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HSM-13011
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SUBJECT: RESULTS FROM SAMPLING FOR PHOSGENE USING SALAD DEVICES POSITIONED ON TARPED BEDDED FIELD TREATED WITH CHLOROPICRIN AND 1,3-DICHLOROPROPENE

In continuing research into the question of in-field conversion of chloropicrin (PIC) to phosgene (carbonyl chloride), the static air-limiting accumulation domes (SALAD) were deployed at a bedded, tarped fumigation in Salinas, Monterey County. This field had been treated with 1,3-dichloropropene and PIC as part of a study of the environmental fate of the fumigants and the permeability of the totally impermeable film (TIF) tarpaulin used to cover the treated beds. The treatment rate was 400 pounds per treated acre for the fumigant Pic-Clor 60 (56.7% PIC, 37.1% 1,3-dichlorpropene and 6.2% inerts) using a drip application method. The beds were tarped with VaporSafe™ film (Raven Industries, Inc.). The application date was August 8th.

On August 9th, three SALAD units were placed on the tarped beds of the application field (Photo One) at 1140 hrs.

Photo One: SALAD units placed on tarped beds

Because of size differences between the diameter of the SALAD units and the width of the beds, and to ensure a more air-tight seal between the units and the tarp, paper tape was used around the edges of the domes.

Unit One was 4 meters from the field edge; Unit Two 3 meters and Unit Three 2 meters (all distances approximate). There were no obvious tears or other defects in the film where the units were situated.

At 1650 hours on that same day (weather clear, somewhat windy, dome temperature via infrared thermometer was 62° F) samples were drawn from the units, using either Sensidyne® chloropicrin detection colorimetric detection tubes or Drager® phosgene colorimetric detection tubes. Results for this sampling, as well as all subsequent samplings, are given in Table One. Sampling set up is shown in Photo Two.

Edge of field chloropicrin samples were drawn on the 23, 27.5 and 45.5 hours post-placement sampling periods; all results were below minimum detection value of 0.05 parts per million (ppm) for chloropicrin. Additionally, phosgene samples were taken directly above the beds (7 centimeter from surface) at time 23 and 45.5 hours post-placement; both results were below minimum detection value of 0.02 ppm for phosgene (Photo Three).

Photo Two: Drager sampling pump in place on SALAD unit

Weather conditions were generally overcast in the morning, with early afternoon clearing followed by an uptick in the winds by the later afternoon, early evening. No noticeable levels of humidity were apparent within the SALAD units. As per manufacturer's instruction, up to two strokes of the aspirator pump were made for PIC sampling and 20 compression cycles of the bellows pump for the phosgene sampling.

Photo Three: Phosgene sample taken on bed surface.

The results shown in Table One suggest that 3 possible conditions were monitored: fairly high permeation/penetration (Unit 1); extremely low permeation/penetration (Unit 2); low permeation/penetration (Unit 3). None of these conditions were previously ascertained.

Table One: Chloropicrin/Phosgene results (ppm)

Hours Post Deployment	Chloropicrin Unit 1	Phosgene Unit 1	Chloropicrin Unit 2	Phosgene Unit 2	Chloropicrin Unit 3	Phosgene Unit 3
0 hours	NS*	NS	NS	NS	NS	NS
5 hours	>16**	**0.4**	<0.05***	NS	2	NS
23 hours	>16	**1**	<0.05	<0.02***	7	<0.02
27.5 hours	8	<0.02	<0.05	<0.02	1	<0.02
45.5 hours	3	<0.02	<0.05	NS	0.75	<0.02

*NS = Not sampled **>16 = Maximum quantifiable detection limit
***<0.05 or < 0.02 = Minimum detectable limit (PIC and phosgene, respectively)

Only Unit 1 had detectable concentrations of phosgene and one of those detected samples may be considered a significant level (1 ppm, which is 10X the Threshold Limit Value adopted by the American Conference of Governmental Industrial Hygienists, 2013 Edition)). However, there was a commensurate high level of PIC (>16 ppm) captured in the SALAD device. This coincides with the results of SALAD IV, that extreme concentrations of PIC may be necessary to provide sufficient conversion to detectable levels of phosgene. Such extreme concentrations were not detected at field-edge sampling for PIC, and bed level sampling for phosgene also yielded non-detectable levels.

This first field deployment of the SALAD units demonstrates that under the confining conditions of the SALAD micro-environment, measureable levels of phosgene may be derived from relatively high levels of PIC (160 times the Cal/OSHA Permissible Exposure Level [PEL] and 8 times the Immediate Dangerous to Life or Health [IDLH] concentration). However, the applicability of this data to in-field worker exposure is unclear, especially given the non-detectability of the ancillary field-edge and bed level samples.

If further SALAD studies are considered warranted, I would suggest that bed level phosgene sampling be formally incorporated into the procedures, as well as in-field PIC sampling at operator breathing zone level (approximately 1.5 meters from soil surface). Furthermore, if possible, SALAD unit positioning should be within 24 hours of application, if not sooner.

Related HSMs:

HSM-12004 - Results from Dome Sampling for Phosgene Using High Initial Concentrations Of Chloropicrin (Extreme Conditions) In A Field Environment

HSM-13012 - Results From Sampling For Phosgene Using Salad Devices Charged With Chloropicrin And Positioned On Non-Absorbent Surface

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