

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

DATE: 1946 Nov 14

DOC#: API004

DOCUMENT DESCRIPTION: Meeting Minutes & Attendee List - API
Medical Advisory Committee

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AMERICAN PETROLEUM INSTITUTE
MEDICAL ADVISORY COMMITTEE

Minutes of Meeting
November 14, 1946 - 10:00 AM
Stevens Hotel
Chicago, Illinois

MEMBERS PRESENT

McIver Woody ✓ - Chairman
T. M. Frank ✓ - Secretary

F. F. Boys ✓
V. C. Baird ✓
Kieffer Davis ✓

A. E. Hoag ✓
J. P. Holt ✓
W. R. Levis ✓

E. K. Linder ✓
M. N. Newquist
B. B. Reeve ✓

ASSOCIATES PRESENT

E. W. Adams ✓
L. C. Beard, Jr. ✓
R. S. Bonsib ✓
J. D. Bushnell

R. C. Cole ✓
N. J. Gothard ✓
H. P. Lankelma ✓
C. R. McKay ✓
(Rep. by C. K. Hewes)

H. R. Warrick ✓
F. M. Watkins ✓
H. J. Wilde ✓
H. H. Zuidema ✓

GUEST

Marshall Clinton, Jr., M.D.

ADVISOR

D. V. Stroop - API

Total in Attendance - 25

MEMBERS ABSENT

W. O. Armstrong ✓
D. M. English ✓

R. A. Jewett ✓
T. J. Kelly ✓

W. A. Morrison ✓
H. S. Thomson ✓

ASSOCIATES ABSENT

W. W. Brooks ✓
R. H. Colley ✓
R. S. Driver ✓

Wm. Grant, Jr. ✓
E. W. Isom ✓
A. J. Koewing, Jr. ✓

D. W. Larmer ✓
G. H. Taber, Jr. ✓

.....

I

MINUTES OF PREVIOUS MEETING

Action

The minutes of the previous meeting, April 5, 1946, were approved as circularized.

API 06836

II

REPORT OF SUBCOMMITTEE ON PERMISSIBLE CONCENTRATIONS - DR. V. C. BAIRD, CHAIRMAN

The report of the Subcommittee on Permissible Concentrations was presented and is given in full in Appendix A.

Action In its acceptance of the subcommittee's report, the Medical Advisory Committee voted to adopt motions as follows:

- A. That final drafts of toxicological reviews should be published with the following statement:

"This toxicological review has been prepared by Dr. Marshall Clinton, Jr., and associates, of Harvard University, under the auspices of the Medical Advisory Committee of the API, reviewed and approved by Dr. Paul Neal, U.S.P.H."

- B. That Dr. Clinton be asked to prepare a suitable preface to the series of reviews to be submitted at the next meeting.
- C. That each review should be dated and be subject to mandatory review every three years, or sooner, on the recommendation of the Medical Advisory Committee.
- D. That the substances for review by Dr. Clinton and associates in the near future include the following:

acrylonitrile ✓
alkyl mercaptans ✓
alkyl disulphides ✓
alkyl thioethers
alkylated thiophenols
thiophenols ✓
thiophens ✓
aromatic mercaptans ✓
alkyl nitrates
naphthenic acids ✓
triphenyl phosphate
tributyl phosphite
maleic anhydride ✓
alpha naphthol
n-butyl-p-amino phenol (DuPont #5) ✓
n,n-di-sec-butyl-p-phenylene diamine (U.O.P. #5) ✓
2,6 di-t-butyl-4-methyl phenol (Paranox 441)
phenylalphanaphthylamine
phenylbetanaphthylamine
phosphorus pentasulphide ✓
carbon monoxide ✓
normal butyl para amino phenol
alkyl peroxides
nitro paraffin
Dowtherm ✓
diethylene glycol ✓
morpholine ✓
lead and copper naphthanate
tricresyl phosphate
pyrethrum

- E. That this list be circularized among the members of this committee, with the request that they note their choice of five compounds to be studied first and, regarding the remainder, which ones they consider of (1) great interest, (2) moderate interest, and (3) least interest.
- F. That in the preface to the series of reviews a statement should be made that petroleum products (except those prepared for medicinal use) may be toxic when ingested.
- G. That in addition to the toxicological studies collected from the literature, much may be learned by an adequate study of patients who have been exposed to toxic substances in amounts sufficient to produce clinical illness or injury. The cure and rehabilitation of such individuals are the responsibility of the company involved. However, Dr. Clinton and his associates are available for consultation and advice (at the expense of the company). The information so obtained will be made available to the members of this committee, at the discretion of the company.
- H. That in order to obtain as much information as possible from each case of clinical intoxication, Dr. Clinton be asked to recommend a standardized procedure to be followed by or under the supervision of the medical director of the company involved. This outline should show what laboratory and physical examinations need to be carried out. Such information should be submitted to Dr. Clinton for compilation and eventually may be included as clinical studies with the toxicological data now being collected and any experimental studies which may be made. This procedure should be followed on substances of general interest, agreed upon by Dr. Clinton and the members (medical) of this committee.
- I. That this committee indicate that it has an interest in the possibilities of the use of radioisotopes; and if Dr. Clinton should find an occasion where these substances can be used, he may prepare an outline for submission to this committee.
- J. That the subject of laboratory research be deferred until next spring's meeting, at which time it can be decided as to whether the committee will want the laboratory research program undertaken.
- K. After hearing of deaths from drinking kerosine, the committee came to the conclusion that the problem is primarily one of education and accordingly referred the matter to the Health Committee of the Petroleum Section of the National Safety Council for proper publicity and education.
- L. A motion was made and adopted to recommend an appropriation of \$10,000 to Harvard University to continue the work of Dr. Clinton and his associates in the research program of this committee.
- M. It was voted to empower the chairman to appoint an Editorial Committee to work with Mr. Stroop in the preparation of the final draft of any publications of the Medical Advisory Committee.

III

REPORT OF SUBCOMMITTEE ON HF ALKYLATION - DR. A. E. HOAG, CHAIRMAN

The Subcommittee on HF Alkylation presented a verbal report of its activity, together with an extensive confidential report on the experiences of one company.

Action In view of this report and the recommendations of the committee, it was voted:

- A. To rename the subcommittee as the Subcommittee on Fluorides.
- B. To recommend an appropriation of \$5,000 to further research work on this subject.
- C. To request help from the groups of investigators at Harvard, the University of Cincinnati (Dr. Kehoe), or elsewhere.
- D. To request cooperation from representatives of all the petroleum companies here represented.
- E. To explore the possibilities of a joint survey of the fluorine problem by the aluminum, chemical, and petroleum industries.
- F. To empower the chairman to enlarge the subcommittee to five members.

Note: The chairman appointed additional members as follows:

Dr. F. F. Boys N. J. Gothard - F. M. Watkins, Associates.
Dr. B. B. Reeve ... E. W. Adams, Associate.

IV

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

The report of the Subcommittee on Carcinogenicity was accepted as presented. It is produced in full as Appendix B.

V

REPORT OF SUBCOMMITTEE ON CHLORINATED COMPOUNDS - DR. F. F. BOYS, CHAIRMAN

The Subcommittee on Chlorinated Compounds reported no activity.

Action It was voted to discharge the Subcommittee on Chlorinated Compounds with thanks for its accomplishments.

VI

REPORT OF SUBCOMMITTEE ON POLICIES AND PRACTICES - DR. R. A. JETTETT, CHAIRMAN

Due to delays in mail service the report of the chairman of the Subcommittee on Policies and Practices was not received from the chairman in time for presentation and consideration. It was received later and is appended as Appendix C for information of members.

VII

SUBCOMMITTEE ON CUTTING FLUIDS

Action

In response to a letter from Mr. Joseph Geschelin, Chairman of the Independent Research Committee on Cutting Fluids, it was voted that this committee appoint a Subcommittee on Cutting Fluids to draw up certain informative data and recommendations with respect to the manufacture, handling, and use of cutting fluids, with particular reference to the prevention and treatment of dermatoses, and that this subcommittee explore the possibility of some action cooperative with the Independent Research Committee on Cutting Fluids.

VIII

CARBON MONOXIDE INTOXICATION

Action

The question of CO intoxication and exposure was referred to the Subcommittee on Permissible Concentrations, with the request for an early report not only on toxicity but on means of checking frequency and degree of exposure, especially by blood tests, and that this matter be called to the special attention of the medical directors of the individual oil companies.

IX

CONTRIBUTIONS TO MEDICAL RESEARCH FUND FOR 1947

Action

It was voted that the Medical Advisory Committee recommend to the Executive Committee of the API that it authorize the officers of the Institute to solicit contributions for the research fund of the Medical Advisory Committee in the amount of \$30,000 for the year 1947, for allocation to work under subcommittees as follows:

Subcommittee on Carcinogenicity	\$10,000
Subcommittee on Permissible Concentrations	10,000
Subcommittee on Cutting Fluids	5,000
Subcommittee on Fluorides	5,000

X

MORTALITY STATISTICS

Action

It was voted to request the officers of the API to collect mortality statistics in the oil industry pursuant to suggestion circularized to Medical Advisory Committee under date of September 4, 1946.

XI

FREQUENCY OF SHIFT CHANGES

Part of the report of the Committee on Policies and Practices was read by Dr. Newquist on the subject of tours. It was voted to endorse the conclusions therein. This is to be found in the full report of the Committee in Appendix C.

XII

It was voted to meet again in conjunction with the A.A.I.P.S. in Buffalo, New York on April 28-29, these dates being subject to revision by the chairman and Mr. Stroop.

Approved:

McIver Woody, M.D.
Chairman

T. H. Frank, M.D.
Secretary

12-11-46

API 06841

November 14, 1946

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APPENDIX A

REPORT TO THE API MEDICAL ADVISORY COMMITTEE BY THE SUBCOMMITTEE
FOR PERMISSIBLE CONCENTRATIONS OF TOXIC SUBSTANCES IN THE PETROLEUM INDUSTRY

Dr. V. C. Baird - Chairman

Our original objectives were as follows:

1. To prepare a list of the toxic substances used and produced in the petroleum industry.
2. To collect and publish information on those substances on the above list on which the toxicology has already been established.
3. To develop a research program for the study of those subjects remaining on the above list which are of sufficient importance on which satisfactory toxicological information has not been determined.

A fairly complete list of toxic substances has been prepared. From this list 24 substances were selected for original studies. Toxicological drafts on 18 of these substances have been completed. The objective of our subcommittee is to have available an authoritative reference on the toxicology of all chemicals produced or used in the industry. Our committee will welcome suggestions for preferential study of any substance or substances from any one on the Medical Advisory Committee.

We submit the attached report from Dr. Marshall Clinton, Jr., showing the activities of his group to date, with proposals for its activities for the next six months. Dr. Clinton will be present at this meeting to discuss his report in person.

We recommend continuation of our present procedure for review of tentative drafts of toxicological reviews by each member and associate member of the Medical Advisory Committee and final approval for publication of final drafts by the committee at each semi-annual meeting.

We recommend that the American Petroleum Institute furnish and distribute to each member and associate of the Medical Advisory Committee a copy of each finally approved toxicological review and a suitable loose-leaf binder in which to keep them. Provision should be made for others to purchase one or more sets of the publication.

November 14, 1946

REPORT OF DR. MARSHALL CLINTON, JR.

TO THE CHAIRMAN OF THE SUBCOMMITTEE FOR PERMISSIBLE CONCENTRATIONS
OF THE MEDICAL ADVISORY COMMITTEE OF THE AMERICAN PETROLEUM INSTITUTE

This report summarizes the objectives and the current activities of our group at Harvard in connection with our contract with the American Petroleum Institute. Suggestions for extending the program are included.

The principal activity of our group at present is the compilation and formulation of toxicological reviews based on the available literature concerning a variety of compounds of interest to the industry. The available information on each compound is being prepared in outline form for submission to the Medical Advisory Committee, more or less according to the outline suggested by the Subcommittee on Permissible Concentrations. It is now our practice to present each review to the Medical Advisory Committee for comments, criticisms and suggestions before preparing final drafts. This enables us to benefit from the invaluable practical experience of the medical and technical departments within the industry. Their response so far has been most gratifying. It is realized that compiling a separate outline for each substance frequently results in repetition, particularly in the sections dealing with placement examinations and safety precautions. Such repetition appears justifiable, however, if the outline of information on each substance is to be a complete unit which can be referred to rapidly and without reference to other substances. It is our belief that this should be continued.

The work of compiling information does not progress with great rapidity, for we consider it best to concentrate on quality rather than quantity. This necessitates repeated searching, checking and double checking, all of which are time-consuming. So far, tentative drafts of information have been sent to Mr. Stroop for distribution to the Medical Advisory Committee on the following substances:

aluminum chloride	iron carbonyl
ammonia	phenol
benzene	styrene
boron trifluoride	toluene
carbon tetrachloride	xylene
"chlorex"	cresol
cumene	hydrogen chloride
furfural	nitrobenzene
hydrogen sulfide	sulfuric acid

API 06843

Reviews on the remaining compounds on the original list submitted to us are progressing. A start has been made at working up other compounds included on the general list of toxic substances but not present on the original "high priority" list. Orientation on the relative urgency of the substances on the long list appears desirable, however, and must come from within the industry.

During the next six months we plan to complete the compiling of information on all substances on the original list as well as on additional substances. As already stated, it will be necessary for the industry to indicate the relative priority of the various substances on the complete list.

We believe that the information which we have compiled and are compiling will be of considerable value to the petroleum industry and to related agencies. We are strongly of the opinion, however, that this is merely one approach to the overall problem, and that others should be exploited. This could be done concomitantly with the continuing collection of information. Two additional approaches to the problem of exposure to hazardous agents appear worthy of early consideration.

Firstly, it would be desirable to institute an active research program involving animal and eventually controlled human exposures in order to fill in important gaps in the information which can be obtained from the literature. Such gaps are encountered with increasing frequency as information is compiled on the less common substances. Experimental exposures should simulate those encountered in the industry.

At present, a study of the long-range toxicity of boron trifluoride appears highly desirable as no information is available on its systemic toxicity or on the possibility of fluorosis from repeated exposures to low concentrations such as may occur in poly-butene plants.

Another study which appears to be worthy of consideration is an investigation of the degree of skin absorption and the resultant toxicity of relatively non-volatile substances containing the benzene ring, such as cumene. Dangerous vapor concentrations of such high boiling substances will not be encountered, but extensive skin contamination may occur. The consequences of such contamination are not known at present. These are two examples which appear most pertinent. A section indicating the additional work which appears desirable has been added to each tentative draft sent to Mr. Stroop.

Secondly, the available information on toxic substances should be integrated in a manner which will permit the practical application of this information to the protection of workers in the petroleum industry. The collected information applies to individual compounds, yet it is apparent that workers are exposed to a great variety of more or less toxic substances in the course of their work. In fact, exposure to a single substance is exceptional. The overall exposure of the individual workers should therefore be investigated, and information compiled as to the pre-employment and periodic examinations necessary to detect evidences of unfitness or deterioration of his health.

HARVARD UNIVERSITY
SCHOOL OF PUBLIC HEALTH

Department of Industrial Hygiene

55 Shattuck Street

Boston 15, Massachusetts

October 23, 1946

Dear Dr. Baird:

During the past few weeks I have given considerable thought to the question of research work aimed at obtaining additional information which will be of tangible value to the petroleum industry. I am impressed by the enormity of the task imposed by systematic investigation of the possible safe limits or exposures for each compound on which adequate information is not at present available. I have discussed this problem with Professor Drinker and others here at Harvard, and the general consensus of opinion is that conventional toxicological researches carried out on animals may not be the best method of approaching the overall problem, although they will settle definite questions about the particular substances at present under investigation.

As you know, one of the chief difficulties involved in any toxicological study is the necessity for determining the concentration of the substance under investigation in biological material. This frequently requires the development of new and complicated chemical methods. We suggest that the determination of concentrations could be made far more readily and applied more widely if the compounds under investigation were synthesized in the chemical laboratory using radiocarbon (C^{14}), which is now available for research purposes. It impresses us that a vast amount of fundamental information about the metabolism and fate of various hydrocarbon or substituted hydrocarbon substances could be determined, as the radioactive carbon is easily traced regardless of the chemical changes which the parent substance undergoes.

I bring up the question of radioisotopes at this time because the Medical School is at present developing a special department for the purpose of furthering researches based on the use of radioactive isotopes, and radioactive carbon can be obtained through University channels. If the American Petroleum Institute is at all interested in having some fundamental studies done on the metabolism and storage of various toxic hydrocarbons, we would be in a position to further such work. There is no limit to the amount of work which could be done if we obtained the services of a good organic chemist capable of incorporating radiocarbon into the molecular structure of the substances desired for study.

Once the original set-up for measuring radioactivity is adapted to biological material any number of substances could be investigated, the limiting factor being the synthesis of organic material incorporating radioactive carbon. It occurs to me that organic chemists capable of doing such work might be available through the petroleum industry.

There is another approach to the problem of industrial poisonings or effects of toxic substances on workers which also appears to us at Harvard to be worthy of exploitation, which I should like to bring to your attention. We have found in the past that detailed clinical study of one or more individuals exposed to hazards will frequently give more useful information concerning the effects of such hazards on humans than long-drawn-out animal experiments. In general, acute or chronic poisonings in humans are inadequately studied from a metabolic or functional standpoint, frequently because they are seen in small emergency hospitals where research facilities are limited. I sincerely believe that a vast amount of valuable knowledge could be obtained from careful study of workers who have actually been poisoned or who have at least undergone exposure to dangerous concentrations of toxic substances. We are at present in an excellent position to conduct any such clinical studies of potentially or actually poisoned workers through our close association with the metabolic service of the Peter Bent Brigham Hospital, one of the Harvard teaching hospitals here in Boston. Clinical investigations of this sort must obviously be made at the time the cases are encountered, but planning in advance that such studies will be made when a worker is poisoned appears worthwhile. Furthermore, it is our experience that workers are willing to cooperate in any such studies when they realize they are being done for their own good.

I will bring the other information which you requested to Chicago. I am passing these ideas on at present to indicate other possible approaches which appear promising to us.

Sincerely yours,

/s/ Marshall Clinton, Jr.
Marshall Clinton, Jr., M.D.

Dr. V. C. Baird
Humble Oil & Refining Company
P. O. Box 2180
Houston 1, Texas

MC/F

November 14, 1946

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APPENDIX B

REPORT TO THE API MEDICAL ADVISORY COMMITTEE
BY THE SUBCOMMITTEE ON CARCINOGENICITY OF HYDROCARBONS

Dr. McIver Woody, Chairman
Medical Advisory Committee
American Petroleum Institute

Dear Doctor Woody:

The Subcommittee on Carcinogenicity of Hydrocarbons submits the following progress report:

1. The committee has had no meeting since its last report was rendered on April 5, 1946. It has conducted its work by telephone and by mail.
2. Six thousand dollars has been paid to the Kettering Laboratory of Applied Physiology to initiate the study at hand, dealing with animal experimentation.
3. Eight samples of petroleum products have been selected for study and delivered; one gallon of each sample to Dr. Kehoe, and one drum of each sample to Sohio Petroleum Company, Covington, Kentucky. The Sohio refinery, which is conveniently located to the Kettering Laboratory, very kindly agreed to store the eight drums of oil. The drums were all received in good order, adequately labeled and they have been reblanketed with nitrogen by the Kettering Laboratory. Information as to the type of samples selected and certain test data, was submitted to all Members and Technical Advisers of the Medical Advisory Committee along with a copy of my letter of September 5, 1946, to Dr. Kehoe.
4. Animal experimentation was started with three of the samples on September 12, 1946 (see copy of Dr. Francis F. Heyroth's letter to me of even date, which was circularized to all Members and Technical Advisers of the Medical Advisory Committee) and in a telephone conversation with Dr. Heyroth on November 12, 1946, he stated that all eight samples were now included in the animal tests. Control studies will be made as soon as they receive their shipment of methylcholanthrene.
5. Dr. Heyroth had nothing special to report at this time and he estimated that several months would be required before findings of any importance could be obtained. It is the intent of the committee to keep in close touch with Dr. Kehoe, by personal visits to the Kettering Laboratory if indicated, in order that the work might be expedited as much as possible and that the Medical Advisory Committee may be kept informed.

API 06847

It is evident that further studies, if any, should await the results of the animal experimentation now under way at the Kettering Laboratories.

I move that this report be received.

Respectfully submitted,

SUBCOMMITTEE ON CARCINOGENICITY
OF HYDROCARBONS

By: /s/ M. N. Newquist
M. N. Newquist, Chairman

Members

A. E. Hoag
J. P. Holt
T. J. Kelly
W. R. Levis

Associates

L. C. Beard, Jr.
R. S. Bonsib
H. H. Zuidema
H. P. Lankelma
H. R. Garrick

Mr. D. V. Stroop, ex-officio

APPENDIX C

REPORT* OF CHAIRMAN OF SUBCOMMITTEE ON MEDICAL
POLICIES AND PRACTICES TO THE API MEDICAL ADVISORY COMMITTEE

R. A. Jewett, Chairman

November 5, 1946

Dr. McIver Woody, Chairman
Medical Advisory Committee
American Petroleum Institute

Dear Doctor Woody:

Questionnaires were sent to each member of the Medical Advisory Committee, as instructed by your committee, with the request that it be completed and returned for analysis.

Eleven completed questionnaires were received and tabulated as herewith presented. Two were received too late to be included. The answers to the questions outline the policies and practices of the eleven oil companies. The answers are self-explanatory but certain comments by your subcommittee are in order with recommendations.

The basis of a health program in industry is based on physical examinations not only for pre-employment but should include a yearly physical examination of all employees. It is to be noted that only four of the eleven companies use this procedure. Your subcommittee recommends this procedure be carried out by all companies. Probably the most important employees are the executives and it is noted that only four companies require yearly examination of their executives. The next of importance are those working in health hazards and here only three companies re-examine employees in such hazards. The recommendation should apply particularly to these two classes of employees.

It is noted that seven of the companies have arrangements for prepaid hospital and medical service. A year ago I presented to the members of my subcommittee several topics, one of which was Prepaid Medical Plans and asked that each member select a subject and report on it. No one took Prepaid Medical Plans to my regret. I am attaching a copy of a report of a survey made of the oil companies in California on this subject by the Oil Producers Agency of California, the results of which are self-explanatory. Rendering of medical service is rapidly going on a prepaid basis with the endorsement of the American Medical Association and most doctors, this for the purpose of defeating so-called State medicine and meeting public demand. Your subcommittee, therefore, recommends that oil companies secure prepaid medicine for their employees.

Absenteeism especially in those companies having sick-pay disability plans is apt to be much higher than in those companies having no sick pay. Only six of the companies have follow-up of absenteeism by trained workers.

* Note by D. V. Stroop, API — A member of the Subcommittee on Medical Policies and Practices has requested that this report should be considered only as a Report of the Chairman of the Subcommittee, pending its adoption by the Subcommittee or the Medical Advisory Committee.

your subcommittee recommends this procedure as not only economically sound but fostering good industrial relations.

It is noted that three of the eleven companies do not keep all records of sickness and accidents in the medical department and then have the information available only through doctors and nurses as is done in but six of the eleven companies. Your subcommittee strongly recommends that all medical records be kept by the medical department. It is evident from the survey that too many higher ups are entitled to the information in the records. It is recommended that every effort to avoid acquainting superiors with the physical conditions recorded in the medical records be kept to a minimum. However, it is recognized that they are entitled to information regarding the degree of disability and the cause of disability only when such disability results from working conditions.

A definite rehabilitation plan is essential in the opinion of your subcommittee which plan can well include the Veterans. It is to be noted that seven of the companies have a definite plan for the Veterans, but it is the opinion of the subcommittee that the care and placement of the Veterans is not the problem that was anticipated; therefore, it can well be included in a general plan.

Health education in industry should be a featured practice of the medical departments but from the answers in the questionnaires on this activity it appears that this phase of the program is sadly neglected. Your subcommittee, therefore, recommends a definite health education program be conducted continually.

The questionnaire shows that but five of the companies have medical inspection of working conditions. Your subcommittee wishes to recommend this procedure as necessary for conducting a good health program, as economically sound in preventing sickness and accidents as well as improving working conditions and personal contacts.

The medical departments of the companies reporting apparently are not interested in research. Industrial medicine is mostly practical medicine, therefore, it is recognized that this subject is better left to collective action and institutions adequately equipped for research.

How physicians in industry are to keep posted on proposed legislation and legal matters is a problem not answered by the questionnaire. The study of this subject is recommended by your subcommittee for the purpose of developing a satisfactory policy of keeping the doctors informed on this subject.

Although the questionnaire does not indicate much activity on the part of the doctors in community health, nevertheless it is believed that they are doing a good job as they recognize that employees spend two-thirds of their time in the community.

The fact that there was no mention of any service not covered by this questionnaire could be taken as a compliment.. However, it would be interesting to know the services being rendered not covered by this questionnaire.

It is a matter of satisfaction to your subcommittee to know that only two members have problems on which they desire information, namely special examinations for those working in hazards and examinations of executives. Your subcommittee is not aware of any description of a well worked out technique

covering examinations for hazards in the oil industry, therefore, it recommends that this be made a subject for research. A manual describing just what physical procedures should be carried out for examinations of employees working in each hazard would thus be made available.

The question of examination of executives is a difficult one because the executives are the ones who give the orders and lay down the policies and practices for others. Measures for the education of executives to have an annual physical examination for themselves is recommended as an integral part of the health educational program.

Physical Examination Form: Your committee instructed the subcommittee to prepare a physical examination form for use in the oil industry.

A request was included with the questionnaire for each member to submit a blank of his physical examination form. From a review of these, the attached form was constructed and approved by your subcommittee.

Tours: A committee was appointed for the purpose of making a recommendation on this subject. Attached is a report of this special committee. Based on this report your subcommittee recommends that your general committee approve the report and acquaint the management of the various oil companies with the recommendation.

The questionnaire covered subjects mentioned at the first meeting and did not attempt to survey every activity of the medical departments. It did ask that any service not covered by the questionnaire be noted. Your committee does not believe because none were noted that no others are in operation but assuming this is true it wishes to bring up what is being done in the field of Dentistry, Psychosomatic medicine, and Psychology. Doubtless your committee will have further suggestions.

Respectfully submitted:

By:

/s/ R. A. Jewett
R. A. Jewett, Chairman
Subcommittee on Policies
and Practices

RAJ:mfw

QUESTIONNAIRE

COMPILED BY

SUBCOMMITTEE ON MEDICAL POLICIES AND PRACTICES

of the

MEDICAL ADVISORY COMMITTEE

of the

AMERICAN PETROLEUM INSTITUTE

July 30, 1946

I MANAGEMENT

Is your medical service under the direction of a doctor? Yes 11

Responsible to Industrial Relations Manager 4 - President 2 -
 Personnel Manager 1 - Comptroller 1 - Plant Manager 2 -
 Executive V.P. 1
 (Executive)

Full time doctor in charge? (Yes) 8 (No)

Part time doctor in charge? (Yes) 3 (No)

Average number of employees covered by your service: 11 companies
 reporting. (Male) 120,200 (Female) 15,600

Are most of the employees in one location 2. Scattered 9.II NATURE OF SERVICE RENDERED

A. Care of the injured under liability laws by:

Company selected doctors? 9 Insurance carrier selected doctors? 1

Combined company and employee selected doctors? 1

B. Pre-placement examinations:

NOTE: What is the best title for these: Pre-placement or Pre-employment?
 4 7

Pre-placement examinations required for males: (Yes) 11 (No)

Pre-placement examinations required for females: (Yes) 11 (No)

Are they made by company selected doctors? 11

Employee selected doctors? 0

Is a prepared company physical examination form record used?
 (Yes) 11 (No)

NOTE: Please enclose a blank form, if "Yes."

Are there any physical impairments or defects ordered rejected? Yes
If "yes" list them:

Hernia 7 - Poor vision 7 - Infectious disease 5 - Marked hypertension 5 -
Heart trouble 5 - Mental 3 - Varicose veins 2 - Syphilis 2 -
Tuberculosis 2

Many other conditions noted once.

Can medically rejected applicants be accepted for employment?

(Yes) 11 (No) If yes, by whom? Management 6 -
Medical Director 2 - Executive V.P. 1 - Department Managers 1 -
Personnel Manager 1

Is a blood test for Syphilis required?

(Yes) 9 (No) 2

0 11

If females are examined, is pelvic examination required or optional?
None made 2 - Selected cases 2

If required, is it made by a company doctor or a report accepted from
a doctor of the applicant's choosing?

C. Re-examinations:

Made on all employees? (Yes) 4 (No) 7

How often? Every 2 years 2 - Varying periods 1 - Every 3 years 1

If not, state which ones are subject to re-examination giving reasons
and length of time between examinations.

Executives yearly 2 - Employees subject to health hazards 3 -
Employees hired since installation of medical service yearly 2

Are there special arrangements whereby executives have an annual
examination by the company medical service? Yes 3 No 8

By a physician of their own choosing? Yes 1 No 10

III. MEDICAL SERVICE TO SICK AND NON-INDUSTRIALLY INJURED EMPLOYEES

A. Is medical advice available by company personnel to all employees?

(Yes) 7 (No) 4
To groups of employees only? (Yes) 2 (No)
At no cost to employees? (Yes) 9 (No)
At a cost to employees? (Yes) 0 (No)

B. How many of your employees are covered by prepaid medical, surgical,
and hospital service through company operated plan? Many 1 - Most 1 -
One-half 1

Employee operated plan? All 1 - Most 1

Joint company and employee operated plan? One-half 1 - Most 1

IV RELEASE FOR DUTY

Are releases for duty to resume work required of employees who have been off for sickness, accident, or personal reasons? (Yes) 8 (No) 3

If so, following how many days absence? 7-3-5-2-7-1

V NURSING SERVICE

Are all nurses, if any, working under the supervision of a doctor? 11

Is any home nursing service rendered? (Yes) 1 (No) 10

If so, at company expense? (Yes) 1 (No)

At employee's expense? (Yes) (No)

Is there any follow-up of absenteeism by nurses? Yes 6 No 5

VI RECORDS

Are all records of sickness and accidents pertaining to medical service rendered, kept in the Medical Department? (Yes) 8 (No) 3

If so, is the information available only through doctors and nurses in charge? (Yes) 6 (No) 5

If not, who is entitled to this information? Personnel workers 1 - Superintendent 1 - Industrial Relations Ligr. 1 - Dept. Mgrs. 1 - Superiors 1

Are the reasons of absenteeism as shown on the records, reported to any superiors? (Yes) 10 (No) 1

If so, to whom and why? Dept. Managers 5 - Superintendent 1 - Operating Committee 1 - Not answered 4

VII REHABILITATION

Is there a company plan for placement of handicapped employees? (Yes) 8 (No) 3

Handicapped Veterans? (Yes) 7 (No) 4

VIII SANITATION AND HYGIENE

A. Any educational activities for better health? (Yes) 8 (No) 3

NOTE: If "yes" list them. Monthly Magazine 4 - Bulletins 2 - Individual pamphlets 2 - Talks 2

B. Inspections:

Are regular inspections of offices and plants made? (Yes) 10 (No) 1

If so, by whom? Safety Inspectors 5 - Doctors 5

Conditions noted: Light Heat Ventilation Dust Fumes

Special Hazards: Skin irritations Chlorinated compounds

Acids: Radio active substances Hydrocarbon vapor and gases

Poisons: Any air conditioning in offices and plants
Offices 1 - some offices 4

IX RESEARCH WORK AND PROGRAMS

List any projects being carried out, if not confidential.
Carcinogenic effect of hydrocarbons - Routine X-ray of chest

List any anticipated ones. None

X LEGISLATION AND LEGAL MATTERS

What source of information of being informed of proposed medical legislation affecting the petroleum industry do you have? API (1) Medical Journal (1) Legal Depts. (5) Magazine Legal Medicine (1) None (3)

Is there any exchange or collection of material for legal defense of actions arising out of medical problems? None 9 Yes 2

XI COMMUNITY HEALTH

A. Are proper precautionary information measures used to protect the public from health hazards arising out of the use of petroleum products?
Yes 9 No answer 2

B. What means of cooperation is maintained by the medical department with:

1. Private physicians treating employees? Personal contact by medical staff.
2. City Health Department. Personal contact by medical staff.
3. County Health Department. Personal contact by medical staff.
4. State Health Department. Personal contact by medical staff.
5. Federal Health Department. Personal contact by medical staff.
6. Private health agencies. None 8 Yes 3

Note any service you have not covered by the above.
None mentioned.

Note any problems you may desire information on.
Special examinations for special hazards 1
Executive examinations 1

By /s/ R. A. Jewett

R.A. Jewett, M.D., Chairman, Subcommittee
on Policies and Practices of the Medical
Advisory Committee of the American
Petroleum Institute.

NAME OF COMPANY
PHYSICAL EXAMINATION RECORD

NAME _____ LOCATION _____ DATE _____

DEPARTMENT _____ OCCUPATION _____

AGE _____ MARITAL STATUS: (M.S.W.D.) NO. OF DEPENDENTS _____ SEX _____

OCCUPATIONAL HISTORY: _____

PERSONAL HISTORY: _____

ACCIDENTS: _____

INFECTIONS: _____

DISEASES: _____

OPERATIONS: _____

HEALTH HABITS: CLEANLINESS _____ DIET _____ ELIMINATION _____ SLEEP _____ WORK _____

RECREATION: _____

HOW MUCH: TOBACCO _____ COFFEE _____ ALCOHOL _____ OTHER DRUGS _____

SEROLOGY: SMALLPOX VACCINATION _____ OTHER INOCULATIONS _____

GENERAL APPEARANCE: HEIGHT _____ WEIGHT _____ TEMPERATURE _____

DEFORMITIES _____

SKIN _____ MUSCLE CONDITION _____

EYES: PUPILS: SIZE _____ SHAPE _____ CORNEA _____ COLOR SENSE _____

VISION: RIGHT _____ LEFT _____ REFRACTED: RIGHT _____ LEFT _____

EARS _____ HEARING: RIGHT _____ LEFT _____

NOSE _____ THROAT _____

TEETH: NO. DECAYED _____ ABSCESSED _____ EXTRACTED _____ CONDITION OF GUMS _____

CHEST: EXPANSION _____ LUNGS _____

ARTERIES _____ VEINS _____

HEART _____

PULSE: RATE _____ RHYTHM _____ REGULARITY _____ BLOOD PRESSURE: S _____ D _____

ABDOMEN _____

HERNIAE: POTENTIAL _____ INCOMPLETE _____ COMPLETE _____

GENITAL ORGANS _____

FOR FEMALES MENSTRUAL HISTORY: _____

GLANDULAR SYSTEM _____

URINARY ORGANS: _____

REFLEXES: PUPILARY _____ PATELLAR _____ TREMOR _____ GAIT _____ OTHERS _____

MENTAL CONDITION: _____ COORDINATION _____

BLOOD TESTS: _____

URINE EXAMINATION: ALBUMEN _____ SUGAR _____ SPECIAL _____

SUMMARY _____

ADVICE GIVEN: _____

EXAMINING PHYSICIAN _____ CLASSIFICATION _____

OIL PRODUCERS AGENCY OF CALIFORNIA

1035 Subway Terminal Building
Los Angeles 13, California

June 24, 1946

TO ALL OPERATORS:

SURVEY OF
VOLUNTARY MEDICAL PLANS

Herewith is a report on voluntary medical and hospitalization plans existent in the oil industry, prepared from replies to the recent Agency questionnaire. Figures and estimates are based on a total of 160 returns, 18.8% of the number to whom questionnaires were sent. Included in the replies were all of the major companies, 21 so-called principal minors, and 132 smaller independents.

All of the majors, 20 of the principal minors, and 15 independents reported that voluntary plans were available to their employees. This is 26.2% of the total number of companies reporting, but examination of the replies, which include the larger employers of the industry, indicates that from 80% to 90% of oil industry personnel have voluntary plans available to them. Those companies who reported no plans are, in the main, employers of but few people. In fact, many questionnaires from these operators bore the notation "no employees," "part-time employees only," "all work done by contract," or something similar.

Types of plans reported by the 42 companies who reported plans in existence fall into four general categories. They are:

- (1) Indemnity payments under group insurance in the form of weekly benefits paid to the employee while he might be ill. These payments are usually limited as to time, and also as to amount, the latter dependent upon the wage or salary bracket of the employee. This is frequently combined with an insurance program providing for death benefits and benefits for dismemberment.
- (2) Grouping of employees who enter into an agreement with an outside medical group, with its panel of doctors, for such service as may be required, with fixed fees and charges.
- (3) The selection of a "private" panel of doctors who attend a particular company's employees. This is also combined with the death, sick payment and dismemberment benefits of a group insurance policy in some instances, and the employee members of the group, through elected representatives, have a voice in its management.
- (4) The grouping of employees into a plan under which they have freedom of choice of physicians and hospitals by the payment of a fixed monthly fee.

Costs of the plans outlined above vary with the type of coverage. Where only the employee is covered, and only in the form of a weekly indemnity if he becomes ill or suffers an accident, the cost is lowest; where complete

surgical attention and hospitalization are provided for both employee and his dependents, the cost is highest. On these bases, reported costs per employee per month range from a low of 75 cents to a high of \$6.50. In 50% of plans reported, the company shares the cost to some degree; in 40.5%, employees bear the entire cost; and in 9.5%, the company bears the entire cost. In practically all cases, the plan is financed on a payroll deduction basis.

In about half the plans, only the employee is covered, but in the other half, his dependents are covered in varying degrees.

A further breakdown of replies to the Agency questionnaire follows:

"Principal Minors"

Companies reporting	21
Companies with plans	20
Percentage of reporting companies with plans	95%

Provisions of plans:	<u>Number</u>	<u>Percentage</u>
Employed hospitalization	20	100
Dependents' hospitalization	10	50
Employee surgery	18	90
Dependents' surgery	6	30
Employee routine medical care	6	30
Dependents' routine medical care	2	10
Cost shared	12	60
Cost borne by employer	1	5
Cost borne by employee	7	35

In 17 plans, 85%, there are limitations on the medical, surgical and hospital services to which the employees are entitled.

Independents

Companies reporting	132
Companies with plans	15
Percentage of reporting companies with plans	11.4%

Provisions of plans:	<u>Number</u>	<u>Percentage</u>
Employee hospitalization	15	100
Dependents' hospitalization	4	27
Employee surgery	12	80
Dependents' surgery	3	20
Employee routine medical care	4	27
Dependents' routine medical care	1	7
Cost shared	9	60
Cost borne by employer	3	20
Cost borne by employee	3	20

In 12 plans, 80%, there are limitations on the medical, surgical and hospital services to which the employees are entitled.

As to major companies, a significant breakdown is almost impossible to achieve, since several of them have more than one plan, optional with the employees, and have different plans in different localities.

It is believed that the 18.8% return to the Agency questionnaire is sufficiently broad to give an accurate reflection of existing conditions as to voluntary medical, hospital and surgical plans available to oil industry employees.

The Agency appreciates the cooperation of those companies who submitted data, and expresses the hope that the information herein will prove of interest to them.

Yours very truly,

/s/ Stark Fox
Stark Fox

SF:8

THE TEXAS COMPANY

135 East 42nd Street
New York 17, N.Y.

C
O
P
Y

October 30, 1946

Dr. R. A. Jewett, Chairman
Subcommittee on Medical Policies
and Practices
General Petroleum Corp. of Calif.
108 West Second St.
Los Angeles 12, Calif.

Dear Doctor Jewett:

You will recall that at the last API meeting, Dr. Woody appointed Doctors B. B. Reeve, A. E. Hoag, J. P. Holt, and myself as members of a special committee to formulate and submit to you a statement or resolution pertaining to the frequency of rotation of work shifts. The committee had a luncheon meeting the same day it was appointed, but concluded that a resolution without supporting data would not be adequate.

Dr. J. P. Holt very kindly reviewed Dr. Kleitman's book on "Sleep and Wakefulness," and I am attaching a mimeographed copy of his letter in this connection, plus a mimeographed copy of "Arranging Shifts for Maximum Production" published by the U. S. Department of Labor. Based upon this material, the committee has formulated a proposed recommendation concerning frequency of rotation of work shifts, copy attached, which includes supporting references.

You may wish to modify the wording of the resolution. In any event I will have an extra supply of mimeographed copies of this material with me at the API meeting in Chicago next month, for distribution to those present, should you so desire.

Very truly yours,

/s/ L. N. Newquist
L. N. Newquist, M.D.

LNN-IPM

cc - Dr. B. B. Reeve
Dr. A. E. Hoag
Dr. J. P. Holt
Dr. McIver Woody
Mr. D. V. Stroop

API 06860

STANDARD OIL COMPANY (N.J.)

30 Rockefeller Plaza
New York 20, N. Y.

July 22, 1946

Dr. K. N. Newquist
The Texas Company
135 East 42nd Street
New York 17, N. Y.

Dear Doctor Newquist:

In accordance with your request I have obtained some information on the question of "shifts" from Doctor Nathaniel Kleitman, Professor of Physiology, University of Chicago, and the literature. The information that we have obtained is given below:

1. Copy of part of a letter from Doctor Kleitman:

"Enclosed find a copy of the U. S. Department of Labor pamphlet you asked for. The suggestions advanced therein were based on data in my book 'Sleep and Wakefulness' (Available at the New York Academy of Medicine Library), as well as on a continuation of this work after 1939. We found a considerable individual variation in a person's ability to change his body temperature in switching from one shift to another. Therefore, infrequent shift rotation, if rotation there must be, is the best arrangement from the standpoints of both safety and efficiency. The other suggestion in the pamphlet - a new timing which would abolish the graveyard shift by splitting it - has been found more difficult to apply in practice, mainly for social reasons or resistance from unions. However, this feature, in my opinion, deserves a trial where it can be 'sold' to workers, to be retained or rejected as experience dictates."

2. The following is a summary of information obtained from the book: "Sleep and Wakefulness" by N. Kleitman, University of Chicago Press (1939):

Long before inverted temperature curves were obtained in birds by a reversal of light and darkness, such results were obtained in monkeys by Galbraith and Simpson. The change was produced rather promptly, but the inverted temperature curve was not so regular as the normal one. Authors also shifted the light and dark changes (3:00 A.M. to 3:00 P.M.) with equally good results.

Toulouse and Pierson demonstrated an inversion of body temperature curves in night nurses 5 or 6 weeks after change from day to night duty. Benedict and Snell were unable to produce an inverted temperature curve in a subject who reversed sleeping and waking routine for ten days.

The diurnal temperature curve is conditioned by mental and physical development, routine performance of certain tasks, diurnal asymmetry of food intake and sleep, and not by a universal cosmic factor which exerts a mysterious influence on our body function. Evidence has been presented that

the diurnal body temperature rhythm is a function of the adaptation of the individual's activity and rest to a 24 hour cycle of day and night. No cosmic or other external cause need be invoked as a causative agent. The cycle is essentially an internal one, conditioned upon repeated performance and adherence to a 24 hour routine in one's activities. A possible physiological mechanism in the diurnal cycle will be suggested in connection with the elaboration of an evolutionary theory of sleep and wakefulness.

Two subjects attempted to adapt themselves to a 28 hour schedule at the University of Chicago. One adapted well, the other did not.

Two subjects were put on a 48 hour schedule - awake 40 hours, sleep 8. The curves became definitely bimodal, with body-temperature curve ranges for the two 24 hour fractions. This represents a complete failure to establish a single 48 hour body temperature curve.

For six weeks each, the following schedules were run:

21 hour cycle, 15 hours awake, 6 hours sleep - 8 well defined temperature curves.
24 hour cycle, 17 hours awake, 7 hours sleep - 7 well defined temperature curves.
28 hour cycle, 19 hours awake, 9 hours sleep - well defined temperature curves resulted.

In another experiment, one subject lived according to each of the three above regimes. Each curve showed 7 waves with minima always in the shaded portion (sleep) on the 24 hour regime, but not on the artificial 21 and 28 hour regimes.

Modifiability of diurnal temperature rhythm: A thorough review and discussion of diurnal rhythm in man is presented by Jores and Welsh.

Jores: Four rabbits had eyes closed and in three days showed neither diurnal temperature curve nor variations in blood sugar. Two blind women placed in a dark room lost body-temperature rhythm in two days. Two blind men kept in the dark for three days and then exposed to light only at night showed deviations from normal temperature curve and urinary volume but no reversal. The same experiment on two normal men had negative results.

Animal experiments to change cycle from 24 hour to 16 hour (mice kept in room with 8 hours light, 8 hours dark) resulted in the suppression of the 24 hour cycle but the 16 hour cycle was not acquired. When the animals were placed in a dark room the 24 hour cycle returned. Johnson: "Although actual time of activity may be quite readily shifted, the general plan of a 24 hour periodicity seems to be of much more fundamental nature." An attempt to establish a 12 hour cycle failed. No temperature rhythm curve of 12 hour cycle resulted.

Lindhard in 1907 succeeded in producing reversal of body temperature curve in members of his crew when they spent a winter or darkness in Greenland. He shifted the hours of light (artificial) and darkness and reversed the eating times. Body temperature measurements, begun a week later, revealed an inversion of normal diurnal curve, which showed that body temperature curve inversion could be accomplished with relatively greater ease when external conditions were such as not to be interfering influences.

Changing to a 21 or 28 hour schedule was a failure at the University of Chicago. Experiments were carried out again in Mammoth Cave. The temperature was taken every 2 hours in the waking period, and four hours after retiring. Awake - 19 hours. Sleep - 9. Light breakfast on arising; two meals after 7 and 13 hours. R (one subject) completely adapted at end of one week (6 temperature curve waves per week). K's weekly record contains seven waves.

From Navy sources: "increasing time of following routine (after initial weeks) apparently has little or no effect on ability to adjust. I have known men with 20 years service as operators to have just as much trouble as when they started. On the other hand, the more successful type may establish a routine easily in a week, becoming quite adapted to it." A divided sleep routine (sleep 11-2 A.M. and 5-8 A.M.) did not prove efficient.

Evolutionary Theory of Sleep and Wakefulness: Wakefulness of necessity is a subcortical, probably hypothalamic, function, whereas supplementary wakefulness of choice, as well as the diurnal sleep-wakefulness cycle, is a cortical function.

I am attaching a copy of the paper: "Arranging Shifts for Maximum Production," U. S. Department of Labor, Division of Labor Standards (1942).

In the book, "Manual of Industrial Hygiene and Medical Service in War Industries" by W. M. Gafaer, published by W. B. Saunders Company (1943), page 318, it is stated that Doctor Thomas Parran, Surgeon General of the U. S. Public Health Service has recommended that "shifts" should not be rotated more often than every two or three months.

From the evidence presented above, it would appear to me that "shifts" should not be rotated as frequently as every two or three weeks. I do not know just what is the optimum interval between rotation of "shifts"; but it would appear that a rotation of "shifts" no oftener than every two or three months is desirable.

I hope that the above information will be of some help to you, and if there is anything further that we can do, please let me know.

Very truly yours,

/s/ J. P. Holt, M.D.

JPH:rv

ARRANGING SHIFTS FOR MAXIMUM PRODUCTION

United States Department of Labor
Division of Labor Standards
1942

INTRODUCTION

More machine hours -- that is what this country needs for greater production to win the war. But while machines run round the clock, the men and women who man them must work by shifts. With multiple-shift production comes the problem of night work: experience has shown that accidents often go up, production down, on the graveyard shift.

Is there a way to schedule the night shift so that production will increase, accidents decrease, a schedule best for the health, safety, well-being, and efficiency of the workers concerned? Because this question is important in the war effort, the Division of Labor Standards, U. S. Department of Labor, presents for discussion some facts which Dr. Nathaniel Kleitman, Associate Professor of Physiology, University of Chicago, has developed through extended study and experimentation, and some suggestions he has made towards solving the night-shift problem.

GETTING USED TO ROTATING SHIFTS

Many war industry employers running their machines 168 hours a week have adopted a system of frequent shift rotation with a view towards making night work easier for their employees. Actually this system of frequent rotation is particularly hard on workers and retards their productiveness. The more frequently that shifts are rotated the more difficult it is for the worker to keep adapting himself to the new routine.

To solve the multiple shift problem intelligently we must know something about the working of the human machine, the manner in which a human being adjusts himself to a schedule of living, and the ease or difficulty with which this schedule can be changed. At birth we spend most of our time in sleep, and there is no evidence of any 24-hour cycle in our bodily activities. We are, however, born into a world which is run on the routine of day-time work, evening leisure, and night sleep. Very early in life we are subjected to an enforced schedule of hours in conformity with the habits of our elders. As a result, already in the second year of life we have the well-established 24-hour cycle of existence. We further fortify that cycle by regularity in our daily schedule of living. This is especially noticed in children whose hours are controlled by their elders in that they get sleepy at a very definite hour and if kept up beyond that hour show themselves to be rather unmanageable, although they are well behaved during their usual waking period.

If you look at a clinical or fever thermometer you will notice an arrow at the 98.6°F. mark. All the lines above that mark are in ominous red. These markings have created the utterly false impression that the normal temperature is something very constant. Actually it is no more constant than, for instance, the pulse rate; the two incidentally vary in the same manner. Instead of normal body temperature, we have a temperature range, varying for different people and for the same person at different times. It amounts to

about 2 or 3°F. over a 24-hour period and the variation in body temperature from hour to hour is such as to create what we call a 24-hour body temperature curve. Under ordinary routine conditions of existence, the peak or plateau of the temperature curve is reached some time during the afternoon, usually between 1:00 and 7:00 p.m. At that time our efficiency is greatest. The low level of body temperature is reached during the early morning hours, somewhere between 2:00 and 5:00 a.m. If a person stays awake overnight, those are the hours of greatest inefficiency and greatest difficulty of remaining awake.

When a person adjusts himself to a new routine of existence with other than customary hours of sleep, work, meals, and leisure, he gradually acquires a body temperature curve with the highest efficiency and less sleepiness during the new activity hours and just the opposite during the new sleeping hours.

It takes several weeks for a new 24-hour sleep-work-meals-leisure cycle to be properly established. Such achievement is wholly impossible under the system which prevails in some establishments of weekly or bi-weekly shift rotation, because the individual is not given a chance to adapt himself to a new routine. He essentially remains on the customary cycle of day-time work and night-time sleep. This makes him dislike work at odd hours. It causes him to be sleepy at a time he should be wide awake and wakeful when he should be sleeping; it leads to a decrease in production rate and a greater tendency to accidents.

The way to overcome this effect is to keep each worker on a given shift for extended periods of time. Since rotation of shifts is very often adopted as a measure of fairness to all workers, the principle can be preserved by having the workers change shifts once in several months, instead of weeks or even days. The change in shifts can be staggered and made to coincide with short periods of vacation, in line with the suggestion that vacations should be distributed around the entire calendar year, instead of concentrated during the summer months. Where the workers themselves prefer it, the maintenance of steady shifts with no rotation whatsoever can be accomplished with due regard to seniority rights.

Whether the shifts are steady or rotated, some effort should be made to modify community life to the extent of making leisure at other than customary hours. For instance, broadcasting companies might be induced to make transcriptions of their popular evening hour programs for rebroadcast during the afternoon and late night hours. Moving picture shows could be extended either way by a few hours, and parties, meetings and lectures organized with an eye to the leisure hours of each third of the working population.

TIMING OF THE SHIFTS

There's a name for those hours from midnight to 8 a.m. — the graveyard or lobster shift. This work period just about matches most people's sleep period. A person could adjust himself to a different timing of shifts if the displacement cycle were smaller. For instance, where the plant runs on three 8-hour shifts, the following timing of shifts is suggested:

RED (Sunset) shift. Working hours from noon to 8:00 p.m. Evening and early night free for leisure activities. Sleep from 1:00 or 2:00 to 9:00 or 10:00 a.m.

WHITE (Victory) shift. Working hours from 8:00 p.m. to 4:00 a.m. Sleep from about 5:00 a.m. to 1:00 p.m. Afternoon and early evening free for leisure.

BLUE (Dawn) shift. Working hours from 4:00 a.m. to noon. Leisure in the afternoon. Sleep from about 7:00 p.m. to 3:00 a.m.

This shift timing has a number of advantages. One of the distinct advantages is the relatively small displacement of the customary sleeping hours, and no one is compelled to sleep in the afternoon hours, when it is hardest to sleep. Another advantage is that it also makes shift changing fall at hours which are not general community rush hours. If several plants are located in the same vicinity, the transportation problem created may require the shift changes to be staggered.

The special advantages of these shifts lie in their appeal to certain groups of workers divided according to age, interests, family status, and recreation habits:

The RED shift will appeal to young unmarried men and women who like to have their recreation late in the evening as it would enable them to stay up to or beyond midnight and sleep later in the morning.

The WHITE shift will appeal to middle-aged individuals whose social life has altered. As their children have all grown up they would not be disturbed while sleeping during the forenoon hours. They would have the afternoon free as they would not be due to begin work until 8:00 p.m.

The BLUE shift fits in very well with the schedules of families of the intermediate age groups, where there are small children. The father could go to bed early in the evening at the children's retiring time. He would return from work shortly after noon and have the afternoon free.

With five 8-hour working shifts per week, the problem of the weekly holiday of 2 days may have an upsetting effect on the establishment and maintenance of the displacement cycle. Workers can hardly be expected on their days off to stay up during the odd hours which they devoted to work during the 5 days preceding. One answer to this problem is to decrease the week end break to 1 day. The 48-hour 6-day work week is coming, where it has not yet been adopted.

Some industries may find it impossible to run their machinery continuously and may have to adopt two 10-hour shifts. These shifts could be distributed as follows:

- A. The early shift from 4:00 or 5:00 a.m. to 2:00 or 3:00 p.m.
- B. The late shift from 2:00 or 3:00 p.m. to midnight or 1:00 a.m.

By this arrangement no one would be expected to work during the early morning hours of greatest inefficiency. The shifts could be steady or of infrequent rotation.

IN SHORT

If management and labor wish to solve the multiple shift problem scientifically, they should take into consideration two important factors. In the first place, workers should stay on any shift long enough so that they can get used to it and live reasonably adjusted life while they are on it. Secondly, the shifts should be timed in such a way as to result in only the minimum displacement of the normal 24-hour cycle of activity.

TO LABOR AND MANAGEMENT

You are faced with an important problem: What are the best shifts in war industries for the efficiency of workers manning machines 24 hours a day? This is one suggestion. What do you suggest? Give us the benefit of your experience.

V. A. ZIEGLER, Director
DIVISION OF LABOR STANDARDS
U. S. DEPARTMENT OF LABOR
WASHINGTON, D.C.

PROPOSED RECOMMENDATION CONCERNING FREQUENCY OF
ROTATION OF WORK SHIFTS

Inasmuch as experience and scientific investigation has shown that the human body requires several days to a week or more to adjust itself from the standpoint of health, safety, and efficiency, to changes in working, sleeping and other habits, and inasmuch as many organizations in the petroleum industry now rotate their work shifts weekly, the Medical Advisory Committee of the American Petroleum Institute recommends that consideration be given to the arrangement of work schedules so that shifts do not rotate more frequently than every two to three months.

Data supporting the above recommendations are as follows:

1. Thomas Parran, Surgeon General of the U. S. Public Health Service, recommended on page 318, "Manual of Industrial Hygiene and Medical Service in War Industries," by W. M. Gafafer, published by W. B. Saunders Company, 1943, that shifts should not be rotated more often than every two or three months.
2. The following statement appears in the publication, "Arranging Shifts for Maximum Production," United States Department of Labor, Division of Labor Standards, V. A. Zimmer, Director, 1942:

"It takes several weeks for a new 24-hour sleep-work-meals-leisure cycle to be properly established. Such achievement is wholly impossible under the system which prevails in some establishments of weekly or bi-weekly shift rotation, because the individual is not given a chance to adapt himself to a new routine. He essentially remains on the customary cycle of day-time work and night-time sleep. This makes him dislike work at odd hours. It causes him to be sleepy at a time he should be wide awake and wakeful when he should be sleeping; it leads to a decrease in production rate and a greater tendency to accidents.

"The way to overcome this effect is to keep each worker on a given shift for extended periods of time. Since rotation of shifts is very often adopted as a measure of fairness to all workers, the principle can be preserved by having the workers change shifts once in several months, instead of weeks or even days."

3. "Sleep and Wakefulness," Dr. Nathaniel Kleitman, Professor of Physiology, University of Chicago, University of Chicago Press, 1939.