

REPORT COMPILED SHEET

Identifying Information

Type Report

(circle)
391 392

1. Licensee Mallinckrodt Chemical Works
2. Address Mallinckrodt/Nuclear Division
St. Louis, Missouri
3. License No(s) 24-4206-1
4. Date of Inspection March 11 - 15, 1968
5. Inspector Edgar C. Ashley
6. Status of Compliance Noncompliance

Items of Noncompliance

7. Section of Regulation
or
License Condition

Details Paragraph

- A. 10 CFR 20.105 (b) (1)
- B. _____
- C. _____
- D. _____
- E. _____
- F. _____
- G. _____

- A. 49
- B. _____
- C. _____
- D. _____
- E. _____
- F. _____
- G. _____

Classified Information

8. This report contains classified or business confidential information.
Yes No

Edgar C. Ashley
Inspector

3-28-68
Date

J. M. Allan
Reviewer

4-2-68
Date

HEALTH PHYSICS ANALYSIS

The health physics picture at Mallinckrodt/Nuclear Division, Mallinckrodt Chemical Works has changed drastically since the last previous reinspection. During reinspections of this licensee conducted in April 1967 and again in September and October 1967, many items of noncompliance were noted which related to the laxity in the administrative control exercised over the Radiation Safety Program. The most serious of these items of noncompliance was the repetitive nature of thyroid burdens among various licensee personnel. In January 1968, Mr. Mont Mason, former Head of Health and Safety Division of the Mallinckrodt Chemical Works, Uranium Division, prime contractor facility at Weldon Springs, Missouri (now defunct) transferred from the Mallinckrodt Chemical Works main plant, downtown St. Louis, to a permanent position of Director of Safety and Maintenance at the Mallinckrodt/Nuclear Division. Mr. Mason advised one of the first things he recognized was the need to make clear the duties and responsibilities of all individual workers, supervisors, department managers, etc. at this facility. A new policy recently instituted by Mr. Mason is that if a particular job can not be done within the realm of radiation safety then that job should not be done at all. This responsibility has been put squarely on the shoulders of supervision in the working areas. Independent measurements by Health Physics personnel such as radiation levels on a daily basis, contamination smears on a daily basis, continuously operating air sampling equipment, daily thyroid counting procedures and the availability to supervision of Health Physics technical assistance are some of the ways in which the licensee hopes to keep improving the Radiation Protection Program. Mr. Mason is gathering personnel exposure data and is rearranging the data in a summary form which can locate trends and any special trouble spots in the radiation work areas. It was obvious during this inspection that Dr. Hallett as Director of Operations has been giving Mr. Mason the wholehearted support of the organization in Mr. Mason's decisions and various actions regarding the upgrading and general improvement of the Health Physics Program. In regards to those aspects of the licensee's program which were reviewed during this inspection, it appeared that the licensee is conducting its program with due regard to radiation safety.

DETAILS

GENERAL INFORMATION

9. This was an announced reinspection of this byproduct material program conducted during the week of March 11, 1968. Dr. Floyd Hallett, Director of Operations, was notified of this forthcoming inspection by telephone on February 26.
10. The State of Missouri Department of Health was not notified prior to this inspection. However, Dr. Fulgrave of that office was telephoned on March 19, 1968, and given the results of this inspection.
11. The following persons were interviewed and supplied the information contained in these notes:

Dr. W. R. Konneker, General Manager and Vice President
Dr. F. P. Hallett, Director of Operations
Mr. Mont Mason, Director of Safety and Maintenance
Mr. Donald Soldan, Manager, Health Physics
Mr. Ralph Nuelle, Instrument Calibration
Mr. George Gerth, Manager, Order and Inventory Control
Mr. William Lawson, Supervisor, Chemical Production
Mr. Harry Sliepen, Supervisor, Shipping Department

INSPECTION HISTORY

12. The last previous reinspection of this licensed program (Reinspection No. 12) was conducted on September 13 and 14 and October 17, 1967. As a result of that inspection, the licensee received correspondence from the Commission (letter dated November 30, 1967) setting forth nine items of noncompliance. In a letter dated December 20, 1967, the licensee replied to the Commission regarding the nine items of noncompliance and corrective steps concerning each of the nine items. In a letter dated January 10, 1968, the Commission acknowledged the licensee's replies and, in addition, acknowledged receipt of letters from Mr. Donald W. Soldan, dated November 21 and December 18, 1967 (three) reporting the exposure of personnel to radioactive material.
13. Reinspection No. 13 was conducted during the week of March 11 - 15, 1968, and is the subject of ~~this report~~ ^{THIS REPORT}.

14. Reinspection No. 13 was limited primarily to a review of the following items:

- a. Previous items of noncompliance and corrective action.
- b. Organization and administrative control.
- c. Personnel monitoring.
- d. Radiation and contamination surveys.
- e. New facilities.
- f. Miscellaneous.
- g. Independent measurements.

PREVIOUS ITEMS OF NONCOMPLIANCE AND CORRECTIVE ACTION

15. Each of the nine items of noncompliance set forth in the Commission's letter dated November 30, 1967, and the licensee's subsequent reply in a letter dated December 20, 1967, are presented in order and denoted by (1), (2), (3), etc.
16. (1) During May, June, and July 1967, several of your employees were exposed to average weekly airborne concentrations of iodine 131 in excess of the limits.
17. The licensee's answer to this first citation was in nine separate parts. Each of these parts were specifically reviewed during this inspection. These corrective actions are discussed in the order as given in the licensee's reply of December 20.
 - a. The licensee realizes that the use of the iodine 131 diagnostic capsule filling machine is one of the major contributors to the relatively high thyroid burdens of the various employees. Mr. Mason advised that only supervisors ^{now} are allowed to make setups and adjustments to the iodine capsule machine. This person performing these operations is required to wear a gown, gloves, head covering, and full-face respirator. Following this work, this particular supervisor must survey himself prior to leaving the machine area and report immediately to the Health Physics Department to be resurveyed and thyroid counted. In addition, the machine operator (currently Mr. Terry Hill) is required to report for health physics independent survey and thyroid count every two hours while he is operating this machine. A review of the

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- licensee's thyroid counting records shows that the supervisor do rt for thyroid counting and external survey following each work session on a machine and that the machine operator does report every two hours during operation times for similar counting.
- b. The licensee's reply stated that steps were taken to design and purchase an improved machine for iodine 131 diagnostic capsule production specifically oriented toward radiation safety and contamination control. During this inspection, the licensee representative advised that several designs have been investigated and that no one design has been finalized, as yet.
- c. The licensee's reply states that the monitoring of thyroid burdens and personnel contamination was greatly intensified and placed on a mandatory routine schedule. All personnel working with or near iodine 131 processes (currently numbering approximately 16 persons) are required to report each morning before entering the laboratory for thyroid counting. Also, these thyroid counts are recorded on a form entitled, "Thyroid Burden Measurements," which is actually a daily worksheet. A copy of this "Thyroid Burden Measurements" form is attached to these notes as Exhibit A. The distribution of this form, as noted on the bottom of the form, has recently been revised in order to cut down the volume of paper being distributed throughout the licensee's facility. At the present time, the white copy is still maintained in a health physics file. The canary colored and goldenrod colored copies are no longer distributed on a daily basis but weekly summaries are made and distributed to these persons. If any person exceeds 50% of 0.14 microcuries of any single count, then a pink copy of this form is given to the respective department head advising that this person is no longer to work with iodine 131 until the thyroid count is reduced to less than 50%. The weekly summary, noted above, includes the summary of the high, low, and average count for a particular week of the ten highest persons. An example of this data is attached as Exhibit B. The numbers represented on Exhibit B are fractional parts of 0.14 microcuries.

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- d. The licensee's reply stated that additional air sampling stations have been installed in the iodine 131 production areas and have been included in their routine checking schedule. At the time of this inspection, it was noted that the licensee had a total of 39 inplant sampling points as compared with the 18 sampling points which were noted during the inspection of April 24, 1967. A sketch of the floor plan of the licensee's facility showing the location of the 39 sampling points is attached to these notes as Exhibit C. For more information regarding the designated uses of the various rooms and areas within this facility, please refer to Exhibits A, B, and F of the 417 report which resulted from the inspection conducted April 24 through 28, 1967.
- e. The new disposable gloves mentioned in the licensee's answer are required for any bench top work where suspect contamination is handled. Although not required, some people are wearing these gloves while working in glove box gloves.
- f. The changes and improvements in laboratory supervision and techniques to increase the control of external contamination which is referred to in this Subitem 6 refers to the personal contact which Mr. Mason and his group makes with the various ^{line supervision} ~~subordinate personnel~~. Mr. Mason stated that he ^{"leans"} ~~relies~~ more on department supervisors and foremen, etc. to see that their people are following good radiation safety practices. Shower facilities have been installed and are used, if in the judgment of health physics, the shower is required to remove external contamination from a person. This may or may not in conjunction with a thyroid count.
- g. Mr. Mason, formerly in charge of health physics at the Mallinckrodt Weldon Springs Atomic Energy facility, joined Mallinckrodt/Nuclear on a permanent basis in January 1968. During this inspection, Mr. Mason advised that one of the first things he recognized while making his evaluation of the health physics program, in general, was that although the facilities, equipment, staff, and techniques were technically adequate, the proper use of people was poor. Some of

17. (continued)

Mr. Soldan's duties which involved only health physics ~~support~~^{supervision} work are now being given to others (such as janitor and laundry service involving contamination is being assigned to John Adams). Mr. Adams has just recently joined Mallinckrodt/Nuclear St. Louis facilities and will be reporting directly to Mr. Mason. In addition, Mr. Mason stated that there was a need to make clear the duties and responsibilities of individuals, supervisors, and department managers. Also, it was learned at this time that Mallinckrodt/Nuclear is giving up the idea of supplying their own film badges. Please see the personnel monitoring section of these notes for further information regarding this aspect of the program.

- h. In the licensee's December 20, 1967 reply they stated that a formal instruction program will begin in January 1968. During this inspection, Mr. Mason and Mr. Nuelle advised that these instructions have not actually taken place because of delays due to the reorganization primarily involving Mr. Mason. Mr. Mason advised, however, that they have had two new employee indoctrination sessions in 1968 involving about ten persons. Two line supervisors sat in on these sessions to help answer job related questions. The formal instruction program, according to Mr. Mason and Mr. Nuelle, is expected to start before the end of March and be completed sometime during May of this year. The length of the program will be determined by the progress of getting persons to understand the subject matter. The main theme of these classroom sessions will be to make persons aware of radiation work, the type of material they are handling (not just chemicals), and proper attitudes during this work. Mr. Mason advised that the formal instruction classes will begin with an opening address by Dr. Hallett regarding company policies, etc. Other details to be covered in these classes will be any and all regulations concerning the licensee including FDA, NIH, AEC; management responsibilities in the area of regulations; fundamental radiation terminology, and concepts of health physics terminology. Mr. Mason advised that this class is not intended to go into great detail - just the idea of

17. (continued)

keeping exposures, contamination, etc. as low as possible. The last part of this formal session will be the services provided by the health physics group with emphasis on cooperation and the fact that noncooperation will not be tolerated. Following this formal instruction period, the supervisors with the assistance from Messrs. Mason, Soldan, or Nuelle will conduct on-the-job sessions to their people.

i This ninth subitem states that the health physics budget has been significantly increased to provide additional professional staff members and equipment. Mr. Mason stated that he was looking for ^{professional} a health physics staff member to assist Mr. Soldan. An example of providing additional equipment for health physics use has been the acquisition of a Peckard Tri-Carb liquid scintillation unit in preparation for using this for the forthcoming building addition in which carbon 14 and tritium will be used.

18. (2) The exposures referred to in Item 1 above (see paragraph 16) were not reported to the Commission. Also, these exposed individuals were not informed in writing of the nature and extent of their exposure.
19. The licensee had devised a method of internal reporting to assure the time of the reports of personnel exposures to the Commission on a timely basis. Please see paragraph 17 - (c) above and Exhibits A and B. Also, it was determined during this inspection that persons referred to in Item (1) were so informed in writing at the same time that the report was submitted to the Commission. Carbon copies of these reports given to the individuals are on file in the Health Physics Office also.
20. (3) From August 18 to September 14, 1967, no surveys were made with respect to airborne concentration in restricted areas in the plant.
21. As determined during the inspection September 1967, a malfunction of the program ^{Timer} ~~program~~ resulted in the failure to collect air sample data. Subsequent to the last previous reinspection, the timer was replaced and a second backup unit was obtained just in case of failure of the timer in use. During this inspection, Mr. Mason stated that one of his prime concerns is to make sure that all surveys are done on schedule without fail.

22. (4) Surveys made of laboratory uniforms potentially contaminated with radioactive material were inadequate to detect the presence of radioactive material prior to their release to a commercial laundry.
23. An Eberline Instrument Company laundry ^{monitor} ~~was~~ is now being utilized. At the same time sources of radiation background have been removed from the Laundry Room to allow a more adequate sensitive assessment of radioactive materials present on laboratory uniforms. Each article of the employee's uniform is permanently inscribed with the individual's name to allow a better determination of the source of contamination. A new uniform survey report form has been initiated. The notes at the bottom of this form ~~state~~ ^{which} state "Found to be within limits for release to commercial laundry", ~~accord-~~ing to licensee representatives, ^{mean} ~~A~~ nothing above instrument background which is now in the vicinity of 100 counts per minute. If an article of clothing is found to be reading above background, it is laundered and resurveyed as noted on the form. A copy of this uniform survey report form is attached to these notes as Exhibit D.
24. (5) Surveys were not conducted of all articles contained in waste baskets to establish whether they were contaminated with measurable amounts of radioactive material prior to their disposal through normal refuse channels.
25. Mr. John Henry and Mr. Van French, Health Physics Janitors, have been assigned to survey and empty all wastebaskets in laboratory restricted areas on a daily basis. Mr. Wally Bushman has been assigned to survey the large dumpster bins located outside the building on a daily basis. The laboratory restricted area wastebaskets are surveyed and emptied during the working day while the dumpsters are surveyed at the end of the working day. The licensee has initiated a ^{radioactive} non-radioactive ^{survey} form for the purpose of recording the results of these surveys. A review of these survey records showed that the wastebaskets surveyed and emptied from the production area normally show the number two circled which indicates that contamination was found and removed prior to emptying. At the same time only occasionally was it noted that other areas showed contamination in the wastebaskets or in the dumpster. Also, comments and

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corrective measures are written each time any contamination is found as provided for on the form. A copy of this "non-radioactive waste survey" form is attached to these notes as Exhibit E.

26. (6) Surveys were inadequate to determine the quantities of radiation existing outside the "blockhouse".

27. The "blockhouse" area which is located just outside the main building and within a fenced-in area has been placed on a routine radiation survey schedule. Any abnormal or unusual radiation levels detected during these surveys are corrected at the time. Additional concrete block shielding has been provided to allow better shielding in the area.

28. (7) The high radiation area existing outside the "blockhouse" described in Item 6 above was not posted as required.

29. A sign showing the conventional radiation symbol in the colors of magenta on yellow and the words, "High Radiation Area," was posted on the "blockhouse" during the last previous reinspection. Since that time that particular sign has been removed and the only signs noted at the "blockhouse" at this time were signs showing the conventional radiation symbol in the colors of magenta and yellow and the words, "Caution - Radioactive Material", and "Caution - Radiation Area". Using the licensee's Ludlum portable beta gamma instrument, a radiation level of between 5 and 10 mr/hr was noted at the "blockhouse" during this inspection.

30. (8) The airborne radioactivity area existing in the production was not posted as required by 10 CFR 20.203(d)(2).

31. As noted in the licensee's reply signs showing the conventional radiation symbol in the colors magenta on yellow with the words, "Caution - Airborne Radioactivity Area", were posted at all entrances to these areas. These particular signs were noted to be in place during this inspection.

32. (9) On or about March 23, 1967, a 100 millicuries strontium 90 source was transferred to the Good Samaritan Hospital, Vincennes, Indiana, when the hospital was not licensed to receive such material.

33. The licensee representatives advised that this was a slipup on their part regarding this nonroutine shipment. For detailed information concerning the licensee's action regarding this one item, please refer to Exhibits C, E, and F of the 417 report which covers the results of the September 1967 inspection.
34. In the Commission's November 30, 1967 letter to the licensee, the licensee was requested to supply information regarding the steps which the licensee has taken or plans to take to strengthen the management of the company's Radiation Safety Program. The licensee replied to this request in a letter to the Commission dated December 20, 1967. On Pages 7 and 8 of this reply, the licensee outlines the sharply increased management concern for the provision of a program to insure maximum protection for their workers. This particular aspect of the licensee's program will be discussed in more detail under the organization and administrative control section of these notes.

ORGANIZATION AND ADMINISTRATIVE CONTROL

35. A new (as of March 1968) organizational chart of the Mallinckrodt/Nuclear Division was given to the AEC representative during this inspection. A copy of this new organizational chart is attached to these notes as Exhibit F. The licensee representatives stated that Dr. Konneker is slowly phasing out of the Mallinckrodt/Nuclear management picture and is getting less and less involved in the operations of this division. As noted on the new organizational chart, Dr. Hallett is the Director of Operations for this division including the Raleigh Pharmaceutical Plant in Raleigh, ^{North}~~North~~ Carolina, and the Orlando Radiochemical Plant in Orlando, Florida.
36. According to Mr. Mason, the licensee's Isotope Committee is being reorganized and should be finalized by about April 1, 1968.
37. Mr. Mason was asked to supply more detail regarding his position as Director of the Safety and Maintenance Division of the function of the various groups within the division. As Manager of the Health Physics Group, Mr. Don Soldan will be responsible for film badges, air sampling, bioassays, contamination wipes, general radiation monitoring, Health

37. (continued)

Physics Laboratory operation, license paper work, records, and reports. Assisting Mr. Soldan in this function is Mr. Wally Bushman, Technologist, and Mrs. Diana Constantine, Technician. Mr. John Adams is the new Manager of Maintenance. Mr. Adams joined the St. Louis facilities of Mallinckrodt/Nuclear on February 27, 1968. Mr. Adams was recently with the licensee's Raleigh Pharmaceutical Plant in Raleigh, North Carolina, and was formerly under Mr. Mason at the Weldon Springs uranium facility. Mr. Adams will be responsible for general building maintenance, house-keeping, and industrial safety. Mr. John Henry and Mr. Van French who currently and in the past have been reporting to Mr. Soldan will be reporting to Mr. Adams when Mr. Adams gets settled in his new position. As a result of this change, Messrs. Henry and French who handle the non-radioactive waste and related surveys along with the Laundry Room function will no longer be under the Health Physics Group as such. At this time Mr. Mason stated that a new contract has been signed with the Clean-Tech Janitorial Service to perform janitorial service in all unrestricted areas - offices, etc. - during the "off" hours. Mr. Ralph Nuelle, as Manager of the Instrument Calibration Group, performs a calibration service regarding instruments and equipment throughout the plant. As Manager of the Instrument Maintenance Group, Mr. Roy AuBuchon performs repair and maintenance of all "technical" instruments at the facility.

38. Mr. Mason stated that he has recently instituted a new policy which Mr. Mason illustrated with a question and an answer. (Q) Can the job be done within the realm of radiation safety? Answer: If not make it so, then get the job done! (It was noted during this inspection that Mr. Mason is being given a free hand and is getting the fullest cooperation from Dr. Hallett.)

39. Another innovation of Mr. Mason is the gathering of individual personnel monitoring data such as thyroid counting and film badge results in order that daily and weekly trends can be watched regarding the exposure of personnel. Some of this data was referred to ⁱⁿ paragraph 17 - (c) and Exhibit B regarding thyroid burdens. Film badge data regarding individual persons as well as the overall picture was also given to the inspector during this inspection and is attached as Exhibit G to the ~~case~~ notes.

40. There has been a definite move to relieve Mr. Soldan of duties not directly related to health physics as such. In the past, anything even remotely related to health physics, at the branches as well as at the St. Louis facility, was channeled through Mr. Soldan which included any supplies which they needed. Now this is being handled by others. Also, with Mr. Mason's presence, Mr. Soldan is not called on to handle as many ^{local} administrative jobs as before.
41. One method by which the licensee has strengthened his overall administrative control of this licensed program has been the initiation of weekly staff meetings conducted by Dr. Hallett at 9 a.m. every Thursday morning without fail. Those persons who are required to be in attendance at this meeting are the four directors of the subdivisions, namely, Mr. Holgate - (Manufacturing), Mr. Coslet - (Quality Control), Mr. Mason - (Safety and Maintenance), and Mr. Murray - (Administrative Service). Others may be required to sit in on the meeting if special subjects are being discussed. During these weekly meetings, Mr. Mason stated that he reports the status of the Health Physics Program. Any problems, including improving techniques, are ironed out at these meetings. In addition to discussing and ironing out any radiation problems which may exist, general company business is also discussed at these meetings. The AEC representative was invited to sit in on the staff meeting on Thursday morning, March 14, 1968. Briefly, some of the items discussed by Mr. Mason and the group involved the Film Badge Program; the fact no excessive external exposures or thyroid burdens have been experienced since the last meeting; the method of hand carrying thyroid count data to Hallett on a daily basis will be revised to cut down the amount of paper work being handled; the fact that both Moorehead, Kentucky, and Sheffield, Illinois waste disposal facilities are being utilized for the solid active waste; that new waste disposal tanks for the new carbon 14 and tritium addition are being checked out at the present time. ^{Repairing of last thyrometer (see p 57)} The new Department of Transportation ^(new) Regulations ^{were} discussed during this meeting and involved questions regarding the carrying of liquids and yellow-labeled items on passenger-carrying aircraft. Dr. Hallett stated that the Glendale, California office reports water in a shipping cask which may be a potential

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safety problem. The consensus of opinion was that the water was probably residue from the steam autoclave and that the matter would be checked into. Still on radiation ~~equipment~~ matters, Mr. Holgate, the Director of Manufacturing (production) stated that a new, automated iodine 131 capsule filling machine has been ordered and it is hoped that this new machine, which will be in the Iodine Room, will be able to be placed in a 3' x 3' x 4 to 5' high plexiglass housing which will be vented and shielded. At this same time Mr. Holgate displayed the blueprints of a shielded transfer wheel which will accommodate transferring the technitium "kows" from the hot cell. According to this particular design, one "kow" at a time would be transferred from the hot cell which would allow a person to be exposed to only one "kow" at a time during this operation. The AEC representative did not stay for the remaining of the meeting which involved only general company business not related to radiation protection work.

PERSONNEL MONITORING

42. All persons working with or near radioactive materials wear a film badge to determine whole body exposure on a weekly exchange basis. At the present time the licensee is supplying their own film badge service. However, at this time, the R. S. Landauer Film Badge Service is being tested and film badges from R. S. Landauer are being worn concurrently with the Mallinckrodt/Nuclear film badge. The licensee expects to switch to the R. S. Landauer Film Badge Service completely prior to July 1, 1968.
43. A review of the licensee's film badge records since the last time this aspect of the program was inspected in April 1967 showed that no person had exceeded 3 rem per quarter during the second, third, and fourth calendar quarter of 1967, and for the first nine weeks of the first quarter of 1968, the highest whole body exposure, so far, has been 1607 millirem with most readings being less than 500 millirem. A spot check of the personnel files in the Health Physics Department show that all persons have properly completed Forms AEC-4 and AEC-5. It is to be noted here that all "skin" exposures are included in the regular whole body data - that is, the whole body data is beta plus gamma, according to the licensee representatives.

44. A review of the wrist badge exposures during the second, third, and fourth calendar quarters of 1967 show that no one person had exceeded the 18.75 rem per quarter limit. During the first eight weeks of 1968, Mr. Eugene Winter has accumulated 13,235 millirem wrist exposure as determined by film badges. The licensee representatives advised that Mr. Winter was using a new instant technitium dispenser. As can be noted by these wrist exposures to Mr. Winter, this particular dispensing method has been done away with and Mr. Winter has been removed from all work involving possible extremity exposures in order not to put him over the 18.75 rem limit. According to the licensee's records, the next highest wrist exposure for the first eight weeks of 1968 is 4595 millirem received by Mr. Condie.

45. Between 25 and 30 persons submit urine samples. One sample is submitted per month and is analyzed according to procedures as outlined in the Mallinckrodt/Nuclear Branch Procedures Manual. The 1967 urinalysis data shows single samples to be mostly all less than the assigned "mpc". Those data which did exceed this "mpc" were correlated with reported thyroid burden data.

46. The licensee's thyroid burden measurement program has been ^{practically} ~~practically~~ stepped up recently. The current thyroid burden measurement schedule is as follows: All persons working in iodine 131 areas of the Production Laboratory are required to be thyroid counted daily before beginning their work between 8 a.m. and 9 a.m. All other Production Laboratory personnel are required to be thyroid counted twice per week - either Monday ~~and~~ Thursday, or Tuesday ~~and~~ Friday. All dispensing personnel are required to be thyroid counted at 8:45 a.m. twice per week - either Monday ~~and~~ Thursday or Tuesday ~~and~~ Friday. All Quality Control personnel are required to be thyroid counted at 8:45 a.m. on Wednesday, once a week. All R&D personnel are required to be thyroid counted at 8:45 a.m. on Thursday, once a week. All Shipping Department personnel are required to be thyroid counted at 8:45 a.m. on Tuesday, once a week. On Tuesday, at 11 a.m., the truck driver who delivers outgoing packages to the airport and to local customers is thyroid counted once a week.

47. A new thyroid burden measurement data card was initiated in December 1967 and is kept for all persons on a thyroid counting schedule. This record card is maintained alphabetically in a Kardex file system in the Health Physics Office and, also, in the individual's personal monitoring file folder also in the Health Physics Office. Each daily thyroid count is entered on this card and any day when a person is counted more than once the average of these two is entered as the daily count on the card. A similar card used for the recording of dosimeter readings at the end of a work day by each individual, was initiated in January 1968. These cards are kept in a Kardex file in the dosimeter and film badge rack *location* leading from the work areas. The information on this card is used as an internal guide to daily exposures. Examples of both iodine 131 thyroid burden data card and dosimeter reading card is attached to these notes as Exhibit H.

RADIATION AND CONTAMINATION SURVEYS

48. Daily smears are taken throughout the entire facility. This includes both restricted and unrestricted areas. The restricted area action point is 2,000 d/m/100 cm² while the unrestricted area action point is 200 d/m/100 cm². If an action point of any smear has been exceeded, it is required that that area be cleaned up and resurveyed on the same day.
49. Similarly, radiation level surveys are performed on a daily basis both inside and outside of the facility in both restricted and unrestricted areas. These surveys are performed to determine the general radiation picture in each of the working areas. Included in this radiation level survey routine is a survey of the outer area of the fenced-in area which surrounds the waste storage and "blockhouse" facility. The licensee's records show that on July 17, 1967 up to 7 mr/hr existed just outside the fence area; on August 16, 1967 up to 3 mr/hr existed in the same area; and again on March 6, 1968 up to 3 mr/hr existed in the unrestricted area outside the fence. The licensee representative stated that these were temporary conditions which existed while waste was being packaged in preparation for shipping for burial site. The maximum time that any of these radiation levels would exist were perhaps three hours. The licensee representatives were advised that the existence of greater than

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2 mr/hr in the unrestricted area outside his fenced-in boundary line and existing for more than one hour constituted noncompliance with 10 CFR 20.105(b)(1) in that if an individual was continuously present in the area he could receive a whole body exposure in excess of 2 millirem in any one hour. Mr. Mason and Mr. Soldan stated that concrete block enclosures would be constructed to reduce the possibility of such radiation levels during times when these temporary conditions exist.

50. The licensee's inplant air sampling results were reviewed between September 1967 and March 13, 1968. These records indicated that no air sample showed greater than (mpca) for 40 hours with occupancy factors figured in - that is some may be four to five times mpc but occupancy investigated to be such that occupancy mpc⁴ not exceeded except for some of those high thyroid previously reported. At the same time, some high thyroids could not be related to any high air concentrations in the past. (This is indicative of bad working habits causing personnel contaminations.) Although not specifically reviewed at this time, Mr. Mason stated that the ^{in-stack} ~~in-stack~~ samples have shown a maximum of 5 times the restricted mpc for iodine 131 and that no roof edge sample has shown as high as mpc.

NEW FACILITIES

51. A new addition to the present facility is being built directly to the south and will connect to the present facility. This new addition will approximately double the licensee's useable space. At the time of this inspection, the new addition ^{was} in the basic construction stages and not expected to be physically built until July 1968 with occupancy hoped for September or October 1968.
52. The basic purpose of the new addition is the handling of tritium and carbon 14 which is now being conducted at the licensee's Orlando, Florida facility. Mr. Art Davis of the Mallinckrodt Chemical Works, Engineering Department, displayed the various blueprints of the new structure and described some of the details of the addition. The tritium handling will be done within complete containment. This will be done in a multi-glove box constructed of safety glass and stainless steel utilizing the bag-in and bag-out system. All waste removed from the box will be in a bag and put in a

52. (continued)

steel drum secondary. The multi-use box will be at $1\frac{1}{2}$ " negative pressure and will contain no waste drains for liquids. The carbon 14 handling will be done in walk-in type hoods with 100 linear feet per minute face velocity being the current plan design. A 2,000 gallon liquid waste tank is being installed ~~for~~ ^{for} this addition which will be metered, sampled, and dumped as needed similarly to the waste tanks utilized for the present facility. In addition to this 2,000 gallon liquid waste tank, a 4,000 gallon emergency floor drain tank is installed to handle sprinkle system overflow in the event it is needed. This 4,000 gallon tank will normally be empty.

53. The Quality Control Department including the animal facilities have been provided for in the new addition. The Production Department will move into the ~~present~~ ^{present} Quality Control facilities at the ~~present~~ ^{time of the move}. The Dispensing Department will also move to the new addition. The Shipping Department except for the technitium "kows" and other heavy items will also be in the new addition along with the Order Department. ^{Q54} The air exhaust systems in ^{Q54} the new addition were discussed with Mr. Davis and Mr. Mason at this time. These gentlemen stated that the tritium exhaust will be monitored and will have a dilution of 4 to 1. No filtering or other washing is planned at this time. Regarding carbon 14 exhaust the licensee's representative stated that multiple banks of absolute filters would be used in the system. Inplant air sampling regarding the tritium and carbon was discussed also. Mr. Mason stated that there has been no set method decided upon, however, bubblers would probably be the case for tritium with nothing decided for the carbon as yet. A further review of this facility and the Health Physics aspects will be reviewed during the next reinspection, the licensee representatives were advised.

MISCELLANEOUS

55. As a result of a recent inspection by Division of Compliance, Region IV, of Omaha Veterans Administration Hospital, Mr. Glen D. Brown, Senior Radiation Specialist, Region IV, in a memo dated November 7, 1967, suggested possible investigation by various regional offices of reported

55. (continued)

contaminated shipments from various suppliers going to the Omaha Veterans Administration Hospital. One of the subject shipments was from Mallinckrodt. Information received concerning this shipment shows the date: July 28, 1967, shipper - Mallinckrodt, contamination place - outside of empty box (inside wiped clean), contamination type - zinc 65, contamination amount - 300 mr/hr beta, 30 mr/hr gamma. During this inspection, the licensee representatives were asked if a shipment of zinc 65 was made to the Omaha Veterans Administration Hospital (OVAH) in July of 1967. The licensee representatives advised that they do not handle zinc 65 at the St. Louis facility on a routine basis and a check was made through the Ordering Department which revealed that the OVAH had ordered one millicurie of zinc 65 contained in 10 ml of HCl from the Mallinckrodt/Nuclear, Orlando, Florida facility. Since the Orlando, Florida facility does not routinely handle zinc 65 either, this amount of zinc 65 was shipped from Nuclear Science and Engineering Corporation, Pittsburgh, Pennsylvania to the Mallinckrodt/Nuclear St. Louis facility. In St. Louis the one millicurie was something less than 10 ml solution. R&D section brought the solution up to 10 ml and autoclaved it which was followed by a sterility test conducted in the Quality Control. Dispensing put a new label on the bottle and transferred ^{it} to a new lead pig and new cardboard can with absorbent material packed inside. This packaged cardboard can was then put in a new shipping box and shipped to OVAH on July 18, 1967. The licensee representatives stated that all items going out to customers are packaged and shipped the same day. They added that it would ^{be} a very odd case that ~~it~~ ^{any package is} left overnight for shipping out the next day. Mr. Soldan stated that no routine surveys are made of outgoing containers although they randomly smear outgoing packages. However, the Shipping Room is among the daily smear scheduled areas. The smear results records for July 18 show no detectable contamination on any wipes taken on the table where the boxes are packed and subsequently shipped. However, on July 17, 1967, the center area of the bench top used in the Shipping Room did show up to 11,000 disintegrations per minute per 100 cm^2 and was shown to be clean to 0 d/m/100 cm^2 the same day. It appeared that only

55. (continued)

possible contamination could be on the outside of the zinc 65 shipment going to Omaha Veterans Administration Hospital if it were to be packed on the table in the Shipping Room on July 17, 1967, and left overnight and shipped out on the 18th thereby picking up some of the contamination noted on the 17th. The value of the contamination amount noted in the memo of 300 mr/hr beta and 30 mr/hr gamma could not be reconciled to other available information. Mr. Soldan stated that he would submit a report regarding this matter to the Omaha Veterans Administration Hospital and will send a carbon copy of this report to Region III when completed.

56. During this inspection, the licensee was asked the current status of the arrangement between Mallinckrodt/Nuclear and the University of Missouri Reactor. Dr. Konneker stated that Mallinckrodt is supporting the University Reactor to allow it to operate 24 hours a day, 7 days a week. Currently the reactor is on a 16 hour per day, 7 days a week schedule and that an increased number of operators are now in training and are expected to be finished in two to six months to allow the reactor to go to the full 24 hour per day schedule. Dr. Konneker stated that three main isotopes in which Mallinckrodt is interested in is molybdenum 99, gold 198, and mercury 197. They have had two to three trial runs regarding the various isotopes but nothing substantial. In conclusion, Dr. Konneker advised that they hoped to get the molybdenum 99 going in the next ~~thirty~~ ^{thirty} days. One point of clarification is that no chemical processing at the University of Missouri is contemplated for these samples.

57. The subject of licensee reporting ^{of} thefts and ~~losses~~ ^{losses} not necessarily causing significant hazards to persons in unrestricted areas, was discussed with Dr. Konneker, Dr. Hallett, and Mr. Mason at this time. The licensee representatives advised that when it is established by Mallinckrodt/Nuclear, a customer, or carrier that a shipment has been lost or stolen in transit the Region III office will be contacted. Dr. Konneker stated that it was his error in calling Washington instead of Region III when he heard about ~~a~~ ^a recent lost package in Detroit, Michigan. Dr. Konneker added that at the time the customer called the news of this loss was

57. (continued)

already on television. During the staff meeting mentioned above in paragraph 41, Dr. Hallett advised the various division heads of the new Mallinckrodt/Nuclear policy concerning reporting of loss or stolen shipments. At this time Dr. Hallett stated that lost shipments which are reported lost or believed lost from a customer or carrier will be reported to CO:III. On the question of delayed shipments - that is, overflow, etc. - Dr. Hallett stated that after a 24-hour delay after the shipment is due at the destination a report will be submitted ~~by~~ by telephone to CO:III *on a just in case basis.*

58. The question of formal arrangements with hospitals and doctors regarding contamination related injuries was discussed at this time. The licensee representative stated that arrangements have been made with Barnes Hospital (Washington University of St. Louis) to handle conventional type industrial accidents and, in addition, St. John's Hospital in the area of the licensee's facility has been used on one occasion for this purpose. No arrangements have been made to handle contamination related injury cases. Mr. Mason stated that Barnes Hospital is already set up to handle radiation and criticality cases from United Nuclear's Hematite facility, although no definite arrangement has been made for Mallinckrodt/Nuclear cases. Mr. Mason advised that work on such arrangements would begin for both hospitals and they should expect to ~~begin~~ ^{- formalize} these arrangements within the next month.

INDEPENDENT MEASUREMENTS

59. In the presence of the licensee representatives, the AEC inspector took a total of ten contamination smears in both restricted and unrestricted areas during this inspection. These smears were sent to Argonne National Laboratory for beta gamma analysis. The location ~~and amount of contamination~~ ~~in each area~~, of each of the smears is listed below:

1. Center of *lunch Room* floor:
2. Center of Laundry Room floor:
3. Stairway landing at film badge rack:
4. Hallway outside of entrance to Production Laboratory:
5. "Cleanside" production entrance stepoff area:
6. Just inside iodine 131 room stepoff area:

The smear analysis has not been returned by AEC as yet. Any significant readings will be furnished to licensee.

59. (continued)

7. Floor, near ~~Transfer~~ door of hot cell, next to floor drain.
 8. On work bench in Shipping Room.
 9. Floor, at entrance to iodine 131 capsule machine room in rear of R&D section.
 10. At top of stairway outside of entrance to Quality Control.
60. Utilizing the licensee's Lublum Model 12 portable survey meter with a 30 milligram/cm² GM probe, a spotcheck of radiation level in wastebaskets, working areas, and other miscellaneous points showed no unusual or abnormal radiation levels at locations surveyed. It is noted that the radiation level detected at the fence surrounding the waste storage area was 0.5MR/hr.

MANAGEMENT DISCUSSION

61. The results of this inspection were discussed with Dr. Hallett, Director of Operations, Mr. Mason, the Director of Safety and Maintenance, and Mr. Soldan, Manager of the Health Physics Group. Dr. Hallett was complimented on the obvious upgrading of the Radiation Protection Program at the licensee's facilities since the last previous reinspection. Dr. Hallett was advised that the addition of Mont Mason and his subsequent reorganization of the Radiation Protection Program and his placing of responsibilities where they belong and making it stick appear to be the two biggest steps in reducing personnel exposures and bettering the Radiation Safety Program in general. Dr. Hallett was advised that one item of noncompliance was noted during this inspection which concerned the presence of excessive levels of radiation in an unrestricted area. During this discussion Mr. Mason and Mr. Soldan assured Dr. Hallett and the AEC inspector that the radiation levels in unrestricted areas would be less than those specified in 10 CFR 20.105 in the future. Dr. Hallett was informed that the licensee may expect to receive correspondence regarding the results of this inspection from Region III. Dr. Hallett requested that correspondence be directed to Mr. Mason, Director of Safety and Maintenance, with a carbon copy to him, (Dr. Hallett).

Time of Day Counted.

16-26 persons

CONTAMINATION CHECK

If thyroid count is $\geq 50\%$ of 0.14 μC

IMMEDIATE ACTION REQUIRED

DATE ACTION REQUIRED
Restricted from T-131 work as other (wash or shower)

EXHIBIT A

	H.V.	STD.	PST.	SB	PERFORMED BY	DATE
BASE					REVIEWED BY	DATE
PEAK						

DISTRIBUTION: WHITE - HEALTH PHYSICS FILE

DISTRIBUTION: WHITE - HEALTH PHYSICS FILE *aka*
CANARY - FPM, WRK, RLH, WPR, RLC, JLB
PINK - ACTION *if* $> 50\%$ - TO Respective Dept Head
GOLDENROD - FPM, RLH

begin
NAME + Lo, Hi, AV

Week	1	2	3	4	5	6	7	8	9	10	11	12	13
------	---	---	---	---	---	---	---	---	---	----	----	----	----

L		.05	.06	.06	.17	.20	.20	-	.12	.17			
H		.18	.44	.45	.35	.26	.27	.11	.24	.27			
A		.12	.20	.25	.30	.25	.25	-	.20	.20			
L		.06	.34	.32	.19	.09	.03	.08	.05	.04	.00		
H		.53	.39	.48	.25	.38	.13	(.61)	(.75)	.31	.20		
A		.40	.35	.39	.22	.25	.09	.37	.32	.17	.10		
L		.05	.05	.03	.07	.07	.05	.04	.12	.08	.00		
H		.05	.14	.29	.10	.96	.03	.10	.19	.11	(.68)		
A		.05	.08	.16	.08	.40	.03	.06	.16	.09	.21		
L		.03	.04	.08	.10	.01	.05	.04			.00		
H		.29	.23	.20	.16	.07	.04	.23			.22		
A		.12	.10	.14	.13	.05	.05	.10	.10	.10	.08		
L							.00	.29	.13	.06	.13		
H							.07	.57	.39	.20	.24		
A							.04	.38	.28	.14	.18		
L		.04	.22	.33	.17	.21	.26	.41	.41	.20	.49		
H		.36	.49	.38	.31	.47	.44	(.93)	(.63)	.33	.28		
A		.20	.34	.35	.25	.35	.32	.76	.49	.27	.37		
L		.10	.16	.11	.13	.08	.14	.00	.09	.04	.00		
H		.34	.21	.18	.18	.37	.33	.26	.15	.04	.01		
A		.18	.19	.15	.16	.20	.24	.16	.12	.04	.01		
L		.15	.33	.25	.18	.23	.21	.18	.23	.20	.21		
H		.37	.45	.50	.35	.42	.46	.50	.48	.38	.35		
A		.28	.36	.35	.24	.29	.36	.32	.38	.20	.30		
L		.02	.06	.07	.02	.06	.04	.02	.00	.09	.00		
H		.09	.15	.12	.09	.19	.07	.12	.10	.15	.25		
A		.05	.09	.13	.07	.10	.06	.06	.04	.12	.11		
L		.00	.00	.00	.00	.00	.04	.15	.03	.12	.07		
H		.00	.05	.05	.02	.03	.18	.23	.26	.39	.19		
A		.00	.02	.02	.01	.01	.10	.19	.13	.21	.11		

Ex 6

EXHIBIT B

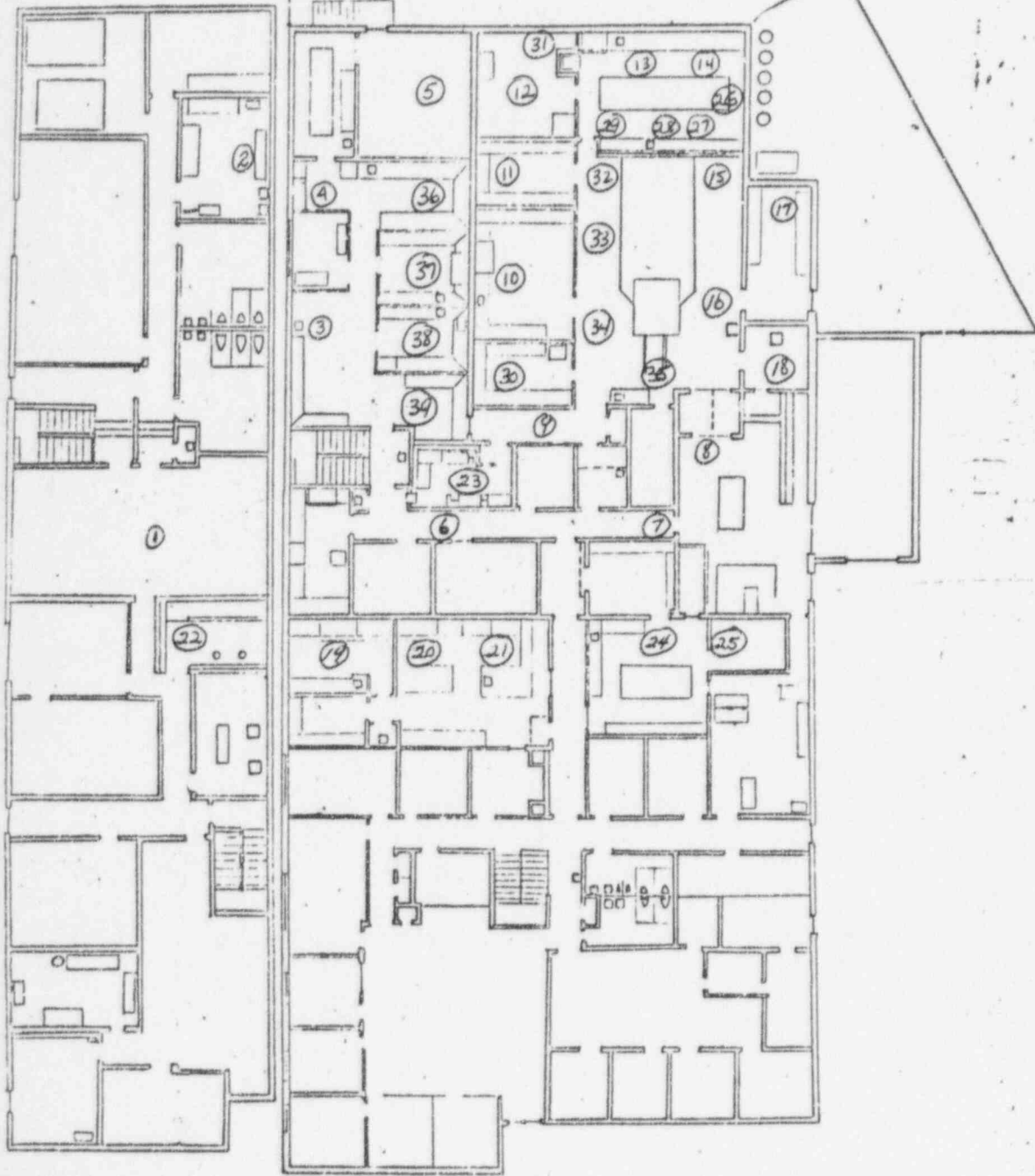


EXHIBIT C

1. SURVEYED AND FOUND TO BE WITHIN LIMITS FOR RELEASE TO A COMMERCIAL LAUNDRY.
2. LAUNDERED AND FOUND TO BE WITHIN LIMITS FOR RELEASE TO A COMMERCIAL LAUNDRY.
3. SURVEYED AND FOUND TO BE ABOVE LIMITS FOR RELEASE TO A COMMERCIAL LAUNDRY.
4. LAUNDERED AND FOUND TO BE ABOVE LIMITS FOR RELEASE TO A COMMERCIAL LAUNDRY.

PERFORMED BY

DAVE

REVIEWED BY

DATE _____

DISTRIBUTION: WHITE - HEALTH PHYSICS FILE
CANARY - MGM, RLH, WPR, JLB, RLC, FPH, WRK. DESTROY

EXHIBIT D

NON-RADIOACTIVE WASTE SURVEY

MCB NO. 02959 - 2/86

CONTAINERS	QUARTER STARTING						
	WEEK STARTING						
	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	
DUMPSTERS	1 2	1 2	1 2	1 2	1 2	1 2	
PRODUCTION	1 2	1 2	1 2	1 2	1 2	1 2	
DISPENSING	1 2	1 2	1 2	1 2	1 2	1 2	
RESEARCH & DEVELOPMENT	1 2	1 2	1 2	1 2	1 2	1 2	
QUALITY CONTROL	1 2	1 2	1 2	1 2	1 2	1 2	
HEALTH PHYSICS	1 2	1 2	1 2	1 2	1 2	1 2	
	1 2	1 2	1 2	1 2	1 2	1 2	
	1 2	1 2	1 2	1 2	1 2	1 2	

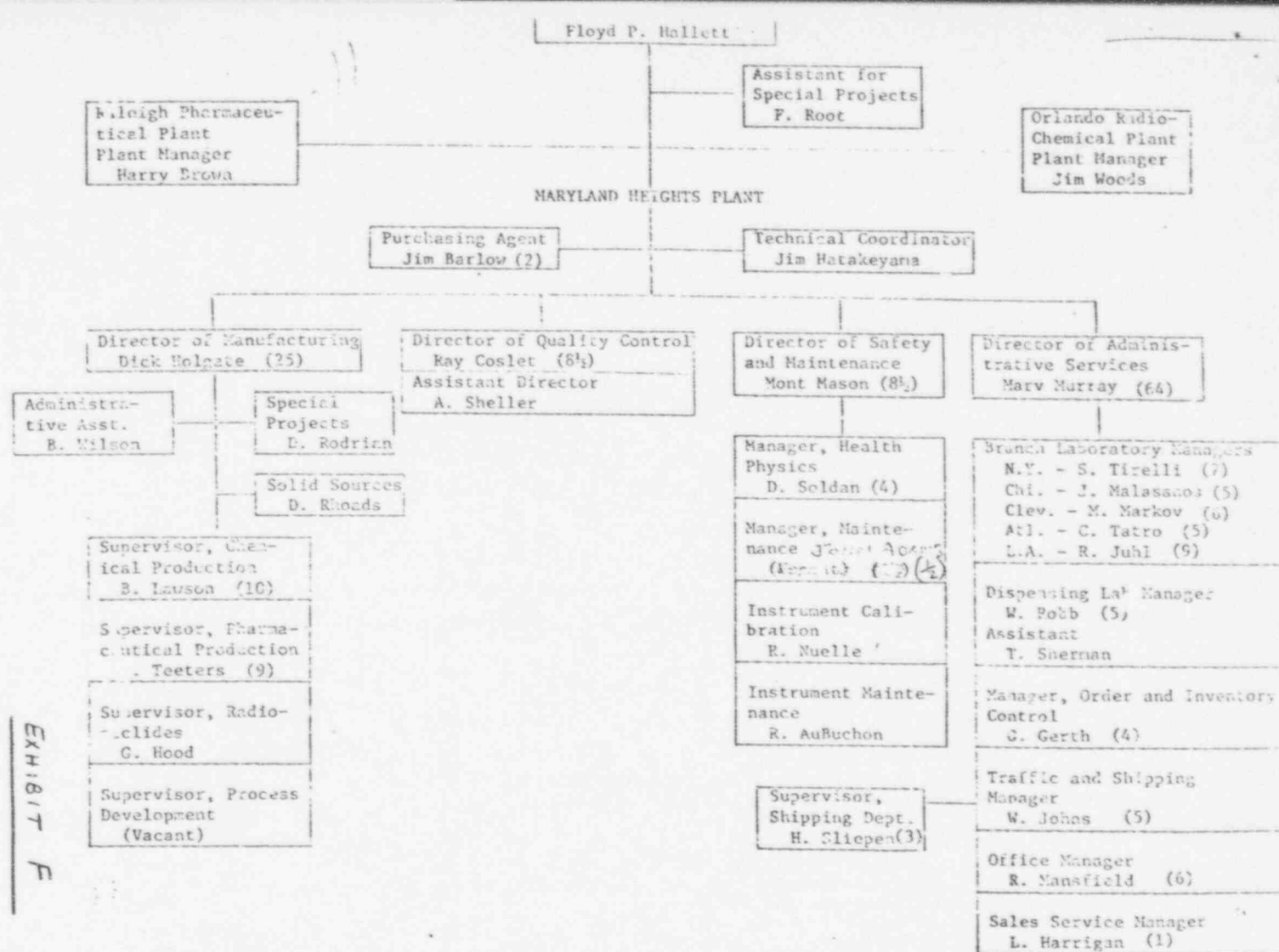
INSTRUCTIONS: Circle 1 or 2 above and initial in the space provided.
 Waste in the above containers was surveyed and released after:
 1. NO RADIOACTIVE MATERIALS WERE DETECTED
 2. RADIOACTIVE MATERIALS WERE DETECTED AND REMOVED TO RADIOACTIVE WASTE.
 If radioactive materials were detected, attempt to identify the source and record comments and corrective measures.

COMMENTS AND CORRECTIVE MEASURES

REVIEWED BY	DATE
-------------	------

DISTRIBUTION: WHITE - HEALTH PHYSICS FILE
 CANARY - MCM, RLH, WPR, JLB
 RLC, FPM, WRK,
 DESTROY

EXHIBIT E



parenthetical figures indicate number of persons supervised.

EXHIBIT F

March 8, 1968

Dr. F. P. Hallett
Mr. R. L. Holgate
Mr. R. L. Coslet
Mr. M. L. Murray

Film Badge Summary Data

The attached 4 sheets of summary data represent the end results of trying several methods for compiling meaningful grouping of badge results to enable you to react when necessary and also to give an indication of trends. Hereafter, sheets 1, 2, and 3 will reach you no later than Thursday of the "badge use week." Sheet No. 4 will be prepared only at the end of each quarter.

Sheet No. 1 summarizes each week's body badge data but without identifying areas or individuals; Health Physics reacts to an unusually high badge or to an elevation in the overall picture. The last grouping on this sheet shows number of people in each cumulative exposure bracket expressed as average mr/wk.

Sheet No. 2 identifies individuals by week who exceed 100 mr body badge that week, or who did not return the badge for that week. The right hand column gives total and weekly average the previous quarter for people on the name list who exceeded an average of 100 per week for the previous quarter.

Sheet No. 3 summarizes wrist badge data by exposure brackets and by individuals exceeding 250 mr in any week. The value of 250 mr/wk was chosen arbitrarily as a control reference.

Sheet No. 4 summarizes body badge data for the 3rd and 4th quarters of 1967. The main purpose of this data is comparison to show trends.

In the following weeks we will Xerox our work sheets and forward a copy to each of you; whenever we have worthwhile comments or recommendations, they will appear as a cover memo.

M. G. Mason

MGM:cd

cc: Dr. W. R. Konneker
Mr. D. W. Soldan
M. J. Brown

EXHIBIT G

W209 BODY FILM BADGE GAMMA
2nd QUARTER 1968 WEEKLY BADGE RESULTS

DATE ENDING	WEEK NO	NO. BADGE		HIGH BDG.	AVERAGE		NUMBER OF FILM WITH EXPOSURE GREATER THAN									
		ISSUED	NR		10 HIGH	ALL	- MT THAT WILL					- MT/WK EVAL FOR D				
							50	100	150	200	250	100	150	200	250	
1/7	1	65	3	170	107	40	13	15	2	0	0	5	2	0	0	
1/15	2	65	2	210	146	61	33	10	4	1	0	6	3	0	0	
1/22	3	65	4	210	163	61	22	16	4	3	0	6	4	0	0	
1/29	4	65	3	170	121	53	21	7	1	0	0	6	4	0	0	
2/5	5	67	0	170	106	37	9	5	2	0	0	4	1	0	0	
2/12	6	67	6	*200	109	41	13	6	1	0	0	6	1	0	0	
2/19	7	67	3	250	180	78	42	16	6	3	0	6	2	0	0	
2/26	8	68	4	246	160	62	31	8	5	3	1	6	2	0	0	
3/4	9	67	10	180	129	50	17	9	2	0	0	7	1	0	0	
	10															
	11															
	12															
	13															

* Calculated as MAXIMUM DOSE TO AN IMPROPERLY STORED BADGE FOR A NORMALLY LOW EXPOSURE INDIVIDUAL.

"G-1"

W209 FILM BADGE (BODY-GAMMA)

INDIVIDUAL RESULTS BETWEEN 7 100 MF-OR- NO RETURN (NR), OR LATE (LR)

- Q 1968

WEEK NO. AND MF THAT WEEK - R- RETURN STATUS; PLUS PER 13WK STATUS

NAME	1	2	3	4	5	6	7	8	9	10	11	12	13	PRIOR QV. CUM. /WK
	170	175	225	125	125	152	246	266	180					2129/165
	170	125	240	170		104	250		(NR)					2662/205
	115	190	215	108	110	130	120	170	102					2119/168
	115	190	146	115	130		220	150	130					1157/89
	(NR)	(LR)	(NR)	(25)	(44)	(NR)	175	(67)	120					2312/189 *
	(NR)	(33)	(NR)	(NR)	(NR)				(NR)					
		120	125	150		150	110		150					1963/155
		210	188	150		102	110	125	102					
		130		(NR)				170	(NR)					
		152		140										
		115												EX 6
		108			170		140	219	(NR)					
			130											
			140											
			108											
			109					125						
			(LR)	(NR)	160	200								
			(NR)			(NR)	(NR)		(NR)					
			(NR)			(NR)			(NR)					
			(NR)			(NR)	(NR)		(NR)					
						(NR)			104					
							104							
							180							
							128		(NR)					
							140							
							190							
							116							
							(NR)	(NR)						
							146							
								205	175					
								107						
									(NR)					
									(NR)					
									(NR)					

HAD 4 LATE RETURNS OR NO RETURNS, RESULTS ARE THEREFORE BEST GUESS FOR LAST QUARTER 1967

"G-2"

WEEK NO. 1ST QUARTER 1968

	1	2	3	4	5	6	7	8	9	10	11	12	13
0.7250 Mr.	6	8	6	6	10	6	9	8	12				
416#3T-Mr.	1750	2400	1225	1150	1400	860	34	1450	1160				
NG 5 H16H-Mr.	790	1170	550	590	700	530	1150	930	790				

WEEKLY HIGHS BY NAME AND QUARTER TOTAL

WEEKLY 1973 BY NAME AND CHARACTERS									
270	525	360	490		550	700		900	-
	795	1150	1645	1895	2445	3145	3150	4050	-
<u>NR</u>	(10)	<u>NR</u>	(170)	650	<u>NR</u>	650	(170)	290	640
				?		?		?	4 NR
									8300
320	530	400		460		350	345	360	475
	850	1250		1970	2003	2353	2698	3028	6120
255									39
									5130
1000	310	400	290	260			1200	680	630
	1310	1710	2000	2260	2425	2541	3741	4428	8230
1750	2400	1225	1150	1400	860	3000	1450	(NR)	1200
	4150	5375	6225	7925	8785	11785	13235		2453
									8400
	306	315	260			650	580	300	320
	551	866	1126	1360	1551	2201	2781	3081	4170
	1225	980	600	380	260	750	650		980
	1380	2360	2460	3340	3600	4330	4595		12700
	1100			590				490	375
	1133	1213	1365	1453	2020	2230	2310	2800	486
	310					310			290
	453					1387			3700
			440					715	205
			1070					1604	3620
				435				460	325
				1072				2113	4250
				265					280
				1084					3660
		NEW →	300	640	390	880	1160		-
			300	940	1330	2210	3370		-
				315					80
				625					1044
				285	340				-
				1525	1865				-
		NEW →		<u>NR</u>	<u>NR</u>	396			-
						?			-
						550	300		435
						2092	3392		5090

PERSONNEL EXPOSURE - CRITICAL BY FIRM RANGE W-1
 SUMMARY OF BODY BADGE GAMMA; WEEKLY BADGES
 3rd AND 4th QUARTERS 1967 BY WEEKS AND TOTAL

3rd QUARTER 1967

WEEK NO.	HIGH BADGE	AVG OF 10 HIGH	AVG OF ALL	NUMBER OF BADGES EXCEEDING — MP THAT WK.					
				50	100	150	200	250	300
1	345	170	65	25	11	4	3	1	1
2	200	140	63	24	11	3	0	0	0
3	440	269	98	38	23	11	6	5	2
4	310	195	76	31	13	9	3	1	1
5	475	307	105	36	19	13	9	7	3
6	278	208	84	33	20	11	5	1	0
7	350	247	87	32	18	10	7	4	2
8	400	258	87	32	18	10	5	3	2
9	330	229	77	31	16	9	5	3	2
10	400	212	75	31	15	6	3	2	2
11	320	216	80	36	15	11	4	1	1
12	625	340	120	38	19	10	6	3	2
13	530	225	90	38	22	12	5	2	1
O.A. AVG	340	233	85	33	19	9	5	2.5	1.5

4th QUARTER 1967

1	315	182	73	35	17	7	4	1	1
2	275	196	79	32	16	9	2	2	0
3	330	174	75	31	12	7	3	1	1
4	230	197	81	37	20	10	4	0	0
5	350	205	80	34	16	10	4	3	2
6	300	212	76	35	19	9	5	3	0
7	260	183	65	26	12	7	2	2	0
8	154	131	61	40	13	1	0	0	0
9	331	161	67	32	14	1	0	0	1
10	150	127	65	42	10	0	0	0	0
11	225	184	74	34	20	7	3	0	0
12	190	116	47	21	7	2	0	0	0
13	180	142	55	23	12	3	0	0	0
O.A. AVG	250	170	69	33	15	6	2	0.9	0.4

"G-4"

DOSIMETER RECORD

DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
WEEK													
MON													
TUES													
WEDS													
THURS													
FRI													
SAT													
SUN													
TOTAL													

QUARTERLY TOTAL COMMENTS

Individuals read & record dosimeter reading every day.
A master file of these cards is kept at the dosimeter
and taken badge room.

NAME DOSIMETER NO.

W.NU-13039-R. 12/67

MALLINCKRODT/NUCLEAR

FRACTIONAL PERMISSIBLE IODINE-131 THYROID BURDEN
(1 FPTB = 0.14 Microcuries of Iodine-131)

DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
WEEK													
MON													
TUES													
WEDS													
THURS													
FRI													
SAT													
SUN													
AVERAGE													

QUARTERLY AVERAGE COMMENTS

This card kept for all persons on thyroid counts in
Health Physics Office.
Filed alphabetically in a carder file system and in individual
Personal Monitoring (P.M.) file folder.
The weekly sheet daily averages are entered here.

NAME SOC. SEC. NO.

EXHIBIT H