#124

Department of Pesticide Regulation
Environmental Monitoring and Pest Management
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Sacramento, CA 95814

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MONITORING A METAM SODIUM FIELD APPLICATION TO DETERMINE AIR CONCENTRATIONS OF THE DECOMPOSITION PRODUCTS - METHYL ISOTHIOCYANATE AND CARBON DISULFIDE

I. INTRODUCTION

Metam sodium (sodium N-methyldithiocarbamate) is a broad-spectrum soil fumigant used to control soil fungi, nematodes, weeds, and soil insect pests. It is typically applied to the soil by metering the liquid concentrate into a sprinkler irrigation system (chemigation) or by using injector blades to mechanically place the material four inches below the soil surface. Recommended label rates range from 60 to 318 pounds active ingredient (ai) per acre dependant upon the soil texture, organic matter content, and the type and number of pests to be controlled.

The pesticidal activity of this chemical is due to the decomposition of metam sodium to methyl isothiocyanate (MITC), a volatile compound (The Agrochemicals Handbook, 1983). To reduce gas escape from the soil surface as a result of sprinkler irrigation or soil injection methods, the pesticide label suggests the application of a pure water seal after soil treatment. The use of a tarp to cover the soil surface is an alternative method to reduce gas escape and increase pesticide activity after soil injection.

Other coproducts of metam sodium degradation include carbon disulfide and hydrogen sulfide. Carbon disulfide is a major hydrolysis product of metam sodium under acidic conditions and is a minor photolytic product in neutral conditions. Carbon disulfide is a volatile compound and has fumigant action on its own. Hydrogen sulfide is also a degradation product of metam sodium but only as a minor photolytic product (Stauffer, 1985). Excessive dosages of both carbon disulfide and hydrogen sulfide have severe, acutely toxic effects to man (Verschueren, 1983).

The Hazard Identification and Risk Assessment Branch (HIRAB) of the Office of Environmental Health Hazard Assessment (OEHHA) has requested that the Department of Pesticide Regulation (DPR) gather data regarding off-site migration of metam-sodium and MITC following metam-sodium application in California (letter dated May 18, 1992 to James Wells, Director DPR from Richard Jackson, Chief, HIRAB). Because metam sodium decomposes rapidly (Metam-sodium Task Force, 1989), only the decomposition products will be monitored. Since there is a lack of current information on MITC air concentrations evolving from a metam sodium field application, this study was initiated to determine MITC concentrations in air adjacent to a metam sodium treated field. A limited number of carbon disulfide and hydrogen sulfide levels will also be taken if the methods and equipment are available.

II. OBJECTIVE

To monitor an untarped, sprinkler applied metam sodium application to determine the concentrations of it's two major breakdown products, MITC and carbon disulfide, in air adjacent to a treated field.

III. PERSONNEL

This study will be conducted by personnel from the Environmental Hazards Assessment Program under the overall supervision of Roger Sava, acting Senior Environmental Research Scientist. Key personnel include:

Project Leader - Pam Wofford
Senior Staff Scientist - Lisa Ross
Field Coordinator - Russ Stein
Statistician - Rosie Gallavan
Analyzing Laboratory - California Department of Food and Agriculture, Chemistry Laboratory Services
Laboratory Liaison - Nancy Miller
Agency and Public Contact - Mark Pepple

All questions concerning this project should be directed to Mark Pepple at (916) 654-0522.

IV. STUDY DESIGN

Site Selection

Based on the 1990 pesticide use reports (DPR, 1990), Fresno, Imperial or Kern County is recommended as a potential location for monitoring during the fall months. The potential study site will be a field ranging in size from 10 to 20 acres. The application should be at the high label use rate of 318 lbs ai/ac (100 gals/ac) and not be blended with other pesticides or fertilizers at the time of application. The metam sodium will be applied through a fixed set sprinkler system to the field. All requirements of the metam sodium technical information bulletin for California will be followed. Other criteria for site selection include a field which is to remain untarped during and following pesticide application and which will be at least one mile (radial distance) from any other metam sodium field application occurring during the study's monitoring period. There also should be few obstacles present, such as trees, buildings or other like objects, at or near the potential site, which would interfere with wind speed and direction.

Air Sampling

To monitor MITC concentrations adjacent to a treated field, ten air sampling stations will be located at the treatment site (see Diagram 1). Four of these (stations 1, 2, 3 and 4) will be located at the center of each side of the field 5 meters out from the edge. Four more sampling stations (locations 5, 6, 7 and 8) will be located 75 meters out from the corners of the field. Two more (stations 9 and 10) will be located along the center-line, 150 meters from the edge of the field in the upwind and downwind direction of the predominant wind flow.

Monitoring will be carried out over a ~~3.5~~ 4 day period. For twelve hours prior to the metam sodium application, two air samplers will be placed within the treatment site to determine the background levels of MITC residue in air. During the application and watering-in period, air samples will be collected continuously in 6-hr time periods. Sampling will continue immediately following completion of application for two 6-hr periods and four 12-hr periods.

All stations will have air samplers to monitor MITC concentrations. Air samplers to monitor for carbon disulfide will be collocated at sample stations 1, 2, 3 and 4 during application and the first sampling period after application. Sixteen additional MITC samples will be collected at various stations during the entire monitoring period to be used for an inter-lab comparison. Another sixteen additional samples will be dispersed throughout the entire monitoring period as replicates to be used for quality assurance. The total number of samples to be collected during this study are 2 background samples + (10 stations x 8 sample intervals per station for MITC) + (4 stations x 3 sample intervals for carbon disulfide) + 16 collocated MITC samples for inter-lab comparison + 16 replicated MITC samples = 126 samples.

Air monitoring will be conducted using SKC personal air sampling pumps (catalog number 224-PCXR7). Each air sampler will be positioned approximately 1.2 m (4ft) above ground level and will be fitted with a 200/400 mg coconut charcoal vapor collection tube (SKC West Inc. catalog number 226-09) for both MITC and carbon disulfide collection. During the application period, the charcoal tubes will be preceded by a 75/100 mg silica gel drying tube (SKC West Inc. catalog number 226-10). Once samples are collected, each tube opening will be tightly capped and samples will be placed on dry ice and remain frozen until analysis.

In addition, depending upon the availability of hydrogen sulfide detectors provided by the Air Resource Board, we will monitor for hydrogen sulfide concentrations during each sampling period. The detector is a hand held unit that reads instantaneous levels of hydrogen sulfide in the air. At the beginning of each sampling period, the detector will be carried to each station and a reading will be taken. Hydrogen sulfide levels will be monitored until a level is reached that can no longer be detected (MDL = 3 ppb).

Additional Monitoring

Meteorological data will be collected at the field site using a weather station. Wind direction, wind speed, ambient air temperature, and relative humidity will be recorded before and throughout the monitoring period.

Values for these variables will be averaged at 15 minute intervals. In addition, soil temperature at the 3 and 6 inch depth will be monitored on site continuously during the monitoring period. Soil samples will be taken to the DPR laboratory in Fresno to determine the soil pH and texture of the field.

V. CHEMICAL ANALYSIS

All primary MITC samples will be analyzed by the California Department of Food and Agriculture laboratory in Sacramento. Analysis will be by gas chromatography and will be performed separately for the primary and breakthrough sections of the tubes. Laboratory methodology and analytical verification will be specified in the final report for the study. Results will be reported in micrograms per cubic meter, with a method detection limit of 0.2 micrograms per sample. The carbon disulfide samples are tentatively scheduled to be analyzed by the ICI, Americas Inc., laboratory along with the collocated MITC samples for inter-lab comparison. The minimum detection level for carbon disulfide is 0.3 ppm.

VI. TIMETABLE

Monitoring will occur sometime between September and December, 1992, as soon as a suitable field is located for study. A final report will be completed four weeks after all chemical analysis are received from the laboratory.

VII. REFERENCES

The Agrochemicals Handbook. 1983. Hartley, D. and H. Kidd, Eds., Published by The Royal Society of Chemistry. The University of Nottingham NG7 2RD England.

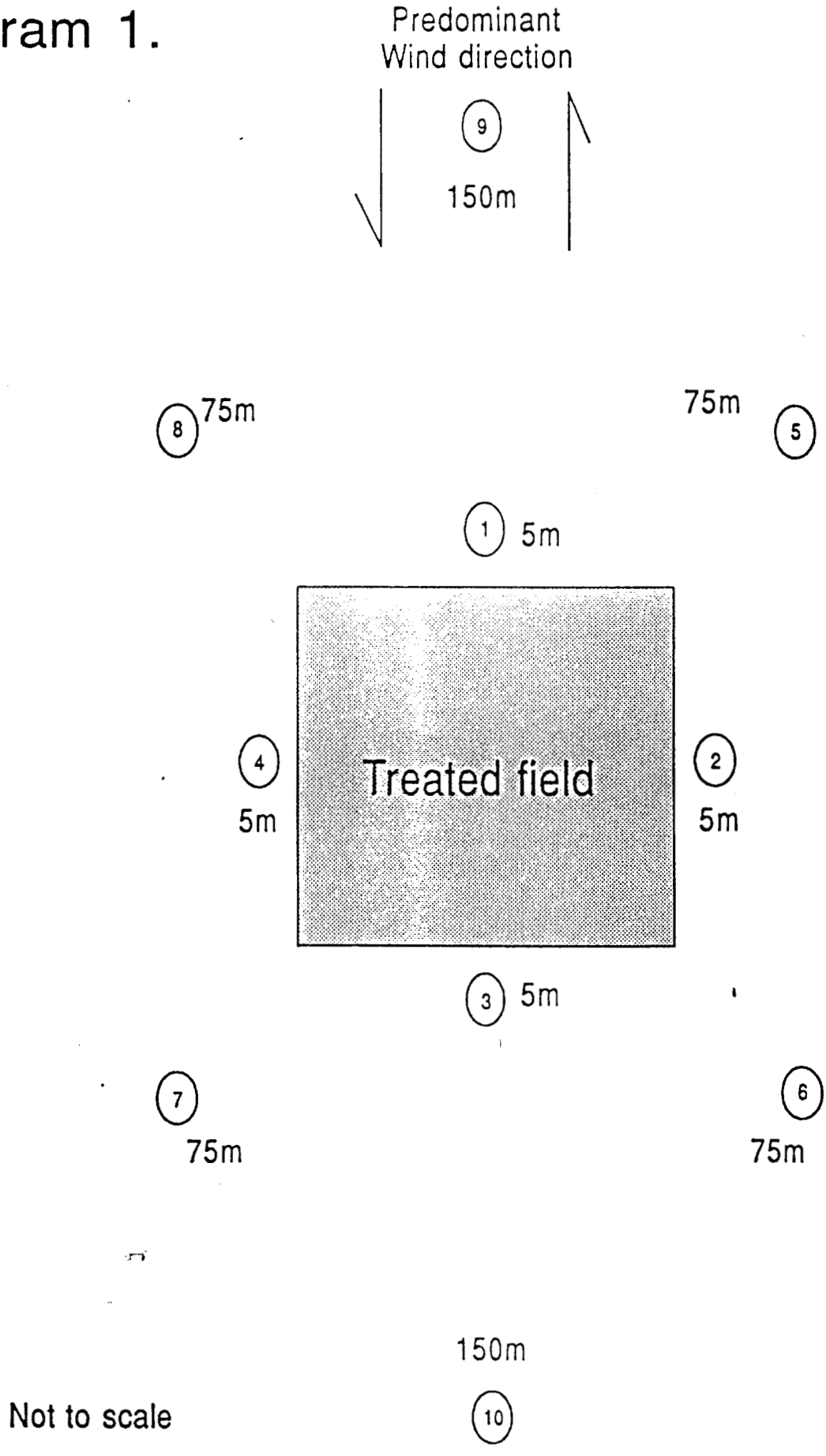
California Department of Pesticide Regulation. 1990. Pesticide use report.

Metam-sodium Task Force. 1989. AB 2021: Two field dissipation studies for terrestrial uses. Data submitted to CDFA, Registration Branch. Volume 50150-025.

Stauffer Chemical Company. 1985. Hydrolysis and photolysis of metam-sodium. Data submitted to CDFA, Registration Branch. Volume 50150-006.

Verschueren, K. 1983. Handbook of environmental data on organic chemicals. Published by Van Nostrand Reinhold Company Inc. New York

Diagram 1.



Not to scale