



Department of Pesticide Regulation



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MEMORANDUM

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SUBJECT: Calculation of Intermediate-Term Residential Exposures Using Measured Air Concentrations from the Ambient Air Monitoring Network

Purpose:

This memorandum is to clarify the calculation of intermediate-term residential exposures to pesticides, including seasonal exposures, from weekly air concentration data collected by the Department of Pesticide Regulation's (DPR) Environmental Monitoring Branch via the Ambient Air Monitoring Network.

Background:

In February 2011, the Department of Pesticide Regulation (DPR) implemented a multi-year statewide ambient air monitoring network (AMN) to measure pesticides in various agricultural communities. The AMN goals are to provide data to assess potential health risks, develop measures to mitigate risks, and to measure the effectiveness of regulatory requirements.

DPR monitors a total of 32 pesticides and five pesticide breakdown products in three California communities, Salina, Shafter, and Ripon, CA. These communities were selected based on total use of the monitored pesticides and the pesticides were selected based primarily on potential human health risk. The AMN collects 24-hr air samples of pesticides once a week on a randomly chosen day within that week. The resulting data set contains 52 weekly measurements each from Salinas, Shafter, and Ripon.



At DPR's request, the California Air Resources Board (ARB) has been monitoring selected fumigants at three additional locations since 2010 for the Toxic Air Contaminant (TAC) Program. ARB collects 24-hr air samples every six days for TAC Program listed pesticides in Oxnard, Watsonville, and Santa Maria, CA. In addition, ARB collected one 24-hr chloropicrin air sample every three days for three months during the peak use season at each site in 2013 and 2014, data which were used in this analysis.

Neither California nor applicable federal agencies have established health standards for pesticides in air. Therefore, DPR developed health screening levels or regulatory target concentrations for acute, seasonal, and chronic exposures for the network monitored pesticides to be able to examine the results in a health-based context. This document utilizes seasonal reference concentrations, seasonal use data, and air monitoring results to determine whether there are residential exposures of concern. DPR defines intermediate-term exposure as periods of frequent exposure lasting more than seven days but substantially less than a year, regardless of whether the exposure is constant or intermittent during that period (Andrews, 2001). In general, it is assumed that the average daily exposure occurs each day within an intermediate-term period. However, if the exposure is intermittent or sporadic during the period, the exposure may be amortized over the total period (Andrews, 2001).

The seasonal exposure term differs for each of the 37 compounds monitored by the AMN. The DPR Worker Health and Safety Branch generally defines the seasonal term based on periods of peak use of an active ingredient as reported in the Pesticide Use Reporting (PUR) database. By using the PUR database, one can determine the heaviest use regions as well as when the bulk of the applications occur. For example, PUR data show that there was one 6-week period of continuous high use for 1,3-dichloropropene in 2001 for Tulare, Kern, and Fresno counties (Powell, 2004).

The following provides an updated analysis of screening levels for the fumigants chloropicrin and 1,3-dichloropropene using the intermediate exposure durations as defined in each individual Risk Characterization Document (DPR, 2012; DPR, 2015).

Chloropicrin

Air concentrations of chloropicrin were measured in Santa Maria, CA during peak use between August and November of 2014 and 2015. Monitoring was conducted by ARB on behalf of DPR for the TAC Program. Air concentrations were analyzed to determine if residential seasonal exposure was of concern. In the chloropicrin RCD dated November 14, 2012, the seasonal reference concentration (RfC) for chloropicrin is 0.35 ppb for children. The adult seasonal RfC is higher than the RfC for children. So, using the children's RfC is also protective of adults. The seasonal RfC for chloropicrin is based on rhinitis in rats after a 90-day inhalation exposure (6 hours/day, 5 days/week), adjusting for differences in breathing rates and exposure duration between rats and children, and applying a default uncertainty factor of 100 (assuming humans

are 10 times more sensitive than rats and there is a 10-fold variation in the sensitivity of humans).

Peak application season for chloropicrin was determined to be June to October based on 2004-2008 pesticide use data for Monterey, Santa Barbara, Santa Cruz and Ventura counties (DPR, 2012). Total use for these 5 months represented more than 95% of annual use. ARB air monitoring data were not available for all time points during the 2014 and 2015 peak application seasons. Consequently, we analyzed the PUR database to determine when peak use occurred within 2014-2015 to be able to compare to ARB air monitoring data that were available. Table 1 shows the pounds of chloropicrin applied in Santa Maria during 2014 and 2015. The highest use occurred during August through October in both years. In 2014, use during these three months represented 86% of annual use with only one other month (May) exceeding 5% of the annual use. In 2015, pesticide use during August through October represented 79% of annual use. Pesticide use in May and June was between 5-8% of the annual use in 2015. Analysis of the pesticide use data showed that peak use was captured in the air monitoring conducted by ARB in these two years.

Table 1. Pounds of Chloropicrin Applied in Santa Maria during 2014 and 2015 from the DPR Pesticide Use Reporting (PUR) Database

2014	Pounds Applied	% Annual	2015	Pounds Applied	% Annual
January	0	0.00	January	0	0.00
February	0	0.00	February	0	0.00
March	10,298	1.46	March	5,257	0.72
April	7,739	1.10	April	40,592	5.52
May	39,690	5.64	May	57,208	7.78
June	11,455	1.63	June	25,672	3.49
July	10,724	1.52	July	18,188	2.47
August	79,180	11.25	August	78,566	10.69
September	372,991	52.99	September	238,480	32.44
October	155,732	22.12	October	267,251	36.36
November	16,084	2.28	November	2,898	0.39
December	0	0.00	December	1,001	0.14
Total	703,891	100.00	Total	735,112	100.00

The 24-hr chloropicrin air concentrations collected in Santa Maria, CA are shown in Table 2. Air concentrations were averaged for each year assuming that concentrations on the days which were not monitored during the peak use season were similar to concentrations on days which were monitored. Samples with no detectable (ND) residues were assumed to have chloropicrin air concentrations equivalent to one-half of the limit of detection of 0.003 ppb (e.g., ND = 0.0015 ppb). As can be seen in Table 2, the seasonal average air concentration in Santa Maria, CA in 2014 was 0.247 ppb, which represents 71% of the seasonal RfC for children. In 2015, the

seasonal average air concentration was 0.190 ppb, which is 54% of the seasonal RfC for children in 2015. Based on these data, the seasonal residential exposure to chloropicrin in Santa Maria is not a health concern for either 2014 or 2015.

Table 2. 24-Hour Chloropicrin Air Concentrations in Santa Maria, CA during Peak Use Months in 2014 collected via the DPR Air Monitoring Network.

2014 Sampling Date	Chloropicrin concentration (ppb)	2015 Sampling Date	Chloropicrin concentration (ppb)
08/05/2014	ND	08/10/2015	ND
08/06/2014	ND	08/12/2015	0.16
08/10/2014	ND	08/15/2015	ND
08/12/2014	ND	08/18/2015	ND
08/17/2014	0.03	08/22/2015	ND
8/18/2014	ND	08/24/2015	ND
08/24/2014	0.1	08/30/2015	0.01
08/25/2014	0.05	09/02/2015	0.08
08/26/2014	0.14	09/06/2015	0.48
09/02/2014	0.02	09/07/2015	0.34
09/03/2014	0.03	09/14/2015	0.08
09/07/2014	0.28	09/15/2015	0.61
09/11/2014	0.23	09/20/2015	0.11
09/17/2014	0.3	09/23/2015	0.46
09/18/2014	0.23	09/26/2015	0.09
09/23/2014	0.3	09/29/2015	0.48
09/25/2014	0.56	10/05/2015	0.51
09/29/2014	0.57	10/06/2015	0.6
10/02/2014	0.3	10/11/2015	0.78
10/05/2014	1.05	10/14/2015	0.08
10/07/2014	0.59	10/17/2015	0.34
10/08/2014	0.52	10/19/2015	0.15
10/12/2014	0.47	10/26/2015	0.08
10/13/2014	0.4	10/28/2015	0.03
10/15/2014	0.38	11/01/2015	0.01
10/20/2014	0.04	11/04/2015	ND
10/23/2014	0.11	11/07/2015	ND
10/26/2014	0.03	11/10/2015	0.02
10/29/2014	0.43	11/16/2015	ND
2014 Average (ppb)	0.247	2015 Average (ppb)	0.190
% Seasonal RfC (Child - 0.35 ppb)	71%	% Seasonal RfC (Child - 0.35 ppb)	54%

1,3-Dichloropropene

The DPR Environmental Monitoring Branch conducted weekly air monitoring for 1,3-dichloropropene (1,3-D) in Shafter, CA (Kern County) during 2013, 2014, and 2015. Air concentrations were analyzed over the highest 3-month period to determine if the residential seasonal exposure presented a health concern. In DPR's 1,3-D Risk Characterization Document dated December 31, 2015, the seasonal reference concentration (RfC) is 3 ppb for children. This value is based on development of nasal histopathology in rats during a 13-week inhalation study (6 hr/day, 5 days/wk) at doses ranging between 0 and 150 ppm, and calculating a lower-bound benchmark dose concentration at the 10% response level (BMCL₁₀) of 16 ppm. The value was then adjusted to a human equivalent concentration of 0.3 ppm by applying a rat-to-human Regional Gas Dose Ratio scalar of 0.115 and taking into account the difference in exposure duration between the experimentally exposed rats and humans exposed under ambient (24 hr/day, 7 days/wk) conditions. Finally, an uncertainty factor of 100 was applied (3 for pharmacodynamic differences between rats and humans, 10 for variability within the human population, and 3 for database uncertainty in using data from adult rats to immature rats to arrive at the final RfC of 3 ppb for children. The adult seasonal RfC of 10 ppb is higher than the RfC for children. So, as mentioned earlier, using the children's value would also protect adults.

The number of pounds of 1,3-D applied per month in Shafter during 2013 - 2015 is shown in Table 3. From these data, it appears that the period of peak application for those years occurred between August and January, with the exception of a spike during March of 2015. The 24-hr 1,3-D air concentrations collected in Shafter are shown in Table 4. Because the seasonal BMCL₁₀ was based on a 13-wk study, we chose the 3-month period (11/6/13 – 1/28/14) that showed the highest 1,3-D concentrations to evaluate the air monitoring data against the seasonal RfC. Because there were no "non-detect" samples during this period, the 13 air concentrations were simply averaged.

The highest 3-month seasonal mean air concentration in Shafter, CA for the 2013-2015 period was 2.231 ppb, or 74% of the seasonal RfC for children. Based on these data, the seasonal residential exposure to 1,3-D in Shafter, CA does not indicate a health concern during the 3-month period in 2013-2014.

Table 3. Pounds of 1,3-Dichloropropene Applied in Shafter during 2013 - 2015 from the DPR Pesticide Use Reporting (PUR) Database

2013	Pounds applied	% Annual	2014	Pounds applied	% Annual	2015	Pounds applied	% Annual
January	22,586	21.7	January	3022	2.8	January	8044	9.1
February	13,059	12.5	February	0	0	February	0	0
March	0	0	March	8977	8.4	March	48,990	55.3
April	0	0	April	8482	7.9	April	0	0
May	0	0	May	0	0	May	0	0
June	0	0	June	0	0	June	0	0
July	16,007	15.4	July	0	0	July	0	0
August	0	0	August	21,066	19.7	August	0	0
September	8888	8.5	September	13,783	12.9	September	2973	3.4
October	5688	5.5	October	31,593	29.5	October	5935	6.7
November	14,958	14.4	November	20,136	18.8	November	22,614	25.5
December	22,887	22.0	December	0	0	December	0	0
Total	104,073	100	Total	107,059	100	Total	88,556	100

Table 4. 24-hour 1,3-Dichlorodoprene Air Concentrations in Shafter, CA during 2013 and 2014 collected via the DPR Air Monitoring Network.

2013 Sampling Date	1,3-D Concentration (ppb)	2013 Sampling Date	1,3-D Concentration (ppb)	2014 Sampling Date	1,3-D Concentration (ppb)	2014 Sampling Date	1,3-D Concentration (ppb)
01/02/13	ND	07/01/13	ND	01/08/2014	2.039	07/09/2014	ND
01/08/13	ND	07/10/13	ND	01/14/2014	0.549	07/14/2014	ND
01/14/13	ND	07/16/13	ND	01/23/2014	0.3	07/24/2014	ND
01/22/13	ND	07/22/13	ND	01/28/2014	0.707	07/28/2014	ND
01/29/13	0.745	07/30/13	ND	02/05/2014	0.085	08/06/2014	ND
02/04/13	0.665	08/08/13	ND	02/10/2014	0.175	08/12/2014	ND
02/12/13	ND	08/12/13	ND	02/20/2014	0.083	08/20/2014	ND
02/19/13	ND	08/21/13	ND	02/25/2014	ND	08/25/2014	ND
02/25/13	ND	08/27/13	ND	03/05/2014	ND	09/02/2014	ND
03/06/13	ND	09/05/13	ND	03/10/2014	ND	09/08/2014	ND
03/11/13	ND	09/09/13	0.648	03/20/2014	1.393	09/18/2014	ND
03/19/13	ND	09/18/13	ND	03/25/2014	ND	09/23/2014	ND
03/27/13	ND	09/23/13	ND	04/03/2014	0.069	10/02/2014	0.564
04/03/13	ND	09/30/13	ND	04/07/2014	0.109	10/06/2014	ND
04/09/13	ND	10/08/13	ND	04/14/2014	ND	10/15/2014	0.209
04/19/13	ND	10/16/13	0.799	04/23/2014	ND	10/21/2014	ND
04/22/13	ND	10/22/13	0.077	04/28/2014	ND	10/30/2014	ND
04/29/13	ND	10/31/13	ND	05/05/2014	ND	11/04/2014	0.37
05/07/13	ND	11/06/13	0.598	05/14/2014	ND	11/12/2014	0.158
05/15/13	ND	11/14/13	0.284	05/20/2014	ND	11/17/2014	0.919
05/21/13	ND	11/18/13	0.54	05/29/2014	ND	11/24/2014	1.435
05/28/13	ND	11/25/13	0.911	06/03/2014	ND	12/03/2014	0.474
06/03/13	ND	12/02/13	7.18	06/11/2014	ND	12/09/2014	ND
06/12/13	ND	12/12/13	2.478	06/16/2014	ND	12/16/2014	0.474
06/18/13	ND	12/17/13	2.0217	6/24/2014	ND	12/22/2014	ND
06/27/13	ND	12/26/13	2.58	06/30/2014	ND	12/29/2014	0.143
		12/30/13	8.81				
Mean air concentration, 11/06/2013 – 1/28/2014: 2.231 ± 2.708 ppb							
% Seasonal RfC (Child - 3 ppb) = 74%							

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