



UNIVERSITY OF PITTSBURGH
PITTSBURGH, PENNSYLVANIA 15213

DOC A 84

3-1

September 12, 1972

Sidney Marks, M.D.
Health Sciences Research
and Applications Branch
Division of Biomedical and
Environmental Research
United States Atomic Energy
Commission
Washington, D.C. 20545

Dear Sid:

This is of particular interest relative to the continued availability of records in Federal centers.

As indicated in the attached letter from Mont Mason, a person who really knows the records and begins a search for them and reevaluates what has happened, finds the picture may be different, than was in general reported.

Please consider the attached letter as confidential, it is purely for your background information.

I should like specifically to request that the shelf list section V2161, not be destroyed.

These are probably the best records in the world in regard to workers exposed to uranium and with the longest latent period for analysis.

Personal regards.

Sincerely,

Tom

Thomas F. Mancuso, M.D.
Research Professor
Occupational Health
Graduate School of Public Health

pjd

Enclosure

cc: B. Sanders

06761

FJD

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September 5, 1972

Dr. T.F. Mancuso
Department of Occupational Health
University of Pittsburgh
4200 Fifth Avenue
Pittsburgh, Pa. 15213

Dear Dr. Mancuso:

Transfer of Mallinckrodt Health Records From Record Center to O.R.

Dr. Shoup called me from Oak Ridge on 8/31 to advise there was confusion between Mr. Beets at O.R. and Mr. Gary at the Record Center in St. Louis about what records were to be transferred (identity of boxes). Mr. Beets apparently thinks the volume to be transferred is of the order of 10 cubic feet, it seems he is concerned about space at O.R., not the material content. I emphasized to Dr. Shoup that the volume which should eventually transferred was contained in about 12 x 4 drawer file cabinets at Weldon Spring. Much earlier I had discussed the space availability with Marci who confirmed there is adequate space in the file room for all these records. At this time there is no reason to provide more than one file cabinet for these records, the rest can remain in the transfer boxes until needed at some later date.

Dr. Shoup agreed with us that we should transfer all the Health Department record and the Medical Records for Destrehan employe's (I had earlier advised Mr. O'Hare with Mallinckrodt of our interest and intent and he had no objection to the above, he asked only that he be sent a letter, after the fact, listing what had been transferred for future MCW reference if needed). There was some feeling that maybe the Medical Records for Weldon Springs late terminations should remain in St. Louis to be available to MCW for a while yet—but there was no strong feeling about this. (Incidentally: Mr. L. Hennies, my former medical supervisor who is still with MCW, is the only remaining MCW person having a working knowledge of and access to these files. He is now at home, temporary total disability as a result of several heart attacks. Even if MCW needed data there is no way it could get it at present. On the other hand, if the records were being supervised by knowledgeable people under your direction—such as Viola and Marci—data could be easily obtained on request and the integrity of the record could be assumed. I did not bring this point up with Dr. Shoup or Mr. O'Hare but left it as a future argument if needed).

06761

D - E Pg 3

Dr. T.F. Mancuso
Page 2

To further our interest and as suggested by Dr. Shoup I returned to the record center on 9/1/72. (Friday) to work with Mr. Gary (asst. director) and a Mr. Gantt (Supervisor) to identify the records to be transferred. I found that in the interims since my last visit my name had been removed from the list of authorized MCW people but Mr. Beets had arranged that I could review shelf file lists. Perhaps at a later date we should reestablish my authorization through AEC, depending upon the outcome of the present proposed record transfer.

I identified from the Record Center shelf list those records which could be transferred and about this I make the following points.

1. In our 8/31 telephone discussion Dr. Shoup agreed with me that the Health Department file, and Medical Records for Destrehan should certainly be transferred now because this encompasses all of the important exposure people and data. Medical Records for Weldon only might remain in St. Louis if there was some reason.
- * 2. A Possibly Serious Problem: Possible Lost Medical Records: When I again reviewed the shelf list with item I as a guide I could not find one complete set of medical files which we had originally titled Terminated From Weldon Thru 4/28/66. My personal records show 1186 names in this set. It is possible that these folders were later interfiled with some other group, or that the typist erred in preparing the list. It is not feasible to resolve this by examining at the rec center all the individual files at the record center. I therefore decided to list all medical records for transfer to your Oak Ridge files so that I can work with Viola and Marci to be sure there are no lost records and that each individual folder is identifiable as to locale.
- * 3. A Serious Problem: Possible Destruction of Key Records. Included in the Record Center Shelf List is a separate section for classified documents. I was permitted to examine this list and was shocked to find a sizeable list of titles for reports originating at Destrehan dealing with Dust Studies and other surveys which will be critical to any eventual matching of individuals to job and exposure. I recall each as being classified originally because it contained information about identity and production quantities of materials which were at that time classified. However, I think each of these was subsequently declassified as the process was declassified. The crucial point is this: I was told that each of these documents was beyond scheduled destruction date only because the record center does not have the required number of qualified observers. I believe these may be the only existing copies

A8 09 4

Dr. T.F. Mancuso
Page 3

These documents make up the shelf list section designated V2161. Mr. Gary explained he had no classification authority and did not have access to these documents himself. Unless some action is taken promptly to safeguard these documents they will be destroyed at the first opportunity.

I do not know the correct procedure to safeguard, and eventually declassify and transfer these documents. Although I classified some of them originally my present non-official status probably has no force. As a minimum, I expect that you or Al Becker should request through Dr. Benson, or Dick Evans, or Floyd Beets at O.R., that Mr. Gary at the St. Louis Federal Record Center be instructed not to destroy V2161. The next step will be follow-up with security to learn the procedure for getting the documents declassified or confirming that they are already declassified, so they can be transferred to you.

I failed to record the total volume I listed for transfer but remember it was of the order of 200 cubic feet stored in individual 1 cubic foot shelf boxes in which it will be shipped. My recollection is that all of this was contained in about 12 x 4 drawer cabinets at Weldon. I certainly agree with Marci that there should be no problem with storage space for these boxes at Oak Ridge. Incidentally, while at Oak Ridge I reassured myself that the building was essentially fire proof and well protected. However, at some point it may be wise to ask the AEC Fire Protection people to reapprove this area for the storage of critical records. Some of the existing or proposed records may qualify for fire proof files under AEC regulations.

I continue work on my report to you as time permits and hope to mail it by 9/8/72. I would like to visit O.R. again soon to review data from the computer center but think it best to wait the outcome of the expected transfer of records from St. Louis so I can help in sorting and identification. I will submit an invoice after completing my report.

Sincerely,
Mont G. Mason

UNIVERSITY OF PITTSBURGH

1 DOC A9 P91

~~DOES~~
P91
TO: Dr. Thomas F. Mancuso

FROM: Mr. Mont G. Mason

DATE: 10-03-72

SUBJECT: Interin Report: MCW--Evaluation of Dust Exposure, plant
4 and plant 6

This transmits the first of several reports to follow on separate subjects concerning the old Mallinckrodt operations. This one is in fact an abstract and introduction for a more detailed report, now nearly completed on an early dust study at St. Louis, which may be the most important single reference in the files. However, I can not fully report on this study until the original and supplemental data become available from the Federal Record Center.

Some comments about the old study are particularly important. In 1949 the Mallinckrodt operations were still highly classified. Before 1947 only a few technical and management employees knew officially the identity of the materials being processed. When disclosure was first made to employees, not too long after the bomb was used in Japan, some rank and file employees were in near panic. They knew they had been handling "bomb materials". With possible high exposure and contamination, they were understandably apprehensive. These apprehensions were further reinforced by drastic changes in work practices and industrial hygiene initiated in 1948 by the new health department. These changes were accompanied by massive infusion of AEC money and health engineering improvements by MCW to reduce exposures and control contamination.

Both MCW and AEC were mindful of the sensitive human relations problems and the Health Department Management bent over backwards to gain and hold the confidence of rank and file as well as union representatives.

The 10-01-49 dust evaluation, and subsequent removal of 34 employees from further exposure, was a potentially explosive situation which the company in good conscience could not avoid. Every action and every statement by management was carefully thought through. Carefully drafted explanations and responses were prepared in advance of announcing the transfer of people. Managers, supervisors, medical staff and health department staff were all coached and coordinated.

As a part of the caution, and on advice of attorney, a formal report was never prepared on this study. Thus, there was

no document to subpoena, only lists of names with numbers and work sheets. There was no lengthy description of the basis for calculations to be pulled apart by the scientific community, with the possibility that such controversy would undermine employee confidence in the company safety measure. Our position simply was that MCW had internal standards against which it measured exposure and had control points for preventive action. The employee transfers were in line with preventing possibly harmful exposure and were solely in the best interest of the employee. However, the employee had no option to remain in exposure if he exceeded the control point.

Fortunately, managements reputation for fairness and honesty prevailed. The transfers were accepted with good grace, there was no hysteria, no strikes, no lawsuits, or other damage claims.

However, even at this late date, some present Mallinckrodt employees who were affected by this study are still sensitive. Some still claim they lost promotional opportunity or were adversely affected in some other way. This old subject is raised by the union at every labor contract renegotiation.

Although the AEC probably does not now have people who remember this occasion (AEC did not participate in the study or the employee relations problems), and only a few Mallinckrodt officers remember it (Mr. Thayer, then manager of the Uranium division and now president of MCW still remembers it vividly), the old study and its consequences could still be an explosive issue.

I bring this up so that we can be mindful of our responsibilities in dealing with any unpleasant findings which might emerge, especially if something should relate directly to this old study. However, I know the Mallinckrodt temperament and am sure that Mr. Thayer would not want to avoid or hide the truth even if it should be a financial liability to the company. I would expect the AEC to have a similar attitude.

With the above in mind, I am suggesting that you read these handwritten materials before they are typed as a formal record in your study. Perhaps they could be presented in a more favorable way or not even made a part of your records.

If the AEC is sincere in a desire for facts about the affects of exposure I do not see how it can turn down a proposal to intensively study this population of the old St. Louis operations, which includes the 10-01-49 group. No further "research" into employment history is necessary. It is only a matter of constructing the old histories out of material (presumably) on file at the Federal Record Center.

Any comments about this document or future similar reports to you will be most welcome at this point, when I am beginning to devote nearly continuous time to the Mallinckrodt data.

I seem to be unable to condense the verbage needed to develop the history of MCW operations. Maybe I'm inserting too much or unneeded detail?

pjd

A9 P33

~~DOCF P33~~

Another subject:

Al Becher asked if I could find out from MCW if it had used a separate tax withholding account number for the uranium operations and if so, if we could get permission to use that number for reference with IRS as another avenue to search for past employees. Recently, I had lunch with the ex-comptroller for the uranium division and raised this question along with an explanation of our objectives. He stated that MCW has always used only a single account number for reporting all its employees withholdings, no separate identification of uranium employees. He was sympathetic to our need but could offer no suggestion or hope for use of some government control number such as IRS or social security, or Department of Labor. The vice-president of personnel had earlier given me an identical answer concerning records under his direction. Please pass this on to Al Becher.

Typed 5/02/68

~~DOE P~~

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Pjt - mly pg

**CONFERENCE WITH AL BECHER
Weldon Springs**

Mallinckrodt -

Exposures and Location

<u>Bldg.</u>	<u>Exposure</u>
103	Hexane
105	Nitrous Oxide
201	Hydrofluorene Acid
301	Metal Reduction

Exposures more than realized at the Weldon Springs Plant -

- Thorium in Bldgs. 103, 301 and 105
- Thorium daughters - gamma radiation
- Thorium - metal

also Tributyl phosphate - thousands of gallons

Hexane in thousands of gallons

(watch for liver damage)

ng

UNIVERSITY OF PITTSBURGH
GRADUATE SCHOOL OF PUBLIC HEALTH
PITTSBURGH, PENNSYLVANIA 15261

Pg 1

Original in
Handwritten
DOC A-11

Good Quality Hardcopy
NIOSH/OCAS

DEPARTMENT OF OCCUPATIONAL HEALTH

June 27, 1971

Dr. James H. Shannon
Research Professor
University of Pittsburgh
5127 Alcoa Building
Pittsburgh, Pennsylvania 15261

Dear John

Wednesday through Friday (June 16-18) were spent in Dalton, Georgia. The purpose of the visit was to inspect the records of the plant and to discuss the possibility of an inspection and/or audit. The workers were instructed to do nothing in the way of cross checking of such records. It was pointed out that the records were reliable and trustworthy in their own right and were not incompatible with this assessment.

The inspection of the records indicated that many of them were spotty and in all probability this was true since it appeared that many of the records were incomplete or other were incomplete and certain records for certain individuals could not be found at all, such as P30's.

I recommended a series of last names check sheets, which I got in writing for Mr. Frank to follow, and I also pointed out (during 6/25) that they were not to be used as a check sheet and not to be used as a check sheet for work records. It was made available for the record. You indicated that the records were not to be used as a check sheet and I have suggested that the records be used as a check sheet for the records of the plant and that the records be used as a check sheet for the records of the plant and that the records be used as a check sheet for the records of the plant.

The large number of employees, especially those who had been in the plant for a long time, whose records were almost always incomplete, was a problem. The fact that the personnel records for these may have followed them to the plant is a possibility. However, any information was not restricted to these two groups by any means.

For many job changes seen spotty, in general, the quality of records is not as good as we have in Dalton or Oak Ridge. Mr. Frank may have had under the impression that the records would be improved in the medical records and nothing else. The fact that I sent to him copies of our records in the months before we went to Dalton, information from his records.

Before the availability of a separate personnel file was begun, sometimes as we had been working, some information as the records could get on job assignments often came from the records or a reliable source for this sort of information. By this type of information was usually derived from personnel records for work records and from other records for accident records. When a worker was involved in any incident, the name of the worker was obtained by the records.

~~CONFIDENTIAL~~ All

On some employees the only information available, besides their name, is the date of pre-employment examination and the terminal examination. On a few only the name of the person who conducted the examination is available. This was one of the factors which led to some of the confusion in the records. In general the completeness of the records and other vital records of employees in the amount of people in the amount records was not as complete as it should have been. In some cases, however, where individuals were employed in the plant, the records were not maintained by the company.

The number of separate records from that time any information on the basis of which individuals could be identified in the plant is not known. It is not known whether all records were maintained in the plant or whether they were maintained in other locations. It is not known whether the records were maintained in the plant or whether they were maintained in other locations. It is not known whether the records were maintained in the plant or whether they were maintained in other locations.

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NIOH/OCAS

Dr. Mancose (continued)

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NIOSH/CCAS

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for days or weeks in one or more work areas.

(6) The employees who were separated before 1944, most of whom could have a medical file but no security file. Why this would be the case, I was not told.
(7) Finally Mr. Mason advised me that since originally girls were merely in the office and no physical examination was given to either. In 1944 for the first time they began giving such examination to girls who were working in the laboratory. The above exceptions perhaps explain some of the apparent anomalies, but unfortunately some different groups, as far as I know can not be identified and differentiated from the rest.

From what I was able to see I did not feel that the records in Malinchrodt were in the best of shape. It seemed to me there had been many duplicate or triplicate records, approaches of record keeping which were abandoned after a few years. Almost all copies of records one could follow through consistently. Procedures were followed for a short time, then abandoned, or sometimes replaced by a different procedure. Since the time was more or less rigidly limited, I did not dare to be faced with the situation of not being able to complete before the end of the same sort of a roster based on the best available sources placed at our disposal. I favored restricting our recording work to those to which we could be reasonably certain of finishing something within the time. We have access for possible future use to some of the environmental data that might prove instructive, especially with respect to industrial health. I tried to get some of the original records to move to Oak Ridge where if need arises we may be able to extract more information on industrial exposure of various employees. When I got to St. Louis, Mr. Mason was not there, so I spoke to the AEC representatives at the plant who indicated they would raise no objection to taking these records if I could get Mr. Mason's consent. To be sure to get this consent I tried to be as selective as I could, taking only those things which I could clearly justify our need for. I am not sure that I took all the things that we might be able to use, and nevertheless, chances are that some of the things I took we may not have use for. Mr. Mason examined the things I was taking and gave his consent. These are in addition to the things which he sent me previously. These records were put in steel boxes to be shipped to Oak Ridge in care of Dr. Shoup, attention Miss Frost.

Miss Frost conceived the idea of equipping her Oak Ridge Office with typewriters, desk calendars, office furniture, etc. from the large surplus warehouse. I talked to Dr. Shoup whether this would be possible, he said he would inquire and then advise Miss Frost, the advice was adverse on this.

This week about Malinchrodt study. While in Galton Spring I also called and talked to Mr. Robinson and Mrs. Shoup about the AEC military records. Mr. Robinson said they had been wondering whether they could hear from us. He advised that they were still holding the records in which we were interested separate from the files. On the basis of communication with Mr. Heets in Oak Ridge, they had found additional records-- but as yet they had not traced the naval contingent of about 157 persons they had not given up search on these, however. He said they were ready for us when we wanted work to start there. I also talked to Mrs. Mahan, she seemed delighted that we had not given up the idea. She promised to do all she could to be helpful. She relieved the items that we wanted would be available in the records. I promised to send her a copy of the letter that you got from Mr. Jablon on the costs of using the records. I asked Mr. Jablon to send to her a copy of his letter; he agreed to do so.

So I advised you the National Lead is to have charge of the Galton Spring establishment as the caretaker.

I am enclosing a copy of a recent letter to Mr. Ferry and also some of my original instructions on the work at Galton Spring.

Cordially,

Trickett

All ~~FILE~~
Pg 4

June 27, 1967

Mr. Walter Bone
Site Representative
M. C. W.
Box 472
St. Charles, Missouri 63301

Dear Mr. Bone:

Miss Viola Faust has informed me that our work at Mallinckrodt Chemical Works is now completed and I want to thank you and your staff for the very excellent assistance and cooperation that my people enjoyed during their stay. We appreciate that this cooperation has made it possible to most effectively utilize the available data in the records at your plant.

Sincerely,

Thomas F. Mancuso, M.D.
Research Professor
Occupational Health

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Maximum concentrations shall not be used as the sole criterion for establishing evidence of hazard to health or well being but the evaluation of a possible hazard shall also be subject to other pertinent factors such as the nature of the contaminant and the frequency and duration of the exposure or clinical evidence of harmful effects.

PURPOSE

Thousands of elements, compounds, and mixtures are employed or encountered in places of employment and the number of new ones being utilized is constantly increasing. Some of these have been found to injure health if present in the working atmosphere in excessive concentrations. Others while not producing demonstrable injury have been found to cause irritation, coughing, sneezing, objectionable breath, or other undesirable results.

Through actual experience in industry a great deal has been learned about the effects of some substances. This information has been supplemented by considerable laboratory research. The body of knowledge regarding toxicity of substances is fairly large and is steadily increasing in size. Much more remains to be learned, however, not only about the newer materials but also about some which have been studied for many years. Honest differences of opinion as to the safe concentrations of some of the more common toxic materials exist among authorities in the field of industrial toxicology. Greater differences of opinion are naturally encountered with respect to the limits to recommend for substances on which there is more limited experience.

Despite the gaps in our present state of knowledge, specific figures must of necessity be provided at least as a guide toward the definition of what

constitutes a safe working atmosphere. Specific figures are desirable not only for the use of the authority in determining essential compliance with code provisions but also are helpful to industry as bench-marks upon which it can base a design of control equipment which it plans to install. There are some who feel that specific figures should not be included unless there is a great deal of conclusive evidence to justify the figure established. However, if no figure is given for a substance because of the absence of positive proof, when question arises as to the presence of a suspected hazard the authority must render a decision regardless of whether or not a specific value is contained in the code. Consequently, it is felt advantageous to make the list in the code as inclusive as is possible.

As defined in this code maximum concentration is that amount of atmospheric contaminant which can be tolerated by man for continuous daily exposure with no impairment of health or well being either immediate or after years of exposure. The specific figures listed in section 13, paragraph (d), refer to average concentrations of an eight hour working shift rather than a maximum which is not to be exceeded even momentarily. The amount to which these figures may be exceeded for short periods during the work day depends upon a number of factors such as the nature of the contaminant, whether very high concentrations even for short periods produce acute poisoning, whether the results are cumulative, the frequency with which high values occur and for what periods of time. All must be taken into consideration in arriving at a decision as to whether a hazardous situation is deemed to exist.

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MALLINCKRODT'S URANIUM OPERATIONS FOR
THE U.S. GOVERNMENT: MED and AEC

3-10-11
A(3)

Mallinckrodt was the first U.S. feed material processor for the U.S. Atomic Weapons program of World War II. It started that work in March 1942, then remained a prime contractor for processing feed materials until the end of December 1966 when the last Mallinckrodt feed material plant closed and the last of its employees in those operations was terminated. More than 3300 Mallinckrodt employees were assigned to those operations for varying lengths of time during that 25 year period. Several hundred of the early workers during the period 1942 through 1952 are among the most highly exposed atomic energy employees to internal deposition or to external gamma or beta radiation in the entire history of the U.S. atomic energy program.

None of the former Mallinckrodt feed materials workers have been evaluated for possible delayed somatic or genetic abnormalities which might be related to high radiation exposure. Health effect information which could be gleaned from living and dead former Mallinckrodt workers would resolve the unknowns concerning uranium toxicity and also make a substantial contribution to knowledge about the long term effects of chronic occupational exposure to penetrating external ionizing radiation.

Natural uranium is the major source material in all primary feed materials for the atomic energy program. It consists of a mixture of uranium 238 and uranium 235 in a ratio of about 0.992 parts U238 to 0.0072 parts U235. Each of these naturally occurring isotopes is a long lived alpha emitter which in turn is the parent of its own separate and complex series of decay product radioelements ending in isotopes of lead. The U238 series contains eight alpha daughters with ___ beta daughters; the U235 series contains eight alpha daughters with ___ beta daughters. Among the decay radioelements are several which have been assigned radio toxicity factors similar to plutonium for internal deposition. Radium 226, which is a daughter of U238, is the reference

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material for essentially all current radiation protection standards for internal emitters. Hard gamma photons from beta decay of bismuth and lead isotopes descendants of radium 226 are the bases for defining the roentgen and rad. Gaseous radon, daughter of radium, is identified with radiation induced disease among uranium miners and other workers, and is a primary reference for assigning health risk factors to air-borne radioactive materials. Thus, natural uranium is not only the principle source material for atomic energy, but it is also the precursor for most of the reference radioisotopes and information about radiation induced occupational diseases which form the foundation for contemporary radiation protection practice and regulations. Unhappily, there is a dearth of solid information about whether uranium per se is or is not a radiation health hazard.

None of the thousands of uranium workers, who were grossly exposed to uncontrolled uranium dust at Mallinckrodt or at other contractor sites from 1942 to 1952, have ever been followed clinically for post employment health anomalies. Hundreds of those workers were chronically exposed to dust concentrations which were orders of magnitude greater than would be permitted by contemporary standards. More than 50 identified individual employees at Mallinckrodt alone are known to have worked long enough in appalling concentrations of alpha emitting radioactive dust to accumulate more than a permissible lifetime inhalation exposure. Comparable levels of exposure are known to have existed at other early feed materials contractor sites. Nothing is known today about the long term consequences to the health of those workmen.

In due time those workers will all have died from whatever cause, and if the high exposure to dust produced an identifiable contributing disease then it may be possible to pinpoint those diseases from death certificate data. The percentage of highly exposed workers is large enough in the early feed plant worker population to give a high

~~Doc D 93~~ *Witig* *A 13*

probability of identifying the diseases in that specific population. However, the so number exposed is a miniscule percentage of the total U.S. atomic worker population which gives a very small probability of pinpointing in that large group.

Of course, during the waiting period for death, the disease, if present, may not be diagnosed as having an occupational origin to the possible disadvantage to that person's medical treatment. Further, the absence of that solid clinical knowledge if it does exist, may have an adverse effect upon contemporary protection standards in the increasingly important uranium industry.

More than 30 years have passed since the beginning of the U.S. feed materials processing industry and more than 20 years have passed since the conditions of gross exposure to radioactive dust in that occupation have been brought under control. Those time periods are sufficient for the manifestation of latent disease. Death information now may provide clues if death related disease is present but an absence of clues at this time is not conclusive that such disease is absent. *Latent period may be 35 yrs* Clinical re-examination of at least the known highly exposed and living early workers is the effective procedure for making a positive determination that exposure induced disease does or does not exist in that population.

There are of course many economic and emotional reasons for not undertaking a program of clinical followup on those individuals but those reasons might not stand the test of future criticism if treatable diseases are later identified in death data. There could also be large economic questions whether too much or too little exposure had been incurred for health protection in the uranium industry during the waiting period. There are also intangible considerations regarding the technology impact on radiation protection standards from having substantive information about the health effect in humans who have been chronically exposed to gross concentrations of uranium dust or other radioactivity.

SECRET

A19

Office Memorandum • UNITED STATES GOVERNMENT

TO : W. E. Kelley, Manager
FROM : Merril Eisenbud, Director, Health and Safety Division
SUBJECT: REPORT ON MALLINCKRODT EMPLOYEES
SYMBOL: HSTME:mg

DATE: January 31, 1951

About a year ago, you asked if it would be possible for us to estimate our "potential liability" among the long term Mallinckrodt employees. As I explained at that time, you presented a rather knotty problem, one which, in the state of our present knowledge, would probably not be answered even to a first approximation.

Stimulated by the question you asked, we have since prepared the attached report, "An Estimate of Cumulative Multiple Exposures to Radioactive Materials". This report gives, by extrapolation of the best available laboratory and human data, estimates of the doses to the critical organs of all Mallinckrodt employees during the period July 1942 to October 1949. The report shows that there are 17 employees whose lungs have had more than 1000 rcm of exposure.

I have purposely withheld distribution of this report for some two months in order to give us a little more time to consider the validity of our estimates. I am now satisfied that these estimates are reasonably sound, again only to a first approximation, and we plan to present our approach to the problem at the forthcoming meeting of the Medical Laboratory Directors. Perhaps some of the visitors will be willing to venture an opinion as to the value of this approach and the meaning of our estimates in terms of "potential liability".

My own judgment is that if these estimates are in error, we err on the side of safety, and that although the possibility of tumor development among the Mallinckrodt employees must be recognized, we can rule out the possibility of a widespread incidence of disease in this group.

Attachment:
"An Estimate of Cumulative Multiple Exposures to Radioactive Materials"

Specifically,

Tom, this is the cover letter.

"When separated from this document: Official use only..."

SECRET

15

~~SECRET~~

~~CONFIDENTIAL USE ONLY~~

MALLINCKRODT - 5
This document consists of 19 pages
No. 7 of 3 copies, series 7

AN ESTIMATE OF CUMULATIVE MULTIPLE EXPOSURES

TO

RADIOACTIVE MATERIALS

MALLINCKRODT CHEMICAL WORKS

26356

PLANTS 5 and 6

July 1942 to October 1949

CLASSIFICATION CANCELLED
DATE 3-12-54
FOR THE Atomic Energy Commission
Walter C. [Signature]
Chief, Declassification Branch

[Faint handwritten notes]

by

Hanson Blatz
and

Merril Eisenbud

Issued: November 20, 1950

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New York Operations Office
Health and Safety Division

CAUTION

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ABSTRACT

An attempt has been made to estimate the cumulative radiation dose to the "critical" organs of all employees of Mallinckrodt plants 4 and 6, who have had more than six months of exposure to radioactive materials. These workers have been exposed to several types of radiation from both internal and external sources.

From the outset, the difficulties involved in such a study were known, but the effort was believed to have been worthwhile. The mechanics required for the dose approximations have now been established, and the data can be adjusted from time to time as new information becomes available. The gaps in our knowledge have been emphasized, and it is to be hoped that this will stimulate further laboratory and field investigations that are required in order to provide data that are not now available. For the present, dose estimates to a first approximation are presented that can serve as a basis of correlation with the clinical history of these employees.

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The Mallinckrodt Chemical Works has been engaged in the refining and processing of uranium under contract with NYCO (formerly Manhattan District) since July 1942. Their operations are conducted in two plants constructed relatively early in the program of the Manhattan District at a time when it was not expected that the processing of uranium ores and compounds would involve potential occupational risks of radiation injury. This point of view was in part originated by the low specific activity of uranium, and in part because it was believed that the plants would operate for only a short period of time.

For the first few years of operation, there were neither radiation measurements nor evaluations of the dust exposure made in these plants. No personnel monitoring procedures were in effect.

Early in 1947, the NYCO evaluated the potential hazards in these plants and, after finding them to be considerable, recommended the necessary corrective actions. In addition, steps were taken by the NYCO in cooperation with the contractor to institute procedures for effective environmental and personnel monitoring. It was recognized that pending elimination of excessive exposures, here was an unique opportunity to conduct clinical studies on a fairly large size population whose radiation exposure for several years had been considerably in excess of any group for which data are available.

This report summarizes our estimates of cumulative radiation exposure to the employees in this plant. As we will see, the exposures were several in type, both external and internal. We believe our estimates of exposure are the best that can be made in our present state of knowledge, but our principal exposure was to radium and uranium dust and the calculated tissue doses must be accepted as only tentative, to be revised as more abundant information about the fate of these dusts in man becomes available. The clinical history of these employees is currently being evaluated and will shortly be correlated with the data of this report.

Types of Exposure:

The process in these plants begins with the receipt of uranium ore and ends in the shipment of metallic uranium and the brown oxide of uranium (UO_2). In this process, the following sources of exposure exist:

1. Gamma radiation, primarily from the radium daughters.
2. Beta radiation from UX_1 and UX_2 , the short-lived daughters of uranium. Highly active beta emitting residues occur at steps in the process which concentrate these daughters.
3. Radon from the ore and process sludges which contain radium.
4. Alpha emitting dusts from the processing of uranium and radium bearing materials.

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Availability of Personnel and Area Monitoring Records:

Although some of the employees have been exposed since 1942, no film badges were worn until 1946. No breath radon determinations were made until 1947, and dust measurements were not made until 1948. We are thus handicapped at the start by a lack of data for most of the period of exposure.

It is proper to assume that exposures prior to the dates when information became available were at least as severe as they were found to be at the time of our initial studies. The exposures may have been moderately more severe, but there is no reason to believe that conditions had been more favorable in the past. Our estimates of cumulative exposure are thus based on the premise that the exposures found to exist at the time of our initial surveys could be extrapolated back through the period for which no data were available. Exposures in the past may have been more severe and our estimates may, therefore, be conservative.

The estimates of cumulative exposure are based on air analyses for alpha emitting dusts (radium and uranium), film badges for external beta and gamma radiation, and breath radon analyses for estimates of fixed radium burden.

The breath radon is collected by obtaining one liter samples of exhaled breath after two days of non-exposure (usually on a Monday morning) and measured by an automatically recording pulse counting device described elsewhere. (1) Since many of the early breath radon samples undoubtedly represent transient as well as fixed burden, estimates of alpha radiation to the bone based on breath radon measurements would in most cases be higher than actual. It has been found that background level at the point of sampling, which in general has been ignored, is a significant influencing factor in the total radon measured. Here again, any such error would result in observations being higher than actual exposures.

The use of film badges was routine except that more particular attention was paid to the quantitative evaluation of beta exposure than is customary because of the relative importance of this type of exposure.

The alpha emitting dusts are collected on a 1-1/8" diameter Whatman No. 41 filter disc by means of a hand held air sampler with a collection rate of from 15 to 20 l.f.m. Our method of estimating exposure to alpha emitting dust, however, is unusual and will be described in brief.

The operations from which the dust exposures originate are, as in the case of many industrial operations, highly repetitive. Prior to the collection of atmospheric samples, each job in the plant is studied

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and the individual operational components of the job listed together with the length of time spent on each particular job component. Air samples are then collected for each component of the job and a weighted daily average exposure was calculated. A sample worksheet showing a typical calculation is given in Table I. It should be noted that the bulk of the air samples are taken in the breathing zone.

Weighted daily averages prepared in this manner are reproducible within a factor of 2. This is not a precise measurement, but it is a quite satisfactory estimate which is in all probability within the range of variability due to other factors, such as differences in breathing rates, upper respiratory retention, lung clearance and metabolic fate.

Method of Estimating Cumulative Doses:

The organs we have considered in attempting to estimate the cumulative radiation dose from these exposures are the skin, bone and lung. The significant contributions to the dose received by these organs are shown in Table II.

We have not considered the bronchial tree per se because we have no means by which we can estimate the dose which the alpha emitting dusts contribute to this structure.

Estimate of Skin Doses:

The dose delivered to the skin by external radiation was estimated from the film badge measurements. Standard practice dictates the use of gamma radiation measured in air as the criterion of skin exposure with a factor of safety estimated to account for backscatter. In the case of external beta radiation to the skin, the known beta emission from metallic uranium is used as a standard of comparison. This measurement includes backscatter by the definition of the rep. These two types of radiation are added to give total skin exposure from external sources. The alpha radiations with which we are concerned are not considered a hazard because of their inability to penetrate the stratum corneum due to their relatively low energies.

Estimate of Lung Doses:

We are conscious of the fact that in calculating the dose from the internal emitters we are on very tenuous ground. As shown in Appendix A, we have calculated that tissue containing 14 parts per million of natural uranium, evenly distributed, is being irradiated at a rate of 300 millirems per week.

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