564

Copy No. 15

707594

AEC Investigation of Cobalt-60 Exposure at the Variable Dose Rate Irradiation Facility, UT-AEC

(Report of Investigating Committee)

February 4, 1971

AEC Investigation of Cobalt-60 Exposure at the Variable Dose Rate Irradiation Facility, UT-AEC

(Report of Investigating Committee)

February 4, 1971

CONTENTS

INTRODUCTION AND SUMMARY

On February 4, 1971, at about 11:30 A.M., a research technician employed by the University of Tennessee, and performing work at the University of Tennessee - AEC Agricultural Research Laboratory was exposed to 8,000 curies of Cobalt-60 gamma radiation from Source No. 5 at the Variable Dose Rate Irradiation Facility (VDRIF). The VDRIF is a Government-owned facility operated by the University of Tennessee under Prime Contract No. AT-(40-1)-Gen-242 between the University and the United States of America as represented by the U. S. Atomic Energy Commission. The accidental exposure occurred while the technician was irradiating lettuce seed samples. Thermoluminescence Dosimetry by a commercially supplied TLD Badge worn on his belt indicates a total body exposure of 260 Rem. Essentially all of the exposure dose was received in about thirty seconds while the employee was positioning sample vials in a holder mounted 17 cm from the source rod. The employee's medical symptoms, primarily nausea and vomiting on the first day and leukocyte count depression, are typical of this level of exposure. Hand exposure is estimated to be no greater than 1,200 Rem. The hands had evidenced no visible symptoms of exposure as of 25 days post-exposure. Inadvertent entry by the employee into the source room with Source No. 5 exposed occurred because two automatic safety interlocks did not perform their intended functions. Had either performed properly, this incident probably would not have occurred. Procedural laxity also contributed to the exposure.

Following a preliminary investigation of the facts by UT-AEC and AEC-ORO representatives, the Manager of Oak Ridge Operations Office appointed a formal committee on February 8, 1971, to investigate the occurrence. The members of the committee are as follows:

W. T. Thornton, AEC-ORO, Chairman
S. J. Ditto, UCC-ND, ORNL
A. F. McFee, UT-AEC, ARL

This document presents the formal report of the committee.

DESCRIPTION OF THE FACILITY

General Description

The Variable Dose Rate Irradiation Facility (VDRIF) is housed in a building (see Figure 1) approximately 90 ft by 40 ft, with 12" concrete walls on three sides. Earth shielding is used on these sides and the roof, with the exposed front of the building being shielded by at least 4 ft of concrete. The control room is connected to the irradiation room by a maze which is shielded from the sources by a 4 ft thick wall. Access to the maze is through a personnel door (see Figure 2) from the control room and an electrically operated roll-up door adjacent to the control room. A second door to the control room serves as the main building entrance.

Inside the irradiation room are the 6 Cobalt-60 sources, normally stored in their shielded containers which are located on 20 ft centers in a rectangular 2 x 3 array (see Figures 1 and 3). Each source contains approximately 8,000 curies distributed as shown in Figure 4. Any or all of the sources may be attached manually to the drive train prior to an irradiation. After the appropriate sources are attached and the irradiation targets are placed in position, the facility operator goes from the irradiation room to the control room, from which he can raise and lower

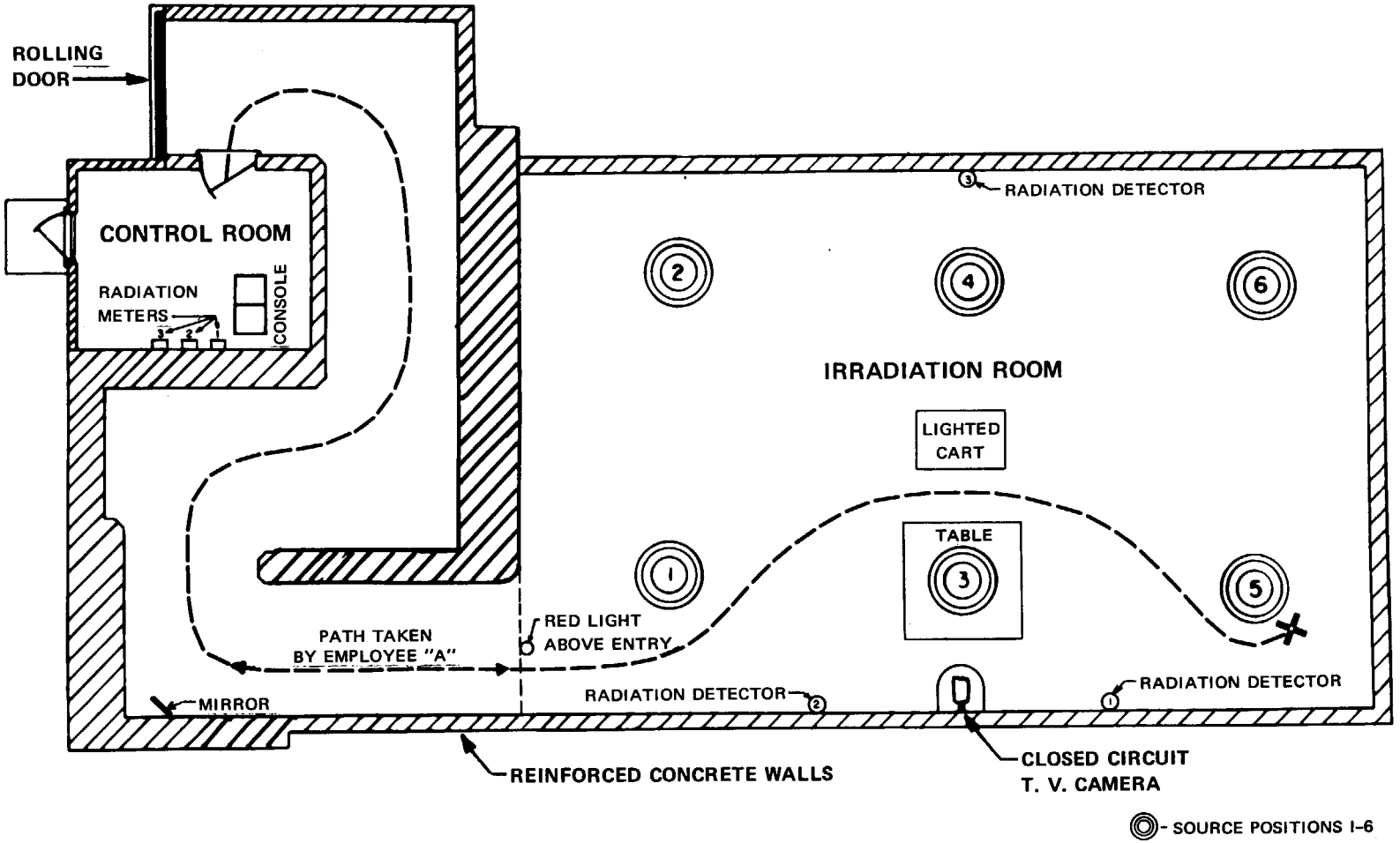


FIG. 1 – VARIABLE DOSE RATE FACILITY —— FLOOR PLAN

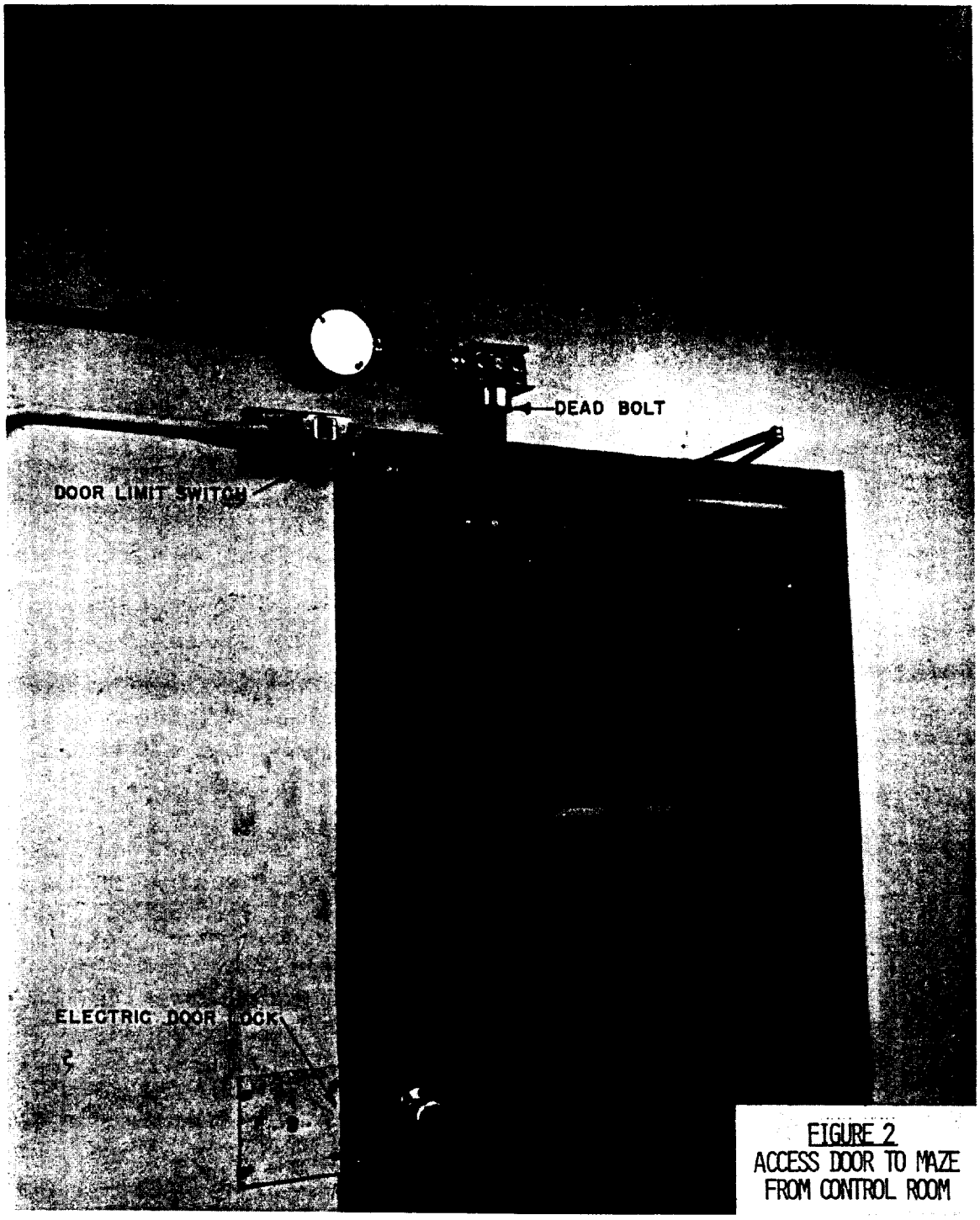


FIGURE 2
ACCESS DOOR TO MAZE
FROM CONTROL ROOM

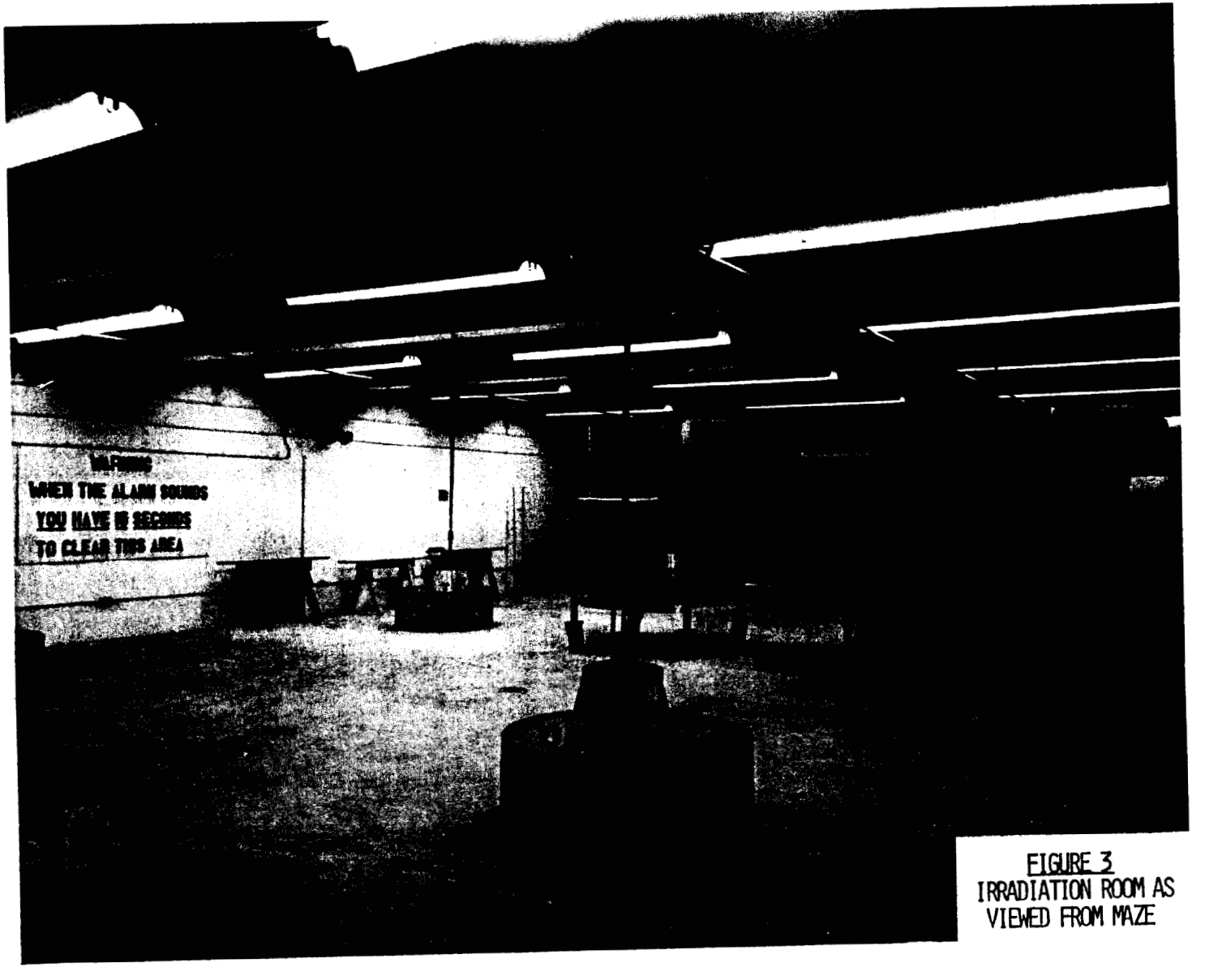


FIGURE 3
IRRADIATION ROOM AS
VIEWED FROM MAZE

the attached sources remotely, with control of elevation and exposure time being achieved by a "program controller," as described later. When fully withdrawn (850 mm) the bottom of the active portion (Figure 4) of a source is approximately 90 cm above the floor. Since the top of the shield is approximately 76 cm above the floor, the bottom of the active portion of the source is then about 14 cm above the top of the shield.

Several features of the control system are intended to supplement administrative control to prevent accidental irradiation of operating personnel. They are intended to function as follows and are described in more detail in a subsequent section.

1. At the beginning of an irradiation run an audible warning is sounded in the irradiation room for about one minute, with the source movement delayed for the first 15 seconds to allow time for anyone to leave the room, if he should hear the warning.

2. An electrical lock secures the door from the control room to the maze (Figure 2) from the time the irradiation program is initiated until the sources are completely returned to their shields.

3. A "dead bolt" arrangement will lock the same door if it is closed and a power outage occurs. This lock must be reset manually when power is restored.

4. Limit switches monitor the closed positions of the two doors to the maze. Should either door be opened, the experiment is terminated and the sources are automatically returned to their shields.

There are a number of indicators to facilitate administrative control of access to the maze. They are as follows (see Figures 5 and 6):

1. Lights on the console indicate when a door is open, when there is high radiation in the irradiation room, and when an experiment is running. Certain control systems failures are also indicated.

2. Three meters in the control room indicate the radiation level in the irradiation room.

3. Three flashing lights (in the control room, outside the building, and in the irradiation room) are activated when an experiment is running or there is a high radiation level in the irradiation room.

4. A position indicator on the console indicates the position of the drive mechanism; hence, the sources, in millimeters withdrawn.

VDRIF Control System

The inputs and outputs of the program controller are shown in block form on Figure 7. The block labeled "Program Controller" comprises logic elements and input-output devices which act upon signals entering the block and produce output signals or actions. These outputs are influenced by the current status of the inputs as well as the sequential behavior of the inputs and the logic elements. The breakdown of equipment in block form is more nearly functional than geographic.

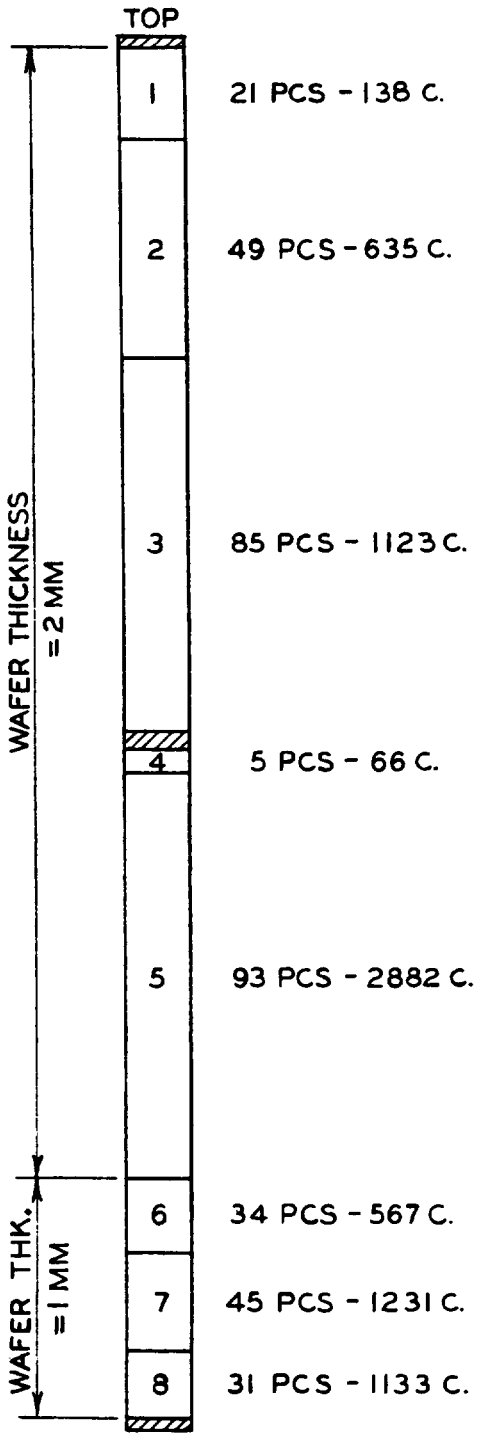


FIG. 4
SOURCE LOADING PLAN

FIGURE 5
CONTROL ROOM

FIG. 6 CONTROL PANEL

The following discussion is intended to describe the functions of the various inputs and those conditions required to achieve specific output responses. Except where noted, the system is assumed to be operating properly.

Each of the radiation monitors has two output contacts as well as a meter output in the control room. One of the contacts opens on high radiation level, the other for low alarm to provide indication of some types of monitor failure. If any low alarm contact opens, a light on the console is turned on indicating radiation monitor failure and the corresponding high alarm signal is blocked, so that it cannot illuminate the "radiation high" light on the console. If any radiation monitor failure is detected in this way, or if high radiation levels are detected, the operator cannot initiate a programmed irradiation; however, the occurrence of a failure after initiation does not abort the run. The high radiation contacts are arranged to activate the high radiation light on the console and to energize the flashing alarm lights in the control room, the irradiation room, and on the outside of the building. These same lights are turned on when the signal is given to withdraw the source, by a logical "OR" circuit.

The start count limit switches are located on drives 3 and 4 and serve as fiducial zero references. Each is a single pole, double throw switch which changes aspect as the drive goes through the reference height. The logic system continuously monitors these switches to detect inconsistencies between the two outputs of each switch and between the two switches. Any detected failure energizes a limit switch failure light on the console. This failure would also prevent initiation of a programmed irradiation but would not abort one in progress. Both SC limit switches must indicate that the sources are in their down limits before the operator can initiate the irradiation. As soon as either indicates that the drive has moved out of the limit a "count" condition is established. This count condition remains throughout the irradiation and is primarily an indication that the sources are up and the automatic run is terminated only after both limit switches are restored to their initial state. A condition for the source drives to be driven down by the automatic program or the operator's use of the down fast button is that the "count" state be activated (implying one of the two SC limit switches is in the "drive withdrawn" state). A number of other functions relative to timing and sequencing also are performed.

The down disable limit switches are installed on rods 2, 3, and 6 and are primarily used to prevent the drives from being driven into the overtravel limit at high speed in the event of certain control failures. They are adjusted 30 mm above the normal zero position and the logic arrangement is such that if the drive is operating in the "fast" mode and either of the three is actuated then a signal is generated to disable the down circuit and prevent further motor operation in the direction to lower the sources.

The door limit switches are standard industrial limit switches mounted on the wall of the maze adjacent to the truck door and on the control room wall adjacent to the door to the maze. Metal operators are bolted to the doors and the switch contacts are held closed when the doors are closed. When either door is opened, the appropriate switch contact is opened by spring forces. This action is sensed by the logic system and an "OR" gate is used to energize the "door open" light on the console. The same "OR" gate transmits a "door open" signal to another "OR" gate which is used to generate an "end exposure" signal. The other two inputs to this latter "OR" gate are a "down fast" pushbutton operation by the operator and an "end time" signal from the program timer. If either door is open initiation of a run is inhibited.

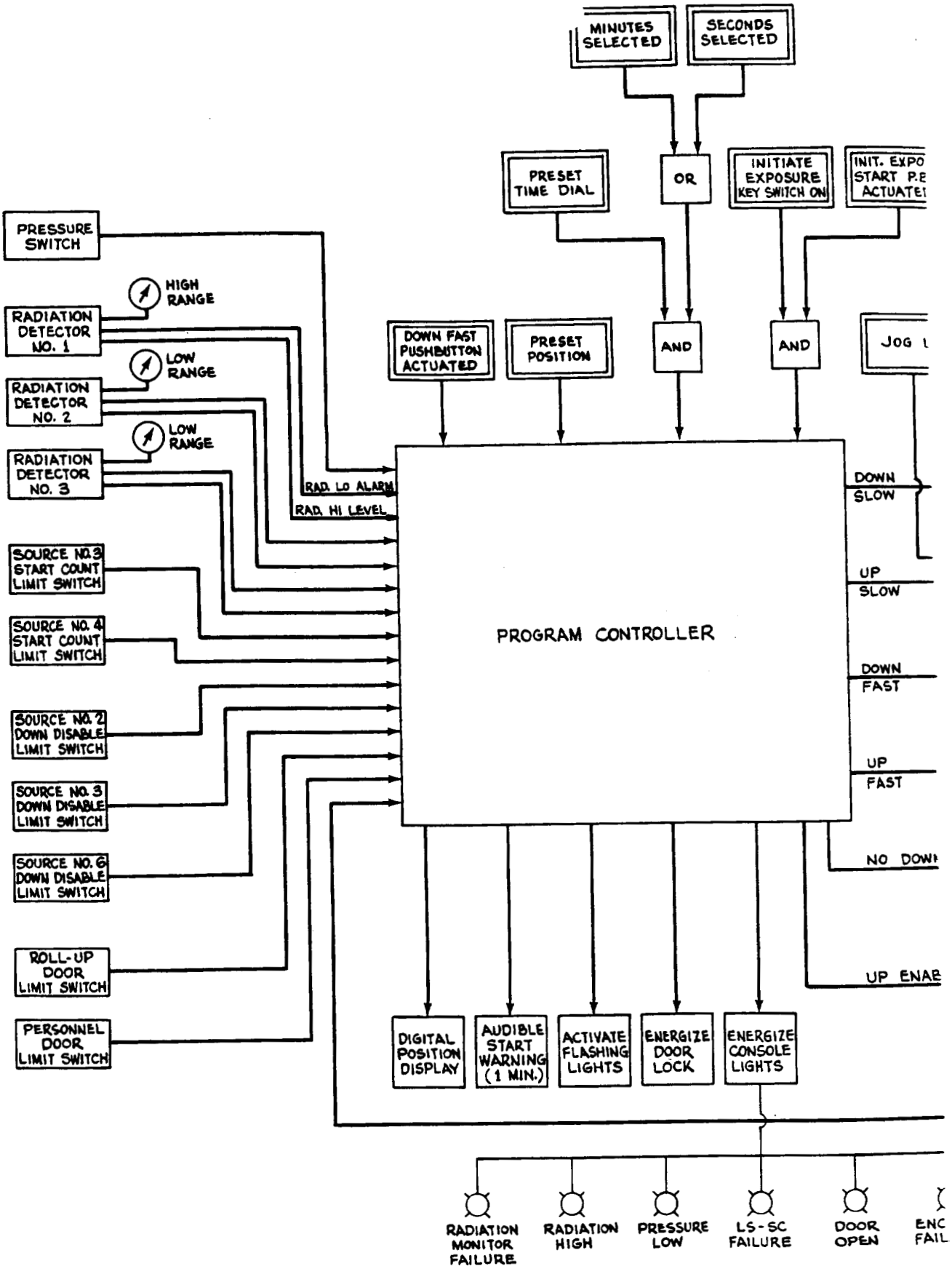
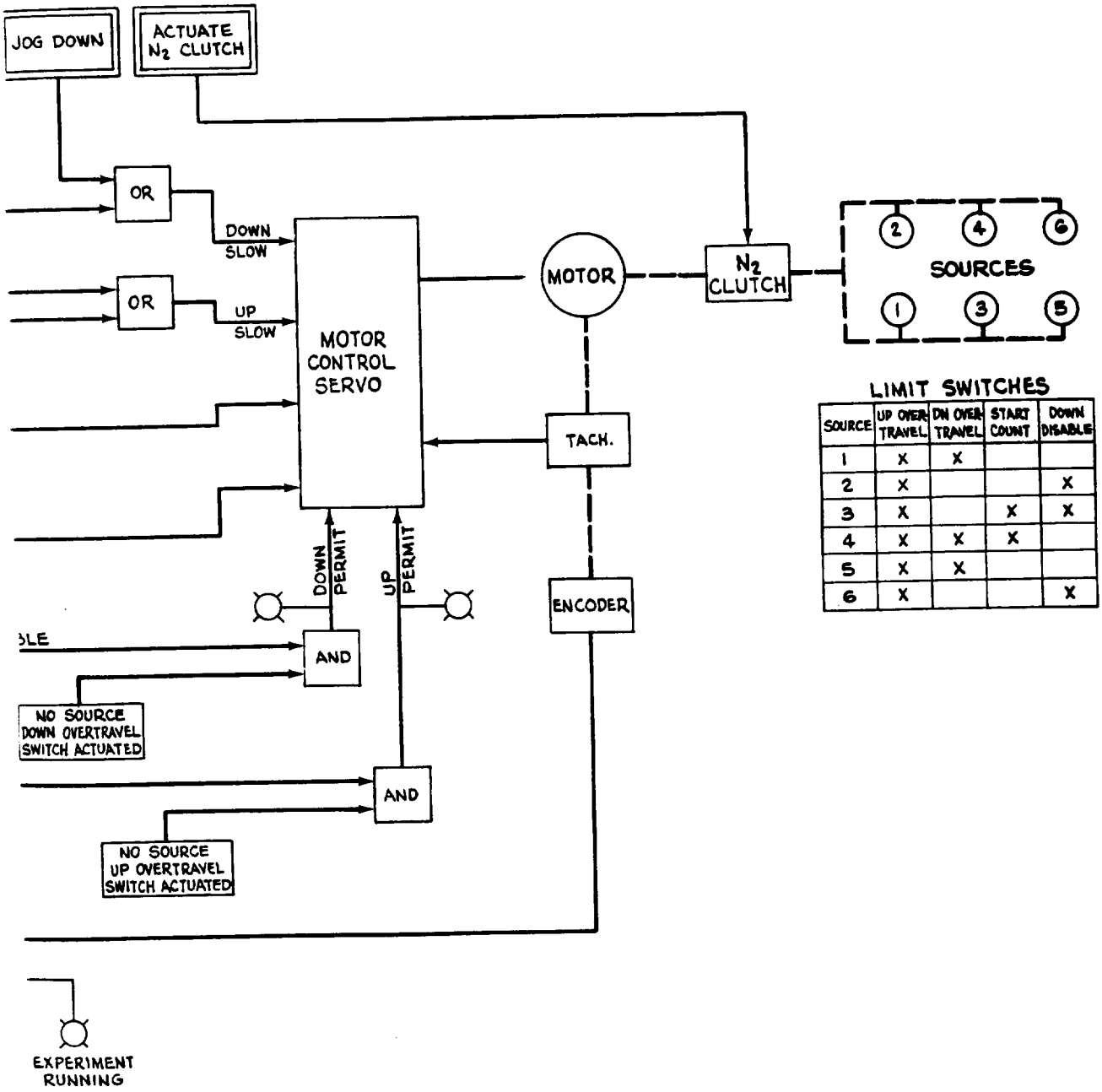


FIGURE 7

FUNCTIONAL SYSTEM DESCRIPTION OF V



LIMIT SWITCHES

SOURCE	UP OVER TRAVEL	DN OVER TRAVEL	START COUNT	DOWN DISABLE
1	X	X		
2	X			X
3	X		X	X
4	X	X	X	
5	X	X		
6	X			X

A pressure switch monitors nitrogen pressure in the system used to supply the force required to decouple the drives from the motor. This decoupling is used to allow the drives to be lowered by a winch from the roof of the building if the motor is inoperable. Its output energizes a light on the console if pressure is low, and will also inhibit starting a run if pressure is low.

The position encoder is a pulse generator which sends pulses to the down counter for controlling the positioning of the sources. These same pulses are counted and displayed on a digital scaler to indicate position to the operator. Note that at the beginning of each run the down counter is preset to the desired position and counts toward zero. Also at the end of exposure the down counter is again preset to the desired position and pulses are counted. The display system is designed so that direction and magnitude are sensed. Thus, after the scaler is reset to zero subsequent readings are relative to the position at the time of zeroing. There is no continuous unambiguous measure or indication of position of the drives.

The operator has several controls at his disposal as seen in Figure 6. First he can dial a preset position demand and a preset exposure time on digital switches. These read directly in millimeters and minutes or seconds depending on the position of a time base selector. He then can initiate an irradiation, subject to the constraints described above, by turning a key switch on and pushing a "go" pushbutton on the console.

The normal sequence of events, as directed by the logic system is as follows:

1. An audible warning is sounded for about 1 minute in the irradiation room.

2. Fifteen seconds after "go" (about 45 seconds prior to end of audible warning) the motor is energized in the "up fast" mode and will continue until the down counter indicates that the source is within 80 mm of its preset position.

3. At that time the drive speed will be reduced to slow, and this will continue until the preset position is reached and the motor stopped.

4. At the end of preset time the motor will be energized in the "down fast" mode until the drive is within 80 mm of the down position, then slowed, and finally stopped by the operation of the start count limit switches as described above.

5. During the time from actuation of the "go" button until the radiation level is below the alarm point three flashing lights are energized as described above.

6. From step 1 through step 4 the door between the control room and the irradiation room is locked. This is accomplished by energizing an "up-enable" relay, which occurs at the same time the "go" button is pressed, the timers are started, and the console "experiment running" light is turned on. This is fifteen seconds before the motor is energized.

The operator can also jog the drives up or down in slow speed by manually operating either of two pushbuttons. The only constraints are limit switches and the "up enable" and "down disable" outputs of the logic system. He can also operate a manual valve to release the drives from the motor by means of a clutch which is spring engaged and air released.

The motor is controlled by signals from the logic system subject to a few additional constraints. The motor receives signals to rotate in a particular direction and at high or low speed. Overtravel limit switches (6 in the up direction, 3 in the down direction) are series connected with the "up enable" contacts to operate a relay to allow rotation in the up direction, and with the "down disable" contacts to operate a "down permit" relay. A tachometer system senses speed of the motor and regulates it to match the demand, fast or slow.

Status of the Control System at Time of Incident

The committee has established that the following conditions were known by the operator and others to exist prior to operation of the facility on February 4, 1971:

1. The automatic door lock was malfunctioning, in that if the door were closed only by the operation of the mechanical door closer the lock would not engage.

2. The position indicator was erratic and frequently gave incorrect information.

3. The position indicator would often incorrectly reset to zero upon the occurrence of electrical noise transients from any one of several sources.

Status of Control System After Incident

Checks of the control system and interlocks by the Committee and the System Designer, after the inadvertent exposure, disclosed the following abnormalities:

1. It was necessary to forcibly close the door between the control room and the source room in order for the electric door lock to engage.

2. The position indicator (Anadex Counter) was erratic in operation and frequently gave erroneous information.

3. If the door between the control room and source room were slammed very hard, the actuating bar for the door interlock switch would sometimes pass the switch lever and allow the switch to return to the "door open" state and would inhibit source withdrawal.

4. Although the radiation monitors were all responding to radiation in the source room, two monitors were found to have no batteries and, therefore, would have failed to operate upon loss of all AC power.

5. Two of the radiation monitors failed to respond to a pushbutton test, indicating a fault in the test circuit.

6. A circuit intended to detect certain failures within the radiation monitor circuits failed to respond when the cable from one of the detectors to its monitor was removed.

7. The warning light in the source room was found to be inoperative.

8. An unused clip lead was discovered in the console behind the front panel. It was said to have been used to "bypass" the 15 second delay of source withdrawal.

9. Although not a malfunction, it was found that opening the door between the control room and source room after the sources began withdrawing does not prevent the sources from being further withdrawn, but allows the sources to be withdrawn to the pre-selected position before re-insertion. This cycle requires approximately 18 seconds for full source withdrawal and re-insertion.

10. On at least one occasion the TV system was found to be inoperable.

DISCUSSION OF THE INCIDENT

Chronology of Events

1. Pertinent Events Preceding February 4, 1971

On February 2 and 3, soybean plant irradiations were being made at the VDRIF. During operations early on February 2, Employee C inadvertently opened the door from the control room to the maze while an irradiation was in progress and the irradiation was immediately terminated by an automatic lowering of the sources, all six of which were being used at the time. This incident demonstrates that at this time the magnetic door lock was not engaged and that the door limit switch was functioning properly. Subsequent to this occurrence, testimony of Employees B, D, and E indicates that loading operations were performed in the maze with the control room door tied open and the door limit switch tied in the closed position while the sources were raised for irradiation of plants. Complete agreement was not reached among Employees B, D, and E on whether this interlock bypassing occurred on February 2 or February 3. It seems most likely, however, from analysis of the log book and the above testimony, that the loading operation involving interlock bypassing occurred between 11:30 A.M. and Noon on February 3. Employee B testified that he tied the switch for the loading operation in the maze and untied it shortly after the operation was completed. The door limit switch is shown in Figure 8 bypassed in the same manner as on February 2 or 3. Employee A indicated he observed string on the switch while in the control room on February 4 preceding the time of his inadvertent exposure; however, the existence of this condition is denied in the testimony of Employee B.

2. Events on February 4, 1971

Shortly after 11:00 A.M. on February 4, 1971, Employee A, a research technician, and Employee B, the principal VDRIF operator, arrived at the VDRIF to carry out the irradiation of lettuce seeds according to the schedule outlined in Table I. Employee B

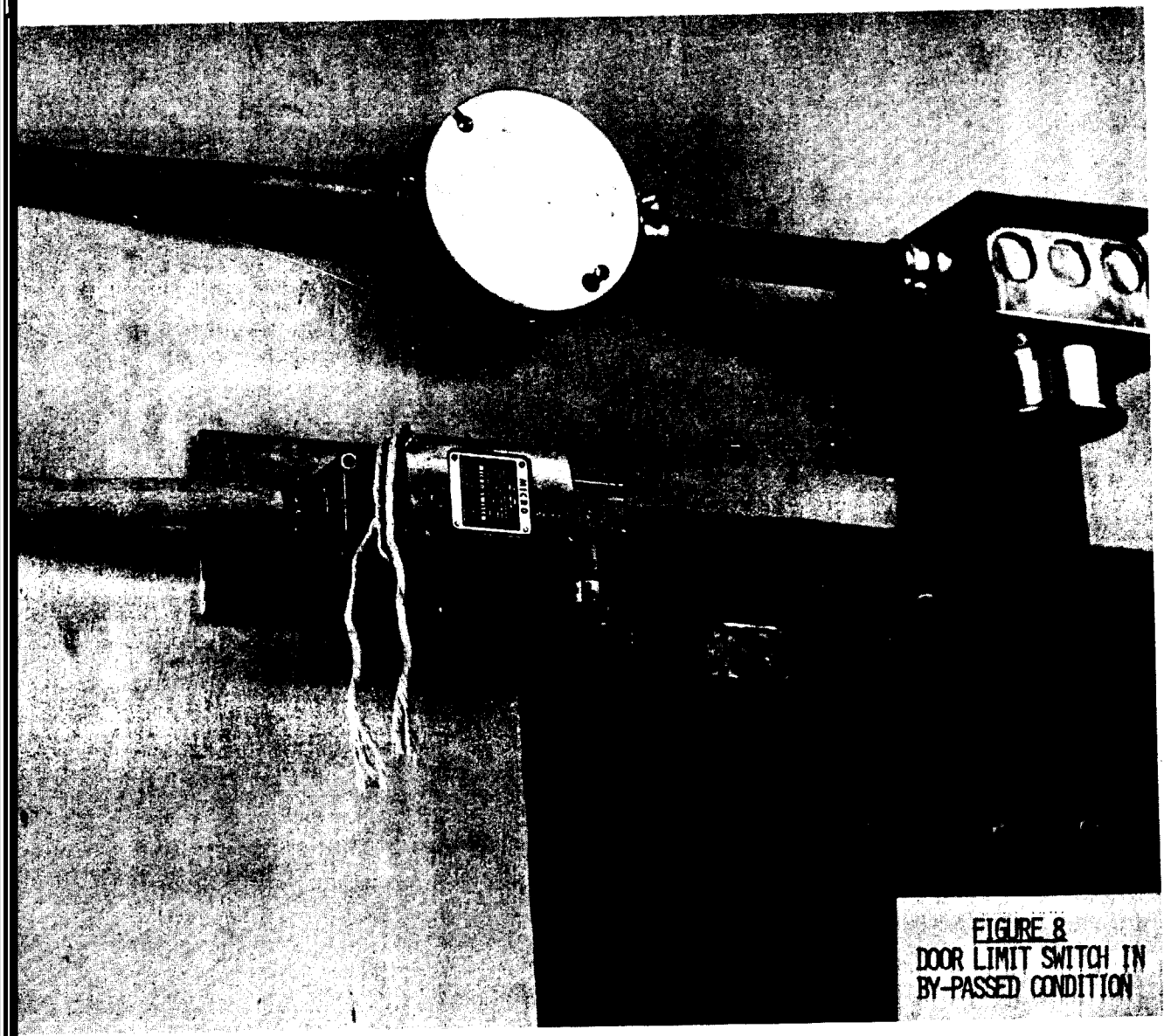


FIGURE 8
DOOR LIMIT SWITCH IN
BY-PASSED CONDITION

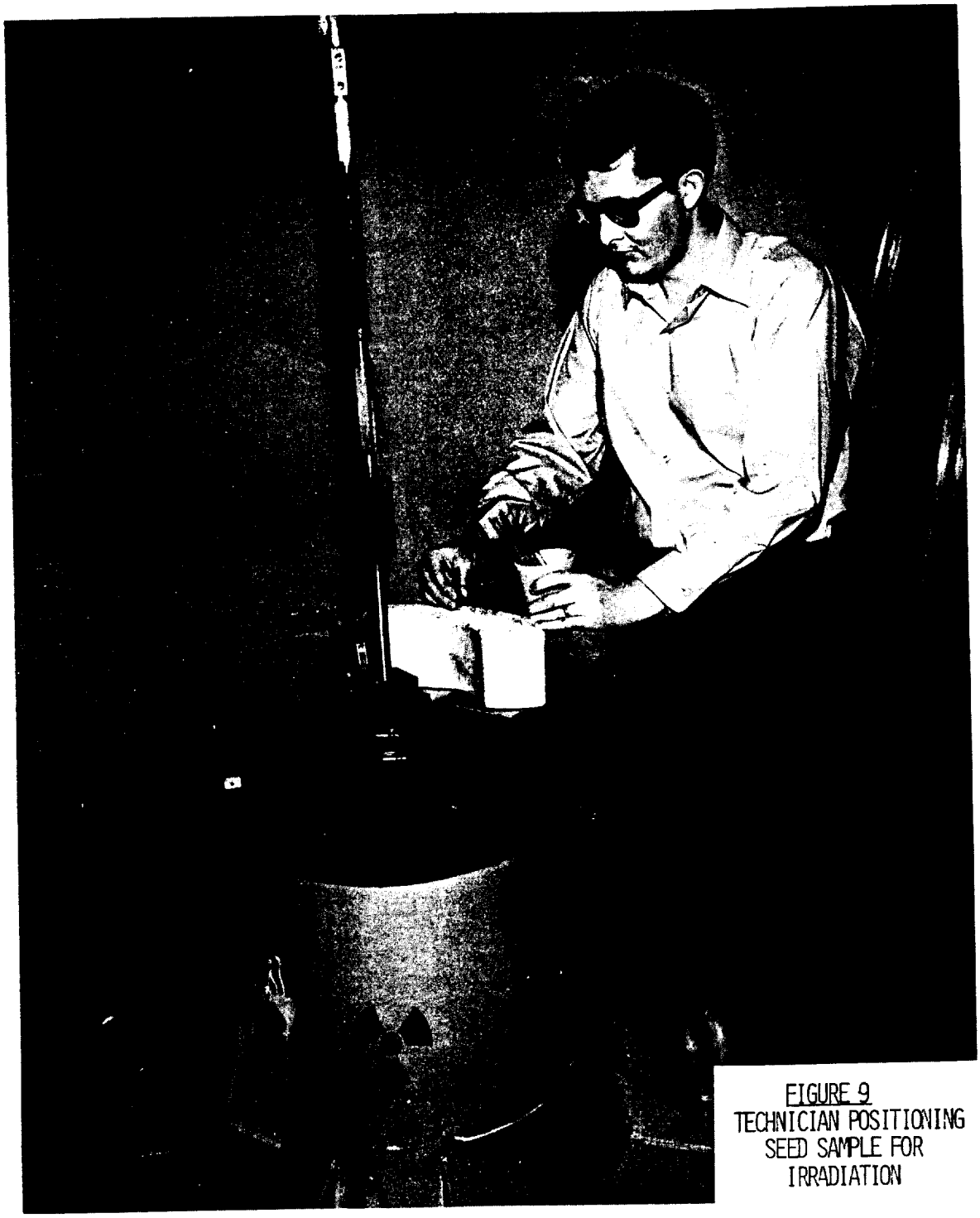


FIGURE 9
TECHNICIAN POSITIONING
SEED SAMPLE FOR
IRRADIATION

disengaged all sources except No. 5 from the drive mechanism which raises the sources since only Source No. 5 was to be used. Employee A meanwhile loaded the four vials for Treatment No. 2. The position of the samples for the experiment is shown in Figure 9.

TABLE I - LETTUCE SEED IRRADIATION SCHEDULE

Category 1: Seeds under O_2 atmosphere

Treatment No.	2	3	4	5	6	7
Dose (kR)	2.5	5.0	7.5	10.0	12.5	15.0
Time (Sec)	52	124	186	248	310	372

Category 2: Seeds under N_2 atmosphere

Treatment No.	9	10	11	12	13	14
Dose (kR)	10	20	30	40	50	60
Time (Sec)	248	496	744	992	1240	1488

Table II is a chronological presentation of events that followed as reconstructed from the Operations Log Book and testimony of the individuals involved.

At 11:36 A.M., subsequent to the exposure of Employee A, a twelve-minute irradiation was conducted. Prior to initiation of this run, Employee B indicated that he tied the door limit switch closed to permit entry into source room with source raised. During this time, Employees A and B attempted to confirm in their own minds whether or not the exposure had actually occurred. This they did by entering the maze to view the raised source briefly. Employee A indicated that he did not observe whether sources were up or down at time he inadvertently entered room. At 11:48 A.M., the irradiated seed samples were removed and a new set placed in position. During this time, while the source was down, a Victoreen Rate Meter was placed in the approximate position where Employee A would have been exposed. At 11:49 A.M., an eight-minute irradiation period was begun. Information on subsequent events is somewhat confused, but it appears that this exposure period timed out at 11:57 A.M.; samples were again changed and a final irradiation started at 11:58 A.M. Shortly thereafter Employees A and B left the VDRIF for lunch. Employee B went immediately to inform the Laboratory Director of the occurrence and after discussions with the Radiation Safety Officer and further discussions with Employee A, it was decided to send Employee A to the ORAU Medical Division for examination. Employee A was admitted to hospital at about 1:30 P.M.

TABLE II. TIME SEQUENCE OF EVENTS PRECEDING AND INCLUDING PERSONNEL EXPOSURE

Time	Interval	Source #5 Position	Operations
11:11 to	11:12	Up	Irradiation of Treatment No. 2 (4 vials).
11:12 to	11:16:15	Down	Employee A enters source room, unloads Treatment No. 2, loads Treatment No. 4 (4 vials).
11:16:15	11:19:21	Up	Irradiation of Treatment No. 4.
11:19:21	11:21	Down	Employee A enters source room, unloads Treatment No. 4, loads Treatment Nos. 5 and 7 (8 vials).
11:21	11:25:04	Up	Irradiation of Treatment Nos. 5 and 7.
11:25:04	11:26:30	Down	Employee A enters source room, unloads Treatment No. 5 (4 vials), loads Treatment No. 3 (4 vials).
11:26:30	11:28:24	Up	Irradiation of Treatment Nos. 3 and 7.
11:28:24	11:30:15	Down	Employee A enters source room, unloads Treatment Nos. 3 and 7, loads Treatment No. 6 (4 vials).
11:30:15	11:33:30*	Up	Irradiation of Treatment No. 6; Employees A and B in control room discuss schedule for balance of experiments.
11:33:30*	11:35*	Up	Employee A enters source room as Employee B turns to make telephone call; Employee A unloads Treatment No. 6 and loads Treatment Nos. 11 and 13 (8 vials).
11:35*	11:35:25	Up	Employee B, unable to complete telephone connection, turns to observe from console that the source is in Up position and realizes that Employee A is in source room. He rushes to door and meets Employee A coming out of the maze. Employee B rushes immediately thru the maze to visually determine position of source. He confirms Source No. 5 is Up and returns to control room. Since he does not recall manually (via down fast button) lowering the source, it is assumed that it lowered according to the programmed exposure time.

*Times estimated by committee from testimony and reconstruction of events. All other times are taken directly from Log Book.

Dosimetry

1. TLD Badge

At the time of exposure to the Cobalt-60 radiation, Employee A was wearing a TLD Badge dosimeter at waist level approximately 10 cm left of center on his belt. The LiF thermoluminescence dosimeter was provided and processed by a commercial supplier located in Santa Fe, New Mexico. The TLD Badge is assumed to provide the best measurement of exposure in this case since reconstruction of the position and time of exposure is not precise enough to accommodate the great variation in dose rate which occurs in close proximity to the source.

Two LiF dosimeters were contained in Employee A's badge. The open-window dosimeter, shielded by 10 mg/cm^2, read 253 Rem, and the other, shielded by a 285 mg/cm^2, read 260 Rem. It is, therefore, concluded that the exposure to the badge worn by Employee A was probably no more than 260 Rem.

2. Incident Reconstruction

a. Total Body Exposure

An attempt was made to provide confirming back up to the badge dosimetry by reconstructing the position of Employee A and the duration of his exposure. Figure 10 is a representation of Employee A's position while unloading and reloading the samples at the time of his exposure. It is noted that the circular wire fence around the source shield is not anchored to the floor; however, based on Employee A's recollection of the operation, it is felt that he would have been no closer to the source than would be required to comfortably reach the sample holder. This position places the badge at 50 cm from the center line of the source rod. In this position, the head is 40 cm from the source rod. Using Lithium Fluoride thermoluminescence and low-Z silver metaphosphate glass dosimeters, the dose rate at the badge was determined to be 570 R/min. It is estimated based on the timed reenactment of the operation that Employee A could have been in approximately this position for 25 to 35 sec. This would place the total body dose estimate at 240 to 340 Rem for this closest proximity to the source. A quality factor of "1" was used in all conversions of roentgens to rems.

If it is assumed that the wire fence was positioned concentrically around the source (as the anchor bolt holes in the floor suggest it had been at some previous time), the distance from source to badge could have been as great as 69 cm and the dose rate would be 390 R/min. Based on the above exposure times, the probable minimum total body dose estimate would be in the range of 160 to 240 Rem.

Dosimetry measurements made on a phantom indicated that the surface dose to the head and the trunk of the body was within approximately 10% of the dose at the waist as would be measured by the badge. Therefore, no further refinement of dose to critical organs such as lens of the eye or gonads is attempted.

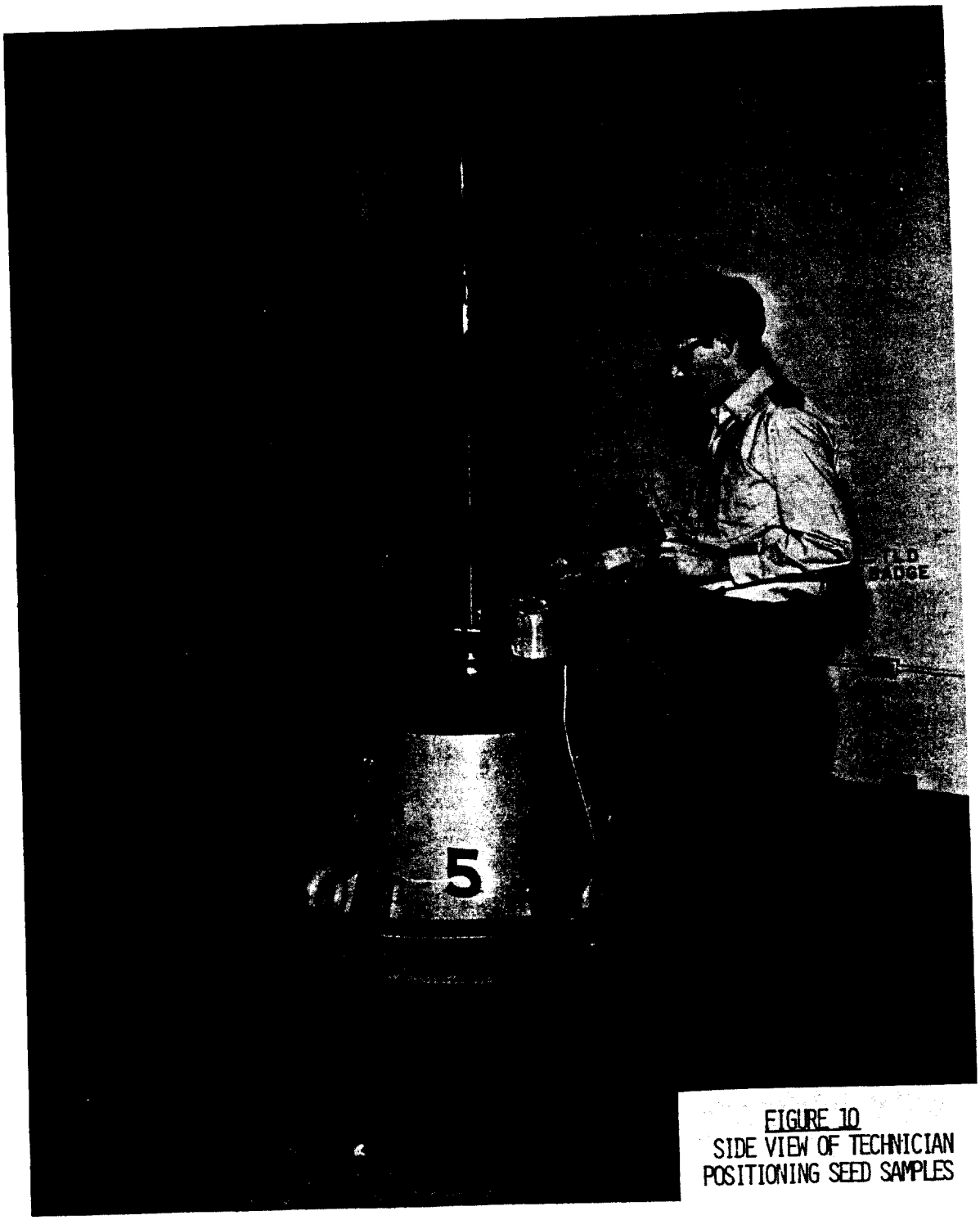


FIGURE 10
SIDE VIEW OF TECHNICIAN
POSITIONING SEED SAMPLES

It is assumed that the exposure received while approaching and leaving position X (See Figure 1) was negligible.

It is evident that the above reenactment of the incident results in dose estimates which bracket the badge dose and tend to confirm its credibility.

b. Hand Exposure

Referring to Figures 9 and 10, the dose rate at Position A is 3400 R/min and at Position C is 900 R/min. Analyses of a video taped reenactment indicate that the right hand would probably have been in Position A for a maximum of 15 seconds and a minimum of 10 seconds. For the balance of the total exposure time, the right hand would have been in Position C. The dose to the right hand is, therefore, estimated to be in the range of 800 to 1200 Rem.

Employee A was not completely certain of the position of the left hand during the operation. Usually, it would be used to steady the sample holder while the exposed vials were unloaded. In this case, to remove the 4 vials would require a 5 second exposure at the dose rate for Position B, i.e., 2000 R/min. For the balance of the operation, 20 to 30 seconds, the left hand would probably have been in Position C. Under these conditions, the left hand exposure would be estimated at 500 to 650 Rem.

If, however, the left hand remained in Position B for the entire unloading-loading operation, the dose would be estimated at from 800 to 1200 Rem. Therefore, the uncertainties involved permit only an estimate that the dose to the right hand is between 800 and 1200 Rem and the dose to the left hand is somewhere between 500 and 1200 Rem.

FINDING OF FACT

1. Employee A entered source room with Source No. 5 raised and received a total body exposure measured by his TLD Badge to be 260 Rem.

2. The electric door lock did not prevent Employee A from opening the door with the source exposed.

3. The door limit switch did not cause the source to be lowered when Employee A opened the door.

4. On February 2, 1971, two days prior to the incident, the door limit switch performed its function properly.

5. On February 2, 1971, the electric door lock failed to perform its function.

6. Incomplete closing of the door resulting in failure of the electric door lock to perform its function had been observed by the operator on previous occasions. Repair had been attempted but operations were continued even though the malfunction persisted. In repeated

tests subsequent to the incident the door closer always failed to close the door far enough to permit engagement of the electric door lock.

7. Repeated checks subsequent to the incident have resulted in proper functioning of the door limit switch.

8. The door limit switch was occasionally bypassed to facilitate operations and the most recent established occasion was on either February 2 or 3, 1971.

9. The source height indicator had a history of erroneous operation and could not be relied on to accurately indicate source position. Employee A stated that the position indicator read zero just prior to the time he entered the source room.

10. Prior to leaving the control room, Employee A failed to observe the flashing red light above the door, the radiation meters in the control room, and upon entering the source room failed to observe the raised source.

11. Repeated checks of the radiation meters, flashing red light in the control room, and control panel lights disclosed no failure of these indicators.

12. Formal procedures for orientation and training personnel participating in the operation of the VDRIF are nonexistent.

13. The operator was in the control room at the time Employee A entered the source room.

14. Employee A was not wearing a "pocket chirper" when he entered the source room, although these instruments were available in the control room.

15. Subsequent to the incident, the flashing red light in the source room was found to be inoperable.

16. Employee B was not wearing a TLD Badge or other personnel monitoring device at the time of the incident.

SIGNATURES OF THE INVESTIGATING COMMITTEE

W. T. Thornton, Chairman

S. J. Ditto

A. F. McFee

RELEASE OF CLAIMS

For and in consideration of the approval of the United States Atomic Energy Commission for a payment to me, [redacted] by my employer, University of Tennessee, as an allowable cost under Contract No. AT-(40-1)-gen-242 between the University of Tennessee and the United States of America, as represented by the Atomic Energy Commission, in the amount of $12,500 over and above any amount I have been paid or may hereafter be paid by said employer or its insurance carrier, Traveler's Insurance Company, under the workmen's compensation laws of the State of Tennessee attributable to an incident of radiation exposure incurred by me while in the performance of my job duties on February 4, 1971; and for and in consideration of the payment to me by University of Tennessee of the said $12,500, receipt of which is hereby acknowledged, I, for myself and for all persons claiming by or through me, hereby waive, release and give up any and all claims, of whatever kind or nature (except any workmen's compensation claim against University of Tennessee), known or unknown, which I now have, if any, or might hereafter have, if any, against the University of Tennessee, the United States of America, the United States Atomic Energy Commission, and its or their officers, employees, agents or representatives.

This release does not affect and is not a release of any workmen's compensation claim or claims I now have or may hereafter have against the University of Tennessee, as employer, or its workmen's compensation carrier, Traveler's Insurance Company, attributable to any job-incurred personal injury or disease arising out of the aforementioned radiation exposure incident of February 4, 1971.

This release is executed this 24 day of October, 1972.

[redacted]

WITNESSES:

[redacted]

Knoxville Tenn
(Address)

[redacted]

Knoxville, Tenn.
(Address)

1024003

[redacted]

Died in April 28

State Supr Court - was loaned from mining claims

Filed Sept 1972
worker comp case
$12,700 - Judge Cole

in 1985 - Lenken Sued Travelers
1986

Oct. 24, 1972
Report for SEC

OFFICIAL USE ONLY

Copy No. 15

PART II

AEC Investigation of Cobalt-60 Exposure at the Variable Dose Rate Irradiation Facility, UT-AEC

(Conclusions and Recommendations of Investigating Committee)

February 4, 1971

OFFICIAL USE ONLY

OFFICIAL USE ONLY

PART II

AEC Investigation of Cobalt-60 Exposure at the Variable Dose Rate Irradiation Facility, UT-AEC

(Conclusions and Recommendations of Investigating Committee)

February 4, 1971

OFFICIAL USE ONLY

CONTENTS

INTRODUCTION AND SUMMARY

On February 4, 1971, at about 11:30 A.M., a research technician employed by the University of Tennessee, and performing work at the University of Tennessee - AEC Agricultural Research Laboratory was exposed to 8,000 curies of Cobalt-60 gamma radiation from Source No. 5 at the Variable Dose Rate Irradiation Facility (VDRIF). The VDRIF is a Government-owned facility operated by the University of Tennessee under Prime Contract No. AT-(40-1)-Gen-242 between the University and the United States of America as represented by the U. S. Atomic Energy Commission. The accidental exposure occurred while the technician was irradiating lettuce seed samples. Thermoluminescence Dosimetry by a commercially supplied TLD Badge worn on his belt indicates a total body exposure of 260 Rem. Essentially all of the exposure dose was received in about thirty seconds while the employee was positioning sample vials in a holder mounted 17 cm from the source rod. The employee's medical symptoms, primarily nausea and vomiting on the first day and leukocyte count depression, are typical of this level of exposure. Hand exposure is estimated to be no greater than 1,200 Rem. The hands had evidenced no visible symptoms of exposure as of 25 days post-exposure. Inadvertent entry by the employee into the source room with Source No. 5 exposed occurred because two automatic safety interlocks did not perform their intended functions. Had either performed properly, this incident probably would have not occurred. Procedural laxity also contributed to the exposure.

Following a preliminary investigation of the facts by UT-AEC and AEC-ORO representatives, the Manager of Oak Ridge Operations Office appointed a formal committee on February 8, 1971, to investigate the occurrence. A copy of the appointment letter is given in Appendix 1.

This section of the investigation report contains the biographical and medical data for the exposed employee and contains conclusions and recommendations of the committee. For detailed facility description, chronology of events, and dosimetry, the reader is referred to Part I of this report.

BIOGRAPHICAL DATA

Name: [redacted]

Date of Birth: December 20, 1938

Sex: Male

Place of Birth: [redacted]

Social Security Number: [redacted]

Position: Research Technician

Place of Employment: UT-AEC Agricultural Research Laboratory

MEDICAL ASPECTS

Employee A was admitted to the Oak Ridge Associated Universities Hospital approximately 2 hours after the exposure. He exhibited considerable nausea and vomiting prior to and during the first few hours after admission, as well as some epigastric pain. Although he stated that his eyes felt

"scratchy" nothing abnormal was seen on examination of the retina. No reddening of the skin was noted. A bone marrow aspirate taken approximately 29 hours post-exposure showed some maturation alteration of the red cell series.

The patient has remained free of symptoms through 25 days post-exposure, except for an early decreased tolerance to exercise, an episode of increased sensitivity to touch on the ulnar aspect of the right hand and a sensation of numbness to the tips of his right thumb and index finger. There was an early rise in the leukocyte count to 15,800 per mm^3 during the first 12 hours followed by a decrease to 7,600. The leukocyte count at 25 days post-exposure was 3,600 per mm^3. This count is not expected to reach its lowest point until 30 days post-exposure.

BIOLOGICAL DOSIMETRY

Leukocyte cultures were performed on blood samples taken approximately 2-1/2 hours after the incident and at several intervals later. Analyses of chromosome aberrations were conducted jointly by representatives of ORNL, ORAU, and UT-AEC. Assuming a 2.5% dose reduction per cm of tissue and a depth to midline of 10 cm, phantom dosimetry corrected for blood volumes indicated a mean midline dose of 165 Rems. Mean chromosome aberration yield in cultures through 11 days post-exposure was 0.235 rings and dicentrics per cell. Fitted to the best available dose-response curves for human leukocytes, this data yielded an average midline dose estimate of 158 Rems. Variations between results obtained by the three laboratories were considered to be within the normal range.

CONCLUSIONS

A. Based on the findings of fact, the committee concludes that the condition of the facility on February 4, 1971, was such that only the proper functioning of the door limit switch would have automatically prevented entry into the source room with sources exposed. Therefore, in view of its proper functioning during tests before and after the incident, it appears most credible to the committee that the door limit switch had been inadvertently left tied in the closed position following operations on February 2 or 3, 1971.

B. It is concluded that the following directly contributed to the exposure of the employee:

   1. Defective electric door lock.

   2. Ambiguity of the source position indicator.

   3. Inadequate orientation and training of Employee A in the safety precautions to be followed at VDRIF.

   4. Inadequate communications between operator and Employee A.

   5. Unsafe operating practices such as:

      a. continuing operation with known defective safety devices (i.e., the electric door lock),

b. failure to use available "pocket chirper" type personnel monitoring equipment, and

c. failure to use TV to observe source position prior to entering source room as specified in the Operation Manual.

6. Failure to maintain the flashing light in the source room in operating condition.

C. It is concluded that the following contributed to a general environment which allowed this incident to occur:

1. Administrative control over the operation of the VDRIF is lax.

2. Operation Manual is incomplete and in some instances ambiguous. The manual had not been distributed to either of the approved operators.

3. No written testing or maintenance procedures or requirements exist and no routine preventive maintenance or testing program was being done.

4. There is no formal procedure for training and certifying operators.

5. The Orientation and Training Program for VDRIF users is not clearly defined and appears to be marginal.

6. Personnel monitoring coverage (i.e., TLD Badging) for persons who work at the VDRIF is incomplete.

D. It is concluded that the VDRIF system design is undesirable in the following aspects:

1. There is no unambiguous indicator of source drive position.

2. The proper functioning of access control devices (i.e., door limit switch and electric door lock) is too dependent on the normal functioning of components designed for precise source positioning. The activation of flashing lights and the horn is also too dependent.

3. The positioning of warning lights is not optimum for their intended purpose.

4. The volume control on the audible warning system is easily accessible for adjustment.

5. The mechanical characteristics of the door lock and door limit switch are unreliable.

RECOMMENDATIONS

A. It is recommended that a reevaluation be made of the protective features of the VDRIF, including administrative as well as automatic; however, it is recognized that a considerable amount of time might elapse before such a review could result in major system changes.

B. It is recommended that the following be done as interim measures to assure that the system can be operated safely:

1. The door lock system should be redesigned so that its operation does not depend so critically on the tight closure of the door.

2. The door limit switch actuator should be modified so that the switch cannot slip past the actuator and falsely indicate that the door is open.

3. The position indicator system should be replaced or supplemented by a simpler more direct measuring system that does not depend upon the encoder which controls positioning, preferably driven by the drive train downstream of the decoupling mechanism.

4. Revise the control system so that opening the door at any time after the "go" button has been pressed will immediately cause the drive to insert the sources or prevent their withdrawal if they have not moved.

5. Repair and relocate the light in the source room and install a lighted sign in the maze which indicates that the sources are not in their shields and entrance is prohibited. Reassignment and relocation of two of the lower limit switches (one, 30 mm and one, overtravel limit) for this latter function would afford a signal that is independent of the normal control system and all other warnings (except for power supply, and that could be supplied by a properly maintained battery system).

6. Adjust loudness level of the audible alarm in the source room with a fixed resistor network and remove the volume control.

7. Repair trouble monitors and test circuits on the radiation meters. Re-install batteries if it is intended that these monitors operate in the absence of AC power.

8. Mount sign on wall at eye level beside door to indicate meaning of flashing light above door to the maze from control room.

C. It is recommended that a testing and maintenance program be established to detect and correct failures at the component level rather than at the system level. The use of redundant devices, such as drive limit switches, gives some immunity to system failure as a result of single component failure. However, unless these component failures are detected and corrected as they occur, the system can become degraded to the point that failure of the system will occur simultaneously with the failure of the

last element. In repairable systems where the utmost reliability is an objective, redundancy, independence of redundant devices, adequate testing, and repair are considered to be essential.

D. It is recommended that formal procedures be established for initiating, documenting, reviewing, approving and implementing system design changes.

E. It is recommended that formal procedure be established to assure that all persons working at the VDRIF wear a TLD Badge and that audible monitoring accompany each entry into the source room.

F. It is recommended that formal procedures be established to assure that VDRIF users are acquainted with the safety aspects of facility operation.

G. It is recommended that additional guidance be provided the VDRIF operator to assure preoperational checks of safety and operating systems.

H. It is recommended that strict formal procedures be provided to define conditions under which safety devices may be bypassed. This should include alternative controls and a procedure for assuring bypass removal.

I. It is recommended that the safety responsibility of the line organization be clearly defined and documented. The audit and advisory responsibility of the RSO does not eliminate the need for this line responsibility.

J. It is recommended that formal procedures be established for certification of a VDRIF operator.

APPENDIX 1 - COMMITTEE APPOINTMENT LETTER

UNITED STATES
ATOMIC ENERGY COMMISSION
OAK RIDGE OPERATIONS
P.O. BOX E
OAK RIDGE, TENNESSEE 37830

AREA CODE 615
TELEPHONE 483-8611

February 8, 1971

Dr. John A. Ewing
Project Leader
UT-AEC Agricultural
Research Laboratory
1299 Bethel Valley Road
Oak Ridge, Tennessee

PROBABLE COBALT-60 EXPOSURE AT THE UT-AEC AGRICULTURAL RESEARCH LABORATORY

Dear Dr. Ewing:

It appears from preliminary technical and medical considerations that the radiation exposure occurrence at the ARL on February 4, 1971, involving Mr [redacted] falls within the criteria for a Class "A" radiation exposure as defined by AEC and OR-0502 and should, therefore, be formally investigated. In accordance with the provisions of AEC-0502, the following individuals are hereby designated to serve on the investigating committee:

W. T. Thornton, AEC, Chairman
S. J. Ditto, UCC-ND, ORNL
A. F. McFee, UT-AEC, ARL

The committee shall follow the guidance of AEC and OR-0502 in investigating and reporting on this occurrence. It is requested that full cooperation be extended to the committee by members of your staff.

Mr. Kenneth D. McCasland of our Chief Counsel's Office has been assigned to act as legal advisor to the committee.

Your cooperation in this matter will be appreciated.

Sincerely,

for S. R. Sapirie
Manager
Oak Ridge Operations

OSH:WTT

cc: R. F. Hibbs, UCC-ND
R. C. Armstrong
C. W. Hill
H. M. Roth
J. A. Lenhard
W. T. Thornton

APPENDIX 2 - IDENTIFICATION OF OTHER UNIVERSITY OF TENNESSEE EMPLOYEES

Employee B - [redacted]

Employee C - [redacted]

Employee D - [redacted]

Employee E - [redacted]

APPENDIX 3 - TESTIMONY OF [redacted]

The following account, to the best of my recollections, is pertaining to the accident of Thursday, February 4, 1971:

The irradiation of the seeds had been scheduled for Thursday morning from 8:30 A.M. to 10 00 A.M. However, due to the fact that Mr. [redacted] had gone to have his medical examination I was planning to run it from 12:30 P.M. to 3:30 P.M. He came back about 11:00 A.M. and asked me if I wanted to run some of the treatment before lunch. We then agreed to run half of the experiment before lunch and the rest (9-14) after lunch. By the time we arrived at the source it was about 11:10 A.M.

As soon as we arrived, I proceeded to gather the first vials for the 1st run. These were treatment No. 2, (please see schedule sheet). As usual, I informed Mr. [redacted] of the time the run would take as well as the dose, in this case 62 sec and 2.5 kR. We both proceeded to go into the irradiation room where he fixed the other sources, so they would not go up, as I placed the styrofoam and the vials in front of the source which we have used in the past. We then returned to the control room and while Mr. [redacted] operated the machine, I got the next vials ready. When that 1st run finished, I gave him the time and dose for the next run. Then I went to the source and exchanged vials and returned to the room. The same procedure was observed for runs Nos. 2, 3, and 4. When run No. 4 was finished I gave him the time (310 sec) and the dose (12.5 kR). Then I proceeded to go to the source, got the 8 vials out and placed the next 4 vials in. When I returned to the control room I sat down--that was when I noticed the white piece of string on the mechanism over the door leading into the irradiation room. However, I did not think much about it since we had no problem with the door that day. After Mr. [redacted] finished operating the machine he turned around and we began to talk. At this point it was approximately 11:25 A.M. In the course of conversation, the subject came up about making another run before lunch or not. Since I was a bit hesitatnt, Mr. [redacted] suggested to go ahead and calculate how long it would take to run the rest of the treatments (9-14). He then suggested to run treatments 11, 13, and 10 for a total of approximately 20 minutes (1240 sec) and then let treatments 12, 14 run for 992 sec and in the meantime go to lunch and later come back and finish the runs. Even though I was not too much in favor of the idea of splitting the last batch of treatments; nevertheless,I said it was a good idea and agreed to do it that way. Now, as soon as I agreed to do it, he said "Well, let's put them on then," which I replied, "I am ready." As soon as I said that I looked over his right shoulder and glanced at the lights which indicates the elevation of the rod--they were all zeros. Therefore, I assumed that our discussion had taken longer than 5 minutes and that he had seen or heard the source shut down. The reason I looked at the meter lights was because in all previous runs that day they had indicated whether the source was up or down. So, I got up out of the chair, got the 8 vials to be run and told Mr. [redacted] the time and the dose (744 sec, 30 kR) and as I was walking toward the door, I was making sure I had picked the right vials (that's why I did not see the red light flashing above the door). Then I opened the door (no resistance whatsoever) and walked toward the source. As I was walking, I was thinking of splitting those last treatments would be such a good idea. I do not remember looking at the rod in as much as I expected it to be down. As I got near the source, I made a slight turn right so as to position myself in front of the vials. Now at this point, I do not remember if I placed the coffee cup (which I use whenever there are more than four vials) on a wooden horse between my back and the wall; or if I held the cup with my left hand and fished the four vials out of the styrofoam container. The end result was

that I exchanged the four vials from treatment 6 and loaded the 8 vials from treatments 11 and 13 in an alternating way (that is to say, I fished out one vial of treatment 13 and put it on the 3rd hole from right to left, then one of treatment 11 and placed it on the 4th hole, etc.) When I finished I just walked back toward the door. As I was approaching the door to enter into the control room, I saw Mr. [redacted] on the other side of the door. He then opened the door and came out into the hallway and very excitedly asked me if I did not see that the source was up! When I replied that I had not seen it, he then ran and looked (from the corner) to the source. We then came back into the control room. When I entered the room, I was in a state of shock, that is why it did not occur to me to glance at the 3 meters on the wall to see if they registered any activity which would have indicated to me whether the source was up or down. Besides that, I thought that if [redacted] had detected that the source was up, he would have shut it down immediately.

Now, from here on out, I am only certain of several things while the others are hazy. I very hazily remember him going in front of the machine for just a few seconds and then go to the door and try to open it several times. Then we engaged in a discussion concerning whether the source was up or down at the time I went there. He asked me several times if the door opened when I tried it, which I answered yes. Then he told me that the source must have been down. He also asked me if I could tell the difference of it being up or down. I said I never have seen it in the up position. Then, I believe, before he activated the source for run No. 6, he went to the door, opened it and fastened so that it would stay open. Then he reached to the upper left hand corner of the door frame and with that white piece of string which I mentioned before, he fixed the mechanism somehow so that he could activate the source. We then went out into the hallway around the bend and looked at the source in the up position. Then again he asked me "Surely, you would have noticed the source that way, didn't you?" I replied that I had not even looked at the rod when I went down. We proceeded to go back to the room. I am not sure if he closed the door then, or waited until the run was over--also, I do not recall him untying the string. Up to this point, I was not sure if I had been exposed or not--so when I would try to reach some conclusion, he would indicate that the source must have been down. Now, when run No. 6 was over, I again gave him the time and dose for run No. 7. Then we both went down to the source and while I was exchanging the vials, he obtained a rate meter and proceeded to position it where I had stood. We returned back to the room and he activated the source and looked at some meters on top of the machine. He then acted rather nervous and sat down. At this point, I asked him if he had, on run No. 5 erased the numbers which indicates the elevation of the rod. At this point he did not answer me, but got up and went outside (through the front door). This behavior, plus his nervousness, gave me strong indication that I had been exposed. That run finished, we put another one to run while we took a break for lunch. During most of the 7th run and during our way back to the lab, we did not say much. When he parked the car and we got out, he said, "See you after lunch." This was approximately 12:10 P.M. This is what happened, to the best of my recollection.

[redacted]

February 9, 1971

SIGNATURES OF THE INVESTIGATING COMMITTEE

W. T. Thornton, Chairman

S. J. Ditto

A. F. McFee

(2)

NOTE TO EDITORS AND CORRESPONDENTS:

Following for your information is the text of an announcement read to Oak Ridge area newspapers, radio and wire services on February 6, 1971. Also attached is a copy of an earlier announcement which was given to the same media on February 5, 1971.

(2)

NEWS

OAK RIDGE OPERATIONS
UNITED STATES
ATOMIC ENERGY COMMISSION
OAK RIDGE, TENN. 37830

FOR IMMEDIATE RELEASE
No. 3090

Telephone No. - Area Code 615
483-8611 Extension 3 4231

OAK RIDGE TECHNICIAN RECEIVED SIGNIFICANT RADIATION DOSE

A technician who was exposed to radiation in an Oak Ridge facility February 4 continues under observation today in the Medical Division Hospital of Oak Ridge Associated Universities.

A radiation detection badge the man was wearing indicates he received an exposure of about 260 rem. A rem is a unit of radiation measurement which represents the effective exposure to tissue for any type of radiation.

Attending physicians describe this level of exposure as being significant and requiring careful medical surveillance with hospitalization necessary for some five to six weeks. This exposure is below levels which normally are considered to be critical.

Physicians today continue to be satisfied with the patient's general condition.

The man was exposed at the Atomic Energy Commission's Agricultural Research Laboratory when he and another technician were irradiating seeds using a radioactive cobalt source. Preliminary investigation indicated that the man inadvertently entered a room containing the source before it had been returned to its shielded container.

# # #

February 6, 1971

NEWS

OAK RIDGE OPERATIONS
UNITED STATES
ATOMIC ENERGY COMMISSION
OAK RIDGE, TENN. 37830

3

FOR IMMEDIATE RELEASE
No. 3094

Telephone No. - Area Code 615
483-8611 - Extension 3-4231

TECHNICIAN RELEASED FROM HOSPITAL

A technician who was exposed to radiation in an Oak Ridge facility February 4 has been released from the Medical Division Hospital of Oak Ridge Associated Universities.

Attending physicians said the technician was released March 24 after clinical data indicated he was past the point when he would be particularly susceptible to infection and could be permitted to return home. Periodic tests and examination will be continued on an out-patient basis.

Physicians said the technician showed predicted distinct radiation effects by laboratory tests, but his general clinical condition was good at all times.

The man had been in the hospital's specially designed "clean room" since returning to the hospital March 1 as an added precaution against infection. He had spent eight days at the hospital immediately following the incident and then was permitted to return home until data from daily tests indicated he needed the protection of a special environment.

(MORE)

The technician was exposed to radiation at the Atomic Energy Commission's Agricultural Research Laboratory, operated for AEC by University of Tennessee, when he inadvertently entered a room before a radioactive cobalt source had been returned to its shielded container. He was irradiating seeds when the incident occurred.

A radiation detection device the man was wearing at the time showed he received an exposure of about 260 rem. A rem is a unit of radiation measurement which represents the effective exposure to tissue for any type of radiation.

# # #

March 25, 1971

NOTE TO EDITORS AND CORRESPONDENTS:

Following for your information is the text of an announcement read to Oak Ridge area newspapers, radio and wire services on February 6, 1971. Also attached is a copy of an earlier announcement which was given to the same media on February 5, 1971.

NEWS

OAK RIDGE OPERATIONS
UNITED STATES
ATOMIC ENERGY COMMISSION
OAK RIDGE, TENN. 37830

FOR IMMEDIATE RELEASE
No. 3090

Telephone No. - Area Code 615
483-8611 Extension 3 4231

OAK RIDGE TECHNICIAN RECEIVED SIGNIFICANT RADIATION DOSE

A technician who was exposed to radiation in an Oak Ridge facility February 4 continues under observation today in the Medical Division Hospital of Oak Ridge Associated Universities.

A radiation detection badge the man was wearing indicates he received an exposure of about 260 rem. A rem is a unit of radiation measurement which represents the effective exposure to tissue for any type of radiation.

Attending physicians describe this level of exposure as being significant and requiring careful medical surveillance with hospitalization necessary for some five to six weeks. This exposure is below levels which normally are considered to be critical.

Physicians today continue to be satisfied with the patient's general condition.

The man was exposed at the Atomic Energy Commission's Agricultural Research Laboratory when he and another technician were irradiating seeds using a radioactive cobalt source. Preliminary investigation indicated that the man inadvertently entered a room containing the source before it had been returned to its shielded container.

# # #

February 6, 1971

NEWS

OAK RIDGE OPERATIONS
UNITED STATES
ATOMIC ENERGY COMMISSION
OAK RIDGE, TENN. 37830

FOR IMMEDIATE RELEASE
No. 3089

Telephone No. - Area Code 615
483-8611 - Extension 3-4231

OAK RIDGE TECHNICIAN IN HOSPITAL
FOLLOWING SYMPTOMS OF RADIATION EXPOSURE

A technician at the Atomic Energy Commission's Agricultural Research Laboratory is in an Oak Ridge hospital today for observation and tests following an incident yesterday after which he showed symptoms of exposure to radiation.

The technician was admitted to the Medical Division of Oak Ridge Associated Universities. He is an employee of the University of Tennessee, which operates the Agricultural Research Laboratory for the AEC.

The technician is believed to have been exposed to a cobalt-60 radiation source shortly before noon yesterday (February 4) when he and another technician were irradiating seeds for use in the Laboratory's experimental programs.

Preliminary investigation of the incident indicates that the man inadvertently entered a room where the irradiation was being carried out while the radioactive source was still outside its shielded container. The door through which he passed to enter the room has two interlock systems designed to prevent inadvertent exposure.

An investigating committee has been named to look into the causes of the accident.

(MORE)

The facility in which the incident occurred is known as the Variable Dose Rate Irradiation Facility and is used routinely for irradiations involving research programs with both plants and animals.

It is heavily shielded with a separate control room to permit remote operation of the radiation sources after specimens for irradiation have been placed within the room.

# # #

February 5, 1971

NEWS

OAK RIDGE OPERATIONS
UNITED STATES
ATOMIC ENERGY COMMISSION
OAK RIDGE, TENN. 37830

FOR IMMEDIATE RELEASE
No. 3089

Telephone No. - Area Code 615
483-8611 - Extension 3-4231

OAK RIDGE TECHNICIAN IN HOSPITAL
FOLLOWING SYMPTOMS OF RADIATION EXPOSURE

A technician at the Atomic Energy Commission's Agricultural Research Laboratory is in an Oak Ridge hospital today for observation and tests following an incident yesterday after which he showed symptoms of exposure to radiation.

The technician was admitted to the Medical Division of Oak Ridge Associated Universities. He is an employee of the University of Tennessee, which operates the Agricultural Research Laboratory for the AEC.

The technician is believed to have been exposed to a cobalt-60 radiation source shortly before noon yesterday (February 4) when he and another technician were irradiating seeds for use in the Laboratory's experimental programs.

Preliminary investigation of the incident indicates that the man inadvertently entered a room where the irradiation was being carried out while the radioactive source was still outside its shielded container. The door through which he passed to enter the room has two interlock systems designed to prevent inadvertent exposure.

An investigating committee has been named to look into the causes of the accident.

(MORE)

The facility in which the incident occurred is known as the Variable Dose Rate Irradiation Facility and is used routinely for irradiations involving research programs with both plants and animals.

It is heavily shielded with a separate control room to permit remote operation of the radiation sources after specimens for irradiation have been placed within the room.

# # #

February 5, 1971

NEWS

OAK RIDGE OPERATIONS
UNITED STATES
ATOMIC ENERGY COMMISSION
OAK RIDGE, TENN. 37830

FOR IMMEDIATE RELEASE
No. 3094

Telephone No. - Area Code 615
483-8611 - Extension 3-4231

TECHNICIAN RELEASED FROM HOSPITAL

A technician who was exposed to radiation in an Oak Ridge facility February 4 has been released from the Medical Division Hospital of Oak Ridge Associated Universities.

Attending physicians said the technician was released March 24 after clinical data indicated he was past the point when he would be particularly susceptible to infection and could be permitted to return home. Periodic tests and examination will be continued on an out-patient basis.

Physicians said the technician showed predicted distinct radiation effects by laboratory tests, but his general clinical condition was good at all times.

The man had been in the hospital's specially designed "clean room" since returning to the hospital March 1 as an added precaution against infection. He had spent eight days at the hospital immediately following the incident and then was permitted to return home until data from daily tests indicated he needed the protection of a special environment.

(MORE)

The technician was exposed to radiation at the Atomic Energy Commission's Agricultural Research Laboratory, operated for AEC by University of Tennessee, when he inadvertently entered a room before a radioactive cobalt source had been returned to its shielded container. He was irradiating seeds when the incident occurred.

A radiation detection device the man was wearing at the time showed he received an exposure of about 260 rem. A rem is a unit of radiation measurement which represents the effective exposure to tissue for any type of radiation.

# # #

March 25, 1971

UNITED STATES
ATOMIC ENERGY COMMISSION
RICHLAND OPERATIONS OFFICE
P. O. BOX 550
RICHLAND, WASHINGTON 99352

March 2, 1971

To Files

CALL FROM TRI-CITY HERALD REGARDING EXPOSURE OF AN OAK RIDGE TECHNICIAN TO 260 REM, 2/4/71. (OR PRESS RELEASE 3089, 2/5/71)

Marilyn Druby called and wanted the following:

1. What is the present status of the man at OR who had received the 260 rem?

2. How does this compare to the highest level of exposure ever at Hanford?

3. What is the lethal dose (LD 50/30)?

I called Wayne Range at OR and he told me that, "the attending physicians are satisfied with the man's condition: he is at home and is up and around and eating normally." He was released on the 11th and is still giving daily blood samples.

The lethal dose is 450 rem (300 rad) surface dose. (per Dr. Lotz) LD 50/30

The highest level exposure at Hanford was incurred on April 7, 1962 (Recuplex) when four men were exposed. The four were hospitalized- one was discharged on the 8th of April. The exposure ranged from 19 to 110 rem. "The incident occured in a transfer tank during a cleaning and maintenance operation. They (the workers) were placed in the hospital for medical observation and testing immediately following the incident, but returned to work in 9 days and still show no radiation effects."*

The above information was passed on to the Tri-City Herald on March 1, 1971.

(The April 13, 1962 and April 27, 1962 GE News carried full accounts of this incident.)

James P. Crane, Public Information Officer
Information Division

*from 1962 Annual Report to Congress

1024030

A technician who was exposed to radiation in an Oak Ridge facility February 4 continues under observation today in the Medical Division Hospital of Oak Ridge Associated Universities.

A radiation detection badge the man was wearing indicates he received an exposure of about 260 rem. A rem is a unit of radiation measurement which represents the effective exposure to tissue for any type of radiation.

Attending physicians describe this level of exposure as being significant and requiring careful medical surveillance with hospitalization necessary for some five to six weeks. This exposure is below levels which normally are considered to be critical. ~~result in fatalities.~~

Physicians today continue to be satisfied with the patient's general condition.

The man was exposed at the Atomic Energy Commission's Agricultural Research Laboratory when he and another technician were irradiating seeds using a radioactive cobalt source. Preliminary investigation indicated that the man inadvertently entered a room containing the source before it had been returned to its shielded container.