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Medical Advisory Committee

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AMERICAN PETROLEUM INSTITUTE
MEDICAL ADVISORY COMMITTEE

FIFTEENTH MEETING

Minutes of Meeting
April 19, 1952
Netherland Plaza Hotel
Cincinnati, Ohio

MEMBERS PRESENT

E. Kern Linder - Chairman
Marshall Clinton - Secretary

W. O. Armstrong
V. C. Baird
F. F. Roys
J. William Crookshank
Kieffer Davis
Robert E. Eckardt
Kenneth R. Fourcher
T. M. Frank

C. H. Hine
T. J. Kelly
M. N. Newquist
James W. Osborn
B. B. Reeve
John C. Ruddock
George M. Saunders
Leo J. Wade

E. Richmond Ware

ASSOCIATES PRESENT

E. W. Adams
L. C. Beard, Jr.
R. D. Bent
L. C. Burroughs
R. C. Cole
Allan E. Dooley

L. M. Henderson
R. M. Landon
K. G. Mackenzie
R. C. Mithoff
C. A. Neilson
F. J. Sanders

R. M. Shepardson

GUESTS

Philip Drinker - Harvard University
A. W. Horton - University of Cincinnati
Gordon F. Moore - Sinclair Refining Company
R. W. Pipkin - Humble Oil and Refining Company
D. V. Stroop - American Petroleum Institute
Norman G. White - Shell Chemical Company

Total in Attendance - 38

MEMBERS ABSENT

Theodore E. Allen
L. E. Curtis
D. M. English
Warren F. Kahle

W. R. Levis
E. P. Luongo
Robert Bell Lynn
Clark R. Miller

R. C. Page

ASSOCIATES ABSENT

W. R. Argyle
J. S. Boylan
C. L. Brown
C. R. Brown
L. O. Crockett
R. S. Driver
Nelson J. Gothard
L. N. Haugen

James E. Hill
E. W. Isom
D. W. Larmer
C. R. McKay
J. R. Morrison
W. H. Price
R. B. Roaper
F. M. Watkins

H. D. Wilde

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I

INTRODUCTION OF MEMBERS AND GUESTS

In opening the meeting the chairman welcomed and introduced those who had not attended previous meetings of the committee.

II

MINUTES OF FOURTEENTH MEETINGACTION

The committee voted to approve the minutes of the Fourteenth Meeting as circularized.

III

REPORT OF SUBCOMMITTEE ON ATMOSPHERIC POLLUTANTS - DR. E. P. LUONGO, CHAIRMAN

In the absence of Doctor Luongo, Doctor Ruddock presented the report which is attached to these minutes as Appendix A. (Also included in Appendix A is a copy of letter dated April 3, 1952 from W. L. Stewart, Jr. to members of the National Committee on Smoke and Fumes.)

ACTION

The report was accepted with the understanding that Philip Drinker, with the assistance of members and associates in New York and Philadelphia, would prepare and submit to the subcommittee an outline of information now available on the physiology of atmospheric pollutants of interest to the petroleum industry, a list of major research projects underway and designed to supplement available information, and a suggested program of work which may be desirable concerning the physiologic aspects of air pollutants if, as, and when, money and research workers become available.

IV

REPORT OF SUBCOMMITTEE ON CARCINOGENICITY - DR. M. N. NEWQUIST, CHAIRMAN

Doctor Newquist reported on the work of the subcommittee with recommendations as follows:

1. The subcommittee approved the appointments to the Research Advisory Committee as made by the subcommittee chairman.
2. The actions of the Research Advisory Committee's meeting of November 26, 1951 received 100 per cent approval by the subcommittee through letter ballot.
3. The actions of the Research Advisory Committee's meeting of February 26, 1952 have been approved by letter ballot as of this date, with a few ballots still to be received.
4. The progress reports of Doctor A. W. Horton and Doctor J. J. Phair were received.
5. A brief report will be made within the next two weeks by the Research Project Advisory Committee to T. J. Sullivan, Chairman of a study committee of the General Committee, Division of Refining, on the past and present activities of the Subcommittee on Carcinogenicity, including future objectives and budgetary requirements.

Recommendations:

1. That the Subcommittee on Medical Policies and Practices be requested to promote the improvement of medical records in the petroleum industry so as to provide reliable health data for the benefit of employee and employer and for any health studies which may be made.
2. That the budget of \$104,760, as submitted by Doctor Kehoe on March 4, 1952 for the year July 1, 1952 to June 30, 1953, be approved.

ACTION

The Medical Advisory Committee accepted the report and adopted the subcommittee recommendations.

V

REPORT OF SUBCOMMITTEE ON FIRST AID - DR. T. M. FRANK, CHAIRMAN

Doctor Frank reported that suggestions collected from members were sent to Charles A. Miller. These were studied in detail and the book has now been rewritten incorporating them all. The editorial work and rewriting has been done by Mr. Miller and his associates, with the chairman of this subcommittee sitting in to advise from a medical viewpoint.

Two differences in medical opinion came to light. One was in the use of the tourniquet. The other was in the exact technique of the Holger Nielsen method of resuscitation. An attempt was made to resolve these differences.

The letter poll from the members of this subcommittee on the inclusion of the Holger Nielsen method was reported as being in favor (all but one) of its inclusion but not as a substitute for other methods.

The only action taken was a vote of thanks to Mr. Miller and his associates, and to the chairman of this subcommittee for their work in revision of the book.

ACTION The report was accepted.

VI

REPORT OF SUBCOMMITTEE ON TOXICOLOGICAL REVIEWS - DR. MARSHALL CLINTON, CHAIRMAN

Doctor Clinton reported that the remaining nine toxicological reviews which were approved for publication at the April 21, 1951 MAC Meeting have been editorially revised and now await publication by the American Petroleum Institute.

The subcommittee voted to recommend that revision of existing toxicological reviews be carried out when advised by Professor Drinker or suggested by members of the Medical Advisory Committee. Professor Drinker will circularize minor changes in reviews, without complete revision, when he deems it advisable.

The subcommittee voted to recommend that Professor Drinker be requested to prepare toxicological reviews on the following subjects:

1. Oil soluble lead soaps.
2. Effects of inhalation of oil mists.

ACTION The Medical Advisory Committee voted to accept the report and recommendations made by the subcommittee.

VII

REPORTS FOR INACTIVE SUBCOMMITTEES

The Medical Advisory Committee received brief informative statements pertaining to the assignments of the following subcommittees:

1. Subcommittee on Cutting Fluids - Dr. F. F. Boys, Chairman.
2. Subcommittee on Eye Hazards - Dr. Kieffer Davis, Chairman.

VIII

REPORT OF CONSULTANT - PROFESSOR PHILIP DRINKER

The committee received from Professor Drinker a brief report which supplemented his discussion of the atmospheric pollutant problem.

IX

AROMATIC HYDROCARBONS

The committee resumed discussion of this subject and requested the chairman to canvass all members by letter ballot to ascertain the extent to which they are interested in developing a research program on the toxicology of such hydrocarbons.

X

NEW BUSINESSA. Report on Appointment and Meeting of a Special Coordinating Committee

Chairman Linder informed the committee on this subject by reading letters as follows:

1. January 25, 1952 from John R. Suman to E. K. Linder, M.D.

"The General Committee, Division of Refining, has resolved:

'That the Chairman of the General Committee of the Division of Refining appoint a subcommittee composed of members of said General Committee to review the past work of said Medical Advisory Committee as it pertains to finished and unfinished petroleum products, and to refinery operations as well as to review work now under way and programs, if any, for future work in this field, and to recommend to the General Committee such steps as it feels should be taken, together with such mechanism as it feels should be established to secure the best possible results from the standpoint of the employees of the petroleum industry and the users of petroleum products.'

"The General Committee also has agreed unanimously:

'...that the Vice President for Refining should confer with the Chairman of the Safety Committee of the Board to determine whether or not a mechanism can be worked out whereby the Medical Advisory Committee can be furnished direct assistance and advice of qualified refiners.'

"Pursuant to this agreement, W. L. Stewart, Jr., Chairman, General Committee, Division of Refining, has conferred with me.

"Possibly the working-out of the mechanism sought by the General Committee would be facilitated and expedited by joint conference and collaboration of members of the refinery subcommittee, which is to be appointed by Mr. Stewart, and of a special subcommittee of medical committee members which you might appoint.

"If such a course of action seems appropriate to you, I would suggest that you communicate directly with Mr. Stewart and tender the services of a special subcommittee of medical committee members which could assist the refinery subcommittee in its review of the past, present and future API medical research program and in working out a mechanism to accomplish the results stated in the resolution."

2. February 1, 1952 from E. K. Linder, M.D., to W. L. Stewart, Jr.

"In accord with Mr. Suman's letter to me, dated January 25, 1952, it is my desire to expedite any action on the part of the Medical Advisory Committee which will aid the General Committee, Division of Refining, work out the mechanism referred to in their resolution as quoted.

"I am appointing a subcommittee composed of six members of the Medical Advisory Committee, which subcommittee will be prepared to collaborate with a subcommittee of the General Committee, Division of Refining. These liaison subcommittees, I am certain, can discuss and promote a better mutual understanding.

"Immediately following the November meeting of the Medical Advisory Committee a Research Project Advisory Subcommittee was appointed for the express purpose of maintaining a closer contact with Doctor Kehoe and associates of the Kettering Laboratory relative to their research on carcinogenicity sponsored by the American Petroleum Institute. A meeting of this subcommittee and Doctor Kehoe and associates was held on November 26 and another meeting is planned for February 26. It is my personal opinion that the November meeting proved of value both to Doctor Kehoe and his associates and also to the Subcommittee on Carcinogenicity. This past meeting, and future meetings, I am sure, will serve their purpose to provide a closer bond of understanding and collaboration in direction of work so as to accomplish the objectives in the least possible time and at the least possible cost.

"Inasmuch as there will be available up-to-date information on the research on carcinogenicity at the Kettering Laboratory immediately following the meeting of February 26, may I take the liberty of suggesting that the liaison subcommittees meet on February 27 in Cincinnati? Should this not be agreeable, or should it be in conflict with previous commitments, we will be quite willing to meet at any other time or place you may suggest.

"The subcommittee, which we shall refer to as the Special Coordinating Committee of the Medical Advisory Committee, will be composed of the following members:

Kieffer Davis, M.D.
Phillips Petroleum Company
Bartlesville, Oklahoma

Kenneth R. Fourcher, M.D.
Standard Oil Company (New Jersey)
30 Rockefeller Plaza
New York 20, New York

E. Kern Linder, M.D.
The Atlantic Refining Company
260 South Broad Street
Philadelphia 1, Pennsylvania

James W. Long, M.D.
Gulf Oil Corporation
Port Arthur, Texas

M. N. Newquist, M.D.
The Texas Company
135 East 42nd Street
New York 17, New York

B. B. Reeve, M.D.
Standard Oil Company (Indiana)
910 South Michigan Avenue
Chicago 80, Illinois"

3. February 15, 1952 from W. T. Gunn to E. K. Linder, M.D.

"Mr. W. L. Stewart, Jr., Chairman of the General Committee, has appointed the following members of the General Committee, Division of Refining, to serve on the Special Coordinating Committee of the Medical Advisory Committee:

W. R. Argyle
Sinclair Refining Company
600 Fifth Avenue
New York 20, New York

M. Halpern
The Texas Company
135 East 42nd Street
New York 17, New York

Harold G. Osborn
Continental Oil Company
P.O. Drawer 1267
Ponca City, Oklahoma

M. G. Paulus
Standard Oil Company (Indiana)
910 South Michigan Avenue
Chicago 80, Illinois

William Naden
Esso Standard Oil Company
15 West 51st Street
New York 19, New York

C. S. Teitsworth
Socony-Vacuum Oil Company, Inc.
26 Broadway
New York 4, New York

"Mr. Stewart feels sure that the Medical Doctors will enjoy working with this group, and that the results will be constructive.

"These gentlemen have been notified of the meeting at 10:00 A.M., February 27, at the Netherland Plaza Hotel, Cincinnati, Ohio."

4. March 11, 1952 from William Naden to W. L. Stewart, Jr.

"In accordance with your instructions, as outlined in Mr. W. T. Gunn's letter of February 14th, the Coordinating Committee which you appointed met with a Subcommittee of the Medical Advisory Committee at the Netherland Plaza Hotel, Cincinnati, Ohio, on February 27, 1952. The following were in attendance:

Special Coordinating Committee of the Division of Refining

W. R. Argyle	Sinclair Refining Co.
Dr. L. C. Beard for C. S. Teitsworth ..	Socony-Vacuum Oil Co., Inc.
F. H. Holmes for M. Halpern	The Texas Company
D. R. Johnson for H. G. Osborn	Continental Oil Co.
W. J. McGill for M. G. Paulus	Standard Oil Co. (Indiana)
Wm. Naden	Esso Standard Oil Co.

Subcommittee of Medical Advisory Committee

Kieffer Davis, M.D.	Phillips Petroleum Co.
Kenneth R. Fourcher, M.D.	Standard Oil Co. (New Jersey)
E. K. Linder, M.D.	The Atlantic Refining Co.
M. N. Newquist, M.D.	The Texas Company
B. B. Reeve, M.D.	Standard Oil Co. (Indiana)
R. M. Landon representing	
James W. Long, M.D.	Gulf Oil Corporation

"At the start of our meeting there were some discussions as to the duties of the two Refining Division committees that were recently appointed to meet with the Subcommittee of the Medical Advisory Committee -- the above committee and also the committee under the chairmanship of Mr. T. J. Sullivan. It was finally felt that Mr. Sullivan's committee was appointed to review the work of the Medical Advisory Committee, but that our committee was appointed 'to determine whether or not a mechanism can be worked out whereby the Medical Advisory Committee can be furnished direct assistance and advice of qualified refiners.'

"In our discussion we reviewed the makeup of the Medical Advisory Committee which is composed of medical doctors from the member companies, together with a comparable number of associate or technical advisors. It was established that the work of the Medical Advisory Committee is to make recommendations as to medical problems and policies as they pertain to the petroleum industry and that decisions regarding the recommendations to be made is the sole responsibility of the fully accredited members (M.D.s) of

the Medical Advisory Committee. Associates have been available to the committee to give advice on matters pertinent to refining and such technical advisors have always had representation on the subcommittees of the Medical Advisory Committee.

"After a thorough review and discussions of the workings of the Medical Advisory Committee and its subcommittees together with the associate members or technical advisors, it was unanimously agreed that a mechanism already exists to furnish qualified assistance and advice on problems that pertain to the Refining Division. It was felt that if the member companies continue to nominate competent technical advisors to this committee that there would be no need for any further assistance.

"Although it might not have been pertinent to the subject we were commissioned to deal with, your committee did express the thought that consideration should be given to having a permanent committee, such as the committee now working under Mr. T. J. Sullivan, to review the work of the Medical Advisory Committee, and to advise the General Committee on Refining regarding the actions taken and recommendations made by the Medical Advisory Committee.

"At the close of the meeting the group accepted an invitation to visit with Doctor Kehoe and his associates at the Kettering Laboratory where we were privileged to witness the work in progress that is going on for API, as well as work going on for other industries. We not only found it extremely interesting but were very favorably impressed with Doctor Kehoe and his associates. We were impressed with the fact of his long association with industry problems in general, and we all felt that he is eminently qualified to handle the medical research projects that have been assigned to the Kettering Laboratory by the API.

"I trust you will accept the above as a report of the Special Coordinating Committee."

B. API Certificates of Appreciation for Members of Medical Advisory Committee

ACTION Following discussion of this subject, the committee voted for appointment of a small subcommittee on awards to study and to report recommendations.

XI

TIME AND PLACE OF SIXTEENTH MEETING

ACTIONS

1. On motion the committee voted to hold annual meetings instead of semi-annual meetings beginning in 1953, with the understanding that such a change should have no effect on the scheduling of subcommittee meetings.
2. It was agreed that subcommittees should have such meetings as may be necessary to ensure the circularization of their reports at least two weeks prior to annual meetings of the Medical Advisory Committee.

3. It was agreed that the Sixteenth Meeting should be held in Chicago on Thursday, September 25, 1952.

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The Fifteenth Meeting was adjourned.

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Members, Associates, and guests met informally at luncheon following which Doctor V. C. Baird presented an interesting illustrated talk on the medical program and organization of the Humble Oil and Refining Company, Houston, Texas.

Those present discussed the company program and gave Doctor Baird a vote of thanks for his contribution to the meeting.

Marshall Clinton, M.D.
Secretary

Approved:
E. Kern Linder, M.D.
Chairman

4-22-52

API 07111

APPENDIX A

To Minutes of 15th Meeting of Medical Advisory Committee

REPORT TO THE API MEDICAL ADVISORY COMMITTEE

BY THE SUBCOMMITTEE ON ATMOSPHERIC POLLUTANTS

Dr. John C. Ruddock - Acting Chairman

Full discussion of all aspects was entered into by all members and associate members present.

Full recognition was made of the work being done by the Stanford group, Professor Drinker, and others. It was thought that a coordination of the results of this work would be of value to the committee and the API in general. A proposal was moved and seconded and unanimously passed that a sum of money be allotted to coordinate the work and collect the findings of various groups, universities, and colleges that are researching the causes of air pollution - in turn, this information be dispersed to the subcommittee for further study. A discussion was held as to who would collect this data - the Subcommittee on Toxicological Reviews, Professor Drinker and staff, or the Subcommittee on Atmospheric Pollutants? At this time an invitation was extended to the members of this subcommittee to attend the Symposium on air pollution at Pasadena, California, May 5-6, 1952, to be held under the auspices of the Stanford Research Institute.

The subcommittee is aware that this is a complex problem, in general, and by no means is peculiar to the petroleum industry. The problem is both local and general. It is a problem that is controlled by geography, atmospheric conditions, night and day, wind and calm, and rain and clouds. The subcommittee is aware also of the important public relations aspects as well as technical consideration. These public relations aspects vary in scope from small communities near industrial activities to large cities and industrial centers, to counties and states. Basic research should be geared to those aspects of the problem that relate to the petroleum industry, including public relations peculiar to a particular area. The discussion brought out the fact that investigating bodies outside of the petroleum industry are stating "factual" data, which if unrefuted would lay the major blame for air pollution on the petroleum industry, whereas investigations to the present time are unanimous to the effect that the petroleum industry is responsible for only a small percent.

There exists a definite void in knowledge on medical or physiologic aspects of air pollution. Medical societies are already discussing the possible detrimental effects of smog. These discussions have no basis in fact and are merely surmise and conclusions. Before an industry is saddled with unrealistic and unnecessarily costly regulations, factual data must be developed by knowledge gleaned by realistic scientific investigations. The subcommittee concurs in the proposed 8 projects outlined by the Subcommittee on Smoke and Fumes of the Division of Refining. Such a study should determine what constitutes air pollution or whether smog is merely a public nuisance. When a conclusion is reached it is requested that it be referred to this subcommittee for further study of the physiologic aspects of air pollutants, which might be the result of operations or products of the petroleum industry.

In the interim before receiving conclusions of the aforementioned survey, it was proposed that each participating company should attempt to make a survey of its own employee group for the purpose of determining, if possible, the physiological effects of smoke and fumes on these employees. It was brought out in the discussion that employees were exposed to fumes and smoke peculiar to the petroleum industry in a higher degree, more frequently and continuous than any other human group.

The subcommittee stands ready, if necessary, to render whatever service and assistance it can in those matters related to the physiologic effects of atmospheric pollution which it may be specifically requested to consider.

AMERICAN PETROLEUM INSTITUTE

50 WEST 50TH STREET

NEW YORK 20, N. Y.

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April 3, 1952

DIVISION OF REFINING
W. T. GUNN, DIRECTOR

GENERAL COMMITTEE

W. L. STEWART, JR., CHAIRMAN
M. HALPERN, VICE-CHAIRMAN
DAVID E. DAY, SECRETARY

To The National Committee on Smoke and Fumes
Division of Refining

Gentlemen:

The program and expense estimate which may be adopted by the Committee at its first meeting in San Francisco on May 13th must be presented by your Chairman to the General Committee of the Division of Refining for approval at its meeting on May 15th.

In order to expedite arriving at decisions as to the nature of the program the Committee should adopt and the amount of money that would be required to finance it, there is set forth below a list of projects suitable for research under Committee sponsorship. In cases where it is anticipated a project may require more than one year's time for completion, the estimated cost covers the work of the first year only.

Brief summaries of the various projects, outlines of the methods of approach which might be suitable, and breakdowns of their estimated costs into equipment and research expense are shown on the sheets attached. The cost estimates were arrived at with the assistance of Stanford Research Institute personnel and hence should be in the correct order of magnitude.

At least six independent research organizations, namely: Armour Research Foundation, Battelle Memorial Institute, Arthur D. Little, Inc., Mellon Institute, The Engineering Research Department of New York University, and Stanford Research Institute are qualified to conduct research on the type projects suggested. Subsequent to the adoption of a program and budget by the Committee in May, it is contemplated that a Subcommittee may be charged with responsibility for obtaining proposals from these qualified organizations for research on each project approved for sponsorship.

National Committee
on Smoke and Fumes

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April 3, 1952

The projects suggested, in the order of their probable importance, are as follows:

	<u>Project</u>	<u>Estimated Time Required</u>	<u>Estimated Cost</u>
(1)	Development of Analytical Methods	1st year	\$ 75,000
(2)	Hydrocarbon Reactions in the Atmosphere	1st year	75,000
(3)	Composition and Origin of "Blue Haze" from Refinery Operations	1st year	65,000
(4)	Quantity, Nature and Origin of Oxidant in the Atmosphere	1 year	75,000
(5)	Development of Tracer Techniques	3 months	10,000
(6)	Composition of Waste Gases from Combustion of Petroleum Fuels	5 months	25,000
(7)	Conversion of SO_2 to SO_3 in the Atmosphere	1 month	1,500
(8)	Atmospheric Impurities in Major United States Cities	1st year	<u>6,000</u>
	Total		\$ 332,500

Any comments will be welcomed regarding these or other projects believed suitable for sponsorship by the Committee.

Very truly yours,

W.L. Stewart Jr.
S.

WLS,Jr.:m
att.-8

Attachment 1

Development of Analytical Methods

Among the substances emitted into the air by oil refineries and consumers of petroleum products are hydrocarbons, oxygenated hydrocarbons, oxides of nitrogen, ammonia, sulfur dioxide, and sulfur trioxide. Heavily polluted air may contain these substances at concentrations of from a fraction of a part per million to several parts per million. The analytical techniques for analyzing specifically for these substances in the presence of other contaminants at such low concentrations are either non-existent or quite unsatisfactory.

The object of the proposed work is to develop specific methods for analyzing for the substances listed above, and to evaluate the methods, using both synthetic and natural industrial atmospheres.

Satisfactory methods for analyzing for hydrocarbons at low concentrations (0.1 to 5ppm.) would be most important to the oil industry. Such techniques do not exist at present and will probably have to be developed and improved upon over a period of several years' time. Therefore, emphasis should be placed on the problem of analyzing for hydrocarbons although improvements in techniques for analyzing for the other substances listed above could be undertaken at the same time.

Estimated Costs - First Year

Equipment	\$ 6,000	
Research	<u>69,000</u>	
Total		\$75,000

Hydrocarbon Reactions in the Atmosphere

Relatively little is known about the reactions which hydrocarbons undergo after they escape into the air from automotive exhausts, filling stations, or refineries. In spite of this, many of the unpleasant properties of Los Angeles smog have been attributed to products of the atmospheric oxidation of hydrocarbon vapors. It is quite likely that unpleasant properties of polluted atmospheres elsewhere also will be attributed to such causes. Studies of the reactions which hydrocarbon vapors in air can undergo would be extremely helpful in evaluating the importance of such reactions.

Previous experience on this problem has shown that two lines of attack have been particularly fruitful. One involves studying the rates at which the reactions occur under various conditions. The other involves the study of the chemical and physical nature of the reaction products and any undesirable effects they may produce.

A start has been made along these lines by studying the mechanisms and products of the reactions of certain olefins with ozone and nitrogen dioxide. However, this has been merely a start and the effect of light, especially when other impurities are present, is almost unknown.

It would be the objective of this work to determine the fate of hydrocarbons in the open atmosphere and measure to what extent they may constitute a nuisance.

It is proposed that the experimental approach would be a continuation of the work that has already been started on the study of mechanisms and identification of reaction products and evaluation of nuisance effects.

Estimated Costs - First Year

Equipment	\$ 6,000	
Research	<u>69,000</u>	
Total		\$75,000

Composition and Origin of "Blue Haze" from Refinery Operations

Based on work that has been done thus far, it is believed that "blue haze" is a mixture of air contaminants. The haze contains particulate matter of a size range that causes it to have a bluish cast under some lighting conditions and to appear reddish-brown under others. Its emission is associated primarily with those operations that involve the combustion of fuels containing sulfur. The emission of "blue haze" is common to practically all petroleum refineries and in some areas represents a considerable problem.

In order to develop means of reducing or eliminating "blue haze" from refinery operations, it is first necessary to know its composition and nature. In order that this knowledge may be gained, a program such as the following should be carried out in several of the principal refining areas at the source of emission of the haze-producing materials:

1. Measure the particle size by collection and optical measurement or by photographic colorimetry.
2. Determine the chemical composition by collection of the haze and use of gross chemical analysis and the chemical micrurgic technique.
3. Measure the ratio of sulfur trioxide to the combined sulfur dioxide and sulfur trioxide concentrations at each emission source.
4. Compile detailed data on combustion conditions, nature of fuel burned (including ash content), and correlate data with quantity and nature of haze produced.

Estimated Costs - First Year

Equipment	\$ 5,000	
Research	<u>60,000</u>	
Total		\$65,000

Quantity, Nature and Origin of Oxidant in the Atmosphere

Past research has shown that hydrocarbons and other materials in the atmosphere may be oxidized to create other substances that are not necessarily emitted directly to the atmosphere as the result of human activities. These reaction products may be damaging or noxious when present in sufficient quantities. In Southern California the atmospheric oxidation is caused by the presence of relatively high concentrations of oxidant, largely ozone, that is present in the atmosphere during periods of smog. On the other hand, studies in New Mexico and elsewhere in the United States do not show periods of high oxidant concentration that typify the Los Angeles situation.

The program outlined here is designed to determine the chemical composition of the oxidants present in the atmosphere, their concentrations under different meteorological conditions, and whether they are present naturally or as the result of human activity.

Continuous measurements of ozone and oxides of nitrogen should be made in several industrial and rural localities. It is suggested that two typical refining centers be selected (one in the East or Midwest and one on the Southern Pacific Coast), and that two typical rural areas in the same geographic areas as the refinery centers be used as controls.

In addition to the continuous measurements at ground level, measurements of total oxidant should be made vertically to an elevation of 10,000 feet at one refinery location and one rural location under various meteorological conditions.

It is estimated that this study can be completed in one year's time.

Estimated Costs - One Year

Equipment*	\$27,000
Research	<u>48,000</u>
Total	\$75,000

- * The total estimated cost for measurement and other equipment is \$40,000. About \$13,000 worth of the necessary equipment is available at Stanford Research Institute. It is assumed in calculating the above costs that airplanes can be supplied by one or another of the petroleum companies.

Development of Tracer Techniques

In many cases of atmospheric pollution it is desirable or necessary to know the amounts of effluent that may, or does, arrive at a given point from one or more sources. This is particularly important where there may be multiple sources of air contamination.

Methods of tracing the course of effluents after they have been emitted from a stack are fairly well developed and most of the necessary equipment is available. However, on an industrial basis, the methods as they now exist are untried.

The tracer technique presently proposed would consist of ejecting into the atmosphere readily identifiable finely divided solid material near some source of suspected emission. Such particles would be collected at those locations where it is suspected that pollutants may be carried. The particle size of the tracer substance would be selected in order that the particles would, for all practical purposes, follow the laws of gas diffusion and would not readily settle. Particles less than one micron in diameter should be suitable for this purpose. More than one suspected source would be evaluated simultaneously by employing different types of particulate matter. The methods developed should be usable over a distance of five miles or more.

It is estimated that this project can be completed in three months of working time.

Estimated Costs - Three Months

Equipment	\$2,500	
Research	<u>7,500</u>	
Total		\$10,000

Composition of Waste Gases from Combustion
of Petroleum Fuels

Much of the man-made contributions to air pollution arise from combustion processes. Since the petroleum industry is a large consumer of fuel, it naturally contributes substantially to the polluting materials in the air over the cities where refineries are located.

A large fraction of the total contaminants in the air will come from one of three sources: combustion of petroleum fuels, combustion of non-petroleum fuels, and combustion of wastes. The study outlined here is designed to provide information on the kinds and quantities of gaseous materials emitted to the atmosphere from various typical unit combustion processes used by the petroleum industry, and its customers.

Adequate data on many of the gaseous constituents of gasoline and diesel exhaust gases now exist. Some additional information on the content of acetylene, aldehydes, organic acids, ammonia, and oxides of nitrogen is needed.

In addition, complete information on the composition of gases from oil and LPG burners (both household and industrial) under various operating conditions is needed.

It is estimated that this phase of the work can be completed in five months' time.

Estimated Costs - Five Months

Equipment	\$ 1,000	
Research	<u>24,000</u>	
Total		\$25,000

Conversion of SO₂ to SO₃ in the Atmosphere

It has been claimed by air-pollution control authorities and others that sulfur dioxide emission to the atmosphere later results in the formation of sulfuric acid aerosols that obscure visibility. Although considerable work has been done on this subject in the past, there still exists considerable disagreement among investigators as to the extent that sulfur dioxide to sulfur trioxide oxidation occurs in the atmosphere.

It is understood that active work is in progress at the University of Illinois and at the University of California at Los Angeles on this problem. It is proposed that the current work be thoroughly investigated, and that no experimental work be planned until the results of the present work have been reviewed.

Work now under way could be reviewed and reported upon in less than one month's time.

Estimated Costs - One Month

Equipment	None
Research	<u>\$1,500</u>
Total	\$1,500

Atmospheric Impurities in Major U. S. Cities

Several of the major cities in the United States and Canada have, within recent years, undertaken new programs to investigate the impurities in their atmospheres. Cleveland, New York, Pittsburgh, Detroit-Windsor, and Los Angeles are among these cities. The important substances sought for have not been the same in each city.

A compilation of all the results obtained, and the test methods used, for all the cities having an active investigational program should be of considerable help in comparing one area with another, in establishing a "normal" impurity of air over industrial cities, and in defining areas of ignorance where further work is desirable.

This work would consist mainly of correspondence with investigators active in the field combined with visits to those cities where major studies are being undertaken. The result of the work should be a report each year, assembling all the data available, assessing the trends in municipal investigations, and reviewing any new analytical or sampling methods that might be developed.

Estimated Costs - First Year

Equipment	None	
Research	<u>\$6,000</u>	
Total		\$6,000