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ANNUAL REPORT

HEALTH DIVISION

1950

HEALTH AND BIOLOGY

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HEALTH DIVISION

INTRODUCTION

(Thomas L. Shipman, M. D., Health Division Leader)

After reading the individual reports of the five Group Leaders, the author of these introductory paragraphs is strongly tempted to omit an introduction altogether to insure the reading of the entire report. Only by a careful reading of each section is it possible to obtain a clear picture of the broad scope of work carried out by the Health Division. Such a perusal, however, would fail to give the reader a true picture of the way in which the Division operates. It is doubtful if in any Division in the Laboratory are the dividing lines between various Groups any less distinct. This same fact was mentioned in the report covering the activities for 1949. As the months go by it becomes increasingly obvious that the elastic organization of the Division is properly designed to permit the collaborative effort necessary to solve the problems of the Division as they arise.

From time to time during the past year it has been necessary to prepare statements justifying this program or that program. Fortunately, in the case of H-Division this is ordinarily a very simple

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process. The Division, of course, has as its primary function the protection of the health of the Laboratory workers and the assurance to the Laboratory that the staff is physically able to put forth its maximum effort. Much of the work of the Laboratory is of a sufficiently bizarre nature, often dealing as it does with relatively unknown substances and procedures, so that much of the routine programmatic work of the Division must be preceded by an intensive period of research and development. This is particularly obvious in the work of the Industrial Hygiene Group. The Los Alamos Scientific Laboratory, however, is an installation of such unique character and with such unusual equipment that common sense demands the inclusion of a properly limited program of basic research. Such a program must, of course, be in proportion to the rest of the Division and the Laboratory as a whole. It so happens that there are enough unknowns directly or indirectly related to the work of the Laboratory and where the existing facilities lend themselves to research programs that there is no trouble in selecting problems for attack. The study on beta ray burns, for example, is one of more interest to Los Alamos than any other installation in the AEC. By the same token, the study of radiation cataracts which has been principally supported by H-Division although sponsored by the Los Alamos Medical Center is logically carried out here because of the availability of the reactors and other equipment essential to the work.

The year 1950, with the outbreak of the Korean War and the

resulting deterioration in the International situation, has had its effect on the Division. No directives or requests were necessary to step up the tempo of the Division's work or to intensify the effort along programmatic lines. The most noticeable change was the identification of all Groups in the Division with various phases of the test program. Certain research programs were abandoned and certain routine work had to be curtailed in favor of work preparatory to Operation Greenhouse. At the close of the year the Division was a bit surprised to find itself accepting full responsibility for the radiologic safety program at Operation Ranger. This latter project is of more than passing interest, marking as it did the first time such a program had been entrusted solely to members of the Laboratory's own staff. One got the feeling that H-Division had finally come of age and it had reached the point where it no longer needed to reach for outside assistance in protecting the operations of the Laboratory. H-Division accepts this responsibility not so much with humility as with pride and gratification.

A. Personnel

During the year the numerical strength of the staff rose from 114 to 127. All Groups in the Division shared in this increase. In addition to the new positions created, 34 terminating workers were replaced with new employees; in no instance do we feel that good material has been replaced with something poorer.

B. Group Activities

A brief mention will be made of the outstanding highlights in each Group. It should be borne in mind that more often than not members of other Groups made valuable contributions to the individual programs.

1. Group H-1, Radiologic Safety: New assignments of office and laboratory space greatly improved the efficiency of the staff and provided more adequate space for the work to be done. The routine work of the Group was considerably extended by the inclusion of the monitoring responsibilities for the Radiographic Group, GMX-1, and also for Omega Site. The Monitoring and Biophysics Sections carried on an intensive study of various film badge techniques. Monitoring activities extended as far as Camp Hood, Texas, and the Naval Proving Ground at Dahlgren, Virginia. The program of Work Order Monitoring has become established on a routine basis with one man assigned essentially full time to the Engineering Department to advise regarding radiation and other hazards in any work to be done. Even a cursory reading of the report of this Group indicates the wide and varied scope of the work performed. It does fail to give a clear picture of the very intensive and valuable work carried out in preparation for Operation Greenhouse.

2. Group H-2, Industrial Medicine: The increased way in which members of the Laboratory staff avail themselves of the service of Group H-2 is in itself a clear indication that University workers and

others are placing increased confidence in the staff of the Group. The large number of physical examinations carried out for a variety of reasons, however, indicates that the members of this Group are not waiting for business to come to them; they are going out looking for it. Of particular significance are the routine studies carried out on all workers in certain areas, such as HT Shop and S Site. Here we have an excellent example of a cooperative venture in which Group H-2 was joined by representatives from H-1 and H-5, and where they also received the wholehearted collaboration of the Divisions and Groups under study.

3. Group H-3, Safety: Here the record certainly speaks for itself. In spite of the greatly increased number of man hours worked in the Laboratory the total number of lost time accidents was the lowest in the Laboratory's history; the frequency rate was the lowest in the Laboratory's history; and the severity rate lower than in any year except 1947. The severity rate actually is so low that it can be very significantly affected by pure happenstance. The excellence of the record, however, is not happenstance. The intensive work of the members of the Safety Group in indoctrinating members of the Fire Department and Security Service, in carrying out detailed fire protection surveys, and in their friendly cooperation with individual Divisions, Groups, and Sections have laid the groundwork for this record. The Safety Engineers themselves, however, would be the first to point out that equally important has been the wholehearted

cooperation of Division, Group, and Section Leaders. An accident record such as has been compiled can only result from widespread safety consciousness throughout the Laboratory.

4. Group H-4, Biomedical Research: A casual glance at the detailed report of this Group might give the impression that the overall program of the Group is somewhat scattered and uncoordinated. On careful re-examination it will become evident that the various programs basically represent a broad attack on problems related to the biological effects of ionizing radiation and possible methods of minimizing or treating radiation injury. Los Alamos, of course, has a heightened interest in both alpha and beta radiation and this interest itself automatically influences the selection of research programs. It is devoutly to be hoped that the biomedical research program at Los Alamos will never be restricted to the exclusive consideration of programmatic problems. The conclusive fact remains that there are a sufficient number of interesting problems directly or indirectly programmatic so that staff members are able to select these problems voluntarily and apply the methods and principles of basic research to them.

Plans for the construction of a new laboratory building are well under way and it is hoped that actual construction can be started within the coming calendar year.

One program to be undertaken during the coming year was little more than hinted at in the Group report. This refers to the

cooperative study to be carried out principally at the Medical School of the University of Utah on the chronic toxicity of plutonium, radium, and mesothorium. This is to be a long term study lasting probably as long as ten years, using the dog as the experimental animal. Had such a study been started five years ago much of the present uncertainty concerning the toxicity of these elements would no longer exist. The study, under the overall supervision of Dr. John Bowers, should prove of utmost significance and the staff of Group H-4 is participating in full partnership.

Also of unusual significance have been the studies carried out during the year on the toxicity and toxicology of tritium.

5. Group H-5, Industrial Hygiene: It is doubtful if anywhere in the country there exists an industrial hygiene organization which is confronted with as many bizarre problems as those arising here at Los Alamos. In his report, the Group Leader has pointed out quite accurately the four main lines of attack: a) work on air pollution and air cleaning; b) participation in the planning for new construction; c) investigation of new materials; and d) increasing emphasis on health education. These aims, it should be remembered, are quite aside from the normal and routine program of air sampling and sample analysis carried out by the Group. In the early years of the Project Industrial Hygiene as such just didn't exist. Today it is recognized as one of the most vital parts of our program. Some of the statistics of the Group alone give an indication of the amount of work undertaken.

The collection of over one thousand air samples by the Field Section and the analyses in the Laboratory Section of nearly seven thousand samples is a creditable record in itself. The study of one hundred forty-five hoods for ventilation characteristics, the complete surveys of HT Shop, V Shop, Sigma and TU Buildings, and S Site represent a monumental amount of work.

C. Conclusion

At the start of the calendar year, 1950, the organizational framework for H-Division was virtually completed and the size and scope of the Division was apparent. By the end of the year, except for the work of CMR-12, the Division had in general accepted its responsibility for all health and safety problems throughout the Laboratory. This was accomplished in the face of a rapidly expanding Laboratory effort as well as the diversions created by participation in the work of J-Division. The individual Group reports all indicate the anticipated programs for the year ahead. Consideration of these forecasts indicates very clearly that the staff members of the Division have no desire to rest on their laurels but anticipate an opportunity to be of constantly increasing service to the Laboratory.

GROUP H-1, RADIOLOGIC SAFETY

(Thomas N. White, Ph.D., Group Leader)

A. Personnel

1. The total number of personnel in this Group at the close of this year is 37. The number of persons assigned to the various Sections is: Administration, 3; Biophysics, 6; Monitoring, 16; Electronics, 9; and Meteorology, 3.

2. Dr. Charles H. Perry became Associate Group Leader on February 20. In addition, Mr. Robert F. Barker was employed as Alternate Leader of the Monitoring Section on September 15.

3. It is estimated that up to six persons may be hired during 1951 in order to fulfill the requirements of the various Sections. The number will depend to a considerable extent on requirements as yet uncertain for training of Civilian Defense personnel for participation in future operations at the new proving ground in Nevada.

B. General Changes, Improvements, and Assistance Rendered

1. The Group office was moved to the second floor of B Building, adjacent to the H-Division office. This change permits more efficient operations, as well as affording more space for the Group H-1 office.

2. The Biophysics Section has been, for a considerable period of time, handicapped because of too small floor space and insufficient personnel. A temporary move has been made to the basement of B Building, which has slightly larger floor space, thus making available a

larger laboratory space and desk space for additional personnel. Although this new arrangement is a considerable improvement over the old, more space is still required.

3. The Monitoring Section quarters have been rearranged so as to afford more efficient use of the available space. The Special Problems Sub-Section has been discontinued, thus making available to the Monitoring Section much needed floor space. On the other hand, since the Biophysics Section has taken over the responsibilities of the Special Problems Sub-Section, the former will have need for additional space.

4. Of the more significant additions to routine monitoring, two may be cited. The first is the acquisition of the personnel monitoring responsibilities (including special problems) for the radiographic installations. This is well under way and is now being handled with a minimum of effort. The second is in the formative stage. So far, a few months have been devoted to studying the rad-safety requirements at Omega Site. A "Suggested Procedure" has been prepared and was under consideration as of the end of December.

5. Considerable non-routine assistance was given by this Group, some of which follows in brief:

a. Considerable time was given to Rala contamination problems.

b. Monitoring of gamma radiation on the various islands of the Eniwetok Atoll was conducted during the building program.

c. Off site experiments were made in regard to contamination which might follow the crash of an airplane carrying nuclear material.

d. On site assistance was given in an extensive series of development tests at the Naval Proving Ground, Dahlgren, Virginia.

e. Thomas N. White was appointed Alternate Group Leader for Group J-9. In this capacity he, with members of the H-1 Group, has made a complete study of the rad-safety problems of Operation Greenhouse.

f. As a member of the Subcommittee on Permissible Internal Dose of the National Committee on Radiation Protection, Charles H. Perry attended several committee meetings. The experimental data on humans, in regard to plutonium, were examined with the assistance of Wright Langham, and permissible dose recommendations were made by Charles H. Perry to the Subcommittee. Tentative permissible levels were submitted for Los Alamos use of other radioisotopes which are peculiar to this installation. Consultation was given to Sandia Base Operations concerning permissible doses of other radioisotopes.

g. This Group assisted in the improvement of the emergency vehicle service which is available for the Los Alamos Area. Complete procedures have been written.

h. Charles H. Perry assisted the University of Utah Medical School as consultant regarding the choice of electronic equipment for their forthcoming plutonium (etc.) experiments. He also appraised the rad-safety problem.

C. Research and Development Problems Completed

Following are some of the more outstanding problems which were

completed this year:

1. Mr. Ellery Storm, with the assistance of the Biophysics Section, completed his theory and practice of determining simultaneously the effective kilovoltage of photon radiation and the exposure in roentgens from a single film badge, using a combination of lead and brass filters over part of the film.

2. As a part of the above program, the energy dependence of Eastman Type K film and Dupont 552 film in the range from 0.25 to 10.0 MEV was investigated. A procedure for monitoring photons in this range was prepared.

3. The Electronics Section modified several Pee Wee's for use in monitoring neutrons. Mr. Edwin Bemis, of the Biophysics Section, instructed members of the Monitoring Section in the proper use of and the interpretation of the indications given by these modified instruments.

D. Future Changes in Group

1. During the 1951 period it is anticipated that the H-1 Electronics Section will be taken over by Group P-1. A Health Instrument Section will be formed in Group P-1 to take care of the Health Division requirements.

2. Plans will be formulated for Group H-1 space in the new Tech Area. A tentative estimate of floor space requirements has been completed.

E. Individual Section Reports

1. Monitoring Section

a. General Changes and Improvements:

The Section Leader spent a week this fall at the Oak Ridge National Laboratory studying the methods of the Health Physics Division. The exchange of ideas and methods which came at the end of the week was profitable to both ORNL and LASL.

The Section has assumed the responsibility for all source-washing and leak-testing. A thorium and radium capsule leak-testing device is being ordered to aid in carrying out this work. Our present equipment can be improved considerably. A lucite aquarium filled with lead-perchlorate solution proved unsuccessful as a shield because it cracked and leaked. A complete local source inventory was completed for the AEC. We have not attained, as yet, full cooperation in notifying our Section of all source movements at the Site.

A new Emergency Vehicle has been outfitted with radiation detecting meters, complete sets of protective clothing, and sampling equipment for other types of hazards. The meters have been placed in rubber-lined aluminum cases. The panel truck, now being used, has too little room for getting at the equipment, however, and a one-ton truck has been requisitioned to replace the smaller truck. A series of trial emergency runs are being carried out at present with the full cooperation of the Security Service, the Safety Director, and the various site personnel.

Work Order monitoring, a future program last year, has been initiated on a routine basis. The procedure gives the Section (as well as other Sections if the hazard is not radiologic) information about any work orders which may result in craftsmen being exposed to hazardous conditions. Another job which was contemplated last year, Radiologic Safety Inspection, is being done. Any non-routine operations which may lead to radiation exposures are investigated by the Inspector. Also, he is responsible for monitoring those areas which are not routinely covered.

Off Site operations have required that monitors be sent to Eniwetok, Virginia, and Texas this year. Future requirements for off site monitors will make it necessary that all monitors in the Section be able to handle any situation which may arise. For this reason, a continuous training program for both old and new members of the Section is being planned. New equipment is on order with which to carry out surveys of low energy beta-emitting products. The use of converted Pee Wee neutron survey meters is being taught the monitors. In order to meet these additional demands, terminating personnel are being replaced and new positions are being filled with persons who have technical backgrounds.

b. Research and Development Programs:

1) Completed This Year:

The response of Eastman Type K and Dupont 552 film to X-rays over an effective energy range of from 0.5 to 10.0 MEV was

determined. For a given exposure in roentgens the density on the film is higher at 4 MEV than at 1 MEV, and it continues to rise with increasing energy to the maximum of the range covered. Interpretation of film badge readings resulting from exposures to X- or gamma rays over a range of energies from approximately 10 KV to 10 MEV is now possible. A beta exposure may also be determined from the film readings. Both of these are interpreted from the differences in probit densities read under a lead-covered section, a brass-covered section, and an uncovered section of the film.

Some of this work was published in April as LA-1107, "A Method for Monitoring X-rays Using Eastman Type K Film". This work is being continued in the Biophysics Section.

2) Started During the Past Year:

A report is being compiled of the processes at the Laboratory which are carried out by remote control. A publication will be forthcoming early next year including as many of these processes as security will allow.

Decontamination studies were started. A manual was compiled of the published material dealing with the subject. A vehicle decontamination pit is being enclosed to improve facilities for work in cold weather.

In order to determine the ratio of the wrist badge readings to the finger exposures, plastic ring badges were initially tested. These badges proved unsatisfactory because the film container

was not light-tight and also was so large that it inhibited the wearer's movements. A pliable sealed vinyl-chloride-plastic ring badge was developed (similar to samples provided by UCRL) to aid in the wrist-to-finger ratio studies. The film is enclosed in a packet made of Scotch Electrical Tape.

2. Electronics Section

a. General Remarks:

Special attention was given to an analysis of the work of this Section to determine on what types of work the greatest fractions of time and effort were being spent. The results were quite informative although somewhat biased by the processing of a large stock of instruments prior to shipment to Eniwetok. The principal finding was that about 60% of the work of the Section was performed for the Laboratory exclusive of the Health Division. The bulk of this "outside" work was maintenance service on Rad-Safety instruments. It was also found that a disproportionate amount of time was being spent on the stockroom.

During the year one employee left the Section and two new ones were hired. The present strength of the Section is: 1 Section Leader, 8 Technicians, and 1 Clerk.

b. Routine Work (Main Items):

Portable Survey Meters Repaired	947
Portable Survey Meters Calibrated	932
Pocket Chamber Chargers Repaired	23

Plateau and Efficiency Checks on G-M Tubes 830

Service Calls on A-C Instruments 237

The above work covers approximately 394 instruments of 20 different types valued at about $100,000.00.

c. Development and Construction Work (Main Items):

Development and construction of 12 instruments (portable A-C operated) for monitoring of tritium in the air.

Conversion of Pee Wee for neutron monitoring (in collaboration with Biophysics Section) - 6 instruments.

Reduction of background of 8 Methane Proportional Counters used for plutonium urinalysis - average now 2.4 counts per hour.

Development and construction of two fluorophotometers for uranium urinalysis, two ionization chamber instruments for tritium urinalysis, and one polarograph.

Partial development of two types of continuous air monitors for alpha activity (one based on the impactor principle, the other a filter type).

3. Biophysics Section

a. The Biophysics Section has moved to larger quarters in the basement of B Building during the year. The personnel of this Section still continued inadequate for the work load during the greater part of the year. We have not succeeded in hiring an Alternate Leader for this Section, and have lost one Research Assistant, Gordon Pettengill, who terminated this fall to begin work toward his Ph.D. We have added

one SCP, Ellery Storm, by transfer from the Monitoring Section, and one Research Assistant, George Angleton.

b. A coordinated program to evaluate the RaLa chemists' dose more accurately has been carried out. This has necessitated the measurement of the surface dose from radio barium-lanthanum betas; the calibration of the monitoring film in terms of this dosage; the evaluation of the gamma-ray energy and dosage by the method of Storm and Bemis; and the evaluation of a reasonably accurate average combined dosage. This yielded the result that whole body gamma dosage is well within permissible levels and that the combined surface dose is slightly above.

c. The surface dose due to the soft X-rays from bare plutonium was measured and the monitoring film was calibrated in terms of this dose.

d. A very useful neutron monitoring instrument was made by converting the standard Pee Wee to have a boron-lined chamber instead of the regular air alpha chamber.

e. This Section participated in a cooperative way with the Air Force Cambridge Research Laboratory in a limited cloud-tracking operation. As a result it became clear that it is not only possible to track a radioactive cloud by means of air conductivity measurements, but it is possible to map out a fall-out pattern beyond what a ground survey with G-M instruments is capable of doing.

f. We also compared the air conductivity method with that of

a sealed ionization chamber in detecting a sealed gamma-ray source. Here we found the ion chamber superior because of the better signal to background ratio. However, for ionization produced by alphas and betas, the air conductivity air survey method is the only feasible one. It is planned to further test these two methods for measuring a dispersed and open source (fall-out) of both gamma and beta emitters at Operation Ranger.

g. At our invitation, Dr. Failla of Columbia University sent a team here to evaluate a simple approximately tissue-equivalent ion chamber against a much more complicated exactly tissue-equivalent one in fluxes of neutrons of different energies. The results showed that the simple chamber is quite adequate for neutron dosimetry irrespective of energy from thermals to 14 MEV and can be easily designed to do this well below tolerance levels.

h. An evaluation of the total time that a pilot might be blind to important aircraft instruments after seeing the fire ball of an atomic bomb has been made. The sun was used as a source.

4. Meteorology Section

a. General Changes and Improvements:

1) Personnel and Administration:

The present personnel quota and administrative procedures for the Meteorology Section were established jointly by the Health Division Leader and the Chief, Air Weather Service, early in 1950. The authorized strength of the Section is four persons, all of

whom are to be qualified forecasters, and at least one of whom is to be trained in research meteorology. The present strength of the Section is three, the officer designated to fill the research meteorologist position having been delayed overseas. It is anticipated that he will be assigned to Los Alamos upon his return to the USA. The Section is completely under the operational control of the Laboratory. Necessary military administration is accomplished by Headquarters 2059th Air Weather Wing, Tinker Air Force Base, Oklahoma, of which the Section is a detachment (Detachment 2059-7L).

2) Operations:

a) Scheduled:

The only scheduled operation of the Section is the preparation and dissemination of a fifty-four hour forecast for the Los Alamos area six days weekly. The information on which these forecasts is based is obtained from a Service "C" weather teletype drop which was installed in February, 1950. This information is supplemented by facsimile charts received daily via Cargo air lift from the Air Weather Station at Kirtland Air Force Base.

b) Non-scheduled:

Furnishing winds aloft and precipitation forecasts and observations in support of the CMR-10 program, January-June, 1950, (to be resumed in 1951).

Furnishing winds aloft, precipitation, and temperature forecasts and observations in support of the off site airfield

contamination experiment.

Obtaining and/or preparing climatological data for various parts of the world as requested throughout the year.

Obtaining winds aloft data in support of miscellaneous Laboratory operations as requested throughout the year.

One member of the Section was placed on part-time loan to J-Division, November 15 to December 15, in connection with a meteorological problem.

b. Research and Development Programs:

1) Programs which were underway a year ago and are still continuing:

The only program in this category is the procurement, analysis, and dissemination of local climatological data. Existing data, which were collected primarily at B Building, have been analyzed to give hourly wind direction frequencies by months, mean velocities by directions, mean, mean maximum, and mean minimum temperatures by months, and mean monthly precipitation amounts. Relative humidity data for several months of 1950 have been collected but in insufficient quantity to permit of climatological treatment. The long range objective of the Section in connection with this program is to obtain wind, temperature, and precipitation records from a minimum of six scattered locations on the reservation in order that micrometeorological effects may be ascertained and made known to interested operating Sections. This portion of the program has been delayed by a difficulty

encountered in procuring the necessary wind equipment through the USAF. The equipment received was found to be incomplete. Missing parts are on order and it is hoped will be received early in 1951.

2) Programs which were initiated during the year and are still continuing:

a) Formulation of semiquantitative forecasting techniques for the local area based on statistical correlation studies of relationships between observed values of the pressure, temperature, and moisture at various nearby stations at a given time and the occurrence of precipitation, wind direction, and velocity, and the temperature extrema experienced at Los Alamos at a later time. The advantage of forecasting by such a method is that a reliability index may be appended to such forecasts which should then prove more useful in operational planning. Assembling of the necessary quantities of data to permit of statistical treatment has been in progress since February, when teletype data became available to the Section.

b) The problem of dispersion of the "Water-Boiler" Reactor stack gases was taken under consideration by the Section during 1950. However, since available theories and equations on the dispersion process are in the testing stage it will be necessary to analyze a considerable body of data before any conclusions may be drawn. At the present a gradual assembling of the data is underway. It is hoped that the Section will be able to begin analysis of it by March of 1951.

GROUP H-2, INDUSTRIAL MEDICINE

(Robert S. Grier, M. D., Group Leader)

A. General Remarks

On June 1, 1947, the Group, which was then known as A-10 and discharged many of the duties of the present Health Division, was officially granted Division status with its own formal Division organization plan. Under this organizational plan there were four original Groups designated H-1, 2, 3, and 4. Of these four Groups only H-2 and H-4 have retained their essential duties and characteristics as at the time of their original organization.

In writing the annual report for Group H-2 it would seem worthwhile to measure its growth and services in 1950 as compared to the years 1948 and 1949.

B. Functions of the Industrial Medical Group

1. Preplacement Examinations:

One very important function of the Group is the screening of new personnel from a medical point of view as judged from the preplacement examination. The primary purpose of this examination is a conscientious effort to place a given individual in a position which is not incompatible with his general health nor constitutes a danger to his fellow workers. Every effort has been made to employ and place individuals with definite physical handicaps for experience throughout

industry has shown that such individuals are in general more conscientious and more productive than their less handicapped fellow employees. That such an attempt has been made and appears to be successful may be shown by the fact that in 1948 the rejection rate was 2.6%; in 1949, 1.9%; and in 1950, 1.6%. It should also be noted that the general overall safety record of the Laboratory has improved concomitantly over the same period of time. One of the great weaknesses of the preplacement examination in the past has been the fact that in most cases the examination has been done by the employee's private physician who knows nothing of conditions at Los Alamos and is unable to evaluate his patient's health in relation to the conditions. In the past year, to remedy this situation, the Group has attempted to do as many of its own preplacement examinations as possible which tends to assure known quality and uniformity that was previously lacking. During the past year the Group has been able to do about 14% of all the preplacement examinations done, or about 230 in number. In addition to providing uniformity and consistency, this number represents considerable financial savings to the Laboratory to the extent of approximately $6000, for the average cost of preplacement examinations done on the outside is $25. It is anticipated that during the coming year an even greater number of preplacement examinations can be done by the Group with resultant improvement in quality and in financial saving to the Laboratory.

2. Termination Examinations:

Another very important function of the Group is that of

performing termination physical examinations on personnel who are leaving the Project. These serve two functions: The first is that of protection to the employee to be certain that he has suffered no injury from exposure to any of the hazards which he may have encountered; and secondly, to protect the University against unjust claims which may arise in the future. At termination if any defect is found, whether of occupational nature or not, the employee is so advised and urged to seek medical care or advice to correct what defect may be found. Termination examinations in addition to being done on all University employees are also done on all Security Inspectors who have had service within the Tech Area and all Zia employees who have had such service. One innovation in the past year has been the pre-employment examination of Zia personnel working in the Tech Area. In the past only termination examinations of Zia personnel have been done and it was obvious that a defect found at termination could not be properly evaluated unless there was some baseline for comparison at the time of employment. While this has resulted in considerably more work for the Group, we believe that the ultimate results and protection more than justified this innovation.

3. Periodic Examinations:

Periodic examinations of various individuals who may have exposure to any of the number of hazards represent another phase of the work. These examinations may be medical, hematological or chemical, or a combination of all three depending upon the type of hazard.

Three special projects during the past year are worthy of mention in this connection. The first was a complete survey of HT Shop, which was undertaken with the cooperation of Group H-5, the Industrial Hygiene Group. This was carried out by Dr. Fred Alexander from a medical point of view. This comprised a survey of air and urinary concentrations of uranium coupled with medical, chemical, and hematological examinations. The survey comprised a group of some fifty men and no evidence could be found of any physical or chemical damage to this group as a result of their exposure.

The second project was also carried out by Dr. Alexander in which a survey of over a hundred men who have heavy exposures to HE was carried out. Here again, complete medical and hematological examinations with liver and kidney tests were carried out on this group of men. No evidence that any had suffered from any deleterious effects from their exposure to HE could be obtained. A number gave a history or showed physical finding of other non-occupational diseases to which the flesh is heir, such as high blood pressure, rheumatism, peptic ulcer, etc. The incidence in this group was no higher than might be expected from a similar age group with no exposure.

The third project was complete examination of over a hundred men to date in preparation for their participation in the Greenhouse Operation. This examination consisted of a complete history, medical examination, x-ray examination, hematology and serology examination. Of the group to date only two have been found physically disqualified

for overseas service and of these two, one was previously known to have had a condition which would disqualify him for such duty. These screening examinations served one additional purpose; namely, that of service as an annual checkup on a large majority of the key personnel in the Laboratory. It had been anticipated at the beginning of the year the Health Group would be able to cover the entire personnel of Division and Group Leaders but due to a combination of factors this has not been possible. These special examinations, to a large extent, have accomplished the same purpose. It is hoped that in the coming year this obligation can be better discharged than it has been in the past.

C. Dispensary Services

The Industrial Medical Group operates two dispensaries at outlying sites, DP West and S Site, in addition to the main dispensary in Q-Building located in the midst of the main Tech Area. At these installations first aid for industrial accidents is rendered and, if possible, definitive care given; in more serious cases the removal to the hospital is expedited. In addition to caring for industrial injuries, colds, stomach upsets, and other minor ailments are looked after. It might be thought at first glance that this represents unfair competition to the hospital in that no fee is charged, but actually this is not the case. Many cases of potentially serious disease are noted before the individual is aware of the seriousness of his condition. These are urged to seek early medical care before a protracted and expensive

illness ensues with concomitant loss of working manpower to the Laboratory. In addition, this service fulfills another need in the group of relatively low paid workers who have no hospitalization insurance and who refuse to go to the hospital for what they consider minor illnesses. This group is largely represented by the Spanish-speaking laboring class. By providing simple treatment for minor ills it has been possible to keep them working with a concomitant gain to themselves and in man hours worked by the University and by other organizations assisting the University. In instances where serious illness is present in this group of people we have, with the cooperation of the hospital, often been able to arrange for them to have excellent care at the hospital at considerably lower rates. In general these dispensaries do not represent competition to the hospital but rather act as a clearing house from which many cases are directed to the hospital which would not ordinarily accrue to them.

Perhaps some idea of the value to the Laboratory of these dispensaries and of their service to the Laboratory employees may be seen in the first graph (Figure I), the upper portion of which shows the increase in the number of total dispensary visits by six month intervals from January, 1948, to January, 1951. The bottom portion of the graph shows the total visits per year to all dispensaries over the same period of time. It is to be noted in 1948 there were over 4700 visits; in 1949, over 7100 visits; and in the year just passed, over 14,000 visits. Figure II shows the increase in dispensary visits

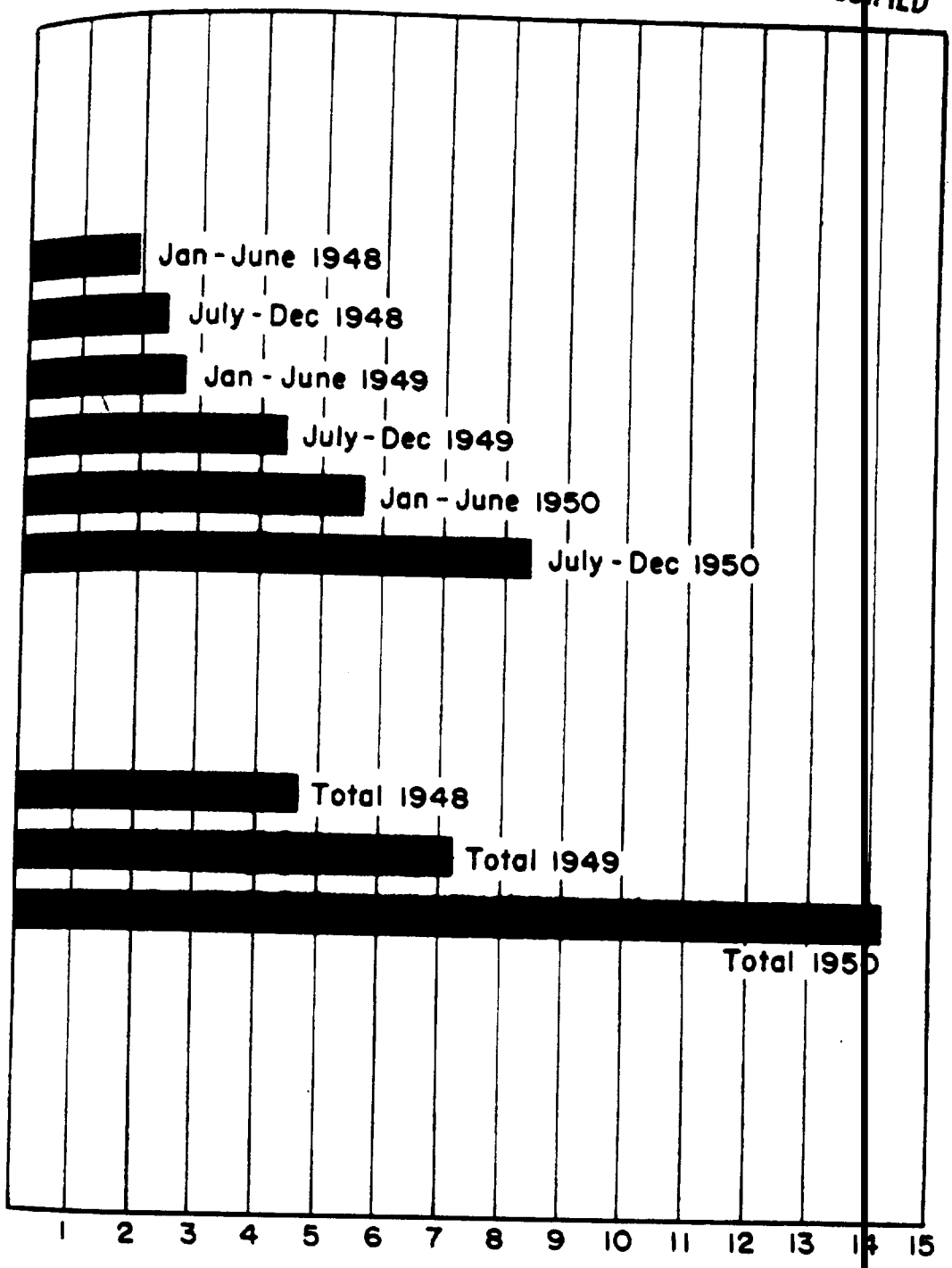

FIGURE I
FIRST AID RENDERED, 1948 - 1950
Number of Thousand Patients Treated

[redacted]

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FIGURE II
FIRST AID RENDERED, 1948 - 1950
Number of Thousand Patients Treated

[redacted]

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per year at the various sites. It is to be noted that the use of figures of dispensary visits does not include the number of visits of individuals for routine blood counts, urinalyses, or chemical studies. If these were included the number of total visits would be nearly doubled. Of these visits in 1948, 63% were for industrial reasons; in 1949, 54%; and in 1950, 48%. There appear to be several reasons for this rather dramatic increase in the volume of work performed by the Industrial Medical Group. One factor has been the policy of the Group to discourage self medication and to encourage the reporting of all illnesses or injuries, no matter how minor. Undoubtedly the lengthening of the work week to six full days has played its part in the increased number of visits. Finally, we would like to believe that the quality of the service rendered by the Group has gained the confidence of the Laboratory personnel and that part of the increase may be due to this.

D. Personnel

During the past year there has been little change in personnel numbers as may be seen in Figure III. This figure shows a breakdown by numbers of the types of work performed in the Group over the past three years. Despite the increased volume of work shown in the previous two graphs, the number of people employed in rendering the service has remained essentially constant since 1948. It may be truthfully said that despite the increased volume of the service rendered, the quality of service and the morale of the Group in general

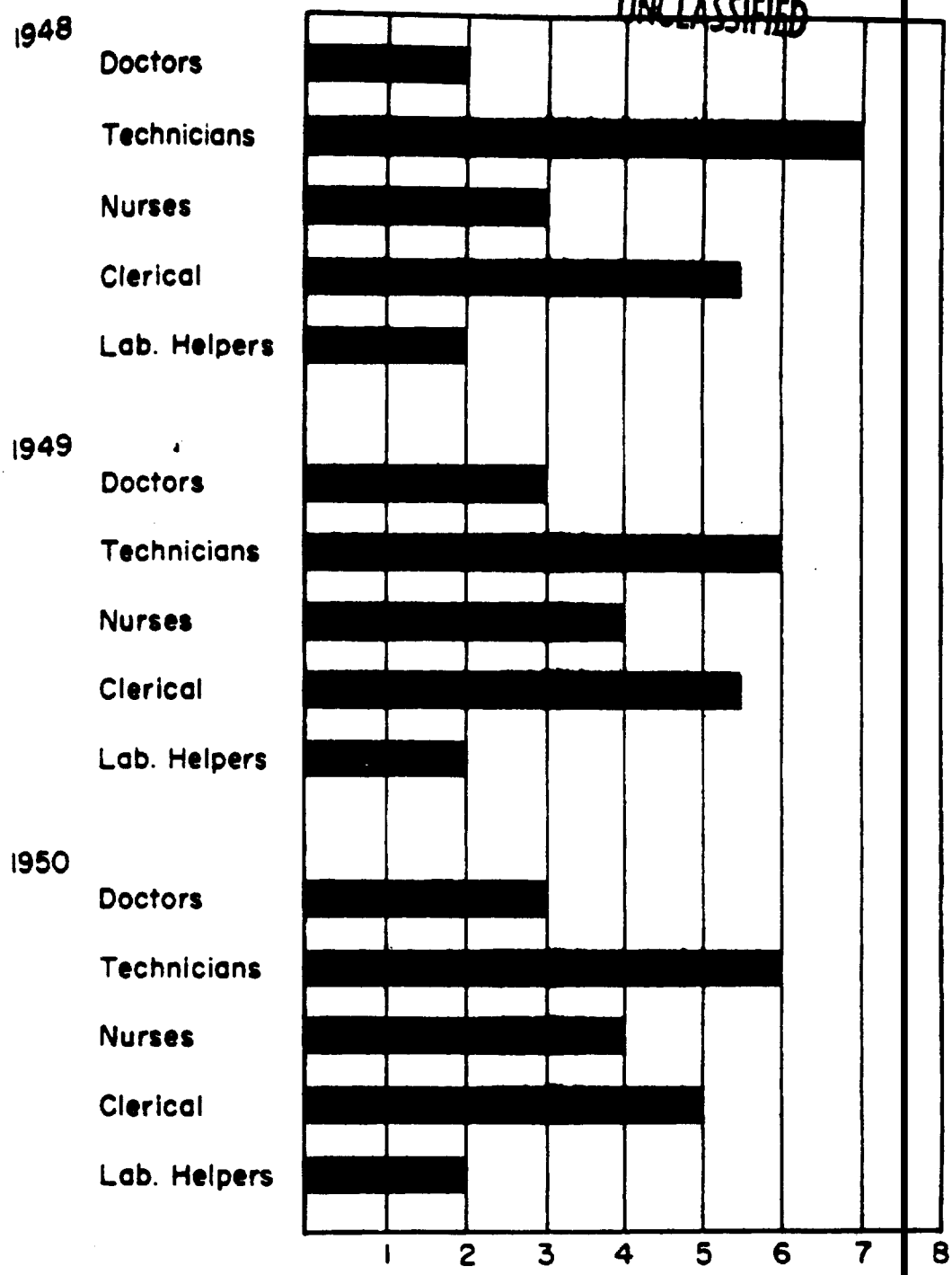

FIGURE III
NUMBER OF PERSONNEL, GROUP H-2

is at the highest at any time since the Group was organized.

E. Clinical Laboratory

Prior to 1949 the work of the Hematological Section of the Group was largely concerned with routine and special blood counts of people exposed to various radioactive hazards. While hazards of radioactivity from many and varied sources are present, there also exists a group of hazards arising from common organic and inorganic compounds such as benzene, toluene, carbon tetrachloride, trinitrotoluene, mercury, lead, and a host of others. These substances act primarily as poisons of the kidney, liver, or blood forming organs. In order to adequately protect employees exposed to these compounds, tests in addition to routine blood counts are necessary. In the past year, to attain this end, at least twelve new clinical chemical tests have been set up, primarily as a measure of liver and kidney function as these functions may be affected by exposure to specific compounds. Many of these liver and kidney function tests are done routinely on groups of employees so exposed in addition to the hematological examinations. During the past year nearly 4000 of these tests have been performed in addition to over 9700 routine hematological examinations. Had it been necessary to perform the clinical chemistries and the urinalyses on the outside, the cost to the Laboratory would have been nearly $12,500. Performing these tests within our own Group results in considerable saving to the Laboratory. One additional project of the Hematology Section has been the introduction of blood typing of all

new employees entering the Laboratory and the gradual addition of blood typing of the old employees, with setting up of a file of the various blood types and RH factors. This project may be looked upon as a step in connection with civil defense.

F. Research Projects

In the autumn of 1949 the Group began a research project to study the metabolism of trinitrotoluene in the animal body using Carbon^{14} labeled TNT. In the past year much of this work has been completed and the results were presented at the meeting of the Laboratory Directors and Industrial Physicians, which was held at Los Alamos during the latter part of September. To date it has been shown that 60% of all the orally administered dose of TNT to a rat is absorbed in twenty-four hours and 90% of the amount absorbed is excreted in the urine. There appears to be little accumulation of the material within the animal body with the largest amounts (less than 2%) found in the liver, kidney, and skin. In general material given by the oral route was rapidly excreted. In addition it was found that dry TNT applied to the skin was rapidly absorbed and excreted. The amount absorbed was roughly proportional to the area to which the material was applied. In addition it was noted that a number of the so-called barrier creams do not prevent the absorption but rather appear to facilitate it. This finding is of considerable practical importance in that it demonstrates that the skin is probably the main route of absorption of the material into the worker's system, at least in the operations performed here.

further, the work is continuing along the lines of identifying the breakdown products of the material in the animal organism and in studying the various effects this material may have on the enzyme systems of the red blood cell. This may play an important part in the understanding and prevention of toxicity which has been observed as related to the blood and blood forming organs of the people exposed to this compound. At the present time the paper presented at the September meeting is being rewritten with a review of the literature with the hope of publication at an early date in an industrial journal.

C. Future Projects and Plans for the Coming Year

1. Education:

While the Group has made considerable progress in the two and a half years of its formal organization, there still remains much to be done and there would appear to be little room for complacency or self-satisfaction of results already achieved. One project worthy of institution in the coming year is that of inter and intra Group education and orientation within the Group of the plans and goals of the Group itself and also the part the Group plays in relation to the other Groups within the Health Division. It is hoped that it would be possible to have regularly scheduled meetings of all the members of the Group at least once and possibly twice a month. At these meetings informal presentation of various aspects of industrial medicine and aims of the Group program as a whole could be presented as well as informal talks from the other Groups in the Health Division. This would point out

the fundamental unity of purpose of the Health Division as a whole and the parts that other Groups may play in our own Group's activity. In addition to intra-Group education, it would be well if there were an increased program of education of employees concerning various hazards to complement the work of H-3. This might be accomplished through informal talks to small groups about precautions dealing with special hazards through the issuing of simple informative pamphlets dealing with precautions to be observed in handling hazardous materials or chemicals, and possibly even through the medium of a colloquium in which the aims, objectives and services offered by the Industrial Medical Group could be presented to the Laboratory as a whole.

2. Preplacement Examinations:

In order to strengthen the preplacement examination program it is hoped that an increasing number of preplacement examinations may be done by our Group and these examinations may be extended to potential candidates to be done at the time they are here for interview. In addition, it is hoped that a general health questionnaire may be sent out at the time that the PSQ is sent from the Personnel Department in order that the Health Group may be able to make some estimate of a prospective candidate's physical qualification as well as his mental and mechanical qualifications, which are of interest to Personnel. By working closely with Personnel from the results of these medical questionnaires some cases of obviously physically or psychologically unfit potential employees might be eliminated from the lengthy and expensive

[redacted]

process of security clearance. In addition such questionnaires would give the Health Group a much better baseline with which to work in order to aid Personnel in the placement of individuals in positions in which they are both medically and intellectually qualified.

3. Visiting Nurses:

With the gradual moving of the Tech Area to new sites there have been increasing numbers of people who work regularly at some distance from any one of our dispensaries. As a result there has been an increasing trend toward self-medication of minor scratches and bruises rather than to incur the loss of time necessary to travel to a dispensary for immediate first aid treatment. While the desire to avoid the loss of time necessary for the treatment of minor injuries at a dispensary is commendable, this is not always to the best interests of the Laboratory, for a neglected scratch has more than once turned into four or five days of actual lost time which necessitated hospitalization of a patient. Tentative plans to correct this situation are being considered along the following lines. The employment of an ex-Navy Corpsman who is well trained and grounded in first aid is contemplated. This man would make regularly scheduled visits daily to all the outlying sites such as TA-33, K Site, Kappa Site, and the sites situated on South Mesa. To these sites would be provided a minimum amount of first aid equipment for minor cuts and bruises as obviously the injuries would not necessarily coincide with the Corpsman's visit; however, on the following day he would check all injuries that had occurred since his

previous visit, keep a record of their occurrence, and note the progress of the patients. Those requiring more treatment than he was able to provide would be referred to one of the dispensaries for further treatment although he would be entrusted with the management of those that were doing well. In addition to his first aid duties, he could serve a very useful function to both the Safety Group and the Industrial Hygiene Group for through his daily contacts he could be trained to be alert to industrial hygiene and safety problems as well. He might also be used to instruct members of the various Groups in fundamentals of first aid, such as artificial respiration and the control of bleeding. The institution of such a service to bring first aid and training to the Groups would more than justify the expense of his employment when balanced against the amount of time lost by various employees traveling to and from the dispensaries.

With the anticipated employment of women to work the various shifts at S Site, the problem of providing nursing aid around the clock at the S Site dispensary has arisen again. Only time can tell whether twenty-four hour maintenance of a nurse at the S Site dispensary will be necessary or not. In anticipation of this employment policy new first aid facilities which are more adequate and ample are being installed in the new Women's Change House. It is anticipated that the personnel of this dispensary will consist of a nurse, a laboratory technician, and if at all possible, a full time doctor. The placing of a laboratory technician at S Site Dispensary will save considerable

time by taking laboratory procedures to the project rather than bringing the employees into the central dispensary. In addition to S Site this laboratory will serve GT Site, TD Site, R Site, and surrounding installations that require special laboratory work. It is anticipated that the S Site Dispensary in addition to its program of first aid will take leadership in a positive program of preventive medicine through education in hygiene, safety practices, nutrition, and general personnel counselling.

With the increased scope of the industrial medical program and the wide dispersion of the Tech Area it will become increasingly difficult for the Industrial Medical Group to fulfill its functions of first aid, education, preventive medicine and research without some additions in Group personnel, especially in the professional fields of doctors and nurses. It is hoped that the Group can acquire two additional full time physicians and the possibility exists that high grade physicians known to present members of the Health Division may be assigned to the Division as part of their tour of duty with the Armed Forces. This would result in the acquisition of exceptionally able physicians with benefit to the Laboratory and at the same time definite benefit to the Armed Services, for during their assignment here the Army in turn would be training a group of industrial physicians acquainted with the peculiarities of atomic energy installations which might at a later date be of infinite service to the Army.

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G. Future Research Projects

Only if additional medical personnel is acquired by the Group will it be possible for the Industrial Medical Group to continue in an active research program. Such a program envisions the winding up of the work on the metabolism of Carbon^{14} labeled trinitrotoluene, and instigation of an investigation of the metabolism of a simple compound of considerable importance to the Laboratory using the Carbon^{14} technique, namely carbon tetrachloride. In general, the program for the coming year of the Industrial Medical Group may be summed up by stating that the desire of the Group is to provide increasing service to the Laboratory in the fields of medical care, preventive medicine, education and increased knowledge through research.

GROUP H-3, SAFETY

(Roy Reider, M. S., Group Leader)

A. Accident Experience

During the year 1950 the Laboratory had the most favorable accident experience in its record; this was coincident with greatly increased work exposure as demonstrated by the man-hour total. For purposes of comparison the Laboratory's past six year statistical summary is given:

Year	Man-hours	Accidents	Days Lost*	Frequency**	Severity***
1945	3,036,018	20	7,599	6.60	2.50
1946	3,162,468	22	26,936	6.95	8.51
1947	2,604,771	21	103	8.06	0.04
1948	2,926,110	16	239	5.50	0.08
1949	3,464,945	22	260	6.40	0.08
1950	4,413,442	15	237	3.40	0.054

*The high figures for the years 1945 and 1946 are due to the arbitrary assigning of fixed lost time charges to cases resulting in a fatality or permanent disability. This is a nationally used standard.

**Frequency is the measure of number of injuries per 1,000,000 man-hours worked.

***Severity is a measure of seriousness of accidents and is given as number of days lost per 1,000 hours worked.

From April 22 until August 18 of 1950 the entire Laboratory was accident free. In this period 1,500,000 man-hours were worked without any disabling injuries reported. On July 3 the Laboratory had gone 1,000,000 man-hours without an accident and this fact was announced

to the Laboratory by a letter from the Director to the payroll list. In this same letter was stated the Laboratory safety policy as enunciated by the Director.

The disabling injuries reported in 1950 were of the following types:

Falling objects	2
Mechanical equipment	3
Falls	2
Struck stationary object	3
Electrical shock	1
Strains	5*
TOTAL	16

*One hernia not recorded statistically.

It is interesting to note above that there were no disabling injuries from either explosives, dangerous chemicals, or radioactive substances.

B. Fire Loss Experience

Fires in Laboratory facilities during the year were from the following causes:

Electrical defects	5
Tuballoy	1
Heating equipment	2
Chemicals:	
Paraffin	1
Ether	1
Polystyrene	1
Acid spill	1
Friction drive	1
Spontaneous ignition	2
TOTAL	15

The total loss from the above fires was less than $2,000.00. The

biggest fire occurred when some polystyrene insulating material was ignited with a heated rod; damage was $1,100.00.

Beginning the first week in May, 1950, widespread forest fires occurred around Los Alamos in general, and the Laboratory site facilities particularly. The fires around the sites were ignited by the activities of the GMX-Division. All the facilities of the Fire Department with the help of the Security Service, the Zia Company, and some Laboratory personnel were needed to combat the fires. The "extreme" fire risk continued until heavy rains early in July. For a short period some of the work of the GMX-Division had to be curtailed.

Previous to the fires some work had been done to scrape fire lanes around sites. After the first fires more fire lanes were made and in the remainder of 1950 the Zia Company did much work in cleaning fallen timber, slash and underbrush.

There were two accidental explosions during the year. One at the scrap disposal ground, cause unknown, caused damage consisting of a broken concrete slab and bent fence, but no one injured. The second, at Anchor Ranch West, when a hundred grams of explosive in an experimental set-up detonated; damage was about $500.00, mostly in the loss of a mold; two employees suffered damaged ear drums with no apparent disability.

C. Motor Vehicle Accidents

The motor vehicle accident experience for 1950 showed no appreciable change compared to the previous year:

Year	Miles	No. of Accidents	Damage	Accident Rate*
1949	1,050,000	62	$4,060	5.9
1950	1,566,000	98	$3,709	6.25

*Number of accidents per 100,000 miles.

There were no accidents of any significance involving vehicles in the transportation of radioactive substances or explosives. Personal injuries in motor vehicle accidents were few in number and minor in nature.

Two information bulletins were issued to Group Leaders on motor vehicle accident prevention. Several cases of disciplinary action were taken toward drivers involved in accidents; temporary suspension of driving privileges, permanent revocation of license, and official letters of reprimand were used.

D. Safety Training

In February, George Kintz, Supervising Engineer, Dallas office of the Bureau of Mines, gave a demonstration on combustible gas mixtures, static electricity and flame propagation; 300 Laboratory personnel attended.

The program for the Indoctrination of Security and Fire Protection Personnel continued with field training meetings and addenda issued pertaining to changes in Laboratory facilities.

A general safety training course was held for monitoring personnel of Groups H-1 and CMR-12.

A series of safety "burning" demonstrations was held for all the

GMX Groups (exclusive of firing groups).

E. Personnel

T. E. Ehrenkranz who had been in the Safety Office since the fall of 1947 resigned his position to continue advanced studies.

C. Austin Burch joined the Group as a safety engineer. At year's end H-3 was recruiting an additional safety engineer.

A safety engineer trainee and fire protection engineer trainee of the Atomic Energy Commission Safety and Fire Protection Division, Santa Fe Office, spent a week each with this office in connection with their training schedule.

F. Safety Committees

Safety committee work was expanded and strengthened during the year. The committees of the Shops Department have been doing an outstanding job.

In GMX-Division an autonomous safety committee was authorized for Group GMX-1. This Group and the committees of the firing groups and of GMX-2 and GMX-3 have been writing the operating safety manuals.

The P-Division committee, with a Group Leader of that Division as chairman, was reactivated and surveyed all facilities within that Division.

The W-Division annual committee surveys were conducted by the several H-Division Groups jointly.

G. Travel

Group Leader, H-3, attended a seminar in January, 1950, at New York

University in the subject, "Industrial and Safety Problems of Nuclear Technology".

Group Leader, H-3, attended the AEC sponsored Safety Information Meeting held at the Brookhaven National Laboratory and the National Fire Protection Association annual meeting in May, 1950.

T. E. Ehrenkranz, Safety Engineer, made a safety inspection of the Los Angeles Experimental Shop in August, 1950.

Group Leader, H-3, consulted the Office of the Chief of Ordnance, Department of the Army, Washington, D. C., in September, 1950.

Group Leader, H-3, and C. A. Burch, Safety Engineer, attended the National Safety Congress in Chicago in October, 1950.

H. Fire Protection Engineering

The Atomic Energy Commission sponsored a program of fire protection engineering surveys of all AEC owned facilities. This work is being carried out in the Laboratory by representatives of the Safety and Fire Protection Division, Santa Fe Office of the Atomic Energy Commission.

During the year the policy of emergency admittance for firemen has been under revision.

A review of the problem of watchmen service was carried out by H-3 at the request of the Director.

I. General Remarks

In July, Reuel Stratton, a representative of an association of most of the nation's life insurance underwriters, visited the Laboratory to evaluate Laboratory jobs with respect to life insurance premiums. H-3

aided the guidance and orientation of Mr. Stratton in his local program.

The Safety Group started a program of periodic training of the ambulance drivers of the Los Alamos Medical Center to familiarize them with the roads and sites of the Laboratory.

The Group Leader, H-3, is scheduled to present a Colloquium on January 16, 1951.

At the request of the Safety Group a project was completed by the Engineering Department providing site and road directional and identification signs for all Laboratory facilities.

A standard radiation danger sign was established and stocked for Laboratory-wide use.

Increased participation in J-Division work began late in 1950. Two representatives of this Group will engage in overseas work in 1951 in connection with J-Division activities.

Group H-3 coordinated the Laboratory participation in the Clean-Up Week and Fire Prevention Week programs sponsored by the Atomic Energy Commission.

Group Leader, H-3, is chairman of a committee established to review the effect of Laboratory exposures on wage rates.

J. Proposed Projects

For 1951 Group H-3 is considering the following:

1. The development of a "Near Incident Report" form. The various groups would be encouraged to use this to report those untoward incidents

that did not have any serious effects in the hope that distribution of such information would be of safety value to other groups with similar exposures.

2. The periodic publication, probably monthly, of an information news letter to the Group Leader list. This letter would include accident information and statistics, description of new safety devices, and educational material and other data of accident prevention significance.

GROUP H-4, BIOMEDICAL RESEARCH

(Wright H. Langham, Ph. D., Group Leader)

A. General Changes and Improvements

Group H-4 is still operating in the reconverted military barracks which became the Group's home in 1947. During the past year appreciable improvement in the general facilities has been accomplished. An additional discarded building has been converted into an animal colony giving 2600 sq. ft. of additional floor space. An addition to MR-Building during the fall of 1950 has provided 220 sq. ft. of office space for the Group offices. For the first time in history of the organization the administrative offices are all together. A telephone switchboard has been installed which has greatly improved the efficiency of communications.

Plans for a new permanent laboratory to house Groups H-4 and H-5, the H-Division Property and Procurement Section, and the combined Biology and Medical libraries of the hospital and the University of California received added emphasis in June, 1950. At the time of this report plans have progressed to the basic drawing stage.

Several pieces of excellent equipment have been added to the Group, including photomicrographic equipment, micro projector, new counting equipment, Van Slyke apparatus, Technicon fraction collector, and other smaller pieces of equipment too numerous to mention.

There have been a number of changes in personnel in all categories.

Dr. Robert E. Carter was made Associate Group Leader. Dr. Ernest C. Anderson and Dr. Rodney Foss were added to the Biochemistry Section as Staff Members. Dr. John Storer was added to the Pathology Section as a Staff Member. Mr. Frederick Worman was added to the Radiation Physiology Section, and Dr. Francis N. Hayes was added to the Organic Section. The Pathology Sub-Section was separated from the Radiation Physiology Section and was made into a Section of its own under the leadership of Dr. Clarence C. Lushbaugh.

The military contingency of the Group was supplemented through J-Division by the addition of Lt. Col. George W. Taylor and Lt. Col. Ernest A. Pinson. Major Francis van Veen was added through the kindness of the Surgeon General's Office and General James P. Cooney. Dr. William Atchley was discharged from the Army and left the Group to accept a Fellowship at the Rockefeller Institute in New York City. Miss Agnes Williams left the Group to enter the University of New Mexico. Miss Molly Magee, Mrs. Betty Rogers, Mrs. Rosemary Dumrose, and Miss Virginia Lotz were added to the Biochemistry Section. Mrs. Frances Barkmann and Mrs. Joan Thrap terminated the Group.

Dr. William Ward Wainwright, who has been with the Group for the past two years terminated to accept a position with the University of Illinois, School of Medicine and Dentistry.

Dr. Lloyd J. Roth, Dr. Edgar Leifer, Irene Uhrik Boone and George Woodward returned to the Group and participated in the summer research program.

Dr. A. Baird Hastings returned to the laboratory during October and spent a week working with the Group.

The present staff of Group H-4 consists of 17 Staff Members, including the military; 2 Research Assistants; 13 Scientific Personnel; and 2 Secretarial and Clerical.

During the year a cooperative venture was planned between Group H-4 and the Medical School of the University of Utah. Appreciable planning has gone into a collaborative effort on the part of Group H-4 and Dr. John Bowers, Dean of the Medical School of the University of Utah, to undertake a long term chronic toxicity study of plutonium, radium and mesothorium in dogs. The preliminary plans for this collaborative effort are essentially complete at the present time.

Cooperation with the staff of the hospital has been encouraged. Two joint programs were undertaken during the year. One was the study of the metabolism of C^{14} labeled anticoagulants. The other, which is still in progress, is the study of the induction of cataracts by neutrons. The latter program was set up by Dr. David Cogan of Harvard and taken over by Dr. John Goff of the Los Alamos Medical Center. During the setting up of the experiment Dr. Cogan spent six weeks with Group H-4.

The general emphasis on the research program of Group H-4 has shifted toward work of a more classified nature. As a result, some of the programs anticipated for 1950 have been curtailed. The continued cooperation of Group GMX-1, under Mr. Gerold Tenney, has contributed

materially to the progress of the H-4 experimental program. Various Groups of P-Division have been extremely cooperative in making available to H-4 various sources of radiation. Special mention should go to Mrs. Elizabeth Graves, of Group P-4, Dr. Richard Taschek, of Group P-3, Dr. William Ogle, of Group P-11, and Dr. Robert Emerson Carter, of Group P-5. Through the cooperation of these people Group H-4 has been able to take advantage of the unusual facilities available at Los Alamos.

B. Appraisal of Future Group Activities

The first half of 1951 promises to be a rather interesting, but rather disorganized, period for Group H-4. The existing International situation may produce changes in the military complement of the Group. Work of a classified nature will undoubtedly deter progress in a number of our research activities. Much of the Group's activities during the last half of 1950 have been concerned with participation in the Med-Bio program of the forthcoming Operation Greenhouse.

The final planning for the new laboratory will also interfere with our routine research program. Additional alterations in our present facilities may be necessary in order to provide adequate space for the expansion of other Groups of H-Division. These interferences, however, are looked upon as being part of the responsibilities of the Group and will be taken in stride. It is hoped that the latter part of the year will see a return to the pursuing of our 1950 research projects.

C. Research and Developmental Programs, 1950

1. Organic Chemistry Section:

a. General Appraisal of Section's Activities:

During 1950 Dr. A. R. Ronzio's Organic Chemistry Section made excellent progress with the isotopic labeling of a number of compounds of biological and medical interest. The Organic Section rendered a number of other services to the Laboratory in general through the synthesis, purification and analysis of materials of interest to various other Groups and Divisions of the Laboratory. Among these activities was work on the development of scintillation counting materials. These services have claimed approximately 30% of the time of the Organic Section.

b. Research and Development Programs Completed in 1950 but not Published:

1) A Study of the Condensation of 4-hydroxycoumarin with Glycoal - C. Wayne Bills, W. W. Foreman, Anthony R. Ronzio.

2) Micro Syntheses with Tracer Elements. XXIV. The Synthesis of Benzyl Alcohol Labeled with C^{14} - C. Wayne Bills, Anthony R. Ronzio.

3) Micro Syntheses with Tracer Elements. XXV. The Synthesis of Guanidine Labeled with C^{14} - Anthony R. Ronzio.

4) Micro Syntheses with Tracer Elements. XXVI. The Synthesis of Cyanuric-C^{14} Chloride and of 2,4,6-C^{14}_3-Triethylenemino-1,3,5-Triazine - D. Lloyd Williams, Anthony R. Ronzio.

This compound involved the synthesis of cyanogen-C^{14} chloride, polymerization to cyanuric-C^{14} chloride followed by reaction

with ethyleneimine.

5) Micro Syntheses with Tracer Elements. XXI. The Synthesis of Thiamin Labeled with C^{14} in the Thiazole Nucleus - D. Lloyd Williams, Anthony R. Ronzio.

6) A New Series of Compounds Obtained by the Condensation of 4-hydroxycoumarin with ortho Dicarbonyl Compounds - Anthony R. Ronzio.

7) Micro Syntheses with Tracer Elements. XXII. The Synthesis of Toluene Labeled with C^{14} at the Methyl Group - C. Wayne Bills, Anthony R. Ronzio.

8) Micro Syntheses with Tracer Elements. XXIII. The Synthesis of Acetyl Chloride and of Acetamide Labeled with C^{14} - D. Lloyd Williams, Anthony R. Ronzio.

c. Research and Development Programs Continued from 1949 and Not Completed:

None.

d. Research and Development Programs Started in 1950 and Not Completed:

None.

e. Work Completed in 1950 and Submitted or Published:

1) Micro Syntheses with Tracer Elements. XI. The Synthesis of Thiourea Labeled with S^{35} - C. Wayne Bills, Anthony R. Ronzio; Nuclear Science Abstracts, 4, 71 (1950).

2) Micro Syntheses with Tracer Elements. X. The Synthesis

of 6-Propylthiouracil - Arthur Murray III, Anthony R. Ronzio; Nuclear Science Abstracts, 4, 71-2 (1950).

3) Micro Syntheses with Tracer Elements. II. Methyl di(beta chloroethyl) amine Hydrochloride (Nitrogen Mustard) and Methyl Bromide Labeled with C^{14} - W. W. Foreman, Arthur Murray III, Anthony R. Ronzio; J. of Org. Chem., 15, 119-22 (1950).

4) Micro Syntheses with Tracer Elements. III. The Synthesis of Thiourea Labeled with S^{35} and of Thiourea Labeled with C^{14} - C. Wayne Bills, Anthony R. Ronzio; J. Am. Chem. Soc., Dec., (1950).

5) Micro Syntheses with Tracer Elements. IV. The Synthesis of Hexestrol Labeled with Tritium - D. Lloyd Williams, Anthony R. Ronzio; J. Am. Chem. Soc., Dec. (1950).

6) Beta-Iododiethylamine Hydroiodide - C. Wayne Bills, Anthony R. Ronzio; Nuclear Science Abstracts, 4, 227 (1950).

7) Micro Syntheses with Tracer Elements. XIII. The Synthesis of Urea Labeled with N^{15} - D. Lloyd Williams; Nuclear Science Abstracts, 4, 227-8 (1950).

8) Micro Syntheses with Tracer Elements. XX. The Synthesis of Dicoumarinyl Acetic Acid Ethyl Ester Labeled with C^{14} - C. Wayne Bills, Arthur Murray III, Anthony R. Ronzio, LADC-796.

9) Micro Syntheses with Tracer Elements. XIX. The Oxidation of C^{14} Methanol to C^{14} Formic Acid - Arthur Murray III, Anthony R. Ronzio, LADC-797.

10) Micro Syntheses with Tracer Elements. XVIII. The

Synthesis of Formaldehyde Labeled with C^{14} of High Specific Activity - Arthur Murray III, Anthony R. Ronzio, LADC-778.

2. Biochemistry:

a. General Appraisal of Section's Activities:

During 1950 the Biochemistry Section continued toxicological studies of radioactive and non-radioactive substances of specific concern to the Los Alamos project. Among such substances were plutonium, tritium, americium, and C^{14} labeled TNT. Fundamental investigations of the effect of radiations on nucleic acids were continued. Metabolic studies using C^{14} labeled organic compounds were undertaken and some of the studies completed and published.

Dr. Jean Sabine joined the Group and initiated studies of the effects of radiation on certain enzyme systems principally cholinesterase.

Dr. Rodney Foss joined the Group in December, 1950, and began to initiate studies of the effects of antimetabolites on the biological effects of ionizing radiation.

Miss Agnes Williams resigned from the position of autoradiographic technician and was replaced by Mrs. Julia Wellnitz.

b. Research and Development Programs Completed in 1950 but Not Published:

1) Relative Metabolism of Americium and Plutonium - R. E. Carter, Marion Corson, Verda Strang, Ogden Johnson, and Theodore Trujillo.

2) The Metabolism of C^{14} Labeled TNT - Robert Grier and Norma Lanter.

3) The Metabolism of Urea Labeled with C^{14} - A. Baird Hastings, Betty Rogers, Molly Magee.

4) Cholinesterase Activity of the Blood of Dogs Subjected to Lethal Doses of X-radiation - Jean Sabine, J. W. Howland.

5) Anti-cholinesterase Activity of Tributyl Phosphate - Jean Sabine.

c. Research and Development Programs Continued from 1949 and Not Completed:

1) Effect of Radiation on the Physical and Biological Properties of the Pneumococcus Transforming Principle - Virgil Koenig, James Perrings, Louise Muenning.

d. Research and Development Programs Started in 1950 and Not Completed:

1) Effects of Acute X-radiation on Cholinesterase of Erythrocytes of Rabbits - Jean Sabine.

2) Cholinesterase of Erythrocytes of Persons Chronically Exposed to Radiation - Jean Sabine.

3) Cholinesterase Studies of Patients with Conditions Associated with Bone Marrow Impairment - Jean Sabine.

4) The Absorption, Distribution and Excretion of Tritium by Man and Laboratory Animals - Ernest Pinson, E. C. Anderson.

5) Effect of Radiation on the Physical Properties of

Pneumococcus Nucleoprotein - Virgil Koenig, James Perrings, Louise Muenning.

e. Work Completed in 1950 and Submitted or Published:

1) The Distribution and Excretion of Plutonium Administered Intravenously to Man - Wright Langham, Payne Harris, R. E. Carter, IA-1151.

2) Studies on the Metabolism of Thiourea. I. Distribution and Excretion in the Rat of Thiourea Labeled with Radioactive Sulfur - John Schulman, Richard Keating; J. Biol. Chem., 183, 215 (1950).

3) Clinical Evaluation of Dicumarinyl Derivatives with a Metabolic Study of the Radioactively Labeled Anticoagulants in Animals - Eric Hausner, C. L. Shafer, Marion Corson, Ogden Johnson, Theodore Trujillo, Wright Langham.

4) The Identification and Relative Distribution of the Metabolites of Radioactive Nicotinic Acid and Nicotinamide - Edgar Leifer, V. J. Roth, D. S. Hogness, Marion Corson.

5) Metabolism of C^{14}-Nitrogen Mustard by Leukemic Mice (in collaboration with Southern Research Institute).

6) The Effect of Cathode-ray Radiation on the Decomposition of C^{14}-o-and p-aminobensoic acids (in collaboration with Food Technological Laboratory, M. I. T.).

7) Excretion of Tritium by Human Subjects - E. C. Anderson, Ernest A. Pinson, LAMS-1099.

8) Method for the Prevention of Leaching and Chemical

Fogging in Nuclear Track Autoradiography - Agnes I. Williams.

9) Cholinesterase of Erythrocytes in Anemias - Jean Sabine.

10) A Device for Rapid Fitting of Data to Two Mass Law Disassociation Curves Applied to Enzyme Reactions - Jean Sabine.

11) The Use of Isotopic Nitrogen in a Study of the Conversion of 3-Hydroxyanthranilic Acid to Nicotinic Acid in Neurospora - Edgar Leifer, Wright Langham, J. F. Nyc, H. K. Mitchell; J. Biol. Chem., 184, 589 (1950).

12) Studies on the Metabolism of Thiourea. II. The Metabolic Fate of Thiourea in the Thyroid Gland - John Schulman; J. Biol. Chem., 186, 717 (1950).

3. Radiation Physiology:

a. General Appraisal of Section's Activities:

The Radiation Physiology Section under Dr. Robert E. Carter has completed a detailed series of studies on the quantitative relationships between radiation dosage and organ weight loss in the mouse. These quantitative relationships have been sufficiently well established that spleen and thymic weight loss may actually be used as a biological dosimeter capable of determining radiation dosage to an accuracy of plus or minus 10 per cent. Using this dosimeter, they have been able to study the biological response of mice to 150, 250, 1,000,000 and 2,000,000 KV x-rays. This method has been developed for use in the Med-Bio program of the forthcoming Greenhouse Operation to measure the biological effects of the neutrons and gamma rays emitted by an

atomic detonation. They have studied the biological effects of 12 million volt gamma rays produced by the Betatron, the relative effect of slow neutrons from the "Water Boiler", fast neutrons from the Cockcroft-Walton accelerator, and other types of radiations peculiar to or available at Los Alamos.

Dr. Wainwright, in cooperation with members of the Dental Staff of the Los Alamos Medical Center, completed a series of studies of the penetrations of dentin and enamel by C^{14}-labeled urea, C^{14}-labeled acetamide, and other radioactive substances. With the termination of Dr. Wainwright these studies were completed and have been dropped from the research program of Group H-4.

b. Research and Development Programs Completed in 1950 but Not Published:

1) The Toxicological and Hematological Effects of Plutonium and Americium Administered to the Rat - R. E. Carter, Verda Strang, Betty Busch.

2) The Measurement of the Gamma Ray and Neutron Components of the Radiations from the Los Alamos "Water Boiler" - P. S. Harris, James T. Brennan.

3) Hematological Changes in Humans Chronically Exposed to Low Level Gamma Radiation - R. E. Carter.

4) Splenic and Thymic Weight of Mice as a Biological Indicator of Radiation Effectiveness - R. E. Carter, P. S. Harris.

c. Research and Development Programs Continued from 1949 and Not Completed:

1) Occurrence of Bi-nucleated Lymphocytes as an Indication of Radiation Exposure of Humans and Laboratory Animals - R. E. Carter, Fred Worman, Verda Strang, Phyllis Sanders.

d. Research and Development Programs Started in 1950 and Not Completed:

1) Splenic and Thymic Weight Decrease of Mice as an Indicator of Biological Effectiveness of Different Kinds and Different Energies.

2) Effect of Radiation on the Water, Nitrogen, Sodium, and Potassium Content of Mouse Spleen and Thymus.

3) Measurement of the Neutron and Gamma Ray Components of the Radiations from the Los Alamos Reactors.

e. Work Completed in 1950 and Submitted or Published:

1) The Effect of Vitamin B_{12} on the Leukopenia Induced by Radiation - R. E. Carter, Betty Busch, Verda Strang.

2) Rapid Diffuse Penetration of Intact Enamel and Dentin by Carbon^{14}-Labeled Urea - W. W. Wainwright, F. A. Lemoine.

3) Time Studies of the Penetration of Extracted Human Teeth by Radioactive Nicotinamide, Urea, Thiourea, and Acetamide. I. Diffuse Penetration from the Enamel Surface, - W. W. Wainwright.

4) Time Studies of the Penetration of Extracted Human Teeth by Radioactive Nicotinamide, Urea, Thiourea, and Acetamide.

II. Penetration of Dentin from the Pulp Chamber - W. W. Wainwright, H. H. Belgorod.

5) Rapid Diffuse Penetration of Intact Enamel and Dentin by Carbon^{14} Labeled Urea - W. W. Weinwright, F. A. Lemoine.

6) Pathways of Enamel Penetration and Tests of Impregnation with Radioactive Salts of Calcium^{45}, Zinc^{63,65}, Silver^{110,111}, Plutonium^{239}, Palladium^{103}, Iodine^{131}, and Copper^{64} - W. W. Wainwright.

7) Effect of Acute Doses of X-rays on Splenic and Thymic Weight of CF-1 Female Mice - R. E. Carter, P. S. Harris, J. T. Brennan - AA-1075.

4. Radiation Pathology:

a. General Appraisal of Section's Activities:

The Radiation Pathology Section has concerned itself with a number of problems among which is a study of the pathology of acute beta radiation burns. An attempt has been set up to produce standard beta radiation burns on rats, thereby permitting the screening of a large number of potentially therapeutic agents. The respiration, healing, and biochemistry of beta radiation burns have also been studied during the past year. Among the other studies pursued by this Section was a continuation of the use of x-ray to determine the mitotic and intermitotic times in normal and malignant rat tissues. Other studies have been in progress which have direct bearing on the acute and chronic effects of ionizing radiation on animal organisms.

b. Research and Development Programs Completed in 1950 but Not Published:

The following projects were completed and are in the process of being written up:

1) Acute Radiation Burns. I. Pathogenesis of Dermal Burns Following Various Amounts of Beta and X-radiation - C. C. Lushbaugh, John Storer, Francis van Veen.

2) Acute Radiation Burns. II. Histopathologic Study of the Ability of Beta Irradiated Rat Skin to Undergo Fibroplasia - C. C. Lushbaugh.

3) Acute Radiation Burns. III. Changes in Water, Fat, and Protein Content of Beta Irradiated Rat Skin - C. C. Lushbaugh, Dorothy Hale.

4) Acute Radiation Burns. IV. The Respiration and Glycolysis of Rat Skin after Exposure to Beta Radiation - C. C. Lushbaugh, Dorothy Hale, Frances J. Thrap.

5) The Use of X-ray and Nitrogen Mustard to Determine the Mitotic and Intermitotic Times in Normal and Malignant Rat Tissues - Richard Widner, John Storer, C. C. Lushbaugh.

c. Research and Development Programs Continued from 1949 and Not Completed:

1) The Effect of Beta Radiation on Various Enzyme Systems of Rat Skin.

d. Research and Development Programs Started in 1950 and Not Completed:

1) Screening of Selected Agents for Prophylaxis and Therapy of Burns.

2) Effect of Body Temperature on Radiation Damage and its Relation to Anoxia.

3) Effect of Radiation on Blood Vessels in the Rabbit Ear Chamber and the Vascularized Cornea of the Rabbit.

4) Effect of Pituitary Hormones on Radiation-induced Testicular Atrophy.

5) Relation of the Incidence of Prolonged Mitotic Depression in Skin Biopsies to X-ray Mortality.

6) Therapy of Experimental Tumors with Radio-gold.

7) Effect of Shielding Ectopic Bone Marrow on Survival of Rats Following Radiation.

8) Studies on the Mechanism by which Spleen Shielding Induces More Rapid Marrow Regeneration Following X-radiation.

9) Comparison of the Life Span of Leukemic Lymphocytes with the Life Span of Normal Lymphocytes to Determine Whether or Not Leukemia is a disease of "Overproduction" or "Underdestruction".

e. Work Completed in 1950 and Submitted or Published:

None.

GROUP H-5, INDUSTRIAL HYGIENE

(Harry F. Schulte, M. S., Group Leader)

A. General Discussion

The preparation of an annual report of the Industrial Hygiene Group is not a simple matter. Space is necessarily limited and one is faced with the dilemma of concentrating on a few relatively spectacular investigations or attempting to crowd in a few words about everything done during the year. Either approach gives a false impression of the work of the Industrial Hygiene Group at Los Alamos. Another difficulty arises from the fact that the work of this Group is tied in very closely with the work of the entire Los Alamos Laboratory and with the rest of the Health Division in particular. The reader must realize that many of the activities described in this report are really cooperative efforts. For more details on the work of the Group, reference should be made to the monthly reports.

A rereading of the 1949 Annual Report reveals that the section on the future program in that report is a surprisingly accurate picture of the work of the Group during 1950. In that section four main lines of program development were anticipated: 1) expansion of work on air pollution and air cleaning; 2) examinations of plans for new construction; 3) a greater variety of substances requiring investigation; and 4) increased emphasis on health education. These have constituted the main trends in the 1950 program, although very little of the regular

work previously undertaken has been discontinued. In fact the outstanding feature of the year has been the great increase in the amount of work undertaken. The number of samples of various sorts collected and analyzed offers an index, but only an index, of this development. 1170 samples were collected by the Field Section, and 6760 samples were analyzed by the Laboratory Section. In addition, 56 units of various sorts were calibrated for air flow and 145 hoods studied for ventilation characteristics. The variety of the samples handled is even more impressive than their number. That these results have been accomplished without an increase in personnel is an indication that the development work on equipment and techniques of the previous year were sound.

B. Program Examples

The following paragraphs outline examples of the type of work carried on. There is an obvious unfairness about this approach since other examples of equal importance could be cited were it not for space limitations. In citing such examples the emphasis, in some cases, is on the area where the investigations are made and in others it is on the material studied.

1. Shops:

A complete industrial hygiene program was inaugurated in HT Shop early in the year. The successful application of the fluorophotometer by the Laboratory Section permitted regular analyses of urine samples from all uranium workers. This also permitted the

Field Section to make a comparison of the counting method with chemical analysis for quantitating filter paper samples of airborne dust. As a result, it was possible to correlate air concentrations of uranium with urinary excretion to a limited degree. The polishing operation was quickly singled out as the source of most overexposures to uranium oxide dust and dry polishing was eliminated entirely for this reason. Careful studies were made of all operations in HT Shop and, through the cooperation of the operators and supervisors, the trend of air and urine concentrations has been consistently downward. A cut-off saw which was installed without prior study produced extremely high concantrations which were brought under control by the use of exhaust ventilation.

In V Shop a thorough study was made of the beryllium hazard. This was then followed by frequent rechecks. Here again the adoption by the Laboratory of a satisfactory method for the analysis of beryllium in air samples enabled the Field Section to carry out these investigations. The results demonstrated that the well-designed enclosing-type hoods which had been installed were operating in a manner to prevent the escape of beryllium dust into the work area. Lead exposures were investigated in the Foundry, and in the W-3 Machine Shop air samples were collected and analyzed for cerium and wolfram.

2. Sigma and TU Buildings:

In the enriched uranium area studies on the concentration of uranium dust were undertaken at a time when exhaust ventilation was

being installed. The results were very useful in demonstrating that the exhaust ventilation was necessary and was successful where properly designed and installed. In several cases the results also pointed to deficiencies in the ventilation equipment which were then remedied. In the normal uranium area the need for exhaust ventilation on the furnaces was demonstrated and is now in the process of completion. The importance of good housekeeping was also shown by means of air samples. There is still a need for further studies on such operations as rolling, forging and extrusion, but these operations are still being used only to a very limited degree and few samples have been taken as yet. The determination of uranium in urine has also been applied in this area. Thorium, arsenic, thallium, and beryllium were also used in Sigma Building during the year and studies were undertaken in advance of their use which enabled operations to be carried on without hazards. Ventilation studies have been particularly valuable in this work.

In TU Building progress has been somewhat irregular. From time to time consideration has been given to the immediate construction of a new building which would incorporate many of the improvements previously shown to be necessary. Air samples and particle size studies have shown this building to be one of the worst from the standpoint of dust production. However, the briquetting operation has been removed from Los Alamos completely and a study is still in progress on the remaining dust producing operations. In general, improvement along health

lines in the Sigma area has been slow but steady.

3. S Site:

At the beginning of 1950 a successful effort was made to secure complete coverage of the entire S Site area with the monthly urine analysis program and these samples were taken and analyzed at monthly intervals for a period of six months. The results were then reviewed with Dr. Lemuel McGee of the Hercules Powder Company, a consultant to the Health Division, and it was decided then to abandon the urine program for the immediate future. The results obtained were of considerable use in locating areas requiring further study but were not of sufficient value from the standpoint of information to be gained about an individual. When the urine program was dropped increased emphasis was put on air sampling and the number of such samples has been steadily increasing. By the close of the year all operations producing excessive dust had been brought under control. Because of the constantly changing conditions, however, continuation of routine air sampling work is necessary. Increased attention was also given to the problem of barium. Here again the ability of the Laboratory to analyze samples for this material permitted accurate estimates to be made of air concentrations and no serious hazards from this source have been found to date.

Construction work on new buildings in the S Site area have been proceeding rapidly and considerable time was spent in reviewing plans for this construction. The health program was extended to include GMX-2 installations at S Site and Anchor Ranch and GMX-1 operations

at GT Site. Carbon tetrachloride being used extensively by GMX-2 presented a number of serious problems during the year. These have been brought under control to a large degree and the use of less toxic materials as a substitute is being actively investigated by GMX-2. Mononitrotoluene, another new substance, still presents some difficulties largely due to its intense unpleasant odor in very minute concentrations. Improved ventilation is being provided in many locations at S Site and Anchor Ranch.

4. Naphthalene:

Because large quantities of naphthalene were being handled by GMX-5, it was necessary to develop an analytical method for the rapid and accurate determination of this contaminant in air. This method was developed by the Laboratory Section and a large number of air samples have been collected during the handling of both the dry powdered and molten naphthalene. Another exposure resulted from machining of large crystals of naphthalene. Recommendations were made for the proper ventilation of these exposures and concentrations were brought down to levels not considered hazardous. However, toxicological data on this material are still very meager and further information would be useful.

5. Waste Disposal:

The developments in the field of liquid waste disposal are largely outside the Industrial Hygiene Group. A Working Group on waste disposal, composed of representatives of all of the various AEC installations throughout the country, was organized during the year

and a member of the Industrial Hygiene Group was appointed to this Working Group and has participated in its several meetings. The Group in the AEC studying waste disposal at Los Alamos has been separated from the Sanitation Section and set up as a separate unit and has developed an active program. The plant for handling Tech Area liquid wastes was put into operation at the close of the year. In the field of airborne wastes the Industrial Hygiene Group has been particularly active. Some assistance has been given to CMR-Division in studies on effluents from the DP West stacks. Detailed studies were made on some of the air cleaning units at Sigma Building and it is planned that eventually all stack effluents will be brought under continuous survey or checked at regular intervals. An incinerator for handling combustible solid waste is in the process of construction and plans are being made by this Group for an extensive study of stack effluents of this incinerator. This has necessitated considerable development work on instruments and techniques.

6. Disaster Planning:

A considerable amount of time was spent by members of the Group in cooperation with representatives of other Groups on the subject of disaster planning. Particular effort was directed toward plans for dealing with an emergency that might be created by the accidental destruction of D Building. The Group also assisted in equipping an emergency vehicle for use at Los Alamos.

7. Hood Survey:

Because of the nature of the activities of the Los Alamos Laboratory there are a very large number of exhaust hoods of various types in operation here. A survey of all such hoods has been undertaken but was still only about one-half complete at the end of the year. Several hundred hoods still remain to be studied and the results to date indicate that there are a large number of hoods which provide insufficient ventilation for the operations being carried on in them. These hoods give an entirely false sense of security to the operators and recommendations are being made for their improvement.

C. Development Work

A considerable amount of development work has been undertaken by the Laboratory Section. The procedures used in the laboratory are in various stages of development, ranging from those in which a great deal remains to be done to those considered satisfactory and in routine use. A number of procedures have been moving toward the latter class during the year. The determination of tritium and uranium in urine and the determination of naphthalene in air are in this category. Studies on the determination of curium and actinium are still in the early development stage. Work on the determination of enriched uranium in urine, which was dropped early in the year due to pressure of other work, was resumed later and definite progress is being made. A considerable number of new laboratory procedures have been undertaken during the year. These include analyses of samples for beryllium, barium,

mercury, cadmium, lead, thorium, cerium, wolfram, bismuth, fluorides, arsenic, uranium, radium, toluene, and cyanides. Improvements have been introduced into the plutonium method and its associated counting technique with the result that backgrounds have been reduced considerably and the significance of low counts has been appreciably increased. This work was undertaken in order to meet proposed new tolerance levels for plutonium. Toward the close of the year, a beginning was made on the exchange of samples with other laboratories in order to provide a check on analytical methods.

In the Field Section there has been considerable emphasis on equipment development. A number of modifications have been made on the Filter Queen to permit its use for industrial hygiene purposes. Two types of continuous recording samplers for alpha emitters have been developed in collaboration with the Electronics Section of Group H-1. These are still in the early stage of development but seem capable of giving very useful data. Sintered platinum discs are being tested for use where samples must be collected at high temperatures. These will have particular value in studies made on the incinerator or other stacks where hot or corrosive gases must be sampled. The silica gel method for sampling of organic solvents has been introduced and is being used routinely in a number of locations. Where stack sampling is carried on every effort has been made to take isokinetic samples and considerable work has been devoted to the modification of instruments to permit such sampling.

D. Talks and Articles

A number of talks were given by members of the Group during the year. A paper on INDUSTRIAL HYGIENE MANAGEMENT OF URANIUM EXPOSURES was presented before a session of the meeting of the Medical and Laboratory Directors of the AEC. A talk on DISASTER PLANNING was given before the combined meetings of the Missouri and Kansas Public Health Associations. Talks on THE DETERMINATION OF NAPHTHALENE VAPOR IN AIR; SAMPLING FOR RADIOACTIVE DUSTS; and DETERMINATION OF THE PARTICLE SIZE OF RADIOACTIVE DUSTS were presented at the meeting of the Rocky Mountain Section, American Industrial Hygiene Association. A talk on METHODS OF SAMPLING FOR TOXIC MATERIALS was presented before the Los Alamos and Santa Fe County Medical Societies. The talks given at the Rocky Mountain Section meeting are in the process of being prepared for publication.

E. Changes in Personnel and Facilities

There has been no increase in professional personnel in the Industrial Hygiene Group during 1950. One clerk-typist has been added to the office and one part-time employee has been added to the Health Pass Ward. An additional field engineer will join the Group at the close of the year. The Laboratory Section's quarters in ML Building have been enlarged but are already crowded with equipment since the variety of new procedures added means that equipment must remain set up even though it is used relatively infrequently. This results in a very high ratio of space to personnel but it cannot be avoided if the

Group is to be prepared to handle problems as they arise. The quarters of the Field Section have not expanded appreciably during the year. The Health Pass Ward has been moved into a different building and now has somewhat more adequate facilities. A number of new items of equipment have been added during the year. These include an Alnor thermo-anemometer and a pitot tube for air flow measurements, a high volume sampler, several Filter Queens, and three new cascade impactors. A polarigraph, two fluorophotometers, an L. R. electroscope, and a new low background counter have been added to the Laboratory.

F. Future Program

An accurate forecast of next year's program such as was provided in last year's report is extremely unlikely as it is difficult to predict at this time because of the present emergency situation. It is quite likely that air pollution and air cleaning work will continue to increase along the lines previously outlined. Some studies on air cleaning will be undertaken in cooperation with the Air Cleaning Laboratory at Harvard University. As long as the building program on South Mesa continues, the Industrial Hygiene Group will maintain active interest in all plans for ventilation and for other measures for the control of hazards there. It is likely that a large number of plans will again be reviewed during the coming year.

Another possible line of development will be that of assistance to the Santa Fe Office of the AEC in dealing with industrial hygiene problems at other sites than Los Alamos. How this is to be handled is

still unsettled. In addition last year the Group undertook to give assistance to the U. S. Public Health Service during its survey of hazards incident to uranium mining and milling on the Colorado Plateau. This study was not yet complete at the end of the year and will probably be reopened when weather conditions permit in the spring.

The Industrial Hygiene Group will cooperate to the fullest extent in the work of the Laboratory on its Weapons Test Program. The magnitude of this work and the extent to which the Group will be involved is still somewhat in doubt at the close of the year but it now seems likely that this will constitute a major item in our 1951 program.

G. Personnel Facilities and Equipment Needs

Should the Group become extensively involved in the weapons test and the civilian defense programs, some expansion of personnel will be necessary. Further expansion of the Los Alamos Scientific Laboratory and extensive work in other plants under Santa Fe Operations Office will also necessitate additional personnel. Both field and laboratory workers will be needed, although an exact estimate of the number cannot be made at present. The space facilities of the Group are now very inadequate and will limit personnel expansion. Both the Field Section and the Laboratory Section are extremely crowded but every effort will be made to utilize existing facilities since plans are progressing rapidly for the construction of a new building to house this Group along with Group H-4. It may be necessary to provide some special temporary facilities to take care of additional needs as they arise.

In particular, the Field Section needs a place to set up a dust chamber. Instrument development which is likely to be accelerated is impossible without a place to test sampling equipment under controlled conditions. The necessity of maintaining extremely low background conditions in ML Building and Q Building eliminates these as possible places to set up a chamber even if space were available. The equipment needs of the Group for the next year are not large if only the regular program of the Laboratory is considered. However, the Weapons Test Program presents an entirely different picture from this standpoint and it is likely that there will be a considerable increase in the number of pieces of equipment required.

This Annual Report is written at a difficult time. The industrial hygiene program is an integral part of the Los Alamos Scientific Laboratory and as such its immediate future is being decided elsewhere. Whatever the decision, the Industrial Hygiene Group will endeavor to give its best efforts to the aim of the elimination of loss of working time due to preventable causes and to the fullest conservation of human resources.

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