

ENGINEERING RESEARCH INSTITUTE  
UNIVERSITY OF MICHIGAN  
ANN ARBOR

QUARTERLY PROGRESS REPORT NO. 2

DISPERSION AND PENETRATION OF  
POLLENS AND INDUSTRIAL CONTAMINANTS

September 16, 1953, to December 15, 1953

By

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Submitted to the Geophysics Research Directorate,  
Air Force Cambridge Research Center, Cambridge,  
Mass. The work reported herein is of a prelimi-  
nary nature and the results are not necessarily  
in final form.

Project 2160

GEOPHYSICS RESEARCH DIRECTORATE  
AIR FORCE CAMBRIDGE RESEARCH CENTER  
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## ABSTRACT

Apparatus for the experimental program of the project has been obtained during the reporting period. This apparatus includes the following items: MSA-Casella cascade impactor; an Aerosol unit (Universal type) holder and a supply of MF millipore filters, with auxiliary equipment; a suitable air pump for use with these units; a recording bivane on a loan basis from Brookhaven National Laboratory; an electrostatic precipitator on a loan basis from the Ingersoll Products Division of the Borg-Warner Corporation; and two standard gravity pollen samplers. Preliminary tests on these various items of equipment have been started by Mr. William H. Hansen, Research Associate.

An aerodynamic analysis of the impaction of particulate matter on the slide of the standard gravity sampler and on similar surfaces has also been started. The problem of the impaction of particulate matter is of fundamental importance in the present investigation, and increased understanding of the processes involved will contribute substantially to the progress of the research program. This aerodynamic analysis is being developed by Dr. Vi-Cheng Liu, Research Engineer.

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INVESTIGATIONS BEING UNDERTAKEN

Present investigations are concerned in part with the performance of the cascade impactor and the millipore filter.

The Casella cascade impactor which was on order has been received. A suitable vacuum pump for use as a source of suction has been obtained, tested thoroughly, and found satisfactory. A supply of auxiliary equipment, including slides, still-air adapter, cover glasses, and Portan graticule, has been purchased and is in use.

An Aerosol unit (Universal type) stainless-steel filter holder for MF millipore filters has been purchased, along with a supply of filters, orifices, etc. The cascade impactor and the millipore filter unit will be used both in series and individually. Experimental studies are proceeding to determine the most advantageous methods of utilizing these two pieces of equipment.

A recording bivane has been obtained on a loan basis from Brookhaven National Laboratory. This bivane will be mounted near the end of a boom which will extend from a window of the room into which pollen or industrial smoke is penetrating. We have also asked Dr. Moyer D. Thomas, of the American Smelting and Refining Company, Salt Lake City, Utah, for working drawings of his bivane, but we have not yet received a reply.

One electrostatic precipitator has been obtained for use in filtering the air of the test room as the first phase of measuring penetration rates. This precipitator has been loaned to the project by the Ingersoll Products Division of the Borg-Warner Corporation. Borg-Warner has improved models coming out in several months, and has offered to loan the project several of these improved precipitators.

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Two standard gravity pollen samplers have been purchased from the Wilkens-Anderson Company, Chicago 51, Illinois. These samplers are made to the specifications of Dr. Oren C. Durham, Chief Botanist, Research Division, Abbott Laboratories, North Chicago, Illinois.

A bridled-cup gust accelerometer as designed by G. C. Gill is being constructed. This instrument is of proven design and performance, having given seven years of trouble-free service in Ontario. The gust acceleration is a useful measure of turbulence, and may well prove to be more significant and convenient to use than the record of the bivane.

Permission has been requested to purchase an Instruments Corporation anemometer, wind vane, and recorder to obtain the wind at a suitable unobstructed location, and also a Beckman and Whitley precision anemometer and recorder to obtain accurate measurements of wind speed just outside a window of the room into which pollen or smoke is penetrating.

Office, laboratory, and observatory space has been or is being obtained. Nearly 300 square feet of office space in the West Engineering Building are being used. Additional laboratory space in the East Engineering Building is being utilized for the work of the project. Negotiations are under way to obtain the use of the eleventh (top) floor of the Burton Memorial Carillon Tower as an observatory for the project. The room and tower are square in plan, the room having three windows in each of the four sides. The floor of the room is 166 feet above ground, much higher than any of the buildings for miles around; the peak of the tower is 196 feet above ground. We propose to place the anemometer cups, wind vane, and gust accelerometer at the top of a 20-foot mast extending vertically upward from the peak of the tower.

The Medical School of the University is offering very helpful cooperation. Dr. John M. Sheldon, Professor of Internal Medicine, Physician in charge of Allergy Clinics, and Director of the Montgomery Allergy Research Laboratory, has placed at our disposal, the resources in equipment and "know-how" of his facilities and staff until such time as the project has acquired its own equipment and its personnel have gained experience in some of the highly specialized techniques of identifying and counting pollens, dusts, and smokes. Dr. Sheldon has assigned Dr. James A. Mc Lean, Instructor in Internal Medicine and Research Assistant in Bronchial Asthma Research, to work with us and to provide us with all assistance possible. A number of conferences have been held with Dr. Mc Lean.

Dr. Henry F. Vaughan, Dean of the School of Public Health, has offered the full cooperation of his school, which has already been of considerable help to the project.

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The experimental program at present consists of evaluating the performance of the Cascade impactor and the millipore filter. We will report on these evaluations in the next progress report.

An aerodynamic analysis of the impaction of particulate matter on the slide of the standard gravity sampler and on other such surfaces has been commenced. This study should provide valuable information which will assist in evaluating the performance of this instrument. It will also be helpful in interpreting the results obtained with the Cascade impactor.

### RESEARCH REPORTS, PUBLICATIONS, ETC.

Scientific Report No. 1, entitled "Some Aspects of the Dispersion of Pollens and Industrial Contaminants in Relation to Micrometeorology" was submitted in October, 1953. Portions of this report will be published in a special issue of the Quarterly Journal of the Royal Meteorological Society during the spring of 1954.

On December 3 a conference on the work of the project was held. Those attending were:

A. H. Fletcher  
Director, Division of  
Environmental Sanitation,  
New Jersey State Department of Health

Earnest Boyce  
Professor of Public Health  
Engineering, Professor of  
Civil and Sanitary Engineering,  
University of Michigan

C. J. Velz  
Professor and Chairman of  
Public Health Statistics,  
University of Michigan

E. Wendell Hewson  
Research Physicist, Engineering  
Research Institute,  
University of Michigan

### FUTURE PLANS

The next quarter will be devoted to testing and calibrating the Cascade impactor and the millipore filters. The performance of the standard gravity sampler will also be studied, both with field tests and by means of an aerodynamic analysis of the instrument. A boom on which instruments are to be supported will be obtained, and the meteorological instruments to be used in conjunction with it will be purchased.

PERSONNEL AND ADMINISTRATION

The following additions to the staff have been made:

William H. Hansen, B. S., (Phys.) B. Arch., Research Associate. Mr. Hansen's experience in instrumentation, which includes rocket instrumentation, and his background in architecture are both valuable in a project such as this which involves details of building structure and a good deal of instrumentation, as well as micrometeorology. Mr. Hansen joined the project in mid-November, worked half-time until mid-December, and since then has worked full-time. He will continue on a full-time basis, working on the sampling procedures.

Vi-Cheng Liu, Ph.D., Research Engineer. Dr. Liu's doctorate is in aerodynamics; he is using aerodynamic methods to determine the relationship between standard sampler counts and meteorological variables such as wind speed and turbulence. Mathematical analyses are being employed, and will be supplemented by wind-tunnel studies. Sufficient knowledge on these points may greatly simplify project instrumentation. Dr. Liu has worked two days a week on the project since mid-November, and will continue on this basis.

C. Samborski and K. L. Gleason, Instrument Makers. These men are employed part-time on the construction of the bridled-cup gust accelerometer.

The principal investigator has been corresponding with Dr. Oren C. Durham, Chief Botanist, Research Division, Abbott Laboratories, North Chicago, Illinois, concerning some of the problems of the project, and hopes to be able to visit Dr. Durham's Laboratory during the coming quarter.

FISCAL INFORMATION

The balance remaining on the contract as of November 30, 1953, was approximately \$22,000.00.

Future expenditures are planned mainly for instrumentation and equipment: approximately \$1300.00 for a Beckman and Whitley precision recording anemometer; approximately \$1450.00 for an Instruments Corporation recording anemometer and wind vane; and approximately \$300.00 for a microscope, as soon as the most appropriate type has been ascertained.

The possibility of further part- or full-time assistance in the research program is being investigated.

