



# Department of Pesticide Regulation



Brian R. Leahy  
Director

## MEMORANDUM

Edmund G. Brown Jr.  
Governor

TO: Marylou Verder-Carlos, DVM, MPVM  
Assistant Director  
Pesticide Programs Division

**HSM-17007**

**(No. assigned after issuance of memo)**

FROM: Susan McCarthy, M.S.  
Environmental Program Manager II  
Chief, Worker Health and Safety Branch  
(916) 445-1717

*[Original signed by S. McCarthy]*

DATE: July 28, 2017

SUBJECT: COMPLETION OF MITIGATION FOR METHYL BROMIDE FIELD SOIL FUMIGATIONS

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The attached memorandum from the Worker Health and Safety Branch (WHS Branch) describes our findings in regards to the need for mitigation of exposures from methyl bromide field soil fumigations. The Methyl Bromide Regulations Risk Management Decision (Reardon 2010) instructed DPR staff to mitigate occupational and bystander exposures. In response, work-hour regulations were amended to further protect methyl bromide handlers (DPR 2010), and buffer zones were widened to further protect bystanders (DPR 2016c). Additional protections, including U.S. EPA revisions to Federal product labels, are summarized in Table 2 of the attached memorandum.

Methyl bromide use for field soil fumigations has declined steadily since 2007. Further, most methyl bromide field soil fumigations ceased at the end of 2016 due to restrictions within the federal Clean Air Act. Certain field soil fumigations will continue to be allowed during 2017 and beyond under the Quarantine and Pre-shipment (QPS) exemption (Enebak 2011; U.S. EPA 2015).

From 2009 to 2014 (the most recent years for which illness statistics are available), the number of reported illnesses associated with methyl bromide field soil fumigations has fluctuated between 1 to 4 episodes per year. The number of episodes is expected to drop even lower beginning in 2017, when only QPS applications will be allowed. It seems reasonable to expect that the number of illness episodes in 2017 and beyond would be roughly 20% of pre-2017 levels, given that roughly 20% of methyl bromide applications have been QPS related.

Given the continued decline and low use of methyl bromide for field soil fumigation, and mitigation already put in place for both occupational and bystander exposures, WHS Branch finds that there is no need to develop additional mitigation measures for methyl bromide field soil fumigations. WHS Branch will, however, continue to monitor associated illnesses that may be reported in the future. Your approval of this conclusion is requested.

### APPROVAL

*[Original signed by M. Verder-Carlos]*  
Marylou Verder-Carlos, Assistant Director

7/31/17  
Date

## References

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- DPR (Department of Pesticide Regulation). 2016c. *Appendix M: Methyl Bromide Field Fumigation Recommended Permit Conditions*, pages M1 – M28. In: Pesticide Use Enforcement Program Standards Compendium Volume 3, Restricted Materials and Permitting. Enforcement Branch, Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento CA. Available at: [http://www.cdpr.ca.gov/docs/enforce/compend/vol\\_3/append\\_m.pdf](http://www.cdpr.ca.gov/docs/enforce/compend/vol_3/append_m.pdf) (accessed 12/27/2016).
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## Attachment

cc: Kevin Solari, Environmental Program Manager I  
Michael Zeiss, Research Scientist III  
Miglena Wilbur, Staff Toxicologist (Specialist)



# Department of Pesticide Regulation



Brian R. Leahy  
Director

## MEMORANDUM

Edmund G. Brown Jr.  
Governor

TO: Susan McCarthy  
Environmental Program Manager II  
Chief, Worker Health and Safety Branch

Via: Kevin Solari  
Environmental Program Manager I  
Worker Health and Safety Branch

*[Original signed by K. Solari]*

FROM: Michael Zeiss  
Research Scientist III  
Worker Health and Safety Branch  
(916) 323-2837

*[Original signed by M. Zeiss]*

Miglana Wilbur  
Staff Toxicologist (Specialist)  
Worker Health and Safety Branch  
(916) 445-3607

*[Original signed by M. Wilbur]*

DATE: July 17, 2017

SUBJECT: MITIGATION OF METHYL BROMIDE FIELD SOIL FUMIGATIONS

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### Summary

This memorandum presents the facts that support a determination that no additional human-health mitigation measures are needed for the pesticide methyl bromide when used for fumigation of field soil. Most methyl bromide field soil fumigations ceased at the end of 2016 due to restrictions within the federal Clean Air Act. However, certain field soil fumigations will continue to be allowed in 2017 and beyond under the Quarantine and Preshipment (QPS) exemption (U.S. EPA 2015). Therefore, it is possible that handler and bystander illnesses might also continue. Nonetheless, we recommend that DPR consider mitigation complete, for three reasons:

- 1) Methyl bromide use for field soil fumigations within California has declined steadily since 2007. Reported use for field soil fumigations in 2015 was about 2.7 million pounds statewide, a decrease of about 55% since 2007 (DPR 2016a).
- 2) Use for field soil fumigation likely will fall sharply beginning in 2017. In past years, a critical use exemption authorized the use of methyl bromide for pre-plant fumigation of strawberry production fields. That exemption expired at the end of 2016, ending the last approved use for routine (non-QPS) field soil fumigation (U.S. EPA 2015).
- 3) Even at current use levels, illness rates are low. Extensive mitigation measures already have been implemented via product labeling, DPR recommended permit conditions, and California regulations developed jointly and mutually by DPR and the Office of Environmental Health



Hazard Assessment, OEHHA (DPR 2010; Reardon 2010). In 2014, the most recent year for which illness statistics are available, there was only one reported illness case - - a handler - - associated with a legal methyl bromide field soil fumigation (DPR 2016b).

For all these reasons, we conclude that no additional human-health mitigation measures are needed for methyl bromide field soil fumigations. However, methyl bromide uses other than field soil fumigations, such as post-harvest commodity fumigations, are outside the scope of this memorandum.

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### **1. Mitigation before DPR’s Risk Characterization Documents (RCDs)**

In 1986, DPR implemented work hour restrictions for handlers involved in methyl bromide field soil fumigations. The work hour restrictions were implemented by adopting section 6784 within title 3 of the California Code of Regulations (3 CCR), which became effective on 9/14/1986. DPR calculated the work-hour restrictions to limit maximum handler exposure to 210 ppb, which was DPR’s estimate of the reference concentration for methyl bromide acute inhalation exposure (Lim 2003, page 22). Reference concentrations are calculated from the human-equivalent No Observed Effect Level (NOEL) and the uncertainty factors, and are amortized for 24 hours of exposure (Lim 2003, page 7, footnotes “b” and “c”).

In 2001, DPR implemented additional mitigation measures by adopting four regulations within 3 CCR. Those four regulations were assigned new section numbers in 2008, but their content has remained essentially unchanged since their 2001 adoption (Table 1).

Similar to the work hour restrictions of the earlier 3 CCR 6784, DPR designed the buffer zone sizes within the original 3 CCR 6450.2 to limit maximum resident and bystander exposure to 210 ppb, which was DPR’s estimate of the reference concentration for methyl bromide acute inhalation exposure (Lim 2003, pages 12 and 22).

**Table 1. Summary of regulatory use requirements for methyl bromide field fumigations**

Current section number as of December 2016	Section number when first became operative in 1/14/2001 (OAL file no. 00-1031-06 S)	Key provisions when first became operative in 2001
6447	6450	Worksite plan, application block size limit, tarpaulin specifications
6447.1	6450.1	Notification to County Agricultural Commissioner and property operator
6447.2	6450.2	Inner and outer buffer zones
6447.3	6450.3	Application method restrictions

**2. Risk estimates within DPR’s RCDs**

In 2002, DPR assessed risks from inhalation exposure to methyl bromide fumigations of field soil, commodities, and structures (Lim 2002a); and risks from the aggregate of inhalation plus dietary exposure (Lim 2002b). DPR subsequently amended the inhalation risk estimates for the subchronic exposure period only, based on additional data and external reviews (Lim 2003):

“After consideration of comments from internal and external scientific reviews, DPR determined that the critical subchronic NOEL should be increased to 5 ppm from 0.5 ppm used in the 2002 RCD. Since the subchronic exposure scenario was not considered in the risk characterization documents for dietary and aggregate exposures, this change in the NOEL does not have any impact to the conclusions of those documents.” [also, did not have any impact on inhalation exposure estimates for exposure periods other than subchronic, such as acute or chronic inhalation exposure] Source of quote: Lim (2003), page 22.

The RCD makes clear that DPR’s risk assessment took into account the mitigation measures that were in effect at the time: “The worker exposure estimates were revised to reflect only work conditions allowed under the current DPR permit conditions / regulations” (Lim 2002a, page v).

For aggregate exposure, Margins of Exposure (MOEs) for field soil fumigations were close to or above 100 for all handlers and bystanders (Lim 2002b). This is primarily because the endpoint for aggregate exposure was less sensitive than for inhalation exposure:

“[for aggregate exposure] the toxicity endpoints were not the most sensitive endpoints when compared to those used to characterize inhalation exposure alone. However, they were the common endpoints reported for both routes of exposure. Developmental toxicity and nasal cavity lesions were observed only after inhalation exposures. Therefore, when a total MOE is higher than that for inhalation exposure alone, it should not be interpreted to mean that a lower risk [is] associated with the aggregate exposure.” Source of quote: Lim (2002b), page 33.

Because inhalation has a more sensitive endpoint, the remainder of this memorandum will focus on inhalation exposure. For inhalation exposure, despite the mitigation measures in effect at the time, MOEs were below 100 for several handler exposure scenarios:

“ . . . there remained some occupational scenarios with MOEs of less than 100 and mitigation measures might be warranted. . . . For field fumigation, the acute MOEs and short-term MOEs remained at less than 100 for disc drivers (deep shank injection), and tractor drivers and basket-men in tarp removal (shallow shank injection with Noble plow). For subchronic exposure, the MOEs for many exposure scenarios (applicators, copilots, disc drivers, and tarp removers) remained less than the benchmark of 100 . . . The MOE for workers at adjacent fields was assumed to be 100 since they work outside of the buffer zone. For residents living at the buffer zone perimeter of fumigated fields, the acute MOEs were generally around 100 for the 95th percentile exposure.” Source of quote: Lim (2003), page 22.

Lim (2003) further explains:

“The interpretation of these MOEs is not as straight forward as those based on point estimates since they are based on a frequency distribution and on maximum air concentrations along the perimeter. When the MOE is less than 100 based on a 95th percentile value, it means that the reference concentration of 210 ppb was exceeded in less than 5% of the 7,166 24-hour meteorological data sets and only along the portion of the buffer zone perimeter with the maximum methyl bromide air concentration.” Source of quote: Lim (2003), page 12.

### **3. Mitigation since the 2003 RCD**

As shown in Table 2, in the years since DPR’s most recent RCD (Lim 2003), DPR and registrants have implemented additional human-health mitigation provisions. California regulations were designed to reduce exposure to levels determined jointly and mutually by DPR and OEHHA (DPR 2010) as specified in DPR’s Risk Management Decision (Reardon 2010). In particular, bystander risk has been mitigated by buffer zones substantially larger than those in effect in 2003. In addition, bystander risk has been mitigated by township caps on agricultural use of methyl bromide, designed to ensure that ambient air concentrations of methyl bromide do not exceed an average daily nonoccupational exposure of five parts per billion (ppb) in a calendar month (Reardon 2010; DPR 2010). Handler risk has been mitigated by revised work hour restrictions designed to achieve a target level of 13 ppb for workers (Reardon 2010).

Additional provisions were implemented via changes to federal labels for methyl bromide soil fumigant products. In particular, handler risk has been further mitigated by label requirements for respiratory protection measures including stop work triggers.

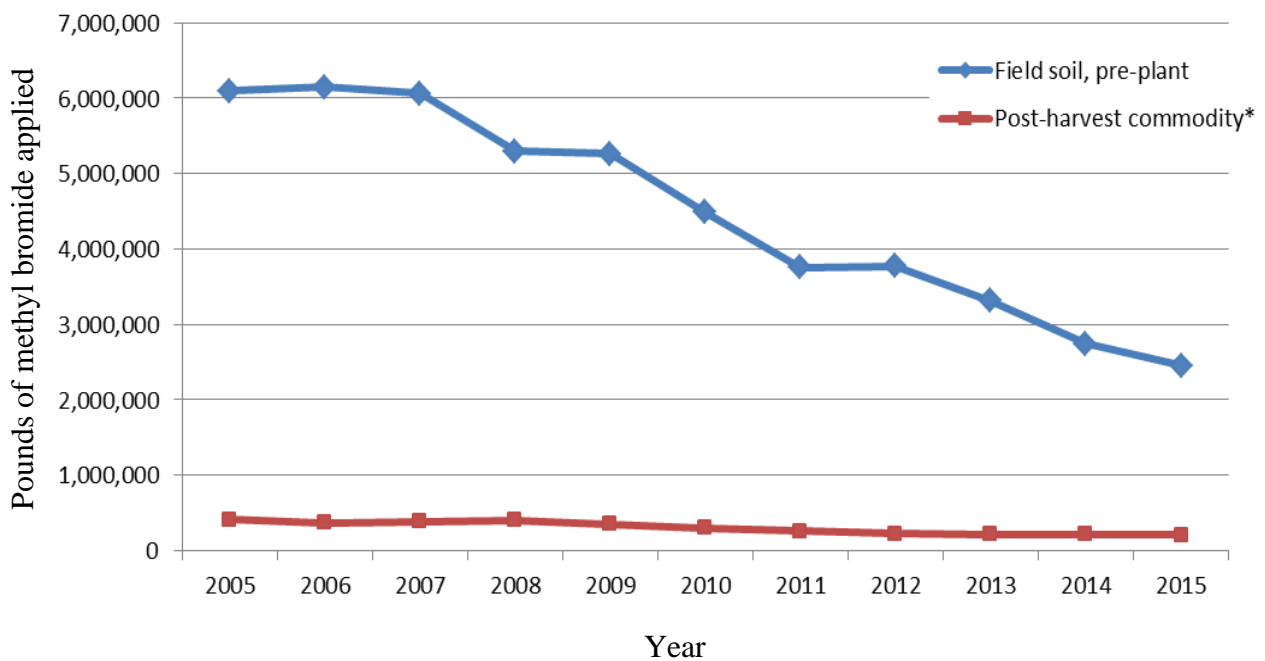
**Table 2. Additional methyl bromide soil fumigation mitigation implemented since DPR's most recent RCD (Lim 2003)**

Description of the protective measure	Where promulgated	Helps mitigate risks to:	
		Handlers	Bystanders
<b>Substantial mitigation of risk:</b>			
Substantially larger buffer zones for most applications	<i>Methyl Bromide Field Fumigation Buffer Zone Determination Rev. 3/10</i> cited in 3 CCR 6447.2 (a)	no	yes
Revised work hour restrictions, calculated to achieve 13 ppb methyl bromide for workers (Reardon 2010)	3 CCR 6784 (b)	yes	no
Respiratory protection and stop work triggers	Product labeling registered since December 2012	yes	no
<b>Additional mitigation provided by:</b>			
Monthly township cap for agricultural use, calculated to achieve 5 ppb methyl bromide in ambient air (Reardon 2010)	3 CCR 6447(g)	yes <i>(subchronic and chronic only)</i>	yes <i>(subchronic and chronic only)</i>
Prohibition of Nontarpaulin/Shallow/Bed fumigation method	No longer allowed by product labeling. Previously allowed by 3 CCR 6450.3 (a) (1). In the current version of that regulation, now renumbered as 3 CCR 6447.3, subsection (a) (1) has been removed.	yes	yes
Prohibition of multiple application methods within ozone non-attainment areas during May – October	3 CCR 6447.3 (a)	no	yes <i>(non-attainment areas only)</i>
For low-permeability tarps, minimum of 9 days before perforation	3 CCR 6447.3 (a) (3) through (a) (6)	yes	yes
Emergency Preparedness and Response Measures	Product labeling, and DPR recommended permit conditions (DPR 2016c)	no	yes
Restrictions near difficult to evacuate sites	Product labeling, and DPR recommended permit conditions (DPR 2016c)	no	yes

#### 4. Reported use

Methyl bromide use for field soil fumigations within California has declined steadily since 2007 (Figure 1). In 2015, the most recent year for which DPR has released official figures, reported use for field soil fumigations was about 2.7 million pounds of methyl bromide statewide, a decrease of about 55% since 2007 (DPR 2016a).

Figure 1. Reported use of methyl bromide within California, statewide, 2005 – 2015  
Source of data: DPR (2016a).



\* Commodity fumigation use was calculated from only those methyl bromide products that are not labeled for field soil application. Some older methyl bromide products are labeled for both field and commodity fumigation. Therefore, this calculation method might slightly underestimate commodity fumigation and overestimate field soil fumigation.

Since 2005, U.S. EPA has been phasing out the production and use of methyl bromide. Exemptions have included certain critical uses, and the quarantine and pre-shipment (QPS) exemption. As of 2016, the only remaining critical use exemption for field soil fumigations was for preparing fields for planting strawberries for agricultural production. The critical use exemption for routine strawberry production expired at the end of 2016 (U.S. EPA 2015). Therefore, methyl bromide use for field soil fumigation is expected to fall sharply beginning in 2017.



In 2017 and beyond, certain field soil fumigations will continue to be allowed under the QPS exemption (Enebak 2011; U.S. EPA 2015). These include field soil fumigations to prepare fields for production of strawberry nursery stock (runners). Based on current use within the counties in which strawberry nurseries are located, continuing future use under the QPS exemption may comprise as many as 300 - 400 methyl bromide applications per year, totaling as much as 1.2 – 1.5 million pounds of active ingredient per year (Appendices 2 and 3).

Methyl bromide use for post-harvest fumigation of commodities declined only slightly during 2005-2015 (Figure 1). Most commodity fumigations will continue to be allowed under the QPS exemption (U.S. EPA 2015). However, methyl bromide use for commodity fumigation is outside the scope of this memorandum. Note that DPR currently is assessing risks associated with methyl bromide commodity fumigation.

## **5. Associated illnesses**

As shown in Table 3, the number of reported illnesses associated with methyl bromide field soil fumigations has fluctuated between 1 to 4 episodes per year from 2009 to 2014, the most recent year for which illness statistics are available (DPR 2016b). This is a very low illness rate given the quantity of methyl bromide applied during those same years (Table 3). This low illness rate is one indication that no additional human-health mitigation measures are needed.

The number of episodes is expected to drop even lower beginning in 2017, when only QPS applications will be allowed. In the years leading up to 2017, roughly 20% of the methyl bromide field soil fumigations were related to production of strawberry nursery plants, a major QPS use (Table 3; Appendix 3). Therefore, it seems reasonable to expect that the number of illness episodes in 2017 and beyond would be roughly 20% of pre-2017 levels.

Table 3 shows that, as is typical for field soil fumigations, episodes in which handlers allegedly were exposed during application of methyl bromide resulted in only one or two illness cases per episode. In contrast, episodes in which occupational bystanders or residents allegedly were exposed via offsite movement of methyl bromide often resulted in multiple illness cases per episode - - up to 33 fieldworker cases in one episode in 2010. Thus, although the number of methyl bromide episodes should decline beginning in 2017, it seems possible that an occasional episode may still result in multiple illness cases.

**Table 3. Illness episodes and cases possibly, probably, or definitely associated with legal\* methyl bromide field soil fumigations, 2009 – 2014.** Source of data: DPR (2016b). For comparison purposes, statewide numbers of methyl bromide field soil fumigations are also provided (DPR 2016a).

Year	County in which episode occurred	Category of person affected	Number of cases (individuals)	Number of methyl bromide field soil fumigations, statewide
2009	Merced	Handler	1	2,701
	San Joaquin	Handler	2	
2010	Monterey	Occupational bystander	33	1,854
	San Benito	Handler	1	
	Tehama	Occupational bystander	1	
2011	San Luis Obispo	Occupational bystander	1	2,111
	Santa Barbara	Occupational bystander	2	
	Siskiyou	Occupational bystander	1	
	Tehama	Handler	1	
2012	Lassen	Handler	1	1,830
	Stanislaus	Handler	1	
	Ventura	Handler	1	
2013	Merced	Resident	4	1,555
	Monterey	Occupational bystander	10	
	Orange	Occupational bystander	1	
2014	Ventura	Handler	1	1,152
<b>Total episodes:</b>	<b>16</b>	<b>Total cases:</b>	<b>62</b>	

\* “Legal” fumigations are those for which the PISP database does not identify any contributory violations. Incidents involving unlawful pesticide use have been excluded from this table as per standard DPR policy (DPR 2009).

## **6. Conclusions**

Most methyl bromide field soil fumigations will cease by the end of 2016 due to restrictions within the federal Clean Air Act. However, certain field soil fumigations will continue to be allowed during 2017 and beyond under the QPS exemption (Enebak 2011; U.S. EPA 2015). Therefore, it is anticipated that low rates of associated illnesses to handlers and bystanders may be possible. Nonetheless, we recommend that DPR consider mitigation complete, for three reasons:

- 1) Methyl bromide use for field soil fumigations within California has declined steadily since 2007. Reported use for field soil fumigations in 2015 was about 2.7 million pounds statewide, a decrease of about 55% since 2007 (DPR 2016a).
- 2) Use for field soil fumigation likely will fall sharply beginning in 2017. In previous years, a critical use exemption authorized the use of methyl bromide for pre-plant fumigation of strawberry production fields. That exemption expired at the end of 2016, ending the last approved use for routine (non-QPS) field soil fumigation (U.S. EPA 2015).
- 3) Even at current use levels, illness rates are low. Extensive mitigation measures already have been implemented via DPR recommended permit conditions and California regulations developed jointly and mutually by DPR and OEHHA (DPR 2010). Additional mitigation measures have been implemented via changes to federal labels for methyl bromide products. In 2014, the most recent year for which illness statistics are available, there was only one reported case of illness associated with a legal methyl bromide field soil fumigation (DPR 2016b).

For all these reasons, we conclude that the facts support a determination that no additional human-health mitigation measures are needed for methyl bromide field soil fumigations.

## **7. References**

- DPR (Department of Pesticide Regulation). 2009. *Guidance for Dietary Exposure Assessment, Version IV*. Medical Toxicology Branch, Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, CA. Available at: [http://www.cdpr.ca.gov/docs/risk/dietary\\_updated.pdf](http://www.cdpr.ca.gov/docs/risk/dietary_updated.pdf) (accessed 12/27/2016).
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- Lim, L.O. 2002a. *Methyl Bromide Risk Characterization Document Volume I Inhalation Exposure*. Medical Toxicology Branch, California Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento CA. Available at: [http://www.cdpr.ca.gov/docs/risk/rcd/metbro\\_in.pdf](http://www.cdpr.ca.gov/docs/risk/rcd/metbro_in.pdf) (accessed 12/22/2016).
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- Reardon, C. 2010. *Methyl Bromide Regulations Risk Management Decision*. Memorandum to Chuck Andrews and Marylou Verder-Carlos dated January 29, 2010. California Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento CA. [copy attached as Appendix 1. Starting September 2017, original will be available at: [http://www.cdpr.ca.gov/docs/whs/pdf/methyl\\_bromide\\_rmd.pdf](http://www.cdpr.ca.gov/docs/whs/pdf/methyl_bromide_rmd.pdf) ]
- U.S. EPA (United States Environmental Protection Agency). 2015. *Protection of Stratospheric Ozone: The 2016 Critical Use Exemption from the Phaseout of Methyl Bromide*. Federal Register pages 61985 – 61993. U.S. EPA, Washington D.C. Available at: <https://www.federalregister.gov/documents/2015/10/15/2015-26301/protection-of-stratospheric-ozone-the-2016-critical-use-exemption-from-the-phaseout-of-methyl> (accessed 12/27/2016).

# Appendix 1

Scanned copy of *Methyl Bromide Regulations Risk Management Decision* (Reardon 2010)



Mary-Ann Warmerdam  
Director

## Department of Pesticide Regulation

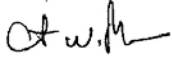
### MEMORANDUM



Arnold Schwarzenegger  
Governor

TO: Chuck Andrews, Associate Director  
Pesticide Programs Division

Marylou Verder-Carlos, Assistant Director  
Pesticide Programs Division

FROM: Christopher Reardon   
Chief Deputy Director  
916-445-4000

DATE: January 29, 2010

SUBJECT: METHYL BROMIDE REGULATIONS RISK MANAGEMENT DECISION

On January 21, 2010, I received your memorandum outlining mitigation measures that would achieve the various regulatory target levels for bystander and occupational exposures to methyl bromide contained in my risk management directive of September 21, 2010.

Based on those mitigation measures, the Methyl Bromide Regulations Work Group members should develop proposed regulatory language to revise the current methyl bromide regulations to implement mitigation to meet the following regulatory target levels:

- Occupational exposure. The risk management decision regulatory target level for workers will be 13 parts per billion (ppb); therefore, work hours will be calculated for 13 ppb.
- Bystander exposure. The regulatory target level will be 5 ppb, with township caps calculated at 171,625 pounds per township, per month. This level should be stated in the revised language of the regulations.
- The township cap will be enforced via permit conditions using one or a combination of the "track and stop use" and "allocation," as stated in your January 21, 2010, memorandum.
- Develop regulatory language to clarify existing requirements in Title 3, California Code of Regulations sections 6447.2(a) and 6784(b)(2)(C).

The work group should develop these regulations and coordinate directly with Chief Counsel Polly Frenkel, and Regulations Coordinator Linda Irokawa-Otani.

cc: Polly Frenkel  
Linda Irokawa-Otani



**Appendix 2. Pounds of methyl bromide applied for production agriculture within eight counties\* that produce strawberry nursery plants, 2005 - 2015**

\* counties of Glenn, Lassen, Merced, San Joaquin, Shasta, Siskiyou, Stanislaus, and Tehama (Mike Nelson, CA Strawberry Nurserymen's Association, personal communication June 2017)

Mike Zeiss used his professional judgement to determine which reported use sites were, or were not, likely associated with production of strawberry nursery plants.  
 Small grains such as barley and wheat sometimes are planted as cover crops in fields that later will be used to grow strawberry nursery plants (Kevin Solari, DPR WHS Branch, personal communication June 2017).  
 Therefore, reported use on small grains was classified as likely associated with production of strawberry nursery plants.

Reported use site:	Year:											Total all years
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
<b>Sites likely associated with strawberry nursery plants:</b>												
BARLEY, GENERAL									5,828			5,828
FORAGE - FODDER GRASSES (ALL OR UNSPEC) (HAY)						5,438						5,438
GRAIN CROPS (ALL OR UNSPEC)	7,179	34,431		32,032	24,215			39,604				137,459
GRASSES GROWN FOR SEED (ALL OR UNSPEC)					3,528							3,528
N-GRNHS GRWN TRNSPLNT/PRPGTV MTRL			5		644	716		184	166	184		1,899
N-OUTDR CONTAINER/FLD GRWN PLANTS	80,392	87,591	82,334	188,300	61,230	52,377	14,568	197,721	189,787	229,146	170,441	1,353,887
N-OUTDR GRWN TRNSPLNT/PRPGTV MTRL	206,103	274,144	293,339	334,036	239,297	232,205	176,307	324,331	472,501	225,666	201,270	2,979,199
RYE (ALL OR UNSPEC)					9,234	9,058						18,291
SOIL APPLICATION, PREPLANT-OUTDOOR (SEEDBEDS,ETC.)	413,324	463,731	625,232	635,488	778,048	977,042	845,000	1,187,758	970,163	1,008,501	817,364	8,721,652
STRAWBERRY (ALL OR UNSPEC)	59,912	37,243	15,152	30,511	8,104	60,741	24,364	238	70,283	42,380		348,927
UNCULTIVATED AGRICULTURAL AREAS (ALL OR UNSPEC)	5,773	106,940	103,253	70,451	9,837	29,694	27,921	29,422	14,605	32,605	64	430,565
UNCULTIVATED NON-AG AREAS (ALL OR UNSPEC)					24,500			2	36,084			60,586
WHEAT, GENERAL	1,468				4,194			93				5,756
<b>Subtotal likely associated with strawberry plant production:</b>	<b>772,683</b>	<b>1,004,081</b>	<b>1,119,315</b>	<b>1,290,818</b>	<b>1,158,637</b>	<b>1,367,271</b>	<b>1,088,159</b>	<b>1,779,259</b>	<b>1,759,416</b>	<b>1,538,481</b>	<b>1,189,139</b>	<b>14,067,259</b>
<b>Sites not likely associated with strawberry nursery plants:</b>												
ALFALFA (FORAGE - FODDER) (ALFALFA HAY)					103							103
ALMOND	67,891	63,154	83,481	25,084	21,465	8,223	7,186	11,533	8,719	4,881	3,569	305,186
APPLE	206		3,959	248			120		83			4,616
APRICOT		0						251	12	20		283
ASPARAGUS (SPEARS, FERNS, ETC.)		18,659										18,659
BLUEBERRY	462		1,688									2,150
CHERRY	19,311	53,726	23,023	7,696	8,044	1,547	6,856	1,715	2,657	1,386	132	126,094
CHESTNUT								23		41		64
COMMODITY FUMIGATION	350		350						301		65	1,066
CORN (FORAGE - FODDER)	157		16	15								187
FOREST TREES, FOREST LANDS (ALL OR UNSPEC)									179			179
GARLIC	1,805			5,457								7,262
GRAPES, WINE			410						1,667			2,076
KIWI FRUIT					25							25
ONION (DRY, SPANISH, WHITE, YELLOW, RED, ETC.)							170					170
ORNAMENTAL TURF (ALL OR UNSPEC)	57,746	9,958	28,508		10,098							106,310
PASTURES (ALL OR UNSPEC)			355									355
PEACH	14,341	1,271	6,692	1,189	2,079	361	536	3,371	180	96		30,117
PEAR	2,004	153	75	39								2,272
PISTACHIO (PISTACHE NUT)			6					35		1		42
PRUNE	36,107	24,437	201	339	103	88	42	59	370			61,746
RANGELAND (ALL OR UNSPEC)							44					44
RASPBERRY (ALL OR UNSPEC)					4,362			5,454				9,816
RESEARCH COMMODITY	466											466
RIGHTS OF WAY			921									921
SWEET POTATO	1,002	7,067	1,776	9,050	4,228	2,213	2,217	576				28,130
TOMATOES, FOR PROCESSING/CANNING								14				14
WALNUT (ENGLISH WALNUT, PERSIAN WALNUT)	117,091	115,893	67,384	60,649	130,386	6,225	42,041	13,669	9,525	2,983	16,869	582,713
WATERMELONS	410											410
<b>Subtotal not likely associated with strawberry plant production:</b>	<b>319,350</b>	<b>294,319</b>	<b>218,845</b>	<b>109,765</b>	<b>180,893</b>	<b>18,658</b>	<b>59,212</b>	<b>36,700</b>	<b>23,693</b>	<b>9,408</b>	<b>20,634</b>	<b>1,291,477</b>
<b>Total all use sites within production agriculture:</b>	<b>1,093,502</b>	<b>1,298,400</b>	<b>1,338,160</b>	<b>1,400,583</b>	<b>1,343,724</b>	<b>1,385,928</b>	<b>1,147,465</b>	<b>1,815,959</b>	<b>1,783,109</b>	<b>1,547,889</b>	<b>1,209,773</b>	<b>15,364,491</b>

**Appendix 3. Number of methyl bromide applications for production agriculture within eight counties\* that produce strawberry nursery plants, 2005 - 2015**

\* counties of Glenn, Lassen, Merced, San Joaquin, Shasta, Siskiyou, Stanislaus, and Tehama (Mike Nelson, CA Strawberry Nurserymen's Association, personal communication June 2017)

Mike Zeiss used his professional judgement to determine which reported use sites were, or were not, likely associated with production of strawberry nursery plants. Small grains such as barley and wheat sometimes are planted as cover crops in fields that later will be used to grow strawberry nursery plants (Kevin Solari, DPR WHS Branch, personal communication June 2017). Therefore, reported use on small grains was classified as likely associated with production of strawberry nursery plants.

Reported use site:	Year:											Total all years
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
<b>Use sites likely associated with strawberry nursery plants:</b>												
BARLEY, GENERAL									1			1
FORAGE - FODDER GRASSES (ALL OR UNSPEC) (HAY)						1						1
GRAIN CROPS (ALL OR UNSPEC)	1	4		5	3			4				17
GRASSES GROWN FOR SEED (ALL OR UNSPEC)					3							3
N-GRNHS GRWN TRNSPLNT/PRPGTV MTRL			1		2	1		2	2	2		10
N-OUTDR CONTAINER/FLD GRWN PLANTS	20	15	17	27	14	10	7	24	34	36	28	232
N-OUTDR GRWN TRNSPLNT/PRPGTV MTRL	108	116	127	131	71	85	71	96	124	80	93	1,102
RYE (ALL OR UNSPEC)					1	1						2
SOIL APPLICATION, PREPLANT-OUTDOOR (SEEDBEDS, ETC.)	95	101	97	87	149	149	201	254	272	254	224	1,883
STRAWBERRY (ALL OR UNSPEC)	12	13	7	6	3	11	5	1	13	6		77
UNCULTIVATED AGRICULTURAL AREAS (ALL OR UNSPEC)	5	15	16	8	6	3	8	10	4	7	1	83
UNCULTIVATED NON-AG AREAS (ALL OR UNSPEC)					1			1	9			11
WHEAT, GENERAL	1				1		3					5
<b>Subtotal likely associated with strawberry plant production:</b>	<b>241</b>	<b>264</b>	<b>265</b>	<b>264</b>	<b>253</b>	<b>261</b>	<b>292</b>	<b>392</b>	<b>459</b>	<b>385</b>	<b>346</b>	<b>3,422</b>

<b>Use sites not likely associated with strawberry nursery plants:</b>												
ALFALFA (FORAGE - FODDER) (ALFALFA HAY)					1							1
ALMOND	358	322	359	244	269	94	164	178	136	124	21	2,269
APPLE	1		2	2			1		1			7
APRICOT		1						2	2	1		6
ASPARAGUS (SPEARS, FERNS, ETC.)		4										4
BLUEBERRY	2		1									3
CHERRY	110	158	149	109	110	53	88	32	36	37	1	883
CHESTNUT								1		2		3
COMMODITY FUMIGATION	1		1						14		3	19
CORN (FORAGE - FODDER)	1		1	1								3
FOREST TREES, FOREST LANDS (ALL OR UNSPEC)									1			1
GARLIC	1			1								2
GRAPES, WINE			1						2			3
KIWI FRUIT					1							1
ONION (DRY, SPANISH, WHITE, YELLOW, RED, ETC.)							1					1
ORNAMENTAL TURF (ALL OR UNSPEC)	11	1	2		1							15
PASTURES (ALL OR UNSPEC)			1									1
PEACH	47	5	24	15	13	4	8	6	4	2		128
PEAR	1	2	4	3								10
PISTACHIO (PISTACHE NUT)			1					1		1		3
PRUNE	21	2	3	7	1	1	2	1	1			39
RANGELAND (ALL OR UNSPEC)							1					1
RASPBERRY (ALL OR UNSPEC)					1			1				2
RESEARCH COMMODITY	2											2
RIGHTS OF WAY			1									1
SWEET POTATO	4	5	5	10	5	4	2	2				37
TOMATOES, FOR PROCESSING/CANNING								1				1
WALNUT (ENGLISH WALNUT, PERSIAN WALNUT)	248	288	348	283	268	104	222	282	155	60	18	2,276
WATERMELONS	1											1
<b>Subtotal not likely associated with strawberry plant production:</b>	<b>809</b>	<b>788</b>	<b>903</b>	<b>675</b>	<b>670</b>	<b>260</b>	<b>489</b>	<b>507</b>	<b>352</b>	<b>227</b>	<b>43</b>	<b>5,723</b>