, entered as 200 #/acre, 2 mm tarp (at pre-app inspection, tarp described as "A & P" or Maybe "A & D", Concentration not to exceed 1600 ppm (in water?), flow meter or continuous digital report scale, record concentration every 15 minutes, 2 or more trained handlers present throughout, Buffer (1/4 mile to any school in session, 160 feet to any occupied structure, 500 feet to occupied structure after 1400, posting required, backflow prevention devices, air monitoring must demonstrate level below 0.1 ppm to end REI. Do not apply when a) Inversion likely, b) after warm, still evening, c) after warm, still, clear morning with little or no fog, d) no or slight offshore air movement during the day. Sprinklers in field (not necessarily pressurized) if occupied structures within 1/4 mile. Monitor 2 ,4, 8 hours after application. If odor detected, turn on sprinklers & call CAC. Application must stop to repair leaks that develop during the process. A certified applicator must decide when to repair tarps and a) must use respiratory protection to check air levels before repair, b) 0.1 - 4 ppm requires full face respirator and c) 4+ ppm requires SCBA. Accident response plan at site, employees trained in implementation.</p>
36-VEN-05	
36-KER-03	<p>LABEL RESTRICTIONS: 1) people exposed, 2) set-up out of compliance: label requires a "bed shaper"; none used, 3) Other violations concern worker safety (one applicator left to work alone for a period, air levels not measured, crew not trained in SCBA use), 4) posting also inadequate. REGULATION: Similar violations to label: causing exposure, inadequate respiratory protection for crew, inadequate posting. FROM 2003 ANNUAL REPORT: A total of 185 cases were investigated in relation to one Kern County episode, and 166 of them (including two applicators and a field worker) reported symptoms evaluated as definitely, probably, or possibly related to pesticide exposure. Sixteen people denied experiencing symptoms, and three reported atypical symptoms that began earlier than the application did. The incident began after an agricultural pest control business injected 100 percent chloropicrin into the soil of a field to prepare it for planting onions. That evening, residents about a quarter-mile from the fumigation site called for assistance, but the responding fire fighters could not determine what had caused the residents' eyes to itch and burn. The next morning, workers returned to continue the application and discovered, by their own reactions, that fumigant was escaping from the soil. They tried to confine it more effectively by lowering the depth at which it was injected, leaving a 50-foot buffer zone untreated at the field margins, purging lines repeatedly before lifting shanks at the ends of rows, and adding weight to the board that the application tractor pulled behind it in an attempt to compact the soil and contain the fumigant. Nevertheless, residents called for help again that evening. This time when fire fighters arrived, they experienced the same symptoms as the residents. They suspected a soil fumigant and called the agricultural biologist on duty, who quickly determined the source of the irritating vapors and assured the incident commander that no more applications would be permitted before the problem was fully resolved. The agricultural commissioner required the pest control business to compact the soil immediately using equipment specifically designed for the purpose. After this was completed, no more people developed symptoms and residents were able to reoccupy their homes.</p>

31-ORA-03	<p>LABEL: Precautions to Follow/During Field Fumigations: This fumigant should not be applied when there is an atmospheric inversion, since uncomfortable concentrations may drift to nearby areas.</p> <p>General Instructions/Application of Tri-Chlor EC Though Drip Line, 2. Tri-Chlor EC must be applied through a drip irrigation system to wet the soil thoroughly in the area being treated. Drip emitters should be placed 8 – 12 “apart and 6. After application of Tri-Chlor EC you should continue to irrigate the area with untreated water to flush the irrigation system. Do not permit Tri-Chlor to remain in the irrigation system after the application is complete. The total volume of water, including the amount used for flushing the irrigation system, should not exceed 1.5 acre-inches (40,000 gallons) of water per acre. Restricted Materials Permit Supplement: 30 ft. buffer zone for both Block 1 and 2. PCO Initialed “Applications shall not be made within 500 feet of occupied properties after 2:00 p.m.”</p>
7-SJ-03	<p>LABEL: Soil temp at application depth must be between 40 – 80 °F, product must be placed at least 10" below final soil surface, Buffer of 100 feet to occupied structures.</p> <p>Soil sealing information imperative and required by label.</p> <p>LABEL states "Immediately after chisel application soil must be sealed to prevent fumigant loss, For broadcast treatment (flat fumigation), sealing can be done by uniformly mixing soil 3-4" deep to eliminate chisel or plow traces to maximize sealing, soil should be compacted with ring roller, cultipacker or roller combination with tillage equipment. Compaction of soil surface alone does not effectively disrupt chisel/plow traces."</p> <p>PERMIT: None specific to chloropicrin, 1,3-D permit conditions apply.</p> <p>Grower's permit further conditioned to increase buffer for similar treatment to 300 ft. and notify residents in writing 5 days prior to application</p>
22-SJ-01	<p>Assessment/Conclusions: PCO did not follow Field Management Plan 1) Changed from broadcast to strip which also affected the required buffer zone, 2) Acreage on treatment site plan was incorrect which led to PCO to miscalculate buffer zones 3) Neither Inner and Outer Buffer Zones met regulatory requirements.</p> <p>Two blocks within 1300 ft. were treated on the same day so required buffers should have been added together.</p> <p>VIOLATIONS: 1) FAC 12973 Use in conflict with label, a new worksite plan was not submitted after the original plan was altered, 2) Application did not start as indicated on original NOI and a new NOI was not filed, 3) Inner Buffer Zone extended into sensitive sites on both the east and west sides, 4) After fumigation plan was altered, the outer buffer zone changed resulting in 2 sensitive sites (occupied structured) within the outer buffer zone.</p>
44-MON-00	<p>13 acre Lettuce Field (Block 11) immediately northeast of fumigated field had harvesters/packers on 7/7 (12 feet separates Block 15 and Block 11); Nearest affected crew was 160 ft. from edge of Block 11. Map also indicates Bldg./House in eastern third of Block 11; House located in Block 4 (10 acres) which is immediately northeast of Block 11. Apparent communication breakdown between all parties involved re: fumigation dates, buffer zones and duration, etc. From schematic diagram: RBZ – 260 feet, Worker Buffer Zone – 30 feet from edge of fumigated field for 24 hours after completion of fumigation. CAC violation noted: CA FAC 12973 – “Violation of Restricted Material Permit Conditions for Methyl Bromide pertaining to notification of adjacent growers to keep fieldworkers out of the worker buffer zone for the duration of the buffer zone time.”</p>

43-VEN-95	The investigator noted that the "cause of the exposure was not due to the mis-use but was due to an inversion." There were no permit conditions at the time of the incident but permit conditions were implemented as a result of this incident. Field fumigation with MeBr and/or Chloropicrin when performed within 500 feet of occupied properties shall observe the following mitigation requirements: Tarp of 1.5 mil or High Density construction, application stops by 2:00 p.m., make no tandem applications (only 1 machine).
51-VEN-92	The investigator concluded that "the atmospheric inversion that occurred from 7:00 p.m. to 10:30 p.m. was enough to concentrate the levels of Chloropicrin in the area so the residents were able to detect its presence." PERMIT CONDITIONS: Violation of MeBr permit conditions in effect at time of incident. When fumigation is within 500 ft of occupied structure comply with the following: Tarp thickness must be 1.5 mils or high "high density", Application must not continue past 2:00 p.m. (CCR 6432), Make no tandem application (Two machines were in operation from 7:00 a.m. to 10:30 a.m.). LAWS: Violation of FAC 12972 (Drift) and Application rate higher than allowed by product label (FAC 12971).PCA recommendation was for 360#/acre and the maximum label rate for strawberries was 355 #/acre. The PUR indicated 360 #/acre was applied to 49 acres of a 51 acre site. REGULATIONS: Supervision Requirements (CCR 6406)
29-MER-92	No label with file.

Table. 9 Descriptions of priority investigations of illness symptoms attributed to exposure to chloropicrin used for agricultural soil fumigation

Priority Number	Application Dates	Associated Cases	PISP Summary	Additional Comments
29-MER-92	5/22/1992	6	An unknown climatic condition caused a fumigant not to disperse in the normal manner. Four nearby residents and two CHP officers developed irritant symptoms. The fumigation tarps were in place without holes.	The investigator concluded that the "problem was probably caused by the warm still air, not the fault on the procedures." He also noted "high temperature for the day was 98 F.
51-VEN-92	9/5/1992	11	A temperature inversion trapped fumigant vapors escaping through the tarp on a fumigated field. Eleven residents are known to have suffered ill effects.	Investigator noted tarp permeability of 8.4.
43-VEN-95	9/5/1995	16	A field was treated with chloropicrin during a weather inversion resulting in off-site movement into a residential area. Paramedics treated 32 people on site, 3 of whom were then taken to the hospital.	The treated acreage was from a PUR dated before the incident occurred. Investigator noted that sprinkler pipes were turned on immediately after application to "get a water seal for 24 hours in top inch of soil". Insufficient information on the water seal.
44-MON-00	9/6/2000	9	About 150 lettuce harvesters worked across a field, towards a field under fumigation. As they approached, they complained of an odor and eye irritation. Some workers vomited; two fainted. The fumigator and grower failed to notify the neighboring grower. The lettuce field and the fumigated field sloped towards each other. A temperature inversion and still air contributed to the episode. The investigator recommended civil penalties for the fumigator and grower for failure to notify the neighbor of the buffer zone extending into the lettuce field.	The investigators review of CIMIS, Western Farm Service (WFS) and US Navy (NPS, Fort Ord) meteorological data indicate that a temperature inversion occurred on the night of 7/6 to early morning of 7/7 when the exposed workers became ill. He also states that the topography of the blocks in relation to each other may have been a contributing factor to the exposure. Two Draeger tube measurements for MB "taken immediately adjacent to fumigated field during the evacuation" = ND. (on road separating Block 11 and Block 15), No PIC readings since appropriate monitoring device not available.

Priority Number	Application Dates	Associated Cases	PISP Summary	Additional Comments
22-SJ-01	4/12/2001	10	Ten people living near or adjacent to fields being fumigated developed symptoms shortly after the fumigant was injected into the soil. The grower committed several violations during fumigation made over a period of several days.	3 applications occurred over 3 consecutive days, reports of symptoms each day, 16.7 acres total - 6.7 (two blocks) on 4/12/01; 4.1 on 4/13/01; 5.9 on 4/14/01. Four fields treated (3 broadcast, 1 stripped).
31-ORA-03	9/9/2003	14	An agricultural PCO applied chloropicrin through a drip system to a field. The next morning, 14 school district employees suffered irritated eyes upon arriving at the transportation yard adjacent to the field. According to the workers, the local weather conditions changed the morning of the incident. They reported the weather as foggy with little air movement. Hazmat personnel could detect no chloropicrin with the grower's Kitigawa detector, which was sensitive to 0.05 ppm.	58 acres were treated but only 30 acres in the western half of the field, which is adjacent to the Irvine Unified School District Transportation Yard was fumigated on 9/9/03., remaining 20 acres were treated on 9/10 after HAZMAT did not detect any PIC and allowed scheduled application. No time given but 1-2 mph wind going from south to east was noted. "DC did not apply sprinkler water post-treatment." For 9/10 application to Block 1 – "Everything appeared to be in compliance. The soil appeared to be well prepared. The tarps were in place with the edges buried properly....." Monitoring: After complaints had been received, HAZMAT used grower's Kitagawa tester to test 4 areas (start: 7:30, end: 8:48), none of which showed detectable levels (up to 0.05 ppm using Kitagawa tester) of PIC. The investigator attributed possible off-gassing to weather conditions and attributed the sulfur like odor to irrigation water applied to the field the day before.

Priority Number	Application Dates	Associated Cases	PISP Summary	Additional Comments
7-SJ-03	2/11/2003	12	An agricultural PCO applied a soil fumigant to a field across the street from 2 houses. Twelve residents at the two houses noted an odor and complained of irritant symptoms. The investigator took 3 soil samples from the field, two within the buffer zone and one in the treated area. Only the sample in the treated area showed the presence of 1,3-D. He sampled soil at depths of 6-18 inches.	PUR indicated 20.7 acres but PCO recommendation and NOI indicate 35 acres.
36-KER-03	10/3/2003	166	An agricultural PCO fumigated a pre-plant onion field with 100% chloropicrin. Off-gassing from the field led 40 residents to complain of symptoms that night. The next morning, the application crew discovered the off-gassing and attempted some corrective measures. They lowered the shanks 2 inches deeper and left larger buffer zones around the field. The agricultural PCO also added weight to a board used to compact the top of the soil. Both evenings, the wind changed direction and blew toward the nearby residential areas. The investigator determined the PCO committed multiple violations of the label and regulations and that the PCO failed to properly pack the soil.	10/3 approx. 11:45 am - 6:00 pm; treated about 18 acres, 10/4 approx. noon - 5:30 pm; treated about 22.5 acres, they had intended to treat another 6.5 acres. COMPACTION: Initially pulled a weighted board behind the tractor in attempt to contain the fumigant without interfering with subsequent planting. Sealed with ring roller when problems were undeniable. Air temperature "calm", "almost still", "very light wind out of the northwest" and wind "good." CIMIS data shows 1) air temp high in the 80's dropping to about 60 at night, 2) soil temperature consistently in mid-70s, 3) wind speed and direction variable (note that on 10/3, wind speed dropped below 2 mph about 6 pm (from SSE), 11 pm (from NE) and midnight (from NE)/ On 10/4, wind never reached 5 mph, dropped below 3 around 6 pm (from SE), shifted to E, NE, NNE).
36-VEN-05	9/13/2005	12	An agricultural PCB crew injected chloropicrin and 1.3-D into drip irrigation lines to fumigate fields across a road from an office building. Office occupants reported an irritant in the air. Wind blew	According to the grower, the application ended at noon and sprinklers were turned on around 1:30. Med. Facility employees experienced burning eyes around 1:30. Data from the Air

Priority Number	Application Dates	Associated Cases	PISP Summary	Additional Comments
			from the field toward the building at 8-10 MPH. the building ventilation system had all its air intakes positioned towards the fumigated fields. The applicators reported no problems with the application, and noticed no odor or irritation. Permit conditions required only a 100-foot buffer zone between the treated field and occupied structures.	Pollution Control District for 9/13/2005 indicate mean wind velocity of 8-10 mph from west to WSW at stations in El Rio, west of site and Simi Valley to the east.
46-SB-05	9/28/2005	7	An agricultural PCO applied chloropicrin and 1,3-D. A nearby family noticed an odor and reported irritant symptoms. The PCO had measured the required 100-ft. buffer zone based on distance to the house. The family initially denied anyone lived in the garage, so the PCO applied fumigant within 100 feet of the garage. Investigators observed furniture in the garage, and the family then admitted that three people slept there. (Those people, however, were not affected.)	
38-MON-05	10/5/2005	324	Wind carried chloropicrin from a field fumigation into a residential area. The fumigant was applied through a drip irrigation system to beds covered in plastic. The drip line was then flushed with water, and more water was applied to the field by sprinkler to supplement the barrier. Similar applications had been made nearer to homes on preceding days, and had caused no problems. Nearby weather stations recorded light winds (2 - 3 mph) blowing from the field toward the affected residential neighborhood. Investigators canvassed the affected neighborhood, conducting 111 interviews that identified 204 affected individuals.	Soil Temp. from CIMIS. CIMIS wind data shows 8 - 10 mph from W to NW during application dropping to 2 -3 mph after application and shifting from west to northeast around 8:00 p.m. when complaints began. Simulation with red dye demonstrated incomplete flushing of water lines and valve malfunction. The expert who designed system disagreed with the procedure and would have directed the fumigant insertion nearer to field, or else neutralization with thiosulfate. Application rate of 200 gals/acre entered, Other entries show 200 lbs/acre. This exceeds the

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			<p>The agricultural commissioner also sent explanatory letters to 1,163 addresses in the area, and received telephone responses from 47. Interviews with these callers identified 136 individuals who reported symptoms. Based on complaints and illnesses, the chloropicrin moved 2 to 3 miles from the field. After this episode, the application system was tested using dye to represent the fumigant. The dye test showed that the flush time should have been longer. It indicated that fumigant probably was in the supposedly clean water used to seal the field. The grower settled a civil law enforcement action for \$180,000. Modeling indicated that the use of contaminated water made only a minor contribution to the problem.</p>	<p>permit specification of 140 lbs/acre.</p>
29-SBD-06	9/26/2006	25	<p>Businesses and residents located downwind from a 4 acre field fumigated with 99% chloropicrin complained of irritant symptoms. They notified the local fire department who responded to the incident. The grower applied the chloropicrin to the beds, covered the beds with a tarp and plowed dirt onto the tarp edges. His employee then sprinkler irrigated the field. He failed to monitor the field at least every 4 hours for leaks and burning eyes. Seven hours elapsed overnight without monitoring. An employee showed up in the morning and turned on the sprinklers. The investigator checked on the soil type and found it to be Tujunga loamy sand, which the fumigant would readily move through.</p>	<p>Air was still in the morning but an intermittent breeze from the north at 2 - 5 mph. Soil type: Tujunga Loamy Sand, slightly acid, rapidly permeable, slow run-off, available water capacity of 4 -5 inches.</p>

Priority Number	Application Dates	Associated Cases	PISP Summary	Additional Comments
30-SBD-06	9/28/2006	26	Following a field fumigation made with 99% chloropicrin, 26 people complained of irritant symptoms, mostly employees from surrounding businesses. The local fire department responded to the incident. Reports of irritant symptoms appeared to subside after the grower turned the sprinklers back on. The soil conservation service characterizes the area soil type as loamy sand, a rapidly permeable soil. This likely contributed to the fumigant moving quickly through the soil and into the atmosphere. The investigator found the daily highs to be in the mid to upper 90s.	Three acres were treated on 9/28. The grower planned to treat remaining 4 acres on the 9/29 but ran out of Pic after doing 1.5 acres. The second application proceeded in spite of the facts that a) when inspector arrived to observe, he found sprinklers running because crew member noted burning eyes, b) the grower reported a call from a neighbor 83 feet away the previous evening and c) the fire department arrived during set-up and reported complaints from local businesses. The responder accepted environmental safety since his eyes only burned a little, right next to the field. 2nd water treatment at 8:00 p.m. was due to a neighbor's complaint; the 4th water treatment at 6:00 a.m. was due to workers with watery eyes. Soil type: Tujunga Loamy Sand, slightly acid, rapidly permeable, slow run-off, available water capacity of 4 -5 inches.
40-MER-06	10/28/2006	10	Residents from 2 houses complained of irritant symptoms after a PCO fumigated a nearby field. Other than posting, notification and permissions, the grower and PCO complied with label and regulatory requirements	Pre-site application inspection on 10/16/06. IBZ = 50 ft. OBZ = 270 ft.
62-MON-07	10/23/2007	31	A family felt irritant symptoms one evening and called 911. The agricultural commissioner's staff identified a field fumigated earlier that day about 150 yards from the affected area. The agricultural PCO fumigated 13 acres, three more than allowed by the permit conditions. The excess acreage increased the buffer zone requirements, but both	Conflicting accounts from pilot and co-pilot re:start time; pilot also said that the field was "not prepared", that some parts of the field were wet, it was hot and there was little or not wind; cac believed first odor complaint was due to manure and not the fumigant; fumigation management plan submitted; After complaints,

Priority Number	Application Dates	Associated Cases	PISP Summary	Additional Comments
			inner and outer buffer zones still fell within agricultural land. The grower acknowledged the fumigant off-gassing from the field, but did not know what went wrong. The fumigation itself had gone smoothly.	grower was at the site and running a water truck around the perimeter (after 7:40 p.m.); tarp management plan indicates that grower was to monitor the field from problems or damage a) every two hours and b) until dark on the day of the application.
21-MON-08	10/16/2007	6	A grower's crew fumigated a field that sloped steeply towards a house. About half an hour after the application started, the home's occupants began to notice irritant symptoms. Ag inspectors had monitored the fumigation and noted no shortcomings. No one on site noticed irritant vapor. The terrain may have funneled the vapors towards the home. The grower had overestimated the distance to the home, and consequently had not notified the family of the impending fumigation.	An application occurred 2 days earlier to a 10 acre parcel (IBZ=40 feet, OBZ=100 feet) north of this parcel. For this treated parcel, the investigator noted a steep grade (~ 15% slope) downhill from the application site towards the complainant's house. He also noted that "rain and irrigation runoff from the field had eroded away part of the field, making a part of the field un-farmable" and that "the erosion created a gully that ran straight from the fumigated field towards the complainant's house at the bottom." where people developed symptoms. Pilot noted the ff.: 1) that it was partly cloudy by 8:00 AM, 2) the wind gradually increased throughout the day, 3) they did not complete all 11 acres and stopped at 4:30 PM because it was too windy, and 4) it rained after they finished up. The co-pilot noted that the wind picked up around 2:00 – 2:30 and was blowing NW to SE. Using CIMIS data, the investigator concluded that at 7:00 a.m. on the day of the application, it was cool (47 -49 F) with light and variable winds blowing towards the complainants house. He also concluded, based on his observations in the

Priority Number	Application Dates	Associated Cases	PISP Summary	Additional Comments
				field, that it was possible that there was too much moisture in the soil which would not have allowed the fumigant to penetrate properly. He also concluded, again using CIMIS data, that there was no atmospheric inversion at the top of the hill but the coolness of the morning air, the light wind and the steep slope from the fumigation site allowed any off-gassing from the west side of the field to linger in the air, sink down the slope and get funneled by the eroded gully towards the affected household.
23-SB-08			A crew of 25 transplanted lettuce seedlings into a field across a road (30 feet) from a field fumigated two days earlier. As they approached the fumigated field, they developed symptoms, which resolved when they moved farther from the fumigation site.	Wind described as "calm", "slight breeze". An irrigator setting pipe for the lettuce identified the wind as coming from the south. Field preparation described as good: good moisture level, no large clods. Applications 4/8/08 and 4/9/08 to total 38 acres. 28.4 acres treated 4/9 and completed at 1:00 p.m.
48-VEN-09			Several workers developed symptoms while on the roof of a 3-story building 1850 feet from a field being fumigated. Only workers on the side of the roof towards the field were affected; those on the other side of the roof and those at ground level felt nothing. There was an inversion layer at 875 feet above ground that day, and the wind was calm.	Information based on 15-day report: This was the second-to-last of a series of applications to a 170 acre field. 12.5 acres treated on this date. Draeger tube readings were negative for chloropicrin at the fumigated block and in the field nearest the building. Inversion layer at 875 feet above ground, wind "calm"
57-SLO-09			CAC staff arrived too late to monitor a strawberry grower's application through drip irrigation equipment. They learned that several greenhouse workers at an adjacent nursery had reported symptoms.	Information based on 15-day report: CAC staff arrived for a use monitoring inspection but found the application completed. Five grower employees reported symptoms, all were "working inside the greenhouses." An application the previous day supposedly

Priority Number	Application Dates	Associated Cases	PISP Summary	Additional Comments
				provoked no complaints. Violations concerning posting, record keeping, registering with CAC, taking workers for care.
62-MON-09			Nine people from three residences complained of symptoms related to an application of chloropicrin applied to 4.8 acres at 200 pounds per acre.	Information based on 15-day report: Treated acres either 4.8 or 6.3 acres (report includes both figures)

Appendix D: Table 1 - Sensitive sites near treated fields, Priority Episodes involving Chloropicrin (1992 – 2009)

Priority No.	NORTH	Dist. (feet)	Northeast	Dist. (feet)	EAST	Dist. (feet)	Southeast	Dist. (feet)	SOUTH	Dist. (feet)	Southwest	Dist. (feet)	WEST	Dist. (feet)	Northwest	Dist. (feet)	Comments
62-MON-09	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	
57-SLO-09	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	
48-VEN-09	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	
23-SB-08	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Residential Area	N/A	Unk	N/A	Unk	N/A	Unk	N/A	
21-MON-08	None	N/A	Residential Area	N/A	None	N/A	None	N/A	None	N/A	Residential Area	700	Residential Area	1000	Residential Area	800	
62-MON-07	Open/Lettuce	N/A	Residential Area	381	Strawberry	N/A	None	N/A	Strawberry	N/A	None	N/A	Residential Area	930	Residential Area	999	
40-MER-06	Field - Raspberries	N/A	Residential Area	185	None	N/A	Residential Area	75	Orchard - Almonds	N/A	None	N/A	Nursery - Strawberries	N/A	None	N/A	
30-SBD-06	Unk	N/A	Unk	N/A	Residential Area	83	Business	215	Animal Hospital	175	Unk	N/A	Unk	N/A	Unk	N/A	Other sensitive sites include a Medical Center 230 feet SE, a convenience store 265 feet SE and a resident 32 feet south and 141 feet east.
29-SBD-06	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Commercial	320	None	N/A	Commercial	75	None	N/A	
46-SB-05	Field	N/A	Garage	72	Residential Area	100	Industrial	N/A	Unk	200	Field	N/A	Field	N/A	Field	N/A	
38-MON-05	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Residential Area	N/A	Unk	N/A	Unk	N/A	
36-VEN-05	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Medical Facility	180	Unk	N/A	
36-KER-03	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A	Apartment Complex	1320	None	N/A	None	N/A	Apartment complex also 1/2 miles (2640 feet) west.
31-ORA-03	Unk	N/A	Unk	N/A	Transportation Office For School District	77	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Irvine Unified School District
7-SJ-03		N/A	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A	
22-SJ-01	None	N/A	None	N/A	Residential Area	32	None	N/A	None	N/A	None	N/A	Residential Area	48	None	N/A	Minimum IBZ should be 50 feet. Minimum OBZ 260 feet. Actual OBZ to houses were 130 ft (west) and 136 ft (east).
44-MON-00	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	
43-VEN-95	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Housing Tract	215	Unk	N/A	
51-VEN-92	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A	Residential Area	412	None	N/A	
29-MER-92	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Unk	N/A	Quote from Agricultural commissioner: "12 residences within 1/4 miles"