Winston H. Hickox
Secretary for Environmental Protection

Department of Pesticide Regulation

Paul E. Helliker, Director
830 K Street • Sacramento, California 95814-3510 • www.cdpr.ca.gov

Gray Davis
Governor

M E M O R A N D U M

TO: Tom Thongsinthusak, Staff Toxicologist **HSM-99020**
Worker Health and Safety Branch

FROM: Sally Powell, Senior Environmental Research Scientist **[Original signed by S Powell]**
Worker Health and Safety Branch

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SUBJECT: REVISED EVALUATION OF POTENTIAL CHRONIC AND SUBCHRONIC EXPOSURE TO METHYL ISOTHIOCYANATE USING PESTICIDE USE REPORT DATA

This memorandum summarizes the revised analysis of potential subchronic and chronic ambient exposures to methyl isothiocyanate (MITC) from agricultural applications of metam-sodium. Subchronic exposure is defined as 30 or more days of exposure in a 90-day period, chronic as 120 or more days in a 365-day period.

The method used to evaluate potential exposure uses the actual dates of applications within a geographic area and assumes that gas could be present in the area for a fixed number of days following each application. Days when gas could be present are considered potential exposure days. The original evaluation for MITC used two days as the off-gassing period. However, a new study has come to our attention that monitored for a longer period and indicates off-gassing continues for at least four days. The evaluation was therefore revised to reflect this information.

The top four counties in number of metam-sodium applications in 1997 were examined. These include three of the top four counties in terms of total pounds of ai applied. Data on all agricultural applications of metam-sodium in these counties in 1997 were extracted from the Pesticide Use Report (PUR) database on the Environmental Monitoring and Pest Management Branch web page.

Off-gassing period.

A four-day off-gassing period after each application was assumed, based on the findings of Van den Berg et al. (1999). They measured MITC flux in the Netherlands after soil injections of metam-sodium by two methods. Following three of four applications, MITC continued to be emitted for four days. ARB monitored a soil injection application in Kern County in 1995 (California Air Resources Board, 1997). The application took 19 hours to complete; 12-hour air samples were taken for 64 hours from the beginning of the application; MITC was detected in all samples. Wofford et al. (1994) monitored MITC levels for 72 hours during and after a sprinkler

application of metam-sodium. MITC was detected at five or more of the 10 sampling locations until 48 hours after application began. Two other application-monitoring studies (CARB, 1993 and 1994b) did not monitor long enough after application to address this question.

Regional exposure.

In late July 1993, the ARB monitored ambient levels of MITC at four locations in Kern County (CARB, 1994a). At each location, 24-hour samples were taken on four consecutive days in two consecutive weeks. At one location, four of eight samples had detectable MITC; at the other three, all eight samples contained MITC.

None of the four sections in which the monitoring stations were located had any metam-sodium application in July 1993. For one location with MITC in all eight samples, no applications were made anywhere within the township in July; at another, only one application was made within the township, and it was on the seventh day of monitoring. At the location with four positive samples, only one application was made in the township, after three positive air samples had been obtained. (There were no applications of MITC itself, nor of Dazomet, another ai that breaks down to MITC, in Kern County in 1993. There were a few nonagricultural uses of metam-sodium in 1993, but none in July.) These findings argue for considering applications in a larger area than the township when estimating ambient exposure.

Exposure was estimated within regions consisting of four adjacent townships. Most of the townships with metam-sodium use in the four top counties lie in distinct geographic clusters, as shown in Figs. 1-4. In each county, one or two 4-township regions (in one case, a 3-township region) having the highest numbers of applications were identified. The regions for which exposure was estimated are shaded in the figures.

The method was to assume that each application made in a region produced MITC gas on the day of application and the three following days. Using the actual dates of applications, the total number of gas days for each region was calculated for the 1997 year (chronic exposure) and for the three-month periods with the greatest number of applications in each county (subchronic exposure).

Results.

In each of the six regions, there was at least one 90-day period with more than 30 days of exposure (Table 1). Stanislaus and Kern Counties each had two 90-day periods with more than 30 days of exposure. In Santa Barbara County, every quarter of 1997 had more than 30 exposure days. The chronic exposure value of 120 days was exceeded in four of six regions in Stanislaus, Kern and Santa Barbara Counties.

Table 1. Potential days of exposure to MITC by region.

County	Townships	Subchronic (days in a 90-d period)	Chronic (days in a 365-d period)
Stanislaus	03S07E, 03S08E, 03S09E	89 (Mar-May) 90 (Jul-Sep)	292
Fresno	13S12E, 13S13E, 14S12E, 14S13E	67 (Mar-May)	79
Fresno	16S15E, 16S16E, 17S15E, 17S16E	64 (Feb-Apr)	91
Kern	29S26E, 29S27E, 30S26E, 30S27E	87 (Jun-Aug)	140
Kern	30S29E, 30S30E, 31S29E, 31S30E	74 (Jun-Aug) 62 (Oct-Dec)	195
Santa Barbara	10N34W, 10N33W, 09N34W, 09N33W	84 (Jan-Mar) 90 (Apr-Jun) 90 (Jul-Sep) 63 (Oct-Dec)	328

This evaluation provides a rough, preliminary assessment of possible exposure based only on the occurrence of applications. No consideration was given to the amount of AI applied, nor was any attempt made to predict the concentrations of MITC in air. It is possible that gas could be present on potential exposure days but in concentrations below any levels of concern. A further caution in interpreting the results concerns the geographic regions considered. There is no implication that a whole region would have MITC present on the exposure days. The region is viewed rather as a source, compact enough that under some climatic patterns, MITC emitted in the region might collect in some limited area. The receiving area would not necessarily even be within the source region. It would certainly not be as large as the source region because if the emitted gas dispersed throughout a four-township region, the resulting concentrations would almost certainly be extremely low.

What this evaluation does indicate is that the possibility of chronic and subchronic exposure to MITC in high metam-sodium use areas does need further attention. Given the impracticality of air monitoring to assess long-term concentrations over large areas, my recommendation would be to measure flux during several metam-sodium applications. This data, in conjunction with weather and pesticide use data, could be used to model long-term regional concentrations of MITC.

References

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Fig. 1. Townships in the principal metam-sodium use area in Stanislaus County (number of applications in 1997). Exposure days were estimated for the shaded region.

TS \ Range	7E	8E	9E	10E
3S	292	832	196	
4S	4		1	1
5S			2	8
6S		7	8	7

Fig. 2. Townships in the principal metam-sodium use area in Fresno County (number of applications in 1997). Exposure days were estimated for the shaded regions.

TS \ Range	11E	12E	13E	14E	15E	16E	17E	18E	19E	20E	21E
10S			2								
11S			5								
12S	17	11									
13S	12	35	27	17	2	2	1				6
14S	3	40	75	29		9			21	4	1
15S		1	5	27	6	10	23	4		1	
16S				6	35	17	15	6			
17S				2	42	19	9	11		2	
18S					1	14	52	16			
19S						16	21	3			
20S						7	7				
21S							5	5			

Fig. 3. Townships in the principal metam-sodium use area in Kern County (number of applications in 1997). Exposure days were estimated for the shaded regions.

TS \ Range	21E	22E	23E	24E	25E	26E	27E	28E	29E	30E	31E
25S				4							
26S	1										
27S	6	6		6		2					
28S	2				17	7	2				
29S					10	36	11				
30S					1	25	4	8	39	17	
31S							8	17	40	9	
32S							2	26	16		8

Fig. 4. Townships in the principal metam-sodium use area in Santa Barbara County (number of applications in 1997). Exposure days were estimated for the shaded region.

TS \ Range	35W	34W	33W	32W
10N	71	185	18	
9N		2	90	2
8N			12	
7N	25	6	6	
6N		3	1	3