

FOR INFORMATION OF

January 6, 1954

Dr. R. E. Wilson  
Standard Oil Company  
910 South Michigan Avenue  
Chicago 80, Illinois

Dear Bob:

I talked with Marvel and we went over the names of people whom you might consider as candidates for the position at the Southern California Air Pollution Foundation.

We both felt that Dr. Joel H. Hildebrand of the University of California at Berkeley would be a good candidate. He retired either last June or is going to retire this June. You probably know him personally. Incidentally, I believe he was just elected President-Elect of the American Chemical Society. Hildebrand is a member of the National Academy of Sciences and is exceedingly well known around the country. His appointment would carry the proper prestige. I feel quite certain that he would have adequate administrative ability to handle the work.

A second man is Dr. Webster N. Jones, who is Vice President of Carnegie Institute of Technology in Pittsburgh. He was for many years Dean of the Engineering College at that institution and just recently became Vice President in charge of public relations and government contracts. He will probably retire in a year or two as he will be 68 in July. He still has lots of energy. Jones was a Ph.D. from Harvard in organic chemistry and then served for many years with the Goodrich Rubber Company where he was Manager of the Milling Division. He left there to go to Carnegie Tech. Incidentally, he had a top position in the rubber program during the war. In case you don't happen to know him, he is the type of person who makes friends very easily and from that standpoint would be entirely satisfactory.

The next name is that of Dr. Harry L. Fisher, who is now President of the American Chemical Society. He was in the rubber industry most of his life after having served as instructor or assistant professor at Columbia University for a number of years. He retired from the industrial position about two years ago and served the National Research Council in Washington until last summer. Then he moved to California where he has some official connection with the University of Southern California. I believe he is giving a course in polymers and rubber chemistry. Fisher has many friends



Dr. R. E. Wilson

-2-

January 6, 1954

FOR INFORMATION OF \_\_\_\_\_

and would be entirely competent to undertake the job.

I can give you two other names for your consideration. One is Dr. W. H. Rodebush who will retire a year from next June and who as you know has been Head of the Physical Chemistry Division of the Department here in Urbana for 25 or 30 years. Rodebush is a California product so that he might be interested in returning there.

Another man is Dr. E. K. Bolton, who retired as Chemical Director of the duPont Company in 1951. Bolton is a very competent person but whether he would be willing to undertake a full time job over a period of years I do not know. He is well fixed financially so that that part would not be a particular attraction to him. If he were willing to do the job you could be sure he would do it well.

Sincerely yours,

Roger Adams, Head  
Department of Chemistry  
and Chemical Engineering

RA:nd

January 12, 1954

Professor Roger Adams  
Department of Chemistry  
University of Illinois  
Urbana, Illinois

Dear Roger:

Thank you very much for sending me a copy of your letter to R. E. Wilson making recommendations for candidates for the Director of the Southern California Air Pollution Foundation. Some of these men have been considered and we shall be sure that all of them are considered at the time the final selection is made.

I am very sorry that you yourself are not able to consider this position, but I hope that after we get organized we may possibly get your advice on setting up and carrying out the research program of the Foundation.

With best wishes,

Sincerely yours,

L. A. DuBridge  
President

LAD:11



DEC 24 1953

# Arthur D. Little, Inc.

CHEMISTS · ENGINEERS



MEMORIAL DRIVE  
AT KENDALL SQUARE

ESTABLISHED  
1886

CAMBRIDGE 42, MASSACHUSETTS

December 21, 1953

Dr. Lee A. DuBridge, President  
California Institute of Technology  
Pasadena 4, California

Dear Lee:

I hasten to write this letter following our long distance telephone conversation Sunday. In order that you might know that the very flattering and challenging proposal which you put to me was made after I had had an opportunity to take stock of my position, you were told of a letter which I had received from Jesse Hobson. It is never indiscreet, of course, to ask a question, but it sometimes is to answer one, and in this case I may be guilty as others might put the wrong construction on my having heard from Hobson in advance of any official communication from those in responsible charge of the project.

The letter to which I referred was written at the instigation of Mr. McBean and the purpose was to solicit my favorable consideration for any offer which might come my way on the score that this was an opportunity for a great public service. Jesse went on to say that he and his associates at Stanford Institute would welcome my appearance on the scene. This letter was received early last week and I replied to it after keeping it before me for several days with the thought that the letter might be semi-official in character and written for the purpose of determining what my position might be in advance of a more direct approach.

My reply stated that I was in no position to consider the undertaking, quite aside from any question of my qualifications. The business of Arthur D. Little, Inc. is still expanding and I feel that by staying with this enterprise for the few remaining years of my tenure as president, I will be doing the most creative job of which I am capable. Within the guidance of this conclusion, I have refused certain other opportunities and have worked out somewhat of a pattern of outside activities that will afford me an outlet for my activities on retirement and also a maximum amount of satisfaction in the meantime. Aside from four directorships, my activities are largely in the educational field, with membership on two boards and three visiting committees. I would also place the National Science Foundation in this latter category.

May I say again that I consider it a very great honor indeed to even be considered for the post in Los Angeles. We at Little's expect to make an issue of air pollution, have already had considerable experience in this area, are pioneering in the development of some new techniques for measurement, and would appreciate being considered in connection with any program that might



evolve out of the present study being given to the Los Angeles situation.

With highest regards and Best Wishes of the Season.

Sincerely yours,

A handwritten signature in cursive script, appearing to read "Earl".

Earl P. Stevenson

EPS/ad



January 13, 1954

Mr. Earl P. Stevenson  
Arthur D. Little, Inc.  
Memorial Drive at Kendall Square  
Cambridge 42, Massachusetts

Dear Earl:

I appreciate very much your letter of December 21. You may be sure that I fully understand the many good reasons why you feel you cannot move to Los Angeles at this stage in your career. I know how much I would resist any suggestion that I pull up my roots from Pasadena and move to a distant corner of the country. We all knew that there was very little chance that you could be persuaded to come here, but the advantage to us if you could come, would be so great that we wanted very much to explore the possibility. How were we to know whether you or your wife did not have a secret dream of moving to California at the first opportunity.

I do hope that there will be an opportunity for the Arthur D. Little Company to work with us on some of the technical problems which we will face, and I appreciate very much your offer of collaboration. We still do not have a Director of the Foundation, but as soon as we do have I will make sure that the possibility of securing help from your organization is brought to his attention.

I assume that I will see you in Washington at the Science Board meeting on January 29. With best wishes,

Sincerely yours,

L. A. DuBridge  
President

LAD:il



JAN 13 1954

LAUREN B. HITCHCOCK  
INDUSTRIAL RESEARCH & DEVELOPMENT  
MANAGEMENT

MURRAY HILL 7-6910

331 MADISON AVENUE  
NEW YORK 17, N. Y.

January 11, 1954

Dr. Lee A. DuBridge, President  
California Institute of Technology  
Pasadena 4, California

Dear Dr. DuBridge,

You probably know that as a result of my meeting with Mr. Ortman, I have agreed to come to Los Angeles to look over the matter on the ground. He has asked me to come to Mr. Call's office Monday morning, January 18th.

Giving the problem some advance thought, therefore, quite a lot of questions naturally occur to me, and undoubtedly many of them will be answered in the course of my visit. I am enclosing a few, some related to a clearer definition of the smog problem, and others to the "ground rules" under which the director would operate. The leaflet setting forth the "Statement of Policy" of the Foundation handed me by Mr. Ortman is an excellent statement if it can be said to represent the united attitude of the several trustees, <sup>and</sup> should indeed be reassuring to any prospective director. Whoever composed it did an outstanding job, in my opinion.

The general problem as you outlined it is certainly an exciting one and most challenging. As I told you, I had made up my mind to establish my own practice here in the East and this Los Angeles matter would require a rather radical "change of sights". Perhaps the principal concern, however, is that the new director might soon become a sort of focal point for the sublimated unhappiness of the multitude there, and that such a role might be soon less than enviable. I suppose this is an occupational hazard, but a little more so in this instance.

If you could have someone leave a little reading matter at the Statler for me next Sunday, I would appreciate a chance to get further information upon my arrival that evening. Then perhaps I can visit further with you in the next two or three days. If the enclosed questions are not immediately answerable, please do not take any time over them. I enjoyed our visit together very much.

Sincerely yours,

*L. B. Hitchcock*



### The Smog Problem

- 1- How much of the time is the "smog" significantly bad?
- 2- What yardsticks, if any, are there for measuring smog intensity?
- 3- Any correlation between "apparent density" of smog, and "badness"?
- 4- Incidence of lung cancer over past decade? other respiratory disorders?
- 5- Have the automotive people (such as the S.A.E. or Gen. Motors) gotten into this yet? Any evidences of interest on their part?
- 6- Same question for tire companies.
- 7- Is there, as yet, any one or two summary reports on what has been done on the problem so far?

## Operation of the Foundation

- 1- Does the Foundation have a charter, or by-laws, or other documents which would further illuminate what might be called the "ground rules"?
- 2- Is there provided an Executive Committee of the Board, to facilitate decisions to questions which the Board would quite properly wish to be consulted about?
- 3- Are these assumptions consistent with your interpretation of the Foundation's ideas?

(a) The role of the "managing director" or "president" would be analagous to that of the president of a corporation, and relationships with the Trustees would be analagous to those existing normally with the Board of Directors of a corporation.

(b) Responsibility for research program and public relations would be the "president's"

(c) Normal good judgement would suggest that he submit major research programs and appropriations to Board (or Executive Committee) for such guidance and approval as may be forthcoming; same for public relations policies.

(d) If (b), then responsibility for selection of staff would also be "president's"

(e) Board, or Executive Committee, would be readily available for consultation when and as needed.

(f) Board would meet at stated intervals to hear progress reports and to discuss major questions or act on recommendations.

(g) Information developed through the Foundation need not be released to the public if in the judgement of the "president" and/or the Executive Committee it would be wiser to withhold it in certain cases; i.e., while the Foundation is intended for public welfare, its books are not available to the public.

(h) The Trustees, regardless of personal business interests, are committed to 100% support of the "Statement of Policy" set forth in the leaflet.



January 14, 1954

Mr. Lauren B. Hitchcock  
c/o Statler Hotel  
Los Angeles, California

Dear Mr. Hitchcock:

I was delighted to learn that you are going to pay a visit to Los Angeles to discuss the smog problem with us. I will look forward to seeing you at Mr. Call's office on Monday morning.

The questions you ask in the attachments to your letter are interesting and will give us plenty to talk about during your visit here. The technical questions you ask on the smog problem I can hardly attempt to answer in a letter, partly because I myself do not have the information immediately available. What I would like to do would be to arrange for an extended discussion between you and Dr. Haagen-Smit of Caltech, and possibly with some other people who are more intimately immersed in the technical problems than I am. There is a certain amount of literature on the subject, but it is quite scattered and mostly consists of reports on special phases of the subject. I am attaching one such report herewith which was prepared by a committee appointed by the Governor and headed by Dr. Arnold Beckman who is a member of the Board of Trustees of the Foundation (also a Caltech Ph.D. and a member of the Caltech Board). I am attaching also some recent material issued by the Air Pollution Control District and also a copy of the Articles of Incorporation and the Bylaws of the Air Pollution Foundation. This represents all the material on which I can lay my hands quickly, but if other pieces of reading matter come to my attention, I will send them along to the Statler.

Many of your questions can be answered in our conference Saturday morning, though others will take more detailed discussion.

Your questions on the operation of the Foundation can, by and large, be answered with a flat "Yes". I think your assumptions about the Foundation's policies and activities are precisely what we had visualized. I can assure you that all members of the Foundation Board are fully behind this enterprise; in fact, I have been astonished with the enthusiasm with which so many people are giving so much time to getting this Foundation under way.

I hope that we are lucky enough during your visit to have (a) one real smoggy day and (b) one really clear one; such an exhibition would answer many of your questions. With best wishes,

Sincerely yours,

L. A. DuBridge

LAD:il

# SOUTHERN CALIFORNIA AIR POLLUTION FOUNDATION

117 WEST NINTH STREET

LOS ANGELES 15

Tel.: MADison 6-9441

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LEROY A. GARRETT  
Secretary of  
Foundation

LAUREN B. HITCHCOCK  
President and Managing Director

February 11, 1954.

Dr. Lee A. DuBridge,  
Chairman, Research Committee,  
Board of Trustees,  
Southern California Air Pollution Foundation,  
c/o California Institute of Technology,  
1201 E. California,  
Pasadena, California.

Subject: RESEARCH PROPOSAL - NO. 1.  
AIROMETRIC SURVEY OF LOS ANGELES BASIN

Dear Dr. DuBridge:

Review of available aerological information indicates to me that it is not sufficient to permit any sound conclusion to be drawn with respect to the possible movement of "smog" or "smog-producing" substances. Valuable work of this character has, of course, already been started by the Los Angeles County Air Pollution Control District. It seems to point up the need for more complete and more conclusive data.

Specifically, it appears to me that considerably more extensive data is needed with respect to the concentration of oxidants, which shows a very close correlation with the familiar subjective effects popularly called "smog". Why this correlation should exist is far from understood as yet, but since it is a convenient index and can be readily measured by instruments already perfected, it can well be one phase of an airometric survey program which can materially advance our understanding of a broad problem.

I recommend the establishment of nine monitoring stations to be strategically located in a way which is calculated to best show the variations in the oxidant value from hour to hour and day to day measurements. These measurements would be made with these devices all at the same time, and probably once every hour. Reduction of these data and correlation with a map of the area would, in the judgement of a number of us familiar with the problem, help to throw considerable light on the origin and movement of "smog".



Dr. Lee A. DuBridge,  
Chairman, Research Committee

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February 11, 1954.

At the present time one such oxidant measuring machine is in operation in Dr. Haagen-Smit's laboratory in Pasadena. A second machine is nearly ready for delivery to Colonel Larson to be installed and operated in the District laboratory at 5201 S. Santa Fe Avenue. This second station thus equipped would be two of the desirable locations mentioned above.

To equip the additional seven stations will require the purchase of seven additional machines. My recommendation is that these be ordered and locations be selected after a conference with the appropriate technical experts. The operation of the nine machines in total will then be made the responsibility of one competent technician and would be kept in operation on a continuous basis for a period of up to possibly twelve months.

It is possible that the data thus provided would permit some definite conclusions which might be rather interesting.

A second phase of this airometric survey which I wish to recommend at this time, involves the taking of certain motion pictures, at times and places to be determined by appropriate technical experts. Preliminarily, I would suggest four elevated locations, two of which might be the top of the General Hospital and Mt. Wilson Observatory. A third possibility might be a high point in the Hollywood hills. However, the exact locations are to be determined. The operation will require the installation of four automatic motion picture cameras, equipped with a device which will expose one frame at a time at intervals of two, four, fifteen or at whatever intervals seem best at further study.

These pictures, each one taken at or about the same moment, might be quite revealing in showing the origin and movement of visible "smog" during the entire daylight period. This visible record could, of course, readily be compared with the oxidant index and again related to the map of the area.

While there appears to be some question as to whether the eye-irritant effect of "smog" is always accompanied by decreased visibility, it does appear that the two phenomena are ordinarily simultaneous.

To have available both the chemical and visual records from a number of strategically located stations, taken in such a way that all the data can be exactly related on a time-sequential basis, would, in my opinion, constitute a valuable addition to our present knowledge.

Because of the possible immediate relevance of this information to the basic interest of the County and its population, this project (including the two phases recommended above) might well prove attractive to the Los Angeles County Board of Supervisors, as the type of basic research which they would like to support.

Dr. Lee A. DuBridge,  
Chairman, Research Committee

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February 11, 1954.

Recognizing the interest in such a program on the part of the Air Pollution Control District laboratories, and the important contribution already made by that group to date, I am submitting this proposition to Colonel Gordon P. Larson in order that he may indicate hereon his agreement as to the merits of this proposal, if he so decides.

Sincerely yours,



L. B. Hitchcock

LBH:mek

AGREED:

Gordon P. Larson, Director,  
L.A. County Air Pollution Control District

cc: Fred D. Fagg, Jr.  
Chairman, Board of Trustees  
Southern California Air Pollution Foundation

Gordon P. Larson, Director,  
L.A. County Air Pollution Control District



February 17, 1954

Dr. Fred D. Fagg, Jr., Chairman  
Southern California Air Pollution Foundation  
c/o University of Southern California  
3551 University Avenue  
Los Angeles, California

Dear Fred:

I have reviewed the letter from Lauren Hitchcock outlining "Research Proposal, No. 1 -- Airometric Survey of Los Angeles Basin". As we agreed at our meeting the other day, I am in favor of proposing this program to the Los Angeles County Board of Supervisors as one which they should well finance through the Air Pollution Control District.

I presume that, if Gordon Larson is also in agreement with this proposal, the proper procedure is for you to present it to the County Board of Supervisors. him

My only word of caution in connection with a public statement on this research proposal is to recall that some area studies of this type have been carried out by other agencies, particularly by the Stanford Research Institute. However, the problem has, by no means, been adequately explored and this present proposal is very much to the point and very desirable.

Very truly yours,

L. A. DuBridge  
President

LAD:11

cc: Mr. Lauren B. Hitchcock  
Mr. Arnold O. Beckman

SOUTHERN CALIFORNIA AIR POLLUTION FOUNDATION  
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704 SOUTH SPRING STREET  
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•  
LEROY A. GARRETT  
Secretary of the  
Foundation

April 5, 1954.

Professor Morris Neiburger,  
Department of Meteorology,  
University of California at Los Angeles,  
405 Hilgard Avenue,  
Los Angeles 24, California.

Dear Dr. Neiburger:

Confirming our conversation in my office April 2, I am very happy to welcome you to our research team as the highly qualified representative in the field of micrometeorology.

This letter will serve as a memorandum of our agreement. Your appointment is effective May 1, 1954 with the title of Senior Meteorologist. Until July 1, 1954, due to your present commitments, you will be able to devote to your duties with us up to approximately 25% of your time, and your retainer for this period prorated in accordance with your annual salary and the time actually spent with us.

Effective July 1, 1954, and for the twelve months period following this date, you will devote approximately two-thirds of your time to your duties with the Foundation, in order to permit you to devote the balance of your time to discharging your obligations under certain O. N. R. contracts. Your salary for the twelve months period commencing July 1, 1954 will be \$12,000. You will also be eligible for social security and hospitalization benefits offered by the Foundation to its employees.

Prior to June 3), 1955 and not later than June 1, 1955, arrangements will be mutually agreed to with respect to your continuance with the Foundation.

Your duties with the Foundation will be to participate as a member of our research team in accumulating and evaluating all available information pertaining to the Los Angeles air pollution problem, and especially with reference to the meteorological aspects of the problem; you will assist in planning, formulating, placing, and supervising certain research contracts which may from time to time be approved by the Foundation.

COPY



Professor Morris Neiburger

April 5, 1954.

You may from time to time consult with others in developing needed information, and may from time to time prepare and publish with the approval of the Foundation suitable reports in scientific journals and other publications. When in the interests of the Foundation, you may attend scientific meetings, present papers, and otherwise serve the interests of the Foundation at Foundation expense.

If this is in accordance with your understanding, please indicate by signing in the space provided below and return one copy for our files.

Sincerely yours,  
*Original signed by*  
*L. B. Hitchcock*  
L. B. Hitchcock

Lbh:es  
Encl

Dr. Morris Neiburger

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# SOUTHERN CALIFORNIA AIR POLLUTION FOUNDATION

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LEROY A. GARRETT  
Secretary of the  
Foundation

APRIL 8, 1954

Dr. Morris Neiburger,  
Department of Meteorology,  
University of California of Los Angeles  
405 Hilgard Avenue,  
Los Angeles 24, California

Dear Dr. Neiburger:

Confirming our conversation yesterday, to provide for your compensation during the short interim period until May 1, we agree to pay you \$50.00 per day as a consulting fee for such services as we may call upon you for, and which you are able to perform, in order to enable us to get started more promptly on certain phases of the aerometric survey of the Los Angeles basin which we are developing in cooperation with the Air Control District.

If acceptable to you, please indicate by signing and returning one of the enclosed copies.

Your presence at our first conference with Col. Larson and representatives of the Ralph M. Parsons Company yesterday on the air tracer proposal was most helpful, and bodes well for your value to us. It is a great satisfaction to us to be underway and to have your help.

Sincerely yours,

L. B. Hitchcock

*Original signed by*  
*L. B. Hitchcock*

LBH:es  
Encl.

CC: Mr. Robert S. Weatherly  
Bcc: Dr. Lee A. DuBridge

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Dr. Morris Neiburger

COPY



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LEROY A. GARRETT  
Secretary of the  
Foundation

LAUREN B. HITCHCOCK  
President and Managing Director

APRIL 8, 1954

## PERSONAL &amp; CONFIDENTIAL

Dr. Nicholas Rensetti  
3705 New Haven Road,  
Pasadena 8, California

Dear Dr. Rensetti:

First of all, I want to welcome you officially as our senior physicist in this Foundation, and to express my pleasure and satisfaction at having you on our research team. Secondly, I want to confirm our conversation of last Monday, as extended by our telephone conversation of yesterday.

It is our mutual understanding that you have accepted the appointment and that you will report for full time duty with us on May 1, 1954. Your duties will include broadly working cooperatively with the rest of our research team in accumulating and evaluating all presently available information pertaining to the Los Angeles smog problem, and then to assist in planning the most worthwhile and effective projects with the purpose of obtaining such additional needed evidence as will enable us to identify smog and its origin, and suggest practical remedies.

Further, your duties will of course involve bringing to us all possible benefits of your field of specialty, namely modern physics and electronics, and thinking for us and about our common problems in terms of your specialty.

From time to time you will undoubtedly wish to attend certain scientific and professional society meetings in furthering these general purposes, for which the Foundation will provide usual traveling expenses. Publication of scientific papers in connection with the Foundation's work is most definitely to be encouraged, whenever appropriate and subject of course to Foundation approval which however, it is hard to imagine would be likely to be withheld, and certainly not to the extent that may be characteristic of some industrial research organizations.



SOUTHERN CALIFORNIA AIR POLLUTION FOUNDATION

Dr. Nicholas Renzetti

-2-

April 8, 1954

It is further understood that you will devote your best efforts on a full time basis to the work of the Foundation, with the understanding that from time to time you may wish to devote one day, normally a Saturday, to assisting the Naval Ordnance Research Organization with which you have been associated. Your compensation will be at the annual rate of \$15,000, plus the assistance of the Foundation in respect of two additional benefits, namely social security and hospitalization plan.

During the last two weeks of the current month of April, you will be available for approximately two afternoon meetings per week to enable us to begin more promptly on our research programs. The compensation for these interim sessions will be at the rate of \$50.00 per day as a consulting fee and not as an employee of the Foundation.

A copy of this letter is being furnished to our business manager for his confidential information. Will you please sign one of these two copies, if it correctly expresses our understanding, and return to me for our files?

I look forward with pleasure to our association in the expectation that you are going to be of great help to us in achieving our objectives.

Sincerely yours,  
*Original signed by*  
*L. B. Hitchcock*

LBH:es  
Encl.

bcc: Dr. Lee A. DuBridg

---

Dr. Nicholas Renzetti

*Furnished*  
*Dr. Lee A. DuBridg*



JUL 29 1954

# SOUTHERN CALIFORNIA AIR POLLUTION FOUNDATION

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•  
LEROY A. GARRETT  
Secretary of the  
Foundation

Trustees Elected  
June 29, 1954:

CHARLES F. KETTERING  
J. PHILIP SAMPSON

July 28, 1954

LAUREN B. HITCHCOCK  
President and Managing Director

Dr. Lee A. DuBridge, President,  
California Institute of Technology,  
1201 E. California,  
Pasadena 4, California.

Dear Dr. DuBridge:

The Foundation will have a number of distinguished guests from the automotive and oil industries attending the banquet on Thursday, August 19 at 7:00 p.m. in the Terrace Room of the Huntington-Sheraton Hotel. This will be preceded by a small reception at 6:00 p.m. on the Pool Terrace to provide an opportunity for the Trustees and distinguished guests to get acquainted.

I hope that you can come to this reception and dinner, as I feel sure this further evidence of your interest in the program will be helpful to all of us, and that you will enjoy meeting some of these visitors.

Please note that ladies are invited.

I have heard Dr. Kettering speak before, and I know that he has the gift of being both stimulating and amusing to mixed audiences of this caliber.

✓ Please let me know if you, and your lady if possible, will attend. The enclosed reservation card should be returned before August 10.

With best personal regards,

Sincerely yours,



L. B. Hitchcock

LBH:mek  
Enclosure

NOV 11 1954

# SOUTHERN CALIFORNIA AIR POLLUTION FOUNDATION

704 SOUTH SPRING STREET  
LOS ANGELES 14, CALIFORNIA  
Tel.: MADison 6-9441

## TRUSTEES

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J. PHILIP SAMPSON

REESE H. TAYLOR

P. G. WINNETT

•

LEROY A. GARRETT  
Secretary of the  
Foundation

November 10, 1954

LAUREN B. HITCHCOCK  
President and Managing Director

## PERSONAL

Dr. P. K. Frolich,  
Scientific Director,  
U. S. Army Chemical Corp.s,  
Washington 25, D. C.

Dear Per:

Subject: Long Path Infrared Spectrometer

The use of the long path infrared spectrometer for the direct detection, identification, and measurement of certain gas concentrations in the atmosphere would be of tremendous help to us here in studying the Los Angeles smog problem. We understand that suitable instrumentation and techniques have been developed by the Chemical Corps. We would very much like to know if under proper circumstances we might be put in touch with appropriate representatives of the Chemical Corps, to discuss the possible application of this procedure to our problem, and the possibility of borrowing the equipment and trained personnel on at least a temporary basis. If the equipment cannot be spared at this time, possibly we could be permitted to have similar equipment built and with some help from the Chemical Corps apply it to this problem here in the Los Angeles Basin.

A good deal of the work we are initiating and undertaking here at our own expense is already becoming of interest to the Chemical Corps, and we believe it would be mutually beneficial to establish some liaison.

Dr. Lee A. DuBridge, President of California Institute of Technology, is Chairman of the Research Committee of our Board of Trustees, which also includes Dr. Arnold O. Beckman, President of Beckman Instruments, Inc. Dr. DuBridge knows of this request to you and will be glad to act as a reference in the event that any question of propriety may be involved.

COPY



**SOUTHERN CALIFORNIA AIR POLLUTION FOUNDATION**

**Dr. P. K. Frolich**

**-2-**

**November 10, 1954**

**Congratulations to the Chemical Corps and to you on your new appointment!**

**With best personal regards,**

**Sincerely yours,**

*Original signed by*

*L. B. Hitchcock*  
**L. B. Hitchcock**

**LBH:mek**

**cc: Major General William M. Creasy,  
Chief, Chemical Corps, U. S. Army,  
Washington 25, D. C.**

**Dr. L. A. DuBridge, President,  
California Institute of Technology**





NOV 12 1954

SOUTHERN CALIFORNIA AIR POLLUTION FOUNDATION

704 SOUTH SPRING STREET  
LOS ANGELES 14, CALIFORNIA  
Tel.: MADison 6-9441

LAUREN B. HITCHCOCK  
President and Managing Director

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- FRED B. ORTMAN
- ALDEN G. ROACH
- J. PHILIP SAMPSON
- REESE H. TAYLOR
- P. G. WINNETT
- 
- LEROY A. GARRETT  
Secretary of the  
Foundation

November 11, 1954

**Dr. Allen V. Astin, Director,  
National Bureau of Standards,  
Washington 25, D. C.**

**Subject: Spectral-Radiometer Program**

**Dear Dr. Astin:**

We would like to bring to your attention the excellent work which Mr. Ralph Stair of the National Bureau of Standards has been doing here during the last five weeks, on leave from the Bureau. We feel that this work is of such promise with respect to urban air pollution problems nation-wide that it deserves official implementation by the National Bureau of Standards. While we believe that an examination of the facts would justify Federal funds and support of this program, we feel the importance of the work would justify support in the meantime by the State of California, Los Angeles County, or this Foundation, which is dedicated to the public interest. All findings of the Foundation are widely published.

Mr. Ralph Stair, using a spectro-radiometer designed and built under his supervision, has been measuring the intensity of solar radiation by wave lengths, from the ultraviolet region to 2.5 microns in the infrared, in order to identify constituents of the atmosphere by their absorption spectra. It is expected that this work will aid in the estimation of concentrations of substances in our atmosphere.

Further laboratory work is involved in order to make possible such estimation of concentrations. We believe the National Bureau of Standards is excellently equipped to complete this study.

We also would like to express the hope that Mr. Stair and his associates will be enabled to complete reduction of the data collected during his recent five weeks' operations made at our station on the roof of the California Institute of Technology in Pasadena.

COPY



Dr. Allen V. Astin, Director -2-

November 11, 1954

Dr. Lee A. DuBridge, President of the California Institute of Technology, and Chairman of the Research Committee of our Board of Trustees, is familiar with this work and has inspected the operation recently conducted by Mr. Stair.

So far this work has been conducted by Mr. Stair on leave from the Bureau and has not involved any expense to the Government.

Another important possible application of this work is to secure evidence of the dissociation of  $\text{NO}_2$ , which is supposed to occur photometrically in the atmosphere and possibly related to the formation of ozone, a critical matter for our smog problem.

We would appreciate your full advice as to (1) in what way funds may be properly made available to the National Bureau of Standards in continuance of this work; and (2) what assistance we might render in bringing this program to the attention of Congress, with a view to securing appropriate Federal support.

We would also like to call attention to the very important contribution by Mr. Stair to what is probably the first direct method of measuring ozone by an electronic and optical system, which equipment and method we hope to have available here in the near future with the cooperation of the Chemical Corps for whom the work was done. Expensive modification is required to this equipment in order to permit its use during daylight hours. Our present plans are to try to finance this work ourselves. Again, it has important potential application nation-wide.

We would like to take this opportunity to express our deep appreciation to you and your associates for their unfailing cooperation and assistance at all times, having special reference to the visits of Drs. Wichers and Weaver earlier this year and to the recent assistance from Mr. Stair.

Sincerely yours,  
*Original signed by*  
*L. B. Hitchcock*  
L. B. Hitchcock

LBH:mek

cc: (see page 3)

COPY

**SOUTHERN CALIFORNIA AIR POLLUTION FOUNDATION**

**Dr. Allen V. Astin, Director -3-**

**November 11, 1954**

**cc: Dr. Wallace R. Brode, Associate Director,  
National Bureau of Standards,  
Washington 25, D. C.**

**The Honorable Goodwin J. Knight,  
Governor of the State of California,  
State Capitol, Sacramento, California**

**The Honorable Thomas H. Kuchel  
United States Senate  
Washington 25, D. C.**

**Dr. Lee A. DuBridge, President, ←  
California Institute of Technology,  
Pasadena, California**

**C  
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Y**



SOUTHERN CALIFORNIA AIR POLLUTION FOUNDATION  
UNIVERSITY OF CALIFORNIA  
Los Angeles 11, California December 3, 1954

OFFICE OF THE CHANCELLOR  
LOS ANGELES 24, CALIFORNIA

December 1, 1954

C  
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Y

Dr. **PRESIDENT SPROUL**, President,  
University of California,  
Berkeley

I am transmitting herewith a letter from Dr. L. B. Hitchcock, President and Managing Director of the Southern California Air Pollution Foundation. I think you will find the letter self-explanatory. As you will note, it sets forth Dr. Hitchcock's recommendations of projects which, in his opinion, are appropriate for the University to consider in any University-directed program of research in the field of air pollution. As Dr. Hitchcock indicates in this letter, the program has been discussed with a number of University people, including Dean Boelter, Dr. Middleton, Dr. Kaplan and others. These consultations were carried out at my suggestion in order that the Foundation program and the recent University-wide inventory of University projects and resources might, insofar as practicable, be dovetailed. The Foundation is proving to be a uniquely valuable instrument for the exploration and coordination of community-wide, State-wide and even, to a degree, nation-wide resources for a concentrated, systematic attack upon one of California's most serious problems.

As I am currently serving as chairman of the board of SCAPP, and a conflict of interests exists since I also serve as a University officer, I am making no recommendation. I will support, however, any recommendations your committee makes after its review of University resources and proposals.

I understand that Vice President Woods' committee is currently preparing budget recommendations for you and the Regents. In order to conserve time I am sending a copy of this memorandum and Dr. Hitchcock's letter directly to Dr. Woods and also to Dean Boelter and Dr. Kaplan.

Accordingly, with the approval of **R. B. Allen**, we have selected from our research program for 1955 certain projects which we believe the State might support such projects is by appropriating funds University of California, we have consulted with representatives of the University so that in submitting the attached list of specific projects, we do so with at least the preliminary assurance that these projects represent the kind of research for which the University has substantial interest and competence, in terms of equipment and personnel.

Based on the foregoing premises, we submit the attached list of research projects with the request that the University of California seriously consider undertaking them at its earliest convenience, and joining with this Foundation in seeking funds for this purpose from the Legislature at its approaching sessions.



DEC 2 1954

SOUTHERN CALIFORNIA AIR POLLUTION FOUNDATION  
704 South Spring Street  
Los Angeles 14, California

December 1, 1954

Dr. Robert G. Sproul, President,  
University of California,  
Berkeley 4, California.

Dear Sir:

As you may know, this Foundation is devoted to research in air pollution, and primarily and most immediately to assisting in the solution of the problem in the Los Angeles Basin. It is already apparent that in a number of important respects, the Los Angeles problem is finding its counterpart in other cities. Our efforts therefore and those of others working in this field are likely to be of state-wide value.

After evaluating available data, we are developing a research program which, in the opinion of our scientific staff and advisors, is best calculated to advance our understanding of air pollution problems, and to lead to the development of workable remedies. A growing list of essential research projects constitutes a most challenging and worthy objective for the scientists of this State. Thirty projects are actively underway under our direct supervision. About twenty additional projects are now ready for the attention of competent and energetic scientific workers, wherever they can be found.

In the financing of this growing and vital program, the support of various segments of the community, including the public, industry and government is essential. The Foundation will have spent about \$500,000 of its own funds received from private sources by the end of calendar 1954. Our program for 1955 recently approved by the Board of Trustees, subject to financing, is estimated in excess of \$1,800,000. Additional work recommended to the Los Angeles County Board of Supervisors raises the estimate to \$2,214,000. Governor Knight has gone on record in favor of prompt and substantial State assistance looking toward the solution of our air pollution problems.

Accordingly, with the approval of our Trustees, we have selected from our research program for 1955 certain projects which we believe merit support by the State. Since it is our understanding that one way in which the State might support such projects is by appropriating funds to the University of California, we have consulted with representatives of the University so that in submitting the attached list of specific projects, we do so with at least the preliminary assurance that these projects represent the kind of research for which the University has substantial interest and competence, in terms of equipment and personnel.

Based on the foregoing premises, we submit the attached list of research projects with the request that the University of California seriously consider undertaking them at its earliest convenience, and joining with this Foundation in seeking funds for this purpose from the Legislature at its approaching sessions.



SOUTHERN CALIFORNIA AIR POLLUTION FOUNDATION

-2-

Because of the almost unlimited horizons in scientific research of all kinds which are unfolding before us, we consider it is of the utmost importance in seeking relief from air pollution in some reasonable time that funds granted in support of projects recommended by the Foundation be restricted to the specific purposes of these projects. While some of our effort must obviously be directed at early relief, and therefore of a highly applied research nature, other equally necessary research is of a basic character, and the enclosed list is largely of the latter type. We believe therefore they should appeal to many of the competent scientists in your University. We stress the importance, however, of directing these efforts towards the solution of the practical problems confronting the State. The Foundation, acting in its capacity of a coordinator, hopes that it may participate in an advisory role in the delineation and conduct of these research projects, as it is already doing with respect to the research projects currently proceeding under its administration at the rate of about \$900,000 per year.

Centralized planning, direction, and coordination would seem to be essential if the available skills and facilities in our State are to be employed efficiently in this undertaking. We wish to make clear that in the growing emergency, we cannot support recommendations for the appropriation of State funds in support of broad, general non-directed research, however beneficial such work may be to succeeding generations. Our attached program has specific and important purposes, even though it involves a large measure of basic research.

Since it is difficult to define accurately the exact scope of projects listed herewith, we should be glad to meet with representatives of the University to elaborate upon these proposals. We seek your advice as to how this program may be implemented in and by the University, and how we may be of assistance in seeking the necessary financial support.

Very truly yours,



Lauren B. Hitchcock  
President and  
Managing Director

LBH:lk

Enclosure

Distribution:


Raymond B. Allen

F. M. Banks

Arnold O. Beckman

L. K. Boelter

Edward W. Carter

Lee A. DuBridge 

Joseph Kaplan

John T. Middleton

Alden G. Roach

Harry R. Wellman

SOUTHERN CALIFORNIA AIR POLLUTION FOUNDATION

ENCLOSURE

LIST OF RESEARCH PROJECTS RECOMMENDED TO THE UNIVERSITY OF CALIFORNIA

Note: Estimates of funds required for each project are based upon a period of 12 months, and in some cases include provision for purchase of equipment or construction of research facilities.

SCAPF 30-54-2 \$250,000  
Combustion Products

Large chamber tests of various pollutants as smog-formers. Preliminary plans have been discussed with representatives of the University at the Los Angeles and Riverside campuses. Wherever this program is centered, it appears likely that some assistance from other campuses will be involved. A number of considerations seem to favor preliminarily the centering of this work at Riverside. In a separate communication the Foundation is offering the University a preliminary grant of \$15,000 in order to expedite the initiation of this work. Recognizing that some months may be required in order to assure the availability of State funds, the Foundation is prepared to advance up to \$100,000 in the interest of making progress, and with the hope that funds advanced would ultimately be reimbursed. However, in order that the work may be started promptly, the Foundation does not make reimbursement a condition of its grant.

SCAPF 10-55-3 \$25,000  
Development of Machine Methods for Computing Wind Trajectories

Survey of methods and equipments which can be brought to bear on computation of wind trajectories by high speed computing machines.

SCAPF 20-55-5 \$50,000  
Mass Spectrometer Studies

To extend and complete studies initiated by Martin Shepherd of Bureau of Standards using the mass spectrometer as the basic tool.

SCAPF 20-55-7 \$10,000  
Development of Infrared Techniques

For the monitoring and analysis of the atmosphere for various trace constituents.

SCAPF 20-55-8 \$10,000  
Application of Non-Dispersive Infrared Analyzer for Hydrocarbons

To determine the capabilities of this technique in the atmosphere with a long path cell.



SCAPF 20-55-9	\$5,000
<u>Application of Non-Dispersive Infrared Analyzer for Carbon Monoxide</u>	
Direct determination of carbon monoxide and recording on recording potentiometer.	
SCAPF 60-54-1	\$33,000
<u>Use of Microwave Spectra for Identification of Smog Constituents</u>	
W. D. Hershberger, UCLA. Laboratory and field investigations.	
SCAPF 50-55-1	\$50,000
<u>Census of Pollutant Sources, Including Rates &amp; Amounts</u>	
Analysis of significant sources of various pollutants. Determination of amount and rate of emission of same.	
SCAPF 60-55-7	\$30,000
<u>Measurement, Composition and Mechanism of Formation of Aerosols</u>	
SCAPF 60-55-8	\$25,000
<u>Absorption Spectra of Gaseous Atmospheric Pollutants</u>	
Literature survey compilation and additional laboratory investigations as necessary to assemble definitive data.	
SCAPF 31-55-1	\$25,000
<u>Development of Tests and Inspection Methods for Exhaust Control Devices</u>	
Total	<u>\$513,000</u>

CALIFORNIA INSTITUTE OF TECHNOLOGY  
PASADENA

December 6, 1954

Dr. Lauren B. Hitchcock,  
President and Director  
Southern California Air Pollution Foundation  
704 South Spring Street  
Los Angeles, California

Dear Dr. Hitchcock:

I have read with great interest the proposal which you made on November 16, 1954 for a 12-month research program, and especially your Item #1 relating to automobile exhaust. In that you have this statement - "Now we must consider . . . whether enough white gas can be provided without resorting to the extra boost by tetraethyl lead." I am not sure what is meant by that statement but it appears to indicate that less gasoline can be provided if it is white gas than if leaded gas is sold. Of course all gasoline that is manufactured is initially white gas so that tetraethyl lead does not increase the quantity available whatsoever. White gasoline will have an octane number of about 65 and therefore cannot be used in our modern high compression engines. Tetraethyl lead does nothing more than to increase the octane number. I assume that you know this, but the statement as presented conveys a different impression. Certainly the problem confronting industry is the attempt to develop a catalyst which will operate satisfactorily on leaded gasoline. Personally, I wish that we could go back to lower compression engines and use no leaded gasoline at all, because although the engines would be less efficient and we would therefore consume more gasoline, the cost might and probably would be less than our total fuel bill is now. Also, the increased consumption of gasoline would discharge still more hydrocarbons into the air than now, but it would be easier to do something about that by the use of a catalyst. When we speak of the modern high compression engine being more efficient we must make clear that it is not more efficient in combustion of fuel but that it operates in a more efficient cycle; that is, the higher compression ratio means also a higher expansion ratio, resulting in the lower exhaust temperature and therefore less exhaust heat wasted and hence more heat utilized in the engine. But we must emphasize again the difference is in the efficiency of the cycle and not in the efficiency of combustion.

You also make the comment about the use of synthetic alcohol with gasoline, and state "It has been claimed that 15% of alcohol in gasoline improves combustion." You state that your first job would be to test this claim, and it is possible it is true but I doubt it very much. I know of no reason why the addition of alcohol to gasoline would improve combustion in any way whatsoever. We would still have to have the same fuel-air ratios



that we do with gasoline alone, and the combustion conditions are inherently such as to leave some unconsumed fuel passing out the exhaust. What alcohol does do is to lower the temperature of the mixture being compressed in the cylinder on account of the fact that its latent heat of vaporization is larger than that of gasoline. This lower temperature tends therefore to eliminate or at least to minimize detonation, and so far as I know, that is the only beneficial effect of alcohol.

Very sincerely yours,

R. L. Daugherty  
Professor of Mechanical Engineering

RLD:rt

RECEIVED JAN 11 1941

From the desk of

L. B. HITCHCOCK

RESEARCH COMMITTEE

Thought you might like to see the description of the projects discussed with the Automobile Manufacturers Association subcommittee in Detroit last week.

Dec. ~~JAN~~ 17 1954

AIR POLLUTION FOUNDATION

PROGRAM - 1955

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Dec. ~~JAN~~ 13 1954

SOUTHERN CALIFORNIA AIR POLLUTION FOUNDATION

RESEARCH PROGRAM - 1955

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## I. COMBUSTION PRODUCTS

### Background

Most of the information concerning relative importance of various sources in producing smog has been obtained in test tubes and small chambers. By virtue of their small size, higher than normal concentrations of suspected pollutants had to be used to produce plant damage, eye irritation, reduced visibility, and other smog manifestations. Some scientists believe this is all that is necessary to prove the sources responsible for smog. Others point out that only experiments at realistic conditions will give the necessary proved facts. To resolve this difference of opinion, we must carry out large-scale experiments.

We obviously can't use the entire Los Angeles Basin as a test tube in which we would "order" various inversions and various amounts of sunlight; and shut down different sources, one at a time or in various combinations including partial shutdowns. But a series of experiments in a large model, perhaps a specially constructed airplane hangar or some other large room, would allow low concentrations of contaminants to be used. These concentrations should be of the same order of magnitude as those experienced in Los Angeles. Work of this nature could be initiated and carried on for one year for \$250,000.

### General Plan

We propose to build and operate a large-scale model of the Los Angeles Basin in which basic experiments with suspected pollutants will be carried out at realistic concentrations. In such a chamber or model, we will attempt:

1. To reproduce smog manifestations (such as reduced visibility, eye irritation, plant damage, rubber cracking, and ozone formation) under controlled conditions similar to those extant in the Los Angeles atmosphere, and
2. To use the equipment devised to test the effectiveness of various



control devices in alleviating smog formation if reproduction can be accomplished by addition of "realistic" concentrations of automobile and diesel exhaust gases, incinerator effluents, industrial effluents, or combinations of these.

The test unit will consist of two greenhouses in series, the first to serve as a reaction chamber and the second as an exposure chamber for plants and personnel. The necessary auxiliary equipment for controls, for mixing and moving air, for irradiation of the controlled atmosphere, and for measuring the various smog manifestations must also be provided.

It is hoped that preliminary work will demonstrate that the addition of realistic concentrations of a common combustion effluent, such as exhaust gas or incinerator stack gases, to a realistic atmosphere will be the difference between "smog" and "no smog." If so, the unit may be used for a study of the effect of design changes in combustion equipment on smog formation.

Plant damage, human eye irritation, rubber cracking, visibility, chemical analyses, oxidant, hydrocarbon, aldehydes, oxides of nitrogen, CO, CO<sub>2</sub>, lead, particulate matter, and similar measurements will be made as required.

#### Status

We are trying to have the State of California finance this project through a grant to the University of California at Riverside. It appears to be the most suitable place for this study. The Foundation will probably make a grant of funds to the University to start this project and operate it until funds can be made available by the Legislature.

## II. SMOG-FORMING REACTIONS

#### Background

Early work on the Los Angeles smog problem emphasized the nature and quantities of pollutants emitted by various sources in Los Angeles County. Although

these studies do not lend themselves to explanations of the properties of the Los Angeles atmosphere, they did provide considerable evidence that reactions were occurring, since some pollutants were found at concentrations too high to be explained by known sources.

A second type of study was concerned with reactions that might occur in the Los Angeles atmosphere between known pollutants under conditions found in the atmosphere itself. Because of experimental limitations, most work of this type has been carried on at concentrations substantially greater than those believed to exist in the atmosphere. In the explanations for the manifestations of smog that have developed from such studies, laboratory experiments have been extrapolated to the open atmosphere. These extrapolations have led to postulated explanations about which there is much disagreement and which may not be representative of what actually happens.

#### General Plan

It has been established that the ozone-forming ability of Los Angeles air is quite high during the early evening hours. Irradiation of air at 8 to 9 p.m. with near ultraviolet light (3000-4000 Å) generates ozone concentrations comparable to those found to exist during periods of severe smog. This technique is being used to determine whether all of the smog effects can be produced by irradiation of polluted air during the early evening hours. Selected sensitive plants are to be exposed to such artificially-produced smog, and simultaneous measurements of visibility reduction and eye irritation made.

Following this, selected oxidizing agents are to be added to the polluted but nonsmoggy air during the early evening to determine whether smog effects can be produced.

The nature of the reactions occurring between the oxidizing agents and pollutants in smoggy air will also be studied, using selective scrubbing agents to



remove such materials as organic acids, aldehydes, ketones, nitrogen dioxide, and sulfur dioxide.

### Status

Project placed at Stanford Research Institute. Construction essentially completed. Plants are being exposed to air which has been subjected to various treatments. Experiments in which ozone was added to night air, allowed to react for one hour, and then the mixture passed over pinto beans produced typical smog damage.

## III. PHOTOCHEMICAL STUDIES

### Background

It was determined by a number of workers that the principal chemical characteristic of Los Angeles smog is the presence of extremely high oxidant concentrations during periods of high pollutant intensity. In an attempt both to duplicate the lachrymatory effects of smog and to identify a possible source of the oxidant, Dr. A. J. Haagen-Smit and his co-workers undertook the investigation of the photochemical reactions of a series of synthetic mixtures of nitrogen dioxide and hydrocarbons in both air and oxygen carriers. In these systems, the oxidant was produced photochemically; the yield was extremely dependent on the hydrocarbon-nitrogen dioxide concentrations. Hydrocarbons containing four or more carbon atoms were found to have oxidant-forming tendencies when irradiated in the presence of nitrogen dioxide.

The most complete study made by Haagen-Smit was on the nitrogen dioxide-3-methylheptane system, with the resultant preparation of a three-dimensional curve showing the interrelation between reactant concentrations and resultant oxidant level. In this latter system, for example, the choice of 0.4 ppm nitrogen dioxide with 10 ppm 3-methylheptane resulted in appreciable rubber cracking under the

selected experimental conditions. However, if the hydrocarbon concentration chosen was zero or greater than 100 ppm, no rubber cracking was observed under his experimental conditions.

G. C. Bassler of Stanford Research Institute repeated some of Haagen-Smit's work with respect to reactant concentrations but with different irradiation conditions and found that cracking occurred at 1170 ppm 3-methylheptane in the presence of 0.4 ppm nitrogen dioxide, and also that cracking occurred in nitrogen dioxide alone.

### General Plan

In comparing the results obtained by Haagen-Smit with those of Bassler on the photochemical reactions of nitrogen dioxide with hydrocarbons, there does not seem to be any doubt that the oxidant production does result in rubber cracking. The major differences in the results obtained by Stanford Research Institute and California Institute of Technology would appear to stem from the differences in wave-length distribution and intensity. The system will be reinvestigated under carefully fixed conditions of wave length, light intensity, and irradiation time to ascertain the important reaction parameters. In addition, the applicability of the integrated oxidant values obtained by rubber cracking to the steady state values at the end of a given irradiation periods can be determined only after further careful investigation. Thus, rubber-cracking results should be compared with data obtained under comparable fixed conditions with both the potassium iodide and the phenolphthalin reagents. For the development of any rational mechanism for the oxidant build-up, some further information concerning the rates of disappearance of the nitrogen dioxide in the system must be ascertained. This latter function may be accomplished by utilizing the varying reactivities of the oxidant and nitrogen dioxide in phenolphthalin.

### Status

Project placed at Armour Research Foundation. Construction of equipment has begun.



#### IV. OXIDATION OF EXHAUST GASES

##### Background

Many attempts have been made to design a device in which the hydrocarbon content of auto exhaust gases could be oxidized completely to carbon dioxide and water. It is obvious, however, that one cannot design a piece of equipment until the process requirements are known.

##### General Plan

It is proposed to initiate a laboratory study to determine the effects of time, temperature, pressure, catalyst, and concentration variables on the oxidation of the hydrocarbons present in exhaust gases. This information will then be made available to any and all persons interested in the design of equipment to carry out this reaction.

##### Status

Armour Research Foundation is presently preparing a proposal for this study.

#### V. EVALUATION OF EXHAUST CONTROL DEVICES

##### Background

Even if a satisfactory device for completing the oxidation of hydrocarbons in exhaust gases were available, a simple means of checking the efficiency of the device would be required for inspection.

##### General Plan

Various complicated tools for measuring the hydrocarbon content of exhaust gases or for measuring the efficiency of exhaust devices are available. It is proposed that the various methods be studied so that those which offer the greatest promise of simplification can be subjected to further development studies.

##### Status

The University of California is interested in initiating a project to be called "Development of Tests and Inspection Methods for Exhaust Control Devices." The Foundation has recommended to President Sproul that State support be given to a project of this nature.

## VI. COMPOSITION OF AUTO EXHAUST

### Background

Investigators have been able to produce smog damage to plants by subjecting them to the reaction products of ozone and various hydrocarbons, and also, ozone and auto exhaust. In all cases, the amount of hydrocarbon necessary has been higher than concentrations experienced in the Los Angeles atmosphere. On the other hand, damage has been produced with ozone and auto exhaust in concentrations even lower than those often experienced in Los Angeles. This anomaly leads one to wonder if plant damage is a function of gross hydrocarbon concentration or if some other effect is responsible for the ease with which auto exhaust-ozone mixtures produce typical smog damage on plants.

### General Plan

A project has been initiated at Midwest Research Institute to freeze out the liquefiable portions of auto exhaust under various conditions of engine operation and through the use of fuels of various composition. These liquefied products will then be separated to various fractions, either chemical or physical, and the effect of each fraction on producing plant damage after being mixed with ozone will be tested. It is possible that one or more of the various fractions will produce plant damage much more readily than the others. In this event, further study will be directed toward the composition of the reactive fractions for the purpose of determining more nearly exactly the material responsible for plant damage.

### Status

Work to date has centered around the calibration of the pinto bean as a tool for the quantitative estimation of plant damage.



## VII. COMPOSITION OF INCINERATOR GASES

### Background

Work by different investigators leading to information on the composition of effluent gases from back-yard incinerators is fragmentary and conflicting. These differences must be reconciled.

### General Plan

A project has been initiated at Battelle Memorial Institute to determine the composition of incinerator effluents from the burning of various waste materials indigenous to the Los Angeles Basin under various operating conditions in a typical back-yard incinerator.

### Status

Work started about November 15th.

## VIII. AREA DISTRIBUTION OF AIR POLLUTANTS

### Background

In order to tie in our knowledge of movement of air masses over the Los Angeles Basin with manifestations of smog as measured at various points in the Basin, information on the contribution of the sources of pollution into these masses of air both in amount and rate is needed.

### General Plan

The entire Los Angeles Basin will be divided into a rectangular grid system of, say, two-mile mesh, making 400 units of four square miles each. For each of these, an inventory of emissions would be made for each hour of the day, giving 24 such determinations for each contaminant. The above data on pollutants entering a mass of air added to the data from the aerometric survey on measurements of concentrations of various pollutants, as well as manifestations of smog, will be correlated with meteorological information--especially wind trajectories, exposure to solar radiation, etc.

### Status

Search is under way for qualified contractors to undertake this task.

## IX. FEASIBILITY AND ECONOMIC STUDIES OF STOP-GAP PROCEDURES

### Background

It is becoming apparent that the ultimate solution to the Los Angeles smog problem may require automotive or fuel changes which will not be effective in the Los Angeles area for perhaps ten years. As the population of the Los Angeles Basin increases, smog frequency may be expected to increase. To obtain relief at an early date, we may have to resort to stop-gap procedures which are not economic in the long run. Many such stop-gap procedures have been proposed, not only by the uninformed, but also by men of considerable stature in scientific, civic, and political affairs of southern California. The facts concerning the technical and economic feasibility of these proposals have not been available either to community leaders or to the public.

Proposals for stop-gap procedures include the following:

1. The use of nonleaded gasoline and the OCM catalytic muffler. This proposal is based on the generally accepted supposition that the catalytic converter for nonleaded gasoline has been successfully developed.
2. The use of the Houdry catalytic converter, which is supposedly effective in oxidizing the hydrocarbon constituents of leaded gasoline.
3. The use of liquefied petroleum gases in place of gasoline in internal combustion engines. This proposal is based on the theory that only hydrocarbons of four carbon atoms per molecule or above contribute to smog.
4. Alcohol blends as automotive fuel. This is based on claims that alcohol improves the combustion of hydrocarbons in the cylinder.
5. Fuel rationing. The supposed advantages of this proposal are obvious.



6. Control of excessive fumes from "smokers." There is considerable opinion that automobiles which emit a blue trail of unburned lubricating oil droplets from the exhaust pipe not only contribute greatly to reduced visibility, but that they also emit much larger quantities of unburned gasoline than properly maintained and operated cars.
7. Further control of hydrocarbon losses which accompany the distribution of automotive fuels. After present control methods are adopted by the petroleum refining industry, the largest contributors to hydrocarbon emissions as such will be from filling tanks at bulk storage terminals, tank trucks, filling station delivery tanks, and automobile fuel tanks. The costs involved in further control of these emissions must be determined.

#### General Plan

It is proposed to study all of the factors involved in making any of the above changes--either in whole or in part, or in combination, one with another. Most of the data will be secured by conversations with experts in the petroleum and automotive fields. In a few cases, some preliminary test work may have to be carried out; but in general, the proposals will be evaluated both on the basis of current knowledge of the effectiveness of the method under consideration and also, on the assumption that partially developed methods may be made 100 percent effective. It is obvious to many technical men that many of these proposals will require such far-reaching expenditure of funds and changes in our way of life that it might be easier to move the city than to impose the suggested remedies on the Los Angeles public. It is important, however, that these facts be clearly pointed out and made available to the public.

#### Status

A proposal has been made to the Board of Supervisors of Los Angeles County that this is the type of program which they might well underwrite. The Foundation

has entered into a contract with the Southwest Research Institute at San Antonio, Texas to make a preliminary survey of economic and technical factors involved in these proposals. We have also initiated a project for preliminary testing of those devices which appear to be in the final stages of development. By the middle of the month, Southwest Research Institute will begin life tests in the field on both the Houdry white gasoline converter and leaded gasoline converter. Two white converters will be put on two 1954 Chevrolets. Four converters for leaded gasoline will be installed on a 1954 Ford V-8, 1954 DeSoto V-8, 1953 Buick V-8, and a 1953 Cadillac. The individual cars will be run on a proposed 20,000-mile road test, during which time the operators will determine the effect of these converters on the operating characteristics of the automobile. At the end of each 1,000 miles, the car will be returned to the laboratory for an inspection and also, for an analysis of the hydrocarbon content of the exhaust gases under different conditions of operation. At the end of the test, exhaust gas analyses will be checked by the Los Angeles County Air Pollution Control District. If the converters fail during the 20,000-mile road test, the catalyst will be reconditioned in the presence of a representative of Southwest Research Institute or the Southern California Air Pollution Foundation, and the converter put back on the car. The Southern California Air Pollution Foundation has agreed to reimburse Oxy-Catalyst, Inc. for the cost of manufacturing these six converters and for the time and expenses of an Oxy-Catalyst representative who will supervise the installation of the device and observe the periodic tests of the converter.

It is possible that when these tests are completed, other types of devices may also be subjected to life tests.

WLF:g  
December 3, 1954