Brian R. Leahy
Director

Department of Pesticide Regulation

Edmund G. Brown Jr.
Governor

M E M O R A N D U M

TO: Randy Segawa
Environmental Program Manager I
Environmental Monitoring Branch

FROM: Bruce Johnson, Ph.D. *Original signed by*
Research Scientist III
Environmental Monitoring Branch
916-324-4106

DATE: April 12, 2013

SUBJECT: ADDITIONAL STUDIES FOR 1,3-DICHLOROPROPENE VOLATILE ORGANIC COMPOUND EMISSION ESTIMATES

The regulations to reduce volatile organic compound (VOC) emissions from field fumigations specify application method adjustment factors or emission ratings for each fumigant and fumigation method. The emission rating is the total amount of fumigant that volatilizes to the air, expressed as the percentage of the fumigant mass applied. The Department of Pesticide Regulation (DPR) has received emission (flux) studies for some 1,3-dichloropropene (1,3-d) fumigation methods that are not currently included in the regulations.

I queried the InMagic registration data base for 1,3-d studies by searching for 50046-*. Of the approximately 250 studies listed, there were potentially four relevant fumigant studies since 2007 (Table 1 – "Inmagic"). Of these four studies, two were inadequate to review at this time and one study was not relevant. The fourth study, 50046-198, was acceptable and relevant. A current review of chloropicrin revealed five fumigation studies of 1,3-d in combination with chloropicrin (Barry personal communication). Of these five, two had been used in the previous evaluations (Johnson 2006, Johnson 2007) and the remaining three were candidates (Table 1 – "Chloropicrin Review"). This resulted in four studies being utilized for reviewing emission ratings (Table 2). These studies were all shank injections. Each study utilized more than one field to examine a diversity of treatments. A primary distinguishing factor amongst these studies and the studies utilized in the previous emission potential calculation was the use of totally impermeable film (TIF) tarp compared to other tarps or no tarp. The TIF tarps included in the studies are ones that are assigned a 60 percent (%) buffer zone credit by 1,3-d labels.

The untarped (compacted surface) in [0199-0143] volatilized cumulative percentages of 53.12% and 66.27% of the applied 1,3-d. The poly tarp in [0199-0142] yielded 43.24% of the applied 1,3-d to offgassing. And the Virtually Impermeable Film tarp in the bedded shank study of [0199-0138] yielded 32.82% (cumulative total volatilization recalculated by Johnson 2013). These estimated flux percentages which were similar to previous, shallow shank 1,3-d applications where two bedded shallow applications each yielded 65% (Gillis and Dowling 1999).

The five fields that utilized TIF consisted of four fields in [50046-0198] and 1 field in [0199-0142]. Johnson (2012) recalculated the cumulative totals in [50046-0198], which resulted in some minor changes to the calculations in the original report. A key difference between these fields was the length of time until tarp cut. The percentage for the longest tarp cut times of 10 and 16 days ([50046-0198], fields 1 and 2) was about 10%. For a tarp cut at day 5 ([50046-0198, fields 3 and 4) or day 6 ([0199-0142], field 2), the percentages ranged from 17% to about 43%.

Thus, the treatment of using a TIF tarp and holding in place for 10d warrants an emission rating of 0.5*(9.91+9.8)=10%.

Using TIF and holding in place for 5 or 6 days is estimated by 0.5*(19+43)=31%

These emission ratings apply to 1,3-d TIF, broadcast (flat field), shallow shank injection (12 – 15 inch depth) applications, as well as deep shank injection (18+ inch depth) applications. There is insufficient data to establish emission ratings for 1,3-d TIF bed, shank injection fumigation methods or TIF drip fumigation methods.

References

Ajwa, Husein and David Sullivan. 2012. Soil fumigant emissions reduction using EVAL barrier resin film (VaporSafe TM) and evaluation of tarping duration needed to minimize fumigant total mass loss. Jan 27, 2012. Department of Plant Sciences, University of California, Davis, 1636 East Alisal Street, Salinas, CA 93905. Sullivan Environmental Consulting, Inc. 1900 Elkin St., Suite 200, Alexandria Virginia 22308. Lab Study ID HA2011A. Study Location, Lost Hills California. [50046-0198].

Ajwa, Husein and David Sullivan. 2010. Monitoring of chloropicrin, 1,3-dichloropropene, and methyl bromide field emissions from shank applications and drip fumigation under EVAL-Resin barrier films. TriCal, Inc. Hollister CA 95024; Department of Plant Sciences, University of California, Davis, 1636 East Alisal Street, Salinas, CA 93905; Sullivan Consulting, Inc, 1900 Elkin Street, Suite 200, Alexandria, VA 22308. May 28, 2010. [0199-0142].

Ajwa, H., D. Sullivan and D. Chellemi. 2009. Monitoring 1,3-dichloropropene, chloropicrin and methyl isothiocyanate emissions from shank applications at three sites near Duette, Florida. Sullivan Environmental Consulting, Inc. 1900 Elkin Street, Suite 200, Alexandra, Virginia 22308. Laboratory Study ID 2009A. MRID 47813901. CDPR data volume [0199-0138].

Ajwa, H., D. Sullivan and D. Chellemi. 2010. Monitoring 1,3-Dichloropropene and Chloropicrin Emissions from Solid-Tarp Shank Applications. Department of Plant Sciences University of California, Davis 1636 E. Alisal Street Salinas, California 93905 PERFORMING LABORATORY Department of Plant Sciences University of California, Davis 1636 E. Alisal Street Salinas, California 93905LABORATORY STUDY ID Florida 10/20/2009 AUTHORS William Joseph Ntow March, 2010.[0199-0143].

Gillis, Matthew J. and Kathryn C. Dowling. 1999. Effect of broadcast and row application methods on 1,3-dichloropropene emissions. Dow AgroSciences LLC, 9330 Zionsville Road, 308/2E. Indianapolis, Indiana. Bolsa Research Project #:BR730, Dow AgroSciences Study Identification number: HEA95177.

Johnson, Bruce. 2006. Memorandum to Randy Segawa dated November 30, 2006 on Calculation of emission potential factors for 1,3-dichloropropene for five areas for periods from May 1 through October 31.

Johnson, Bruce. 2007. Memorandum to Randy Segawa on Recalculation of 1,3-dichloropropene emission factors dated September 24, 2007. Available at: <http://www.cdpr.ca.gov/docs/emon/pubs/ehapreps/analysis_memos/1903_3_apdx.pdf >

Johnson, Bruce. 2012. Memorandum to Randy Segawa on “SUBJECT: REANALYSIS OF LOST HILLS DATA FOR CONSISTENCY AND ERROR DETECTION” dated December 4, 2012. Available at: <http://www.cdpr.ca.gov/docs/emon/pubs/ehapreps/analysis_memos/2410_segawa.pdf>.

Johnson, Bruce. 2013. Memorandum to Randy Segawa on Correction of Cumulative Volatilization Percentages as found in [0199-0138] dated March 19, 2013.

Table 1. Studies derived from Inmagic search and from chloropicrin review where 1,3-d was studied in combination with chloropicrin.

ID	Study	Source
50046-0192	DOCUMENT NUMBER: 50046-0192 [Tracking ID: 230324-ER] APPLICANT: Dow Agrosciences LLC PRODUCT: 1,3-Dichloropropene EPA REG. NO: 62719 [Reducing fumigant emissions with film & water seal in strawberry beds] 60 pages Status: In Evaluation	Inmagic
50046-0197	DOCUMENT NUMBER: 50046-0197 [Tracking ID: 247753-E] APPLICANT: Dow Agrosciences LLC PRODUCT: Telone EC EPA REG. NO: 62719-321 [Emission Rates, Salinas, CA] 20 pages Status: Archived	Inmagic
50046-0198	DOCUMENT NUMBER: 50046-0198 [Tracking ID: 251539-ER] APPLICANT: Trical, Inc. PRODUCT: Telone EPA REG. NO: 11220- [Field volatility] 402 pages Status: Archived	Inmagic
50046-0200	DOCUMENT NUMBER: 50046-0200 pt.1 [Tracking ID: SBRA-254605-E] APPLICANT: Dow Agrosciences LLC PRODUCT: 1,3-Dichloropropene EPA REG. NO: 62719- [Drift monitoring data, Merced Co., CA] 405 pages Status: Shelved in Library	Inmagic
0199-0143	Ajwa, H., D. Sullivan and D. Chellemi. 2010b. Monitoring 1,3-dichloropropene and chloropicrin emission from solidtarp shank injections at two sites near Fort Pierce, Florida. Sullivan Environmental Consulting, Inc. 1900 Elkin Street, Suite 200, Alexandra, Virginia 22308. Laboratory Study ID HA2009H. MRID 48085701. CDPR data volume 0199-0143.	Chloropicrin review
0199-0138	Ajwa, H., D. Sullivan and D. Chellemi. 2009a. Monitoring 1,3-dichloropropene, chloropicrin and methyl isothiocyanate emissions from shank applications at three sites near Duette, Florida. Sullivan Environmental Consulting, Inc. 1900 Elkin Street, Suite 200, Alexandra, Virginia 22308. Laboratory Study ID 2009A. MRID 47813901. CDPR data volume 0199-0138	Chloropicrin review
50046-153	Knuteson., J.A. and S.C.Dolder. 2000. Field volatility of 1,3-Dichloropropene and chloropicrin from shallow drip irrigation application of Telone C-35 (InLine) to strawberry beds covered with VIF tarp. Global Environmental Chemistry Laboratory - Indianapolis Lab. Dow AgroSciences LLC. 9330 Zionsville Road, Indianapolis, Indiana 46268-1054. Laboratory Study ID 980070.01. MRID 45112901, CDPR data volume 50046-153.	Chloropicrin review
0199-0142	Ajwa, H. and D. Sullivan. 2010. Monitoring of chloropicrin, 1,3-dichloropropene, and methyl bromide field emissions from shank applications and drip fumigation under EVAL-resin barrier films. Sullivan Environmental Consulting, Inc. 1900 Elkin Street, Suite 200, Alexandra, Virginia 22308. Laboratory Study ID HA200902-2. CDPR data volume 0199-0142	Chloropicrin review
50046-152	van Wesenbeeck, I. and A.M. Phillips. 2000. Field volatility of 1,3-Dichloropropene and chloropicrin from surface drip irrigation application of In-Line to vegetable beds under polyethylene tarp. Global Environmental Chemistry Laboratory - Indianapolis Lab. Dow AgroSciences LLC. 9330 Zionsville Road, Indianapolis, Indiana 46268-1054. Laboratory Study ID 990072. MRID 45112902, CDPR data volume 50046-152.	Chloropicrin review

Table 2. Status of 9 selected studies for use with update of VOC factors for 1,3-d.

ID	Status
50046-0192	Studies inadequate
50046-0197	Insufficient information to review, requested additional information
50046-0198	Reviewed and acceptable
50046-0200	Regional study - not relevant.
0199-0143	Reviewed and acceptable
0199-0138	Reviewed and acceptable
50046-153	Used in previous VOC determination
099-0142	Reviewed and acceptable
50046-152	Used in previous VOC determination

Table 3. Four studies analyzed for updating the 2013 VOC 1,3-d emission potentials

Study	Unit	Acres	Application Method	Rate (lbs a.i./acre)	Date of Application	Time of Application	Location	Length of Monitoring (d)	Percentage of Applied Volatilized	Tarp Cutting (d after application)
50046-0198	Field 1	8	Broadcast, Shank 12", TIF	231	4-Jun-11	700	Lost Hills, CA	18	9.91 (a)	16
	Field 2	2	Broadcast, Shank 12", TIF	221	4-Jun-11	800	Lost Hills, CA	12	9.8 (a)	10
	Field 3	2	Broadcast, Shank 12", TIF	240	4-Jun-11	800	Lost Hills, CA	7	19.05 (a)	5
	Field 4	2	Broadcast, Shank 12", TIF, KT	241	4-Jun-11	1100	Lost Hills, CA	7	16.6 (a)	5
0199-0143	Field 1	0.37	Broadcast, Shank 8",Surface Compaction via roller, HDPE	165.9	17-Nov-09	1200 (b)	Fort Pierce, FL	10	53.12	NA
	Field 2	0.37	Broadcast, Shank 8",Pre-Application Cultivation, HDPE	142.3	17-Nov-09	900 (b)	Fort Pierce, FL	10	66.27	NA
0199-0138	Field 1	1.2	Bedded, Shank 8", Metalized	37.7	13-Jan-09	1100 (b)	Duette, FL	9.8	36.71 (c)	NA
	Field 2	1.1	Bedded, Shank 8", VIF	42	13-Jan-09	1300 (b)	Duette, FL	9.9	32.82 (c)	NA
0199-0142	Field 1	1	Broadcast, Shank 12", Poly Tarp	140	10-Sep-09	900	Oxnard, CA	13	43.24	6
	Field 2	1	Broadcast, Shank 12", TIF	140	10-Sep-09	1300	Oxnard, CA	13	42.90	6

Notes:
(a) As recalculated in Johnson (2012)
(b) Based on offsite-monitor log
(c) As recalculated in Johnson (2013)