M E M O R A N D U M

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SUBJECT: SIMULATION OF CONCENTRATIONS AND EXPOSURE ASSOCIATED WITH UPDATED TOWNSHIP CAPS FOR MERCED COUNTY FOR 1,3-DICHLOROPROPENE

Summary

More recent 1,3-dichloropropene (1,3-d) use was utilized in a modeling study to update township use levels in a high use area in Merced County. This study was very similar to a previous Merced modeling study, which evaluated a Dow AgroSciences (DAS) township cap proposal in a high-use 25 township domain in Merced. The main difference between this study and the previous study was the levels of use that were specified. In the previous modeling study, the four high-use townships were set to a level of 1.5x (1.5x=135,375 adjusted lbs 1,3-d/year), as specified in the DAS proposal. In this study, they were set to 2.0x (2x=180,500 adjusted lbs 1,3-d/year), which was more reflective of current use trends. Meteorology and temporal and spatial use patterns were all based on Merced-specific data.

As in the previous closely related study, the DAS Soil Fumigant Exposure Assessment (SOFEA) modeling tool was utilized to estimate air concentrations associated with this proposal. The resulting air concentration distributions were then used as input to High End Exposure Version 5 Crystal Ball (HEE5CB), a Worker Health and Safety exposure model, to estimate exposure by simulating two exposure scenarios: Low Mobility (person spends entire life within the highest township), Intermediate Mobility (person's home in highest township, but travels around throughout the other 3x3 township area).

For both mobility scenarios, the estimated lower and upper bounds for males and females all exceeded the 1.0×10^{-5} at the 95th percentile reference criteria. For males, the low mobility scenario produced estimates of 1.35×10^{-5} to 1.50×10^{-5}, while for the intermediate mobility, 1.17×10^{-5} and 1.31×10^{-5}. Similarly, estimates for female risk were for low mobility, 1.32×10^{-5} to 1.46×10^{-5}, and for intermediate mobility, 1.18×10^{-5} to 1.31×10^{-5}. Levels of use current as of 2005 would appear to result in exposures which exceed the reference level.

Background

Two recent memorandums simulated township cap configurations using SOFEA Tool (SOFEA–Cryer 2004, 2005; Wesenbeeck and Cryer 2004) for Ventura (Johnson 2007a) and Merced (2007b). These two township cap configurations were suggested by DAS in January of 2005 (Wesenbeeck 2005). The townships of interest are depicted in Table 1. Since that time, the use of 1,3-d in Merced has changed. The purpose of this memorandum is to assess the concentrations and exposures associated with a "2x Merced proposal" which is based on updated use in Merced. Detailed methodology and can be found in Johnson (2007ab). This memorandum will report mainly the results and where the methodology differed from Johnson (2007b).

Table 1. Merced township domain for simulation study.

05S09E	05S10E	05S11E	05S12E	05S13E
06S09E	06S10E	06S11E	06S12E	06S13E
07S09E	07S10E	07S11E	07S12E	07S13E
08S09E	08S10E	08S11E	08S12E	08S13E
09S09E	09S10E	09S11E	09S12E	09S13E

Objectives

1. Utilize Merced use information to create probability distributions of field size, application rate, application date and related variables for use in SOFEA.
2. Utilize recent Merced use information and compare to a 2x scenario (2x=180,500 adjusted pounds of 1,3-d).
3. For the 2x scenario, use SOFEA to estimate upper and lower bound concentration distributions reflecting low-mobility and intermediate-mobility assumptions using Merced meteorology.
4. Utilize the concentration distributions from Step 3 in HEE5CB (HEE5CB, Powell 2006) to estimate exposures for male and female lifetimes for the four cases resulting from upper/lower bounds and low- and intermediate-mobility.

Methods

DAS provided a use summary (Shatley 2006) which contained adjusted pounds of 1,3-d by township over recent years. For Merced, an important use area for 1,3-d is a range of townships shown in Table 1. This 25 township area spans townships 5S to 9S and ranges 9E to 13E. From the 1,3-d township use data in Shatley (2006), for each township listed in Table 1, I found the average yearly use in adjusted pounds of 1,3-d over the years 2003-2005. I divided this average by 90,250 adjusted lbs, which is the default township cap amount. This resulted in an array of township cap factors (Table 2).

Table 2. Township cap factors based on CDMS adjusted use averaged over 2003-2005.

	09E	10E	11E	12E	13E
05S	0.00	0.12	0.73	0.76	0.07
06S	0.00	0.56	1.69	1.93	0.40
07S	0.00	0.45	2.11	2.28	0.00
08S	0.02	0.00	0.00	0.00	0.05
09S	0.12	0.00	0.00	0.00	0.00

It is useful to compare the township caps based on actual use to the township cap proposed by DAS in 2005 (Wesenbeeck 2005) and which I simulated recently (2007b). Table 3 displays the township caps proposed in 2005 (Wesenbeeck 2005). There were some differences in the outer row of townships between the DAS 2005 proposal and current use: some decreased and some increased. More importantly, differences occurred in the central 3x3 township region and specifically in the upper two rows of the 9 townships. In both cases, the lower row of the central 3x3 townships consists of zeros. However, townships 6S10E and 7S10E are roughly 50% higher than in the 2005 proposal and three of four townships (12E06S, 11E07S, 12E07S) are closer to 2.0x than 1.5x. Thus actual average use in these central 3x3 townships over 2003-2005 exceeded the scenario originally proposed in 2005.

Table 3. Township cap factors proposed by DAS in 2005 (Wesenbeeck 2005).

	09E	10E	11E	12E	13E
05S	0.18	0.72	0.41	0.24	0.09
06S	0.09	0.36	1.50	1.50	0.23
07S	0.39	0.33	1.50	1.50	0.03
08S	0.09	0.00	0.00	0.00	0.00
09S	0.00	0.00	0.00	0.00	0.00

In order to generalize the use amounts reflected in Table 2, I simulated the scenario using all of the factors as found in Table 2, except that I used 2.0 for 06S11E, 06S12E, 07S11E, and 07S12E. Using factors of 2.0x for these four more closely approximates the form of the 2005 DAS proposal and is equal to the average use in those four townships (average of 1.69, 1.93, 2.11 and 2.28 is 2.00). The resulting township cap factors which I used for these simulations are shown in Table 4.

Table 4. Township cap factors based updated use (2003-2005) and setting 4 highest townships to 2.0x.

	09E	10E	11E	12E	13E
05S	0.00	0.12	0.73	0.76	0.07
06S	0.00	0.56	2.00	2.00	0.40
07S	0.00	0.45	2.00	2.00	0.00
08S	0.02	0.00	0.00	0.00	0.05
09S	0.12	0.00	0.00	0.00	0.00

The inner 9 factors in the 3x3 township area (shaded) were entered into the spreadsheet PDFParameters!A1:C3 and the remaining 16 factors (the outer ring) were entered into the spreadsheet Twn_Mass_Wt_Ext!J12:N16.

Outside of the 25 factors for township caps, the other input parameters were identical to those in Johnson (2007b). In other words, the current simulation used Merced specific use, meteorology, section factors and crop acreages. Five simulations, one for each meteorological year for Merced, were simulated. The file runs were denoted as J1326-J1330. The "highest" township was determined by comparing HEE5CB upper bound analysis for each of the four specific townships at 2.0x. These four runs using HEE5CB were designated as exp0065-exp0068. Then I ran the four cases: upper/lower bound and low/intermediate mobility with HEE5CB (exp0069-exp0072).

Results

Township 07S12E had the highest exposure compared to the other three townships at 2.0x. Consequently, 07S12E was used as the home location. For the low mobility situation, male risk was bounded by 1.35E-5 and 1.50E-5 (Table 5). These values were substantially in excess of the 1.0E-5 reference level (Gosselin 2001). Similarly, the female risk was bounded by 1.32E-5 and 1.46E-5. For the intermediate mobility case, male risk was bounded between 1.17E-5 and 1.31E-5, while female risk was between 1.18E-5 and 1.31E-5.

Table 5. Bounded risk estimates for Merced with updated use and a 2x cap for the four highest townships for intermediate and low mobility scenarios.

	Male		Female	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Low	1.35E-05	1.50E-05	1.32E-05	1.46E-05
Intermediate	1.17E-05	1.31E-05	1.18E-05	1.31E-05

In all cases, the upper and lower bounds of the risk estimate exceeded 1.0E-5. Cap levels of 2.0x in the four high use townships together with the surrounding levels of current use are unsustainable in relation to the reference level.

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