FILE NAME: Oil Industry and American Petroleum Institute (API)

DATE: 1952 Sept-Dec

DOC#: API029

DOCUMENT DESCRIPTION: Letters, Memos, Reports, Financial Reports & Other Relevant Documents from Sept-Dec, 1952

September 5, 1952

AIR MAIL

Dr. T. K. Frank
Pan American Refining Corporation
Texas City, Texas

Dear Dr. Frank:

I am enclosing two blank ballots for you to use in voting on the minutes of the Research Project Advisory Committee meeting on July 10, 1952.

I did not receive your marked ballot and apparently it has gone astray in the mail.

Please return the marked ballot to me as soon as possible.

Very truly yours,

MKH:jb
Enclosures
bc: Dr. E. H. Boughton

Copy from D. V. Stroop for Information of Members and Associates of Medical Advisory Committee.

9-11-52

REPORT OF SUBCOMMITTEE ON CARCINOGENICITY TO THE MEDICAL ADVISORY COMMITTEE, API - SEPTEMBER 25, 1952

1 - The Subcommittee on Carcinogenicity has held no stated meeting since its last meeting in Cincinnati April 18, 1952, which action has been approved by letter ballot.

2 - The R.P.A. Committee held its third meeting at Kettering Laboratory on July 10, 1952, the minutes of which have been circularized to all members and associates of the Medical Advisory Committee and which minutes have been approved by the subcommittee by letter ballot.

3 - The research project (MC-1) has been continued on about the same scope as it has been during the past two years but with better results from the standpoint of quantitative mouse testing. Data sheets on various mouse experiments were mailed by Dr. Horton on July 16, 1952, to members of the Medical Advisory Committee, who also have received from Dr. Horton prior to this meeting a tabular summary of the current and completed biological experiments.

4 - Dr. Horton will present an interim progress report as part of this report.

5 - The subcommittee recommends that the various medical directors on the Medical Advisory Committee cooperate more fully by submitting the data requested by Dr. Phair in connection with the epidemiological survey and particularly the data concerning current cases.

6 - Dr. J. J. Phair will present as part of this report:

a. A progress report on the epidemiological studies.

b. Dr. Kehoe's decision as to whether or not Kettering Laboratory would be willing to undertake a critical review, with abstracts, of the literature on cancer as related to petroleum and his estimate of the additional cost if undertaken.

7 - With respect to the epidemiological survey (See Exhibit A) among employees of customers, the letter ballots of the members of the subcommittee showed sufficient differences of opinion to warrant referral of this subject back to the subcommittee for further consideration. (Some letter ballots not received as of 9/10/52, but final tally will be available for the Chicago meeting.)

8 - The subcommittee by letter ballot approved of continuing Research Project MC-1 at approximately its present scope and cost ($100,000 per year) for the year beginning July 1, 1953. However, a few members recommended that the general level of research activity and the budget be decreased.

Dr. Kehoe will submit for this meeting an estimate of the budgetary requirements subdivided insofar as possible in terms of scientific objectives.

9 - Recommendations, if any, eventuating from the meeting of the Research Project Advisory Committee to be held on September 24, 1952.

Respectfully submitted,

M. N. Newquist, Chairman.

EXHIBIT A

API - MEDICAL ADVISORY COMMITTEE

ACTIONS WITH RESPECT TO CANCER REGISTRY

Fifth Meeting - April 28, 1947 - Buffalo, New York

Page 2 of Minutes, Item D, Report of Subcommittee on Carcinogenicity

"Establish a registry of malignancies to report to the Subcommittee on Carcinogenicity. This registry would collect data on all malignancies incident in employees of the petroleum industry. It would set up its own procedures, forms, extent of data, follow-ups, pathology, treatment, outcome, autopsy reports, etc. after consultations with existing registries."

Seventh Meeting - April 2, 1948 - Boston, Massachusetts

Page 3 of Minutes, Item 3, Report of Subcommittee on Carcinogenicity

"The committee recommended that Dr. Robert A. Kehoe and his associates collaborate with the Chairman of the Subcommittee on Carcinogenicity and as many members as is necessary in the preparation of a plan of collecting statistical medical information on cancer in the petroleum industry versus the country at large; and if possible versus other industries. The committee also recommended that a definite proposal be made for implementing the collection and coalition of such information (every effort should be made to separate any cancers caused by contact with known products from those arising from other causes)."

Eighth Meeting - November 12, 1948 - Chicago, Illinois

Page 2 of Minutes, Item 5-d, Report of Subcommittee on Carcinogenicity

The carcinogenic program -- at the University of Cincinnati should include: "Epidemiological studies of this problem in the industry."

Tenth Meeting - November 11, 1949 - Chicago, Illinois

Appendix A, 3rd paragraph, Report of Subcommittee on Carcinogenicity

"Dr. J. J. Phair, Professor of Preventive Medicine, University of Cincinnati, discussed the epidemiological aspects of this problem. He proposed the establishment of a cancer register at the University of Cincinnati to serve the petroleum industry and submitted a draft of a form to be used in obtaining the necessary morbidity information. It was agreed that legal advice should be obtained as to whether reporting such cancer cases to the University of Cincinnati would be an invasion of the patient's rights."

Meeting - Subcommittee on Carcinogenicity - August 26, 1947 - New York, New York

Page 2 of Minutes, Item 6-(a)

"It is desirable to assemble data regarding (1) nature, (2) frequency and (3) duration of exposure of employees and customers to intermediate or commercial products containing as a constituent heavy catalytic distillates or residua which contain fractions boiling above 700° F. Also, to obtain the number of (1) employees and (2) customers so exposed. In order to obtain uniformity, Dr. Woody will outline the procedure for survey and approach the companies to conduct the above survey."

RANDUM FROM DR. M. N. NEWQUIST

YORK, N. Y. September 10, 1952

D. V. Stroop

The attached report is
self-explanatory and for
inclusion in your report to
go to the members of the
Medical Advisory Committee
as of 9/11/52.

M. N. N.

REPORT OF SUBCOMMITTEE ON CARCINOGENICITY
TO THE
MEDICAL ADVISORY COMMITTEE, A.P.I., - SEPTEMBER 25, 1952

1 - The Subcommittee on Carcinogenicity has held no stated meeting since its last meeting in Cincinnati April 18, 1952, which action has been approved by letter ballot.

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5 - The subcommittee recommends that the various medical directors on the Medical Advisory Committee cooperate more fully by submitting the data requested by Dr. Phair in connection with the epidemiological survey and particularly the data concerning current cases.

6 - Dr. J. J. Phair will present as part of this report:

a. A progress report on the epidemiological studies.

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7 - With respect to the epidemiological survey (See Exhibit A)

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Dr. Kehoe will submit for this meeting an estimate of the budgetary requirements subdivided insofar as possible in terms of scientific objectives.

9 - Recommendations, if any, eventuating from the meeting of the Research Project Advisory Committee to be held on September 24, 1952.

Respectfully submitted,

M. N. Newquist, Chairman.

API - Medical Advisory Committee EXHIBIT A

ACTIONS WITH RESPECT TO CANCER REGISTRY

Fifth Meeting - April 28, 1947 - Buffalo, New York

Page 2 of Minutes, Item D, Report of Subcommittee on Carcinogenicity

"Establish a registry of malignancies to report to the Subcommittee on Carcinogenicity. This registry would collect data on all malignancies incident in employees of the petroleum industry. It would set up its own procedures, forms, extent of data, follow-ups, pathology, treatment, outcome, autopsy reports, etc. after consultations with existing registries."

Seventh Meeting - April 2, 1948 - Boston, Massachusetts

Page 3 of Minutes, Item 3, Report of Subcommittee on Carcinogenicity

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Eighth Meeting - November 12, 1948 - Chicago, Illinois

Page 2 of Minutes, Item 5-d, Report of Subcommittee on Carcinogenicity
"The carcinogenic program -- at the Univ. of Cincinnati should include:
"Epidemiological studies of this problem in the industry."

Ninth Meeting - November 11, 1949 - Chicago, Illinois

Appendix A, 3rd paragraph, Report of Subcommittee on Carcinogenicity

"Dr. J. J. Phair, Professor of Preventive Medicine, University of Cincinnati, discussed the epidemiological aspects of this problem. He proposed the establishment of a cancer register at the University of Cincinnati to serve the petroleum industry and submitted a draft of a form to be used in obtaining the necessary morbidity information. It was agreed that legal advice should be obtained as to whether reporting such cancer cases to the University of Cincinnati would be an invasion of the patient's rights."

Meeting - Subcommittee on Carcinogenicity - August 26, 1947 - New York, N.Y.

Page 2 of Minutes, Item 6-(a)

"It is desirable to assemble data regarding (1) nature, (2) frequency and (3) duration of exposure of employees and customers to intermediate or commercial products containing as a constituent heavy, catalytic distillates or residua which contain fractions boiling above 700°F. Also, to obtain the number of (1) employees and (2) customers so exposed. In order to obtain uniformity, Dr. Woody will outline the

API 05408

UNIVERSITY OF CINCINNATI
DEPARTMENT OF PREVENTIVE MEDICINE AND INDUSTRIAL HEALTH

KETTERING LABORATORY
COLLEGE OF MEDICINE—EDEN AVENUE
CINCINNATI 19, OHIO

September 20, 1952

CABLE ADDRESS: KETLAB, CINCINNATI
TELEPHONE: CAPITOL 1414

Mr. D. V. Stroop
American Petroleum Institute
50 West 50th Street
New York City 20

Dear Mr. Stroop:

I am sending you herewith, for your information, a statement of expenditures made on behalf of American Petroleum Institute during the second quarter of 1952. (This statement does not include the amount of $50,000.00 which was received on July 18.) I believe the statement is self-explanatory, but if you have any questions or comments, Doctor Kehoe would appreciate your bringing them to his attention.

Very truly yours,

E. R. Fortlage

E. R. Fortlage, Secretary to
Dr. Kehoe

ef

Enc.

API 05409

UNIVERSITY OF CINCINNATI

KETTERING LABORATORY

ACCOUNT OF AMERICAN PETROLEUM INSTITUTE

FOR 2nd QUARTER 1952

SALARIES (Based on Proportion of Time Actually Spent on Project)

Direct Salaries	9006.61	
Indirect Salaries		
Histopathological Preparation	928.00	
Other Services	7179.84	17,114.45

MISCELLANEOUS EXPENSE

Purchase of Animals	316.52	
Special Laboratory Supplies	1108.44	
Travel	552.29	
Overhead		
(Proportion of Heat, Gas, Electricity, Steam, Telephone, General Laboratory Supplies, Postage, Annuities, Pensions, Maintenance, etc	2838.94	4,816.19
TOTAL		21,930.64

Balance Available for Further Work
at End of 1st Quarter 1952 ..... 30,317.66

Balance Due Kettering Laboratory
at End of .....

Receipts .....

Expenditures 2nd Quarter 1952 ..... 21,930.64

Balance Available for Further Work
at End of 2nd Quarter 1952 ..... $8,387.02

Balance Due Kettering Laboratory
at End of .....

API 05410

FORM 1230X. KET. LAB.. 500. 7-52

MEMORANDUM FROM THE KETTERING LABORATORY

FOURTH MEETING OF THE ADVISORY COMMITTEE

API RESEARCH PROJECT MC-1 Minutes

Chicago, Illinois

September 24, 1952

A. Biological Testing of Refinery Intermediates and Products.

The main emphasis is being placed currently on raw lubricant stocks. Selected samples of such straight run distillates have been analyzed spectrophotometrically and classified according to spectrum type (Type C includes those which show a definite absorption maximum at 428-436 mμ; Type B are those which show no maxima in their absorption curve but do exhibit an inflection at approximately 385 mμ). No straight run distillate containing some material boiling above 800°F. has yet been found which could be classified as Type A (no inflections nor maxima in its absorption spectrum indicative of three to six ring aromatic hydrocarbons). Further, the untreated Type B and Type C oils on which mouse tests have been completed have demonstrated moderate carcinogenic potencies ($P_{MC} \simeq 0.1$) in this laboratory. However, reports from other research organizations have indicated the possibility that some straight run distillates in this boiling range may have no more than a negligable potency to mice.

Highly refined white oils have exhibited no tumor-inducing character whatsoever under conditions of testing comparable to those used for the untreated distillates. Such white oils, of course, show very little, if any, absorption

in the 350-450 mμ region. However, this lack of spectral absorption is not, by any means, a necessary specification for a non-carcinogenic lubricant. The solvent-refined product, API-100, still absorbs radiation of these wavelengths almost as strongly as the straight run distillates tested, but has not induced a single tumor in C3H mice in the course of a year of repeated applications. This result is contrasted with that on API-99 (P_{MC} = 0.07), a lubricant of similar viscosity, which had been only mildly acid-treated in its refining.

In investigating further the etiology of the cases of scrotal carcinoma among wax pressmen, the mouse test would appear to be a very useful tool. It may be possible to determine whether the lack of difficulty in many refineries can be related to the non-carcinogenicity of the paraffin distillates employed or if the whole answer lies in the precautionary measures being taken, along with other factors, such as low susceptibility to the disease on the part of certain types (races, etc.) of employees. The preliminary indications are that weakly carcinogenic lube stocks can be handled safely so long as reasonable precautions are taken to prevent prolonged or frequent exposure on the part of the workmen.

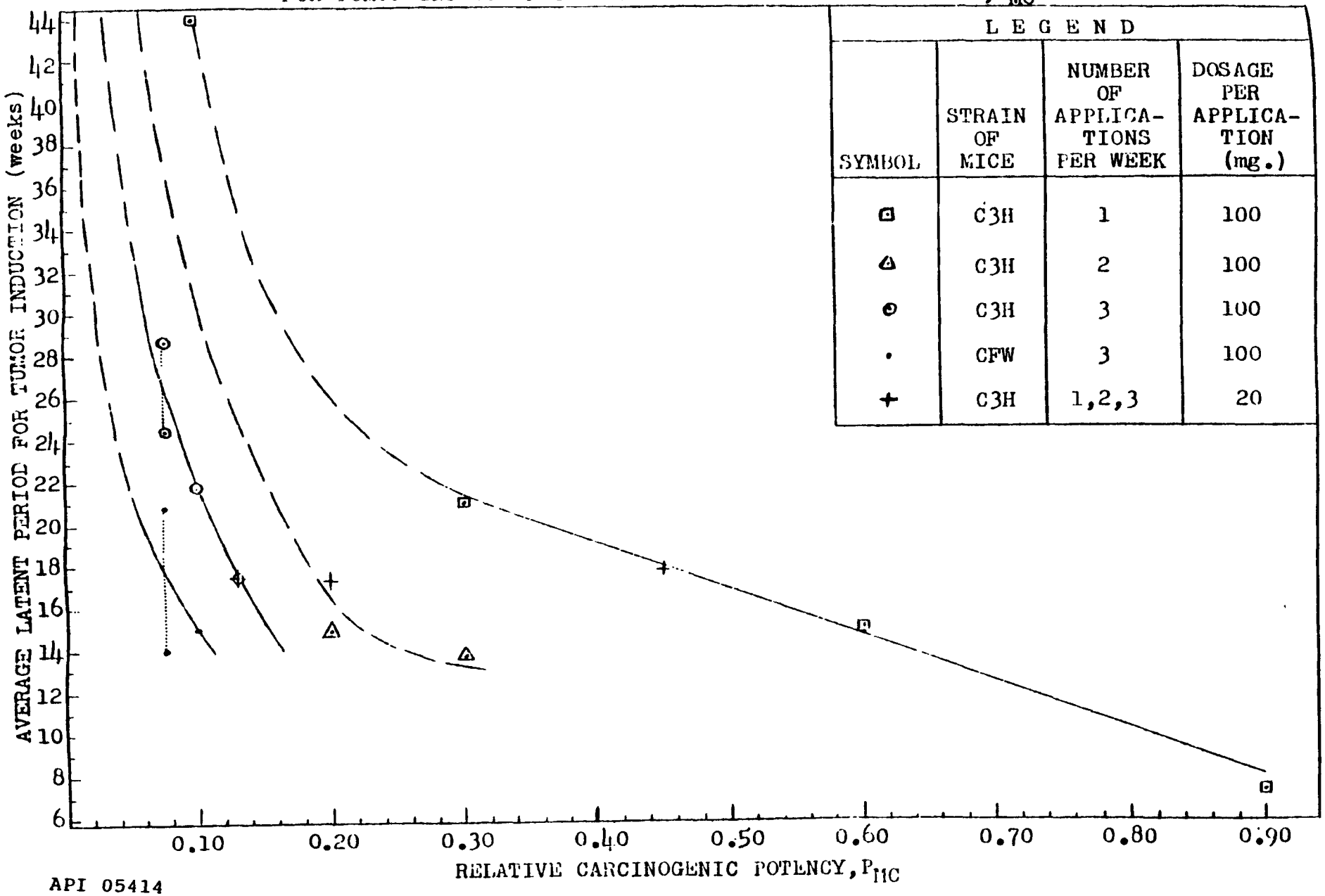
In addition to the mouse tests on lube stocks, a large number of experiments are being carried out on cracked streams already subjected to a preliminary biological screening test. The purposes of these observations are described in the following sections of this memorandum.

B. Biological Methods for Measuring the Relative Potencies of Petroleum Stocks under Various Conditions.

Since the expansion of the biological testing program in 1949, all results of experiments on oils have been related to those of tests on an external reference standard, the synthetic polycyclic methylcholanthrene. Three different frequencies of exposure have been employed in covering the wide range of potencies of the refinery streams which have been examined. For various reasons, it has been assumed that the mechanism of the cancer-inducing action of most hydrocarbon-type oils was the same as that of the reference standard and hence that the translation of the results of experiments involving one, two, or three applications of oil per week to a common potency (P_{MC}) scale was justified.

A number of experiments have been started in 1952 to determine whether this assumption was valid. It will be apparent from Figure 1 that it was necessary to select oils with potencies in the range, 0.10 to 0.16, if satisfactory tests at all three frequencies of application were to be obtained. Hence, API-63, a catalytically cracked residuum, and API-113, a blended industrial fuel oil, were chosen for the current experiments. The preliminary results are in line with the expectation that P_{MC} values are independent of the frequency at which the oils are applied to the mice.

Figure 1 - RELATION OF AVERAGE LATENT PERIOD FOR TUMOR INDUCTION TO RELATIVE CARCINOGENIC POTENCY, P_{MC}



LEGEND			
SYMBOL	STRAIN OF MICE	NUMBER OF APPLICATIONS PER WEEK	DOSAGE PER APPLICATION (mg.)
⊡	C3H	1	100
△	C3H	2	100
⊙	C3H	3	100
•	CFW	3	100
+	C3H	1,2,3	20

API 05414

Since the amount of oil applied upon the skin of a mouse with a camel's hair brush cannot be held exactly constant, experiments have been started to determine the effect of the variable average dosage per application on the rate of induction of tumors by various types of carcinogenic oils. With solutions of the reference standard, methylcholanthrene in benzene, reduction of the average dose from 100 mg. to 20 mg. per application did not alter the rate significantly (see Figure 1). This comparison will be repeated with the new sub-line of the C3H strain which is now being supplied by the Jackson Memorial Laboratory. The methylcholanthrene will be purified by chromatography, etc., for the new tests to avoid complication by trace impurities.

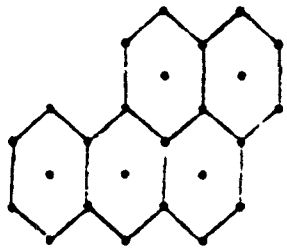
Similar results were obtained with the fuel oil, API-113. The rate of induction of tumors was found to be independent of the amount of oil per application within the range of 5 to 100 milligrams. Indeed, the average latent period for three experiments with API-113 on C3H mice, involving doses of 5, 20, and 100 mg. per application, varied by less than one week (17.2-18.0 weeks). Since many of the fuel oil blends tested on other projects have proven excessively toxic to C3H mice, this was a welcome finding. Thus the systemic toxic effects accompanying the employment of a heavy fuel oil in an experiment of this type may be minimized by reducing the total quantity of oil applied without delaying the induction of tumors significantly.

In contrast to the foregoing results on standard methylcholanthrene solutions and fuel blends, two tests on the highly potent catalytically cracked residua, API-8 and 71, have indicated that the rate of induction of tumors with these materials is strongly dependent on the amount of oil involved in the individual application. The presence of accelerating constituents in these oils, particularly in API-71, had previously been suspected on the basis of fractionation studies and related biological tests. It should be possible now to determine by biological testing the critical level of concentration for the action of such a material. To this end, experiments have been started on API-8 at three dosage levels (5, 20, and 50 mg. per application). Experiments are also being started with distillate fractions, boiling at 465° to 690° F., of API-71, from which polycyclic compounds containing more than two aromatic rings have been removed by chromatography. These fractions will be tested in such a manner as to determine which, if any, demonstrate the type of irritating and accelerating properties exhibited by various dodecylbenzenes.

The average time required for the development of grossly malignant changes in tumors induced by a carcinogenic oil seems to be related inversely to the degree to which the oil has these specific irritating properties. In a number of experiments, further relationships have been noted between the absorption spectrum of the oils and this "delay period". These findings are being developed further in connection with the analytical tool.

C. Development of Rapid Methods for Estimating the Relative Carcinogenic Potency of Any Given Refinery Intermediate or Product.

Continued efforts to relate the observed carcinogenic potencies of the large number of refinery streams which have been tested on mice to certain of their physical and chemical properties have led to a working hypothesis concerning the types of compounds responsible for the physiologic action of these complex oils. It has been postulated that, primarily, their cancer-inducing action dependsupon the presence of specific polycyclic aromatic hydrocarbons containing three or more rings. The isolation of the 5-ringed compound



3,4-Benzpyrene ($C_{20}H_{12}$)

from the FCC cracked residuum, API-8, provided evidence that the carcinogenic structures in such petroleum products may be identical to those in coal tars. From the available chemical and biological data, there is every reason to believe that an important contribution to the observed potencies of cracked products is also being made by certain polycyclic hydrocarbons of lower molecular weight than benzpyrene.

The second basic postulate is that the rate of induction of tumors by a refinery stream depends not only upon the concentration and activity of specific polycyclic carcinogens, but also upon the concentration of non-carcinogenic but accelerating constituents such as certain long chain alkylbenzenes. Under certain conditions, it is felt that the effect of such constituents on the rate at which an oil will induce tumors in mice may be much greater than that of even the necessary carcinogens themselves.

The third important mechanism operating to modify the normal physiological action of an oil containing carcinogenic hydrocarbons would appear to be an inhibitory one. It is necessary to postulate this type of mechanism to explain the lack of potency of certain crude oils and reduced crudes to mice. The inhibitory components are probably contained in the highest boiling ends of these crudes and could well be non-hydrocarbon in composition.

The relative potency of a given oil is thus considered to be the resultant of three semi-independent vectors, the effective concentrations of the carcinogens, the accelerators, and the inhibitors. Fortunately, the third factor can probably be safely neglected for most refinery streams, excepting crude oils, reduced crudes, and cracked residua from viscosity breaking operations. Hence our efforts along chemical lines are being directed toward the identification of the carcinogens and the accelerators responsible for the demonstrated potencies of the available samples of cracked products and straight run distillates.

The levels of concentration of 3,4-benzpyrene in the fractions of catalytically cracked residua which boil above 900°F., as estimated from fractionation studies made in the laboratory, are more than enough to explain the observed potencies of these cuts. Hence, current work is being centered on fractions which boil in the 700-900° range, to identify or classify the structure of carcinogens responsible for the very significant potency of these fractions.

All of the materials which would react with maleic anhydride, including anthracenes, benzanthracenes, naphthopyrenes, 6,7-benzoquinolines, etc., have been exhaustively extracted from the FCC cracked residuum, API-8, for mouse testing. The extent of the contribution of phenanthrene and fluorene derivatives to the potency of a similar catalytically cracked product is also being determined by animal testing. Additional biological experiments are planned, employing fractions in which certain classes of 4-ring hydrocarbons have been concentrated by the techniques of vacuum fractional distillation, chromatography, and liquid thermal diffusion.

The most reliable semi-empirical correlations between potencies and physical properties of oils, which have been developed in this and in other laboratories, have depended upon ultraviolet spectra in the 360-450 mμ range. 3,4-Benzpyrene and Anthanthrene (one of the Dibenzpyrenes) have characteristic absorption bands in this range (383 and 429 mμ, respectively, in isooctane). It is felt that the success of these methods depends rather strongly upon

the degree of influence of pyrene-type carcinogens upon the potency of any particular oil in question. Where carcinogens of lower molecular weight are of predominating importance and where the concentration of monocyclic aromatic hydrocarbons with specific irritant properties becomes significant, as could be true in the case of cracked or straight run distillates, boiling 500-750°F., these methods have not proved to be satisfactory. Thus, although the potency of the San Joaquin (California) distillate, API-79, 86 percent of which boils above 750°F., was predicted very closely on the basis of the absorption band at 429 mμ, that of the West Texas distillate, API-105, 73 percent <750°, was very much higher than was indicated by spectrophotometric data. Similarly, one of the very few incorrect predictions of the potency of a catalytically cracked residuum was that for the TCC product, API-71, an oil containing an unusually large colorless fraction, boiling 500-750°F. As previously mentioned, a number of cuts have been prepared from this fraction to narrow down the search for possible accelerating irritants.

Since 3,4-benzpyrene seems to be an important component of the majority of the petroleum stocks which have been carcinogenic to mice, some effort is being given to the development of a reasonably rapid method of analysis for this compound. The major problem involves its separation from the non-carcinogenic isomer, perylene, which is usually present in higher concentration.

Correction factors for physical properties such as viscosity, mid-boiling point, etc., have been discussed at length. Some preliminary animal tests have been started to determine whether the viscosity of an oil is an important factor in determining the rate at which it induces tumors. A straight run distillate (viscosity, 235 SSU/100°F.) is being compared with a 5 percent solution of a polymer of an alkylstyrene in the same distillate, the viscosity of the material having thus been raised to 1756 SSU/100°F. If the solution containing the polymer has a significantly different potency than the virgin distillate, it will of course be necessary to be sure that the polymer itself has no effect on the skin before the difference can be attributed to a purely physical change in the oil.

From the Kettering Laboratory, College of Medicine,
University of Cincinnati, Cincinnati, Ohio

Investigative Team:

Frank P. Cleveland, M.D.
Ralph T. Denham, B.S.
Frank R. Dutra, M.D.
Mary Jane Graf, B.S.
Francis F. Heyroth, Ph.D., M.D.
A. Wesley Horton, Ph.D.
John J. Phair, M.D.
Ruth C. Pierle, Ph.D.
Helen E. Plagge, B.S.
Fred Shaffer, M.S.
Raymond R. Suskind, M.D.
Dorothy A. Templeton, B.S.
Russell Tye, M.S.
Waldo J. Younker, M.S.
Effie Bright
Anna Marie Gross
Lea Murbach

Report:

A. Wesley Horton, Ph.D.

Approved: Robert A. Kehoe
Robert A. Kehoe, M.D.
Director

Date: September 24, 1952

For Information Only - Not for Publication

API Research Project MC-1

TABULAR SUMMARY
OF
CURRENT AND COMPLETED
BIOLOGICAL EXPERIMENTS

September 1, 1952

The Kettering Laboratory
in the
Department of Preventive Medicine and Industrial Health
College of Medicine
University of Cincinnati
Cincinnati, Ohio

API 05423

INDEX

INDEX TO PROCESSES

INDEX TO TABLE I

* Experiments which are complete, including micro-pathology, are indicated by an asterisk in the body of the tables.

INDEX TO TABLE I

API Sample Number	Process	Appendix Page Number
23	F. C. C.	5,12
23-1	Solvent extraction with concentrated H_2SO_4	20
23-2	Solvent extraction with concentrated H_2SO_4	20
24	Non-catalytic cracking of catalytic gas oil	6
25	Distillation	17
25-1	Dilution of No. 25	17
26	F. C. C.	13
27	Solvent extraction	16
28	Delayed coking	9
29	Catalytic feed to non-catalytic cracking	6
30	Non-catalytic cracking of catalytic gas oil	6
31	T. C. C.	11
32	Wax pressing	18
33	Delayed coking	9
34	Houdry	6,15
35	Non-catalytic cracking of catalytic gas oil	6
36	T. C. C.	11
37	Polyforming	10
38	Catalytic feed to non-catalytic cracking	6
39	Non-catalytic cracking of catalytic gas oil	6
40	T. C. C.	11
41	Delayed coking	10
42	F. C. C.	13
43	F. C. C.	13
43-1	MEK - Benzol solvent dewaxing	18
44	F. C. C.	6,14
45	Non-catalytic cracking of catalytic gas oil	6
46	F. C. C.	7,12
47	Non-catalytic cracking of catalytic gas oil	7
48	F. C. C.	14
49	Hydroforming	10
50	Houdry	15
51	Houdry	15
52	Dubbs coking	8
53	Dubbs coking	8
54	Catalytic feed to non-catalytic cracking	7
55	Non-catalytic cracking of catalytic gas oil	7
56	Straight run distillation	17
57	Wax pressing	18
58	Naphtha reforming	10
59	Non-catalytic cracking of virgin gas oil	5
60	T. C. C.	11
61	Non-catalytic cracking of catalytic gas oil	7
62	Acid treating	19
63	Houdry	7,15
64	Non-catalytic cracking of catalytic gas oil	7
65	Non-catalytic cracking of virgin gas oil	5
66	Viscosity breaking	8
67	Viscosity breaking	8
68	F. C. C.	14
69	Polyforming	10
70	Solvent extraction	16

INDEX TO TABLE I

API Sample Number	Process	Appendix Page Number
71	T. C. C.	11,21
71-1	Chromatography	21
71-2	Chromatography	21
72	Non-catalytic cracking of virgin gas oil	5
73	F. C. C.	14
74	Delayed coking	9
75	Solvent extraction	16
76	Naphtha reforming	10
77	Hydroforming	10
78	T. C. C.	11
79	Straight run distillation	17
81	Houdry	15
82	T. C. C.	11
83	Air oxidation	21
83-1	Air oxidation	21
83-2	Chromatography	21
84	Delayed coking	9
85	F. C. C.	14
86	Steam cracking	8
87	Batch coking	9
88	F. C. C.	12
89	F. C. C.	12
90	Delayed coking	9
91	F. C. C.	7,12
92	Non-catalytic cracking of catalytic gas oil	8
93	Non-catalytic cracking of catalytic gas oil	8
94	Non-catalytic cracking of virgin gas oil	5
96	Delayed coking	9
97	Delayed coking	9
98	Delayed coking	9
99	Lubricating oil	18
100	Lubricating oil	18
101	F. C. C.	12
102	F. C. C.	12
103	Delayed coking	10
104	F. C. C.	12
105	Straight run distillation	17
108	Non-catalytic cracking of virgin gas oil	5
109	T. C. C.	11
110-1	Fractional distillation	18
111-4	Fractional distillation	18
111-6	Dilution of No. 111-4	18
111-7	Dilution of No. 111-4	18
112-1	Fractional distillation	18
112-3	Fractional distillation	18
113	Fuel oil blending	19
114	Straight run distillation	17,19
114-1	Viscosity effects	19
115	Straight run distillation	17

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

PROCESS	API SAMPLE NUMBER	PRODUCT	ANALYTICAL DATA					
			GRAVITY	VISCOSITY	DISTILLATION (2mm corr. to 760mm)			
					<750° (%)	750-925° (%)	>925° (%)	E.P. (°F.)
Non-catalytic cracking of virgin gas oil	2	Cracked sidestream	21.2	33/100° SSU				
"	6	Cracked residuum	5.2		33	26	41	-
"	59	Cracked residuum	8.5			32		-
"	65	Cracked residuum	6.6	163.5/100° SSU	43.8	29.9	26.3	-
"	72	Cracked residuum	9.6	37.1/122° SSF	35	37.5	27.5	-
"	94	Cracked residuum	10.4	31.7/122° SSF	35	48	17	-
"	108	Cracked residuum	2.3	1530/130° SSU	32	25.5	41.9	-
Non-catalytic cracking of catalytic gas oil	20	Cracked residuum	4.7	132/122° SSF	51	33	16	-
Dilution of No. 20	20-1	50% oil No.20, 50% dodecyl-benzene						
Non-catalytic cracking of catalytic gas oil	23	FCC gas oil feed	26.7	55.5/100° SSU	78.5	20.6	.9	838

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

API SAMPLE NUMBER	BIOLOGICAL DATA: STRAIN OF MICE AND NUMBER OF APPLICATIONS PER WEEK	DOSAGE PER APPLICATION (mg.)	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./weeks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)	RELATIVE CARCINOGENIC POTENCY, P_{MC}
2	C3H 1	100	20	14[1]	0/75	-	-
6	CFW 3	100	30	21	76/30	20.5^{+5}_{-1}	$0.06^{+.01}_{-.03}$
59	C3H 3	100	20	11	82/69	41.7^{+13}_{-2}	-
65	C3H 3	100	20	9	89/29	20.4^{+2}_{-4}	$0.11^{+.03}_{-.01}$
72	C3H 3	100	20	15	73/18	13.7 ± 1	$\sim 0.17^{+.04}_{-.02}$
94	C3H 3	100	20	10	60/39	25^{+13}_{-1}	$0.08^{+.01}_{-.04}$
108	C3H 3	100	20	7	71/28	21.8^{+4}_{-1}	$0.1^{+.01}_{-.02}$
108	C3H 3	5	20	20	0/3	-	-
20	CFW 3	100	20	15	100/22	13.7^{+2}_{-1}	$\sim 0.11\pm.02$
20	C3H 3	100	20	10	90/21	17^{+1}_{-2}	$0.13^{+.02}_{-.01}$
20-1	CFW 3	100	20	17	100/25	14.4^{+2}_{-1}	$0.10^{+.01}_{-.02}$
23*	CFW 3	100	20	20	100/19	10^{+3}_{-1}	-
23*	C3H 2	100	20	18	94/28	17.2 ± 2	$\sim 0.18^{+.02}_{-.01}$

[1] Number alive after 52 weeks.

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

PROCESS	API SAMPLE NUMBER	PRODUCT	ANALYTICAL DATA					
			GRAVITY	VISCOSITY	DISTILLATION (2mm corr. to 760 <750° - (%)	750-925° (%)	>925° (%)	[illegible] (%)
Non-catalytic cracking of catalytic gas oil	24	Cracked residuum from No. 23	5.9	51.9/210° SSU	32.3	34.6	33.1	.
"	29	TCC gas oil feed	15.7	70/100° SSU	73	27	-	8
"	30	Cracked residuum from No. 29	8.5	10/210° SSF	36	38	26	.
"	34	Houdry gas oil feed	28.0	47.5/100° SSU		9		8
"	35	Cracked residuum from No. 34	2.7	2320/100° SSU	35	28	37	.
"	38	Total cracking charge; combination unit	16.1		32.2	23.3	43.1	.
"	39	Cracked residuum from No. 38	7.8	177/122° SSF	31.0	19.8	48.4	.
"	44	FCC decanted oil feed	15.2	241/100° SSU	31.1	54.2	13.6	.
"	45	Cracked residuum from No. 44	-1.7	179/122° SSF	26.4	33.4	39	.

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

API SAMPLE NUMBER	BIOLOGICAL DATA							
	STRAIN OF MICE AND NUMBER OF APPLICATIONS PER WEEK	DOSAGE PER APPLICATION (mg.)	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS T.I./weeks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)	RELATIVE CARCINOGENIC POTENCY, P_{MC}
24	CFW 3	100	19	18	100/15	8.5^{+2}_{-1}	-
29	C3H 1	100	20	19	84/30	19.3^{+9}_{-2}	$0.39^{+.09}_{-.21}$
30*	C3H 1	100	20	13	92/33	24^{+3}_{-2}	$\sim 0.23^{+.05}_{-.04}$
34*	CFW 3	100	18	17	94/32	19.5^{+3}_{-1}	$0.06^{+}_{-}.01$
35	CFW 3	100	20	15	87/20	15.6^{+2}_{-1}	$0.09^{+.01}_{-.02}$
38	CFW 3	100	20	13	62/58	29.3^{+10}_{-1}	$\sim 0.02^{+}_{-}.01$
39	CFW 3	100	20	11	54/24	21.5^{+2}_{-1}	$\sim 0.05^{+}_{-}.01$
39	CFW 3	100	10	7	57/20	16.4^{+3}_{-1}	$0.09^{+.01}_{-.02}$
44	C3H 1	100	20	16	94/40	27^{+7}_{-3}	$\sim 0.19^{+.04}_{-.06}$
45	C3H 1	100	20	9	89/41	30.1^{+6}_{-3}	$\sim 0.16^{+.03}_{-.04}$

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

PROCESS	API SAMPLE NUMBER	PRODUCT	ANALYTICAL DATA					
			GRAVITY	VISCOSITY	DISTILLATION (2mm corr. to 760mm)			
					<750° (%)	750-925° (%)	>925° (%)	E. P. (°F.)
Non-catalytic cracking of catalytic gas oil	46	FCC gas oil feed			87.9	12.1	0	780
"	47	Cracked residuum from No. 46			76	15.5	8.5	-
"	54	Total cracking charge	33.0	7.8/122° SSF	93.9	4.1	2.0	822
"	55	Cracked residuum from No. 54	4.2	18.8/122° SSF	55.9	26.1	18	-
"	61	Cracked residuum	6.3	73.6/100° SSU	66.8	18.2	15	-
"	63	Houdry gas oil feed	25.6	25.7/100° SSU	48.5	37.6	13.9	-
"	64	Cracked residuum from No. 63	19.9	31.8/100° SSU	52.5	31.8	15.7	-
"	91	FCC gas oil feed	20.4	57.8/100° SSU	80.1	17.9	2.0	830

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

API SAMPLE NUMBER	BIOLOGICAL DATA						
	STRAIN OF MICE AND NUMBER OF APPLICATIONS PER WEEK	DOSAGE PER APPLICATION (mg.)	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./weeks	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)	RELATIVE CARCINOGENIC POTENCY, P_{MC}
46*	CFW 3	100	20	15	100/24	16^{+3}_{-1}	$0.09^{+.01}_{-.02}$
47	CFW 3	100	20	14	93/17	11.6^{+5}_{-1}	-
54	CFW 3	100	20	16	100/36	23.4^{+3}_{-1}	$\sim 0.04 \pm .01$
55	CFW 3	100	19	15	87/21	13.2^{+4}_{-1}	$\sim 0.12^{+.03}_{-.04}$
61	CFW 3	100	20	17	88/26	13.6^{+7}_{-1}	$\sim 0.12^{+.02}_{-.06}$
63*	C3H 3	100	20	18	89/26	19^{+2}_{-1}	$0.12^{+.01}_{-.02}$
63	C3H 1	100	20	19	37/36	-	-
63	C3H 2	100	20	18	100/33	21.8^{+4}_{-1}	$\sim 0.15^{+.01}_{-.02}$
63	C3H 3	100	19	15	100/19	15.4 ± 1	$0.15 \pm .01$
64*	C3H 3	100	20	13	100/23	15.8^{+2}_{-1}	$0.14^{+.01}_{-.02}$
91*	C3H 2	100	20	19	95/23	16 ± 1	$\sim 0.19 \pm .01$

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

PROCESS	API SAMPLE NUMBER	PRODUCT	ANALYTICAL DATA					
			GRAVITY	VISCOSITY	DISTILLATION (2mm corr. to 760mm)			
					<750° (%)	750-925° (%)	>925° (%)	E.P. (°F.)
Non-catalytic cracking of catalytic gas oil	92	Cracked residuum from No. 91	6.1	102.5/100° SSU	70.5	27	2.5	-
"	93	Cracked residuum	7.9	49.4/100° SSU	87	4.5	8.5	-
Steam cracking	86	Cracked residuum	3.5	5000/100° SSU	51.9	28.4	18[1]	880[1]
Viscosity breaking	18	Cracked residuum from No. 17	3.1	1123/210° SSU	23.7	24	52.3	-
"	66[2]	Cracked residuum	6.5	18/210° SSF	22.1	29	48.9	-
"	67[2]	Cracked sidestream from fractionator producing No. 66	15.6	81/100° SSU	84.6	10.7	4.7	-
Dubbs coking	52[2]	Cracked sidestream	21.0	43.5/100° SSU	95.2	2.5	2.3	-
"	53[2]	Blowdown oil	10.5	203/100° SSU	61.3	23.3	15.4	-

[1] Distillation stopped when cracking occurred.

[2] Feed to unit included catalytically cracked components.

API 05435

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

API SAMPLE NUMBER	BIOLOGICAL DATA						
	STRAIN OF MICE AND NUMBER OF APPLICATIONS PER WEEK	DOSAGE PER APPLICATION (mg.)	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./weeks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)	RELATIVE CARCINOGENI POTENCY, P_{MC}
92	C3H 2	100	20	14	78/23	14^{+6}_{-1}	$\sim 0.21^{+.02}_{-.05}$
93	C3H 3	100	20	18	94/30	$27.3^{+}_{-}1$	$0.07^{+}_{-}.01$
86	C3H 1	100	20	17	100/49	35^{+3}_{-1}	$\sim 0.12^{+.01}_{-.02}$
18	CFW 3	100	10	9	56/30	18^{+11}_{-4}	$0.07^{+.04}_{-.05}$
18	CFW 3	100	20	6	50/25	-	-
66	C3H 2	100	20	19	100/37	28.2^{+2}_{-1}	$\sim 0.11^{+}_{-}.01$
67	C3H 2	100	20	13	77/17	11.7^{+2}_{-1}	-
52	CFW 3	100	20	15	87/36	19.7^{+11}_{-1}	$0.06^{+.01}_{-.04}$
53	CFW 3	100	20	20	100/15	8^{+4}_{-1}	-

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

PROCESS	API SAMPLE NUMBER	PRODUCT	ANALYTICAL DATA					
			GRAVITY	VISCOSITY	DISTILLATION (2mm corr. to 760mm)			
					<750° (%)	750-925° (%)	>925° (%)	E.P. (°F.)
Batch coking	87	Cracked sidestream	14.9	500/100° SSU				
Delayed coking	28	Cracked sidestream	15.3	361/100° SSU		42.4		-
"	74	Total furnace charge (including recycle)	12.5	198/122° SSF	22.3	32.5	45.2	-
"	33	Cracked sidestream from No. 74	16.8	131.4/100° SSU	60	38.1	1.9	-
"	84	Cracked sidestream	30.2	55/100° SSU	79	19.9	1.1	-
"	90	Cracked sidestream	30.5	40.6/100° SSU	90.2	9.2	.6	850
"	96	Cracked sidestream	33.2	43.7/100° SSU	77.7	22.2	.1	924
"	97	Total furnace charge (including recycle)	16.6	386/100° SSU	57.8	32.2	10	-
"	98	Cracked sidestream from No. 97	31.0	38.1/100° SSU	100			740

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

API SAMPLE NUMBER	BIOLOGICAL DATA						
	STRAIN OF MICE AND NUMBER OF APPLICATIONS PER WEEK	DOSAGE PER APPLICATION (mg.)	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./weeks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)	RELATIVE CARCINOGENIC POTENCY, P_{MC}
87	C3H 3	100	20	12	17/5	-	-
87	C3H 2	20	20	11	91/30	20.5 ± 4	$\sim 0.16 \pm .03$
87	C3H 2	100	20	14	14/11	-	-
28*	CFW 3	100	20	19	84/15	10.6^{+2}_{-1}	-
28	C3H 1	100	20	19	84/51	24.2^{+6}_{-1}	$\sim 0.23^{+.02}_{-.07}$
74	C3H 2	100	20	16	94/47	29^{+7}_{-2}	$\sim 0.11^{+.01}_{-.04}$
33*	CFW 3	100	20	18	95/15	8^{+2}_{-1}	-
33*	C3H 1	100	20	19	95/30	15.5^{+5}_{-1}	$0.56^{+.04}_{-.23}$
84	C3H 3	100	20	19	95/24	15.6^{+2}_{-1}	$0.15^{+.01}_{-.02}$
90	C3H 3	100	20	17	100/38	21.7^{+4}_{-3}	$0.10 \pm .02$
96	C3H 3	100	20	15	93/27	16.2^{+3}_{-1}	$0.14^{+.01}_{-.02}$
97	C3H 3	100	20	15	87/22	16.3^{+2}_{-4}	$0.14^{+.04}_{-.02}$
98	C3H 3	100	20	11	73/39	24.8^{+2}_{-8}	$0.08^{+.05}_{-.01}$

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

PROCESS	API SAMPLE NUMBER	PRODUCT	ANALYTICAL DATA					
			GRAVITY	VISCOSITY	DISTILLATION (2mm corr. to 760mm)			
					<750° (%)	750-925° (%)	>925° (%)	E.P. (°F.)
Delayed coking	103	Cracked sidestream	25.2	135/100° SSU	43.9	35.1	20.4	-
"	41	Wax tailings, 50% benzene	1.2	131/240° SSF	9.6	49.8	40.6	-
Naphtha reforming	19	Cracked residuum	17.0	39.7/100° SSU	91	8.95	0	910
"	58	Cracked residuum	6.3	117/122° SSF	85	14.3	0	860
"	76	Cracked residuum	30.6	31/130° SSU	~91	8		860
Polyforming	13	Cracked residuum	10.1	154/100° SSU	63	15	22[1]	890[1]
"	37	Cracked residuum	11.2	60.2/100° SSU	66	15	19[1]	862[1]
"	69	Cracked residuum	15.9	43/130° SSU	75.1	8.3	16.6	-
Hydroforming	49	Cracked residuum	10.1		~95	3.5		~915
"	77	Cracked residuum	22.8		100			670

[1] Distillation stopped when cracking occurred.

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

API SAMPLE NUMBER	BIOLOGICAL DATA						
	STRAIN OF MICE AND NUMBER OF APPLICATIONS PER WEEK	DOSAGE PER APPLICATION (mg.)	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./weeks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)	RELATIVE CARCINOGENIC POTENCY, P_{MC}
103	C3H 3	100	20	17	94/23	14.2^{+3}_{-1}	$0.16^{+.01}_{-.03}$
41	C3H 2	100	20	13	85/25	20.6^{+3}_{-6}	$\sim 0.16^{+.05}_{-.02}$
19	CFW 3	100	20	11	100/37	27^{+2}_{-12}	$\sim 0.03^{+.07}_{-.01}$
58	CFW 3	100	30	24	88/31	18.5^{+8}_{-1}	$0.07^{+.01}_{-.04}$
76	CFW 3	100	29	28	96/52	21.8^{+5}_{-1}	$\sim 0.05^{+.01}_{-.02}$
13*	CFW 3	100	30	16	94/38	24.3^{+3}_{-5}	$\sim 0.04^{+.02}_{-.01}$
13	CFW 2	100	30	28	86/44	23.4^{+7}_{-2}	-
37	CFW 3	100	20	12	92/46	26^{+1}_{-5}	$\sim 0.03^{+.02}_{-.01}$
37	CFW 3	100	10	5	100/30	19.5^{+7}_{-1}	$0.06^{+.01}_{-.02}$
69	CFW 3	100	20	18	78/30	21.4^{+6}_{-1}	$\sim 0.05^{+.01}_{-.02}$
49	C3H 1	100	20	19	84/41	34.4^{+2}_{-1}	$\sim 0.13 \pm .01$
77	CFW 3	100	20	19	89/41	28^{+6}_{-2}	$\sim 0.03 \pm .01$

TABLE I

SKIN PAINTING EXPERIMENTS OF HIGH BOILING SAMPLES

PROCESS	API SAMPLE NUMBER	PRODUCT	ANALYTICAL DATA					
			GRAVITY	VISCOSITY	DISTILLATION (2mm. corr. to 760mm)			
					<750° (%)	750-925° (%)	>925° (%)	E.P. (°F.)
T. C. C.	3	Cracked sidestream	33.2	32.7/100° SSU				
"	60	Cracked sidestream	24.9	40/100° SSU	100			
"	109	Cracked sidestream	24.1	46.1/100° SSU				
"	7	Cracked residuum	20.2	34.5/100° SSU	~100			
"	9	Cracked residuum	18.4		97	2.33	-	780
"	10	Cracked residuum	11.6	117/100° SSU	56.7	36.6	6.7	-
"	31	Cracked residuum	16.0	14.8/122° SSF		35.6		870
"	36	Cracked residuum	21.9	90/100° SSU		48		892
"	40	Cracked residuum	19.8		77.2	22.2	.65	860
"	71	Cracked residuum	22.8	59/100° SSU	77	21.5	1.5	845
"	78	Cracked residuum	16.1		45.7	44.3	10	-
"	82	Cracked residuum	13.6	126/130° SSU	25.7	51.5	22.8	-

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

API SAMPLE NUMBER	BIOLOGICAL DATA							
	STRAIN OF MICE AND NUMBER OF APPLICATIONS PER WEEK	DOSAGE PER APPLICATION (mg.)	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS T.I./weeks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)	RELATIVE CARCINOGENIC POTENCY, P_{MC}
3	C3H 1	100	20	9[1]	0/62	-	-
60	CFW 3	100	20	14	57/48	37.5^{+9}_{-4}	~ 0.01
109	C3H 3	100	20	15	93/25[a]	16.7 ± 2	$0.14^{+.02}_{-.02}$
7	C3H 1	100	20	9[1]	11/55	-	-
9*	C3H 3	100	10	9	100/47	33.8^{+4}_{-1}	$\sim 0.05 \pm .01$
9*	CFW 3	100	20	16	100/41	27.8^{+5}_{-4}	$\sim 0.03 \pm .01$
10*	C3H 1	100	20	17	94/39	22.5^{+7}_{-2}	$0.26^{+.08}_{-.09}$
31	C3H 1	100	20	17	100/32	19.3^{+4}_{-1}	$0.39^{+.05}_{-.14}$
36	C3H 1	100	20	16	94/44	31.3^{+5}_{-7}	$\sim 0.15^{+.08}_{-.04}$
40	C3H 1	100	20	9	100/42	32.2 ± 3	$\sim 0.14^{+.03}_{-.01}$
71	C3H 1	100	20	20	90/22	15^{+4}_{-1}	$0.58^{+.05}_{-.18}$
78	C3H 1	100	19	17	82/20	14.8 ± 1	$0.59 \pm .04$
82	C3H 1	100	20	20	95/34	26^{+2}_{-8}	$\sim 0.2^{+.25}_{-.02}$

[1] Number alive after 52 weeks.

[a] Crusts, comparable to those produced by dodecylbenzene, developed in the early stages of the test on API-109 and were sloughed after 7-10 weeks.

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

PROCESS	API SAMPLE NUMBER	PRODUCT	ANALYTICAL DATA					
			GRAVITY	VISCOSITY	DISTILLATION (2mm corr. to 760mm)			
					<750° (%)	750-925° (%)	>925° (%)	E.P. (°F.)
F. C. C.	4	Cracked sidestream	21.6					
"	23	Cracked sidestream	26.7	55.5/100° SSU	78.5	20.6	.9	838
"	46	Cracked sidestream			87.9	12.1	0	780
"	88	Cracked sidestream	22.5	78/100° SSU	69.3	30.2	.5	900
"	89	Cracked sidestream	27.0	51/100° SSU	100			745
"	91	Cracked sidestream	20.4	57.8/100° SSU	80.1	17.9	2.0	830
"	101	Cracked sidestream	24.8	40.1/100° SSU	89.7	9.1	.3	790
"	102	Cracked sidestream	23.5	53.1/100° SSU	99	-	1	750
"	104	Cracked sidestream				7.6		

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

API SAMPLE NUMBER	BIOLOGICAL DATA							
	STRAIN OF MICE AND NUMBER OF APPLICATIONS PER WEEK	DOSAGE PER APPLICATION (mg)	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./weeks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)	RELATIVE CARCINOGENIC POTENCY, P_{MC}
4	C3H 1	100	20	9[1]	0/69	-	-
23*	CFW 3	100	20	20	100/19	10^{+3}_{-1}	-
23*	C3H 2	100	20	18	94/28	17.2±2	$\sim 0.18^{+.02}_{-.01}$
46*	CFW 3	100	20	15	100/24	16^{+3}_{-1}	$0.09^{+.01}_{-.02}$
88	C3H 2	100	20	18	94/26	15.2^{+2}_{-1}	$\sim 0.20 \pm .01$
89	C3H 3	100	30	28	89/21	12^{+2}_{-1}	-
91*	C3H 2	100	20	19	94/23	16±1	$\sim 0.19 \pm .01$
101[2]	C3H 3	100	20	6	100/12	7	-
102	C3H 2	20	20	20	0/3	-	-
102	C3H 2	100	20	20	0/3	-	-
104	C3H 3	100	20	5	100/12	7	-
104	C3H 2	100	20	20	0/3	-	-
104	C3H 2	20	20	20	0/3	-	-

[1] Number alive after 52 weeks.

[2] Crusts, comparable to those produced by dodecylbenzene, developed in the early stages of the test on API-101 and were sloughed after 5 to 6 weeks.

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

PROCESS	API SAMPLE NUMBER	PRODUCT	ANALYTICAL DATA					
			GRAVITY	VISCOSITY	DISTILLATION (2mm corr. to 760mm)			
					<750° (%)	750-925° (%)	>925° (%)	E.P. (°F.)
F. C. C.	8	Cracked residuum	11.1	110.3/100° SSU	75	22		890
Dilution of No. 8	8-4	50% oil No. 8, 50% (white oil + W.Texas residuum)						
"	8-16	50% oil No. 8, 50% sec.-amylbenzene						
"	8-21	50% oil No. 8, 50% colorless fraction from No. 8 obtained by chromatography						
F. C. C.	12	Cracked residuum	18.1	71/100° SSU				
"	26	Cracked residuum			61.3	34.1	4.6	-
"	42	Cracked residuum	14.2	139.8/100° SSU	28.6	63.6	7.8	-
"	43	Cracked residuum	24.2	Pour Point 110°	24.5	67.8	7.7	-

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

API SAMPLE NUMBER	BIOLOGICAL DATA							
	STRAIN OF MICE AND NUMBER OF APPLICATIONS PER WEEK	DOSAGE PER APPLICATION (mg.)	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./week)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)	RELATIVE CARCINOGENIC POTENCY, P_{MC}
8*	C3H 3	100	30	23	91/16	7.6^{+4}_{-1}	-
8	C3H 2	100	20	17	94/14	5.7^{+4}_{-1}	-
8*	C3H 1	100	20	17	94/24	14.4^{+2}_{-1}	$0.61^{+.05}_{-.09}$
8	C3H 1	20	20	19	100/50	33.7^{+9}_{-8}	$\sim 0.13^{+.07}_{-.03}$
8	C3H 1	5	40	40	0/3	-	-
8	C3H 1	20	40	40	0/3	-	-
8	C3H 1	50	40	40	0/3	-	-
8-4	C3H 3	100	30	21	86/23	16.6^{+2}_{-1}	$0.14^{+.01}_{-.02}$
8-16	C3H 1	100	20	19	100/52	31.2^{+4}_{-6}	$\sim 0.15^{+.06}_{-.03}$
8-21	C3H 1	100	20	17	70/27	20.2^{+2}_{-3}	$0.35^{+.14}_{-.08}$
12	CFW 1	100	18	17	88/34	14.7	-
12	CFW 3	100	15	14	100/14	8^{+2}_{-1}	-
26	C3H 1	100	20	19	100/20	12^{+3}_{-1}	$0.72^{+.04}_{-.14}$
42	C3H 1	100	20	18	94/34	22.4±1	$0.27^{+.03}_{-.02}$
43	C3H 1	100	20	15	100/37	33.4±3	$\sim 0.14 \pm .02$

TABLE I

SKIN PAINTING EXPERIMENTS OF HIGH BOILING SAMPLES

PROCESS	API SAMPLE NUMBER	PRODUCT	ANALYTICAL DATA					
			GRAVITY	VISCOSITY	DISTILLATION (2mm corr. to 760mm)			
					<750° (%)	750-925° (%)	>925° (%)	E.P. (°F.)
F. C. C.	44	Cracked residuum	15.2	241/100° SSU	31.1	54.2	13.6	-
"	48	Cracked residuum	6.0	91.7/100° SSU	47.1	37.3	15.6	-
"	68	Cracked residuum	9.8	81/130° SSU	43.3	44.9	11.8	-
"	73	Cracked residuum	17.5	16.9/122° SSF	21	62	17	-
"	85	Cracked residuum	8.1	216/100° SSU	42.6	47.8	9.6	-

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

API SAMPLE NUMBER	BIOLOGICAL DATA						
	STRAIN OF MICE AND NUMBER OF APPLICATIONS PER WEEK	DOSAGE PER APPLICATION (mg)	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./weeks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)	RELATIVE CARCINOGENIC POTENCY, P_{MC}
(44)	C3H 1	100	20	16	94/40	27^{+7}_{-3}	$\sim 0.19^{+.04}_{-.06}$
48	C3H 1	100	19	13	100/36	30.1^{+4}_{-3}	$\sim 0.16^{+.03}_{-.02}$
68	C3H 1	100	20	15	100/17	13.5^{+5}_{-1}	$0.65^{+.05}_{-.22}$
73	C3H 1	100	20	12	83/22	18^{+4}_{-2}	$0.45^{+.09}_{-.18}$
73	C3H 1	100	20	20	95/31	22.5^{+4}_{-2}	$0.26^{+.08}_{-.07}$
85	C3H 1	100	20	18	100/25	15^{+5}_{-1}	$0.58^{+.05}_{-.22}$

TABLE I

SKIN PAINTING EXPERIMENTS O[illegible] HIGH BOILING SAMPLES

PROCESS	API SAMPLE NUMBER	PRODUCT	ANALYTICAL DATA					
			GRAVITY	VISCOSITY	DISTILLATION (2mm corr. to 760mm)			
					<750° (%)	750-925° (%)	>925° (%)	E.P. (°F.)
Houdry	11	Cracked residuum	4.3	71/100° SSU	84	16	0	880
"	34	Cracked residuum	28.0	47.5/100° SSU		9		815
"	50	Cracked residuum	21.3	64/100° SSU	85	15	0	820
"	51	Cracked residuum	25.7	67/100° SSU	83	17	0	811
"	63	Cracked residuum	25.6	25.7/100° SSU	48.5	37.6	13.9	-
"	81	Cracked residuum	22.7	40/210° SSU	40.8	52.6	6.6	-
Cycloversion	22	Cracked residuum	25.6		49.5	44.2	6.3	-

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SKIN PAINTING EXPERIMEN 'S ON HIGH BOILING SAMPLES

API SAMPLE NUMBER	BIOLOGICAL DATA						
	STRAIN OF MICE AND NUMBER OF APPLICATIONS PER WEEK	DOSAGE PER APPLICATION (mg.)	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./weeks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)	RELATIVE CARCINOGENIC POTENCY, P_{MC}
11	C3H 3	100	20	19	89/19	13.5^{+3}_{-2}	$\sim 0.17 \pm .03$
34*	CFW 3	100	18	17	94/32	19.5^{+3}_{-1}	$0.06 \pm .01$
50	CFW 3	100	20	16	100/21	13.8^{+2}_{-1}	$\sim 0.11 \pm .02$
51	CFW 3	100	20	18	83/19	12.6^{+3}_{-1}	-
63*	C3H 3	100	20	18	89/26	19^{+2}_{-1}	$0.12^{\pm .01}_{-.02}$
63	C3H 3	100	19	15	100/19	15.4 ± 1	$0.15 \pm .01$
63	C3H 2	100	20	18	100/33	21.8^{+4}_{-1}	$\sim 0.15^{\pm .01}_{-.02}$
63	C3H 1	100	20	19	37/36	-	-
81	C3H 1	100	20	20	100/36	26.3^{+5}_{-9}	$\sim 0.20^{\pm .28}_{-.05}$
81	C3H 1	100	40	40	0/3	-	-
81	C3H 1	20	40	40	0/3	-	-
22	CFW 3	100	20	15	93/17	10^{+2}_{-1}	-

TABLE .

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

PROCESS	API SAMPLE NUMBER	PRODUCT	ANALYTICAL DATA					
			GRAVITY	VISCOSITY	DISTILLATION (2mm corr. to 760mm)			
					<750° (%)	750-925° (%)	>925° (%)	E.P. (%)
Solvent extraction	14	Furfural extract from Kansas 200 stock	10.3	1910/100° SSU	30.3	69.7	-	902
"	15	Furfural extract from Oklahoma 400 Pale	10.9	10303/100° SSU	14.7	85.3	-	-
"	16	Phenol extract from Coastal 900-X	9.7	352/210° SSU		62		910
"	17	Duosol extract from California waxy residuum, 50% in sec.-amyl benzene	7.1	2276/210° SSU	3	28.7	68.3	-
"	27	Phenol extract from San Joaquin naphthenic distillate	11.0	173/100° SSU		19		910
"	70	Nitro-benzene extract from Barbers Hill 60/80	15.7	99.4/210° SSU	.5	85.3	14.2	-
"	75	SO_2 extract from TCC gas oil	14.4	38.3/100° SSU	100			

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

API SAMPLE NUMBER	BIOLOGICAL DATA							
	STRAIN OF MICE AND NUMBER OF APPLICATIONS PER WEEK	DOSAGE PER APPLICATION (mg.)	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./weeks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)	RELATIVE CARCINOGENIC POTENCY, P_{MC}
14	CFW 3	100	20	9	33/14	-	-
15	CFW 3	100	30	0*	0/14	-	-
16	CFW 3	100	10	6	67/73	-	-
16	C3H 3	100	10	7	43/70	-	-
17	CFW 3	100	20	12	67/62	25^{+7}_{-2}	$\sim 0.03 \pm .01$
27	CFW 3	100	20	12	83/17	13^{+2}_{-1}	$\sim 0.13 \pm .03$
70	CFW 3	100	20	6	50/25	22.2^{+3}_{-1}	$\sim 0.05^{+.01}_{-.02}$
70	C3H 3	100	20	14	93/44	34.8^{+3}_{-8}	$\sim 0.05^{+.02}_{-.01}$
75	CFW 3	100	20	13	77/51	29.4^{+9}_{-1}	$\sim 0.02 \pm .01$

* All animals dead in 14 weeks.

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

PROCESS	API SAMPLE NUMBER	SPECTRUM TYPE[1] OR PRODUCT	ANALYTICAL DATA					
			GRAVITY	VISCOSITY	DISTILLATION (2mm corr. to 760mm)			
					<750° (%)	750-925° (%)	>925° (%)	E.P. (°F.)
Straight run distillation	1	Distillate # 11896	31.9	37/100° SSU				
"	56	Waxy Midcontinent distillate, Type B (.5)	29.9	87/100° SSU	52.4	41.6	(2.0)	830
"	79	San Joaquin naphthenic distillate, Type C (2.2)	16.6	63.9/210° SSU	~13	86.2		855
"	105	West Texas paraffin distillate, Type B (.5)	28.9	54.3/100° SSU	72.9	23.4	3.3	-
"	114	Type B (.63)	24.6	235/100° SSU				
"	115	Type C (.58)	23.2	234/100° SSU				
"	5	Residuum from Wilmington crude #11885	12.8	572/12[illegible]° SSF	26	26	48	-
Distillation	25	700°+ bottoms from F.C.C. heavy cycle gas oil	24.3	115/100° SSU	49	45	6	-
Dilution of No. 25	25-1	50% oil No.25, 50% (White oil + W. Texas residuum)						

[1] See page 8 of Section A of report dated April 5, 1952, for discussion of the classification of Straight Run Distillates by Spectrum Type.

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

API SAMPLE NUMBER	BIOLOGICAL DATA						
	STRAIN OF MICE AND NUMBER OF APPLICATIONS PER WEEK	DOSAGE PER APPLICATION (mg.)	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./weeks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)	RELATIVE CARCINOGENIC POTENCY, P_{MC}
1	C3H 1	100	20	2[1]	0/72	-	-
56	CFW 6	100	20	16	81/22	14.7^{+3}_{-1}	-
56	CFW 3	100	20	17	88/22	16.4^{+2}_{-1}	$0.09 \pm .01$
79	C3H 2	100	20	4	100/33	-	-
79	C3H 2	100	20	15	67/57	30.8^{+9}_{-5}	$\sim 0.10 \pm .02$
105	C3H 3	100	20	17	88/33	21.2^{+6}_{-3}	$0.1^{+.02}_{-.03}$
114							
115							
5	C3H 1	100	20	2[1]	0/[illegible]	-	-
25	C3H 3	100	30	22	82/19	12.5^{+3}_{-1}	-
25-1	C3H 3	100	30	26	92/40	23^{+6}_{-3}	$0.09^{+.02}_{-.03}$

[1] Number alive after 52 weeks.

TABLE

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

PROCESS	API SAMPLE NUMBER	SPECTRUM TYPE[1] OR PRODUCT	ANALYTICAL DATA					
			GRAVITY	VISCOSITY	DISTILLATION (2mm corr. to 760mm.)			
					<750° (%)	750-925° (%)	>925° (%)	E.P. (°F.)
Fractional distillation	110-1	Type B (.004)	61.0	.95/70°F[2]	100			
"	111-4	Type B (1.62)	23.0	17/140°F[2]				
Dilution of No. 111-4	111-6	50% No. 110-1 50% No. 111-4						
"	111-7	50% No. 111-4 50% No. 112-1						
Fractional distillation	112-1	Type B (.016)	65.9					
"	112-3	Type B (.045)	39.7					
Lubricating oil	99	Type C (.5)	20.0	52/210° SSU	~38			
"	100	Type B (.3)	29.5	53/210° SSU	~0			
Wax pressing	32	Dewaxed paraffin distillate fraction from Lima crude						
"	57	Dewaxed oil from No. 56	28.7	91.3/100° SSU	80	19.5	.5	898
MEK - Benzol solvent dewaxing	43-1	Dewaxed oil from F.C.C. decanted oil No. 43	12.9	195/100° SSU	29.5	57	13.5	-

[1] See page 8 of Section A of report dated April 5, 1952 for discussion of the classification of Straight Run Distillates by spectrum type.

[2] Kinematic viscosity (centistokes).

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

API SAMPLE NUMBER	BIOLOGICAL DATA							
	STRAIN OF MICE AND NUMBER OF APPLICATIONS PER WEEK	DOSAGE PER APPLICATION (mg.)	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./weeks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)	RELATIVE CARCINOGENIC POTENCY, P_{MC}
110-1	C3H 3	20	20	20	0/22	-	-
111-4	C3H 3	20	19	17	88/22	16.6 ± 1	$0.14 \pm .01$
111-6	C3H 3	20	20	20	20/22	-	-
111-7	C3H 3	20	20	20	30/22	-	-
112-1	C3H 3	20	20	20	0/22	-	-
112-3	C3H 3	20	20	20	10/20	-	-
99	C3H 3	100	20	16	94/47	28.5 ± 4	$0.07 \pm .02$
100	C3H 3	100	20	18	0/49	-	-
32	CFW (3-6)[1]	100	20	15	[illegible]	30.8^{+3}_{-2}	-
57*	CFW 6	100	20	17	100/25	15^{+3}_{-1}	-
43-1	C3H 1	100	20	19	94/25	19.2^{+3}_{-1}	$0.40^{+.05}_{-.13}$

[1] Three applications per week for 14 weeks, six applications per week thereafter.

TABLE I

SKIN PAINTING EXPERIMENTS O.' HIGH BOILING SAMPLES

PROCESS	API SAMPLE NUMBER	PRODUCT	ANALYTICAL DATA					
			GRAVITY	VISCOSITY	DISTILLATION (2mm corr. to 760mm)			
					<750° (%)	750-925° (%)	>925° (%)	E.P. (°F.)
Filtration dewaxing of No. 8	8-3	Press oil, 85% of original (.94% S)	11.3		65	21.4	13.4	-
Desulfurization of 8-3 hydrogenation	21	Hydrogenated heavy gas oil (.15% S)	18.1		74	20	6	-
Acid treating	62	Hydrolyzed acid sludge				58		850
Effect of viscosity on tumor induction	114	Straight run distillate, see page 17 of Appendix	24.6	235/100° SSU				
"	114-1	95% API-114, 5% alkylpolystyrene		1756/100° SSU				
Fuel oil blending	113	Industrial fuel oil		30/122° SSF	43	20	37	-

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

API SAMPLE NUMBER	BIOLOGICAL DATA						
	STRAIN OF MICE AND NUMBER OF APPLICATIONS PER WEEK	DOSAGE PER APPLICATION (mg.)	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./weeks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)	RELATIVE CARCINOGENIC POTENCY, P_{MC}
8-3	C3H 3	100	20	20	90/17	9^{+3}_{-1}	-
21	C3H 3	100	20	20	100/13	8^{+2}_{-1}	-
62	C3H 3	100	20	17	24/79	-	-
114							
114-1							
113[1]	C3H 3	20	27	23	48/20	-	-
113[2]	C3H 3	20	27	16	69/20	-	-
113[3]	C3H 3	20	27	25	48/-	-	-
113[3]	C3H 2	20	27	23	13/19	-	-
113[3]	C3H 1	20	27	27	0/20	-	-
113[3]	C3H 3	100	40	37	73/20	17.2±1	0.13±.01
113[3]	C3H 3	5	39	38	74/20	17.2±1	0.13±.01
113[3]	C3H 3	1	20	20	0/3	-	-
113[3]	C3H 3	20	20	20	0/3	-	-
113[4]	C3H 3	20	20	20	0/3	-	-

1 Age of mice at start of experiment, 21 weeks.
2 Age of mice at start of experiment, 17 weeks.
3 Age of mice at start of experiment, 14 weeks.
4 Age of mice at start of experiment, 8 weeks.

API 05458

TABLE I

SKIN PAINTING EXPERIMENTS OF HIGH BOILING SAMPLES

PROCESS	API SAMPLE NUMBER	P R O D U C T
Fractional distillation of No. 8	8-6[1]	b. 35-83°C./0.04 mm.; 0-9.3%
"	8-7[1]	b. 83-102°C./0.02 mm.; 9.3-19.4%
"	8-8[1]	b. 102-133°C./0.03 mm.; 19.4-30.3%
"	8-9[1]	b. 133-139°C./0.03 mm.; 30.3-39.8%
"	8-10[1]	b. 142-175°C/0.03 mm.; 39.8-49.6%
"	8-11[1]	b. 175-197°C./0.03 mm.; 49.6-59.2%
"	8-12[1]	b. 198-217°C./0.035 mm.; 59.2-69.1%
Diels-Alder reaction	8-12a[1]	non-adduct from reaction (95.4% of API-8-12)
Fractional distillation of No. 8	8-13[1]	b. 215-238°C./0.045 mm.; 69.1-78.5%
"	8-14[2]	b. 238-258°C./0.045 mm.; 78.5-80.8%
"	8-15[1]	Residue; 80.8-100%
"	8-18	Reblend of distillation fractions, 8-6 thru 8-15
Diels-Alder reaction	8-23a-8-23h	Materials extracted from API-8 by maleic anhydride
Solvent extraction with conc. H_2SO_4	8-19[1]	Extract from 8-10 and 8-11
"	8-20[1]	Raffinate from 8-10 and 8-11
"	23-1	Extract from No. 23, 20% in benzene
"	23-2	Raffinate from No. 23, 20% in benzene
Fractionation	12-7[3]	Non-adduct of Diels-Alder reaction on raffinate from sulfuric extraction of fraction b.130-180°C/.2m

[1] 50% solution in benzene. [2] 33.3% Solution in benzene.

[3] 30% solution in benzene.

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

API SAMPLE NUMBER	BIOLOGICAL DATA: STRAIN OF MICE AND NUMBER OF APPLICATIONS PER WEEK	DOSAGE PER APPLICATION (mg.)	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./weeks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)	RELATIVE CARCINOGENIC POTENCY, P_{MC}
8-6	C3H 2	100	20	12[1]	0/66	-	-
8-7	C3H 2	100	20	12[1]	0/74	-	-
8-8	C3H 2	100	20	16[1]	0/74	-	-
8-9	C3H 2	100	20	18	55/62	32^{+26}_{-1}	$\sim$ 0.09
8-10*	C3H 2	100	20	16	94/44	29^{+3}_{-1}	$\sim$ 0.1±.01
8-11*	C3H 2	100	20	20	90/33	23.5^{+2}_{-1}	$\sim$ 0.14±.01
8-12*	C3H 2	100	20	14	93/28	18^{+2}_{-3}	$\sim$ 0.18±.02
8-12a*	C3H 2	100	16	16	100/26	16^{+2}_{-1}	$\sim$ 0.19±.01
8-13*	C3H 2	100	20	14	79/25	20.5^{+2}_{-1}	$\sim$ 0.16±.01
8-14	C3H 2	100	20	12	25/21	-	-
8-15	C3H 2	100	20	13	92/35	26.6±2	$\sim$ 0.12±.01
8-18	C3H 1	100	15	14	93/[illegible]	12.7^{+4}_{-1}	$0.69^{+.04}_{-.18}$
8-23a-8-23h	C3H 3	15	20	20	0/3	-	-
8-19	C3H 2	100	9	9	22/32	-	-
8-20	C3H 2	100	9	9	67/28	22.6^{+2}_{-3}	$\sim 0.15^{+.02}_{-.01}$
23-1*	C3H 2	100	20	19	89/26	16.3±2	$\sim 0.19^{+.02}_{-.04}$
23-2	C3H 2	100	20	19	100/44	24.4^{+2}_{-4}	$\sim 0.13^{+.03}_{-.01}$
12-7	C3H 2	20	20				

[1] Number alive after 52 weeks.

TABLE I

SKIN PAINTING EXPERIMENTS O. HIGH BOILING SAMPLES

PROCESS	API SAMPLE NUMBER	P R O D U C T
Air oxidation (cobalt naphthenate catalyst)	83	Two hour oxidation product
"	83-1	Four hour oxidation product
	83-2	Aromatics by chromatography from No. 83 plus 30.6% by weight of sec.-amylbenzene
Chromatography	8-22	Aromatics by chromatography from API-8 plus 30.6% by weight of sec.-amylbenzene
"	8-5	Aromatics of No. 8 from Silica Gel
"	8-17	Reblend of chromatography fractions of No. 8
"	12-2	Non-aromatics (cut with 20% heptane)
Distillation 1 plate vacuum)	12-4	Aromatics b. 510-710°F. (corrected)
"	12-5	Aromatics b. 1010-1065°F. (5 g./100 ml. benzene)
"	12-6	Aromatics residue; b.>1065°F. (5g./100 ml. benzene
Chromatography	71-1	See page 34 of Section A-4 of report dated April 5, 1952, for description
"	71-2	Proportionate reblend of all fractions from chromatography of API-71
	71	See page 11 of Appendix for description

TABLE I

SKIN PAINTING EXPERIMENTS ON HIGH BOILING SAMPLES

API SAMPLE NUMBER	BIOLOGICAL DATA: STRAIN OF MICE AND NUMBER OF APPLICATIONS PER WEEK	DOSAGE PER APPLICATION (mg.)	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./weeks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)	RELATIVE CARCINOGENIC POTENCY, P_{MC}
83	C3H 2	100	20	14	100/17	11.6^{+2}_{-1}	-
83-1	C3H 2	100	20	16	94/17	11 ± 1	-
83-2	C3H 1	100	20	19	47/37	-	-
8-22	C3H 1	100	20	19	47/36	-	-
8-5	C3H 1	100	20	12	92/22	17^{+2}_{-1}	$0.5^{+.04}_{-.09}$
8-5	CFW 1	100	20	19	74/28	10.4^{+12}_{-1}	-
8-17	C3H 1	100	20	17	94/30	13.9^{+6}_{-1}	$0.63^{+.04}_{-.27}$
12-2	CFW 3	100	20	15[1]	0/41[2]	-	-
12-4	CFW 3	100	20	16	56/34	17^{+7}_{-1}	$0.08^{+.01}_{-.04}$
12-5	CFW 3	100	20	12	92/34	24^{+7}_{-5}	$\sim 0.04 \pm .02$
12-6	CFW 3	100	20	12	67/8[illegible]	-	-
71-1	C3H 1	20	30	30	3/9	-	-
71-2	C3H 1	20	30	30	0/20	-	-
71	C3H 1	20	33	33	15/19	-	-

[1] Number alive after 36 weeks.

[2] Experiment discontinued after 41 weeks.

TABLE II

CONCENTRATION STANDARDS WITH METHYLCHOLANTHRENE IN BENZENE

API SAMPLE NUMBER	CONCENTRATION (g./100 ml.)	NUMBER OF APPLICATIONS[1] PER WEEK	ORIGINAL NUMBER OF MICE		FINAL EFFECTIVE NUMBER OF MICE		MAXIMUM INCIDENCE OF TUMORS (T.I./weeks)		AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)		STARTING DATE
			C3H	CFW	C3H	CFW	C3H	CFW	C3H	CFW	
228	0	3	20	20	18[3]	13[3]	0/90	0/62	-	-	12/4/50
201	0.01	3	10	10	9	5	44/71	100/70	-	-	7/20/49
210	0.02	3		20		14		78/53		30.5^{+10}_{-6}	2/3/50
203	0.075	3	10	10	9	9	100/34	100/23	24.5^{+2}_{-2}	14^{+2}_{-1}	5/20/49
203	0.075	3	20	10	20	7	85/35	100/31	28.7^{+2}_{-4}	20.9^{+2}	10/9/50
219	0.10	3	30	20	28	16	96/35	100/33	21.8^{+3}_{-2}	15^{+2}_{-1}	4/14/50
243*	0.13	3	20		20		100/24		17.5^{+1}		7/28/51
243[2]	0.13	3	20		19		100/26		17.6^{+3}_{-5}		10/1/51
227*	0.10	1	20		15		87/49		44^{+2}_{-12}		8/22/50
205	0.30	1	20*	20	19	17	100/35	100/30	21^{+3}_{-1}	22.4^{+2}_{-3}	6/13/50
209[2]	0.45	1	20		20		100/24		17.8^{+1}		10/4/51

[1] Dosage per application was 100 mg. except where otherwise specified.
[2] Dosage per application was 20 mg.
[3] Number alive after 52 weeks.

TABLE II

CONCENTRATION STANDARDS WITH METHYLCHOLANTHRENE IN BENZENE

API SAMPLE NUMBER	CONCENTRATION (g./100 ml.)	NUMBER OF APPLICATIONS[1] PER WEEK	ORIGINAL NUMBER OF MICE		FINAL EFFECTIVE NUMBER OF MICE		MAXIMUM INCIDENCE OF TUMORS (T.I./weeks)		AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)		STARTING DATE
			C3H	CFW	C3H	CFW	C3H	CFW	C3H	CFW	
206*	0.60	1	20		20		100/30		15^{+2}_{-1}		10/10/50
220	0.90	1	20		20		100/18		7.2		5/3/50
238	0.20	2	20		20		95/22		15^{+2}_{-1}		9/[illegible]/51
238[2]	0.20	2	20		20		100/27		17.4^{+3}_{-1}		10/2/51
205	0.30	2	20	20	20	16	100/20	88/25	13.7^{+2}_{-1}	15.2^{+5}_{-1}	6/9/50

[1] Dosage per application was 100 mg. except where otherwise specified.

[2] Dosage per application was 20 mg.

API 05464

TABLE II

CONCENTRATION STANDARDS WITH SYNTHETIC CARCINOGENS[1] IN DODECYLBENZENE[2]

API SAMPLE NUMBER	CONCENTRATION (g/100 ml.)	NUMBER OF APPLICATIONS[3] PER WEEK	ORIGINAL NUMBER OF MICE		FINAL EFFECTIVE NUMBER OF MICE		MAXIMUM INCIDENCE OF TUMORS (T.I./weeks)		AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)		RELATIVE CARCINOGENIC POTENCY, P_{MC}	
			C3H	CFW	C3H	CFW	C3H	CFW	C3H	CFW	C3H	CFW
221*	0	3	20		18		33/37		-		-	
221-1[4,5]	0	3	3		3		0/3		-		-	
221-2[4,6]	0	3	3		3		0/3		-		-	
226	0.005	3	20	20	11	17	55/40	41/54	-	-	-	-
225*	0.01	3	20	20	16	11	81/43	91/54	31.4^{+3}_{-10}	31^{+15}_{-4}	$.06^{+.04}_{-.01}$	$\sim.02\pm.01$
213	0.04	3		20		15		100/18		10		-
211	0.10	3	20	8	20	7	100/22	100/17	10.5^{+2}_{-1}	9.5^{+4}_{-1}	-	-
208	0.13	3	30		30		100/15		9.5 ± 1		-	
249[4]	0.15	3	20		18		89/14		8.8^{+4}_{-1}		-	
249	0.15	3	20		16		100/12		8.8 ± 1		-	
212	0.30	3	20		19		100/18		9.5 ± 1		-	
245[1]	0.15	3	20		18		100/19		9.7^{+3}_{-1}		-	

1 The carcinogen was methylcholanthrene in every experiment except in API-245, in which case 3,4-benzpyrene was used.
2 Product obtained by alkylation of benzene with the propylene tetramer (aluminum chloride catalyst).
3 Dosage per application was 100 mg. except where otherwise noted.
4 Dosage per application was 20 mg.
5 11-42% fraction obtained from API-221 by chromatography from alumina.
6 42-84% fraction obtained from API-221 by chromatography from alumina.

API 05465

TABLE II

CONCENTRATION STANDARDS WITH METHYLCHOLANTHRENE IN SEC.-AMYLBENZENE

API SAMPLE NUMBER	CONCENTRATION (g./100ml.)	NUMBER OF APPLICATIONS[1] PER WEEK	ORIGINAL NUMBER OF MICE		FINAL EFFECTIVE NUMBER OF MICE		MAXIMUM INCIDENCE OF TUMORS (T.I./weeks)		AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)		RELATIVE CARCINOGENIC POTENCY, P_{MC}	
			C3H	CFW	C3H	CFW	C3H	CFW	C3H	CFW	C3H	CFW
224	0	3		30		23		17/59		-		-
223	0.075	3	20	20	16	18	81/46	83/46	34.8^{+3}_{-6}	29.2^{+6}_{-1}	$\sim.05^{+.01}_{-.02}$	$\sim.02\pm.01$
222	0.15	3	20	20	20	19	100/44	100/33	24.5^{+2}_{-1}	22.6 ± 2	$.08\pm.01$	$\sim.05\pm.01$
234	0.30	2	20		19		100/27		15.1		-	
235	0.60	2	19		19		100/19		12.8		-	

[1] Dosage per application was 100 mg.

TABLE II

CONCENTRATION STANDARDS WITH SYNTHETIC CARCINOGENS IN VARIOUS SOLVENTS

API SAMPLE NUMBER	STARTING DATE	CARCINOGEN[1]	SOLVENT	CONCENTRATION (g./100ml.)	STRAIN OF MICE	NUMBER OF APPLICATIONS PER WEEK	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./weeks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)	RELATIVE CARCINOGENIC POTENCY, P_{MC}
	2/17/47	MC	API-80[2]	Sat.Sol. (~0.2 g.)	C3H	1	20	16	81/49	33.5	~0.13
218	2/3/50	MC	API-5[3]	0.30	CFW	3	20	16	81/29	22^{+4}_{-1}	~$^{+\ \ }_{-.02}$
218	2/3/50	MC	API-5	0.30	C3H	3	20	17	100/30	23.2^{+4}_{-1}	$0.09^{+.01}_{-.02}$
244	9/14/51	BP	benzene	0.15	C3H	3	20	20	100/33	24.6^{+1}_{-5}	$0.08^{+.03}_{-.01}$
245	12/3/51	BP	DDB	0.15	C3H	3	20	18	100/19	9.7^{+3}_{-1}	-
246[4]	3/22/52	MC	API-112-3	0.15	C3H	3	20	20	100/22	12.3^{+6}_{-1}	-
246[4]	4/11/52	MC	API-112-1	0.15	C3H	3	20	18	94/19	12.6^{+4}_{-1}	-
247	4/4/52	MC	API-80	0.20	C3H	3	7	7	86/20	15.3^{+3}_{-1}	$0.15^{+.01}_{-.03}$
248[4]	4/11/52	MC	API-110-1[5]	0.15	C3H	3	20	20	75/19	16.4^{+3}_{-1}	$0.14^{+.01}_{-.02}$

1 20-Methylcholanthrene (MC) and 3,4-Benzpyrene (BP).
2 Technical white oil.
3 Wilmington residuum; see page 17 of Table I for description.
4 Dosage per application was 20 mg.
5 See page 18 of Table I for description.

TABLE II

CONTROL EXPERIMENTS WITH VARIOUS SOLVENTS

API SAMPLE NUMBER	SOLVENT	NUMBER OF APPLICATIONS PER WEEK	ORIGINAL NUMBER OF MICE		FINAL EFFECTIVE NUMBER OF MICE		MAXIMUM INCIDENCE OF TUMORS (tumor index/weeks)		INCIDENCE OF GROSS CARCINOMA (%/weeks)		STARTING DATE
			C3H	CFW	C3H	CFW	C3H	CFW	C3H	CFW	
80	White oil	3	30		24[1]		0/55		0/55		8/7/51
95	White oil	3		33		24[1]		0/56		0/56	7/28/51
221*	Dodecyl-benzene	3	20		18		33/37		0/52		5/5/50
224	Sec.-amyl-benzene	3		30		23		17/59		[illegible]	7/14/50
228	Benzene	3	20	20	18[1]	13[1]	0/90	0/62	0/90	0/62	12/4/50
241	Distilled water	3	[illegible]	17	23[1]	8[1]	0/56	0/56	0/56	0/56	7/28/51

[1] Number alive after 52 weeks.

TABLE II

EXPERIMENTS EMPLOYING A LIMITED NUMBER OF APPLICATIONS OF METHYLCHOLANTHRENE (MC) IN BENZENE

API SAMPLE NUMBER	CONCENTRATION (g./100 ml.)	STRAIN OF MICE	NUMBER OF APPLICATIONS PER WEEK	TOTAL NUMBER OF APPLICATIONS OF MC SOLUTION	SOLVENT APPLIED FOLLOWING LAST MC APPLICATION	NUMBER OF APPLICATIONS PER WEEK OF SOLVENT	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./wks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)
238	0.20	C3H	2	16	Nil		20	20	35/21	-
238	0.20	C3H	1	11	Nil		20	20	80/33	-
205	0.30	C3H	1	11	Nil		20	20	100/32	-
242	0.5	C3H	3	5	Benzene	6	10	9	44/33	-
					Sec.-amyl-benzene	6	10	6	100/15	9.7^{+1}_{-1}
242	0.5	CFW	3	5	Benzene	6	10	9	89/47	10.5^{+25}_{-1}
					Sec.-amyl-benzene	6	10	10	100/32	10^{+4}_{-1}

TABLE III

EXPERIMENTS ON ACCELERATION OF CARCINOGENESIS BY SPECIFIC SOLVENTS[1]

API EXPERIMENT NUMBER	DESCRIPTION OF EXPERIMENT: MATERIALS APPLIED TO MICE DURING FIRST SIX WEEKS OF EXPERIMENT	DESCRIPTION OF EXPERIMENT: MATERIALS APPLIED TO MICE DURING SEVENTH WEEK TO END OF EXPERIMENT	STRAIN OF MICE	NUMBER OF APPLICATIONS PER WEEK	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./wks.)[2]	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)
221*	DDB	DDB	C3H	3	20	18	33/37	-
9*	API-9[3]	API-9	CFW	3	20	16	100/41	27.8^{+5}_{-4}
9*	API-9	API-9	C3H	3	10	9	100/47	33.8^{+4}
221-9*	DDB	API-9	C3H	3	20	20	100/27	13.2 ± 2
221-9	DDB	API-9	C3H	3	20	15	93/22	12.8^{+1}_{-3}
504-9	PDD	API-9	C3H	3	20	17	94/26	14.9^{+1}_{-4}
57*	API-57[3,4]	API-57	CFW	6	20	17	100/25	15^{+3}_{-1}
221-57	DDB	API-57	CFW	6	20	18	100/15	5.4
208	API-208[5]	API-208	C3H	3	30	30	100/15	9.5 ± 1
221-208	DDB	API-208	C3H	3	20	20	100/14	5.8

1 Dodecylbenzenes obtained by alkylation of benzene with 12-carbon olefins; DDB obtained with propylene tetramer; 2-phenyldodecane (PDD) obtained with 1-dodecene.
2 Time measured from date of initial painting with material labeled with API code number.
3 See Table I for description.
4 Hair clipped.
5 See Table II for description.

TABLE III

EXPERIMENTS ON ACCELERATION OF CARCINOGENESIS BY SPECIFIC SOLVENTS[1]

API EXPERIMENT NUMBER	DESCRIPTION OF EXPERIMENT: MATERIALS APPLIED TO MICE DURING FIRST SIX WEEKS OF EXPERIMENT	SINGLE APPLICATION[2] IN SEVENTH WEEK	NINTH WEEK TO END OF EXPERIMENT	STRAIN OF MICE	NUMBER OF APPLICATIONS PER WEEK	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./wks.)[3]	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)[3]
229	Nil	API-229[4,5]	Nil	C3H	-	40	40	12/13	-
230	Nil	API-229[5]	DDB	C3H	3	40	37	92/34	10
231	Nil	API-8[5,6]	Nil	C3H	-	45	38[7]	0/63	-
232	Nil	API-8[5]	DDB	C3H	3	45	34	56/26	-
236	DDB	API-8	DDB	C3H	3	31	28	28/30	-
237	DDB	API-229	DDB	C3H	3	40	38	87/22	9.4
239	Nil	API-8[5]	water	C3H	3	30	26	0/60	-
240	Nil	API-8[5]	white oil, API-80	C3H	3	30	21	0/57	-

1 Dodecylbenzenes obtained by alkylation of benzene with 12-carbon olefins; DDB obtained with propylene tetramer; 2-phenyldodecane (PDD) obtained with 1-dodecene.

2 Single application followed by two week interval before further treatment of mice.

3 Time measured from date of single application of carcinogenic material involved in experiment.

4 Solution of 0.5 g. 9,10-dimethyl-1,2-benzanthracene in 100 ml. sec.-amylbenzene.

5 Hair clipped.

6 See Table I for description.

7 Number alive after 52 weeks.

TABLE IV

EXPERIMENTS ON THE RETARDATION OF TUMOR FORMATION BY WASHING - CFW MICE

API EXPERIMENT NUMBER	CARCINOGENIC OIL APPLIED	NUMBER OF APPLICATIONS PER WEEK	HAIR CLIPPED	PERIOD OF EXPOSURE TO OIL BEFORE REMOVAL BY WASHING	WASHING AGENT	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.I./weeks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)
8	8[2]	1	no	Control (no washing)	none	20	14	86/26	11^{+9}_{-1}
300	8	1	no	10 min.	soap solution	10	4[1]	0/81	-
301	8	1	no	1 hour	"	10	5[1]	14/36	-
302	8	1	no	4 hours	"	10	9	56/70	-
12	12[2]	3	y	Control (no washing)	none	15	14	100/14	8^{+2}_{-1}
303	12	3	yes	1 hour	soap solution	15	14	100/40	25.6
304	12	3	yes	9 hours	"	15	11	100/21	15.4

[1] Number alive after 52 weeks.
[2] See Table I for description.

TABLE IV

EXPERIMENTS ON THE RETARDATION OF TUMOR FORMATION BY WASHING - CFW MICE

API EXPERIMENT NUMBER	CARCINOGENIC OIL APPLIED	NUMBER OF APPLICATIONS PER WEEK	HAIR CLIPPED	PERIOD OF EXPOSURE TO OIL BEFORE REMOVAL BY WASHING	WASHING AGENT	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS (T.1./weeks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)
305	8[2]	3	yes	20 min.	detergent solution	20	14	93/51	39.2^{+5}_{-2}
306	8	3	yes	1 hour	"	20	17	94/44	32.4^{+2}_{-1}
307	8	3	yes	1 hour	white oil-detergent[1]	20	20	85/33	24.6^{+2}_{-5}
308	8	3	yes	20 min.	white oil	20	15	100/52	28.2^{+6}_{-3}
113	113[2]	3	yes	Control (no washing)	none	20	18	89/25	14^{+5}_{-1}
309	113	3	yes	1 hour	detergent solution	20	16	38/67	-
310	113	3	yes	4 hours	"	20	13	54/57	43.4^{+14}_{-15}
311	113	3	yes	4 hours	white oil-detergent[1]	20	12	83/52	42.6^{+5}_{-3}

[1] White oil rinse followed by washing with detergent solution.

[2] See Table I for description.

TABLE IV

EXPERIMENTS ON THE RETARDATION OF TUMOR FORMATION BY WASHING - CFW MICE

API EXPERIMENT NUMBER	DESCRIPTION OF EXPERIMENT	NUMBER OF APPLICATIONS PER WEEK	HAIR CLIPPED	ORIGINAL NUMBER OF MICE	FINAL EFFECTIVE NUMBER OF MICE	MAXIMUM INCIDENCE OF TUMORS T.I./weeks)	AVERAGE LATENT PERIOD FOR TUMOR INDUCTION (weeks)
312	Barrier cream applied 9:00 AM API-8 applied 11:00 AM Removal of oil by washing with detergent solution 12:00 AM	3	yes	20	10	70/45	38.5^{+4}_{-1}
313	Barrier cream applied 9:00 AM API-8 applied 11:00 AM API-8 applied 2:00 PM Removal of oil by washing with detergent solution 4:30 PM	3	yes	20	13	100/31	23.4^{+2}_{-1}

LEGEND FOR DATA SHEET ON INDIVIDUAL EXPERIMENTS

Symbols used in connection with average weight curves:

$\overline{\nabla}_i$ Time of death (from disease) of ith tumor-free mouse.

i Time of death (from disease) of ith tumor-bearing mouse.

$\overline{\overline{\nabla}}_i$ or $\overline{i}$ Time mouse killed.

∇_i Mouse missing from cage.

Gross and microscopic pathology:

$\boxed{i}$ Time of appearance of first papilloma in ith mouse. When this symbol is first used for a given mouse after its death, the presence of non-invading carcinoma (intra-epithelial) or small areas of benign neoplasm was determinable only by histopathology.

$[i]$ Time of appearance of papilloma which regressed later or was not confirmed by histopathology.

$\textcircled{i}$ Time of appearance of gross changes indicative of malignancy in tumor of ith mouse. Diagnosis confirmed except in cases where no tissue section available. When this symbol is first used for a given mouse after its death, the invasive malignancy of the tumor was determinable only by histopathology.

(i) Gross diagnosis of malignancy of tumor not confirmed by histopathology.

$\overset{NS}{\boxed{i}}$ or $\overset{NS}{(i)}$ No tissue section available for histopathology because of extensive post-mortem decomposition or cannibalism.

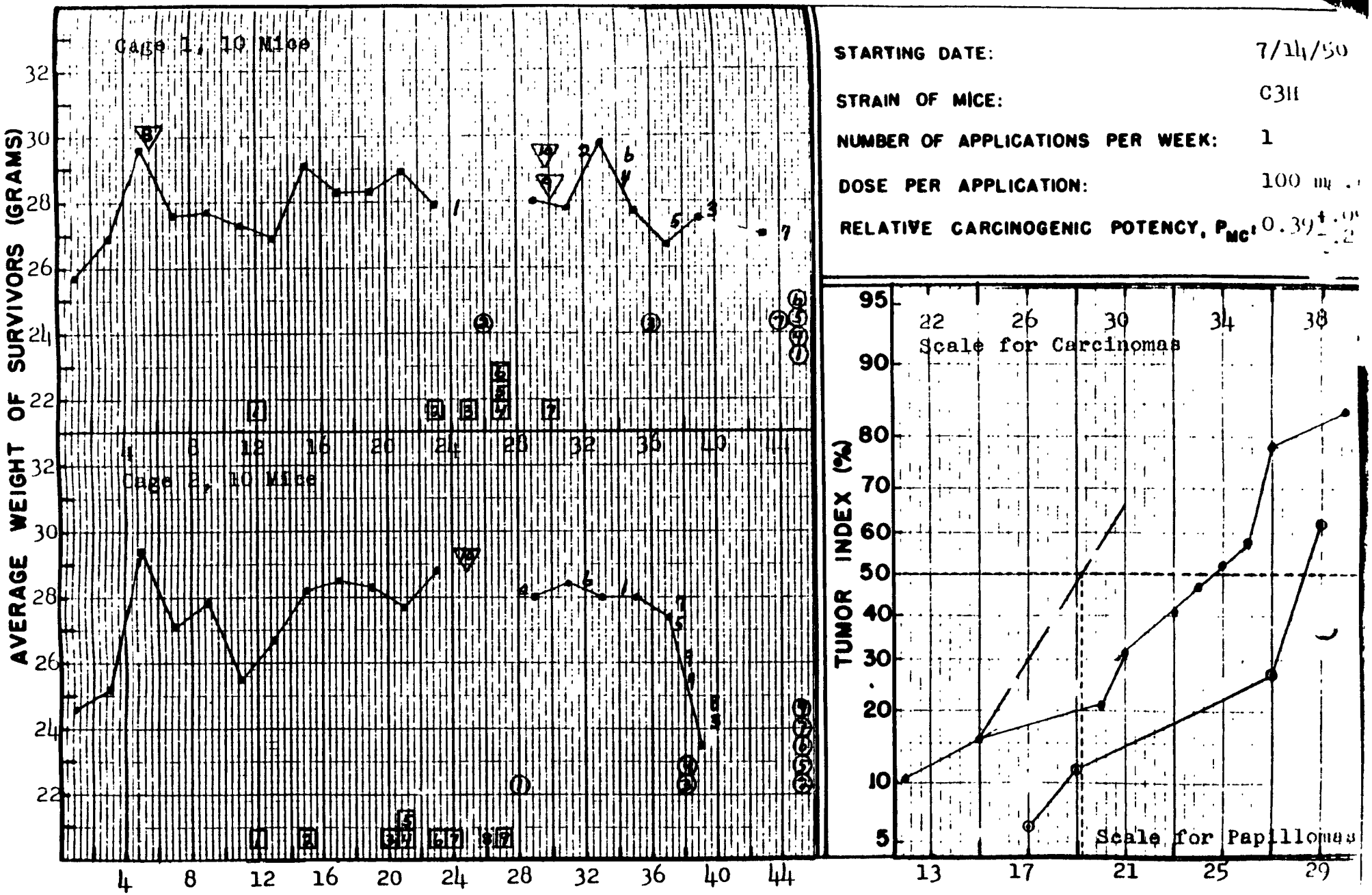
$*$ Tumors not recorded during this week.

Cumulative dose-response curves (summation of data from all cages unless otherwise specified):

Experimental curve for benign papillomas.

Hypothetical curve for papillomas. This curve furnishes average latent period (time for 50 percent tumor index) from which relative potency, P_{MC}, is determined).

Experimental curve for grossly malignant tumors.



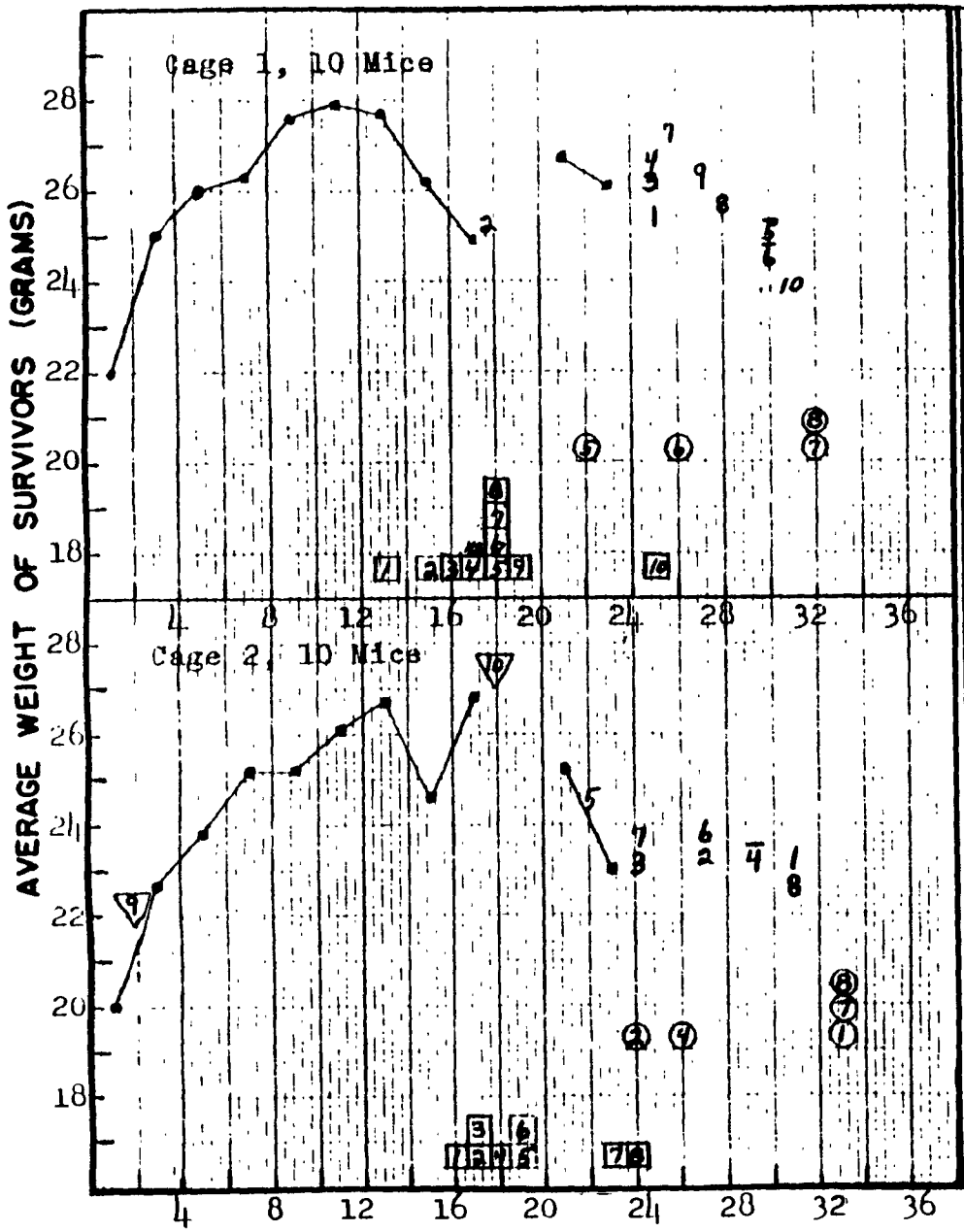
API 05476

Issued 9/1/52

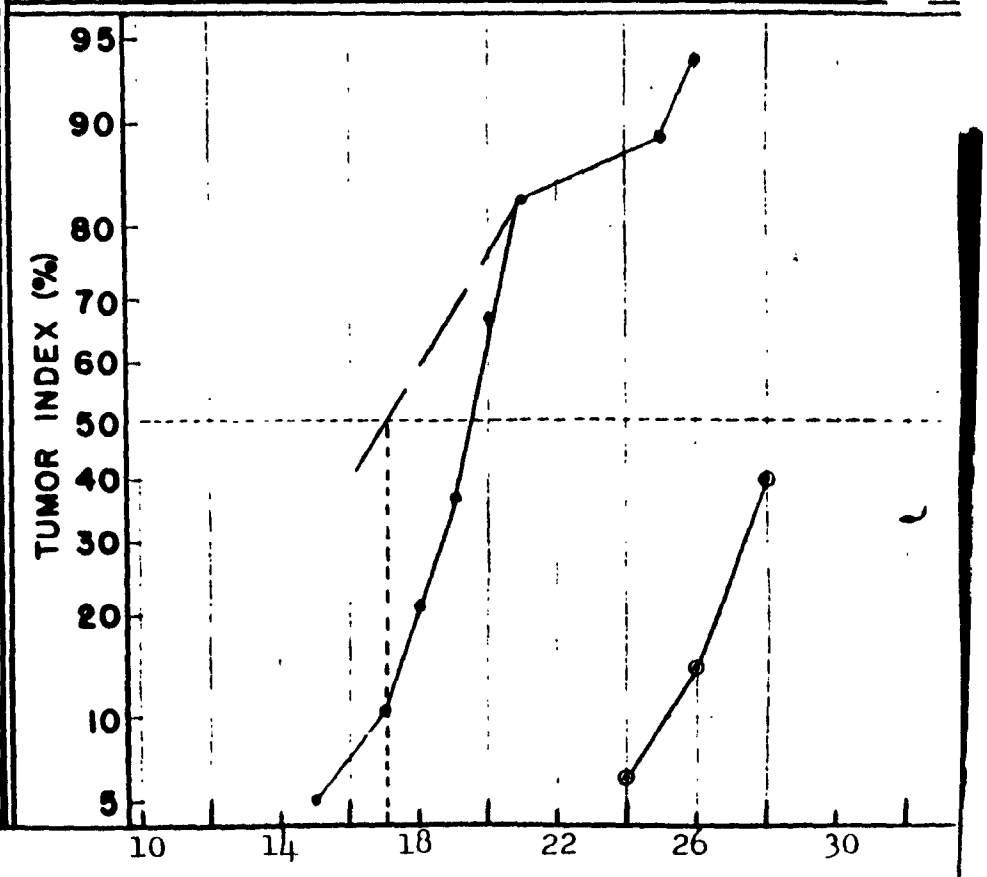
TUMOR INCIDENCE (%)
95
90
80
70
60
50
40
30
20
10

AVERAGE WEIGHT OF SURVIVORS (GRAMS)

API-85, F.C. . Cracked Residuum



STARTING DATE:	5/29/51
STRAIN OF MICE:	C3H
NUMBER OF APPLICATIONS PER WEEK:	1
DOSE PER APPLICATION:	100 mg.
RELATIVE CARCINOGENIC POTENCY, P_{MC} :	$0.58^{+.05}_{-.22}$



API 05478

Issued 9/1/5[illegible]

MEMORANDUM FROM THE KETTERING LABORATORY
API RESEARCH PROJECT ON CARCINOGENICITY
EPIDEMIOLOGICAL STUDIES

September 24, 1952

During the four months following the summation given at the April 1952 meeting in Cincinnati, 37 case reports have been received, making a total of 939 collected by the Registry since its inauguration in September 1950. The accompanying tabulations (Pages 3, 4, and 5) have been corrected to include the additional material but, as will be noted, the pattern found earlier has not been changed materially.

Much effort has been devoted to preparations for the correlation of the occupational histories and the kind and degree of petroleum exposure with other variables. All of the reports were carefully reviewed in great detail, with particular reference to the descriptive terms employed by the various medical directors to describe the occupations and petroleum contacts of the cases reported. From the findings of these studies, codes have been drawn up to be used in the tabulation of these two important variables. The proposed classifications can be found on pages 17 to 20. The numerical codes employed for the other items are given also for your information. A sample of the Key-sort card has been included likewise.

It is hoped that the medical directors will be guided by these classifications in filling out future reports. It will be helpful if any error, inconsistency or difficulty is encountered in using the occupational or contact codes, to bring it to our attention so that corrections can be made as soon as possible. A revised record form embodying the new classifications is planned for distribution in the near future.

FIGURE 1 - 939* CASE REPORTS FROM 13 COMPANIES
RECEIVED BY THE CENTRAL REGISTRY
ACCORDING TO SEX, RACE AND
MALIGNANCY

SEX	RACE	MALIGNANT	BENIGN	TOTAL
MALE	White	685	22	707
	Colored	25	-	25
	Not Given	114	38	152
	TOTAL	824	60	884
FEMALE	White	28	1	29
	Not Given	9	5	14
	TOTAL	37	6	43
NOT GIVEN		4	-	4
TOTAL BOTH SEXES		865	66	931

* Eight reports could not be used. Five were not tumors; one of these was Boeck's Sarcoid. Three gave only the occupational history. (Additional information has been received on one case reported 4-5-52 as incomplete.)

FIGURE 2 - MALIGNANT TUMORS IN MALES AS REPORTED ACCORDING TO TYPE OF TUMOR AND PRIMARY SITE

Type of Tumor / Site	Gland. Epith. 00-09	Non-Gland. Epith. 10-19	Leuke-mias 20-29	Lympho-mas 30-39	Nervous Tissues 40-49	Vascular Tissues 50-59	Muscle 60-69	Non-Epith. Tissues 70-79	Embry. & Mixed Tissues 80-89	Tumors Not Class. 90--	Total
Buccal Cavity 00-09	11	61						1			73
Digest. Sys. & Perit. 10-19	243	18		3				6		2	272
Respiratory System 20-29	27	86						1	1	3	118
Breast 30-39	1										1
Genital Organs 40-49	40	14							9		63
Urinary System 50-59	21	20						1	1		43
Skin & Soft Tissue 60-69		147			2			3	2	1	155
Bones 70-75	6	3		1				2	1		13
Brain 76-79		2			2	1				13	18
Lymph. & Hem. System 80-89			12	17							29
Other Sites 90---	8	25		1				1		4	39
Total	357	376	12	22	4	1		15	14	23	824

API 05482

FIGURE 3 - MALIGNANT TUMORS IN FEMALES AS REPORTED ACCORDING TO TYPE OF TUMOR AND PRIMARY SITE

Type of Tumor / Site	Gland. Epith. 00-09	Non-Gland. Epith. 10-19	Leuke-mias 20-29	Lympho-mas 30-39	Nervous Tissues 40-49	Vascular Tissues 50-59	Muscle 60-69	Non-Epith. Tissues 70-79	Embry. & Mixed Tissues 80-89	Tumors Not Class. 90---	Total
Buccal Cavity 00-09		1									1
Digest. Sys. & Perit. 10-19	8										8
Respiratory System 20-29	1	1									2
Breast 30-39	12	1									13
Genital Organs 40-49	2	2									4
Urinary System 50-59		1									1
Skin & Soft Tissue 60-69	1	5									6
Bones 70-75								1			1
Brain 76-79											
Lymph. & Hem. System 80-89											
Other Sites 90---		1									1
Total	24	12						1			37

API 05483

FIGURE 4 - MALIGNANT TUMORS AS REPORTED BY SEX AND PRIMARY SITE
COMPARED WITH U.S.A. MORBIDITY AND MORTALITY ESTIMATES

SEX	MALES				FEMALES				BOTH SEXES		
Site	Number Reported	Per Cent of Total	U.S.A.* Per Cent Cancer Cases	U.S.A.** Per Cent Cancer Deaths	Number Reported	Per Cent of Total	U.S.A.* Per Cent Cancer Cases	U.S.A.** Per Cent Cancer Deaths	Number Reported	Per Cent of Total	U.S.A.** Per Cent Cancer Deaths
Buccal Cavity	73	8.9	10.0	4.7	1	2.7	2.0	1.2	74	8.6	2.
Digestive Sys. & Peritoneum	272	33.0	36.0	47.7	8	21.6	23.0	38.7	280	32.5	43.2
Respiratory System	118	14.3	8.0	15.4	2	5.4	2.0	3.9	120	13.9	9.6
Breast	1	0.1		0.2	13	35.1		19.1	14	1.6	9.7
Genital Organs	63	7.6	12.0	13.0	4	10.8	51.0	23.5	67	7.8	18.3
Urinary System	43	5.2	7.0	6.6	1	2.7	3.0	3.4	44	5.1	5.0
Skin and Soft Tissue	155	18.8	17.0	2.2	6	16.2	11.0	1.5	161	18.7	1.8
Bones	13	1.6		1.3	1	2.7		1.1	14	1.6	0.1
Brain	18	2.2		2.4				1.5	18	2.1	2.
Lymph. & Hema-topoietic Sys.	29	3.5							29	3.4	
Other Sites	39	4.7	10.0	6.5	1	2.7	8.0	6.2	40	4.6	7.4
TOTAL	824	100.0	100.0	100.0	37	100.0	100.0	100.0	861	100.0	100.0

*Primary site of development of cancer among white males and females according to Dorn, Harold F.: Illness from cancer in the United States. Reprint No. 2537, Public Health Reports. (Based upon morbidity records collected from ten large cities in the United States between 1937 and 1939.)

**Cancer deaths by site in the United States for 1948 as prepared by the Statistical Research Section, American Cancer Society, utilizing statistics from the National Office of Vital Statistics.

API 05484

API 05485

McBEE KEY-SORT CODE

API CASE STUDY

Banks

T 1-2-3 Case Number - Punch directly

Bank 1 - Units
2 - Tens
3 - Hundreds

T 4-5 Company Number - Punch as coded by Central Registry

Bank 4 - Units
5 - Tens

(Actual code numbers are confidential information)

T 6-7-8-9 For Future Use

Banks

T 10 Geographic Location - Punch as coded

0 - Not Specified

1 - North Eastern States:

Connecticut	New Jersey
Delaware	New York
Illinois	Ohio
Indiana	Pennsylvania
Kentucky	Rhode Island
Maine	Vermont
Maryland	Virginia
Massachusetts	West Virginia
Michigan	Wisconsin
New Hampshire	

2 - South Eastern States:

Alabama	North Carolina
Florida	South Carolina
Georgia	Tennessee
Mississippi	

3 - North Central States:

Colorado	North Dakota
Idaho	South Dakota
Kansas	Utah
Montana	Wyoming
Nebraska	

3A - North Eastern-Central Border States:

Iowa	Missouri
Minnesota	

4 - South Central States:

Arizona	Oklahoma
New Mexico	Texas

4A - South Eastern-Central Border States:

Arkansas	Louisiana

5 - South Pacific States:

California	Nevada

5A - North Pacific States:

Oregon	Washington

6 - Marine Workers

7 - Pipe Line Crew and Production Workers

Banks

B 1-2-3 Type of Tumor - Punch as coded by American Cancer Society

Bank 1 - Malignancy Code

Bank 2 - Units)
3 - Tens) - Histogenic Classification

Histogenic Classification

Tumors of Glandular Epithelium (00-09)

00 - Ductal tumor
01 - Tumor of mucinous secreting epithelium
02 - Papillary tumor, not elsewhere classified
03 - Neoplastic cyst, not elsewhere classified
04,05 - Functionally active tumors
06-08 - Other specific glandular tumors
09 - Unspecified tumors of glandular epithelial origin

Tumors of Nonglandular Epithelium (11-14)

11 - Tumor of transitional epithelium
12 - Tumor of basal epithelium
13 - Tumor of baso-squamous epithelium
14 - Tumor of squamous epithelium
15,16 - .....

Tumors of Melanin Forming Tissue (17)

17 - Tumor of melanoblast

Tumors of Epithelium, not elsewhere classified (18-19)

18 - Specific tumors of epithelium, not elsewhere classified
19 - Unspecified tumors of epithelial origin

Leukemias (20-29)

20 - Lymphocytic leukemia
21 - Monocytic leukemia
22 - Granulocytic leukemia
23-25 - .....
26 - Compound leukemias
27 - Leukemia and lymphoma
28 - Other specific leukemias
29 - Leukemia, type not specified

Banks

B 1-2-3 Type of Tumor (Continued)

Lymphomas (30-39)

30 - Lymphosarcoma
31 - Reticulum cell sarcoma
32 - Hodgkins disease
33 - Plasma cell myeloma
34 - Giant follicular lymphoma
35 - .....
36 - Compound lymphomas
37 - .....
38 - Other specific lymphomas
39 - Lymphoma, type not specified

Tumors of Nervous Tissues and Associated Structures (40-49)

40 - Tumor of ganglion
41 - Tumor of sympathicoblast
42 - Tumor of neuroepithelium
43 - Tumor of paraganglion
44 - Argentaffinoma
45 - Tumor of peripheral nerve sheath
46 - Tumor of meninges
47 - Tumor of glia
48 - Other specific tumors of nervous tissue and structures
49 - Unspecified tumors of nervous tissue origin

Tumors of Vascular Tissue (50-59)

50 - Tumor of blood vessel
51 - Hemangiomatosis
52 - Multiple hemorrhagic hemangioma of kaposi
53 - Tumors of specialized vascular structures
54 - Tumor of lymph vessel
55-57 - .....
58 - Other specific tumors of vascular tissue
59 - Unspecified tumors of vascular tissue origin

Tumors of Muscle (66-69)

66 - Tumor of smooth muscle
67 - Tumor of striated muscle
68 - Other specific tumors of muscle
69 - Unspecified tumors of muscle origin

Banks

B 1-2-3 Type of Tumor (Continued)

Tumors of Connective Tissue (70-77)

70 - Tumor of fibrous tissue
71 - Tumor of mucinous connective tissue
72 - Tumor of lipoid tissue
73 - Tumor of cartilage
74 - Giant cell tumor
75 - Ewings sarcoma
76 - Tumors of osseous tissue, not elsewhere classified
77 - Tumors of serous and synovial surfaces

Tumors of Nonepithelial Tissues, not elsewhere classified (78-79)

78 - Specific tumors of nonepithelial tissue, not elsewhere classified
79 - Unspecified tumors of nonepithelial tissue origin

Tumors of Embryonal and Mixed Tissues (80-89)

80 - Tumor of trophoblast
81 - Tumor of embryonal gonadal tissue
82 - Tumor of teratoid tissue
83 - Tumor of epithelial and mesodermal tissues
84 - Tumor of epithelial and lymphoid tissues
85 - Tumor of mixed tissues, salivary gland type
86 - Tumor of dental tissues
87 - Tumor of mesenchyme
88 - Other specific tumors of embryonal and mixed tissues
89 - Unspecified tumors of embryonal and mixed tissue origin

Tumors Not Elsewhere Classified (97-99)

97 - Tumors of uncertain histologic type - no agreement as to classification
98 - Tumors of specific tissues, not elsewhere classified
99 - Tumor, cancer, neoplasm and other general and nonspecific terms

Other Conditions (XX, X8 and X9)

XX - No information
X8 - Not a neoplasm
X9 - Diagnosis not completed - possibly a neoplasm

Banks

B 1-2-3 Type of Tumor (Continued)

Malignancy Code

General Malignancy Code (Used with all Histogenic Code Numbers except Code Numbers 20-39)

X - Not a neoplasm - no premalignant significance
0 - Not a neoplasm, but having premalignant significance
1 - Benign neoplasm - no premalignant significance
2 - Benign neoplasm, but having premalignant significance
3 - Diagnosis not completed - suspected malignancy
4 - Neoplasm, malignancy not determined
5 - Malignant neoplasm, non-infiltrating (including carcinoma in situ)
6 - Malignant neoplasm, differentiated
7 - Malignant neoplasm, undifferentiated (anaplastic)
8 - Malignant neoplasm, differentiation not determined
9 - Malignant neoplasm, metastatic site

Leukemia Malignancy Code (Used with Histogenic Code Numbers 20-29)

5 - Aleukemic, not otherwise specified
6 - Chronic
7 - Acute
8 - Not determined

Lymphoma Malignancy Code (Used with Histogenic Code Numbers 30-39)

1 - Specified as benign (except the term "benign lymphoma")
6 - Single
7 - Multiple
8 - Multiplicity not stated

Banks

3 4-5 Primary Site - Punch as coded by Maryland State Cancer Program

Bank 4 - Units
5 - Tens

	International Classification Number
Buccal Cavity and Pharynx	
00 - Lip, upper	140A
01 - Lip, lower	140B
02 - Lip, unspecified	140C
03 - Tongue	141
04 - Floor of mouth	143
05 - Salivary gland	142
06 - Other and unspecified parts of mouth	144
07 - Oral nasopharynx	145
08 - Nasopharynx	146
09 - Hypopharynx	147
0X - Pharynx, other and unspecified parts	148
Digestive System and Peritoneum	
10 - Esophagus	150
11 - Stomach	151
12 - Duodenum	152A
13 - Small intestine	152B
14 - Large intestine, except rectum	153
15 - Rectum	154
16 - Biliary passages	155A
17 - Liver	155B
18 - Pancreas	157
19 - Peritoneum	158
1X - Unspecified digestive organs	159
Respiratory System	
20 - Nose, nasal cavities and middle ear	160A
21 - Accessory sinuses	160B
22 - Larynx	161
23 - Trachea	162A
24 - Bronchus and lung	162B
25 - Media stinum	164
2X - Other and unspecified thoracic organs	165
30 - Breast	170

Banks

B 4-5

Primary Site (Continued)	International Classification Number
Genital Organs	
40 - Cervix uteri	171
41 - Corpus uteri	172
42 - Other specified parts of uterus	173
43 - Uterus, unspecified part	174
44 - Ovary and oviduct	175A,175B
45 - External and unspecified female genital organs	176
47 - Prostate	177
48 - Testis	178
49 - Penis	179A
4X - Other and unspecified male genital organs (scrotum)	179B
Urinary System	
50 - Kidney	180
51 - Bladder	181A
55 - Other and unspecified parts of urinary system	181B

Skin	Melanoma	Other Types
60 - Skin of lip	190A	191A
61 - Skin of face, head, neck	190B	191B
62 - Skin of upper extremities	190C	191C
63 - Skin of trunk	190D	191D
64 - Skin of lower extremities	190E	191E
65 - Skin, unqualified	190F	191F

Soft Tissue	
66 - Soft tissues of face, head, neck	197A
67 - Soft tissues of upper extremities	197B
68 - Soft tissues of trunk	197C
69 - Soft tissues of lower extremities	197D
6X - Other and unspecified soft tissues	197E

(Note: This group will include neoplasm of peripheral nerves which are coded to 193 of the International List.)

Banks

B 4-5

Primary Site (Continued)	International Classification Number
Bones	
70 - Jaw bone	196A
71 - Bones of head and face	196B
72 - Bones of upper extremities	196C
73 - Bones of trunk	196D
74 - Bones of lower extremities	196E
75 - Bones, unspecified site	196F
Brain and Other Parts of Central Nervous System	
76 - Eye	192
77 - Brain	193A
78 - Other central nervous system and intracranial nerves	193B
Lymphatic and Hematopoietic System	
80 - Reticulum cell sarcoma	200.0
81 - Lymphosarcoma	200.1
82 - Other malignant neoplasm of lymphoid tissue	200.2
83 - Hodgkin's disease	201
84 - Giant follicular lymphoma	202.0
85 - Other forms of lymphoma	202.1
86 - Multiple myeloma	203
87 - Lymphatic leukemia	204.0
88 - Myeloid leukemia	204.1
89 - Monocytic leukemia	204.2
8X - Other and unspecified leukemia	204.3,204.4
8Y - Mycosis fungoides	205
Malignant Neoplasm of Other Sites	
90 - Thyroid	194
91 - Adrenal	195A
92 - Pituitary	195B
93 - Thymus	195C
94 - Pineal	195D
95 - Other and unspecified endocrine glands	195E
96 - Other specified sites	199A
9X - Unspecified sites or unknown	199B

Banks

B 6 Stage of Disease - Punch as coded

0 - Unknown or not given
1 - Early
2 - Advanced local
3 - Regional nodes
4 - Distant metastases
5 - Fatal termination reported

B 7-8 For Future Use

B 9 Age at Onset - Punch as coded

0 - Unknown or not given
1 - 0-19 years
2 - 20-29 years
3 - 30-39 years
4 - 40-49 years
5 - 50-59 years
6 - 60-69 years
7 - 70+ years

B 10 Sex and Race - Punch as coded

0 - Unknown or not given
1 - Female white
3 - Female other race
4 - Male white
5 - Female unknown race
6 - Male other race
7 - Male unknown race

Banks

L 1-2 Primary Petroleum Occupation - Punch as coded

Bank 1 - Units
2 - Tens

00 - Unknown or not given

Production

01 - Rigger and driller
02 - Well puller
03 -
04 -
05 - Others with frequent exposure to crude petroleum
06 -
07 -
08 -
09 - Others with infrequent exposure to crude petroleum

Refining

20 - Catalytic cracking (includes thermal cracking of catalytic feeds) - Operators
21 - Catalytic cracking (includes thermal cracking of catalytic feeds) - Laborers, still cleaners, etc.
22 - Thermal cracking - Operators
23 - Thermal cracking - Laborers, still cleaners, etc.
24 - Coking operations - Operators
25 - Coking operations - Laborers, still cleaners, etc.
26 - Blending of heavy fuel oils (#3-6)
27 - Blending of heating oil #2
28 -
29 - Others on cracking operations

30 - Refining and blending of lubricants - Operators
31 - Refining and blending of lubricants - Laborers, still cleaners, etc.
32 - Packaging of lubricants
33 - Manufacture and packaging of greases
34 -
35 - Others - Lubricants and greases
36 - Refining and filtration (Pressing or centrifugation) of paraffin - Operators
37 - Refining and filtration (Pressing or centrifugation) of paraffin - Laborers, still cleaners, etc.
38 - Packaging of paraffin
39 - Others - Paraffin

Banks

L 1-2 Primary Petroleum Occupation

Refining (Continued)

40 - Distillation of crude oil - Operators
41 - Distillation of crude oil - Laborers, still cleaners, etc.
42 - Production of asphalt - Operators
43 - Production of asphalt - Laborers, still cleaners, etc.
44 -
45 -
46 -
47 -
48 -
49 - Straight run distillations - Others

50 - White oil manufacturing - Operators
51 - White oil manufacturing - Laborers, still cleaners, etc.
52 -
53 -
54 -
55 -
56 - Petro-chemical operations - Operators
57 - Petro-chemical operations - Laborers, still cleaners, etc.
58 -
59 - Special products - Others

60 - Maintenance - Pipe Fitters
61 -
62 - Maintenance - Boilermakers
63 - Maintanance - Mechanics
64 - Maintenance - Tank cleaners
65 -
66 -
67 -
68 -
69 - Maintenance - Others

70 -
71 - Loading department
72 -
73 -
74 -
75 -
76 - Control laboratory
77 -
78 -
79 - Others not otherwise specified - General Refining Operations

Banks

L 1-2 Primary Petroleum Occupation (Continued)

Transportation

80 -
81 -
82 -
83 -
84 -
85 - Pipe line workers
86 - Marine division - Transportation of light and medium distillates (end boiling point <650°)
87 - Marine division - Fuel oil carriers
88 - Fuel oil carriers - Others
89 - Transportation - Others

Marketing and Executive

90 - Service stations
91 -
92 -
93 -
94 -
95 - Others - Office workers, etc.
96 -
97 -
98 -

Others (Not included in the four main divisions)

99 - Job to be described in detail on card

L 3-4 Secondary Petroleum Occupation - Coded as for Primary Petroleum Occupation (See page 17)

Bank 3 - Units
4 - Tens

Banks

L 5 Principal Petroleum Product Contact - Punch as coded

(Note: If only one product is listed and if the exposure is described as rare, infrequent or light, the information will be punched only in the secondary petroleum contact field - Bank L-6.)

0 - No contact or casual contact
1 - Not given or unspecified petroleum products
2 - Crude petroleum, reduced crude, asphalts
3 - Gasoline, light ends and solvent naphthas (≤400° F.)
4 - Medium distillates (400-650° F.)
5 - Lube distillates and related uncracked intermediates (600-1000° F.)
6 - Refined products
7 - Products derived from thermal cracking units in refineries before or without catalytic cracking (600-1000° F.)
8 - Products derived from coking operations (≥600°F.)
9 - Products derived from catalytic cracking and reforming processes or from thermal cracking units in refineries with catalytic crackers (600-1000° F.)
10 - Chemical additives
11 - Petro-chemicals

L 6 Secondary Petroleum Product Contact - Coded as for Primary Petroleum Product Contact - Bank L-5

L 7 Approximate Number of Years Employed in the Petroleum Industry Prior to Onset - Punch as coded

0 - Unknown or not given
1 - 0-1 year
2 - 2-4 years
3 - 5-9 years
4 - 10-14 years
5 - 15-19 years
6 - 20+ years

Banks

R 1-2 Principal Other Occupation - Punch as coded

Bank 1 - Units
2 - Tens

00-09 - Professional and Semi-professional
10-19 - Proprietors
20-29 - Skilled Labor
30-39 - Sales and Service
40-49 - Factory Workers and General Laborers
50-59 - Miscellaneous

R 3 Approximate Number of Years Employed at Principal Other Occupation - Punch as coded

0 - Unknown or not given
1 - 0-1 year
2 - 2-4 years
3 - 5-9 years
4 - 10-14 years
5 - 15-19 years
6 - 20+ years

R 4 Primary Irritant Other Than Petroleum - Punch as coded

Physical Agents

1 - Trauma
2 - Radiant Heat
3 - Solar Rays
4 - Ultraviolet Rays
5 - Radioactive Substances or Roentgen Rays

Inorganic Substances

6 - Arsenic
7 - Chromates
8 - Others (Specified in detail)

Organic Substances

9 - Aromatic Amines
10 - Tar or Pitch
11 - Soot
12 - Creosote and Anthracene Oils
13 - Others (Specified in detail)

Banks

R 5 Approximate Number of Years Exposed to Primary Irritant Other Than Petroleum - Punch as coded

0 - Unknown or not given
1 - 0-1 year
2 - 2-4 years
3 - 5-9 years
4 - 10-14 years
5 - 15-19 years
6 - 20+ years

R 6 Secondary Irritant Other Than Petroleum - Punch as coded for Primary Irritant Other Than Petroleum - Bank R-4, page 21

R 7 Approximate Number of Years Exposed to Secondary Irritant Other Than Petroleum - Punch as coded

0 - Unknown or not given
1 - 0-1 year
2 - 2-4 years
3 - 5-9 years
4 - 10-14 years
5 - 15-19 years
6 - 20+ years

This was read to committee 9/25/52 OVS

Sept. 25 1952

For information of Medical Advisory Committee -

At meeting of Program + Budget Review Committee held in White Sulphur Springs - Sept 23rd 1952 (day before yesterday) consideration was given to a staff estimate of $100,000 to be selected in 1953 for expenditure in fiscal year 1953-54 for medical research.

The Chairman, Robert H. Colley, The Atlantic Refining Company called attention to the fact that this amount was the same as that approved 1952 and requested staff comment on status of the medical research program -

expressed my personal opinion that there were indications toward a decrease in the expenditures on cancer research at Kettering but that support was growing for a new project on toxicology of $C_9 - C_{12}$ aromatic hydrocarbons.

The committee approved, tentatively, for action at Chicago in November the staff estimate of $100,000 for medical research.

API 05502

UNIVERSITY OF CINCINNATI
DEPARTMENT OF PREVENTIVE MEDICINE AND INDUSTRIAL HEALTH

KETTERING LABORATORY
LLEGE OF MEDICINE—EDEN AVENUE
CINNATI 19, OHIO

CABLE ADDRESS: KETLAB, CINCINNATI
TELEPHONE: CAPITOL 1414

November 24, 1952

Mr. D. V. Stroop, Director
Department of Technical Services
American Petroleum Institute
50 West 50th Street
New York City 20

Dear Mr. Stroop:

For your information I am sending you herewith a statement of expenditures made on behalf of American Petroleum Institute for the third quarter of 1952. I believe that the statement will be self-explanatory, but if you have any questions or comments, Doctor Kehoe would appreciate your bringing them to his attention.

Very truly yours,

E. R. Fortlage, Secretary to
Dr. Kehoe

ef

Enc.

API 05503

UNIVERSITY OF CINCINNATI
KETTERING LABORATORY

ACCOUNT OF AMERICAN PETROLEUM INSTITUTE

FOR 3rd Quarter 1952

SALARIES (Based on Proportion of Time Actually Spent on Project)

Direct Salaries	8894.62	
Indirect Salaries		
Histopathological Preparation	1092.00	
Other Services	8178.16	18,164.78

MISCELLANEOUS EXPENSE

Purchase of Animals	550.80
Special Laboratory Supplies	472.89
Travel	552.26
Overhead (Proportion of Heat, Gas, Electricity, Steam, Telephone, General Laboratory Supplies, Postage, Annuities, Pensions, Maintenance, etc.	4303.80
TOTAL	24,044.53

Balance Available for Further Work at End of 2nd Quarter 1952	8,387.02
Balance Due Kettering Laboratory at End of	
Receipts July 1952	50,000.00
Balance Available	58,387.02
Expenditures 3rd Quarter	24,044.53
Balance Available for Further Work at End of 3rd Quarter 1952	34,342.49
Balance Due Kettering Laboratory at End of	

FORM 1230X KET LAB 500 7-52

API 05504

December 16, 1952

To Members
Research Project Advisory Committee

I am attaching the minutes of the Fourth meeting of the Research Project (MC-1) Advisory Committee which was held in Chicago September 24, 1952.

The Research Project Advisory Committee will hold its next meeting at the Kettering Laboratory in Cincinnati Friday, January 16, 1953, commencing at 9:30 A.M. Eastern Standard Time.

I would greatly appreciate receiving promptly from the members suggested items to be included on the agenda which will be circularized prior to the meeting.

Very truly yours,

M. N. NEWQUIST, M. D.
Chairman, Research Project
Advisory Committee

MNN:RMS
ENCLOSURE

~~MC:~~ ~~E. W. Adams~~
~~L. C. Beard, Jr.~~
~~Kieffer Davis, M.D.~~
~~R. E. Eckardt, M.D.~~
~~T. M. Frank, M.D.~~
~~C. M. Hine, M.D.~~
~~R. M. Landon~~
~~E. K. Linder, M.D.~~
~~K. G. Mackenzie~~
~~R. C. Mithoff~~
~~R. M. Shepardson~~

Members and Associates - Subcommittee on Carcinogenicity

Members and Associates - Medical Advisory Committee

Dr. R. A. Kehoe
Dr. A. W. Horton
Dr. J. J. Phair
Mr. D. V. Stroop

API 05505

Fourth Meeting
R.P.A. COMMITTEE (MC-1)

Chicago, Illinois - Sept. 24, 1952, 10:00 a.m. D.S.T.
Conrad Hilton Hotel Room 523

AGENDA

1. Consideration of the various items listed in the report to be made on 9-25-52 by the Subcommittee on Carcinogenicity to the Medical Advisory Committee, including progress reports by Dr. R. A. Kehoe, Dr. A. W. Horton, and Dr. J. J. Phair.

   (Copies of the reports have been circularized by Mr. Stroop.)

2. For information and any action that may be indicated.

   (a) Letter of August 26, 1952, from Mr. G. G. Rumberger to Mr. Elmer O. Mattocks.

   (b) Letter of August 13, 1952, ~~from~~ to Col. S. J. Auld from Dr. M. N. Newquist.

   (c) Letter of September 10, 1952, from Dr. R. E. Eckardt to Dr. M. N. Newquist.

3. Other.

4. Time and place of next meeting.

Respectfully submitted,

M. N. NEWQUIST, Chairman

E. W. Adams
L. C. Beard, Jr.
Kieffer Davis, M.D.
R. E. Eckardt, M.D.
T. M. Frank, M.D.
C. H. Hine, M.D.
R. M. Landon
E. K. Linder, M.D.
K. G. Mackenzie
R. C. Mithoff
R. M. Shepardson

D. V. Stroop (2)
R. A. Kehoe, M.D. (3)

For Information Only - Not For Publication

REPORT ON FOURTH MEETING

Research Project MC-1 Advisory Committee
September 24, 1952
Conrad Hilton Hotel
Chicago, Illinois

- - - - -

MEMBERS PRESENT

M. N. Newquist, M.D. - Chairman
R. E. Eckardt, M.D. - Acting Sec'y.
E. W. Adams
L. C. Beard, Jr.
Kieffer Davis, M.D.
T. M. Frank, M.D.
R. M. Landon
E. K. Linder, M.D.
K. G. Mackenzie
R. C. Mithoff
R. M. Shepardson

MEMBERS ABSENT AND NOT REPRESENTED

C. M. Hine, M.D.

OTHERS PRESENT

R. D. Bent	-	Atlantic Refinign Company
R. C. Cole	-	Phillips Petroleum Company
H. W. Gerarde, M.D.	-	Standard Oil Development Co.
A. W. Horton	-	University of Cincinnati
R. A. Kehoe, M.D.	-	University of Cincinnati
E. C. Mattocks	-	American Petroleum Institute
A. C. Pabst	-	Socony-Vacuum Oil Co., Inc.
J. J. Phair, M.D.	-	University of Cincinnati

The attached agenda of the meeting, which had been distributed by Dr. Newquist prior to the meeting, was used as the program.

ITEM 1

The report of the Subcommittee on Carcinogenicity to be presented to the Medical Advisory Committee on September 25, 1952, was reviewed. This report, which had been sent to members of the Subcommittee on September 11, 1952, had received approval by the Subcommittee.

The final tabulation of the voting on epidemiological studies of cancer among employes of customers was as follows:

Do you recommend that Kettering Laboratory, University of Cincinnati, make epidemiological studies of cancer among employes of customers?

Yes 12 No 12 Not voting 1

If yes, what is your opinion on the following points?

a. Random selection of plants for survey.
Yes 3 No 6 Not voting 3

b. Limit surveys to plants where cancer cases are allegedly due to petroleum products.
Yes 6 No 0 Not voting 6

c. Maintain a cancer registry wherein only cancer cases proven to be due to exposure to petroleum products would be recorded.
Yes 5 No 2 Not voting 5

DR. HORTON'S REPORT

Dr. Horton used as the basis for his discussion the memorandum from Kettering Laboratory, dated September 24, 1952, which had been distributed to members of the Medical Advisory

[illegible] these. Perhaps the most important feature stressed by Dr. [illegible] was the observation that there are non-carcinogenic oils [illegible] are not white oils; that is to say that apparently it is [illegible] necessary to carry out such an extreme degree of refining [illegible] produce a white oil in order to eliminate the carcinogenic [illegible] oil. In support, Dr. Horton stressed the results obtained [illegible] with AFI-100 and AFI-99. There was considerable discussion by [illegible] as to just what the nature of AFI-100 and AFI-99 might be [illegible] some many of them did not feel that the specific gravity and [illegible] viscosity indicated that these represented a type of oil that [illegible] might ordinarily be found on the market. It was emphasized, [illegible] also, by Dr. Horton that these oils were taken out of can[illegible] and were used presumably in certain test engines.

Dr. Horton suggested that because of the negative results obtained when white oils are painted on mice, it might be advisable to test such materials on rabbits since the English are placing much emphasis on the importance of rabbits in skin cancer testing work.

There was next a considerable amount of discussion [illegible] experiments which have indicated that dodecyl benzene has a [illegible] irritant action on the skin of the mouse which seems to enhance the carcinogenicity of truly carcinogenic compounds. These experiments were summarized on page 29 of the tabular summary of current and completed biological experiments dated September 1, 1952. These results that dodecyl benzene can sensitize the skin to a subsequent [illegible] if it is applied prior to the application of the carcinogen. These results are indicated in experiments designated [illegible] [illegible] the first 5 samples listed in Table III, page 35, [illegible]

experiments indicate that if the skin is sensitized with dodecyl benzene prior to the application of API-9, the average latent period of tumor induction is approximately 1/2 of what it is when this sensitization process is not carried out. It is from an accumulating body of data of this nature that Dr. Horton is developing the concept that certain materials contain accelerators to the carcinogens. It is believed by Dr. Horton that these accelerators are particularly important in what he designates as side streams and are of considerably less importance in residua. Thus he has found that an oil which has been prepared by distillation which has no benzpyrene, or essentially none, still has a considerable activity. The laboratory is attempting to find out the class or classes of compounds which are responsible for this activity.

Dr. Horton's laboratory has developed a very rapid method for quantitatively determining the amount of benzpyrene in an oil sample. This discussion led to the suggestion that Dr. Horton should consider performing an experiment in which a batchwise solvent extraction of a typical lube stock base (for instance API-56, API-79, or API-105) with subsequent testing of the extract(s) and raffinate(s) would be performed. It is felt that such an experiment might essentially remove 4 and 5 ring aromatic compounds, leaving the 1, 2, and 3 ring materials for testing.

Experiments are now underway to determine the effect on PyC of painting once, twice or three times a week. In addition, experiments on the effects of varying the amount of material applied at a given application (i.e. from 5-100 mg.) are also being conducted. Preliminary, it is beginning to appear that the amount of

material applied each time may be significant in materials which have a considerable amount of the accelerators in them but probably is not important in those materials in which these accelerators are minimal or absent. Thus, when the potency of a material seems to correlate with its benzpyrene content, the amount of material applied per application seems not to have any effect on this potency determination; but when a material seems to have a higher potency than its benzpyrene content would suggest it should have, the amount of material applied at each application may have a considerable effect on the potency determined.

In addition to the presence of accelerators, Dr. Horton has some evidence to indicate that there may be inhibitors in certain petroleum products, and that these inhibitors are present in the residua of distillation processes but are absent in the side streams. This fact, correlated with certain other observations, has given some suggestive evidence, although certainly not conclusively demonstrated, that the inhibitors may be heavy metals or may be compounds associated with the heavy metals. Dr. Horton believes that these inhibitors probably account for the reason why crude oils are essentially non-carcinogenic, while gas oils prepared from such crudes may exhibit some carcinogenicity. It is Dr. Horton's belief that crude oils contain sufficient benzpyrene and other related carcinogens to demonstrate a significant degree of carcinogenicity, whereas, animal and human data indicate that they do not. It was Dr. Horton's intent not to pursue inhibitors very strenuously. Certain members of the committee, however, believe that the pursuit of such inhibitors might have very important practical considerations

to the petroleum industry and suggested that they not be abandoned lightly.

Because of the great complexity of carcinogenesis in petroleum products, which now appears to be a summation of the concentration of carcinogens, the presence of accelerators, and the presence of inhibitors, many of the members of the committee felt that the development of a simple analytical tool to test for carcinogenicity would be considerably more difficult, if not impossible, than originally believed. Thus, it was felt that carcinogenicity is not the result of a single class of compounds but rather the summation of three separate and distinct types of activity, and that, therefore, the development of an analytical tool has been considerably complicated.

DR. PHAIR'S REPORT →

Dr. Phair discussed the memorandum from the Kettering Laboratory API Research Project on Carcinogenicity Epidemiological Studies, dated September 24, 1952. This memorandum had been previously distributed to members of the Medical Advisory Committee. There was some discussion of the significance of the figures presented in Figure 4, page 6 of this memorandum. Dr. Phair emphasized the importance of not drawing any conclusions from this table at the present time since the number of cases is so small. He emphasized again the necessity of collecting a large number of cases for analysis before any statistically significant differences can be demonstrated. Premature conclusions from data of this type will be detrimental and should not be done. Dr. Phair asked for the criticisms of each of the members of this committee and of the

Medical Advisory Committee of the coding system which he is using on the case record cards. Dr. Kehoe and Dr. Phair reported that the Kettering Laboratory would be willing to undertake a critical review with abstracts of the literature on cancer as related to petroleum and that the annual cost of such bibliographic service would be $4430. The Chairman of the RPA Committee then further emphasized the necessity of medical directors of petroleum companies, who have membership on the Medical Advisory Committee, in submitting their cancer cases to Dr. Phair if his work is to have any significance. If they are unwilling to submit their records, then this should be brought out in the open and the epidemiological side of these studies dropped now rather than attempting to continue when the lack of sufficient cases doom the project to failure before it starts.

ITEM 2a

The inquiry from Mr. G.G. Rumberger, Marathon Corporation, dated August 26, 1952, to Mr. E. O. Mattocks concerning possible carcinogenicity of petroleum waxes and Mr. D. V. Stroop's reply were presented for information with the verbal comment that contributors to the API Fundamental Research Project are not thereby entitled to reports on other API research projects. Copies of this correspondence were sent to members of the Medical Advisory Committee.

ITEM 2b

Dr. Newquist's letter of August 13, 1952, to Col.S.J. Auld concerning possible reporting in England of the research work at Kettering Laboratory was presented for information. A copy of this letter was sent to each member of the Medical Advisory Committee.

ITEM 2c

Dr. R.E. Eckardt's letter of September 10, 1952, to Dr. Newquist commenting on the research activities of Dr. Paul Kotin of the University of Southern California on the matter of cancer and smog was discussed. It was the consensus of the R.P.A. Committee that Dr. Eckardt and any other interested members of the committee might, as individuals, meet informally with Dr. Kotin at the time of the Industrial Health Conference in Los Angeles in April 1953 if they so desired.

ITEM 3 - BUDGET FOR YEAR JULY 1, 1953 - JUNE 30, 1954

Dr. R. A. Kehoe submitted a proposed budget totalling $104,073 for support of research project MC-1 for the next fiscal year, a copy of which is attached. In executive session, the R.P.A. Committee recommended a reduction of $25,790, making a proposed budget of $78,283 for fiscal 1953-1954. The following recommendations were made with respect to Dr. Kehoe's budget:

I - Delete	
II and III to be combined	$25,720
IV - Reduce the total amount by $10,000 and apply the balance to items A & B as deemed best.	33,130
V - Delete items B & C and increase item A by $6,263.00.	19,433
	$78,283

Any change in research activities necessitated by this reduction in the budget would be discussed by the R.P.A. Committee with Dr. Kehoe and Dr. Horton at the next R.P.A. Committee meeting.

ITEM 4

The next meeting of the R.F.A. Committee was set tentatively for January 16, 1953 at the Kettering Laboratory in Cincinnati.

R. E. Eckardt, M. D.,
Acting Secretary

M. N. Newquist, M. D.,
Chairman

AMERICAN PETROLEUM INSTITUTE
50 WEST 50TH STREET
NEW YORK 20, N. Y.

December 19,1952

To Members,
Research Project Advisory Committee

E. W. Adams
L. C. Beard, Jr.
Kieffer Davis, M.D.
R. E. Eckardt, M.D.
T. M. Frank, M.D.
C. H. Hine, M.D.
R. M. Landon
E. K. Linder, M.D.
K. G. Mackenzie
R. C. Mithoff
R. M. Shepardson

Gentlemen:

I am attaching the minutes of the Fourth meeting of the Research Project (MC-1) Advisory Committee which was held in Chicago, September 24, 1952.

The Research Project Advisory Committee will hold its next meeting at the Kettering Laboratory in Cincinnati, Friday, January 16, 1953, commencing at 9:30 A.M. Eastern Standard Time.

I would greatly appreciate receiving promptly from the members suggested items to be included on the agenda which will be circularized prior to the meeting.

Very truly yours,

M. N. Newquist

M. N. NEWQUIST, M.D.
Chairman, Research Project
Advisory Committee

MNN:RMS
Enclosure

mc: Members and Associates
Subcommittee on Carcinogenicity
Members and Associates
Medical Advisory Committee
Dr. Robert A. Kehoe
Dr. A. W. Horton
Dr. J. J. Phair
Mr. D. V. Stroop

Fourth Meeting
R. P. A. COMMITTEE (MC-1)

Chicago, Illinois - Sept. 24, 1952, 10:00 a.m. D.S.T.
Conrad Hilton Hotel Room 523

AGENDA

1. Consideration of the various items listed in the report to be made on 9-25-52 by the Subcommittee on Carcinogenicity to the Medical Advisory Committee, including progress reports by Dr. R. A. Kehoe, Dr. A. W. Horton, and Dr. J. J. Phair.

   (Copies of the reports have been circularized by Mr. Stroop.)

2. For information and any action that may be indicated.

   (a) Letter of August 26, 1952, from Mr. G. G. Rumberger to Mr. Elmer O. Mattocks.

   (b) Letter of August 13, 1952, to Col. S.J. M. Auld from Dr. M. N. Newquist.

   (c) Letter of September 10, 1952, from Dr. R. E. Eckardt to Dr. M. N. Newquist.

3. Other

4. Time and place of next meeting.

Respectfully submitted,

M. N. NEWQUIST, Chairman

E. W. Adams
L. C. Beard, Jr.
Kieffer Davis, M.D.
R. E. Eckardt, M.D.
T. M. Frank, M.D.
C. H. Hine, M.D.
R. M. Landon
E. K. Linder, M.D.
K. G. Mackenzie
R. C. Mithoff
R. M. Shepardson

D. V. Stroop (2)
R. A. Kehoe, M.D. (3)

API 05517

For Information Only - Not For Publication

REPORT ON FOURTH MEETING

Research Project MC-1 Advisory Committee
September 24, 1952
Conrad Hilton Hotel
Chicago, Illinois

- - - - -

MEMBERS PRESENT

M. N. Newquist, M.D. - Chairman
R. E. Eckardt, M.D. - Acting Sec'y.
E. W. Adams
L. C. Beard, Jr.
Kieffer Davis, M.D.
T. M. Frank, M.D.
R. M. Landon
E. K. Linder, M.D.
K. G. Mackenzie
R. C. Mithoff
R. M. Shepardson

MEMBERS ABSENT AND NOT REPRESENTED

C. M. Hine, M.D.

OTHERS PRESENT

R. D. Bent	-	Atlantic Refining Company
R. C. Cole	-	Phillips Petroleum Company
H. W. Gerarde, M.D.	-	Standard Oil Development Company
A. W. Horton	-	University of Cincinnati
R. A. Kehoe, M.D.	-	University of Cincinnati
E. O. Mattocks	-	American Petroleum Institute
A. C. Pabst	-	Socony-Vacuum Oil Company, Inc.
J. J. Phair, M.D.	-	University of Cincinnati

The attached agenda of the meeting, which had been distributed by Dr. Newquist prior to the meeting, was used as the program.

ITEM 1

The report of the Subcommittee on Carcinogenicity to be presented to the Medical Advisory Committee on September 25, 1952, was reviewed. This report, which had been sent to members of the subcommittee on September 11, 1952, had received approval by the subcommittee.

The final tabulation of the voting on epidemiological studies of cancer among employes of customers was as follows:

Do you recommend that Kettering Laboratory, University of Cincinnati, make epidemiological studies of cancer among employes of customers?

Yes 12 No 12 Not voting 1

If yes, what is your opinion of the following points?

a. Random selection of plants for survey.
Yes 3 No 6 Not voting 3

b. Limit surveys to plants where cancer cases are allegedly due to petroleum products.
Yes 6 No 0 Not voting 6

c. Maintain a cancer registry wherein only cancer cases proven to be due to exposure to petroleum products would be recorded.
Yes 5 No 2 Not voting 5

DR. HORTON'S REPORT

Dr. Horton used as the basis for his discussion the memorandum from Kettering Laboratory, dated September 24, 1952, which had been distributed to members of the Medical Advisory Committee. Perhaps the most important feature stressed by Dr. Horton was the observation that there are non-carcinogenic oils which are not white oils; that is to say that apparently it is not necessary to carry out such an extreme degree of refining as to produce a white oil in order to eliminate the carcinogenicity of an oil. In support, Dr. Horton stressed the results obtained with API-100 and API-99. There was considerable discussion by the associates on just what the nature of API-100 and API-99 might be since many of them did not feel that the specific gravity and viscosity indicated that these represented a type of oil which

might ordinarily be found on the market. It was emphasized, however, by Dr. Horton that these oils were taken out of cans and were used presumably in certain test engines.

Dr. Horton suggested that because of the negative results obtained when white oils are painted on mice, it might be advisable to test such materials on rabbits since the English are placing so much emphasis on the importance of rabbits in skin cancer testing work.

There was next a considerable amount of discussion on the experiments which have indicated that dodecyl benzene has a specific irritant action on the skin of the mouse which seems to enhance the carcinogenicity of truly carcinogenic compounds. These experiments were summarized on page 29 of the tabular summary of current and completed biological experiments dated September 1, 1952. They indicate that dodecyl benzene can sensitize the skin to carcinogens even if it is applied prior to the application of the carcinogen. These results are indicated in experiments designated 221, 9, 9, 221-9, 221-9 (the first 5 samples listed in Table III, page 29). These experiments indicate that if the skin is sensitized with dodecyl benzene prior to the application of API-9, the average latent period of tumor induction is approximately 1/2 of what it is when this sensitization process is not carried out. It is from an accumulating body of data of this nature that Dr. Horton is developing the concept that certain materials contain accelerators to the carcinogens. It is believed by Dr. Horton that these accelerators are particularly important in what he designates as side streams and are of considerably less importance in residua. Thus he has found that an oil which has been prepared by distillation which has no benzpyrene, or essentially none, still has a considerable activity. The laboratory is attempting to find out the class or classes of compounds which are responsible for this activity.

Dr. Horton's laboratory has developed a very rapid method for quantitatively determining the amount of benzpyrene in an oil sample. This discussion led to the suggestion that Dr. Horton should consider performing an experiment in which a batchwise solvent extraction of a typical lube stock base (for instance API-56, API-79, or API-105) with subsequent testing of the extract(s) and raffinate(s) would be performed. It is felt that such an experiment might essentially remove 4 and 5 ring aromatic compounds, leaving the 1, 2, and 3 ring materials for testing.

Experiments are now underway to determine the effect on PMC of painting once, twice or three times a week. In addition, experiments on the effects of varying the amount of material applied at a given application (i.e. from 5-100 mg.) are also being conducted. Preliminary, it is beginning to appear that the amount of material applied each time may be significant in materials which have a considerable amount of the accelerators in them but probably is not important in those materials in which these accelerators are minimal or absent. Thus, when the potency of a material

seems to correlate with its benzpyrene content, the amount of material applied per application seems not to have any effect on this potency determination; but when a material seems to have a higher potency than its benzpyrene content would suggest it should have, the mount of material applied at each application may have a considerable effect on the potency determined.

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Because of the great complexity of carcinogenesis in petroleum products, which now appears to be a summation of the concentration of carcinogens, the presence of accelerators, and the presence of inhibitors, many of the members of the committee felt that the development of a simple analytical tool to test for carcinogenicity would be considerably more difficult, if not impossible, than originally believed. Thus, it was felt that carcinogenicity is not the result of a single class of compounds but rather the summation of three separate and distinct types of activity, and that, therefore, the development of an analytical tool has been considerably complicated.

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the criticisms of each of the members of this committee and of the Medical Advisory Committee of the coding system which he is using on the cas record cards. Dr. Kehoe and Dr. Phair reported that the Kettering Laboratory would be willing to undertake a critical review with abstracts of the literature on cancer as related to petroleum and that the annual cost of such bibliographic service would be $4,430. The Chairman of the RPA Committee then further emphasized the necessity of medical directors of petroleum companies, who have membership on the Medical Advisory Committee, submitting their cancer cases to Dr. Phair if his work is to have any significance. If they are unwilling to submit their records, then this should be brought out in the open and the epidemiological side of these studies dropped now rather than attempting to continue when the lack of sufficient cases doom the project to failure before it starts.

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ITEM 2c

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ITEM 3 - BUDGET FOR YEAR JULY 1, 1953 - JUNE 30, 1954

Dr. R. A. Kehoe submitted a proposed budget totalling $104,073 for support of research project MC-1 for the next fiscal year, a copy of which is attached. In executive session, the

R.P.A. Committee recommended a reduction of $25,790, making a propcsed budget of $78,283 for fiscal 1953-1954. The following recommendations were made with respect to Dr. Kehoe's budget:

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R. E. Eckardt, M. D.,
Acting Secretary

M. N. Newquist, M. D.,
Chairman

BUDGET OF THE KETTERING LABORATORY

FOR THE INVESTIGATION OF THE POTENTIAL CANCER HAZARD OF THE

PETROLEUM INDUSTRY

SPONSORED BY THE MEDICAL ADVISORY COMMITTEE

of the

AMERICAN PETROLEUM INSTITUTE

July 1, 1953 - June 30, 1954

I. Determination of the location and extent of the cancer hazard from refinery intermediate and product streams

Direct Salaries	$ 4,000.00	
Indirect Salaries	3,500.00	
Miscellaneous Expense	2,000.00	
Overhead	1,860.00	
		$ 11,360.00

II. Development of semi-quantitative biological testing methods for measuring the relative carcinogenic potencies of petroleum products

Direct Salaries	$ 3,500.00	
Indirect Salaries	4,200.00	
Miscellaneous Expense	2,300.00	
Overhead	1,630.00	
		$ 11,630.00

III. Determination of the relationships between the rapidity of induction of benign and malignant tumors in experimental animals and various exposure factors such as frequency of application, dosage per application, area of exposure, number of applications, special irritant or toxic properties of the oil applied, etc.

Direct Salaries	$ 4,500.00	
Indirect Salaries	5,200.00	
Miscellaneous Expense	2,300.00	
Overhead	2,090.00	
		$ 14,090.00

.....

Indirect Salaries include Histopathological Preparation and other services.

Miscellaneous Expense includes purchase of animals, special laboratory supplies, and travel.

IV. Development of rapid analytical methods for estimating the relative carcinogenic potency of any given refinery intermediate or product

A. Isolation and identification of compounds responsible for observed potency of various types of oils and determination of physical and chemical properties of these compounds which could be used in the development of a widely applicable analytical tool (including associated animal testing)

Direct Salaries	$12,000.00
Indirect Salaries	10,200.00
Miscellaneous Expense	3,050.00
Overhead	5,500.00
	$ 30,750.00

B. Semi-empirical correlations with carcinogenic potencies based on the chemical or physical properties of known or suspected carcinogens in the oils (including associated aniamal testing)

Direct Salaries	$ 5,000.00
Indirect Salaries	3,700.00
Miscellaneous Expense	1,350.00
Overhead	2,330.00
	$ 12,380.00

V. Epidemiological Program

A. Collection and correlation of data on cases of cancer among employees of the petroleum industry

Direct Salaries	$ 5,000.00
Indirect Salaries	3,500.00
Miscellaneous Expense	2,350.00
Overhead	2,320.00
	$ 13,170.00

B. Special investigations of cases of cancer in particular plants in the industry or among customers of the industry

Direct Salaries	$ 2,500.00
Indirect Salaries	1,750.00
Miscellaneous Expense	850.00
Overhead	1,163.00
	$ 6,263.00

C. Survey of pertinent literature on cases of cancer occurring among workers exposed to tar or oil in their occupation

Direct Salaries	$ 2,000.00
Indirect Salaries	1,400.00
Miscellaneous Expense	100.00
Overhead	930.00
	$ 4,430.00

December 24, 1952

Dr. Robert A. Kehoe
University of Cincinnati
The Kettering Laboratory
College of Medicine - Eden Avenue
Cincinnati 19, Ohio

Dear Doctor Kehoe:

Pursuant to our continuation contract with the University of Cincinnati, covering the work on investigation of the toxicity and mode of action of certain petroleum products, we enclose the Institute's check in the amount of $46,372.98, which represents the difference between $54,760.00 and the unexpended balance of $8,387.02 as reported at the end of the second quarter, June 30, 1952.

This check completes the payments due under the present contract for the year ending June 30, 1953.

Very truly yours,

DVS:e
Enclosure
cc: Dr. E. Kern Linder
Dr. M. H. Rasquist
Mr. Lacey Walker

Note to Mr. Walker:
This expenditure is to be charged against the Medical Research Fund.

DVS

UNIVERSITY OF CINCINNATI
DEPARTMENT OF PREVENTIVE MEDICINE AND INDUSTRIAL HEALTH

THE KETTERING LABORATORY
COLLEGE OF MEDICINE—EDEN AVENUE
CINCINNATI 19, OHIO

-CABLE ADDRESS: KETLAB, CINCINNATI
TELEPHONE: CAnyon 1414

December 30, 1952

Mr. D. V. Stroop, Director
Department of Technical Services
American Petroleum Institute
50 West 50th Street
New York City 20

Dear Mr. Stroop:

I herewith acknowledge with thanks receipt of American Petroleum Institute's check in the amount of $46,372.98, covering expenditures to be made on their behalf.

Very truly yours,

E. R. Fortlage

E. R. Fortlage, Secretary to
Dr. Kehoe

ef

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