

ENGINEERING RESEARCH INSTITUTE
THE UNIVERSITY OF MICHIGAN
ANN ARBOR

Quarterly Status Report No. 9

DISPERSION AND PENETRATION OF
POLLENS AND INDUSTRIAL CONTAMINANTS

July 1, 1955 to September 30, 1955

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This report, not necessarily in final scientific form, is intended only for the internal management uses of the contractor and the Air Force.

Project 2160

DEPARTMENT OF THE AIR FORCE, GEOPHYSICS RESEARCH DIRECTORATE
AIR FORCE CAMBRIDGE RESEARCH CENTER
AIR RESEARCH AND DEVELOPMENT COMMAND
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ABSTRACT

The experimental program during the reporting period was centered at a test house which had been placed in a field near the North Campus. Simultaneous measurements of ragweed pollen concentrations inside and outside the test house and of mean wind speed and turbulence were made. The experimental system devised is described, and the program of measurements undertaken is outlined. The aerodynamic analysis which was carried out is being prepared for presentation in Scientific Report No. 2 and for subsequent publication.

OBJECT

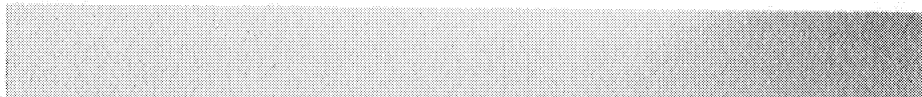
The object of the research is to study both theoretically and experimentally (1) the dispersion of airborne particulates, and (2) the penetration of these particulates into structures as a function of atmospheric turbulence and wind velocity and direction.

I. INVESTIGATIONS BEING UNDERTAKEN AND PLANNED

A. EXPERIMENTATION DURING THE REPORT PERIOD

As stated in the last report, an open-meadow site was chosen for this year's ragweed-pollen-season experiments. The Detroit firm of Darin and Armstrong loaned a construction field-office structure, delivered and set up at the test site free of charge. Figure 1 is a photograph of the test house, looking toward NNE, with experimental equipment in place.

Equipment.—The test house is of standard construction, except for special structural reinforcement and skids to provide for portability. Overall dimensions are 12 x 20 ft. For our purpose, since a shelter was necessary for much of our instrumentation, a partition was installed 8 ft from the east end, dividing the inside into an instrument room 8 x 12 ft and a test room 12 x 12 ft, each having an outside door and two windows. In Fig. 1 the cables and tube are hanging from the south window of the instrument room.



Outside equipment shown in Fig. 1 includes the outside 12-head sampler in position on its supporting scaffold with air tube and solenoid valve cable connected, and the Beckman-Whitley anemometer. Closeups of the 12-head unit and the anemometer are shown in Figs. 2 and 3, respectively.

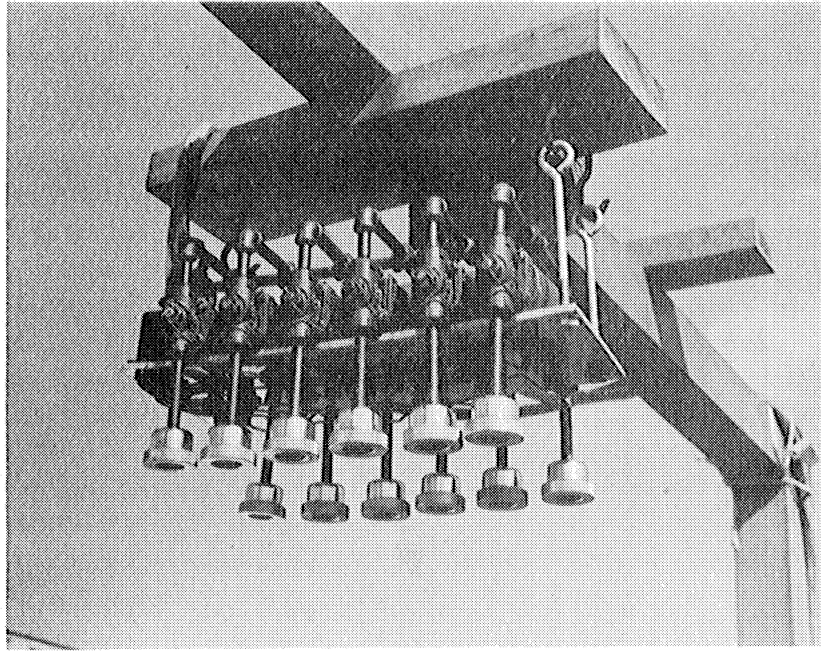


Fig. 2.

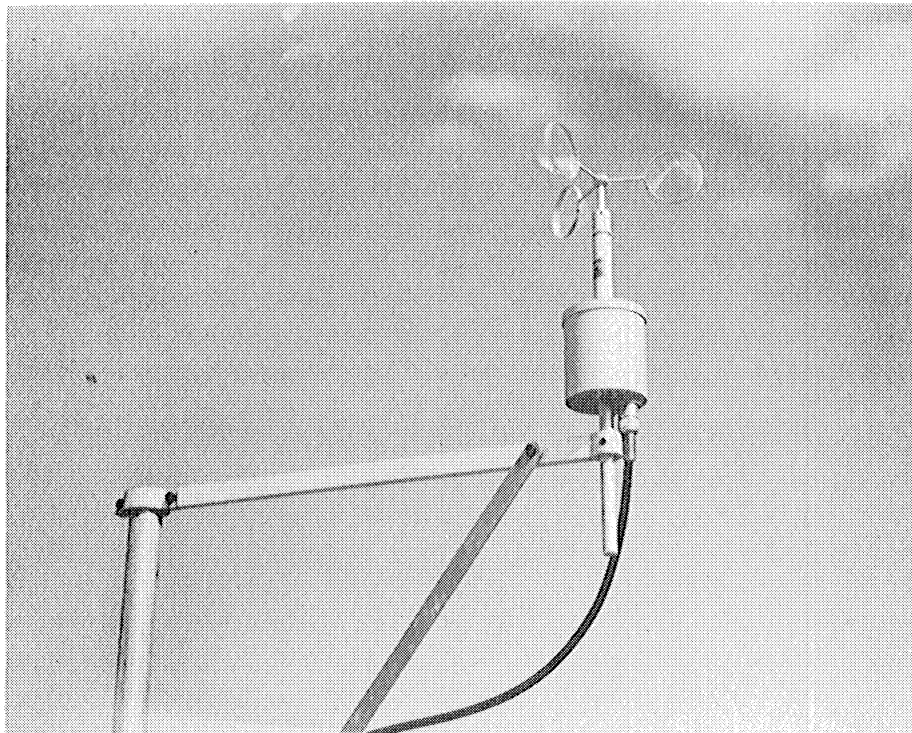


Fig. 3.
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Figure 4 shows the interior of the test room. During operations, four 12-in. oscillating fans were kept running, one in each corner, directed at midposition toward the center of the room. The 12-head sampling unit was suspended at the center of the room at a height of 6 ft above the floor. Cleaning between tests was accomplished by means of the Borg-Warner (at left) and Norge (center, rear) electrostatic precipitators, in addition to a conventional vacuum cleaner. During tests, the door was kept shut and locked and varying rates of ventilation were obtained by opening the windows from the outside to various specified heights.

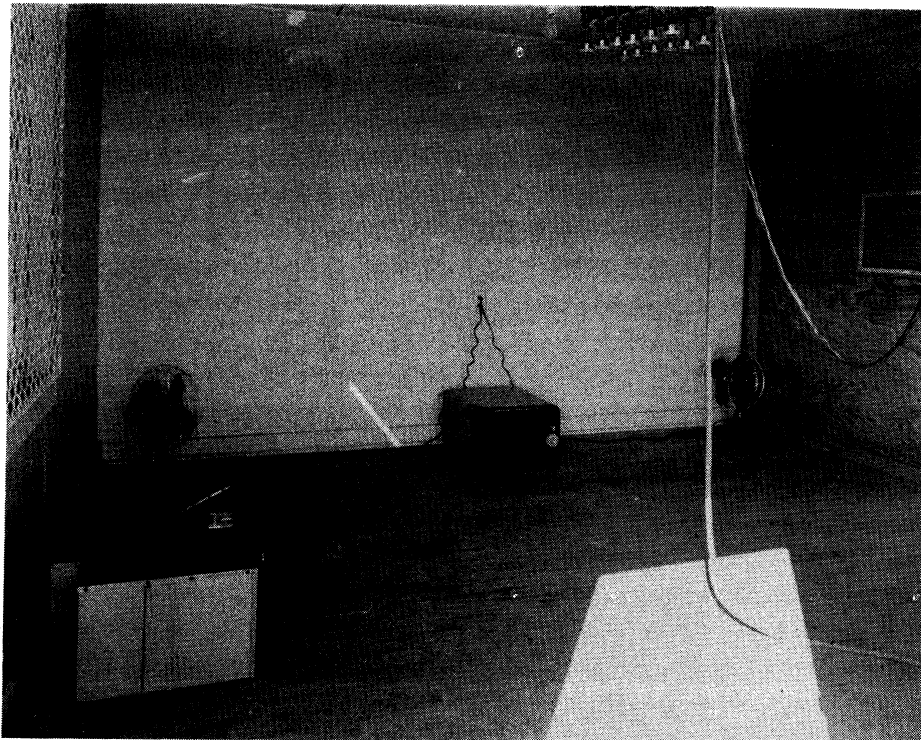


Fig. 4.

Figure 5 shows the contents of the instrument room. The two Automatic Electric Mfg. Co. timers, mounted on a plywood board together with electric outlet boxes (on the table, left) controlled the opening and closing of the 12 inside-outside pairs of samplers, and the on-off switching of the pumps. The two double-mounted Eberbach pumps (one for each sampling unit) are on the floor at the left end of the table. The Beckman-Whitley recorder and associated electronic equipment are shown on the right end of the table.

Electric power was brought through a 1000-ft cable from the nearest transformer pole to a switch box mounted in the instrument room.

In order to locate sources of pollen in the vicinity of the test house, a ragweed survey of the area was conducted by a qualified botanist.

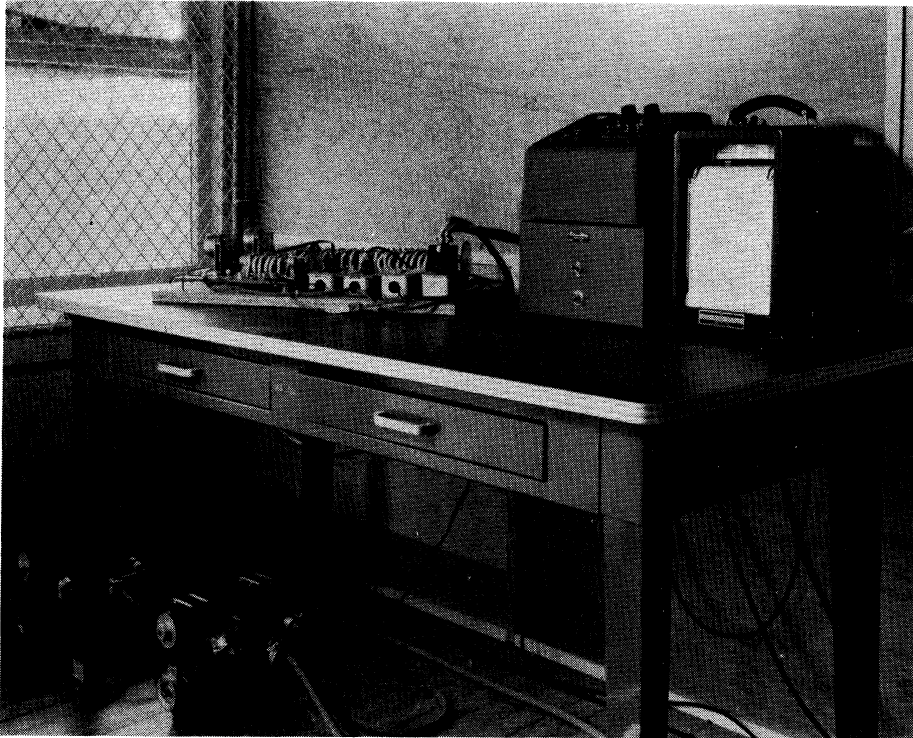


Fig. 5.

Experimentation.—All the samples are paired, i.e., each sample taken inside the test room is paired with an outside sample taken during an identical time period. The following tests were made:

1. Fifteen-minute samples once each hour for 12 hours, test-room doors and windows closed. Fans on No. 2 (intermediate) speed.

2. Five-minute samples taken in succession with no time lapse between, test-room door closed:

- a. Windows open 1 ft, fans on No. 3 (slow) speed;
- b. Windows open 3 in., fans on No. 2 speed;
- c. Windows open 1 in., fans on No. 2 speed;
- d. Windows closed, fans on No. 2 speed;
- e. Windows open 1 in., fans on No. 1 (high) speed;
- f. Windows open 1 in., fans on No. 3 speed.

3. Ten-minute samples taken in succession with no time lapse between, door closed, windows open 1 ft, fans on No. 2 speed.

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4. Ten-minute samples taken in succession with 5-minute time lapse between successive sampling periods, door closed, fans on No. 2 speed:

- a. Windows closed;
- b. Windows open 1 in.;
- c. Windows closed, precipitators on during run.

The results of some of these experiments were examined superficially during the course of the season for guidance in establishing the procedures for subsequent experiments. They are at present undergoing more thorough analysis, the results of which will be assembled either for inclusion in our final report or for separate presentation.

B. EXPERIMENTATION PLANNED

No further experimentation is planned, since the final quarterly period will be devoted fully to counting ragweed pollen on the Millipore filters, evaluating meteorological data from the records obtained, and analyzing the results for presentation in the final report.

C. AERODYNAMIC ANALYSIS

The aerodynamic analysis conducted during the report period will be presented in Scientific Report No. 2, "Turbulent Dispersion of Dynamic Particles," by Vi-Cheng Liu, scheduled for October, 1955. It is planned to submit this material for publication in the Journal of Meteorology.

II. PERSONNEL, ADMINISTRATIVE, AND FISCAL INFORMATION

The following changes in student employment on the project occurred:

<u>Name</u>	<u>Position</u>	<u>Employment Dates</u>	
		<u>Started</u>	<u>Ended</u>
Gerald C. Gill	Assoc. Research Engineer	21 July	
J. A. Ismaili	Asst. in Research	26 July	25 August
P. Rangaswamy	Asst. in Research	15 August	
J. W. Hardin	Asst. in Research	26 August	2 September

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Actual expenditures up to the end of September, 1955, were approximately \$73,470, with an encumbrance of \$120, for a total of \$73,590. The balance as of that date was approximately \$1410.

