# Air Sample Studies for Measurement of Pesticide Contamination from Storage Areas[1]

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INTRODUCTION. In previous studies on photodegradation of selected organosphosphate pesticides, analysis of thin-layer plates, which were exposed to sunlight, indicated evidence of contamination by other pesticides. It was theorized that the source of this contamination was a nearby building used for the storage of a wide variety of pesticides. This study was prompted by concern for the possibility of contamination of the pesticide residue research laboratory, Figure 1, which is located about 30 feet away, as well as concern about the contamination of the vivarium, where biological research is dependent upon the rearing of susceptible colonies of insects. Thus, any contamination of these buildings could have deleterious effects on departmental research.

TESSARI and SPENCER (1971), in studying airborne contamination of pesticides in the home environment of occupationally exposed men, developed a simple and inexpensive method to sample ambient air. This method was used in the study reported herein; the objective of which was to ascertain the existence and identity of pesticides emanating from the pesticide storage building.

EXPERIMENTAL AREA. The Department of Entomology and Economic Zoology, Rutgers University, New Brunswick, NJ, occupies approximately four acres. Figure 1 indicates the various buildings and their geographical relationships. It is obvious that there is not much distance between the pesticide storage building and the office and laboratory structures.

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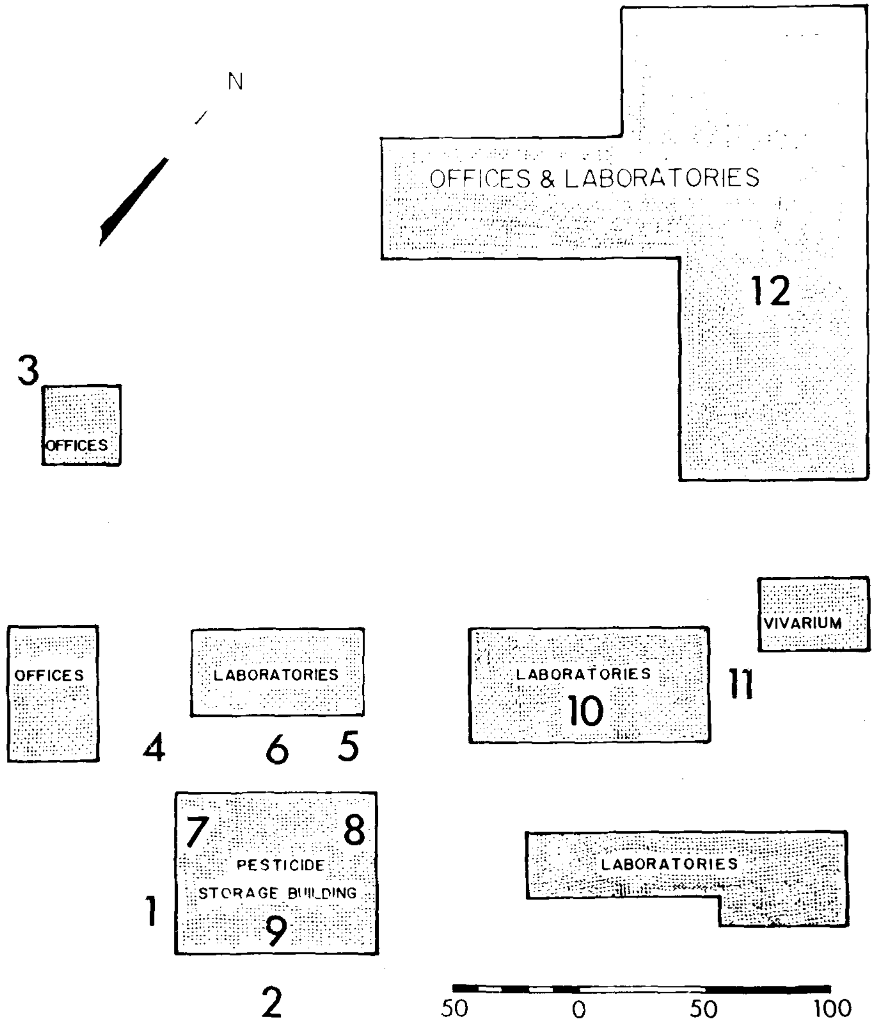


Figure 1 - Experimental Area, 4 acres. Nos. 1-12 indicate sites of sampling stations.
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Stanchions (supporting frames in which the 1' x 2' gauzes were stretched) were placed in the following locations: #1 - next to the exhaust fan of a room housing pesticide mixing apparatus, not in use at the time of experiment; #2 - opposite and about 25 feet from the garage doors of the storage building; #3 - behind a small wood frame house, used as an office building, approximately 100 feet from the pesticide storage building; #'s 4,5 and 6 - as indicated, about 10 feet equidistant between the storage building and the pesticide residue research laboratory; #'s 7, 8 and 9 - in the storage building; #'s 7 and 8 were placed over drums of malathion; #9 was in an area containing spray equipment and small packages of various pesticides, e.g. phorate, T.E.P.P., methomyl, parathion and phosvel; #10 - on the roof of the Mosquito Laboratory Building; #11 - between the Mosquito Laboratory and the Vivarium; #12 - on the roof of the George's Road Laboratories behind a masonry barrier.

The prevailing winds are northwesterly.

APPARATUS AND METHODS. The method of sampling used by TESSARI and SPENCER (1971) was slightly modified in this study since Malathion was the only pesticide measured and it was not necessary to separate organophosphates from organochlorides. Therefore, the entire cleanup procedure was ignored. The extract from the screens was reduced in volume and injected directly into the gas chromotograph (Tracor MT 220);

| | |
|---|---|
| Column | - Glass, ¼" O.D. 6' long packed with 3% OVI on chromosorb W, HP 80/100 mesh |
| Detector | - Flame Photometric with phosphrous filter 230°C |
| Inlet temp. | - 220°C |
| Column temp. | - Program rate 5°/min.; initial temp. 150°C Final temp. 210°C. |
| Carrier gas | - Nitrogen 80 ml./minute |

Screens were made from Nylon Sheer 94R x 32 30 Denier S.D. Nylon T-6 from Deering Milliken, Inc. and were Soxhlet extracted with acetone before treatment with ethylene glycol. The screens were exposed for 1, 3 and 7 days and collected directly into mason jars containing a 1:1 mixture of acetone:hexane. Laboratory controls were blank.

RESULTS AND DISCUSSION. While the method employed in sampling the air does not allow for quantitation, valid comparisons can be made between the various locations in a given sampling. There is no way of measuring the flow of air through, around and past the stretched gauze. In addition, the fact that here are structures, would increase the nonuniformity with regard to wind direction and wind force, i.e. building corners tend to set up wind eddies. The pesticide storage building is corrugated metal which reflects sunlight thereby setting up convention currents on the sunny side but not on the shadow side. The heat in the building sends currents out during the heat of the day. These currents probably carry some of the volatilized pesticide out. If both ends of the building are open, the draft would also carry volatilized pesticide out.

The concentration of pesticide vapors in the air within the storage building is relatively great. Table 1 consists of data collected in June and July, 1973 from 3 different samplings of 1-day, 3-day and 7-day exposures. The weather during the one and three day exposures was clear, warm 65-75°F. and sunny. While the temperature ranged between 65-85°F. during the seven-day exposure there were heavy rains together with the warm, sunny and balmy weather. The concentration of malathion found on the outside screen does not reflect the duration of exposure but does show that the relative concentration of one of the stored pesticides, malathion (Cythion) is indirectly proportional to the distance from the storage building. It is especially dramatized by the concentration on the screen stationed behind the extension building (Stanchion 3) which shows that the barrier effect of the building is probably responsible for consistently low concentrations. The stanchions in the pesticide storage building contained as much as 165 times the level of malathion as that found at stanchion #3. In all cases, the amounts of malathion found at stanchions 1, 2, 4, 5 and 6, near the source of contamination, were the highest. The interior of the storage facility represented by Stanchion numbers 7, 8 and 9 show concentrations for each sampling which average 46 times the average concentration of the outside screens on the 1-day exposure, 42 times the average concentrations of the outside screens on the 3-day exposure and 58 times the average concentration of the outside screens on the 7-day exposure.

TABLE 1

Residues of Malathion (micrograms) Collected In and Around Pesticide Storage Building

| Stanchion | 1 day 7/9/73 | 3 days 6/15/73-6/18/73 | 7 days 6/26/73-7/3/73 |
|---|---|---|---|
| 1 | 0.24 | 2.30 | 1.64 |
| 2 | 3.31 | 2.03 | 2.16 |
| 3 | 0 | 0.35 | 0.48 |
| 4 | 0.02 | 1.40 | 1.68 |
| 5 | 1.37 | 1.10 | 2.52 |
| 6 | 2.45 | 1.22 | 2.17 |
| 7 | 164.88 | 64.31 | 92.25 |
| 8 | 84.20 | 34.16 | 68.62 |
| 9 | 95.62 | 48.05 | 82.52 |
| 10 | 2.49 | 0.50 | 0.89 |
| 11 | 7.01 | 0.61 | 0.96 |
| 12 | 1.62 | 0.50 | 0.51 |

The 1-day exposure of the inside screens shows the highest concentration. This is probably due to the 90°F. temperature. Since this level was the highest reached in any of the samplings, it can be assumed to have been high enough to have volatilized more pesticide than on other sampling days.

Whether these inside levels of malathion constitute a health hazard is up to question since it was impossible to calculate the actual concentration of the pesticide in the air, but grounds for suspicion have been laid. While no data is being presented concerning the presence of other pesticide residues, the chromatograms indicated that a number of other organophosphate pesticides, some more toxic than malathion, were present in the air.

There are two immediate potential hazards that can be associated with large pesticide storage facilities. The first is the toxic effect of exposure of humans in the normal everyday handling of the chemicals. These can be divided into two types; a) the immediate large-dose overexposure with distinct lethal possibilities, b) the low level chronic exposure over a long period with a gradual reduction in cholinesterase activity. The growing use of organophosphate substitutes for the chlorinated hydrocarbons has amplified the danger of misuse and overexposure due to increased amounts held in storage.

The second potential hazard is associated with the extraordinary possibilities of fire. SMITH and LEDBETTER (1971) concluded that fire hazards must be anticipated, when the storage of pesticides is contemplated, by designing diluents whose boiling points are substantially higher than the temperature at which the pesticide decomposes so that the amount of pesticide distilled is reduced. They reported on fires in pesticide storage warehouses where fifty-five people were seriously poisoned. BENSON (1973) reported on the serious threat that stored pesticide poses. Eighteen of twenty-six firemen who responded to the fire alarm were temporarily incapacitated from "possible organophosphate pesticide poisoning."

These easily assembled, easy to carry air sampling stations can be used, when judiciously positioned, to monitor the area subjected to an aerial application of pesticides. This method could also be employed to define the drift associated with an aerial pesticide application. The purpose of these monitors would not necessarily involve the quantitation but rather to indicate the presence or absence of the organophosphate applied. Since this method is sensitive enough to measure volatilized airborn pesticides, it would certainly be sensitive enough to measure higher concentrations that would exist as a result of purposeful application.

It is hoped that the use of a calibrated air sampler will be employed to definitely quantitate the concentration of pesticides within and outside the pesticide storage building so as to have an accurate measure of the mantle of pesticide vapors associated with a pesticide storage facility.

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