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REPOSITORY DOE-OHRE

COLLECTION PLUTONIUM INJECTION

BOX NO. 1

FOLDER Center for Human Radiobiology (40-004)

40-004

ARGONNE
NATIONAL
LABORATORY

INTRA-LABORATORY MEMO

November 27, 1985

TO: E. Huberman

FROM: R. A. Schlenker RAS

SUBJECT: Freedom of Information Act Request

We have been unable to locate the memo from Rowland to Schultz dated December 21, 1972 which you requested about 5:15 p.m. yesterday following the receipt of a letter from D. T. Goldman to A. Schriesheim concerning this matter. As today is the last business day before the deadline, December 2, further search is not possible without missing the deadline. Locating this memo is complicated by the fact that Rowland retired about two years ago and Schultz is dead.

Other intra-laboratory memos on the 18 plutonium research subjects referred to in the Goldman letter, mention them by name and give personal information about them. The release of such documents would be a violation of the patients' privacy and the right-to-privacy is protected by law. It would also constitute a violation of normal ethical practice in the handling of patient medical records.

The subjects referred to have been studied by several organizations since the mid 1940s. Non-personal information can be found in the scientific literature. A good review and guide to the literature up to the time of its publication can be found in Patricia W. Durbin, "Plutonium in Man: A New Look at the Old Data," pp.469-530, Radiobiology of Plutonium, Edited by Betsy J. Stover and Webster S.S. Jee, Published by the J. W. Press, Department of Anatomy, University of Utah, Salt Lake City, 1972.

lw

8000330

ARGONNE
NATIONAL
LABORATORY

INTRA-LABORATORY MEMO

April 7, 1978

TO: CHR Records File

FROM: A. F. Stehney

SUBJECT: Return of remains of Case No. 40-004

On April 6 I phoned , about returning the remains of her father which had been exhumed in 1975. I apologized for the delay and said that we had had difficulty in applying the techniques necessary for plutonium. I told her that we resolved our problems, the remains have now been sent to Austin, which should receive them in a few days. I emphasized that the delay was no fault of Dr. Lieben's.

did not seem upset that we had not returned the remains within a year as originally indicated. She seemed more concerned about whether we had been able to accomplish our objectives and said that we could have returned them in five years if necessary. She had written to make sure that her father's remains were not forgotten. I said that we had obtained new information about plutonium that we could not have otherwise obtained, and I thanked her for her cooperation. She thanked me for phoning and seemed quite satisfied with the outcome.

A. F. Stehney

AFS:frc
cc: J. Lieben, M. D.
G. J. Hamilton

FROM Dr. Jan Lieben
The Cambridge
~~School House Lane~~
Philadelphia, Pa. 19144

TO
B. L. Guess Lighting Co.
221 SO. STAPLES
CORPUS CHRISTI, TEXAS 78401
Phone: 882-3387

SUBJECT: In June of 1975 my father's remains were exhumed and sent to the Center for Human Radiobiology of the Argonne National Laboratory in Argonne, Ill. I was under the impression that they would be returned to Austin, Texas after about a year's use for experimentation. However, to date they have not been sent back and I am writing you to find out when I can expect them to be. Your prompt reply and cooperation will be greatly appreciated.

DATE: Mar. 22, 1978

FOLD

(Remains of _____,)

Home address:

RETURN TO → SIGNED

/ / /

c / c

/ / /

/ / /

This is terrible!!

DATE SIGNED

GRAYARC CO., INC., BROOKLYN, N.Y. PERSON ADDRESSED RETURN THIS CC TO SENDER

ARGONNE NATIONAL LABORATORY
U of C-AUA-USAEC

PRIVACY ACT MATERIAL REMOVED

CENTER FOR HUMAN RADIOBIOLOGY

Argonne National Laboratory • Massachusetts Institute of Technology • New Jersey Field Station • Southwest Field Station

April 28, 1975

MEMO TO: File

F R O M: Mary Margaret Shanahan

SUBJECT: case no. 40-004

The current address for the funeral director for the late _____ is:

MMS:mgs
xc: M. H. Chalfen
A. F. Stehney
J. E. Farnham

PRIVACY ACT MATERIAL REMOVED

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
RADIOACTIVITY CENTER Room 4-063
Cambridge, Massachusetts 02139 Tel. 617-253-4831

ARGONNE
NATIONAL
LABORATORY

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INTRA-LABORATORY MEMO

Received: March 28, 1975 (b)

TO: CHR Records Room

FROM: Jan Lieben, M.D.

SUBJECT: Contacts

3/22/75:

10. Drove to _____, phone _____. Met with _____, sister of _____. She is the only relative left of _____. Obtained her signature for exhumation of _____. In return she asked me to help her find _____ the husband of _____ who was born in Orange, N.J. and whom she had last seen at _____ funeral. He was in the Navy then and had decided to make the Navy his career. I consented to try for it — particularly since we'll need her signature for the exhumation of her sister _____ if I can get _____ consent.

11. Visited again home of _____ (has an unlisted phone) in Union, N. J. The house is still closed up so I assume he has not returned from Florida yet. (This was my third visit.)

3/24/75:

12. Re _____ Received signatures from _____ and from _____. This completes this plutonium case.

13. Forwarded above to M. M. Shanahan.

JL:jmt

cc: A. M. Brues
J. E. Farnham
M. M. Shanahan
A. F. Stehney

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ANL-26 (11-68)

ARGONNE NATIONAL LABORATORY

PRIVACY ACT MATERIAL REMOVED

INTRA-LABORATORY MEMO

Received: March 28, 1975 (a)

TO: CHR Records Room

FROM: Jan Lieben, M.D.

SUBJECT: Contacts

7.

3/13/75:

1. Called _____ at _____, Louisiana 70053, phone _____. Explained our request and he agreed to sign exhumation form.

2. Wrote letter to _____ and forwarded forms.

3/17/75:

3. Called _____, phone _____, re exhumation of _____ (see report of 3/7/75). _____ has made no statement against any exhumation to _____. Will now call _____.

4. Obtained photocopies of Health Passport of _____.

3/18/75:

5. Called _____ and informed him of _____ statement (see item #3). "I will have to call him" said _____. "Send me the forms."

6. Sent letter with his father's Health Passport which I had copied and exhumation forms to _____.

3/21/75:

7. Received signature re exhumation of _____ from his son, _____. This now gives us four of six signatures.

8. Made appointment to see _____ re exhumation of _____.

PRIVACY ACT MATERIAL REMOVED

3/22/75:

9. Mailed _____ signature for _____ signature for _____ and _____ copies of Health Passport to M. M. Shanahan.

NOTE: This is almost all from the 1921 Payroll. There are a few odds and ends left like _____ in Union, N.J., _____ in Hollywood, _____ in Highlands, N.J. and another very few leads to be followed up.

JL:jmt

cc: A. M. Brues J. E. Farnham M. M. Shanahan A. F. Stehney

8000335

ANL-26 (11-68)

ARGONNE
NATIONAL
LABORATORY

PRIVACY ACT MATERIAL REMOVED

INTRA-LABORATORY MEMO

Received: March 18, 1975 (b)

TO: CHR Records Room

FROM: Jan Lieben, M. D.

SUBJECT: Texas

3/7/75

1) Visited the , Austin, Texas, phone . He definitely knew that his grandfather did not drink any radium water. I discussed the fact that his father had promised me he would come to MIT for measurements. knew this. He thinks he might go along with the exhumation unless his father had expressly made a statement regarding being against exhumation to his lawyer, Leo T. Sullivan, of Bell Air, Maryland, phone 838-4700. I am to call Sullivan and then him. He loaned me his father's Health Passport a medical history which I shall copy and return to him. (One of my most successful trips so far.)

2) Forwarded signatures of , and to .

3) Wrote letters to and re: exhumation.

JL:nml

PRIVACY ACT MATERIAL REMOVED

cc: A. M. Brues
J. E. Farnham
M. M. Shanahan
A. F. Stehney

8000336

ANL-26 (11-68)

ARGONNE NATIONAL LABORATORY

PRIVACY ACT MATERIAL REMOVED

INTRA-LABORATORY MEMO

Received: March 18, 1975 (a)

TO: CHR Records Room

FROM: Jan Lieben, M. D.

SUBJECT: Texas

3/6/75

1) Re ( ). Visited San Antonio, Texas, phone . Obtained last and final signature for exhumation of his mother. This concludes this case.

2) Visited at , phone . A son of above. Obtained his signature for exhumation of his father, . There are 3 more brothers and 2 sisters in the family. From his home we called . Obtained his verbal o.k. Then we called . Obtained her verbal o.k. Will send forms to both of them. The family is split up. The above three do not talk to the following three.

3/7/75

3) Visited . at , phone (home) (summer residence). Obtained his signature.

4) Made appointment to visit 2nd daughter, ( ) at her residence, phone (home) (business).

5) Made visit. Obtained signature. From her house I called the 4th brother at . He was not home. Am to call him at home next Thursday when he will return from a business trip. All members of family were informed that had plutonium injections which they seemed to know.

JL:nml

PRIVACY ACT MATERIAL REMOVED

cc: A. M. Brues
J. E. Farnham
M. M. Shanahan
A. F. Stehney

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ANL-26 (11-68)

ARGONNE
NATIONAL
LABORATORY

PRIVACY ACT MATERIAL REMOVED

INTRA-LABORATORY MEMO

Received: February 27, 1975 (a)

TO: CHR Records Room

FROM: Jan Lieben, M.D.

SUBJECT: Phone Calls

1. Called re her children. "My daughter is of . She'll talk to you. My son is very busy — you start with her.

2. Re . Called for at . "No here — don't know where they are."

3. Re . Finally reached , phone . "No I was not executor of — there must be another ."

4. Re . Called re his brother's whereabouts. "I'll have dinner with him this weekend — he is back — call me next week."

5. Re . Called in re death records. Spoke to . The section is owned by of . Information gave his phone as .

40-004

6. Re . Called (see #1 above). "Am busy with a bridge club now, call me some other time."

7. Re Sisters. Reached and explained our interest. "Will you please let me have a description of what you are doing and what you want so I can discuss it with my brother. He is against it, my mother says; I have not made up my mind as yet.

8. Asked M. M. Shanahan to write to .

JL:jmt
cc: A. M. Brues
J. E. Farnham
M. M. Shanahan
A. F. Stehney

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ANL-26 (11-68)

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CENTER FOR HUMAN RADIOBIOLOGY

September 11, 1973

Please reply to:
Southwest Field Station
M.I.T. Radioactivity Center
5619 E. Monterosa Street
Phoenix, Arizona 85018
Tel. 602-949-5600

MEMO TO: Jan Lieben, M.D.

F R O M: Mary Margaret Shanahan

SUBJECT: 40-004

I decided to try my luck at locating someone who could help us find the next-of-kin of who died in Chicago in 1945 and who was buried in a "local cemetery" in Austin, Texas.

I finally deciphered the name of the Chicago undertaker as being on . Since they were no longer listed in the Blue Book I hunted for another undertaker on Cottage Grove Avenue, discussed the problem with them, learned that had been out of business for some years, the building is now occupied by the Masonic Order, and that I should call Mr. Stanton at the Chicago Board of Health (744-3804) for information on . Mr. Stanton was very helpful, having been involved in matters of this sort for some 40 years. He said that there were only two people in Chicago who would know about the records of (Mr. O'Connor of Brown Funeral Home on East 95th Street or Bilger and Sons on East 87th Street).

Instead of calling either of the above persons I decided to go through all the undertakers in Austin (8) in the hope that whoever buried would still be in business. My first call was to t Funeral Home, 1100 Colorado Street, tel. 512-476-[illegible]. As the lady who answered said, "You've hit the jack pot today". She agreed to look at their detailed records on the burial, warning me that at sometime in the 1940's they had had a fire, and sure enough 1945 was the year of the fire! She was able to tell me that was buried in Cemetery but that the records for are maintained by the ( ).

I had previously checked telephone information and found that there were no listings for or . I did call who lived on 9-1/2 street (the lived on tel. , but there were no in her family. I tried tel. several times but no answer. The Assumption Cemetery is on an automatic answering service and you have about 25 seconds to leave your message. I did not leave one, thinking that at this point you would probably want to continue the search for next-of-kin.

s

PRIVACY ACT MATERIAL REMOVED

xc: M.H.Chalfen
A.F.Stehney

8000339

RECEIVED
CHR RECORDS
SEP 18 1973

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CENTER FOR HUMAN RADIOBIOLOGY

Argonne National Laboratory • Massachusetts Institute of Technology • New Jersey Field Station • Southwest Field Station

TO: M. M. Shanahan MIT Radioactivity Center

FROM: A. F. Stehney RER Division

SUBJECT: Exhumation of CHR cases with prefix number 40.

Enclosed are folders containing copies of all CHR information on ten radioactivity patients in the "40" series. These are all the cases in this series for which we now have death certificates.

Please take the necessary steps to locate relatives and obtain permissions to exhume any or all of these ten persons. It should be noted that we want to examine the remains in order to determine the microscopic distribution of residual radioactivity from past medical treatment.

Date

A. F. Stehney, Deputy Director
Center for Human Radiobiology

Today, I received from A. F. Stehney copies of folders for the following ten CHR cases:

40-001	40-005	40-008	40-011	40-015
40-004	40-007	40-010	40-013	40-017

Date

M. M. Shanahan, Deputy Director
MIT Radioactivity Center

dk

cc: R. D. Evans
R. E. Rowland
CHR Records Room

PRIVACY ACT MATERIAL REMOVED

8000340

CENTER FOR HUMAN RADIOBIOLOGY
9700 S. Cass Avenue, Argonne, Illinois 60439 Tel. 312-739-7711 Ext. 4625

Orig.: Purch. Dept.
cc: R. E. Rowland
A. F. Stehney

PRIVACY ACT MATERIAL REMOVED

CENTER FOR HUMAN RADIOBIOLOGY

January 2, 1973

Mr. Leo A. Oster
Chief, Office of Vital Records and
Deputy State Registrar
Springfield, Illinois 62706

Dear Mr. Oster:

We would like very much to have you search the death records of Illinois for the two names below. We do not have the residential addresses, but hope that you can locate the records from the information we do have.

(Female)
Date of Birth: about _____
Date of Death: 13 January 1965
(Place of Death: Billings Memorial Hospital, Chicago)
(Occupation: High School Teacher)

Date of Birth: about _____
Date of Death: _____
(Place of Death: Billings Memorial Hospital, Chicago)
(Occupation: Machinist)

Again, I am asking that the scientific search fee of $1.00 per name be sent in advance. Please send the results of your search to my personal attention, at the address at the bottom of the page.

Many thanks for your continuing cooperation.

Very truly yours,

PRIVACY ACT MATERIAL REMOVED

Harvey A. Schultz
Curator of Records
Center for Human Radiobiology

dk

RADIOLOGICAL AND ENVIRONMENTAL RESEARCH DIVISION, ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue, Argonne, Illinois 60439 Telephone 312-739-7711

CORRESPONDENCE/PICTURES

8000342

ARGONNE NATIONAL LABORATORY

Radiological and Environmental
Research Division

R. E. Rowland
Director

Harvey

These two contributions should be added to the file of the Pu case identified as Ch.-1.

B. L.

Cole

[redacted]

June 16, 1945

ref to AM 13

LCV. A41584

To: Dr. R.S. Stone

From: Dr. J.J. Nickson

Subject: [illegible]

LMC [illegible]
This document consists
of [illegible] pages and 0 figures
No. 11 of 25 copies. Series A.

CLASSIFICATION CHANGED
TO: NOT CLASSIFIED
Del-1112 3-15-56
Authority of USAEG
2-17-05 [illegible]

Routine plutonium assay of the urine of the Chicago personnel has continued. No significant change in the overall picture has been observed. In addition to the Chicago specimens, samples have been assayed from other sites.

1. Total number of individual specimens analyzed . . . 101
   a. Chicago 61
   b. Other sites 40
2. Total number of analyses . . . . 16[illegible]
3. Individual specimens (Chicago) with high activity . . 0

Properties of the Citrate Complex of Plutonium

Using cation-exchange technique, a study of the stability of the complex formed by plutonium with citric acid has been made over the pH range of 7-0.5. It is found that with 0.05 M citric acid in isotonic salt solution the plutonium is strongly complexed but begins to break up sharply at about pH = 2. No complex exists at pH = 1.

A quantitative study of the composition and dissociation constant of the plutonium citrate complex at pH 7.3 is in progress. Preliminary data of a fragmentary nature indicates that the complex consists of one molecule of plutonium in combination with one molecule of the tertiary citrate ion, giving a dissociation constant of 7×10^{-5} at an ionic strength of 0.16.

RECEIVED
CHR RECORDS
JAN 2 1973

Analysis of Urine of HM-100

The urine of HM-100 was wet ashed by the nitric acid-hydrogen peroxide procedure. The inorganic residue was dissolved in 4 N HNO_3 and an LaF_3 analysis carried out on an aliquot portion. Of course, an SO_2 reduction was required before the LaF_3 could be precipitated.

At first each individual urine sample was analyzed; later twelve hour samples were analyzed and finally twenty-four hour samples were used.

[redacted]

8000344

The following results indicate the amount of plutonium excreted in the urine. The amount of plutonium originally injected into MX-100 was 6.7 µg. The analyses are still continuing. Up to the last result recorded, MX-100 had excreted a total of 3.38% of the amount injected.

Date and time of sample	Volume in ml.	Specific gravity	Total activity in c/m	c/m per 100 ml urine	Total µg excreted	% of inj.
Individual Samples						
4/26/45 3:30 PM	152	1.011	9960	6550	.145	2.23
4/26/45 5:00 PM	218	1.020	775	355	.0114	.175
4/26/45 7:45 PM	335	1.015	145	45	.0021	.033
4/27/45 12:30 AM	245	1.004	160	65	.00234	.035
4/27/45 3:00 AM	414	1.004	164	37	.00236	.035
4/27/45 7:25 AM	182	1.021	143	78	.0021	.032
4/27/45 1:15 PM	108	1.019	149	138	.00218	.033
4/27/45 7:55 PM	73	1.013	100	137	.00145	.022
4/27/45 10:45 PM	97	1.015	92	96	.0013	.020
4/28/45 1:15 AM	148	1.012	136	92	.00198	.030
4/28/45 5:30 AM	160	1.013	107	67	.00157	.024
4/28/45 7:30 AM	108	1.011	109	100	.00159	.024
12 hour samples						
4/28/45 9:30 AM to 4/28 9:00 PM	258	1.013	200	77	.00286	.045
4/28/45 9:30 PM to 4/29 9:30 AM	415	1.019	170	41	.00250	.038

12 hour samples

4/29/45 9:00 AM to 4/29 9:00 PM	630	1.012	340	54	.005	.035
4/29/45 9:00 PM to 4/30 9:00 AM	540	1.019	210	39	.0031	.018
4/30/45 9:50 AM to 4/30 9:00 PM	515	1.010	52	10	.00076	.012
4/30/45 9:00 PM to 5/1 9:00 AM	430	1.011	91	20	.0013	.020
5/1/45 9:00 AM to 5/1 9:00 PM	660	1.010	97	15	.0014	.012
5/1/45 9:00 PM to 5/2 9:00 AM	485	1.010	77	16	.0011	.017
5/2/45 9:00 AM to 5/2 9:00 PM	600	1.010	63	10.5	.00092	.014
5/2/45 9:00 PM to 5/3 9:00 AM	380	1.010	42	11	.00061	.0094
5/3/45 9:00 AM to 5/3 9:00 PM	920	1.010	60	6.5	.0009	.013
5/3/45 9:00 PM to 5/4 9:00 AM	895	1.006	45	5	.00063	.0095

24 hour samples

Date and Time of Sample	Volume in ml	Specific gravity	Total activity c/m	c/m per 100 ml urine	Total ug excreted	% of injected
5/4/45 to 5/5/45	2510	1.003	326	5	.0018	.027
5/5/45 to 5/6/45	3250	1.005	153	4.7	.0022	.034
5/6/45 to 5/7/45	3275	1.005	216	6.6	.0031	.047
5/7/45 to 5/8/45	2320	1.005	120	5.2	.0018	.026
5/8/45 to 5/9/45	1490	1.004	81	5.4	.0012	.018
5/9/45 to 5/10/45	2635	1.004	150	5.7	.0022	.034

24-hour samples

Date and Time of sample	Volume in ml.	Specific gravity	Total activity c/m	c/m per 100 ml urine	Total ug excreted	% of inj.
5/10/45 to 5/11/45	[illegible]	[illegible]	117	4.7	.0027	[illegible]
5/11/45 to 5/12/45	[illegible]	1.005	[illegible]	2.1	[illegible]	[illegible]
5/12/45 to 5/13/45	2650	1.000	120	4.5	.0026	[illegible]
5/13/45 to 5/14/45	2900	1.000	117	4.0	.0017	.026
5/14/45 to 5/15/45	3200	1.000	70	2.1	.001	.015
5/15/45 to 5/16/45	3060	1.000	173	5.6	.0025	.026
5/16/45 to 5/17/45	3470	1.000	147	4.2	.0022	.024
5/17/45 to 5/18/45	3100	1.000	120	3.9	.0018	.027
5/18/45 to 5/19/45	3500	1.000	136	3.9	.0020	.030
5/19/45 to 5/20/45	1440	1.000	77	5.3	.0011	.017
5/20/45 to 5/21/45	2640	1.000	684	26.0	.010	.15
5/21/45 to 5/22/45	800	1.005	113	14.0	.0017	.026
5/22/45 to 5/23/45	3000	1.000	405	13.9	.006	.092
5/23/45 to 5/24/45	2920	1.000	154	5.3	.0023	.035
5/24/45 to 5/25/45	3350	1.000	95	3	.0014	.021
5/25/45 to 5/26/45	2930	1.000	112	3.8	.0016	.024
5/26/45 to 5/27/45	3830	1.000	126	3.3	.0018	.027
5/27/45 to 5/28/45	2440	1.000	92	3.8	.0013	.020
5/28/45 to 5/29/45	2940	1.000	49	1.7	.0007	.010
5/29/45 to 5/30/45	1240	1.001	30	2.2	.0004	.006
5/30/45 to 5/31/45	2880	1.000	42	1.5	.0006	.009
5/31/45 to 6/1/45	3400	1.000	64	1.9	.0009	.014
6/1/45 to 6/2/45	3250	1.000	45	1.4	.0007	.010

Efficiency of the IR-4H method of analyzing for excreted plutonium urine containing only a few c/m of this excreted Pu:

A series of plutonium analyses using the IR-4H resin batch-test method were carried out. The human urine used contained only a few c/m of excreted Pu and thus closely approximated the conditions under which the method would be applied. Two different forms of the IR-4H resin were studied. One set of runs was made with the HCl form and another set with the H_3PO_4 form. Each type of resin was prepared by treating the carbonate form which comes from the manufacturer with the appropriate acid.

In each analysis the urine was made 0.1 N in HCl and one gram of IR-4H resin was added for each 100 ml of urine. The mixture was now shaken for two hours. The urine was then carefully decanted off and the resin washed

into an H sintered glass funnel. Now 40 ml of 4 N HCl were allowed to percolate slowly through the resin and into a 50 ml centrifuge tube. This solution was then analyzed by the LaF_3 method. The results obtained were compared with those obtained using the wet-ashing--LaF_3 procedure. It is apparent that at these low activities the IR-4H resin method gives results which are of the same order as those of the wet ashing--LaF_3 method. However, there are substantial variations when one considers these results on a percentage basis. Undoubtedly some of these variations arise from lack of efficiency in the IR-4H analysis. However, since the activities are so low, the wet ashing--LaF_3 method is also subject to variations. This is borne out by some of the higher results which one obtains with the IR-4H technique; e.g. samples 41, 44 and 46.

In general, the time saved by using the IR-4H method amounts to many hours when one contrasts it to the wet ashing--LaF_3 procedure. Since the IR-4H method permits analysis of 500 to 1000 ml samples of urine, it is more desirable. However, one must not forget that at these very low activities the method gives rather variable results and is consequently inferior to any method which will give precise determinations.

c/m of plutonium per 500 ml of urine from HX-100

Sample	Wet-ashing LaF_3 method	IR-4H HCl form	% of w.a.* LaF_3 method	IR-4 H_3PO_4 form	% of w.a. LaF_3 method
27	9	10	110%	----	----
27	9	7	78%	----	----
34	13	----	----	7	54%
38	54	46	85%	37	69%
40	12	9.5	79%	10.5	87%
41	16	15	94%	20	125%
43	16	14	88%	16	100%
44	7	7.5	107%	12	170%
46	6.4	6	94%	7	109%
47	8	4	50%	6	75%

*w.a. is wet-ashing

MUC-Hy 1168
This document consists of 3 pages and 0 figures.
No. 3 of 4 copies. Series A

Metallurgical Laboratory

October 20, 1943

Dr. Farrington Daniels

Dr. J.J. Nickson

TO BE HELD IN CONFIDENCE

Abstract of monthly report for Section H-III

The routine analysis of the urine of Chicago and Clinton for plutonium has continued. No results have been recorded which would indicate a high exposure. Small volumes, 100 ml, are still being used for the Chicago specimens. This, however, will be changed in the very near future.

Research on methods for urine analysis has continued. On the basis of the data available the $BiPO_4$-LaF_3 method appears to be the more logical to adopt for routine use. The procedure which makes use of ashing the urine has the advantage of being more easily worked and in all probability will be more reliable.

The adsorption process has some decided advantages and therefore research will continue on this process. The results of the last few experiments have been most encouraging.

During the past month the rabbit which was injected with plutonium died as a result of extension of the neoplasm. A post-mortem was obtained. The liver had 33% of the amount of plutonium injected. The bone marrow taken from one rib gave the highest specific activity of any tissue; it had 70 counts per minute per gram of tissue. The details of the tissue analysis will be found in the monthly report.

1631 films were developed during the month. 19 over exposures were noted of which eight were shield and window over exposures and eight were window over exposures. Three wrist badges were found to have readings greater than 0.6 r. 3040 pocket meters were read during the month. 22 over exposures were noted.

Delivery of alpha survey and hand meters stepped up considerably during the past month. This followed the essential completion of similar orders from Y. The availability of these instruments will considerably simplify the work of the Health-Physics group. Turnover in personnel during the past month has been considerable following the removal of war manpower control. This has created a training problem in the section.

Slow neutron flux measurements are being made on a routine basis at the Argonne. Numerous areas are being found which have flux greater than

1500 slow neutrons per square centimeter per minute. For the most part these are not in work areas. Survey of off-project rooms for contamination has occupied much of the special surveyor's time. Numerous areas in Kent and Jones have been found which have above permissible levels of alpha, beta or gamma activity. Procedure for decontaminating such areas and informing the University of such decontamination has been the subject of numerous discussions.

jn

J. J. Nickson, M.D.

cc: R.S. Stone
File

[redacted]

B

May 12, 1945

Product Excretion

Human

Same as in Table 1 report CH-3607

Urine		Stool	
Period	% Excreted	Individual Samples No.	% Excreted
1st 24 hrs	2.540	6 hrs	0.010
2nd " "	0.153	28 "	0.059
3rd " "	0.084	40 "	0.044
4th " "	0.133	51 "	0.067
5th " "	0.032		
6th " "	0.038		
7th " "	0.023		
8th " "	0.023		
9th " "	0.027		

I.V. - 6.5 ug total

Blood Product Concentration

Time After Injection	Conc. per ml W. B.	% of injected* in circ. blood	
10 min	3.2×10^{-4} ug	20 %	27%†
45 min	2.5×10^{-4} ug	15 %	20%†

* Assume 4000 ml blood

† assume 5.4 liters blood

This is Chicago Case #1 : RER 12/19/72

[redacted]

V-A76180

P. O. BOX 1663
SANTA FE, NEW MEXICO

Human Experiments
Pu

PRIVACY ACT MATERIAL REMOVED

12 September 1945

5

Dr. E. R. Russell
Metallurgical Laboratory
P. O. Box 5207
Chicago 80, Illinois

Subject: Results on

Dear Ed:

Here is the information I promised you. I hope it reaches you in time. As you can see the feces results are rather rough. This is probably due to sampling difficulties and to the fact that they gave several enemas in the first part of the test. The U/F ratio is more nearly 2/1 than 4/1 as I told you when in Chicago.

These results are to appear in a report soon, so do not put them in print yet. I am glad to have you use them in your talk, however.

Sincerely,

Wright Langham

WHL/fp

PRIVACY ACT MATERIAL REMOVED

8000352

Days	c/m/Day	% of Dose
1	332	0.100
2	341	0.102
3	268	0.080
4	256	0.077
5	225	0.067
6	147	0.044
7	227	0.068
8	263	0.079
9	143	0.043
10	124	0.037
11	115	0.035
12	90	0.027
13	98	0.029
14	83	0.025
15	97	0.029
16	75	0.022
17	97	0.029
18	86	0.025
19	94	0.028
20	106	0.032
21	84	0.025
22	82	0.024
23	130	0.039
24	79	0.024
25	69	0.021
26	76	0.023
27	56	0.017
28	80	0.024
29	75	0.022
30	68	0.020
31	70	0.021
32	40	0.012
33	119	0.036
34	67	0.020
35	85	0.025
36	60	0.018
37	75	0.022
38	60	0.018
39	68	0.020
40	61	0.018
41	67	0.020
42	44	0.013
43	44	0.013
44	50	0.015
45	50	0.015
46	57	0.017
48	Lost	
50	50	0.015
52	58	0.018
54	63	0.019
56	51	0.015
58	Lost	
60	Lost	
62	115	0.035
64	64	0.019
66	141	0.043

Hams = .006
ours = .011

.020

8000353

Days	c/m/Day	% of Dose
1	915	0.278
2	915	0.278
3	734	0.224
4	734	0.224
5	1038	0.314
6	37	0.011
7	37	0.011
8	37	0.011
9	35	0.011
10	35	0.011
11	35	0.011
12	35	0.011
13	104	0.032
14	104	0.032
15	123	0.037
16	123	0.037
17	27	0.008
18	27	0.008
19	27	0.008
20	156	0.047
21	156	0.047
22	156	0.047
23	67	0.020
24	67	0.020
25	82	0.025
26	50	0.015
27	50	0.015
28	42	0.013
29	42	0.013
30	24	0.007
31	24	0.007
32	24	0.007
33	61	0.019
34	149	0.045
35	82	0.025
36	18	0.006
37	18	0.006
38	42	0.013
39	42	0.013
40	22	0.007
41	24	0.007
42	17	0.005
43	18	0.006
44	18	0.006

Period	% Excreted-Man % Excreted-Px-33	% Excreted-Man % Excreted-Px-38	% Excreted-Man % Excreted-Px-39
	Urine		
1st 24 hrs	0.4	0.3	0.2
2nd "	1.5	0.44	0.3
3rd "	2.6	0.38	0.6
4th "	5.0	1.1	0.65
5th "	1.1	0.29	0.22
6th "	1.7	0.99	0.47
7th "	0.99	0.63	0.47
8th "	1.0	0.92	0.59
9th "	1.4	1.3	0.79
	Feces		
1st 24 hrs	0.015	0.0068	0.0032
2nd "	0.187	0.063	0.023
3rd "	0.062	0.073	0.053

If we are to place any weight on our animal studies it is quite clear from these results that by far the urinary excretion of dogs and man is more comparable than fecal excretion. Data presented by Mr.Langham on a human tracer experiment using 4.7 ug of the 44 citrate compare very favorably with our results. He also reported low fecal excretion. In his discussion he also pointed out that 50% of the injected plutonium was present in the circulating blood four hours after the injection. Our data showed that at the end of 45 minutes only 15% of the plutonium remained in the circulating blood.

Dr. Stone asked which of the two methods would be suitable for detecting low activities in the urine. Since the IR-1 column procedure was designed to detect approximately 1 γ count per minute in a 100 ml specimen and the tolerance has been set at a level approximately 10 times smaller, the method is certainly not adequate for 0.1 counts. It was suggested that less frequent analyses and larger volumes be used for each specimen. The IR-4 method which has been used for 500 to 1000 ml specimens

has shown considerable variation and is to be investigated further. Specimens from 2 to 3 liters have been assayed by evaporation and precipitation with LaF_3. This is to be avoided if possible because of the long and laborious process.

It was suggested that the plutonium blood concentration be followed more closely and compared with urinary excretion to see if there is any definite relationship. A minimum of two animals must be studied inasmuch as the difference between dogs 38 and 39 was so great.

It was stated that rabbit fecal product excretion is much closer to that of man in the early period than other animals. Data beyond four days after injection for man was not available.

The question of controls was mentioned by Mr. English. The data collected by our group have shown very few controls. The values ranging from 0 to 10^{-5} ug per 500 ml specimens. It was suggested that future work should include a number of control specimens.

In discussing a tolerance limit for plutonium contained in the body the question again arose as to what fraction of a day's urine should be analysed in order to calculate the retained plutonium. Morning specimens have always shown a higher unit activity and any retention calculated from these analysis would be the maximum. For accurate data, the entire 24-hour specimen must be assayed or a large fraction thereof. If the tolerence limit is to be set at 0.7 ug and 0.01% taken as the amount excreted, then 4.8 α counts per day must be detected. It is seen that a minimum of 25% of a 24-hour specimen is to be used for assay purposes. If we are to detect lower activities then the fraction of the daily urine to be assayed should be correspondingly larger. The discussion was concluded with the following suggestions:

1. That larger volumes of urine be assayed for plutonium, preferably portions of 24-hour specimens.
2. That less frequent specimens be collected from the Chicago personnel.
3. That a larger number of control specimens be run.

Edwin R. Russell

ERR/mn

Note: The attached table on human excretion is an addition to the excretion tables in MUC-ERR-83.

[illegible] Report Sheet

Name	Volume Analyzed	Date of Sample	cts/min less cts/min control	Est. Body Content
Blood Samples				
[illegible] Yeaw	10 cc.	6-24-49	102.	
[illegible]	50 cc.	7-6-49	+ .11	
Urine				
[illegible] E. Yeaw	55	6-29-49	+.50	+ 2.0
(210) E. Yeaw	650	7-1-49	+.02	< 0.1
[illegible] E. Yeaw	730	7-5-49	-.02	—

8000357

[redacted]

MUC # [illegible]
This document consists of 4 pages and 0 figures.
No. 3 of 20 copies, Series A

Health

Notes on Plutonium Excretion

Discussed at the Health Division Meeting, May 14 and 15, 1945

Discussion led by: E.R.Russell

Tables showing the excretion of product by various animals were presented (MUC-ERR-83). The question was raised as to what value could be set as the daily urinary product excretion from this data. Answer---0.01% of the material retained in the body. The question arose as to why dog 38 (table on page 2) showed a much lower excretion than 0.01%. On the basis that only 65% of the material is absorbed from the muscle and that 20% has been excreted, the 0.01% would also apply to this animal. The data in the tables for all animals, rats, dogs, and rabbits, show from 0.01% to 0.03% daily excretion when constancy is reached.

Dr. Stone---What comparisons have been made as to the concentration of plutonium in the blood and the urinary excretion? Comparisons on 7-and 14-day blood concentrations and urinary excretion indicated little definite information could be gained. Comparing dogs 38 and 39 at 40 days after injection showed that dog 38 had 2.72 ug of plutonium in the circulating blood and during the 24-hour period excreted by way of the urine only 0.125 ug while dog 39 had 0.685 ug of plutonium in the circulating blood and excreted 0.163 ug. This would suggest that dog 38's kidneys are not functioning as well as dog 39's. The unit product concentration in blood and urine for both animals also shows the same discrepancy.

The fecal product excretion for all animals studied has been shown to be from 3 to 4 times higher than the urine collected during corresponding periods. It was suggested that stools be assayed to establish the product content in humans. The difficulties encountered in analysing stools and the comparison of human fecal product excretion to that of dogs would lead one not to rely on this procedure. Dr. Hamilton stated that he is working on a method for stool analyses that should be published very shortly.

The table below was presented to show the value of dog excretion studies to the interpretation of data accummulated on humans. The excretion of Pu for these dogs is compared with that of a single male human having been injected with 6.5 ug of +6 plutonium citrate.

CLASSIFICATION CANCELLED
DATE DEC 8 1966
For the Atomic Energy Commission
ROBERT L. JACKSON RLJ for the
Chief, Declassification Branch

DCV-A72691

Product Excretion

Human

6.5 ug +6 Citrate

URINE		FECES	
Period	% Excreted	Period	% Excreted
1st 24 hrs	2.540	1st 24 hrs	0.010
2nd "	0.153	2nd "	0.103
3rd "	0.084	3rd "	0.067
4th "	0.133		
5th "	0.032		
6th "	0.038		
7th "	0.023		
8th "	0.023		
9th "	0.027		
10th "	0.034		
11th "	0.047		
12th "	0.028		
13th "	0.018		
14th "	0.034		
15th "	0.026		
16th "	0.012		
17th "	0.028		
18th "	0.026		
19th "	0.015		
20th "	0.038		
21st "	0.034		

Blood Changes

After Injection	Conc per ml	% of Inj*
10 min	3.2×10^{-4}ug	20%
45 min	2.5×10^{-4}ug	15%

* Assume 4000 ml blood

From the above data we should expect higher urinary product excretion from humans than from dogs.

Chicago Case #1

12/19/72

June 9, 1945

TO: J. J. Nickson, M.D.

FROM: E. R. Russell

Monthly Summary: Analytic Group, Section H-3
For the month ending June 8, 1945

J. J. Nickson, M.D. - Section Chief
E. R. Russell - Group Leader

Problem Assignment: 249-MLH-3501 - Detection of Product in Urine
J. Jackson - E. R. Russell

Routine ~~product~~ plutonium assay of the urine of the Chicago personnel has continued. No significant change in the overall picture has been observed. In addition to the Chicago specimens, samples has benn assayed from other sites.

1. Total number of individual specimens analyzed 101
   a. Chicago 61
   b. Other Sites 40
2. Total number of analyses 163
3. Individual specimens (Chicago) with high activity . . . 0

Problem Assignment: 249-MLH-3502 - Development of Methods for Product in Urine J. Schubert - D. Revinson - E. R. Russell

Properties of the Citrate Complex of ~~Product~~ plutonium

Using cation-exchange techniques, a study of the stability of the complex formed by product with citric acid has been made over the pH range of 7-0.5. It is found that with 0.05 M citric acid in isotonic salt solution the product is strongly complexed but begins to break up sharply at about pH = 2. No complex exists at pH = 1.

A quantitative study of the composition and dissociation constant of the ~~product~~ plutonium-citrate complex at pH 7.3 is in progress. Preliminary data of a fragmentary nature indicates that the complex consists of one molecule of ~~product~~ plutonium in combination with one molecule of the tertiary citrate ion, giving a dissociation constant of 7×10^{-3} at an ionic strength of 0.16.

Chicago Case #1

RER 12/19/72

Problem Assignment: 249-MLH-3501, 3502 E. Motta - R. Lesko

Analysis of Urine of MX-100

The urine of MX-100 was wet ashed by the nitric acid-hydrogen peroxide procedure. The inorganic residue was dissolved in 4 N HNO_3 and a LaF_3 analysis carried out on an aliquot portion. Of course an SO_2 reduction was required before the LaF_3 could be precipitated.

At first each individual urine sample was analyzed; later twelve hours samples were analyzed and finally twenty-four hour samples were used. The following results indicate the amount of product excreted in the urine. The amount of product originally injected into MX-100 was 6.7 ug. The analyses are still continuing. Up to the last result recorded, MX-100 had excreted a total of 3.88 % of the amount injected.

Individual Samples

Date and time of Sample	Volume in ml.	Specific gravity	Total activity in c/m	c/m per 100 ml urine	Total ug excreted	% of Inj.
4-26-45 3:30 P.M.	152	1.011	9960	6550	.145	2.23
4-26-45 5:00 P.M	218	1.010	776	355	.0114	.175
4-26-45 7:45 P.M.	325	1.006	145	45	.0021	.023
4-27-45 12:30 A.M.	245	1.006	160	65	.00234	.036
4-27-45 3:00 A.M.	414	1.004	154	37	.00226	.035
4-27-45 7:35 A.M.	182	1.011	143	78	.0021	.032
4-27-45 1:15 P.M.	108	1.019	149	138	.00218	.033
4-27-45 7:55 P.M.	73	1.013	100	137	.00145	.022
4-27-45 10:45 P.M.	97	1.015	92	95	.0013	.020
4-28-45 1:15 A.M.	148	1.012	136	92	.00198	.030
4-28-45 5:30 A.M.	160	1.013	107	67	.00157	.024
4-28-45 7:30 A.M.	108	1.011	109	100	.00159	.024

12-hour Samples

Date and Time of Sample	Volume in ml	Specific gravity	Total activity c/m	c/m per 100 ml urine	Total ug Excreted	% of Injected
4-28-45 4-28-45 9:30 A.M. to 9:00P.M.	258	1.013	200	77	.00296	.045
4-28-45 4-29-45 9:30 P.M. to 9:30 A.M.	415	1.019	170	41	.00250	.039
4-29-45 4-29-45 9:00 A.M. to 9:00 A.M.	630	1.012	340	54	.005	.085
4-29-45 4-30-45 9:00 P.M. to 9:00 A.M.	540	1.010	210	39	.0031	.048
4-30-45 4-30-45 9:50 A.M. to 9:00 P.M.	515	1.010	52	10	.00076	.012
4-30-45 5-1-45 9:00 P.M. to 9:00 A.M.	430	1.011	91	20	.0013	.020
5-1-45 5-1-45 9:00 A.M. to 9:00 P.M.	660	1.010	97	15	.0014	.012
5-1-45 5-2-45 9:00 P.M. to 9:00 A.M.	485	1.010	77	16	.0011	.017
5-2-45 5-2-45 9:00 A.M. to 9:00 P.M.	600	1.010	63	10.5	.00092	.014
5-2-45 5-3-45 9:00 P.M. to 9:00 A.M.	380	1.010	42	11	.00061	.0094
5-3-45 5-3-45 9:00 A.M. to 9:00 P.M.	920	1.010	60	6.5	.0009	.013
5-3-45 5-4-45 9:00 P.M. to 9:00 A.M.	895	1.006	45	5	.00063	.0095

24-hour Samples

Date and Time of Sample	Volume in ml	Specific gravity	Total activity c/m	c/m per 100 ml urine	Total ug Excreted	% of Injected
5-4-45 to 5-5-45	2510	1.006	126	5	.0018	.027
5-5-45 to 5-6-45	3250	1.005	153	4.7	.0022	.034
5-6-45 to 5-7-45	3275	1.005	216	6.6	.0031	.047
5-7-45 to 5-8-45	2320	1.005	120	5/2	.0018	.028
5-8-45 to 5-9-45	1490	1.004	81	5.4	.0012	.018
5-9-45 to 5-10-45	2635	1.004	150	5.7	.0022	.034
5-10-45 to 5-11-45	2480	1.003	117	4.7	.0017	.026
5-11-45 to 5-12-45	2560	1.005	54	2.1	.0008	.012
5-12-45 to 5-13-45	2650	1.000	120	4.5	.0018	.028.
5-13-45 to 5-14-45	2920	1.000	117	4.0	.0017	.026
5-14-45 to 5-15-45	3300	1.000	70	2.1	.001	.015
5-15-45 to 5-16-45	3060	1.000	173	5.6	.0025	.038
5-16-45 to 5-17-45	3470	1.000	147	4.2	.0022	.034
5-17-45 to 5-18-45	3100	1.000	120	3.9	.0018	.027
5-18-45 to 5-19-45	3500	1.000	136	3.9	.0020	.030
5-19-45 to 5-20-45	1440	1.000	77	5.3	.0011	.017
5-20-45 to 5-21-45	2640	1.000	684	26.0	.010	.15
5-21-45 to 5-22-45	800	1.005	113	14.0	.0017	.026
5-22-45 to 5-23-45	3080	1.000	405	13.0	.006	.090
5-23-45 to 5-24-45	2920	1.000	154	5.3	.0023	.035
5-24-45 to 5-25-45	3350	1.000	96	3	.0014	.021
5-25-45 to 5-26-45	2930	1.000	112	3.8	.0016	.024
5-26-45 to 5-27-45	3830	1.000	126	3.3	.0018	.027
5-27-45 to 5-28-45	2440	1.000	92	3.8	.0013	.020
5-28-45 to 5-29-45	2940	1.000	49	1.7	.0007	.010
5-29-45 to 5-30-45	1340	1.001	30	2.2	.0004	.006
5-30-45 to 5-31-45	2880	1.000	42	1.5	.0006	.009
5-31-45 to 6-1-45	3400	1.000	64	1.9	.0009	.014
6-1-45 to 6-2-45	3250	1.000	45	1.4	.0007	.010

Efficiency of the IR-4H method of analyzing for excreted product in human urine containing only a few c/m of this excreted Pu:

A series of product analyses using the IR-4H resin batch-test method were carried out. The human urine used contained only a few c/m of excreted Pu and thus closely approximated the conditions under which the mthod would be applied. Two different forms of the IR-4H resin were studied. One set of runs was made with the HCl form and another set with the H_3PO_4 form. Each type of resin was prepared by treating the carbonate form which comes from the manufacturer with the appropriate acid.

In each analysis the urine was made .1 N in HCl and one gram of IR-4H resin was added for each 100 ml of urine. The mixture was now shaken for two hours. The urine was then carefully decanted off and the resin washed into a M sintered glass funnel. Now 40 ml of 4 N HCl were allowed to percolate slowly through the resin and into a 50 ml centrifuge tube. This solution was then analyzed by the LaF_3 method. The results obtained were compared with those obtained using the wet ashing--LaF_3 procedure. It is apparent that at these low activities the IR-4H resin method gives results which are of the same order as those of the wet ashing--LaF_3 method. However, there are substantial variations when one considers these results on a percentage basis. Undoubtedly some of these variations arise from lack of efficiency in the IR-4H analysis. However, since the activities are so low, the wet ashing--LaF_3 method is also subject to variations. This is borne out by some of the higher results which one obtains with the IR-4H technique; e.g. samples 41, 44, and 46.

In general, the time saved by using the IR-4H method amounts to many hours when one contrasts it to the wet ashing--LaF_3 procedure. Since the IR-4H method permits analysis of 500 to 1000 ml samples of urine, it is more desirable. However, one must not forget that at these very low activities the method gives rather variable results and is consequently inferior to any method which will give precise determinations.

c/m of Product per 500 ml of Urine from MX-100

Sample	Wet-ashing LaF_3 method	IR-4H HCl form	% of w.a.* — LaF_3 method	IR-4 H_3PO_4 form	% of W.A.— LaF_3 method
27	9	10	110%	----	------
27	9	7	78%	----	------
34	13	----	----	7	54%
38	54	46	85%	37	69%
40	12	9.5	79%	10.5	87%
41	16	15	94%	20	125%
43	16	14	88%	16	100%
44	7	7.5	107%	12	170%
46	6.4	6	94%	7	109%
47	8	4	50%	6	75%

* w.a. is wet-ashing

To: Mr. J. D. Nickson
From: E. R. Russell
Re: Human Fecal Plutonium Excretion
6.5 mg I.V. injection
4-26-45

Time of Specimen	Weight of Specimen	% of Injected Pu excreted
4/26 - 6 hrs	13.05 grams	0.076
4/27 - AM	189.5 "	0.157
4/27 - PM	45.5 "	0.161
4/28	106.9 "	0.270
4/29 AM	318.7 "	0.264
4/29 PM	141.5 "	0.195
4/30	76.2 "	0.154 (?)
5/1	49.6 "	0.214
5/2	57.0 "	0.109
5/3	54.2 "	0.076
5/4	64.4 "	0.105
5/6 (1)	112.0 "	0.121
5/6 (2)	166.3 "	0.079
5/8	129.9 "	0.082
5/9	144.7 "	0.040
5/10	70.1 "	0.044
5/11	166.7 "	0.042
5/12	122.7 "	0.029
5/14	232.1 "	0.031
5/15	128.6 "	0.027
5/16	130.0 "	0.0154
5/17	112.7 "	0.0156
5/18	83.6 "	0.0179
5/19	86.7 "	0.0174
5/20	155.0 "	0.0158
5/21	21.3 "	0.0091
5/22 AM	123.9 "	0.0136
5/22 PM	52.3 "	0.0082
5/23	129.7 "	0.0110
5/24	98.5 "	0.0219
5/25	122.3 "	0.0078
5/26	108.6 "	0.0063
5/27	[illegible] "	[illegible]
5/28	[illegible] "	[illegible]

5/29	69.3	"	0.0071
5/30	87.4	"	0.0056
5/31	115.0	"	0.0074
6/1 (1)	67.9	"	0.0043
6/1 (2)	71.0	"	0.0031
6/2	85.0	"	0.0051
6/4	275.2	"	0.0043
6/5	59.1	"	0.0038
6/6	127.7	"	0.0042
6/7	76.4	"	0.0061
6/8	174.5	"	0.0056
6/9	141.8	"	0.0049
6/10	97.6	"	0.0043
6/11 (1)	99.6	"	0.0043
6/11 (2)	54.0	"	0.0043
6/12	125.0	"	0.0038
6/13	97.5	"	0.0031
6/14	79.7	"	0.0025
6/15	122.0	"	0.0048
6/16	75.1	"	0.0043
6/17	169.9	"	0.0038

Total excreted to date — 2.55%

Analyses by H. Delaney

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Fiskin, Rose, Fonce, file

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MUC # ERR-104
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June 28, 1945

TO: Dr. J. J. Nickson

FROM: E. R. Russell

Chicago Case #1
RER 12/19/72

IN RE: Human Fecal Plutonium Excretion
6.5 ug I.V. Injection 4/26/45

Time of Specimen	Weight of Specimen	% of Injected Pu Excreted	Time of Specimen	Weight of Specimen	% of Injected Pu Excreted
4/26 6hrs	13.05gms	0.076	5/23	129.7 gms	0.0110
4/27 A.M.	189.5 "	0.157	5/24	78.5 "	0.0219
4/27 P.M.	45.5 "	0.161	5/25	172.3 "	0.0078
4/28	106.9 "	0.270	5/26	108.6 "	0.0063
4/29 A.M.	318.7 "	0.264	5/27	197.7 "	0.0150
4/29 P.M.	141.5 "	0.195	5/28	126.7 "	0.0058
4/30	76.2 "	0.154	5/29	69.3 "	0.0071
5/1	49.6 "	0.214	5/30	87.4 "	0.0056
5/2	57.0 "	0.109	5/31	115.0 "	0.0074
5/3	54.2 "	0.076	6/1 (1)	67.9 "	0.0043
5/4	64.4 "	0.105	6/1 (2)	71.0 "	0.0031
5/6 (1)	112.0 "	0.121	6/2	85.0 "	0.0051
5/6 (2)	166.3 "	0.079	6/4	275.2 "	0.0043
5/8	129.9 "	0.082	6/5	59.1 "	0.0038
5/9	144.7 "	0.040	6/6	127.7 "	0.0042
5/10	70.1 "	0.044	6/7	76.4 "	0.0061
5/11	166.7 "	0.042	6/8	174.5 "	0.0056
5/12	122.7 "	0.029	6/9	141.8 "	0. 049
5/14	232.1 "	0.031	6/10	97.6 "	0.0043
5/16	130.0 "	0.0154	6/11 (1)	99.6 "	0.0043
5/17	112.7 "	0.0156	6/11 (2)	54.0 "	0.0043
5/18	83.6 "	0.0179	6/12	125.0 "	0.0038
5/19	86.7 "	0.0174	6/13	97.5 "	0.0031
5/20	155.0 "	0.0158	6/14	79.7 "	0.0025
5/21	21.3 "	0.0091	6/15	122.0 "	0.0048
5/22 A.M.	123.9 "	0.0136	6/16	75.1 "	0.0043
5/22 P.M.	52.3 "	0.0082	6/17	169.9 "	0.0038
(5/15	128.6 "	0.027)			

Total excreted to date 2.55 %

Analyses by H. Delaney

cc Dr. Stone
Mr. Rose

CLASSIFICATION CANCELLED
BY AUTHORITY OF THE U.S., A.E.C., C.O.O.
BY Haylande D. Young
DIRECTOR OF TECHNICAL INFORMATION
ARGONNE NATIONAL LABORATORY

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MUC #. ERR-137

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August 17, 1945

Listed for DOC 1/14/53

Human Excretion of Plutonium

6.5 ug injection
4/26/45

Chicago Case #1

RBR 12/19/72

Date	Days	% Injected dose excreted In Urine	% Injected dose excreted In Feces
4/27/45	1	2.531	1 0.233
4/30/45	3	0.133	4 0.154
5/3/45	6	0.0224	7 0.076
5/7/45	10	0.028	——
5/11/45	14	0.012	14 0.042

(62)

[redacted]

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DCV-A30887

Date: June 11, 1946

Subject: Distribution and Excretion of Plutonium

Chapter VII, Volume 20 A, PPR

By: E. R. Russell and J. J. Nickson, M.D.

To: _____

Before reading this document, sign and date below:

Name	Date	Name	Date
Bruce	7/12/46		
Kinsolving Kinsolving	7/15/46		
R. M. Zagaria	7/22/46		

[redacted]

[redacted]

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Acknowledgement

It has been difficult to give credit to specific individuals for their contributions which are included in this chapter. Some of the work was done at other sites and privately communicated to us.

Specifically, we are indebted to Dr. Wright Langham and associates for information concerning the cupferron-chloroform procedure, to Dr. K. G. Scott and his associates for the information on the hexone and T.T.A. extraction procedures and to Dr. M. D. Taylor, Mr. L. E. Motta, Mr. D. Revinson, Mr. Harold Delaney, Miss J. A. Jackson, Miss Cordelia Brown, and Miss Wilana Monroe, all of our group, for testing and working out most of the procedures.

J. J. Nickson, M.D.
E. R. Russell

Table of Contents

1. Introduction

Following the discovery of plutonium, the determination of its half life as 24,300 years, and the fact that the material is alpha active, it became obvious that elaborate precautions were necessary if the worker was to be protected from harm. Experience in the radium industry had indicated clearly that very small amounts of the radium element deposited in the body were capable of producing serious illness or death. As a result of these considerations, the conditions under which plutonium is handled in the laboratory have been ringed about with elaborate protective regulations and devices.

In addition, however, it seemed highly desirable, if not essential, to know as precisely as possible the amount of plutonium in the individual worker. Animal experimentation indicated that the plutonium content of the urine and feces would be a useful guide to the total amount of plutonium in the body. It was decided to use urine for the routine determination(3) primarily because of the greater ease in handling urine samples. As will be discussed below, it appears that in humans the amount of plutonium excreted per day is greater in the urine than in the feces.

Initially, a tentative maximum permissible body content of plutonium was established on an arbitrary basis. From purely physical considerations it seemed that plutonium,

weight for weight, should be approximately one-fiftieth as toxic as radium. Since the tolerance amount of radium is generally accepted as 0.1 microgram in the body, the plutonium tolerance value was initially set at 5.0 micrograms in the body.

In order that one might estimate the plutonium content of the body through analysis of the urine, it was necessary first to establish the excretion rate. Preliminary experiments[1] with rabbits indicated that after the first two or three weeks of plutonium intake, approximately 0.01% of that retained in the body is excreted in a 24-hour urine specimen. Many excretion experiments with other animals and man have shown that this is nearly the correct value for the sub-acute excretion rate. Recent work discussed elsewhere indicates that this figure may be greater than the true excretion rate of plutonium which has been in the body for a year or more. It is possible that the figure of 0.01% may have to be reduced in the future.

If 5 micrograms is to be the body threshold, and 0.01% excretion is assumed, then analytical procedures capable of detecting 28 alpha counts per minute (plutonium) in a 24-hour urine specimen, or 2 counts per minute in a 100 ml specimen should be adequate. An adsorption procedure, described later, was designed specifically to assay 100 ml specimens. Any specimen showing less than 2 alpha counts per minute was not considered significant. This procedure

served its purpose well. However, when it became apparent that the factor of fifty between radium and plutonium toxicity was too high, it was evident the method was not sufficiently sensitive. Comparative toxicity studies with these two elements showed that a factor of ten would be much safer and therefore the plutonium tolerance threshold was lowered to one microgram.

If the tolerance threshold is 1.0 microgram, the analytical procedure should detect at least 0.2 micrograms in the body, therefore 0.2×10^{-4} microgram in a 24-hour urine specimen would be significant. Since the average urine specimen used in Chicago is approximately 1/3 of a 24-hour sample, the method must then be sufficient to detect 0.7×10^{-5} microgram or 0.4 alpha counts per minute of plutonium. Smaller samples present an even more difficult problem.

The problem of detecting such small quantities of plutonium was mainly one to be solved by the development of adequate counters. Dr. Jesse and associates have produced counters with backgrounds of less than 0.1 count per minute. With such counters 0.2 counts per minute can be detected with fair accuracy. Counting times are long, of course.

It should be pointed out that contamination is one of the greatest sources of error in the determination of low alpha activity. This will be borne out very clearly in the results of the survey of project personnel. It is necessary that collection, handling and assaying of the

urine be carried out under "sterile" conditions.

It is the purpose of this chapter to present a detailed description of the methods used in the detection of plutonium in humans and to briefly discuss the results. In closing, suggestions are given for the establishment and operation of a laboratory for the detection of plutonium in individuals working with or in areas contaminated by the element.

2. Estimation of Plutonium in the Body

2.1 Methods of Urine Analysis: A survey of the analytical methods for plutonium used by the chemistry division revealed that with certain modifications some of those might be used to assay urine. A direct lanthanum fluoride precipitation from a small volume of acidified urine is adequate for many purposes. Where the volume is large and the concentration of plutonium is exceedingly small, such a method is not applicable as too large a quantity of lanthanum is required. In addition, certain salts in the urine may cause difficulty.

In the development of analytical methods applicable to urine analysis the time element as well as manpower requirements to assay a given number of samples were considered. It was felt that an adsorption procedure would offer the greatest possibility of routinely assaying daily the largest number of specimens with a minimum of personnel. As was

It was previously mentioned that plutonium is eliminated from the body in the urine at a fairly constant rate--the rate being approximately 0.01% per day. This figure was proposed on the basis of some very preliminary excretion studies on rabbits(1). Subsequent experiments on mice, rats, and dogs showed that the excretion rate may vary by a factor of five in the different species(11). It was felt necessary to establish independently the excretion rate of humans.

The fecal plutonium excretion, however, varied as much as a thousand fold from species to species. This made it difficult to assign any rate for human fecal plutonium excretion.

4.1 Results of Human Excretion Studies:

Urinary excretion of plutonium. Three experiments were begun within a few weeks (one at Chicago) in which plutonium was injected into a human and the plutonium excretion followed daily. During the first 15 days of the experiments there was less than 10% difference between the daily urinary plutonium excretion of the individual studied by Dr. W. Langham and associates at Los Alamos and the individual studied by Dr. J. J. Nickson, E. R. Russell and associates at Chicago. The individual studied by Dr. J. G. Hamilton at Berkeley showed a slightly lower excretion but not by a factor of 2. Following the initial period where a rapid decrease in the excretion rate is observed, there was a slight divergence in the results obtained from the three subjects. The individual

studied at Los Alamos showed an average daily excretion of slightly less than 0.02%, the one at Chicago slightly above 0.012% and the individual at Berkeley slightly less than 0.006%. These values persisted over a 100-day period. Since these experiments were completed, two additional studies have been made at Chicago. The excretion rate of one of these individuals after the first two weeks has remained between 0.010 and 0.015% per day. The other individual was not available for further study after the 16th day.

In view of the fact that the majority of the urinary plutonium excretion studies on humans have indicated that a sub-acute excretion rate of 0.01% per day is very nearly correct, this value appears to be at this time a reasonable one to use in determining the concentration of plutonium in the body of workers. It may be pointed out that the urinary plutonium excretion of dogs[13] parallels that of man.

Fecal excretion of plutonium. In addition to following the urinary excretion of plutonium of the above individuals, the plutonium content of the daily fecal specimens was also determined. It has been predicted by several workers on the basis of animal excretion studies, that the plutonium fecal excretion rate would be greater than the urinary excretion rate. It therefore appeared that stool determinations would be easier to interpret. All of the human studies that have been made have failed to confirm this thesis. Plutonium in

a 24-hour fecal specimen is from 2 to 4 times less than that in a corresponding 24-hour urine specimen.

The average daily fecal plutonium excretion for the four cases studied is 0.003% ranging from 0.001% to 0.006% of that contained in the body. From the difficulties encountered in detecting 2×10^{-5} micrograms of plutonium, it would appear that surveys of personnel through fecal analysis would be difficult.

4.2 Distribution of Plutonium in the Body: The development and understanding of any satisfactory means of plutonium therapy is dependent upon a knowledge of the distribution of the element in the organism. Since nearly 90% of the plutonium finding its way in the body is retained there for many years it is vitally important that we week some means of increasing the excretion rate. The first step in devising means of therapy is to learn in what organs the plutonium is concentrated.

There have been many experiments involving animals in which plutonium was injected and at some later date its distribution determined. The majority of these tests have shown that the liver, spleen, bone marrow, and lymph nodes are the principle sites of deposition. The same general distribution has been found for the one fairly normal human which was studied. The distribution data is given in Table I. In addition the distribution of plutonium in a female containing

approximately 90 micrograms was determined (see Table II.) This individual had many abnormally functioning organs and therefore the distribution may not be representative. It is interesting to note that even under these conditions the marrow and bone are among the principle sites of deposition.

Chicago Case 1 : RER 12/19/72

Table I

Distribution of Plutonium in a 68-year, White Male (155 days after injection of 6.5 ug of plutonium as the citrate)

Tissue	Grams of tissue analysed	∝Cts/gram of tissue	*Relative Affinity for Plutonium
Marrow (rib)	0.8292	70.9	10.13
Liver	34.11	59.8	8.54
Sternum	5.38	20.6	2.94
Periosteum	0.1215	20.0	2.86
Spleen	32.12	11.1	1.59
Tumor (lung)	2.03	7.4	1.06
Cancer Tissue	2.87	7.2	1.03
Rib (cortex)	1.0125	7.0	1.00
L.Nodes (aorta)	0.63	6.7	0.96
Lung	15.39	2.6	0.37
Testicle (glandular)	4.3425	2.3	0.33
Kidney	27.35	1.7	0.24
Heart	4.9435	1.2	0.17
Diaphragm	35.73	1.0	0.14
Abdominal Fat	17.05	0.2	0.03
Bile	8 cc	?	---

* = cts/gram found ÷ cts/gram assuming equal distribution throughout the body.

Table II Chicago Case 2 : RER 12/19/74

Distribution of Plutonium in a 54-year, White Female
(16 days after injection of 94.91 µg of plutonium citrate)

Tissue	Grams of tissue Analysed	cts/gram of tissue	*Relative Affinity for Plutonium
Marrow (rib	0.2065	1399	8.49
Rib (cortex)	0.430	1299	7.88
Callus and bone	0.1933	828	5.02
Callus (bone free)	0.262	534	3.17
Kidney	6.00	360	2.18
Thyroid	2.64	226	1.37
Contents (lower bowel)	10.05	183	1.11
Liver	8.70	162	1.00
Pancreas	6.045	148	0.90
Periosteum (rib)	0.461	123	0.75
Lung	14.40	107	0.65
Fat	5.850	96	0.58
Spleen	10.850	94	0.57
Tumor (liver)	1.97	71	0.43
Heart	).40	70	0.42
Ovary (l.)	1.975	63	0.38
L. Node (abd.)	1.53	48	0.29
Intestines (small)	3.40	45	0.27
Intestines (large)	6.87	43	0.26
Muscle (striated)	15.32	40	0.24
Blood (heart clot)	1.835	22	0.13

* = cts/gram found • cts/gram assuming equal distribution throughout the body.

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- 1 -

[illegible] [illegible] were of necessity exposed to some degree to plutonium and since plutonium is known to be very radiotoxic it was [illegible] desirable to have some method of determining whether or not a given person had any plutonium in [illegible]. [illegible] [illegible] [illegible] desirable to be able to estimate as accurately as possible how much [illegible] deposited in any person. Animal experiments were used to [illegible] [illegible] [illegible] as possible. Some human studies were needed to see how to apply the animal data to the human problems. Hence, two people were selected [illegible] [illegible] [illegible] was such that they could not be endangered by injections of plutonium.

Chicago Case #1
RGR 12/29/22

I. CASE HISTORIES

Case [illegible]

A [illegible] year old white male was admitted to the Billings Hospital [illegible], [illegible] [illegible] surgical treatment of a recurrent epithelioma of the buccal [illegible]. [illegible] [illegible] to the Billings Hospital in March, 1945 the abnormal findings on physical examination were limited to the findings in the face and neck. The [illegible] portion of the mandible and contiguous area of the [illegible] [illegible] [illegible] infected ulcerating area approximately seven centimeters [illegible]. [illegible] anterior portion of the mandible was exposed in the depths of the [illegible]. [illegible] margins of both the buccal membrane and the cutaneous portions of [illegible] were raised and hard. Bone was exposed in the central portion of the [illegible] cutaneous surfaces.

[illegible] examination of the chest revealed a metastatic lesion in the [illegible] [illegible]. The laboratory examinations were essentially negative except for [illegible] hypochromic anemia. The Wasserman and Kahn were negative. Studies of [illegible] [illegible] from the excised tumor were diagnosed as epidermoid carcinoma. [illegible] local surgery was performed on April 1?, 1945 and April 2?, 194?. On April [illegible], 1945 at 9:17 AM the patient was given an intravenous injection of [illegible] [illegible] of [illegible] plutonium as a citrate salt in 0.9 per cent salt solution at [illegible]. The volume of the injection was 2.05 cc. The patient remained in [illegible] [illegible] until August, 1945 when he complained of pain in the chest. [illegible] [illegible] extension of the pulmonary metastases was found. He expired on [illegible], [illegible].

[illegible] findings were weight, 168 pounds (76.4 kg.). An extensive [illegible] [illegible] recurrence of the epidermoid carcinoma of the mouth was found. [illegible] [illegible] carcinomatous invasion of the structures of the sub-mental [illegible] [illegible] angles. Bilateral pulmonary metastases were present. [illegible] [illegible] vascular thrombosis, cavitation and abscess formation were [illegible] [illegible] acute bronchopneumonic process in the lower lobe of the [illegible] [illegible] was noted on gross examination of the kidneys. Microscopic [illegible] [illegible] "a mild focal interstitial nephritis, probably a [illegible] [illegible] are only moderately sclerotic. Parenchymatous degeneration [illegible] [illegible] marked and a few hyaline and calcified casts are [illegible].

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Chicago Case #2
RER 12/14/72

Case No. 2

A fifty-five year old white female was admitted to the Billings Hospital in December, 1945 for diagnosis and treatment. Six months previously (June, 1945), she had noted generalized lymphadenopathy. Two months later (August, 1945), pain, aggravated on motion, developed in the trunk. On admission to the Billings Hospital in December, 1945 the essential physical findings were the presence of bilateral non-tender, moderately enlarged lymph nodes in the cervical, axillary, and inguinal regions and generalized tenderness to pressure over the ribs. X-ray examination of the chest, pelvis, skull, and spine revealed many small, rounded areas of decreased density scattered throughout the bones examined. In addition, partial collapse and wedging of the last thoracic and first and second lumbar vertebrae with some associated calcification was noted.

Laboratory examinations were essentially negative except for a moderate hypochromic anemia and leukocytosis. and were negative. Study of sections of the tumor excised from the skull and left axilla revealed carcinomatous tissue. It was felt that the carcinoma probably originated in the left breast.

The patient's general condition was poor at the time of admission and deteriorated steadily throughout the period of hospitalization. On December 27, 1945 at 9:02 AM, 9.9% micrograms of +6 plutonium citrate were injected intravenously. The salt was contained in 4.4 cc of an isotonic saline solution 0.01 M in citrate at pH 6.5. The clinical course was not visibly altered following the injection. The patient expired on January 13, 1945.

The major autopsy findings were: (1) an adenocarcinoma probably arising in ectopic left axillary breast tissue with metastases to the liver, mesentery of the small intestine, lumbar vertebrae, ribs, skull and pelvis. Numerous healing pathological fractures of the ribs were found. (2) A lymphoblastoma involving the axillary, inguinal, peribronchial, periaortic, and pelvic lymph nodes. Thus the patient had two co-existing presumably independent tumors, an unusual finding. The weight at autopsy was recorded as 85 pounds (38.6 kg.).

Histologically, the bone marrow in all places examined was almost entirely replaced by tumor. The spleen showed a marked myeloid metaplasia. The kidneys showed many convoluted tubules filled with hyaline casts. The tubular epithelium showed evidences of degeneration and repair. Comparison of the biopsy sections with the post mortem sections shows no evident difference in the character of the tumor following the injection of plutonium. The cells characteristic of lymphoblastoma are also present in the biopsy sections.

II. METHODS

The control period in Case I was one week long and was used primarily to determine the approximate daily urinary output available for analytical purposes. In these cases the control period was somewhat shorter and was used for the same purpose.

In both cases the specimens were collected in the usual urinals and bed pans, the material being transferred in the case of the urine, to a gallon bottle to which 5 cc of concentrated hydrochloric acid had been added. The addition of the acid minimizes the likelihood of adsorption of plutonium by the container. The fecal specimens were transferred to "coal-tar" enameled containers.

In Case II because of the condition of the patient, adequate separation of the urine and fecal specimens was not always possible. As a result adequate fecal excretion data could not be obtained.

Hematological studies made at frequent intervals in both cases included: hemoglobin in grams per ml; erythrocytes, leucocytes, platelets per cubic mm; reticulocytes in per cent; leucocyte differential; sedimentation rate (Westergren); and hematocrit reading. Liver function tests were performed in Case II by S. Schwartz using the cephalin flocculation and thymol turbidity tests and bilirubin determinations.

Autopsies: The autopsies were performed by members of the Pathology Department of the School of Medicine of the University of Chicago. The specimens were preserved in 95 per cent alcohol as experience elsewhere had shown that the usual ten per cent formalin preservative tends to leach plutonium out of the specimen. Insofar as possible the specimens were placed in individual containers.

RESULTS

Case I

Excretion of Plutonium in the Urine: For forty-eight hours following intravenous injection of the plutonium solution, each specimen of urine was collected and analyzed separately. The first voiding was approximately six hours after the injection. The results of the analyses are given in Tables I, II and III and Figure I. It is interesting to note that there is very little difference in the percent of the plutonium excreted in the third through the twelfth specimens although the unit concentration of plutonium in the urine varies widely. After forty-eight hours, the specimens voided in each 12 hour period were pooled for sixty days, followed by pooling of specimens for each twenty-four hour period for the duration of the experiment. The results are given in Tables III and IV. The twenty-four urine volumes ranged from 1500 ml to 3600 ml. There was little correlation between urinary volume and quantity of plutonium excreted.

The urinary excretion of plutonium in the first 24 hour period is very nearly 50 per cent of the total excreted in the urine throughout the entire period of observation, and is 36 per cent of the total excreted in both urine and feces. The rapidity with which the rate of excretion diminishes is remarkable. Within 48 hours, the excretion level had fallen to approximately one-hundredth of that found during the first six hours. In approximately two weeks the excretion rate had fallen to approximately 0.004 times the initial rate.

Table I.

Percent of Plutonium Excreted in Urine in the First 38 Hours.
(Individual Specimens)

Specimen No.	Volume of Specimen (cc)	c/m per 100 ml urine	% of injected plutonium excreted
1 (6 hours)	152	6550	2.23
2	218	355	0.175
3	325	45	0.033
4	245	65	0.036
5	414	37	0.035
6 (24 hours)	188	78	0.032
7	103	138	0.039
8	122	137	0.042
9	73	95	0.020
10	97	92	0.020
11	148	67	0.024
12 (48 hours)	160	100	0.024

Table II.

Percent of Plutonium Excreted - 2nd to 8th Day.
12 Hour Urinary Output Analyzed

Days after Injection	Volume of Specimen (cc)	c/m per 100 ml urine	% of Injected Plutonium Excreted
2.4	253	77	0.045
3	415	41	0.039
3.5	630	54	0.035
4	540	39	0.040
4.5	515	19	0.022
5	430	20	0.020
5.5	660	15	0.020
6	485	16	0.017
6.5	600	10.5	0.014
7	380	11	0.0094
7.5	920	6.5	0.013
8	895	5	0.0095

Table III.

Percent of Plutonium Excreted - 9th to 155th Day.

Days after Injection	Volume of Specimen (cc)	c/m per 100 ml urine	% of Injected Plutonium Excreted
9	2510	5	0.007
10	2250	4.7	0.006
11	3275	6.6	0.009
12	2320	5.2	0.007
13	1490	5.4	0.005
14	2635	5.7	0.007
15	2450	4.7	0.006
16	2520	2.3	0.003
17	2650	4.5	0.006
18	2920	4.0	0.006
19	2290	2.1	0.005
20	3060	5.6	0.009
21-30 avg.	2723	3.2	0.005
31-40 avg.	3018	1.9	0.003
41-50 avg.	3346	2.2	0.007
51-60 avg.	3020	3.3	0.001
61-100 avg.	2505	2.9	0.005
101-125 avg.	2125	1.7	0.003
126-138 avg.	----	2.0	0.010
139-155 avg.	----	1.7	0.003

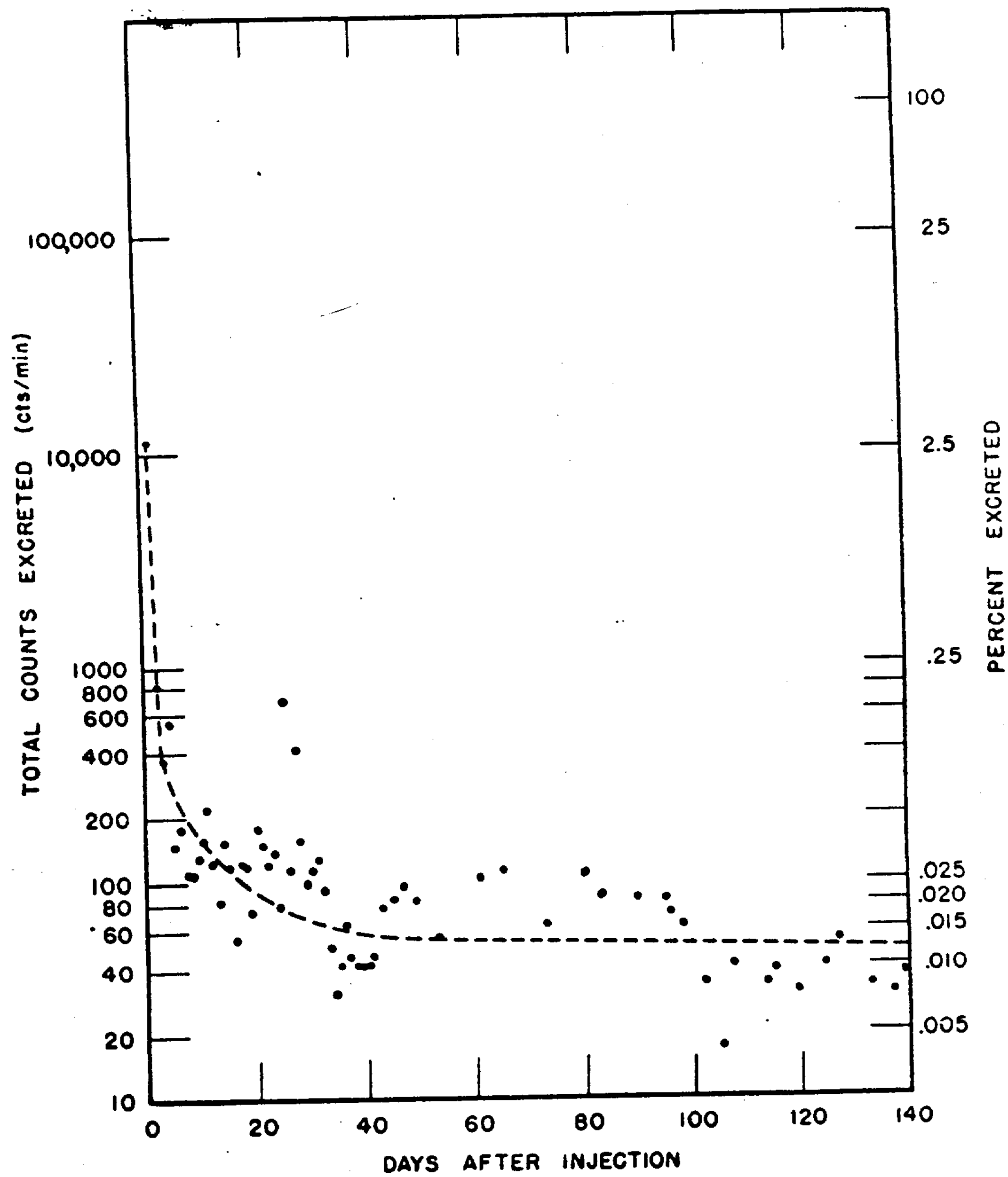


Figure I

[illegible] excretion of plutonium in a [illegible] year old white male following [illegible] of [illegible] micrograms of plutonium citrate.

Fecal Plutonium Excretion. During the first four days after injection seven individual fecal specimens were collected and analyzed for plutonium. Following this period the samples were collected at 24 hour intervals for several months and then 24 hour specimens were taken every four days until death. The results are given in Tables IV and V and Figure II.

Table IV.

Fecal Plutonium Excretion
Individual Fecal Specimens Collected in First 96 Hours.

Sample No.	Time of Collection after Injection	Weight of Specimens (gms)	c/m per gm of feces	% of Injected Plutonium Excreted
1	6 hours	13.0	26.0	0.076
2	28 hours	169.5	3.7	0.157
3	49 hours	45.5	16.2	0.161
4	51 hours	106.9	11.2	0.270
5	not recorded	141.5	6.2	0.195
6	not recorded	318.7	3.7	0.214
7	96 hours	76.2	9.1	0.154

Table V.

Fecal Plutonium Excretion
Daily Specimens from the 5th to the 130th Day

Days after Injection	Weight of Specimen (gms.)	c/m per gram feces	% of Injected Plutonium Excreted
5	49.5	19.3	0.214
6	57.0	8.7	0.109
7	54.2	6.3	0.075
8	64.4	7.3	0.105
10	278.3	3.2	0.200
[illegible]	129.9	2.8	0.082
[illegible]	144.7	1.2	0.048
[illegible]	70.1	2.8	0.054
[illegible]	166.7	1.0	0.042
[illegible]	122.7	1.1	0.033
[illegible]	232.1	0.6	0.032
[illegible]	168.9	0.9	0.037
[illegible]	130.0	0.53	0.0154
[illegible] mgs.	132.4	0.59	0.0140
[illegible] mgs.	115.5	0.29	0.0060
[illegible] mgs.	123.0	0.18	0.0039
[illegible] mgs.	143.6	0.21	0.0043
[illegible] mgs.	68.2	0.16	0.0031

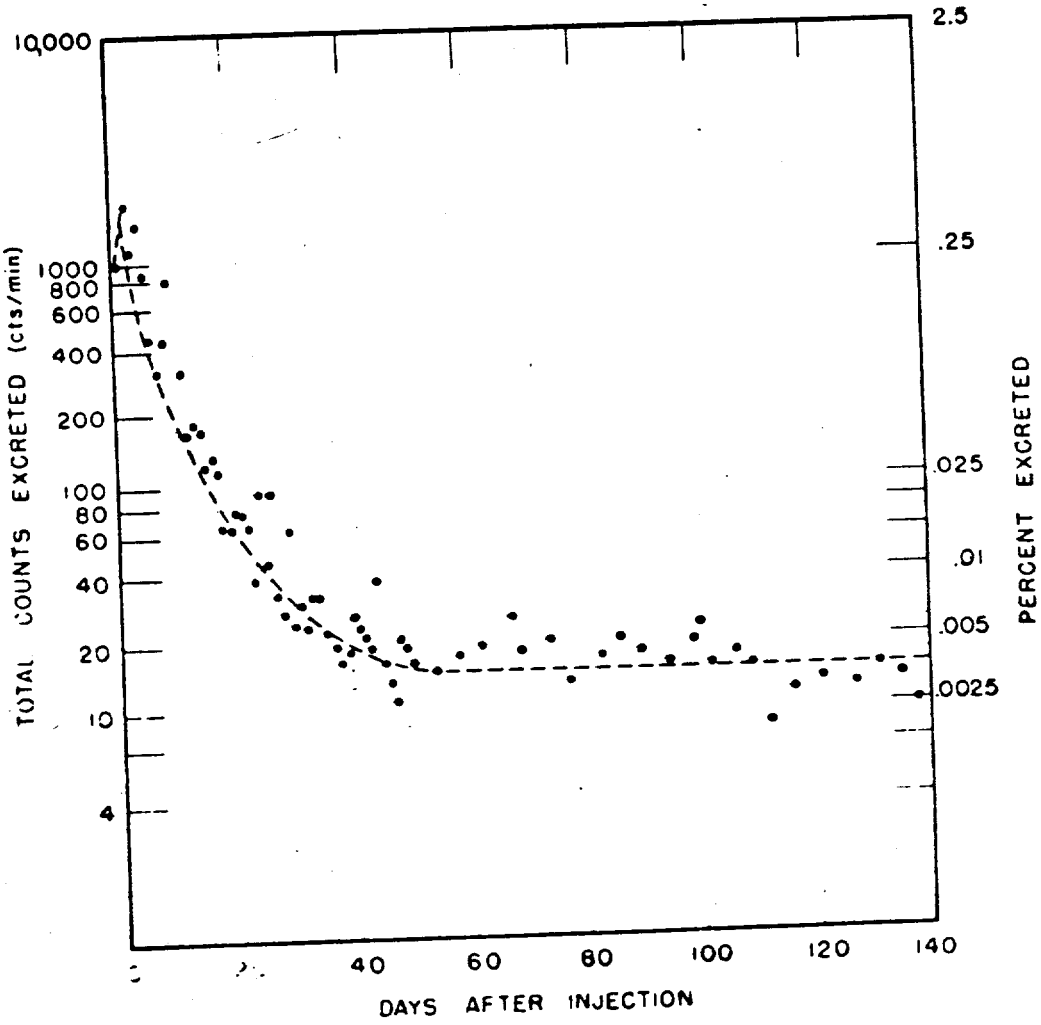


Figure II

Excretion of plutonium in the feces of a sixty-eight year old white male following intravenous injection of 6.50 micrograms of plutonium citrate.

Total excretion of plutonium for 133 days is estimated as 8.13 percent of the injected dose. The urinary excretion is estimated as 5.24 percent of the injected dose, the fecal excretion as 2.90 percent of the injected dose. The average excretion figures are multiplied by the appropriate factor in arriving at the above estimates, since average figures only are given throughout much of the period of study.

Clinical Studies of Peripheral Blood. No changes were observed in the hematological constituents of the peripheral blood which could be attributed to the action of the isotope administered. These data are recorded in Table VI and in Figures III, IV and V.

Table VI.

Blood Findings - Case I

	Hgb. gms. %	RBC M/cu. mm.	Hematocrit cc/100 cc	Reticulocytes %	Platelets/ cu. mm.	PMN %	PMN Absolute	Lymphocytes %	Lymphocytes Absolute	Monocytes %	Eosinophils %	Basophils %	Sed Rate 60' (uncorrected) (Westergren)
4-24-45	10.6	2.97	34	1.0	499,400	77	7238	17	1598	4	1		108
4-24-45	9.7	3.64		1.4	591,000	77	8046	15	1560	6	1	1	
4-26-45	10.9	3.56	35	1.6	332,200	69	5741	27	2403	7	2	1	106
4-26-45	Intravenous injection of 6.50 micrograms of plutonium												
4-27-45	10.5	3.61	34.5	1.5	480,700	79	10191	15	1935	4	1	1	100
4-28-45	10.5	3.71		1.5		81	7657	15	1455	4			
4-30-45	10.3	3.90		1.2		64	4256	21	1396	8	2	1	
5- 1-45	10.0	3.52	31	1.5	298,100	66	4323	23	1506	11	9	1	113
5- 2-45	9.5	3.66		1.7	292,000	63	4821	28	1675	5	4		
5- 3-45	9.5	3.14		3.2	299,200	63	3969	24	1377	6	7		
5- 4-45	9.7	3.71	32	2.4	436,700	70	5250	20	1500	3	6	1	113
5- 5-45	10.4	3.77		1.5		76	4832	14	895	6	4		
5- 7-45	9.7	3.79		3.0	350,900	70	5460	23	1794	5	2		
5- 8-45	9.8	3.80		3.0	294,900	68	5633	15	1870	1		1	
5- 9-45	9.2	3.54	30	3.0		70	5355	27	1300	7	6		69
5-10-45	9.3	3.54		2.1	244,200	64	4096	18	1152	6	11	1	
5-12-45	9.1	3.80	29	2.6		60	4800	25	2000	5	9		93
5-15-45	9.0	3.53	31	1.5	361,900	62	4067	28	1716	0	7		109
5-19-45	9.5	3.14	31	1.6	317,000	61	3355	35	2105	3		1	94
5-22-45	9.3	3.69	29.5	2.0	345,500	55	4823	26	2275	7	12	1	103
5-25-45	8.5	3.09	28	3.3	334,400	62	4495	28	2030	4	6		99
5-29-45	10.0	3.78	34	1.0	323,400	80	8120	13	1319	5	1	1	78
6- 1-45	9.6	3.36	31.5	1.7	141,000	62	4643	20	1530	6	12	1	84
6- 5-45	10.1	3.70	32	1.0	283,000	65	6337	30	2927	4	2		93
6- 8-45	9.8	3.60	33	1.0	272,000	71	5254	21	1554	6	1	1	85
6-12-45	9.7	3.57	33	1.8	202,700	55	3685	38	2546	5	2		89
6-19-45	10.0	4.07	33	1.1	238,700	60	4653	34	2615	5	1	1	110

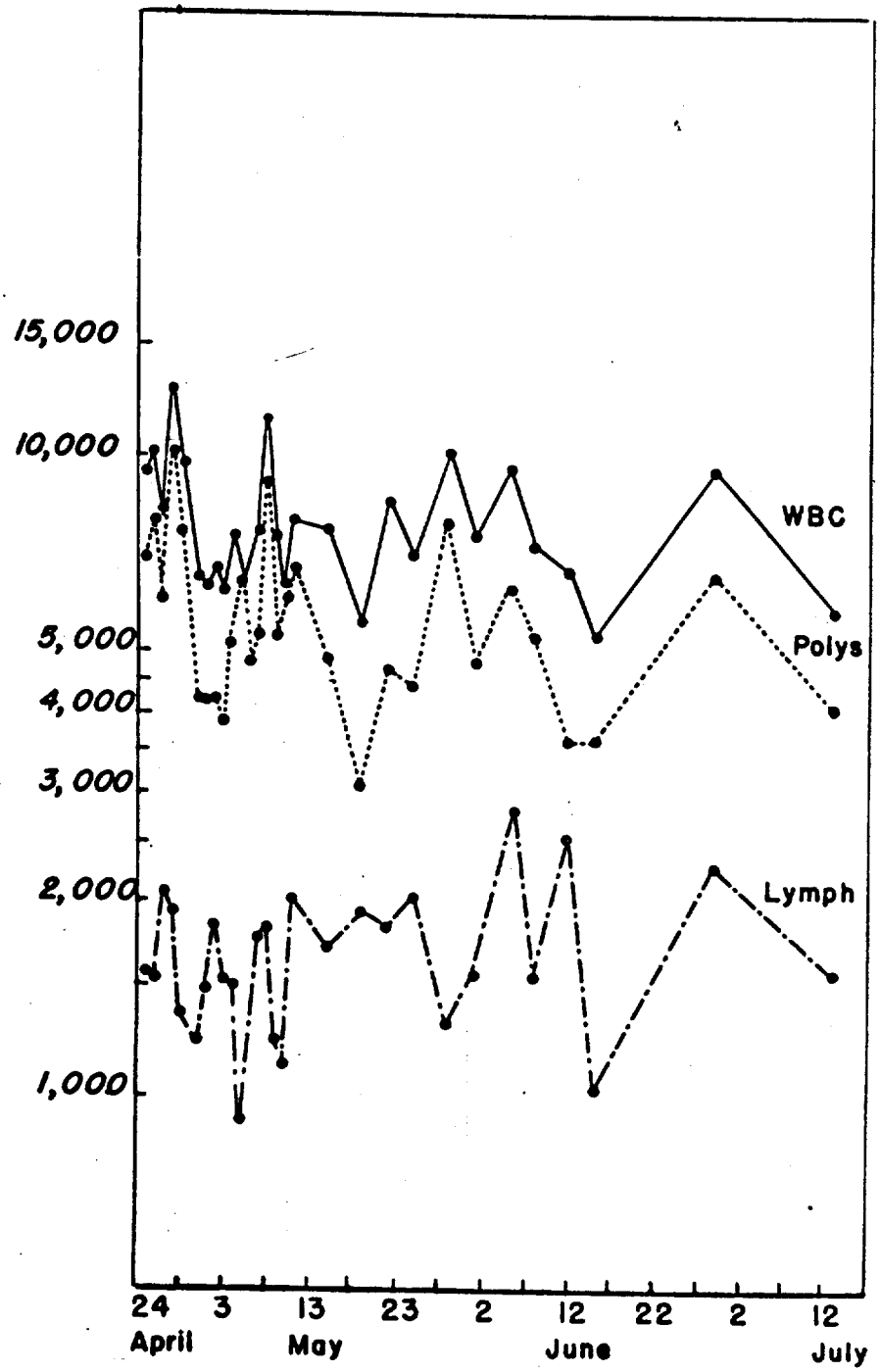


Figure III

Total white blood cell, polymorphonuclear cell, and lymph cell counts per cubic millimeter, in Case I.

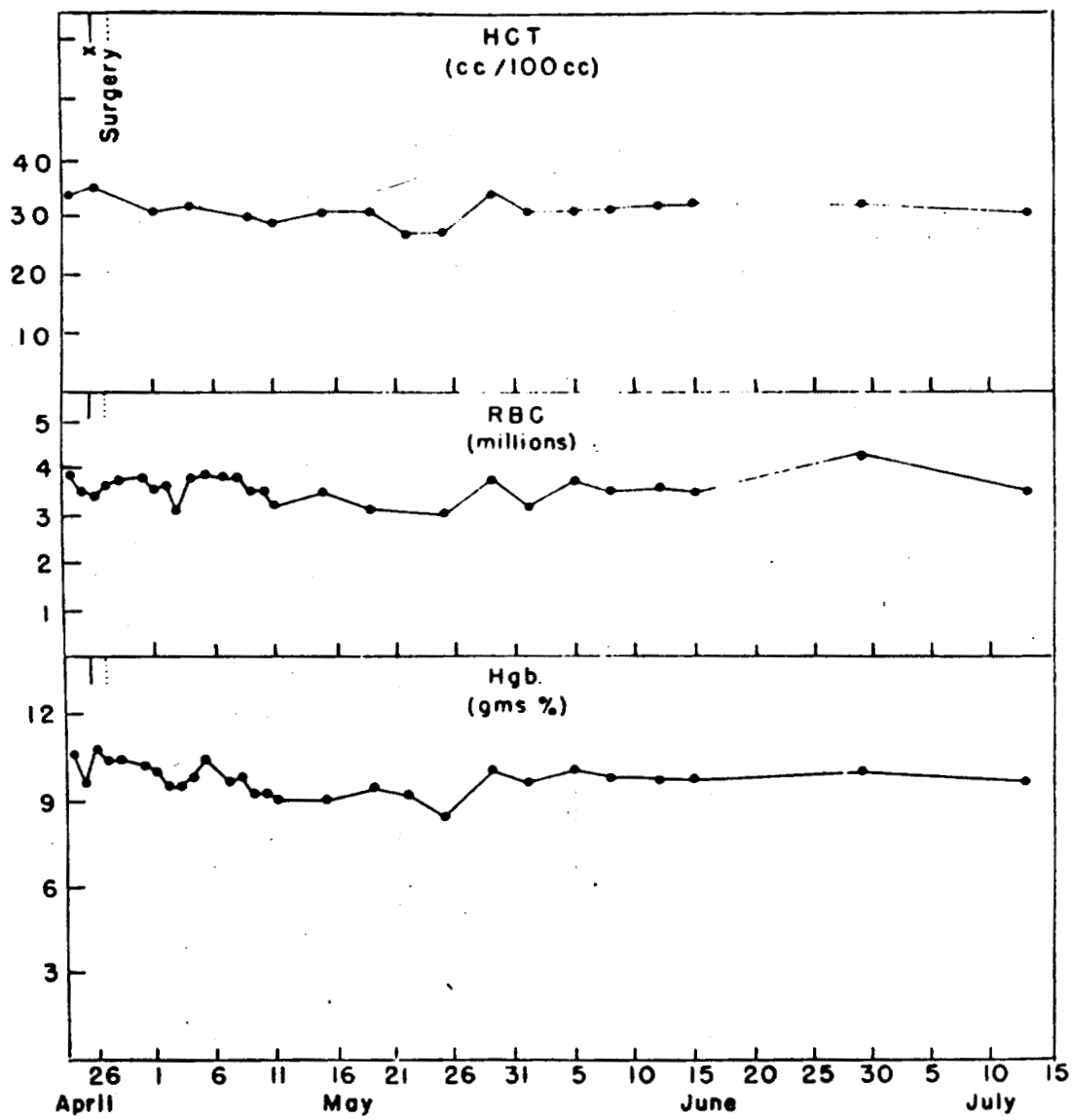
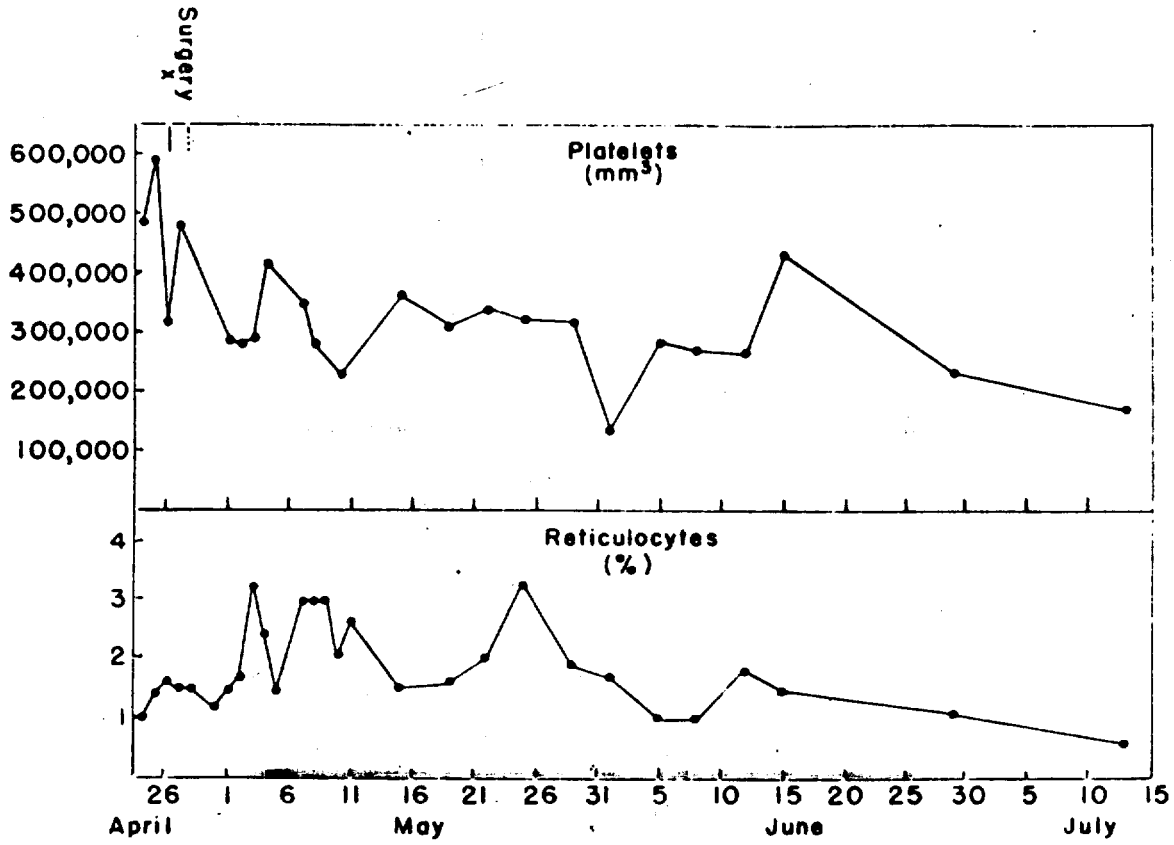


Figure IV

Hematocrit reading, red blood cell count, hemoglobin determination in Case I. The injection was given on April 26, 1945.

Figure V

Platelet and reticulocyte counts in Case I.



Post Mortem Findings. The patient died 155 days after the injection of plutonium. The analytical data is recorded in Table VII. The specimen of marrow and spicules showed the greatest activity per gram of tissue. The plutonium content per gram of liver was nearly as great. The activity of the cortex of the rib was one-tenth that of the bone marrow. No activity could be detected in the sample of bile analyzed. The effects of plutonium on normal and tumor tissue was looked for in the post mortem material by H. Lisco. He found no changes which he felt could be attributed to the action of the plutonium.

Table VII.

Distribution of plutonium in tissues of Case I, 155 days after the injection of 6.5 microgram of plutonium.

Tissue	Weights of Organs (gms)	Gms of Tissue Analyzed	Observed Counts per/min.	Cts/gm of Tissue per/min.	ug/gm of Tissue ($\times 10^{-3}$)	Relative Affinity for Plutonium*
Marrow + Spicules		0.8292	58.8	70.9	1.043	10.13
Liver	2050	34.11	2040.0[1]	59.8	0.880	8.54
Sternum		4.38	111.1[1]	20.6	0.303	2.94
Periosteum (rib)		0.1215	2.12	20.0	0.299	2.90
Spleen	260	32.12	354.9	11.1	0.164	1.59
Lung Tumor		2.03	14.8	7.4	0.109	1.06
Cancer Tissue		2.87	20.9	7.2	0.106	1.03
Rib (cortex)		1.0125	6.06[1]	7.0	0.103	1.00
L. Nodes (aortic)		0.63	4.17	6.7	0.099	0.96
Lungs	1950	15.39	40.7	2.6	0.038	0.37
Testicle (gl. portion)		4.3425	10.0	2.3	0.034	0.33
Kidneys	340	27.35	53.3	1.7	0.025	0.24
Heart		4.9435	6.0	1.2	0.018	0.17
Diaphragm		35.73	33.3	1.0	0.015	0.14
Fat (abd.)		17.05	3.4	0.2	0.003	0.03
Bile		8 cc	2.6	?	0.000	---

* Counts per gram/counts per gram assuming uniform distribution of plutonium.
1 90% correction factor applied to observed counts to give actual counts/gm.

TABLE 3

DISTRIBUTION OF PLUTONIUM IN HUMAN TISSUES FOLLOWING INTRAVENOUS INJECTION OF PLUTONIUM SALTS

Tissue[2]	Subject[1] and % of Injected Dose/g of Tissue								Rel. Pu	Org.	Calc.
	Hp-5	Hp-9	Hp-11	Chi. I	Chi. II	Hp-12	Cal. I	Av. %/g	Affinity[3]	Wt./g[4]	%/Organ
Bone Marrow	--	--	.0096	.0153	.0210	--	.0290	.0187	13.3	3,000	(56.1)[6]
Radius (Frag. head)	--	--	--	--	--	.0187	--	--	--	--	--
Liver	.0320	.0144	~~.0053~~	.0139	~~.0624~~	--	--	.0136	9.7	1,700	23.1
Rib (Cortex)	--	--	--	.0015	.0196	--	.0170	.0127	9.1	--	--
Patella	--	--	--	--	--	.0109	--	--	--	--	--
Vertebra	.0071	.0080	.0070	--	--	--	--	.0073	5.2		--
Sternum	.0070	--	.0100	.0044	--	--	--	.0071	5.1	SKELETON ~~10,000~~ 7,330	65.7[5]
Rib (Whole)	.0050	.0038	.0068	--	--	--	--	.0052	3.7		--
Periosteum (Rib)	--	--	--	.0043	.0019	--	.0048	.0037	2.6	--	--
Spleen	.0007	.0015	.0048	.0024	.0014	--	.0019	.0021	1.5	200	0.4
Kidney	.0002	.0002	.0015	.0004	.0054	--	--	.0015	1.0	300	0.4
Thyroid	.0001	--	.0009	--	.0034	--	--	.0014	1.0	30	--
Adrenal	.0004	--	.0022	--	--	--	--	.0013	1.0	14	--
Lung	.0005	--	.0016	.0006	.0016	--	--	.0011	0.8	950	1.0
Pancreas	.0002	.0002	--	--	.0022	--	--	.0009	0.6	65	--
Gonads	.0003	--	.0012	.0005	.0009	--	--	.0007	0.5	--	--
Lymph Node	--	--	--	.0014	.0001	--	--	.0007	0.5	700	0.5
Teeth (Av. of 7)	--	--	--	--	--	.0003	--	--	--	--	--
Heart	.0000	.0000	--	.0003	.0011	--	--	.0003	0.2	350	0.1
Large Intestine	.0002	--	.0004	--	.0001	--	--	.0002	0.1	2,300	0.5
Small Intestine	.0001	--	.0005	--	.0001	--	--	.0002	0.1	--	--
Muscle and Skin	.0000	--	.0002	.0002	.0001	--	--	.0001	0.1	38,500	3.9
Blood	--	--	--	--	--	--	--	--	--	5,400	0.2[8]
Balance	--	--	--	--	--	--	--	.0001[7]	--	9,600	0.9
Total	--	--	--	--	--	--	--	--	--	70,000	96.7

(1) The various subjects received the following doses of plutonium: Hp-5 = 5 μg; Hp-9 = 6.3 μg; Hp-11 = 6.5 μg; Chi. I = 6.5 μg; Chi. II = 94.9 μg; Hp-12 = 4.7 μg; Cal. I = 103 μg.

(2) Tissues were obtained at the following times after injection: Hp-5 151 days; Hp-9 456 days; Hp-11 5 days; Chi. I 155 days; Chi. II 16 days; Hp-12 5 days; Cal. I 4 days.

(3) Calculated by dividing %/g of tissue by %/g of body weight if a unit dose of Pu was equally distr. in a 70 Kg. man.

(4) Hermann Lisco, Memorandum to AEC, July 21, 1947, Project Standard Man.

(5) Assumption made that vertebra, sternum and whole rib represent average bone of skeletal system.

(6) Bone marrow not included in total recovery because bone samples were not freed of marrow before analysis.

(7) Balance assumed to have same Pu content as muscle.

(8) Value for blood taken at 30 day point, Fig. 3.

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Case II.

Excretion Studies. The urinary excretion data is listed in Table VIII and plotted in Figure VI. Unfortunately no comparison of fecal and urinary excretion can be made in this case. The collection of separate urine and stool samples was impossible. In fact the graph of urine excretion in Figure VI might with greater truth be called the graph of total product excretion.

The 24 hour excretion rate was 0.152 percent of the amount injected. This represents an excretion of 0.144 micrograms of the 94.9 micrograms injected. Following the initial 24 hour period the excretion rate was comparable to that in the other cases studied. The total known excretion was 0.684 percent of the amount injected, or 0.[illegible]9 micrograms.

Table VIII.

Daily Plutonium Urinary Excretion, Case II.

Days after Injection	24-hour Volume	Alpha Counts/min/ 100 cc.	% of Injected Dose Excreted
1	1660 ml	594	0.152
2	1725	622	0.167
3	1750	250	0.067
4	1150	126	0.033
5	2020	134	0.042
6	1300	207	0.042
7	1190	132	0.0243
8	1500	110	0.0284
9	1400	89	0.019
10	1280	154	0.030
11	1120	108	0.019
12	940	100	0.014
13	875	251	0.034
14	630	99	0.009
15	330	124	0.016
16	150	164	0.004

Studies of the Peripheral Blood: No alterations in the hematological constituents of the peripheral blood occurred following the administration of 97.2 micrograms of plutonium which could be attributed to the presence of the element. The interpretation of changes in the thymol turbidity and cephalin flocculation tests, and in the amount of bilirubin in the blood serum was not possible because of the terminal state of the subject. These data are presented in Table IX and in Figure VII.

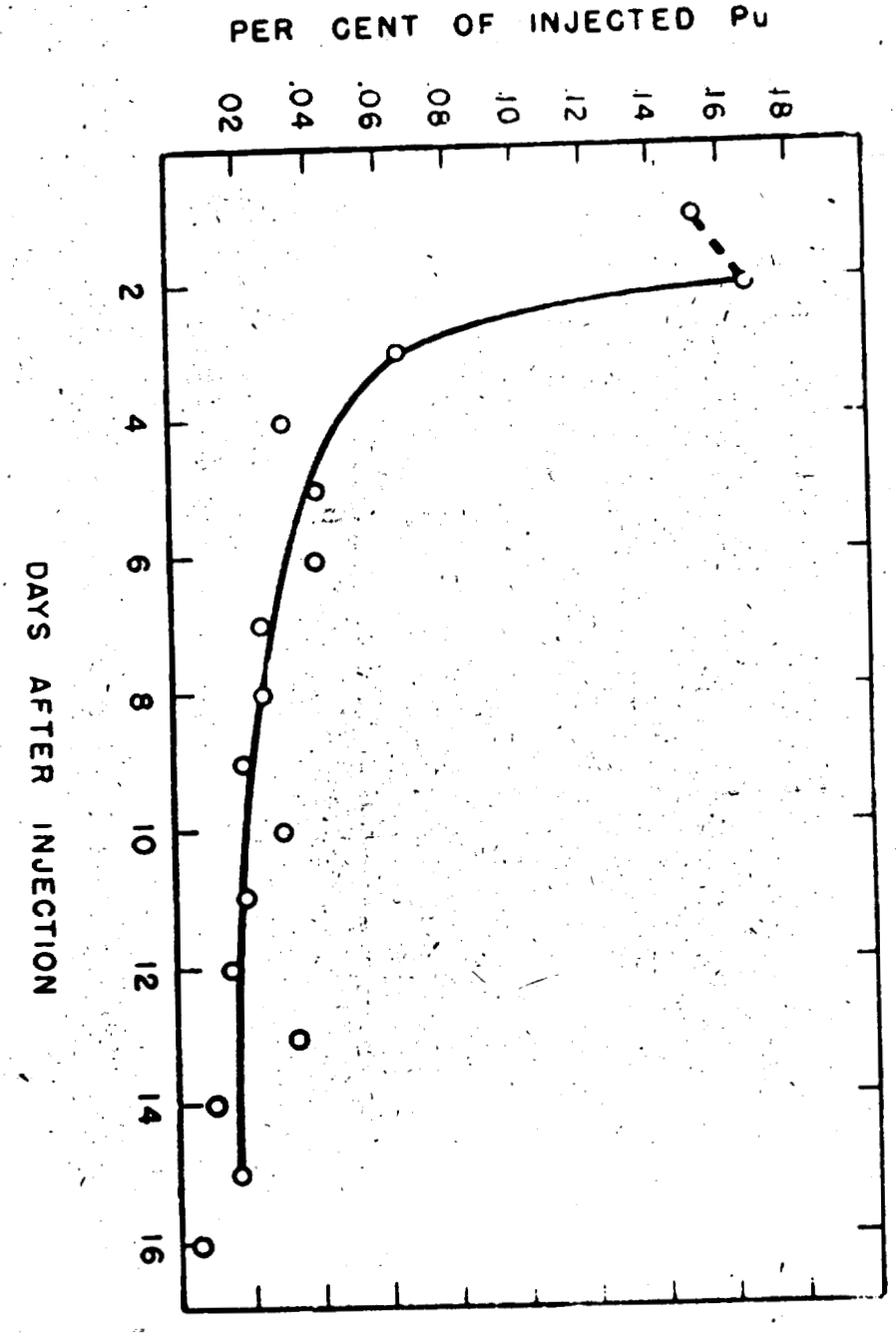

Figure VI

Excretion of plutonium in the urine following the injection of 94.9 micrograms of plutonium citrate.

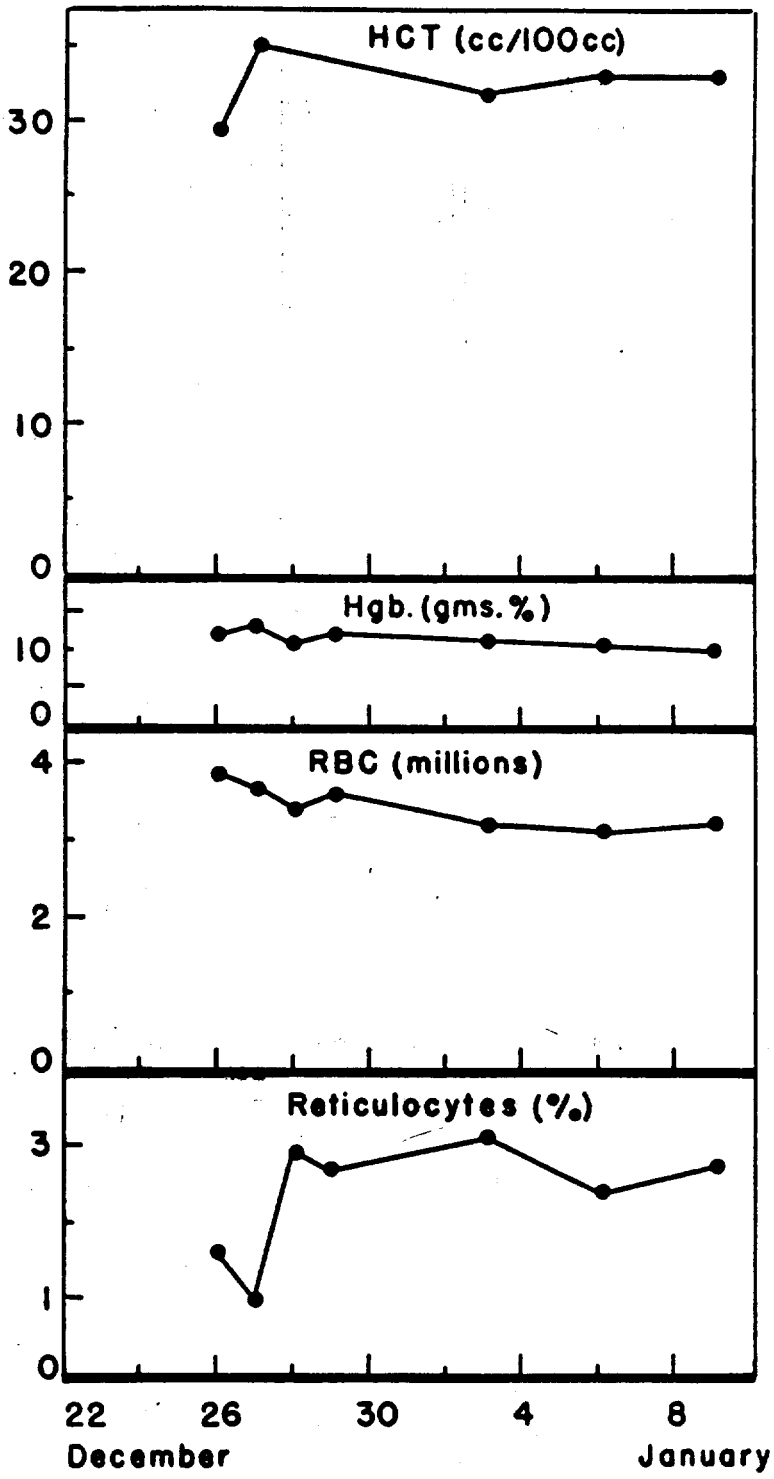

Figure VII

Hematocrit, hemoglobin, red blood cell and reticulocyte findings in Case II.

Table IX

Blood Findings in Case II

Date	12/26/45	12/27/45*	12/28/45	12/29/45	1/2/46	1/5/46	1/8/46	1/12/46
Hb	12.1	12.9	11.8 gm	12.8 gm	11.[illegible]	11.0	10.5	11.0
RBC	3.96	3.72	3.47	3.65	3.37	3.25	3.32	3.36
Hematocrit	29	35			32	33	33	33
WBC	17,250	20,950	16,550	18,300	17,900	18,950	20,500	20,950
Reticulocytes	1.6%	1.0	2.9%	2.7%	3.2	2.4	2.8	1.9
Sed Rate	115	101			59		58	57
Neutrophiles, %	83	75	77	71	81	82	80	85
Neutrophiles, No.	14,276	15,675	12,705	12,993	14,499	15,498	16,400	17,765
Eosinophiles, %	5	2	4	3	2	1	2	12
Basophiles, %			1					
Lymphocytes, %	12	15	11	15	10	13	13	12
Lymphocytes, No.	2,064	3,135	1,815	2,745	1,790	2,[illegible]57	2,665	2,508
Monocytes, %	2	8	7	10	7	4	5	3
Stabs				1%				
Metamyelocytes, %					2			
Polychromasia			sl.	sl.	sl.	sl.		sl.
Hypochromasia	sl.	sl.					sl.	
Anisocytosis	sl.	sl.	sl.	sl.	sl.	sl.	sl.	sl.
Normoblasts								2
Polys. toxic	x							x
Cephalin Flocculation		1+	2+	1+	1+	1+	2+	1+
Serum Bilirubin								
15 min.		0.48	0.42	0.42	0.63	0.36	0.58	0.38
Total		1.0	0.72	0.76	1.04	0.56	1.00	0.64
Thymol Turbidity		90	88	89	89[2]	89[1]	86[2]	90

* Injection of plutonium on this day following the withdrawal of blood for study.

Distribution of Plutonium in the Tissues. The Plutonium content of the tissues analyzed is listed in Table X. The marrow and rib specimens showed the highest specific activity, as would be expected from the animal work. The plutonium content per gram of liver tissue was roughly one-tenth that of the bone marrow. The specific activities per gram of muscle and fat were respectively one-twentieth and one-thirty-fifth that of the bone marrow. H. Lisco reviewed the histological material for evidence of changes similar to that attributed to plutonium in the experimental animals. No such change was observed. It should be pointed out that the amounts per gram of body weight were greater in the animals in which changes were seen.

Table X.

Plutonium Distribution in Tissue 16 Days after Injection.

Tissue	Weight of Organ (gms)	Weight of Sample (gms)	Total Counts[1] in Sample	Counts[1]/ gm of Tissue	Micrograms Plutonium/ gram of tissue ($\times 10^{-3}$)	Relative Affinity for Plutonium[2]
Marrow (Rib)		0.2065	289	1399	20	8.49
Rib (Cortex)		0.430	558	1299	18.6	7.88
Callus and Bone		0.1933	160	828	11.2	5.02
Callus (bone free)		0.262	140	534	7.7	3.17
Kidney	190	6.00	2162	360	5.1	2.18
Thyroid		2.64	597	226	3.2	1.37
Contents (lower bowel)		10.05	1833	183	2.6	1.11
Liver	1110	8.70	1405	162	2.3	1.00
Pancreas	60	6.045	893	148	2.1	0.90
Periosteum		0.461	57	123	1.7	0.75
Lung	490	14.40	1533	107	1.5	0.65
Fat, Mesenteric		5.850	560	96	1.2	0.58
Spleen	85	10.850	1021	94	1.2	0.57
Tumor (Liver)		1.970	140	71	1.0	0.43
Heart	250	9.40	660	70	1.0	0.42
Ovary, L.		1.975	122	63	0.90	0.38
Lymph Node (abd.)		1.53	73	48	0.70	0.29
Intestines (small)		3.40	151	45	0.64	0.27
Intestines (large)		6.87	291	43	0.60	0.26
Muscle (Str.)		15.32	613	40	0.57	0.24
Blood (Heart Clot)		1.835	40	22	0.31	0.13

1 - Alpha counts per minute from plutonium.

2 - Counts/gram found divided by counts/gram assuming equal distribution of the plutonium.

DISCUSSION

It must be emphasized that the data discussed above, while obtained on humans, may not be applicable to the population with which we are mostly concerned. The majority of occupationally exposed persons are in the 20-40 year age group and are in good general health. The persons discussed above both had carcinomas, one of which had widespread metastases. In case #2, the injection was made but seventeen days before death and the terminal state may have influenced the metabolic behavior of the element. In case #1 no gross evidence of other than local disease, except for the metastasis to the lung, was noted at the time of injection. Thus, barring alterations due to age, the early distribution of the plutonium was presumably a "physiological" one. However, it must be pointed out that we have no information on the early distribution pattern of the plutonium in this case. The data given in TableVII represents the distribution of the injectate 155 days later, after profound metabolic disturbances, causing his death, had occurred. It is impossible to say what influence this may have had in altering the early distribution pattern.

As is well-known, the biological behavior of a given agent varies greatly from one species of mammal to another. Hence, experience with humans injected with plutonium was vital to any interpretation of the data obtained from animals. The rate of plutonium excretion in rats[2], mice[2], rabbits[3] and dogs[4] varies widely. The route of excretion varies from species to species[2,4]. Since our estimate of the body content, and hence ultimately of the desirability of removing a given worker from his job, depended upon the excretion rate of plutonium in the human, it became necessary to determine that rate directly in the species concerned. Knowledge of the distribution of the element as well as its rate and route of elimination from the human body provided information which could be correlated with the more extensive experimental investigation in animals and provided information which made possible the estimation of the amount of plutonium already deposited in the workers by the determination of the daily plutonium excretion rate of the individual concerned.

Clinical Picture. Insofar as can be determined the clinical course in neither of the two cases was influenced by the injection of plutonium. In Case #1, the concentration of that material was 0.085 micrograms per kilogram of body weight immediately following the injection. In the second case the concentration of plutonium was 2.46 micrograms per kilogram of body weight.

That the amount of plutonium injected in these subjects produced no appreciable clinical effect is likely in view of the fact that the amount of plutonium necessary to produce damage is far greater. Table XI lists some of the experimental values[2].

Table XI.

Comparison of Dose Levels of ^{239}Pu Plutonium in Animals and Their Effects.

	ug/kg	Effects	Time
Rats	700 - 1000	LD 50%in	30 Days
Rats	200 - 600	LD 50%in	150 Days
Rats	10	None	420 Days

It will be seen that the level of 10 micrograms per kilogram is approximately 117 times the dosage level in Case I and 4 times the dosage level in Case II.

Haematological Studies. No hematological changes of the peripheral blood were observed in either subject. In view of the very slow excretion rate and long half-life of deposited plutonium it might be assumed however that a condition comparable to that described by Hartland(5), Castle(8) and Bomford and Rhoads(9) in individuals with chronic radium poisoning (severe anemia, leukopenia and thrombocytopenia with or without bone sarcoma) might well develop in either case were it possible to observe subjects over extended periods of time. The difficulty which arises in attempting to extrapolate from the radium damage data on the human to the expected effect of plutonium is, among other things, due to the difference in the excretion pattern and the impossibility of estimating what the ingested dose might have been in the individuals who have succumbed to radium poisoning. While bone sarcomas have been reported in individuals with a total of 0.5 μg of radium in the body at death, little information is available as to the amount which was in the body initially and this initial dose may be the critical amount.

Case I

Excretion Studies. The fact that the rate of excretion of plutonium apparently had not reached a constant even 100 days after injection deserves emphasis. The rate of fall is slight but definite. This point deserves emphasis as it may indicate that the excretion rate 1000 days after exposure may be even less than the average of 0.012 per cent found after 150 days in this case. Evidence for continued diminution in the excretion rate of plutonium 238 (isotope of plutonium 239) is found in the patient studied by the University of California group which is described in the biology volumes of this report. In this patient, 158 days after injection, the daily excretion rate is approximately 0.0015 per cent of the injected dose(6), a figure definitely lower than our figure of 0.012 per cent one hundred and fifty days after injection.

Should the lower figure prove to be the more correct one the difficulty of detecting tolerance concentrations of plutonium by means of the urinary excretion of that element is materially increased.

It is interesting to note the totals of urinary and fecal excretion for the time periods of 0-24 hours, 2-10 days, and 11-100 days. Table XII gives these data for Case I in terms of per cent of the injected dose:

Table XII

Summary of Plutonium Excretion for Indicated Time Periods, Case I

Time	Urine	Stool	Total
0-24 hours	2.53%	0.233%	2.764%
2-10 days	0.638%	1.748%	2.386%
11-100 days	1.902%	0.767%	2.669%

It is apparent that the total excretion is roughly equal for each of the various periods. One might speculate that the next order of magnitude, that is 101-1000 days, might also show a total plutonium excretion of approximately 2.5 percent. If this percentage excretion for the 101-1000th days period is subsequently borne out by experimental observation, it would paint a rather discouraging picture from the point of view of the normal excretion rate for plutonium.

The fecal excretion pattern is similar to that described for the excretion in the urine. No sharp early peak in the excretion rate is noted however. On the other hand, the rapidity with which the rate falls is not so marked. Indeed, the total plutonium excreted from the second to the tenth day is greater in the feces. However, as pointed out above, the fecal excretion after the twentieth day is distinctly less than the urinary excretion.

It will be noted that throughout this paper the excretory rate is given as "percent per day of the injected dose". It would be more accurate to speak of the percent per day of the amount in the body. Because of the low rate of excretion of plutonium the correction factor is small and it is felt that the small inaccuracy introduced by this practice is justifiable, particularly in preliminary studies.

Distribution of plutonium in the Body. It may be useful to compare the relative concentrations of plutonium in the various organs in the two cases. It is recognized that such comparisons cannot be pushed too far because of the many uncontrolled variables.

For ease of comparison, the values from Case I in Table XIII are adjusted to an injection amount of 94.91 micrograms, the amount injected in Case II, assuming the same distribution would occur with the larger dose.

In both cases the bone marrow shows the greatest concentration of plutonium per gram of tissue. On the basis of animal experimentation it is felt that the plutonium probably initially localizes in the osteoblastic and collagenous tissue surrounding the spicules, forming the endosteum. Since the proportion of this tissue is greatest in the marrow specimen, it shows the highest activity. It is of interest also to note the much higher proportional activity of the bone cortex in Case II, where the cortex shows almost as much activity as the marrow. The decalcification of the bones noted in this case would result in a greater proportion of plutonium-containing tissue than found in the comparable specimens in Case I, where the calcium content of the bones was apparently normal. The specimen of callus from the rib in Case II did not show as high concentration as the cortex or marrow specimens do. Since the callus represents a healing pathologic fracture, it is entirely possible that the uptake of plutonium was abnormally low.

Table XIII

Comparison of the concentration of plutonium per gram of tissue. For ease of comparison the values from Case I are adjusted to an injection amount of 94.91 micrograms, the amount injected in Case II.

Tissue	Case I Gm Pu/gr tissue ($\times 10^{-3}$)	Case II Gm Pu/gm tissue ($\times 10^{-3}$)
Bone Marrow + Spicules	15.2	20.0
Bone Cortex	1.50	18.6
Kidney	0.36	5.1
Liver	12.8	2.3
Lung	0.55	1.7
Fat	.04	1.5
Spleen	2.39	1.2
Tumor	1.59	1.0
Heart	0.26	1.0
Ovary		0.90
Testicle	0.50	
L. Nodes	1.44	0.70
Muscle, striated	0.22	0.57

The amounts in the livers are of considerable interest. The reasons for the wide discrepancy shown are not known at the present time. In Case I the liver content at death, some 150 days after injection, constituted approximately one-third of the injected amount. This value is far higher than the data from experimental animals would lead one to anticipate(2). It is true that early values comparable to the one listed here may be found in the experimental animal. Most uniformly, however, the initial high value has dropped by a factor of five or ten by the hundredth day(2). Why, in this instance, the liver should have retained plutonium so tenaciously is not understood. Indeed, it must be admitted that we cannot rule out the possibility that the amount in the liver was at one time lower than the final value. Liver biopsies would be extremely useful in following the plutonium content of that organ over a wide time range.

In Case II the content of plutonium in the liver was approximately one-sixth of the amount noted in Case I and constituted approximately one percent of the amount injected. This figure is, if anything, somewhat lower than one would expect the concentration in the liver to be on the 16th day after injection, judging again from the results of animal experiments.(2)

The concentration of plutonium in the spleen in Case I, which showed some congestion but no other evidence of pathologic change, was distinctly greater than the concentration in the spleen in Case II where a marked myeloid metaplasia was observed. The relative concentration of plutonium in the spleen observed in these two cases given here are distinctly less than those observed in experimental animals, particularly in dogs(4). In most instances the plutonium concentration in the spleen compares favorably with that of the bone marrow. Certainly the difference noted between the results in the two human cases are far less than the difference between species(2,4). Again no explanation for this fact can be given at this time.

It is interesting to note that in both cases the primary tumors, two carcinomas and a lymphosarcoma, did not concentrate plutonium to a significant degree. While it is impossible to generalize from two cases, it seems unlikely that plutonium will be of any value in the treatment of carcinomas in humans. As a general principle any radioactive agent injected for therapeutic purposes must concentrate to a greater degree in the tumor than elsewhere.

There is a marked difference in the concentration of plutonium in the kidneys of the two cases. The higher value is found in Case II. Two factors may reasonably be expected to operate in the direction of producing a higher concentration of plutonium in this case. First, and probably more important, is the fact that the death occurred shortly after the injection. The data obtained from animal experiments indicates that the kidney concentration is higher shortly after injection(2). In both cases evidence of degenerative changes in the tubules of the kidneys was noted in the tissue sections. In addition, in Case I changes suggestive of a pyelonephritic lesion were noted. It is possible that the urinary excretion data will be found subsequently to be too low because of the presence of disease in the kidneys. Evidence obtained elsewhere, however, would indicate that the figures for urinary excretion given here are not seriously in error(7).

The lack of plutonium in the bile is of considerable interest. Within the limits of the method (approximately 10^{-4} micrograms of plutonium per gram of tissue) none was found. Similar findings were noted in the plutonium injected dogs(4).

The relative activity of the contents of the lower bowel in Case II are higher than would be anticipated from the results of the analysis of the feces. Further, the value is four times higher than that obtained for specimens of the tissue of the large and small intestine in this case. If the assumption is made that the amount of plutonium in the bile was negligible as in Case I, it would seem then that plutonium is being excreted by the large or small intestine. Since other heavy metals are excreted by the large intestine it seems reasonable to tentatively assume that plutonium is also excreted by this route. The assumption cannot be verified until further experimental data is available.

In general the relative amount of plutonium per gram of tissue tends to be higher in Case II than in Case I. It is possible that the explanation lies in the comparative lack of fatty tissue in Case II so that the organs and tissues studied tend to have a greater proportion of plutonium than was noted in Case I. The total fat is difficult to estimate from the data at hand and therefore the total amount of plu-

cases reported elsewhere) the following tentative conclusions may be drawn. It must be recognized clearly that these are not in the true sense of the word conclusions but are only working hypotheses that must be confirmed and elaborated upon by subsequent investigations.

(1) The urinary rate of excretion of plutonium in humans is exceedingly low. The best evidence available at this time would indicate that the "chronic" (150th day) excretion rate does not exceed 0.01 percent per day of the amount fixed in the body.

(2) The fecal rate of excretion of plutonium fixed in the body is lower than the urinary rate by a factor of approximately three. What evidence we have would indicate that the rate of fecal excretion does not exceed 0.003 percent per day of the amount in the body.

(3) The highest concentration of the plutonium fixed in the body is found in the bone marrow. The liver concentration has varied so widely in the two cases here reported that it is impossible to predict on a reasoned basis what the general picture might be.

(4) The concentration of plutonium in the neoplastic tissue of these cases was not high.

BIBLIOGRAPHY

(1) Russell, E. R., Schubert, J., et al, "The Quantitative Determination of Plutonium in Biological Tissues", PPR, Vol. 20-B.

(2) Snyder, R., and Kisielski, W., "Acute Toxicity of Plutonium for Mice and Rats", PPR, Vol. 22.

(3) Russell, E. R., MUC-ERR-83, "Collected Data on Excretion", May, 1945.

(4) Painter, E., Russell, E. R., and Prosser, L., "Clinical Physiology of Dogs Injected with Plutonium", PPR, Vol. 22.

(5) Martland, H. S., "Occupational Poisoning in Manufacture in Luminous Dials", J.A.M.A., Vol. 92, p. 552, 1929.

(6) Stone, R. S., MUC-RSS-569, November, 1945.

(7) Langham, Wright, personal communication.

(8) Castle, W. B., Drinker, K. and Drinker, C., "Necrosis of the Jaw in Workers Employed in Applying a Luminous Paint Containing Radium", Jr. Indust. Hyg. and Toxicol. 7:371, 1925.

(9) Bomford, R. R., and Rhoads, C. P., "Refractory Anemia - Part I, Clinical and Pathological Aspects, Part II, Aetiology and Treatment". Qr. Jr. of Med. 10:39, 1941.

[redacted]

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Please change the classification of this report to [redacted] return the obsolete pages to Carrol Cohen, at Office Services, Museum E-117-B.

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W. H. Zinn, Director

THE DISTRIBUTION AND EXCRETION OF PLUTONIUM IN TWO HUMAN SUBJECTS

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Assisted by

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TABLE 9 (Contd)

INDIVIDUAL FECAL EXCRETION VALUES OF PLUTONIUM FOLLOWING INTRAVENOUS ADMINISTRATION(1) TO HUMAN SUBJECTS (EXPRESSED AS PER CENT OF DOSE EXCRETED PER DAY)

DAYS POST INJECTION	PER CENT OF INJECTED DOSE EXCRETED PER DAY											
	Hp-1	Hp-2	Hp-3	Hp-4	Hp-5	Hp-6	Hp-7	Hp-8	Hp-9	Hp-10	Hp-12	Chi-I
48	-	-	-	-	-	-	-	.008	-	-	-	.0054
49	-	-	-	-	-	-	-	.008	-	-	-	.0047
50	-	-	-	-	-	-	-	.008	-	-	-	.0040
51	-	-	-	-	-	-	-	.008	-	-	-	-
52	-	-	-	-	-	-	-	.010	-	-	-	-
53	-	-	-	-	-	-	-	.010	-	-	-	-
54	-	-	-	-	-	-	-	.010	-	-	-	.0038
55	-	-	-	-	-	-	-	.010	-	-	-	-
56	-	-	-	-	-	-	-	.010	-	-	-	-
57	-	-	-	-	-	-	-	.007	-	-	-	-
58	-	-	-	-	-	-	-	.007	-	-	-	.0043
59	-	-	-	-	-	-	-	.007	-	-	-	-
60	-	-	-	-	-	-	-	.007	-	-	-	-
61	-	-	-	-	-	-	-	.008	-	-	-	-
62	-	-	-	-	-	-	-	.008	-	-	-	.0048
63	-	-	-	-	-	-	-	.008	-	-	-	-
64	-	-	-	-	-	-	-	.008	-	-	-	-
68	-	-	-	-	-	-	-	-	-	-	-	.0063
70	-	-	-	-	-	-	-	-	-	-	-	.0045
74	-	-	-	-	-	-	-	-	-	-	-	.0050
78	-	-	-	-	-	-	-	-	-	-	-	.0033
79	-	-	-	.006	-	-	.005	-	-	-	-	-
80	-	-	-	.006	-	-	.005	-	-	-	-	-
81	-	-	-	.006	-	-	.005	-	-	-	-	-
82	-	-	-	.006	-	-	.005	-	-	-	-	.0042
83	-	-	-	-	-	-	.006	-	-	-	-	-
84	-	-	-	-	-	-	.006	-	-	-	-	-
85	-	-	-	-	-	-	.006	-	-	-	-	-
86	-	-	-	-	-	-	-	-	-	-	-	.0050
90	-	-	-	-	-	-	-	-	-	-	-	.0042
94	-	-	-	-	-	-	-	-	-	-	-	.0040
98	-	-	-	-	-	-	-	-	-	-	-	.0050
100	-	-	-	-	-	-	-	-	-	-	-	.0056
102	-	-	-	-	-	-	-	-	-	-	-	.0038
106	-	-	-	-	-	-	-	-	-	-	-	.0043
108	-	-	-	-	-	-	-	-	-	-	-	.0038
112	-	-	-	-	-	-	-	-	-	-	-	.0021
116	-	-	-	-	-	-	-	-	-	-	-	.0029
120	-	-	-	-	-	-	-	-	-	-	-	.0032
126	-	-	-	-	-	-	-	-	-	-	-	.0030
130	-	-	-	-	-	-	-	-	-	-	-	.0037
136	-	-	-	-	-	-	-	-	-	-	-	.0034
138	-	-	-	-	-	-	-	-	-	-	-	.0025

*Values eliminated from revised mean on basis of the Chauvenet Criterion.

(1) All cases except Chi-I received Pu^{+4} in 0.4 per cent $Na_3C_6H_5O_7 \cdot 2H_2O$ Solution.

(2) Russell, E.R., Nickson, J.J., Argonne National Laboratory Report CH-3607.

Not 53.

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TABLE 6 (Contd)

INDIVIDUAL URINARY EXCRETION VALUES OF PLUTONIUM FOLLOWING INTRAVENOUS ADMINISTRATION[1] TO HUMAN SUBJECTS (EXPRESSED AS PER CENT OF DOSE EXCRETED PER DAY)

DAYS POST INJECTION	PER CENT OF INJECTED DOSE EXCRETED PER DAY														
	Hp-1	Hp-2	Hp-3	Hp-4	Hp-5	Hp-6	Hp-7	Hp-8	Hp-9	Hp-10	Hp-12	Chi.-I[2]	Chi.-II[2]	Chi.-III[2]	Cal.-I[3]
74	-	-	-	-	-	-	-	-	-	-	-	.010	-	-	.0079
75	-	-	-	-	-	-	-	-	-	-	-	.013	-	-	.0051
76	-	-	-	-	-	-	-	-	-	-	-	.0081	-	-	.0041
77	-	-	-	-	-	-	-	-	-	-	-	.0043	-	-	.0065
78	-	-	-	-	-	-	-	-	-	-	-	.014	-	-	.0074
79	-	-	-	-	-	-	-	-	-	-	-	.0052	-	-	.0066
80	-	-	-	-	-	-	-	-	-	-	-	.0046	.024	-	.0048
81	-	-	-	-	-	-	-	-	-	-	-	.0042	-	-	.0055
82	-	-	-	-	-	-	-	-	-	-	-	.002	.018	-	.0030
83	-	-	-	-	-	-	-	-	-	-	-	.0041	-	-	.0068
84	-	-	-	-	-	-	-	-	-	-	-	.0029	-	-	.0022
85	-	-	-	-	-	-	-	-	-	-	-	.007	-	-	-
86	-	-	-	-	-	-	-	-	-	-	-	.0043	-	-	.0100
87	-	-	-	-	-	-	-	-	-	-	-	.0076	-	-	.0079
88	-	-	-	-	-	-	-	-	-	-	-	.0033	-	-	.0037
89	-	-	-	-	-	-	-	-	-	-	-	.0049	-	-	.0071
90	-	-	-	-	-	-	-	-	-	-	-	.0032	.017	-	.0077
91	-	-	-	-	-	-	-	-	-	-	-	.0075	-	-	.0088
92	-	-	-	-	-	-	-	-	-	-	-	.014	-	-	.0071
93	-	-	-	-	-	-	-	-	-	-	-	.008	-	-	.0060
94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.0071
95	-	-	-	-	-	-	-	-	-	-	-	.0093	.017	-	.0052
96	-	-	-	-	-	-	-	-	-	-	-	.011	.015	-	.0042
97	-	-	-	-	-	-	-	-	-	-	-	.0083	-	-	.0057
98	-	-	-	-	-	-	-	-	-	-	-	.012	.013	-	.0053
99	-	-	-	-	-	-	-	-	-	-	-	.003	-	-	.0070
100	-	-	-	-	-	-	-	-	-	-	-	.0096	-	-	.0081
101	-	-	-	-	-	-	-	-	-	-	-	.005	-	-	.0052
102	-	-	-	-	-	-	-	-	-	-	-	.009	.008	-	.0040
103	-	-	-	-	-	-	-	-	-	-	-	.006	-	-	.0070
104	-	-	-	-	-	-	-	-	-	-	-	.0086	-	-	.0051
105	-	-	-	-	-	-	-	-	-	-	-	.019	-	-	.0058
106	-	-	-	-	-	-	-	-	-	-	-	.0075	-	-	.0046
107	-	-	-	-	-	-	-	-	-	-	-	.0098	-	-	.0060
108	-	-	-	-	-	-	-	-	-	-	-	.0083	.009	-	.0052
109	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.0044
110	-	-	-	-	-	-	-	-	-	-	-	.0056	-	-	.0015
111	-	-	-	-	-	-	-	-	-	-	-	.0085	-	-	.0042
112	-	-	-	-	-	-	-	-	-	-	-	.015	-	-	.0051
113	-	-	-	-	-	-	-	-	-	-	-	.0095	.007	-	.0056
114	-	-	-	-	-	-	-	-	-	-	-	.011	-	-	.0029
115	-	-	-	-	-	-	-	-	-	-	-	.0145	.009	-	.0053
116	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.0047
117	-	-	-	-	-	-	-	-	-	-	-	.0069	-	-	.0023
118	-	-	-	-	-	-	-	-	-	-	-	.0035	-	-	.0039
119	-	-	-	-	-	-	-	-	-	-	-	.0066	-	-	.0036
120	-	-	-	-	-	-	-	-	-	-	-	.0051	.007	-	.0025
121	-	-	-	-	-	-	-	-	-	-	-	.0041	-	-	.0047
122	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.0039
123	-	-	-	-	-	-	-	-	-	-	-	.0115	-	-	.0014
124	-	-	-	-	-	-	-	-	-	-	-	.0088	-	-	.0039
125	-	-	-	-	-	-	-	-	-	-	-	.0103	.009	-	.0036
126	-	-	-	-	-	-	-	-	-	-	-	.0037	-	-	.0032
127	-	-	-	-	-	-	-	-	-	-	-	.008	.011	-	.0040
128	-	-	-	-	-	-	-	-	-	-	-	.0073	-	-	.0019
129	-	-	-	-	-	-	-	-	-	-	-	.0052	-	-	.0024
130	-	-	-	-	-	-	-	-	-	-	-	.0054	-	-	.0014
131	-	-	-	-	-	-	-	-	-	-	-	.0075	-	-	.0011
132	-	-	-	-	-	-	-	-	-	-	-	.0055	.008	-	.0038
133	-	-	-	-	-	-	-	-	-	-	-	.0038	-	-	.0037
134	-	-	-	-	-	-	-	-	-	-	-	.0091	-	-	.0027
135	-	-	-	-	-	-	-	-	-	-	-	.011	.007	-	.0029
136	-	-	-	-	-	-	-	-	-	-	-	.0056	-	-	.0026
137	-	-	-	-	-	-	-	-	-	-	-	.0075	-	-	.0032
138	-	-	-	-	-	-	-	-	-	-	-	.0073	.003	-	.0010

*Values eliminated from revised mean on basis of the Chauvenet Criterion.

[1] All cases except Chi-1, 2, 3 and Cal-1 received Pu^{+4} in .4 per cent $Na_3C_6H_5O_7 \cdot 2H_2O$ solution. The latter cases received PuO_{2+x}.

[2] Russell, E. R., Nickson, J. J., Argonne National Laboratory Report CH-3607 and unpublished data.

[3] Hamilton, J. G., et al, Report No. CH-3589.

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TABLE 9

INDIVIDUAL FECAL EXCRETION VALUES OF PLUTONIUM FOLLOWING INTRAVENOUS ADMINISTRATION(1) TO HUMAN SUBJECTS (EXPRESSED AS PER CENT OF DOSE EXCRETED PER DAY)

DAYS POST INJECTION	PER CENT OF INJECTED DOSE EXCRETED PER DAY											
	Hp-1	Hp-2	Hp-3	Hp-4	Hp-5	Hp-6	Hp-7	Hp-8	Hp-9	Hp-10	Hp-12	Chi-1(2)
1	.052*	.204	.018*	.134	.004*	.085	.147	.178	.333	.087	.370	.250
2	.221	.204	.157	.274	.311	.085	.120	.266	.389	.087	.370	.465
3	.241	.204	.157	.274	.311	.179	.087	.210	.389	.087	.297	.234
4	.050	.317	.095	.306	.185	.179	.080	.080	.131	.110	.297	.330
5	.105	.317	.089	.306	.110	.179	.055	.080	.131	.110	.183	.223
6	.046	-	.070	.126	.110	.179	.055	.080	.131	.110	.183	.116
7	.021	-	.070	.126	.110	.037	.055	.080	.131	.110	.020	.083
8	.021	.120	.070	.126	.064	.037	.055	.070	.131	.034	.020	.112
9	.021	.120	.070	.126	.051	.037	.032	.070	.131	.034	.020	-
10	.021	.084	.027	.117	.051	.037	.032	.070	.131	.034	.020	.021
11	.046	.084	.027	.117	.052	.023	.032	.070	.118	.034	.020	-
12	.046	.084	.027	.117	.052	.023	.032	.045	.118	.034	.020	.033
13	.046	.084	.027	.117	.032	.023	.023	.045	.118	.034	.020	.045
14	.046	.062	.023	.085	.032	.023	.023	.045	.118*	.022	.020	.044
15	.035	.062	.023	.085	.032	.015	.023	.045	.118*	.022	.023	.042
16	.035	.062	.023	.040	.017	.015	.023	.032	.414*	.022	.023	.034
17	.035	.062	.023	.040	.017	.015	.016	.032	.157*	.022	.023	-
18	.035	.055	.016	.040	.017	.015	.016	.025	.157*	.022	.023	.031
19	.015	.055	.016	.028	.017	.015	.016	.025	.055	.012	.053	.027
20	.015	.055	.016	.028	.020	.015	.016	.025	.055	.012	.053	.019
21	.015	.055	.016	.028	.020	.010	.008	.025	.055	.012	.053	.019
22	.015	.022	.006	.028	.020	.010	.008	.045	.055	.012	.053	.018
23	.017	.022	.006	.026	-	-	.008	.045	.052	.012	.026	.010
24	.017	.022	-	-	-	-	.008	.009	.052*	.012	.026	.023
25	-	.022	-	-	-	-	.011	.009	.052*	.006	.026	.013
26	-	.021	-	-	-	-	.011	.009	.052*	.006	.026	.023
27	-	.021	-	-	-	-	.011	.009	.043*	.006	.016	.0083
28	-	-	-	-	-	-	.011	.009	.043*	.006	.016	.0069
29	-	-	-	-	-	-	-	.009	.043	.006	.016	.0158
30	-	-	-	-	-	-	-	.018	.043	.006	.016	.0063
31	-	-	-	-	-	-	-	.018	.035	-	.016	.0074
32	-	-	-	-	-	-	-	.018	.035	-	.016	.0062
33	-	-	-	-	-	-	-	.018	.035	-	.016	.0079
34	-	-	-	-	-	-	-	.018	.035	-	.016	.0079
35	-	-	-	-	-	-	-	.018	.035	-	.022	.0054
36	-	-	-	-	-	-	-	.018	-	-	.022	.0054
37	-	-	-	-	-	-	-	.028	-	-	.022	.0050
38	-	-	-	-	-	-	-	.025	-	-	.022	.0042
39	-	-	-	-	-	-	-	.011	-	-	-	.0047
40	-	-	-	-	-	-	-	.011	-	-	-	.0063
41	-	-	-	-	-	-	-	.011	-	-	-	.0064
42	-	-	-	-	-	-	-	.011	-	-	-	.0053
43	-	-	-	-	-	-	-	.011	-	-	.008	.0027
44	-	-	-	-	-	-	-	.011	-	-	.008	.0092
45	-	-	-	-	-	-	-	.014	-	-	.008	.0042
46	-	-	-	-	-	-	-	.014	-	-	.008	.0039
47	-	-	-	-	-	-	-	.014	-	-	-	.0028

~~CONFIDENTIAL~~

Table 1. (1 - 2)

Material balances of soft tissues and excreta. Six persons injected i.v. with Pu(IV) citrate, Pu(VI) nitrate, or Pu(VI) citrate

	Pu(VI) Citrate						Pu(VI) Nitrate		
	Chi-1; 160 days p.i. Male, 68 yr. 76.4 kg			Chi-2; 17 days p.i. Female, 55 yr. 38.6 kg			Cal-1; 4 days p.i. Male, 58 yr. 58 kg		
	% Pu/g[g]	wt (g)	Calc. (%) dose	% Pu/g[g]	wt (g)	Calc. (%) dose	% Pu/g[g]	wt (g)	Calc. (%) dose
Liver	0.0135	2,050[b]	27.8	0.0024	1,110	2.70		1508	-
Spleen	0.0025	260[b]	0.65	0.0012	85[b]	0.10	0.0019	167[b]	0.32
Kid.	0.00038	340[b]	0.12	0.0054	190[b]	1.03			
Lung	0.00058	1,950[b]	1.13	0.0016	490[b]	0.78			
Pancreas				0.0022	60[b]	0.13			
Intestines				0.00065	555	0.36			
Testes	0.00052	66	0.034						
Thyroid				0.0034	14	0.048			
Adrenals									
Muscle	0.00025[c]	30,560	8.98	0.0006	11,310	6.79	0.0004[c]	23,200	9.28
Skin		5,348		0.0006[c]	2,320	1.39	0.00058	4,550	2.64
Heart	0.00028	382	0.11	0.00105	250	0.26			
Diaphragm	0.00023								
Lung tumor	0.0017	32	0.054						
Lymph node	0.0015	764	1.16	0.00074	390	0.29			
Ovaries				0.00094	10	0.009			
Intestines							0.0004		
Subcutaneous tissue							0.0004		
Liver tissue							0.0011		
Residual soft tissue	0.00012[d]	23,800	2.98	0.0003[d]	14,700	4.41	0.0002[d]	16,690	3.34[h]
Blood									5.66
Excreted[g]			6.74			0.70			1.19
Total accounted for			49.8			19.0			25.7
Skeleton (calc.)		9,428	50.2		7,125[i]	81.0		9,428[i]	(mid-range 42.5)

Footnotes to Table I

[a] Body weight estimated to be the mean weight of six male cases whose body weights were recorded.

[b] Measured tissue weight.

[c] Pu concentrations in muscle and skin (when not measured) were estimated to be the average of other measured soft tissues such as heart, pancreas, etc.

[d] Pu concentration of residual soft tissue was estimated to be one-half the concentration in skin and muscle.

[e] Measured totals are used when available. Excretion between the cessation of collections and deaths of HP-5 and HP-9 was estimated from extrapolation of the last available measurements and the slopes of the U and F curves of persons followed for longer times. Excreta from HP-11 were estimated to be the mean for all the other Pu(IV) citrate-injected cases.

[f] Includes 7.95%, the average Pu content of blood of the two sickest persons (HP-4 and HP-10), from whom blood samples were obtained at this time.

[g] %/g of Pu recalculated from original data.

[h] Includes 3.25% estimated from the tissues of Chi-2, and HP-11.

[i] Chi-2 was emaciated; her skeleton was assumed to be the average reported by Mechanik[66] for slightly built females. Cal-1 had lost 15 lb during his illness; his skeletal weight was calculated from his body weight in good health, 64.8 kg.

APPENDIX 5

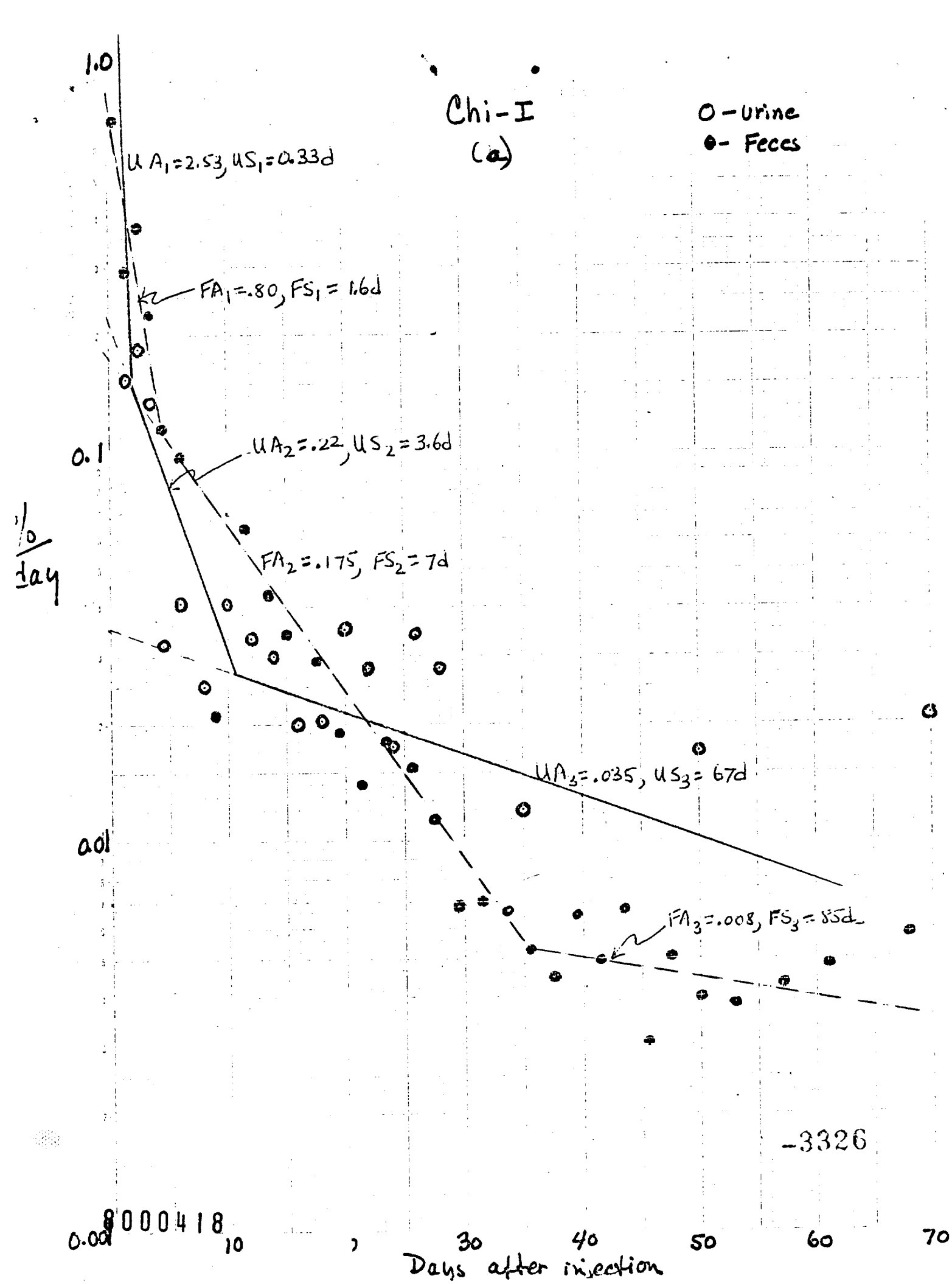
Reconstruction of whole rib from divided samples. Original data were consulted and computational and typographic errors corrected.

Case No.	Sample	Pu conc (%/g)	Sample weight (g)	% dose in sample
Chi-1	Sternum	0.0047	4.38	
	Rib, cortex	0.0016	1.0125	0.0016
	Periosteum	0.0046	0.1215	0.00056
	Marrow & spicules[a]	0.0160	0.8292	0.0133
	Whole rib (calculated)	0.0079	1.963	0.0155
Chi-2	Rib, cortex	0.0210	0.43	0.0090
	Marrow	0.0196	0.2065	0.0040
	Whole rib (calculated)	0.020	0.6365	0.0013
Cal-1	Rib, cortex	0.0072	9.0	0.065
	Periosteum	0.0048	0.445	0.00216
	Trabeculae	0.0319	0.84	0.0269
	Marrow	0.0190	-	0.019
	Whole rib (calculated)	0.0081	140[b]	0.113

[a] Origin of marrow sample noted as rib in Russell and Nickson (Ref. 47).

[b] Whole rib sample weighed before division into four separate samples.

from UCRL-20850



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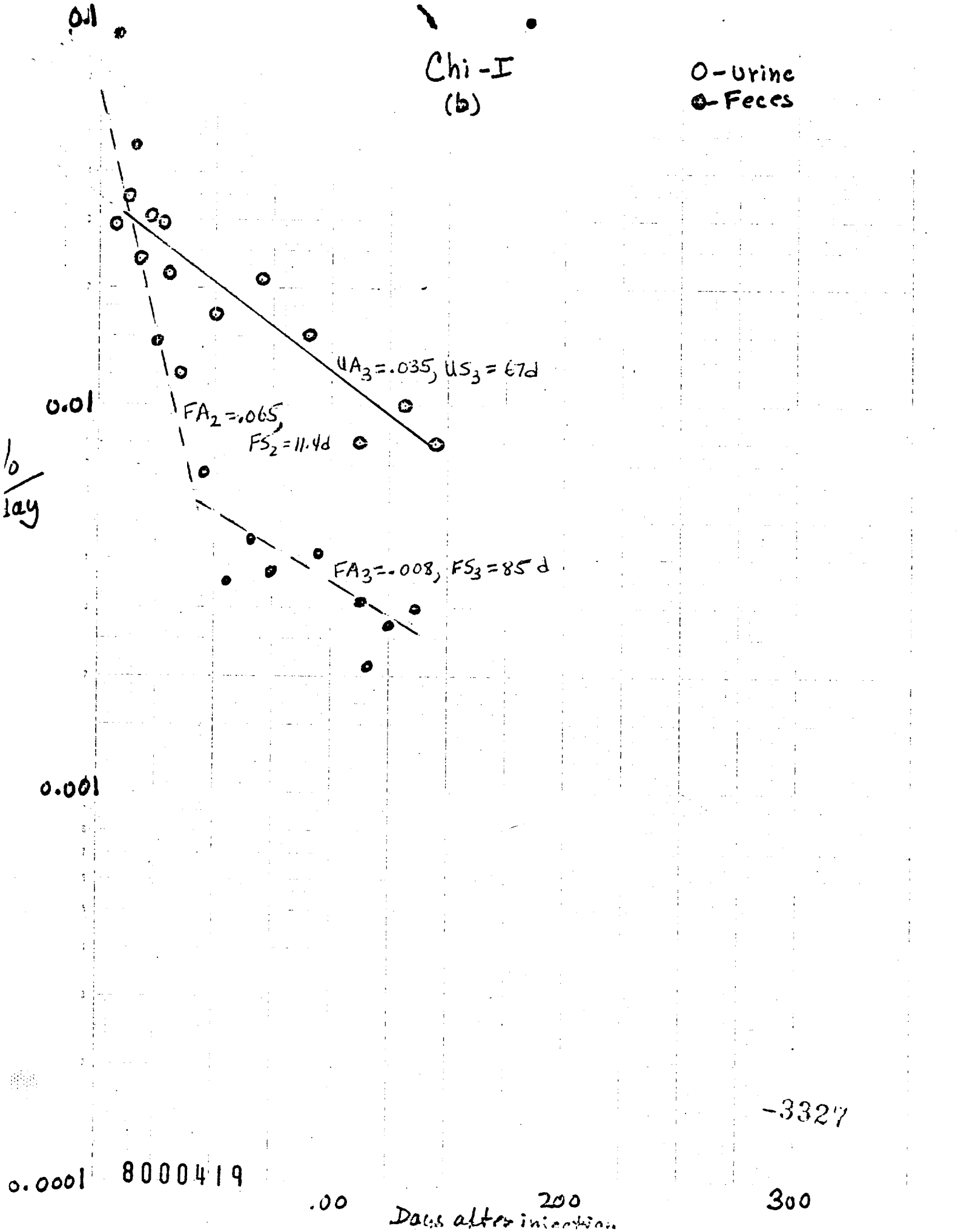

-3327

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HISTORICAL

8000420

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue, Argonne, Illinois 60439

Telephone: 312-972-7678

February 27, 1986

Dr. Robert G. Thomas
ER-72
GTN
Mail Stop G236
U.S. Department of Energy
Washington, D. C. 20545

Bob

Dear Dr. Thomas:

With respect to your telephone inquiry relating to plutonium studies in the Environmental Health Section (previously Center for Human Radiobiology), I refer you back to the factsheet furnished Dr. Thiessen in 1984 (copy enclosed).

I had follow-up completed on cases Cal-III and HP-6. Case Cal-III died in 1984 of causes not reasonably relatable to plutonium. Case HP-6 is living as of several days ago. Both the interviewer who contacted the household, and a review of the case file, suggest that the functioning of this subject is such that direct contact is contraindicated. I hope this is of some assistance to you.

Best personal wishes.

Sincerely yours,

Jim Stebbings

James H. Stebbings, Sc. D.
Epidemiology Group Leader

JHS:llf

Enclosures

cc w/enc.: H. Drucker, BIM
E. Huberman, BIM
D. T. Goldman, DOE-CH

40-004

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue, Argonne, Illinois 60439
Telephone 312/972-4146

July 23, 1984

Dr. Jacob Thiessen
Mailstop E-201, Human Health Studies
Office of Health and Environmental Research
Office of the Environment
U.S. Department of Energy
Washington, D. C. 20545

SUBJECT: Congressional Investigation into Health and Safety Policies of the Department of Energy (DOE)

Dear Dr. Thiessen:

In response to Dr. C. W. Edington's memorandum of June 27, 1984, on the above subject, I have enclosed a factsheet on "Plutonium Studies at the Center for Human Radiobiology (CHR)." The factsheet is in the format requested by Dr. Edington.

Please let me know if you need more information or documentation.

Sincerely yours,

A. F. Stehney
Environmental Research Division

AFS:pat
Enclosures

cc: H. Drucker
H. J. Rauch
P. Failla
P. F. Gustafson
E. Huberman
J. Rundo

Project Name:
Plutonium Studies at the Center for Human Radiobiology (CHR)

Date Started: 2 January 1973
Date Terminated: Ongoing

Principal Investigators: R. E. Rowland, A. F. Stehney

Objectives of Test:

1. To determine the excretion rate of plutonium 27 years after injection.
2. To determine the retention and body distribution of plutonium.

Short Description:

In 1945-1947, 18 hospital patients of limited life expectancy were injected with plutonium in order to obtain information about the retention and organ distribution of plutonium. An important objective was to determine the relationship between the body content and the rate of excretion in order to provide data for estimating the body content of plutonium from measurements of plutonium in excreta (bioassay). The results of this study were described in Report LA-1151 (1950).[1]

The data in LA-1151 were reviewed in a manuscript prepared by P. W. Durbin for publication in the 1972 volume, Radiobiology of Plutonium.[2] Tissue and bone samples had been obtained at autopsy from six of the cases at times ranging from 5 days to 456 days after injection, and the longest collection time for excreta was about 5 years. In addition to preparing the manuscript, Durbin traced the later history of the cases and discovered that four were still living in 1972.

The Center's direct knowledge of the plutonium injection cases dates from December 13, 1972, when Dr. Durbin brought her records to CHR for possible further follow-up. The Center then undertook to determine excretion rates in study subjects who were still alive and to exhume deceased subjects in order to determine the amounts and body distribution of plutonium. During 1973, CHR obtained metabolism samples from three living patients, obtained permission to exhume from next of kin of three deceased patients, and disinterred and transferred to CHR the remains of one of these deceased. The metabolism samples (blood and excreta) were taken at Strong Memorial Hospital (SMH), Rochester, New York.

In 1974, the U.S. Atomic Energy Commission (AEC) reviewed the origins and subsequent follow-up of the plutonium studies. On December 31, 1974, the AEC authorized CHR to proceed with the program of study of the living patients who were injected with plutonium during 1945-1947 and of the bodies of deceased individuals from that group for whom legal consent for examination is obtained.

Follow-up Data:

Table 1 summarizes CHR follow-up activities and last known status (July 5, 1984) for each of the plutonium injection cases.

CHR personnel have published 10 reports on results obtained by study of these cases.[3-12] Copies of these reports are attached.

Table 1. Plutonium injection cases: Summary of CHR activities and last known status (July 5, 1984).

Old Case Number	CHR Case Number	CHR Activities	Status
Cal-I	40-001	10/16/75: Exhumed cremains Aug 78: Returned	Died 1/9/66
Cal-II	40-002	No contacts; said to have died in Australia	Died 1/6/47
Cal-III	40-003	6/11/73: Examined at CHR 6/23-26/77: Metabolism study at SMH	Living 10/19/83
Chi-1	40-004	6/10/75: Exhumed Apr 78: Returned	Died 10/3/45
Chi-2	40-005	No contacts; cremation ashes scattered	Died 1/13/46
Chi-3	40-006	No contacts; case unidentified	Lost to study, 1946
HP-1	40-007	1973: Next of kin refused permission to exhume	Died 1/12/60
HP-2	40-008	1973: Next of kin refused permission to exhume	Died 4/4/48
HP-3	40-009	1/28-2/18/73: Metabolism study and radioactivity measurement at SMH 1/23-24/79: Metabolism study at SMH	Died after 6/5/81
HP-4	40-010	9/24/73: Exhumed Jul 75: Returned	Died 4/29/47
HP-5	40-011	1973: Next of kin refused permission to exhume	Died 4/29/46
HP-6	40-012	2/14/73: Metabolism study at SMH 6/21-7/1/73: Metabolism study at SMH	Living 12/30/74
HP-7	40-013	1973 and 1977: Next of kin refused permission to exhume	Died 10/27/46
HP-8	40-014	No contacts	Died 11/22/75
HP-9	40-015	5/18/78: Exhumed Jul 81: Returned	Died 7/2/47
HP-10	40-016	No contacts	Died 6/2/57
HP-11	40-017	No contacts	Died 2/26/46
HP-12	40-018	No contacts	Died 4/13/53

References:

1. W.H. Langham, S.H. Bassett, P.S. Harris and R.E. Carter. Distribution and excretion of plutonium administered to man. Los Alamos Scientific Laboratory, LA-1151 (September 1950).

2. P.W. Durbin. Plutonium in man: a new look at the old data. In The Radiobiology of Plutonium, B.J. Stover and W.S.S. Jee (eds.), The J.W. Press, Salt Lake city, UT, pp. 469-537 (1972).

3. J. Rundo, P.M. Starzyk, J. Sedlet, R.P. Larsen, R.D. Oldham and J.J. Robinson. The excretion rate and retention of plutonium 10,000 days after acquisition. In Diagnosis and Treatment of Incorporated Radionuclides, Proc. Seminar, Vienna, 8-12 December 1975, IAEA, Vienna, pp. 15-22 (1976).

4. R.E. Rowland and P.W. Durbin. Survival, causes of death, and estimated tissue doses in a group of human beings injected with plutonium. In The Health Effects of Plutonium and Radium, Proc. Symp. Sun Valley, Idaho, 6-9 October 1975, W.S.S. Jee (Ed.), The J.W. Press, Salt Lake City, UT, pp. 329-342 (1976).

5. R.A. Schlenker, B.G. Oltman, and H.T. Cummins. Microscopic distribution of ^{239}Pu deposited in bone from a human injection case. In The Health Effects of Plutonium and Radium, Proc. Symp. Sun Valley, Idaho, 6-9 October 1975, W.S.S. Jee (Ed.), The J.W. Press, Salt Lake City, UT, pp. 437-450 (1976).

6. J. Rundo and F.H. Ilcewicz. Blood content and excretory plasma clearance of plutonium 10^4 days after injection. Abstracts of Papers-22nd Ann. Mtg. Health Phys. Soc., Atlanta, 3-8 July 1977, Pergamon Press, NY, p.26 (1977); Health Phys. 33, 668 (1977).

7. R.E. Rowland. The risk of bone sarcoma from plutonium-239. In Biological Implications of Radionuclides Released from Nuclear Industries, Proc. Symp., Vienna, 26-30 March 1979, Vol. II, IAEA, Vienna, pp. 211-224 (1979).

8. R.P. Larsen, R.D. Oldham, and R.E. Toohey. Macrodistribution of plutonium in the human skeleton. In Actinides in Man and Animals, Proc. Snowbird Actinide Workshop, 15-17 October 1979, M.E. Wrenn (Ed.), RD Press, Salt Lake City, UT, pp. 191-197 (1981).

9. J. Rundo. The late excretion of plutonium following acquisition of known amounts. In Actinides in Man and Animals, Proc. Snowbird Actinide Workshop, 15-17 October 1979, M.E. Wrenn (Ed.), RD Press, Salt Lake City, UT, pp. 253-260 (1981).

10. R.A. Schlenker and B.G. Oltman. Plutonium microdistribution in human bone. In Actinides in Man and Animals, Proc. Snowbird Actinide Workshop, 15-17 October 1979, M.E. Wrenn (Ed.), RD Press, Salt Lake City, UT, pp. 199-206 (1981).

11. R.A. Schlenker and B.G. Oltman. Uranium concentrations in human bone. In Actinides in Man and Animals, Proc. Snowbird Actinide Workshop, 15-17 October 1979, M.E. Wrenn (Ed.), RD Press, Salt Lake City, UT, pp. 473-476 (1981).

12. R.E. Toohey, C.G. Cacic, R.P. Larsen, and R.D. Oldham. The concentration of plutonium in hair following intravenous injection. Health Phys. 40, 881-886 (1981).

Attachments:
Reprints of references 3-12 are attached.

Department of Energy
Argonne Area Office
9800 South Cass Avenue
Argonne, Illinois 60439

NOV 21 1985

Dr. Alan Schriesheim, Director
Argonne National Laboratory
9700 S. Cass Avenue
Argonne, Illinois 60439

Dear Dr. Schriesheim:

SUBJECT: FREEDOM OF INFORMATION ACT (FOIA) REQUEST DATED OCTOBER 30, 1985, DOCKET NO. 11048504D

The enclosed FOIA request is for a copy of a memo from R. E. Rowland to H. A. Schultz dated December 21, 1972, which discusses records of 18 plutonium research subjects. The requestor is also asking for any supporting documentation and any subsequent memos regarding the subject.

Due to statutory time limitations for responding to FOIA requests, we must have your response no later than December 2, 1985.

Sincerely,

Thomas J. Balcerski

for David T. Goldman
Area Manager

Enclosure:
As Stated

cc: A. Zilberstein, ANL, w/enclosure
R. E. Rowland, Princeton, KY, w/enclosure 502-365-2979
[redacted]

DEC 04 1985

8000427

THE KNOXVILLE JOURNAL

A GANNETT NEWSPAPER
P.O. BOX 911
KNOXVILLE, TENNESSEE 37901

1985 NOV -4 PM 3:39

Oct. 30, 1985

Mr. Ronald Turner
MA-232.1
U.S. Department of Energy
Freedom of Information and Privacy Act Branch
1000 Independence Ave. S.W.
Washington, D.C. 20585

To the FOI Officer:

This request is made under the federal Freedom of Information Act, 5 U.S.C. '552.

Please send me copies of Memorandum, dated 12-21-72, from Dr. R.E. Rowland to H.A. Schultz, senior staff assistant, Records and Data Processing, Center for Human Radiobiology, Argonne National Lab. Memo discusses instructions from Rowland to Schultz on records of 18 plutonium research subjects. Records were transferred to Schultz for his disposition. Please include any supporting documentation and any subsequent memos regarding this subject.

As you know, the FOI Act provides that if portions of a document are exempt from release, the remainder must be segregated and disclosed. Therefore, I will expect you to send me all nonexempt portions of the records which I have requested, and ask that you justify any deletions by reference to specific exemptions of the FOI Act. I reserve the right to appeal your decision to withhold any materials.

I promise to pay reasonable search and duplication fees in connection with this request. However, if you estimate that the total fees will exeed $50, please notify me so that I may authorize expenditure of a greater amount.

I am prepared to pay reasonable search and duplication fees in connection with this request. However, the FOI Act provides for waiver or reduction of fees if disclosure could be considered as "primarily benefiting the general public." I am a journalist employed by The Knoxville Journal and intend to use the information I am requesting as the basis for a planned article. Therefore, I ask that you waive all search and duplication fees. If you deny this request, however, and the fees will exceed $50, please notify me of the charges before you fill my request so that I may decide whether to pay the fees or appeal your denial of my request for a waiver.

As I am making this request as a journalist and this information is of timely value, I will appreciate your calling me by telephone, rather than by mail, if you have any questions. Thanks and I will look forward to your reply within 10 business days, as required by law.

Sincerely,

Randell Bl[illegible], reporter
(615) 522-4141, Ext. 423

8000428

DEC 04 1985

DOE F 1325.8
(7-79)

U.S. DEPARTMENT OF ENERGY

memorandum

DATE November 12, 1985

REPLY TO ATTN OF MA-232.1 – Joan Ogbazghi

SUBJECT Freedom of Information Request #1104850

TO Jane Monhart, CH Operations Office

ATTN Bernie Russ

The attached Freedom of Information (FOI) request is being sent to you for action as the records requested appear to be principally within the purview of your organization. If our determination is incorrect, please inform me immediately to whom you are forwarding this request.

If other divisions, offices or field organizations also have records relevant to this request, you as the appropriate FOI Office are responsible for requesting their participation and for coordinating the response. It is important that an appropriate response be forwarded to the requester within 10 working days as failure to act can be deemed a denial.

On the reverse side of this memorandum, a "Reminder of Procedures for Handling FOI Requests" should assist your staff. If you have any questions, I can be reached on FTS 252-5955.

John H. Carter
Chief of FOI and Privacy Acts
Activities Branch
Division of Reference and
Information Management

Attachment

DEC 04 1985

8000429

November 14, 1985

Mr. Randall Beck
The Knoxville Journal
P.O. Box 911
Knoxville, TN 37901

Re: 11048509D
11048507D
11048508D
11048522D

Dear Mr. Beck:

Your October 30, 1985, Freedom of Information requests (copies enclosed) addressed to the U.S. Department of Energy were received on November 4, 1985, and have been sent to our Freedom of Information Officers at our Chicago, Oak Ridge, Richland and San Francisco Operations Offices. They will correspond directly with you about your requests.

In compliance with the Freedom of Information Act, the 10 day response period will begin when the offices designated above have received your requests. If you need further assistance, please contact Jane Monbart, Chicago Operations Office, 9800 South Cass Avenue, Argonne, IL 60439, (312) 972-2076; Wayne Range, Oak Ridge Operations Office, P.O. Box E, Room 1012, Oak Ridge, TN 37831, (615) 576-0885; Gail M. Bokkan, Richland Operations Office, 825 Jadwin Avenue, P.O. Box 550, Richland, WA 99352, (509) 376-8274; Elsie Mutobe, San Francisco Operations Office, 1333 Broadway, Wells Fargo Building, Oakland, CA 94612, (415) 273-4358.

We have assigned the above referenced numbers to your requests and ask that you refer to them in any future correspondence.

Sincerely,

Original signed by John H. Carter

John H. Carter
Chief of FOI and Privacy Acts
Office of Administrative Services

Official File Copy
Action Officer 4
Official File (RF)
[illegible]2952
MA-232.1:JBO:sjb:26025:11/13/85

DEC 04 1985

8000430

CENTER FOR HUMAN RADIOBIOLOGY

Operated for the U.S. Department of Energy by Argonne National Laboratory

PRIVACY ACT MATERIAL REMOVED

June 20, 1978

Gretna, Louisiana 70053

Dear _____ :

This letter is written with regard to the Center's investigations in the case of your father, _____. You will be interested to know that his remains were returned to Austin, Texas in April and have been reburied by the funeral director, the _____.

Although numerous measurements were made prior to reburial, a considerable length of time is required for the completion of analyses and interpretation of the results.

Thank you for allowing us this opportunity to advance our research on the long-term skeletal effects of the internal deposition of radioactive materials.

Sincerely yours,

A. F. Stehney
Associate Director
Center for Human Radiobiology

AFS:llw

bxc: J.E. Farnham
G.J. Hamilton
R.A. Schlenker
CHR Records Room

PRIVACY ACT MATERIAL REMOVED

Same letter to these children on June 20, 1978.

_____, Austin, Texas 78704

_____, Austin, Texas 78756

_____, Austin, Texas 78756

_____, Arlington, Texas 760

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue
Argonne, Illinois 60439 Telephone 312/972-[illegible]

ARGONNE NATIONAL LABORATORY
U of C-AUA-USAEC

CENTER FOR HUMAN RADIOBIOLOGY

Argonne National Laboratory • Massachusetts Institute of Technology • New Jersey Field Station • Southwest Field Station

May 16, 1975

PRIVACY ACT MATERIAL REMOVED

Mr. Robert Creecy
Associate Manager
Cook-Walden Funeral Home
6100 North Lamar
Austin, Texas 78757

Dear Mr. Creecy:

Many thanks for your letter of April 30, 1975 giving your estimate of the cost for the exhumation of Mr. [redacted]. The estimate of $401.25 is satisfactory to us.

As you requested, we are enclosing the originals of the six (6) signed permission forms from [redacted] next-of-kin: [redacted] (sons and daughters).

Mr. Joseph E. Farnham of our staff will probably want to be present when the exhumation is carried out. If he has not already done so, he will be in touch with you shortly to arrange a mutually convenient time. If for any reason you should want to phone him, he can be reached at 312-739-7711, ext. 2326 during working hours, or at 312-479-9354 at home.

Sincerely yours,

s

Mary Margaret Shanahan

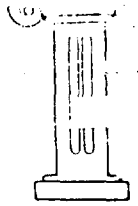
encs.
xc: A.F.Stehney
M.H.Chalfen
J. E. Farnham

PRIVACY ACT MATERIAL REMOVED

RECEIVED
MAY 23'75
CHR RECORDS

SOUTHWEST FIELD STATION
5619 East Monterosa St., Phoenix, Arizona 85018 Tel. 602-949-5600

8000432



PRIVACY ACT MATERIAL REMOVED

I, AUSTIN, TEXAS 78757 512/454-5611

April 30, 1975

Miss Mary Margaret Shanahan
Deputy Director
M I T Radioactivity Center
Southwest Field Station
5619 East Monterosa Street
Phoenix, Arizona 85018

Dear Miss Shanahan:

In answer to your letter of April 10, 1975, the following is an estimate of the cost of exhuming the remains of Mr.

Opening & Closing of grave (week-day)	*120.00*
Ziezler case	*125.00*
Trip to Airport	*25.00*
Air Frieght as quoted by Braniff per one hundred lbs.	*31.25*
Funeral Home charges	*100.00*

advises us that they will need copies of the signed permission forms.

If you have any questions, please contact me.

Sincerely,

Funeral Home

PRIVACY ACT MATERIAL REMOVED

, Associate Manager

RC/jc

RECEIVED
MAY 15 '75

8000433

FUNERAL HOME

ARGONNE NATIONAL LABORATORY
U of C-AUA-USAEC

CENTER FOR HUMAN RADIOBIOLOGY

Argonne National Laboratory • Massachusetts Institute of Technology • New Jersey Field Station • Southwest Field Station

April 10, 1975

Funeral Home

Austin, Texas 78700

Gentlemen:

We are writing to you concerning the exhumation of Mr. _____ who died on October 3, 1945 in Chicago, Illinois, but who is buried in the _____ Cemetery, Austin, Texas.

We have on hand signed permission forms from all known next-of-kin as follows: _____, Mr. _____, Mr. _____, sons of _____, and from _____, _____, daughters of Mr. _____.

I would appreciate receiving from you at your earliest convenience an estimate of the cost of exhuming Mr. _____ remains and shipping them by air to:

Mr. Joseph E. Farnham
Center for Human Radiobiology
Radiological and Environmental Research Division
Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439

According to Cook County, Illinois, regulations, the ziegler case containing the remains must be sealed prior to shipment to O'Hare Airport, Chicago.

The undertaker who will handle the arrangements on the Illinois end is Mr. _____ Funeral Home

Lemont, Illinois

Our studies, which are sponsored by the U. S. Atomic Energy Commission, take about a year, so it will be necessary to close

8000434

SOUTHWEST FIELD STATION
5618 East Monteross St., Phoenix, Arizona 85018 Tel. 602-[illegible]-5600

PRIVACY ACT MATERIAL REMOVED

the grave once the remains have been removed, and to reopen the grave when the remains are returned for reburial.

We hope that your charges and those of the cemetery can be kept to a minimum since, as you probably know, government research funds are rather limited these days.

Upon receipt of your estimate of the cost of this exhumation we will notify you of its acceptance. We will want to arrange in advance the date for the work to be done since one of our staff will be present at the time of the exhumation.

Please address your reply to me at the address given on the bottom of the first page of this letter.

Sincerely yours,

s
xc: M.H.Chalfen
A.F.Stehney
J.E.Farnham
V.Markiewicz

(Miss) Mary Margaret Shanahan
Deputy Director
M.I.T. Radioactivity Center

PRIVACY ACT MATERIAL REMOVED

PRIVACY ACT MATERIAL REMOVED

No. 40-004

Name

Order

Remarks DISTRIBUTIONS

Retouched

Order Finished

Reorder

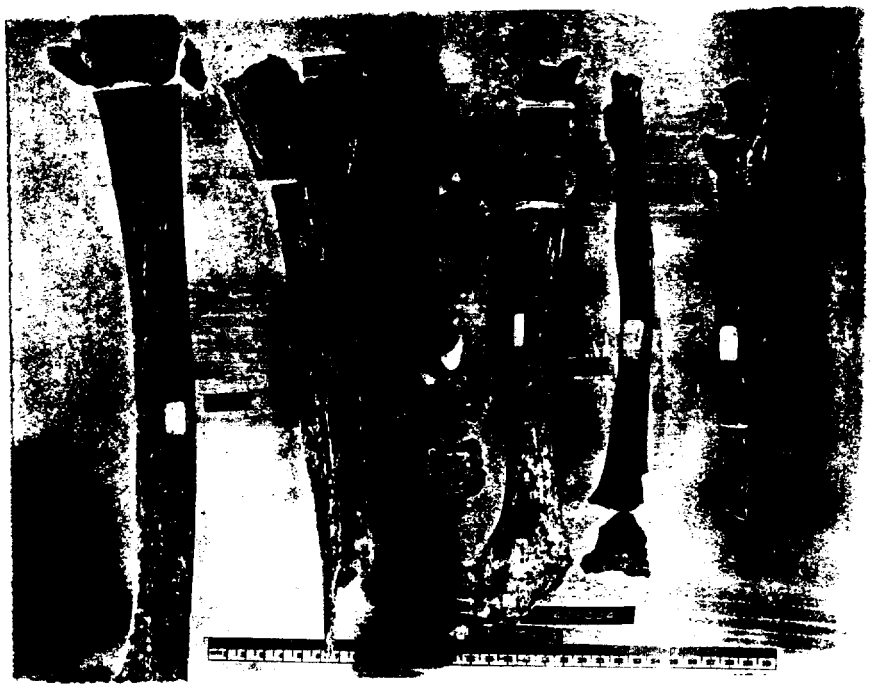
Reorder

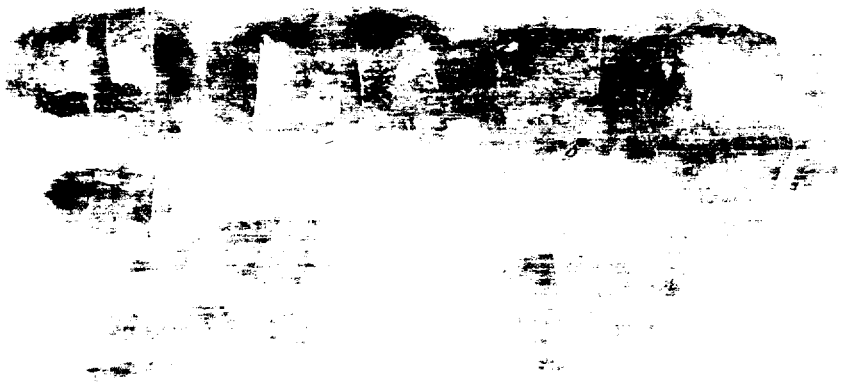
16 Prints

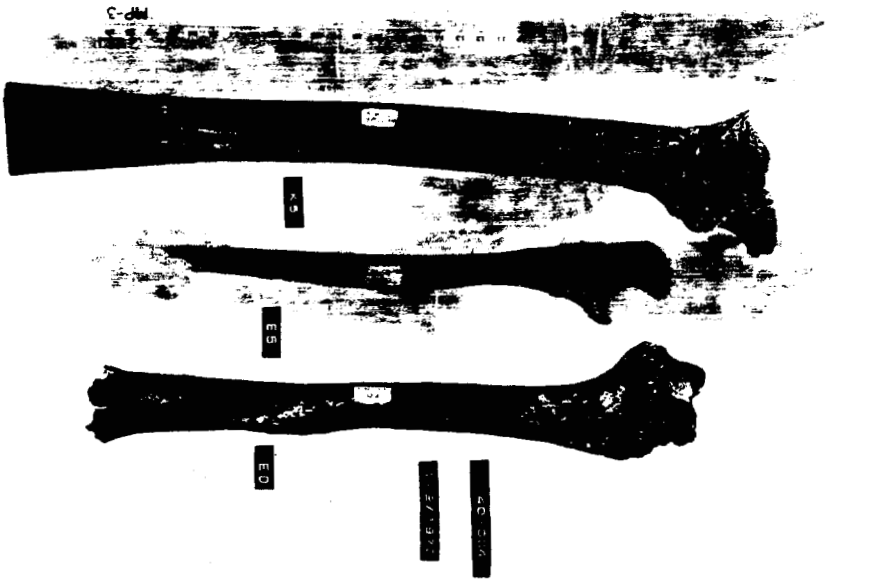
PRTD. IN U. S. A.

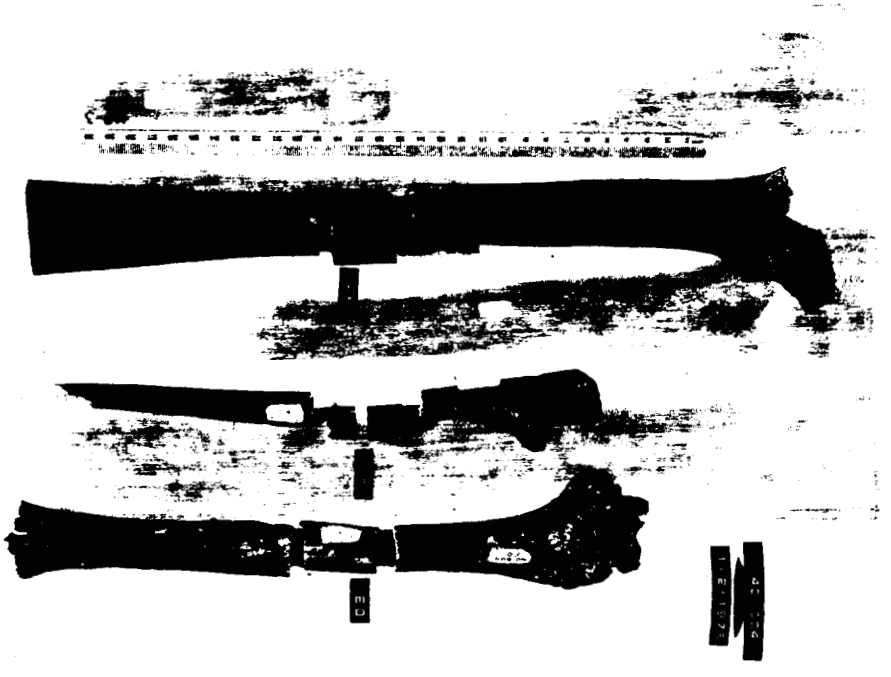
PRIVACY ACT MATERIAL REMOVED

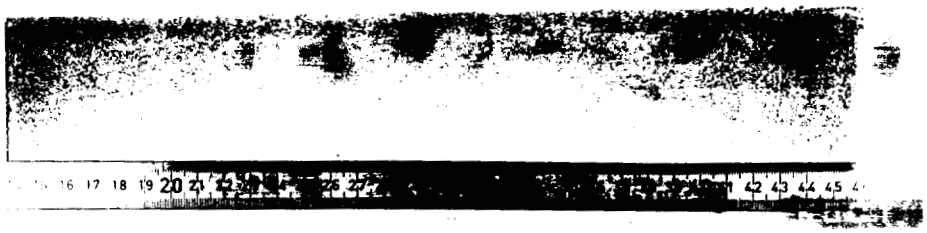
8000436



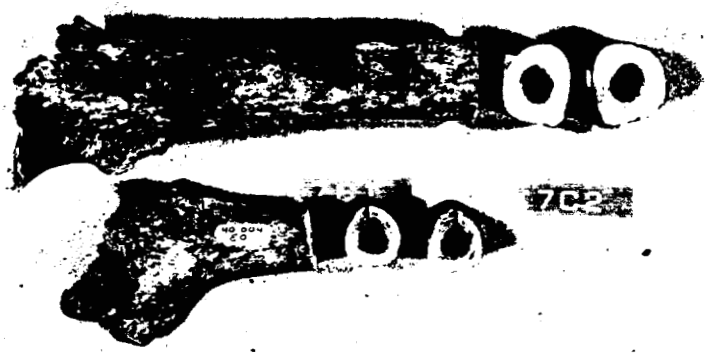


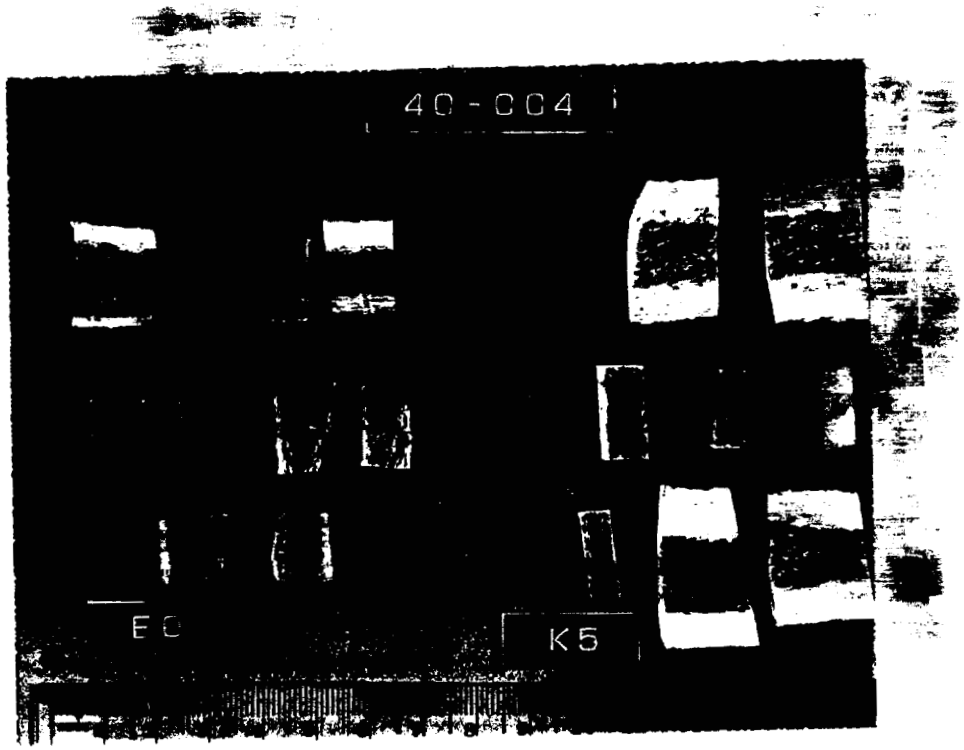


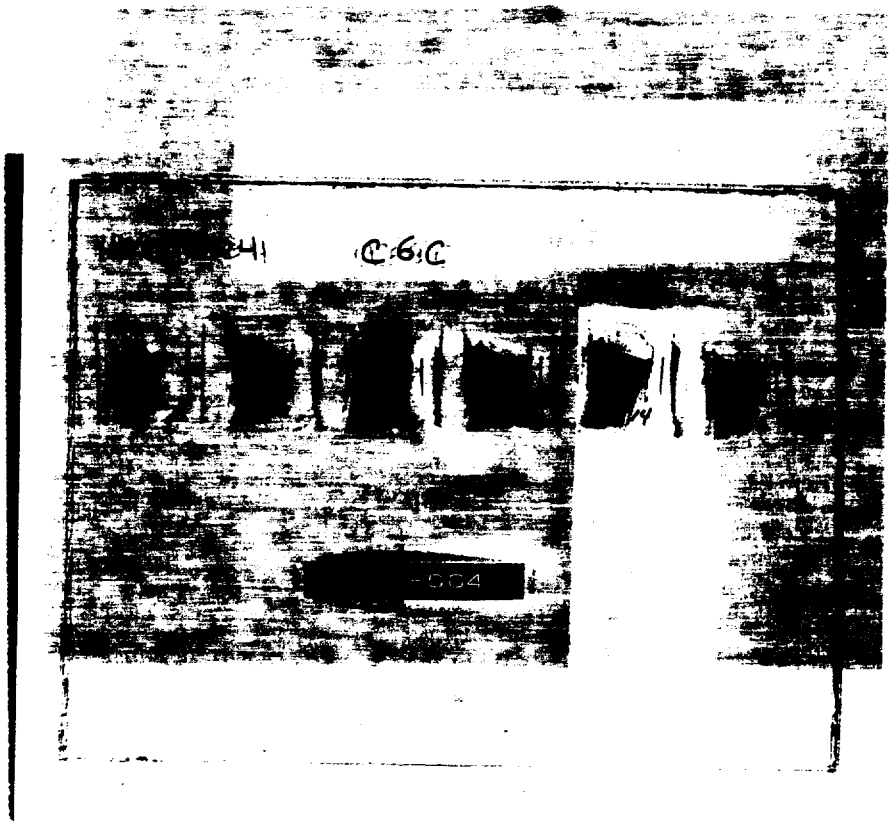


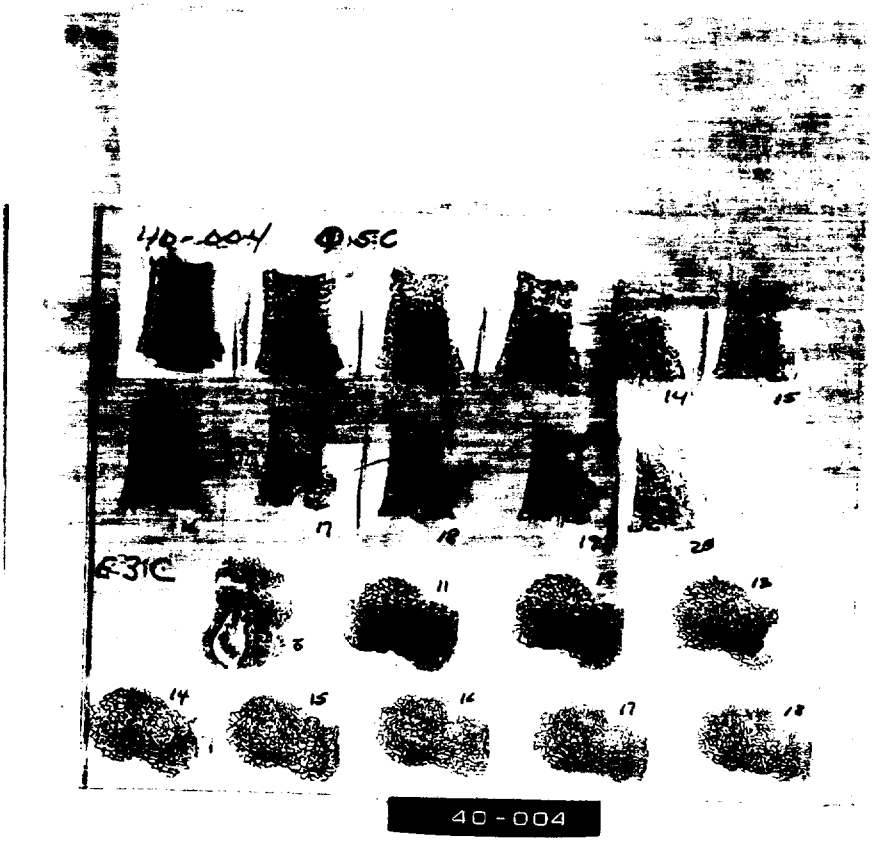


40-004



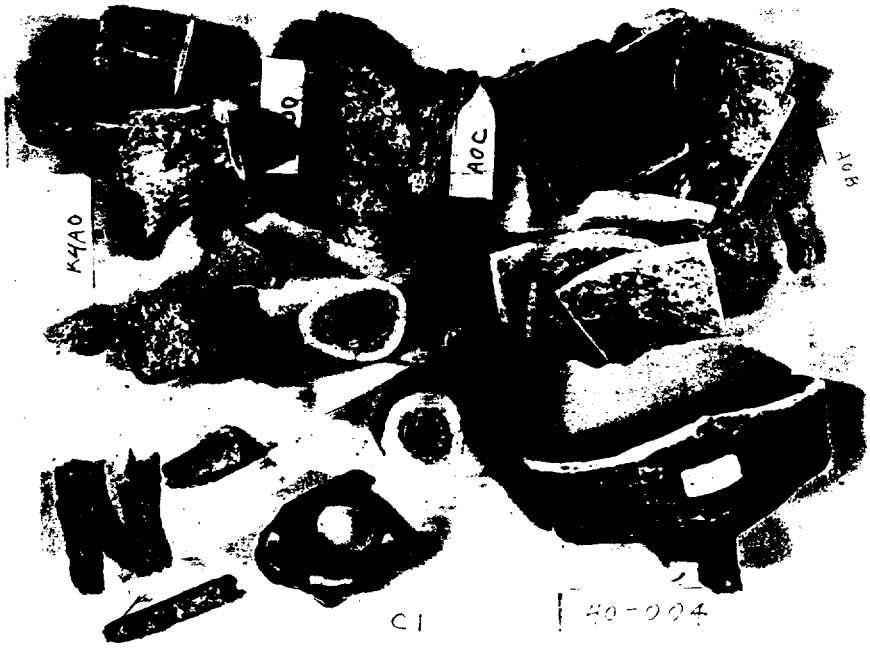






8000440


K400
A0C


K4A0
A0C
A0B
C1
40-004

WESTCOTT
SAVES
40-004
EODO
EICO
K5BO
L3
K7BO
K6BO

WESTCOTT
SAVES
40-004
EODO
EICO
K5BO
L3
K7BO
K6BO
SAVE
RC
RC

E0D0 - 13.65g

E1C0 - 23.0g

K5B0 - 21.69g

L3 - 21.67g

K7B0 - 34.17g

K6B0 - 25.42g

780412

To RC

E0D1 - 8.45g

E1C2 - 14.92g

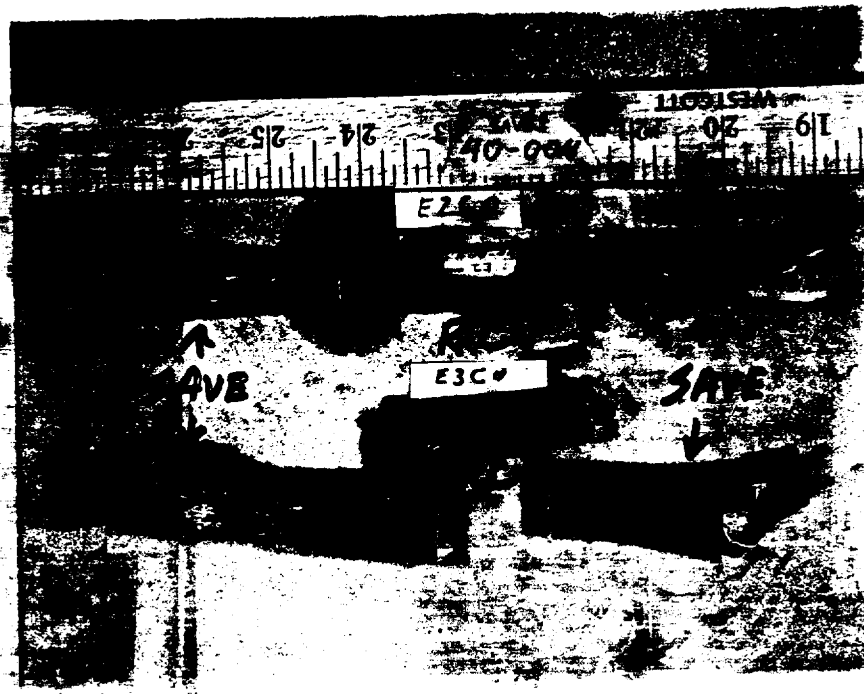
K5B0 - 21.69g

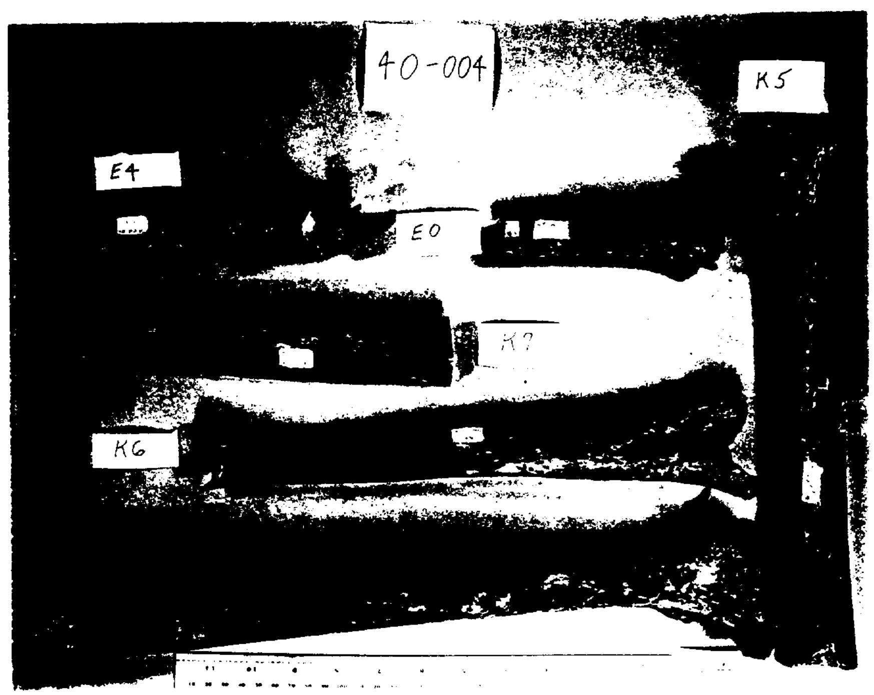
L3 - 21.67g

K7B2 - 16.41g

K6B0 - 25.42g

780412





8000444

E2CO
RC - 11.11g
SAVE - 22.48g

780412

E3CO
RC - 10.69g
SAVE - 24.89g

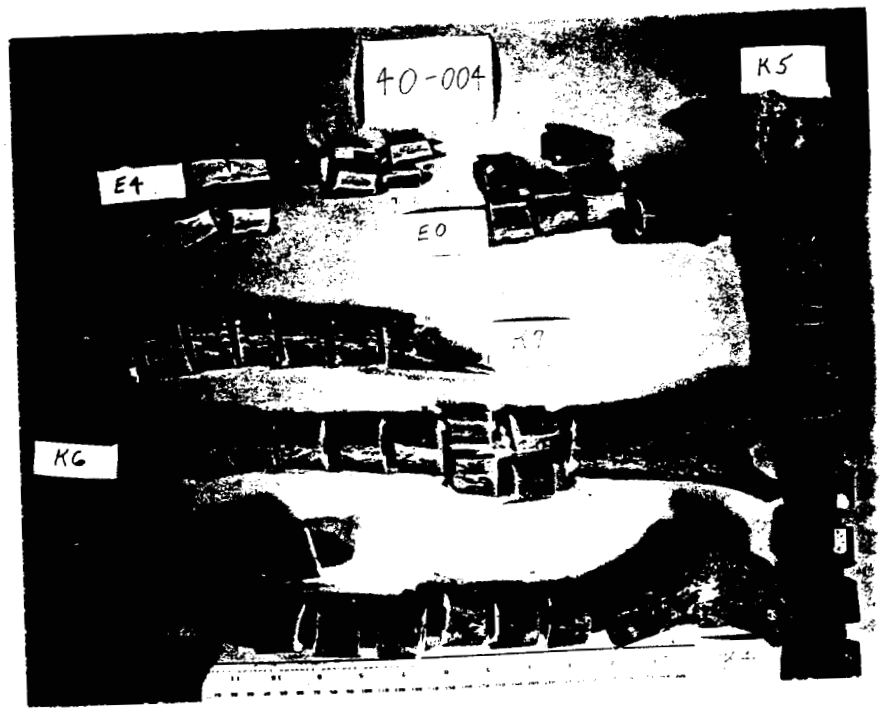
770520
Sagittal Sectioning

8000445

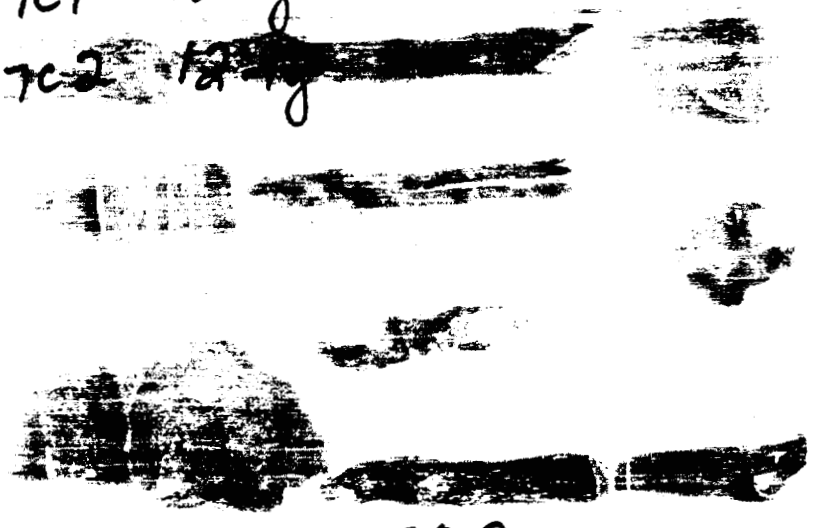
K4C1 K4C2 K5C2 K5C1

40-004

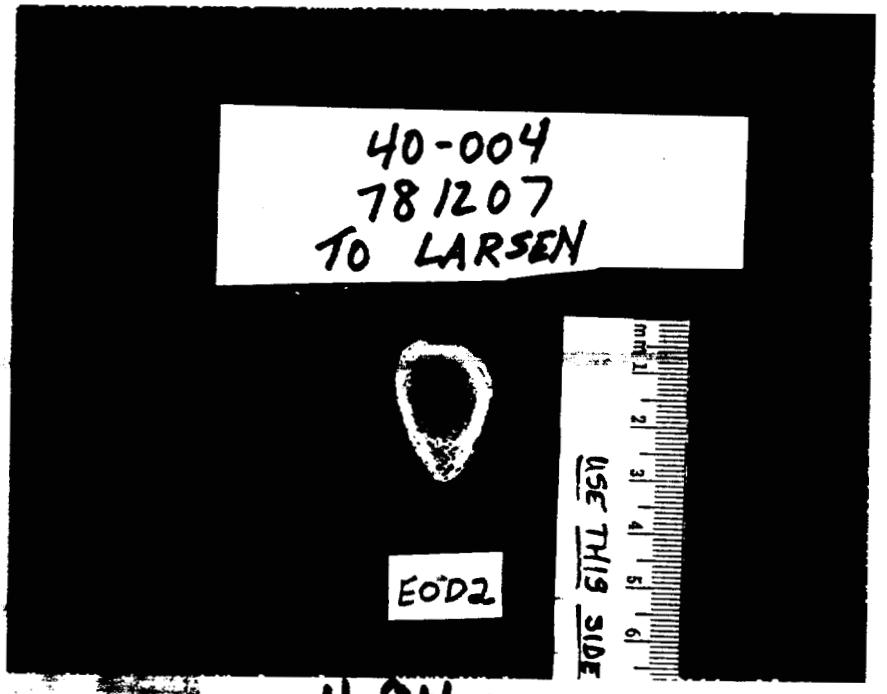
K7C1 K7C2



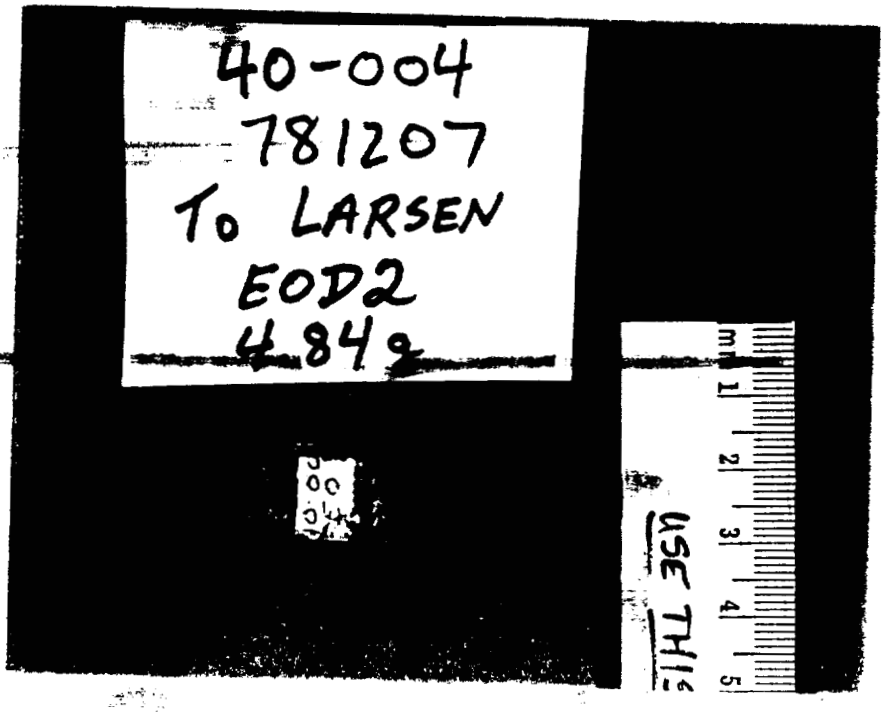
K4C1 19.7g
K4C2 20.1g
K5C2 23.2g
K5C1 21.4g
K7C1 13.1g
K7C2 [redacted]

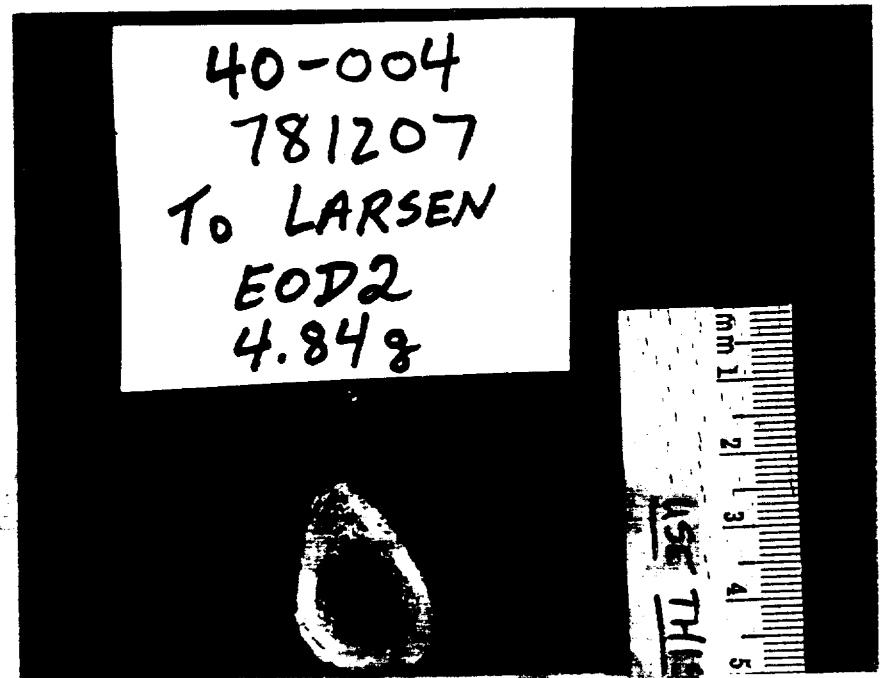


770520
Sagittal Sectioning


40-004
781207
TO LARSEN
EOD2
USE THIS SIDE

4.84 g


40-004
781207
To LARSEN
EOD2
4.84g
USE THIS



8000449

PRIVACY ACT MATERIAL REMOVED

No. 40-004

Name

Order 750710

Remarks SKELETAL PHOTOS

Retouched

Order Finished

Reorder

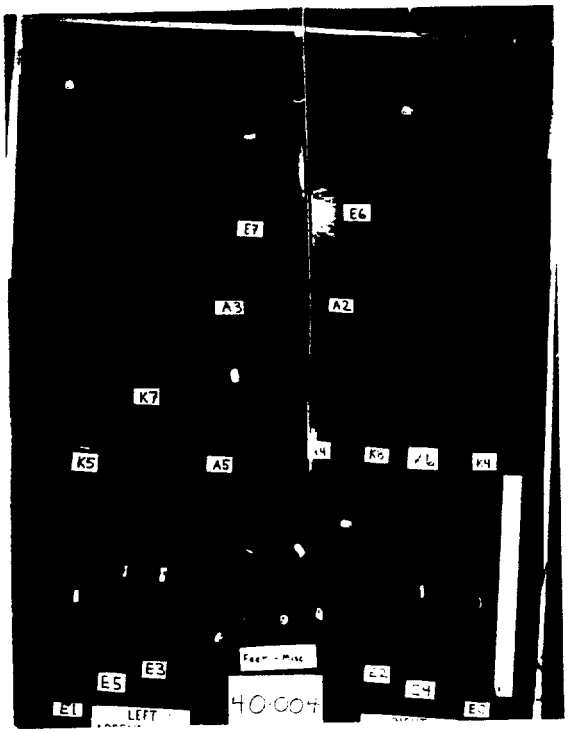
Reorder

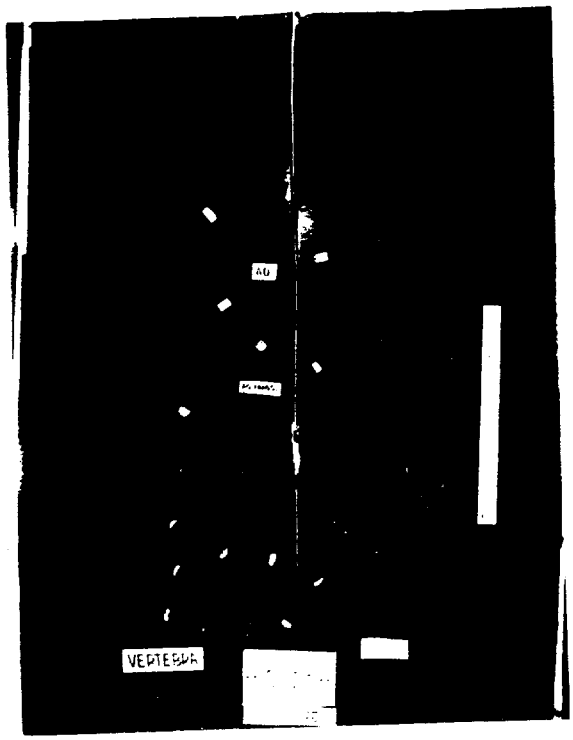
7 photos

PRTD. IN U. S. A.

PRIVACY ACT MATERIAL REMOVED

8000450


E7
E6
A3
A2
K7
K5
A5
K4
E5
E3
E1
LEFT
40-004


A0
VERTEBRA

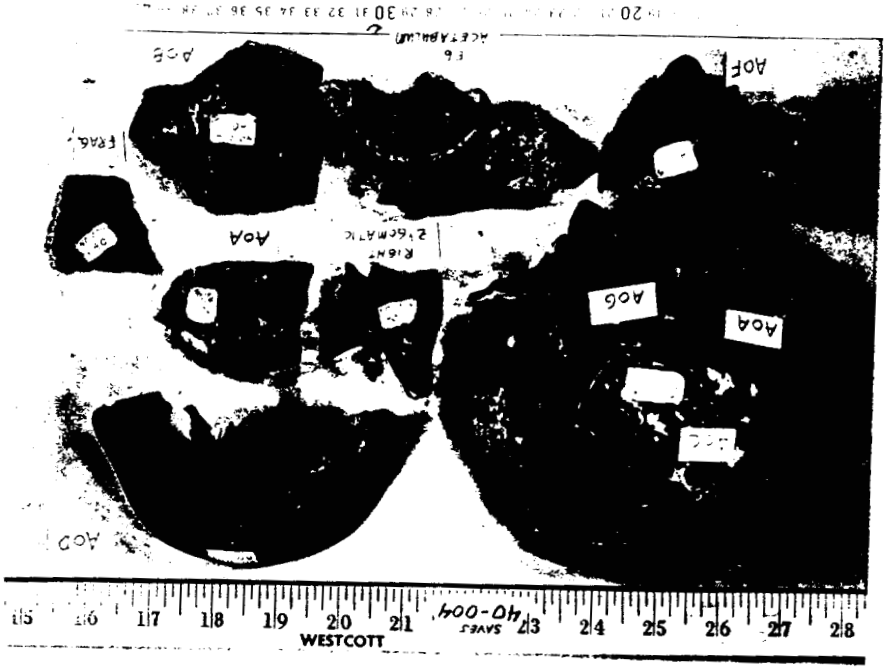
"SAVES" AS of
780413

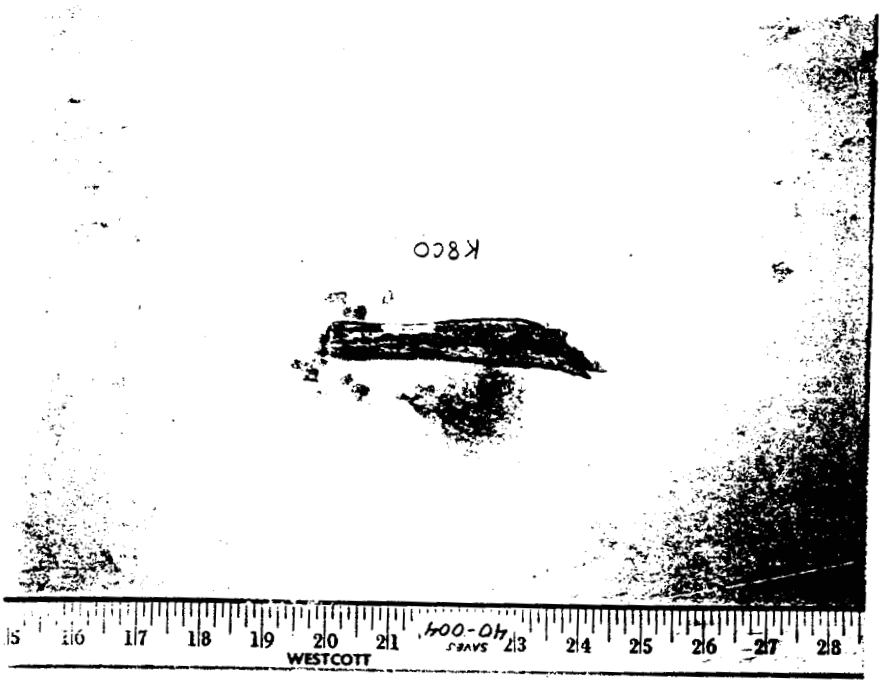

WESTCOTT
SAVES
40-004
E2
EOD2
C1
K6B0
K7B1
ESC0
C2
Foot FRAGS
K4C0
K4E0
E3

8000453

40-004 RC

8000454 40-004 RC





8000455

"SAVES" AS OF

780413

"SAVES" AS OF

780413

8000456

ORIGINAL to file.
Copies to RAS.
+RC.

PRIVACY ACT MATERIAL REMOVED

BONE AND DOSIMETRY GROUP
SAMPLE DISTRIBUTION

Case No. 40-004 Date: 780412

Sample Type (SPCI): Autopsy ___, EXH X, Cremains ___, Surgical ___, Willed ___

Sample(s): Midshaft segments from E0, E1, E2, E3, K5, K6, K7.
All Left talus for cancellous bone.

	Code No.	Description	Weight	Wet or D
1.	E0D1 to RC	Humerus n R	8.45g	D
2.	E1C2 to RC	Humerus n L	14.92g	D
3.	E2C0 to RC	Radius n R	11.11g	D
4.	E3C0 to RC	Radius n L	10.69g	D
5.	K5B0 to RC	Femur n L	21.69g	D
6.	K6B0 to RC	Tibia n R	25.42g	D
7.	K7B2 to RC	Tibia n L	16.41g	D
8.	L3 to RC	Talus n L	21.67g	D

8000458

BONE AND DOSIMETRY GROUP
SAMPLE DISTRIBUTION

Case No. 40-004 Date: 781207

Sample Type (SPCI): Autopsy ___, EXH X, Cremains ___, Surgical ___, Willed ___

Sample(s):

	Code No.	Description	Weight	Wet or Dry
1.	EOD2 to RPL	HUn Rn shaftn distaLn pc.	4.84g	D
2.				
3.				
4.				
5.				
6.				
7.				
8.				

8000459

ARGONNE
NATIONAL
LABORATORY

PRIVACY ACT MATERIAL REMOVED

40-004
(concep)
INTRA-LABORATORY MEMO

May 20, 1977

Memo To: R. P. Larsen
R. A. Schlenker

From: J. E. Farnham

Subject: Bone specimens from Case 40-004

A series of bone segments were cut and removed from diaphyseal regions of six of the bones among the specimens given to Dr. Larsen in November of 1976, see memo date November 19, 1976. The accompaning photographs show (1) the bone specimens before the segments were cut and (2) after the segments were out. A listing of the segments retained for Dr. Schlenker's research needs follows:

E0 right humerus diaphysis, 5 segments, 24.1g
E4 right ulna diaphysis, 6 segments, 15.95g
K4 right femur diaphysis, 6 segments, 126.78g
K5 left femur diaphysis, 6 segments, 123.0g
K6 right tibia diaphysis, 8 segments, 81.05g
K7 left tibia diaphysis, 5 segments, 67.1g

JEF:dmm

xc: CHR - Records Room

PRIVACY ACT MATERIAL REMOVED

8000460

ANL-26 (11-68)

ARGONNE
NATIONAL
LABORATORY

INTRA-LABORATORY MEMO

November 19, 1976

TO: CHR Records

FROM: J. E. Farnham

SUBJECT: Skeletal remains of Case 40-004

Per Dr. Schlenker's request, all the skeletal remains, with the exception of those bone specimens consumed in micro-autoradiographic studies, are being distributed to Dr. Larsen of the Radiochemical Analysis group. Two photos of the distributed bones are attached to this memo:

#1 Most Long Bones and Skull Bones

A0 - Parts	578.7 g
E0 - [E0A0 and 1/2 E0E0 missing]	80.3 g
E1 - [1/2 E0A0 missing]	90.5 g
E3 - [part of E3A0 & E3E0 missing]	36.3 g
E4 - [1/2 E4A0 & E4E0 missing	42.2 g
E5 -	42.35 g
K4 -	342.7 g
K5 - [only pc. of K5B0 & K5D0 present]	226.7 g
K6 - [1/2 K6A0 & K6E0 missing]	168.8 g
K7 - [most of K7A0 & K7E0 missing]	120.6 g
C6D0-	4.05 g
Q5D0-	5.86 g

#2 Other bones

E6A0 -	109.76 g
E7A0 -	96.05 g
Rib fragments -	67.7 g
A2 - [1/4 A2A0 & A2E0 missing]	35.5 g
A3 - [1/2 A2A0 & A2E0 missing]	
A4A0 -	15.4 g
A5A0 -	28.6 g
E2 - [1/2 E2A0 & E2E0 missing]	34.1 g
Foot bone fragments -	100.3 g
K8C0 -	10.3 g

8000461

ANL-26 (11-68)

C1 -	9.9 g
C2 -	11.8 g
Q7D0 -	8.2 g
R5D0 -	9.9 g
Misc. bone chips -	42.58 g

It is estimated that the above listed bone specimens constitute 50% of the original skeletal mass. The total dry weight of these specimens is 2319.11 grams.

clc

40-004

A0D2	BO	PU239	2.36577E+01	1.89481E-01	811109	GMA
C10	BO	PU239	3.92329E+01	1.33389E+00	811111	GMA
E0DC	BO	PU239	1.22830E+01	1.62416E-01	811111	GMA
E0DI	BO	PU239	2.41375E+01	2.66863E-01	811116	GMA
E0DT	BO	PU239	6.47179E+01	7.48028E-01	811109	GMA
E0D1	BO	PU239	1.78641E+01	2.83603E-01	780922	GMA
E1C2	BO	PU239	1.60975E+01	1.51492E-01	780922	GMA
E1C2E	BO	AM241	4.17000E-02	5.40000E-03	780901	GMA
E2C0	BO	PU239	9.50325E+00	2.03379E-01	780922	GMA
E3C0	BO	PU239	8.01162E+00	2.05194E-01	780922	GMA
K4A6	BO	PU239	4.66741E+01	5.80520E-01	780922	GMA
K4B1	BO	PU239	1.56297E+01	4.90242E-01	780922	GMA
K4C3	BO	PU239	1.56442E+01	1.48669E-01	811109	GMA
K5B0	BO	PU239	1.51479E+01	5.42043E-01	780922	GMA
K6B0	BO	PU239	9.89159E+00	3.26312E-01	780922	GMA
K7B2	BO	PU239	1.09780E+01	1.87708E-01	780922	GMA
L31	BO	PU239	1.15804E+01	2.27031E-01	780922	GMA
Q5AC	BO	PU239	1.08004E+02	2.78045E+00	811109	GMA
Q5AI	BO	PU239	2.08244E+02	4.82369E+00	811109	GMA

missing

MOVED

CHARGES

see 10/4/78 memo
no detailed report
available
10/15/84
GP/HFL

8000464

Q5AT	BO	PU239	2.35269E+02	6.16121E+00	811109	GMA
010	BO	PU239	1.10755E+02	1.14878E+00	780922	GMA
010E	BO	AM241	1.92000E-01	1.70000E-02	780901	GMA

— missing

all 10/4/78 memo
no detailed report
available 10/15/84
GA/HFL

8000465

Chic-I
(MX-100)

PRIVACY ACT MATERIAL REMOVED

Name

Hospital No Billings 354370 Path #6591

Date of birth

Date of injection - Apr. 26, 1945 ^{239}Pu (VI) acet

Age at injection

SNOP CODED

Date of death Oct 5, 1945 MAY 1977

Age at death Time after injection - 160 days

Death certificate No

PRIVACY ACT MATERIAL REMOVED

8000466

Name [redacted] Age 68 Occup. Machinist No. 6591

Institution Billings Memorial Hospital 354370

Clinical Diagnosis Epidermoid carcinoma of mouth with metastases.

PRIVACY ACT MATERIAL REMOVED MAR [illegible]

Att. Phys. Dr. A. Brunschwig Post-mortem by Dr. R. C. Weber

Date and Hour of Death 10-3-45 at 2:10 AM Date and Hour of Post-mortem 10-3-45 at 1:30 PM

ANATOMICAL DIAGNOSIS:

Extensive postoperative recurrence of epidermoid carcinoma of the mouth. Resection of the mandible and associated soft parts of the floor of the mouth, with pedicle graft reconstruction (partially completed); healed patent gastrostomy. Extensive carcinomatous invasion of the structures of the anterior portion of the neck. Bilateral pulmonary carcinoma metastases, some associated with vascular thrombosis, cavitation and abscess formation. Large left pulmonary-pleural carcinomatous abscess; carcinomatous invasion of left pleural adhesions and of the contiguous thoracic wall. Diffuse pulmonary edema and hyperemia. Acute bronchopneumonia in the lower lobe of the left lung; focal chronic proliferative aspirative bronchopneumonia. Severe parenchymatous and slight fatty degeneration of the liver. Myocardial hypertrophy and disseminated myofibrosis. Chronic pericholangitis. Chronic atrophic gastritis. Benign prostatic hypertrophy; hyperplastic nodules in lateral lobes. Mild chronic pyelonephritis. Slight erosive peptic esophagitis.

EXTERNAL APPEARANCE: The body is that of an elderly man weighing 168 pounds and measuring 69 inches in length. The skull is normal in appearance. The ears, conjunctivae, sclerae, pupils and external nares appear to be normal. The anterior portion of the mouth is surgically absent. Both horizontal rami of the mandible are absent as well as the musculature of the anterior portion of the neck and the sublingual and submaxillary salivary and lymph glands. There is a vitallium plate between the ends of the mandible. The entire protruding portion of the chin has been resected including the anterior part of the floor of the mouth, the hyoid bone and the right jugular vein. However, the upper margin of the lower lip, a very narrow strip, has been preserved. A temporal-frontal visor pedicle flap has been constructed and has been brought down with one arm attached to the right cheek beneath the margin of the lower lip. It is adherent and growing. The other margin of the flap is still attached to the left temple with the left temporal artery supplying it with blood. The frontal area from which the graft has been taken has been subsequently regrafted and is completely healed. There are two sinuses in the lower neck, one low in the midline, the other on the right side under the vertical ramus of the mandible. These sinuses

PRIVACY ACT MATERIAL REMOVED

8000467

open into a granulating tissue which is permeated with tumor. The tongue, which is preserved, is exposed anteriorly because of the incomplete closure of the flap. There is extensive cancerous involvement at the base of the tongue, of the remaining skin of the anterior portion of the neck and especially around the two sinuses. The entire anterior surface of the neck is very hard on palpation but no discrete mass can be detected. The maxilla is edentulous. Rigor mortis is present. There is no lymphadenopathy in the axillary or inguinal regions. There is a patent recent gastrostomy opening in the midline above the umbilicus through which a tube is anchored. The genitalia are normal. There are no decubitus ulcers.

ABDOMINAL CAVITY: The fat layer of the abdominal wall is 3 cms. thick and the muscles are pale. The peritoneal surfaces are normal. There is abundant mesenteric fat. The mesenteric nodes are small. The fundus of the bladder is below the symphysis. The gastrostomy opening is intact. There is no leakage. The inguinal rings are closed. There are no adhesions present in the abdomen. The diaphragm rises to the 5th rib on the right and the 5th rib on the left. The margin of the liver extends 3 cms. beyond the costal margin in the right midclavicular line and 8 cms. below the ensiform cartilage. There are no nodules on the surface of the liver, which is entirely smooth. The abdominal lymph nodes are not remarkable.

PLEURAL CAVITIES: The right pleural cavity is essentially normal. There are no adhesions and no pleural fluid is present. The left pleural cavity contains a small quantity of serous fluid. The left lung is bound densely to the thoracic wall over a circular area 9 to 10 cms. in diameter, which extends from the 2nd to the 6th ribs in the axillary line. The left lung cannot be freed without tearing the borders of a cyst like cavity, which is walled off by firm cancerous adhesions. When they are torn, the cavity (10 x 9 x 5 cms.) is found to lie between the two pulmonary lobes and the parietal pleura. On the pleural wall

THYROID AND THYMUS: The thyroid is embedded in a mass of scirrhous neoplastic tissue and cannot be removed. The tumor has largely replaced the glandular structure. The thymus is identified in its normal position and is atrophic.

HEART, AORTA AND VESSELS: The emptied heart weighs 560 gms.. It has a considerable amount of subepicardial fat. There is no evidence of dilatation of the right chambers. There is a "soldier's spot" on its anterior surface near the apex. The valve measurements are as follows: tricuspid 12 cms., pulmonary 8.5 cms., mitral 11.5 cms., aortic 8 cms.. The valve cusps and leaflets show no remarkable abnormalities. The aorta shows a moderate amount of atherosclerosis, compatible with the age. Coronary arteriosclerosis is minimal. The myocardium on section reveals no gross areas of fibrosis or myomalacia. The foramen ovale and ductus arteriosus are closed. The wall of the left ventricle averages 13 mms. in thickness, that of the right 2 to 4 mms.. The venae cavae and portal vein present no abnormalities.

LUNGS: The right lung weighs 730 gms. and the left 1220 gms.. The relationship of the left lung to the chest wall has been described above (See Pleural Cavities). Both lungs are boggy and hyperemic. Externally they are firmer than normal, lumpy, and of a dark red-violet color, especially so in their lower lobes. The cut surfaces are wet and hyperemic, with distinct coarse patches of gray-red bronchopneumonic consolidation. These are marked only in the left lower lobe. Each lung contains a considerable number of pale tumor nodules, some of them firm, and others cystic. The latter have central cavities of varying sizes, filled with cloudy gray fluid. These cavities are bordered by rims of neoplastic tissue from 1 mm. to 5 mms. thick. The largest cystic metastases are in the lower lobes. In the left lower lobe one cancerous abscess is 5 cms. in diameter and another one measures 1 cm.. The right lower lobe contains a cancerous abscess 2 cms. in diameter. Both of these lobes, like the remaining lobes, contain multiple small metastases, some of them with tiny central cavities. The largest solid nodule, 3 cms. in diameter, lies in the right lower lobe. Communications between the various cavities and the larger bronchi cannot be demonstrated. Bordering the interlobar surfaces of the left lung (and the abscess described above) neoplastic tissue invades the parenchyma of both lobes for a considerable distance (up to 2 to 3 cms.).
Note: The findings in the lung make it very probable that cystic degeneration of a large metastasis was responsible for the well localized pleural involvement.

PERIBRONCHIAL GLANDS: The peribronchial glands are small and some are calcified. All contain anthracotic pigment. There is no evidence of gross tumor involvement.

LIVER AND GALL BLADDER: The bile ducts are patent. Pressure upon the gall bladder expresses bile from the ampulla of Vater. The liver weighs 2050 gms.. Externally it is purple pink. The capsule is smooth. Cut sections of the liver show a markedly congested surface, with the central veins distended with blood. No tumor is present grossly.

SPLEEN: The spleen weighs 260 gms.. Externally it is dark purple red with a smooth capsular surface. The cut surfaces bulge considerably and the pulp has

a semisolid texture. The fibrous elements and Malpighian corpuscles are not prominent.

PANCREAS: The pancreas, including a considerable amount of fat, weighs 100 gms.. It is grossly normal.

GASTRO-INTESTINAL TRACT: The gastric rugae appear to be normal. The gastrostomy opening is patent. The stomach is firmly adherent to the anterior abdominal wall at the gastrostomy site which is intact. The gastric mucosa is slightly hyperemic in the region of the gastrostomy. The duodenum, jejunum, ileum and colon are normal throughout.

ADRENALS: Both adrenals appear to be grossly normal and are rich in lipoid.

KIDNEYS: These organs are dark purple externally. The right kidney weighs 160 gms., the left 180 gms.. The capsules strip with ease. The cut surfaces bulge somewhat. The cortices are 5 mm. thick, while the medullary areas average 10-12 mms. in thickness. There is no tumor present and there is no gross evidence of renal infection.

URINARY TRACT: The ureters are patent and normal throughout. The urinary bladder is small and grossly normal.

GENERATIVE ORGANS: The prostate is hyperplastic, soft and nodular. It has a diameter of 5 cms.. There is a soft nodule about 1 cm. in diameter in each lateral lobe. The urethra is not obstructed. The testicles are grossly normal. The tubules tease with increased resistance compatible with this age group.

LYMPH NODES IN GENERAL: The lymph nodes outside of the area of tumor extension in the neck are of normal size and consistency. The peribronchial nodes show no evidence of tumor. A number are calcified, apparently having been the site of an old tuberculous process.

BRAIN, MENINGES AND SPINAL CORD: Not examined.

MUSCULAR SYSTEM: The abdominal and thoracic muscles are moderately pale. This body is not wasted as is so often the case with carcinoma patients.

SKELETON: Aside from the surgical removal of a portion of the mandible, the skeleton is grossly normal. There is no obvious tumor involvement of bone marrow although it is possible that there is invasion of the left ribs beneath the cancerous plaque (See Pleural Cavities).

(The autopsy permit does not allow exploration of the neck or head, so that the extent of the tumor growing locally cannot be determined.)

CLINICAL HISTORY: The patient, a 68 year old white man, was admitted to the hospital on 3-29-45, complaining of an ulcerating lesion on his jaw of 9 months' duration. He had enjoyed excellent health until the latter part of June, 1944,

when he noticed a small swelling just under the anterior aspect of the chin. The tumor grew until it reached the size of a hen's egg. The lesion was excised in October of 1944 and a diagnosis of a squamous cell carcinoma of the buccal cavity was made. Postoperatively the patient received about 2000 R of x-rays to the area, but within two weeks the tumor had reappeared and continued to grow necessitating another operation in December of 1944. Postoperatively the lesion failed to heal. He was again given intensive x-ray therapy and was referred to the U. of C. Clinics.

When admitted he was a well developed, well nourished white male. On the under surface of the jaw was a large necrotic ulcer with hard elevated irregular edges. No cervical glands were palpated. A portion of the mandible could be seen in the floor of the ulcer. The heart was not enlarged. A systolic murmur was heard at the apex; B.P. 106/80. The lungs were clear to ausculation and percussion. The abdomen was negative. X-rays of the chest were normal. The laboratory studies revealed a slight anemia; hb. 11.5, RBC 4.36, WBC 7,000. Plasma proteins were 6.51, alb. 3.98, glob. 2.53, A/G 1.58.

On 4-3-45 a preliminary Pezzar catheter gastrostomy was done, and on 4-11-45 radical excision of the lower jaw and partial reconstruction with a bone plate were performed. Between 4-29-45 and 7-19-45 seven different plastic operative procedures were carried out. On 8-11-45 two sinuses in the lower neck were enlarged and in this procedure diffuse carcinomatous infiltration of the neck became evident.

The patient was maintained throughout on gastrostomy feeding because of inability to swallow. On 8-21-45 chest x-rays revealed carcinomatous invasion of thoracic structures. The patient became very weak and had considerable pain. Mental confusion was noted terminally. He expired on 10-3-45.

HISTOPATHOLOGY

The following sections did not contain tumor tissue:

Myocardium: Fine perivascular subendocardial scarring is quite widespread. There are no very large scars and no significant sclerosis of medium sized and small arteries. The muscle fibers are coarse. There is no fatty change.

Kidney: There is a mild focal interstitial nephritis, probably a pyelonephritis, as the arteries are only moderately sclerotic. Parenchymatous degeneration of tubules is fairly marked and a few hyaline and calcified casts are seen.

Liver: The lobules are small and the cords are thin. There is a quite marked chronic pericholangitis. A few liver cells are vacuolated and others contain eosinophilic inclusions surrounded by a halo. The blood sinuses contain increased numbers of cells, some of which are polymorphs while some are myeloid and erythrogenic cells. There is little fat stainable by scarlet red.

Spleen: This organ has a congested and hemorrhagic red pulp, small lymph follicles and hyaline narrowed arteries.

Pancreas: The only detectable change is some invasion of adipose tissue (postmortem changes).

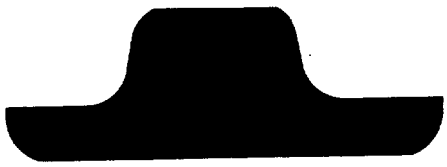
Adrenal: Vacuolated lipoid rich cortical cells are fairly abundant. A few round cells (myeloid cells ?) are found in the medulla.

Esophagus: The section shows thick epithelium and one erosion beneath which the wall is infiltrated by round cells.
Stomach: There is a chronic gastritis with moderate atrophy of the glands and numerous lymph follicles.
Testis: A few (5 to 10%) of the tubules are atrophic. The other tubules have thick basement membranes and depressed spermatogenesis, although some tubules contain spermatids.
Prostate: This gland shows a nodular adenomatous hyperplasia.
Tracheobronchial lymph nodes: These nodes are hyperplastic with increased macrophages and polymorphs in their sinuses.
Bone marrow: The ratio of cellular and adipose tissue is approximately 50%. There is a definite left shift of the granulocytes; megakaryocytes are abundant and erythroblastic islands are well preserved.
Blood (in various blood vessels): In general the proportion of white cells appears low but a fair number of polymorphs are noted.

The following tissues contain neoplastic tissue:
Cancer tissue from neck: Two large sections contain only neoplastic tissue which is partially necrotic and focally invaded by leukocytes. The greater portions are composed of keratohyaline masses and degenerating pearls. Some areas are cystic and in a few foci the necrotic tissue is beginning to be calcified. Each section contains a few cellular areas with plexiform epidermoid carcinoma showing keratinization of individual cells and of occasional small pearls. A very few mitotic figures are present here.
Two other sections, presumably from the neck, show a mixture of plexiform carcinoma like that above and of foci of marked keratinization. The carcinoma tissue obviously invades atrophic skeletal muscle and lymphatic channels.
Bone: One section shows cancerous invasion into an osteocartilagenous structure (from the description this probably represents a metastasis in the pleura invading a rib).
Pharyngeal mucous membrane: Well beneath the epithelium is a dense growth of carcinoma tissue like that just described.
Lungs: Five of 6 sections examined contain carcinoma; the fifth shows an acute confluent pneumonia with abundant fibrin and many polymorphs. There is an early fibrinous pleuritis. Another feature is the presence of corpora amylacea, some of which bordered by foreign body giant cells. There are also foci of chronic pneumonia with giant cells. One small bronchus is obliterated by granulation tissue (old, aspirative pneumonia).

The other sections reveal epidermoid cancer invading the pleura and infiltrating walls of bronchi and blood vessels as well as the lung tissue proper. An important feature is the growth of cancer tissue in organized thrombi within fairly large blood vessels, both arteries and veins. The wall of a large cavity (left lower lobe) shows the features of an active but fairly chronic lung abscess with bits of degenerating cancer tissue in its walls. Nearby there are thrombosed small vessels infiltrated by cancer cells. Some sections show sheets of cancer tissue or actual nodules projecting on the pleural surf
Comparison with sections removed at operation: The general features of the cancer tissue are quite similar - in tissues obtained at operation and at necropsy.

BACTERIOLOGY: A check on the bacteriology revealed that cultures of a lung abscess revealed a few hemolytic strep and many hemolytic staph. aureus.



ARGONNE
NATIONAL
LABORATORY

INTRA-LABORATORY MEMO

October 4, 1978

TO: Records

FROM: Robert Oldham R. Oldham

SUBJECT: Sample Analyses Without Detailed Result Forms

The following analyses on the samples indicated do not have Detailed Result Forms. Results were entered directly into CHEM FILE from notebooks containing the calculations using the CHEM coding Form, CHR-ANL-12/19/73.

NUCLIDE ANALYZED	SAMPLE ID	LAB NO
AM241	40-004.010	2980
"	40-004.E1C2	2986
"	40-009.19	946
"	40-009.20	947
"	40-009.22 to 40-009.27	949 to 954
"	40-010.B51	1824
"	40-010.E14	1877
"	40-012.08	1147
"	40-012.10	1149
"	40-012.11	1150
"	40-012.13	1152
PU239	40-009.01 to 40-009.28	930 to 955
"	40-012.07 to 40-012.23	1146 to 1162
PU238	40-001.BY1	3006
"	40-003.04	1130
"	40-003.11	1137
"	40-003.12	1138

cc: J. Plondke
R. Oldham

RO/ns

8000475

ARGONNE
NATIONAL
LABORATORY

INTRA-LABORATORY MEMO

November 15, 1978

TO: Jean Plondke

FROM: Robert Oldham Robert Oldham

SUBJECT: Ca Results on Samples from Cases 40-004 and 40-010

Please remove Ca results that have been reported for the following samples from CHEM FILE:

40-004	E1C2
40-004	K4A6
40-004	010
40-010	B51
40-010	E14
40-010	E72
40-010	K50
40-010	110

Please also remove Ca Detailed Result sheets from records for the above samples and prepare new Summary Reports once the Ca results have been deleted.

cc: RDO

RDO/ns

8000476

ANL-26 (11-68)

DETAILED RESULTS: PRIVACY ACT MATERIAL REMOVED 40-004 A0D2 PU239 (NEW) 81110

239PU (PLUTONIUM)
****

NAME: *CASE NO.: 40-004 *SAMPLE NO.: A0

EVENT: DEATH/E *DATE OF EVENT: 451003 *LAB NO.: 2981

TYPE :BO SAMPLE DESCRIPTION: FRONTAL SEE R TOOHEY

ITEM	UNIT	ANALYSIS NUMBER 1	2	3
1. SAMPLE SUB-NUMBER		A0D2B	A0D2C	A0D2D
2. METHOD		CRI	CRI	CRI
3. DATE REQUESTED		770812	770812	770812
4. DATE ANALYZED		790123	790206	790308
5. SAMPLE SIZE	GMA	123.480	123.480	123.480
6. ALIQUOT (FRACTION)		0.001	0.001	0.002
7. SAMPLE SIZE MEASURED	GMA	0.126	0.170	0.188
8. 242 PU SPIKE	DPM	37.400	37.400	37.400
9. STD. ERROR OF ITEM 8	DPM	0.130	0.130	0.130
10. 242 PU SAMPLE COUNTS	CTS	13928	20540	53121
11. 239 PU SAMPLE COUNTS	CTS	2459	4962	13932
12. 239 PU IN SAMPLE	PCI	2.975	4.070	4.419
13. STD. ERROR(COUNTS+SYS)	PCI	6.588E-02	6.592E-02	4.478E-02
14. CONCENTRATION 239PU	PCI/GMA	23.618	23.886	23.544
15. STD. ERROR(CNT+SYS)	PCI/GMA	0.523	0.387	0.239
16. REFERENCES-CHR DOCS.		R112RO	R112RO	R112RO

****
* RESULTS: AT TIME OF FIRST MEASUREMENT *
****

1. PU CONCENTRATION OR RATE(WTD. MEAN)	23.635	PCI/GMA	
2. STD.ERROR(EXTERNAL)	0.101	PCI/GMA	
3. STD. ERROR(INTERNAL)	0.189	PCI/GMA	
4. VARIANCE RATIO,F	0.285		
5. FRACTIONAL STD. ERROR	0.0080		
6. PU (MEAN) IN ALIQ #1 : 2.977_+	0.024	PCI	

****
* RESULTS: AT TIME OF EVENT *
****

PU CONCENTRATION OR RATE: 23.658 ± 0.189 PCI/GMA

ANALYZED BY: RDO CHECKED: 11/11/81 REVIEWED BY/DATE: RDO 11/12/81

COMMENTS AND REFERENCES:

TO (BY/DATE): CHR FILE:_____SR FORM:_____SA CARD:_____CHEM FILE:_____

CHR FORM 10/14/77(HFL)

PRIVACY ACT MATERIAL REMOVED

8000477

239PU (PLUTONIUM)
****

PRIVACY ACT MATERIAL REMOVED

NAME: *CASE NO.: 40-004 *SAMPLE NO.

EVENT: DEATH/E *DATE OF EVENT: 451003 *LAB NO.: 2979

TYPE :BO SAMPLE DESCRIPTION: VERT1CERV

ITEM	UNIT	ANALYSIS NUMBER 1	ANALYSIS NUMBER 2
1. SAMPLE SUB-NUMBER		C10C	C10D
2. METHOD		CRI	CRI
3. DATE REQUESTED		770812	770812
4. DATE ANALYZED		790206	790308
5. SAMPLE SIZE	GMA	7.777	7.777
6. ALIQUOT (FRACTION)		0.020	0.022
7. SAMPLE SIZE MEASURED	GMA	0.155	0.168
8. 242 PU SPIKE	DPM	37.400	37.400
9. STD. ERROR OF ITEM 8	DPM	0.130	0.130
10. 242 PU SAMPLE COUNTS	CTS	21620	54458
11. 239 PU SAMPLE COUNTS	CTS	8224	20876
12. 239 PU IN SAMPLE	PCI	6.409	6.459
13. STD. ERROR(COUNTS+SYS)	PCI	8.597E-02	5.717E-02
14. CONCENTRATION 239PU	PCI/GMA	41.373	38.380
15. STD. ERROR(CNT+SYS)	PCI/GMA	0.555	0.340
16. REFERENCES-CHR DOCS.		R112RO	R112RO

****
* RESULTS: AT TIME OF FIRST MEASUREMENT *
****

1. PU CONCENTRATION OR RATE(WTD. MEAN)	39.196	PCI/GMA	
2. STD.ERROR(EXTERNAL)	1.333	PCI/GMA	
3. STD. ERROR(INTERNAL)	0.290	PCI/GMA	
4. VARIANCE RATIO,F	21.154		
5. FRACTIONAL STD. ERROR	0.0340		
6. PU (MEAN) IN ALIQ #1 :	6.072 ±	0.206	PCI

****
* RESULTS: AT TIME OF EVENT *
****

PU CONCENTRATION OR RATE: 39.233 ± 1.334 PCI/GMA

ANALYZED BY: SMM CHECKED: 11/2/79 REVIEWED BY/DATE: RDO 11/

COMMENTS AND REFERENCES:

TC (BY/DATE): CHR FILE:_____SR FORM:_____SA CARD:_____CHEM FILE:_

CHR FORM 10/14/77(HFL)

PRIVACY ACT MATERIAL REMOVED

8000478

DETAILED RESULTS: 40-004 EODC PU239 (NEW)

239PU (PLUTONIUM) PRIVACY ACT MATERIAL REMOVED
****

NAME: *CASE NO.: 40-004 *SAMPLE NO

EVENT: DEATH/E *DATE OF EVENT: 451003 *LAB NO.: 3401

TYPE :BO SAMPLE DESCRIPTION: HUMRTDIST CORT PORTION OF EOD2

ITEM	UNIT	ANALYSIS NUMBER 1
1. SAMPLE SUB-NUMBER		EODCA
2. METHOD		CRI
3. DATE REQUESTED		781208
4. DATE ANALYZED		790221
5. SAMPLE SIZE	GMA	3.016
6. ALIQUOT (FRACTION)		0.069
7. SAMPLE SIZE MEASURED	GMA	0.209
8. 242 PU SPIKE	DPM	37.400
9. STD. ERROR OF ITEM 8	DPM	0.130
10. 242 PU SAMPLE COUNTS	CTS	46559
11. 239 PU SAMPLE COUNTS	CTS	7078
12. 239 PU IN SAMPLE	PCI	2.561
13. STD. ERROR(COUNTS+SYS)	PCI	3.387E-02
14. CONCENTRATION 239PU	PCI/GMA	12.271
15. STD. ERROR(CNT+SYS)	PCI/GMA	0.162
16. REFERENCES-CHR DOCS.		R112RO

****
* RESULTS: AT TIME OF FIRST MEASUREMENT *
****

1. PU CONCENTRATION OR RATE(WTD. MEAN)		12.271	PCI/GMA
2. STD.ERROR(EXTERNAL)		0.000	PCI/GMA
3. STD. ERROR(INTERNAL)		0.162	PCI/GMA
4. VARIANCE RATIO,F		0.000	
5. FRACTIONAL STD. ERROR		0.0132	
6. PU (MEAN) IN ALIQ #1 :	2.561 +	0.034	PCI

****
* RESULTS: AT TIME OF EVENT *
****

PU CONCENTRATION OR RATE: 12.283 ± 0.162 PCI/GMA

ANALYZED BY: SMM CHECKED: 11/12/81 REVIEWED BY/DATE: RDO 11/

COMMENTS AND REFERENCES:

TC (BY/DATE): CHR FILE:_____SR FORM:_____SA CARD:_____CHEM FILE:_

CHR FORM 10/14/77(HFL)
8000479

PRIVACY ACT MATERIAL REMOVED

DETAILED RESULTS: 40-004 EODI PU239 (NEW) 8

239PU (PLUTONIUM) PRIVACY ACT MATERIAL REMOVED
****

NAME: *CASE NO.: 40-004 *SAMPLE NO.

EVENT: DEATH/E *DATE OF EVENT: 451003 *LAB NO.: 3402

TYPE :BO SAMPLE DESCRIPTION: HUMRTDIST MIX OF TRAB CORT OF EOD2

ITEM	UNIT	ANALYSIS NUMBER 1
1. SAMPLE SUB-NUMBER		EODIA
2. METHOD		CRI
3. DATE REQUESTED		781208
4. DATE ANALYZED		790228
5. SAMPLE SIZE	GMA	0.406
6. ALIQUOT (FRACTION)		0.400
7. SAMPLE SIZE MEASURED	GMA	0.162
8. 242 PU SPIKE	DPM	37.400
9. STD. ERROR OF ITEM 8	DPM	0.130
10. 242 PU SAMPLE COUNTS	CTS	48146
11. 239 PU SAMPLE COUNTS	CTS	11188
12. 239 PU IN SAMPLE	PCI	3.915
13. STD. ERROR(COUNTS+SYS)	PCI	4.329E-02
14. CONCENTRATION 239PU	PCI/GMA	24.115
15. STD. ERROR(CNT+SYS)	PCI/GMA	0.267
16. REFERENCES-CHR DOCS.		R112RO

****
* RESULTS: AT TIME OF FIRST MEASUREMENT *
****

1. PU CONCENTRATION OR RATE(WTD. MEAN)		24.115	PCI/GMA
2. STD.ERROR(EXTERNAL)		0.000	PCI/GMA
3. STD. ERROR(INTERNAL)		0.267	PCI/GMA
4. VARIANCE RATIO,F		0.000	
5. FRACTIONAL STD. ERROR		0.0111	
6. PU (MEAN) IN ALIQ #1 :	3.915_+	0.043	PCI

****
* RESULTS: AT TIME OF EVENT *
****

PU CONCENTRATION OR RATE: 24.137 ± 0.267 PCI/GMA

ANALYZED BY: SMM CHECKED: [illegible] REVIEWED BY/DATE: RDD 11/81

COMMENTS AND REFERENCES:

TO (BY/DATE): CHR FILE:_____SR FORM:_____SA CARD:_____CHEM FILE:__

CHR FORM 10/14/77(HFL)

8000480

PRIVACY ACT MATERIAL REMOVED

DETAILED RESULTS: 40-004 EODT PU239 (NEW) 811

PRIVACY ACT MATERIAL REMOVED

239PU (PLUTONIUM)
****

NAME: *CASE NO.: 40-004 *SAMPLE NO.: 1

EVENT: DEATH/E *DATE OF EVENT: 451003 *LAB NO.: 3403

TYPE :BO SAMPLE DESCRIPTION: HUMRTDIST TRAB PORTION OF EOD2

ITEM	UNIT	ANALYSIS NUMBER 1
1. SAMPLE SUB-NUMBER		EODTA
2. METHOD		CRI
3. DATE REQUESTED		781208
4. DATE ANALYZED		790226
5. SAMPLE SIZE	GMA	9.320E-02
6. ALIQUOT (FRACTION)		0.400
7. SAMPLE SIZE MEASURED	GMA	3.728E-02
8. 242 PU SPIKE	DPM	37.400
9. STD. ERROR OF ITEM 8	DPM	0.130
10. 242 PU SAMPLE COUNTS	CTS	65755
11. 239 PU SAMPLE COUNTS	CTS	9407
12. 239 PU IN SAMPLE	PCI	2.410
13. STD. ERROR(COUNTS+SYS)	PCI	2.786E-02
14. CONCENTRATION 239PU	PCI/GMA	64.656
15. STD. ERROR(CNT+SYS)	PCI/GMA	0.747
16. REFERENCES-CHR DOCS.		R112RO

****
* RESULTS: AT TIME OF FIRST MEASUREMENT *
****

1. PU CONCENTRATION OR RATE(WTD. MEAN)		64.656	PCI/GMA
2. STD.ERROR(EXTERNAL)		0.000	PCI/GMA
3. STD. ERROR(INTERNAL)		0.747	PCI/GMA
4. VARIANCE RATIO,F		0.000	
5. FRACTIONAL STD. ERROR		0.0116	
6. PU (MEAN) IN ALIQ #1 :	2.410 +	0.028	PCI

****
* RESULTS: AT TIME OF EVENT *
****

PU CONCENTRATION OR RATE: 64.718 ± 0.748 PCI/GMA

ANALYZED BY: SMM CHECKED: DS 11/12/81 REVIEWED BY/DATE: RDO 11/12/81

COMMENTS AND REFERENCES:

TO (BY/DATE): CHR FILE:_____SR FORM:_____SA CARD:_____CHEM FILE:_____

PRIVACY ACT MATERIAL REMOVED

DETAILED RESULTS: 40-004 PD PU239 (NEW) 780722

239PU (PLUTONIUM) PRIVACY ACT MATERIAL REMOVED
****

NAME: *CASE NO.: 40-004 *SAMPLE NO.: 7DD

EVENT: DEATH/E *DATE OF EVENT: 451003 *LAB NO.: 2935

TYPE :PU SAMPLE DESCRIPTION: HUMRIDMT

ITEM	UNIT	----------ANALYSIS NUMBER---------- 1
1. SAMPLE SUB-NUMBER		E0D1
2. METHOD		CRI
3. DATE REQUESTED		770812
4. DATE ANALYZED		780522
5. SAMPLE SIZE	GMA	0.198
6. ALIQUOT (FRACTION)		1.000
7. SAMPLE SIZE MEASURED	GMA	0.198
8. 242 PU SPIKE	DPM	42.740
9. STD. ERROR OF ITEM 8	DPM	0.380
10. 242 PU SAMPLE COUNTS	CTS	37215
11. 239 PU SAMPLE COUNTS	CTS	6844
12. 239 PU IN SAMPLE	PCI	3.541
13. STD. ERROR(COUNTS+SYS)	PCI	5.621E-02
14. CONCENTRATION 239PU	PCI/GMA	17.848
15. STD. ERROR(CNT+SYS)	PCI/GMA	0.283
16. REFERENCES-CHR DOCS.		8 105C

****
* RESULTS: AT TIME OF FIRST MEASUREMENT *
****

1. PU CONCENTRATION OR RATE(WTD. MEAN) 17.848 PCI/GMA
   2. STD.ERROR(EXTERNAL) 0.000 PCI/GMA
   3. STD. ERROR(INTERNAL) 0.283 PCI/GMA
   4. VARIANCE RATIO,F 0.000
   5. FRACTIONAL STD. ERROR 0.0159

6. PU (MEAN) IN ALIQ #1 : 3.541 ± 0.056 PCI

****
* RESULTS: AT TIME OF EVENT *
****

PU CONCENTRATION OR RATE: 17.864 ± 0.284 PCI/GMA

ANALYZED BY: CGC CHECKED: RDO 7/25/78 REVIEWED BY/DATE: RPL 7/25/78

COMMENTS AND REFERENCES:

TO (BY/DATE): CHR FILE:______SR FORM:______SA CARD:______CHEM FILE:______

CHR FORM 10/14/77(HFL)

8000482

PRIVACY ACT MATERIAL REMOVED

DETAILED RESULTS: 40-004 E1C2 CASE3 (NEW) 78071

PRIVACY ACT MATERIAL REMOVED

CALCIUM
****

NAME: *CASE NO.: 40-004 *SAMPLE NO.: E1C2

EVENT: DEATH/E *DATE OF EVENT: 451003 *LAB NO.: 2986

TYPE: BO *SAMPLE DESCRIPTION: HUMLTMS

ITEM	UNIT	ANALYSIS NUMBER 1	ANALYSIS NUMBER 2
1. SAMPLE SUB-NUMBER		E1C2C	E1C2C
2. METHOD		CHA	CHA
3. DATE REQUESTED		780414	780414
4. DATE ANALYZED		780630	780705
5. SAMPLE SIZE	GMA	0.246	0.246
6. ALIQUOT FRACTION		0.200	0.200
7. VOL. OF ALIQUOT	ML	25.000	25.000
8. VOL. MEASURED	ML	0.025	0.025
9. ALIQUOT FACTOR		2.000E-04	2.000E-04
10. SAMPLE SIZE MEASURED	GMA	4.914E-05	4.914E-05
11. CA IN ALIQUOT	UG	15.100	14.900
12. STD. ERROR(SYS) - 2%	UG	0.362	0.359
13. CA CONCN OR RATE	MG/GMA	307.285	303.216
14. REFERENCES-CHR DOCS.		RC30JS	RC30JS

****
* RESULTS *
****

1. CA CONCENTRATION OR RATE(WTD. MEAN)	305.231	MG/GMA
2. STD.ERROR(EXTERNAL)	2.035	MG/GMA
3. STD. ERROR(INTERNAL)	5.188	MG/GMA
4. VARIANCE RATIO,F	0.154	
5. FRACTIONAL STD. ERROR	0.017	

****

CA (MEAN) IN ALIQ #1 : 14.999 ± 0.255 UG

CA CONCENTRATION OR RATE: 305.231 ± 5.188 MG/GMA

****
* ASH CONTENT OF BONE, (CA/ASH=0.387) *
****

ASH CONTENT 0.1938± 0.0033(SE) GMA
ASH/GMA 78.9%

PWU JUL 20 1978

ANALYZED BY: PWU CHECKED: _____ REVIEWED BY/DATE: RDO 9/25/78

COMMENTS AND REFERENCES:

TO (BY/DATE): CHR FILE:_____SR FORM:_____SA CARD:_____CHEM FILE:_____
CHR FORM 3/7/75(HFL)

8000483

PRIVACY ACT MATERIAL REMOVED

DETAILED RESULTS: 40-00 [illegible] (NEW) [illegible]

239-PU (PLUTONIUM)
****

PRIVACY ACT MATERIAL REMOVED

NAME: _____ *CASE NO.: 40-004 *SAMPLE NO.: 1

EVENT: DEATH/E *DATE OF EVENT: 451003 *LAB NO.: 2936

TYPE :BC SAMPLE DESCRIPTION: HUMLTMS

ITEM	UNIT	ANALYSIS NUMBER 1	2	3
1. SAMPLE SUB-NUMBER		E1C2A	E1C2E	E1C2D
2. METHOD		CRI	CRI	CRI
3. DATE REQUESTED		770812	770812	770812
4. DATE ANALYZED		780519	780729	780823
5. SAMPLE SIZE	GMA	0.106	0.501	0.518
6. ALIQUOT (FRACTION)		1.000	1.000	1.000
7. SAMPLE SIZE MEASURED	GMA	0.106	0.501	0.518
8. 242 PU SPIKE	DPM	42.740	42.740	43.770
9. STD. ERROR OF ITEM 8	DPM	0.380	0.380	0.290
10. 242 PU SAMPLE COUNTS	CTS	39124	25804	16352
11. 239 PU SAMPLE COUNTS	CTS	3498	10652	6807
12. 239 PU IN SAMPLE	PCI	1.721	8.098	6.209
13. STD. ERROR(COUNTS+SYS)	PCI	3.402E-02	1.173E-01	1.313E-01
14. CONCENTRATION 239PU	PCI/GMA	16.317	16.169	15.840
15. STD. ERROR(CNT+SYS)	PCI/GMA	0.322	0.234	0.251
16. REFERENCES-CHR DOCS.		R 105C	R1118W	R1118R

****
* RESULTS: AT TIME OF FIRST MEASUREMENT *
****

1. PU CONCENTRATION OR RATE(WTD. MEAN)	16.083	PCI/GMA	
2. STD.ERROR(EXTERNAL)	0.135	PCI/GMA	
3. STD. ERROR(INTERNAL)	0.151	PCI/GMA	
4. VARIANCE RATIO,F	0.799		
5. FRACTIONAL STD. ERROR	0.0094		
6. PU (MEAN) IN ALIQ #1 : 1.697_+	0.016	PCI	

****
* RESULTS: AT TIME OF EVENT *
****

PU CONCENTRATION OR RATE: 16.099 ± 0.151 PCI/GMA

ANALYZED BY: CGC CHECKED: LDD 9/25/78 REVIEWED BY/DATE: RPL 9/25/78

COMMENTS AND REFERENCES:

TO (BY/DATE): CHR FILE:_____SR FORM:_____SA CARD:_____CHEM FILE:_____

CHR FORM 10/14/77(PFL)

8000484

PRIVACY ACT MATERIAL REMOVED

OBTAINED RESULTS:

PRIVACY ACT MATERIAL REMOVED

23+9B (PLUTONIUM)
****

NAME:

*CASE NO.: 40-004 *SAMPLE NO.: P2C

EVENT: DEATH/B *DATE OF EVENT: 451003 *LAB NO.: 2987

TYPE :BC SAMPLE DESCRIPTION: RADIUMS

ITEM		UNIT	ANALYSIS NUMBER 1
1.	SAMPLE SUB-NUMBER		EDCO
2.	METHOD		CRI
3.	DATE REQUESTED		770812
4.	DATE ANALYZED		780524
5.	SAMPLE SIZE	GMA	0.204
6.	ALIQUOT (FRACTION)		1.000
7.	SAMPLE SIZE MEASURED	GMA	0.204
8.	242 PU SPIKE	DPM	42.740
9.	STD. ERROR OF ITEM 8	DPM	0.380
10.	242 PU SAMPLE COUNTS	CTS	27185
11.	239 PU SAMPLE COUNTS	CTS	2740
12.	239 PU IN SAMPLE	PCI	1.941
13.	STD. ERROR(COUNTS+SYS)	PCI	4.255E-02
14.	CONCENTRATION 239PU	PCI/GMA	9.494
15.	STD. ERROR(CNT+SYS)	PCI/GMA	0.208
16.	REFERENCES-CHR DOCS.		P 1050

****
* RESULTS: AT TIME OF FIRST MEASUREMENT *
****

1.	PU CONCENTRATION OR RATE(WTD. MEAN)	9.494	PCI/GMA
2.	STD.ERROR(EXTERNAL)	0.000	PCI/GMA
3.	STD. ERROR(INTERNAL)	0.208	PCI/GMA
4.	VARIANCE RATIO,F	0.000	
5.	FRACTIONAL STD. ERROR	0.0219	

6. PU (MEAN) IN ALIQ #1 : 1.941 + 0.043 PCI

****
* RESULTS: AT TIME OF EVENT *
****

PU CONCENTRATION OR RATE: 9.503 ± 0.208 PCI/GMA

ANALYZED BY: CGC CHECKED: EDO 7/25/78 REVIEWED BY/DATE: RPL 7/25/78

COMMENTS AND REFERENCES:

TO (BY/DATE): CHR FILE:_____SR FORM:_____SA CARD:_____CHEM FILE:_____

CHR FORM 10/14/77(HFI)

8000485

PRIVACY ACT MATERIAL REMOVED

DETAILED RESULTS: 40-004 K4C3 PU239 (NEW) 811

PRIVACY ACT MATERIAL REMOVED

239PU (PLUTONIUM)
****

NAME: _ *CASE NO.: 40-004 *SAMPLE NO.: K

EVENT: DEATH/E *DATE OF EVENT: 451003 *LAB NO.: 2984

TYPE :BO SAMPLE DESCRIPTION: FEMRTMS

ITEM	UNIT	ANALYSIS NUMBER 1	ANALYSIS NUMBER 2
1. SAMPLE SUB-NUMBER		K4C3B	K4C3C
2. METHOD		CRI	CRI
3. DATE REQUESTED		770812	770812
4. DATE ANALYZED		790207	790312
5. SAMPLE SIZE	GMA	21.684	21.884
6. ALIQUOT (FRACTION)		0.010	0.009
7. SAMPLE SIZE MEASURED	GMA	0.229	0.207
8. 242 PU SPIKE	DPM	37.400	37.400
9. STD. ERROR OF ITEM 8	DPM	0.130	0.130
10. 242 PU SAMPLE COUNTS	CTS	35222	35310
11. 239 PU SAMPLE COUNTS	CTS	7455	6819
12. 239 PU IN SAMPLE	PCI	3.566	3.254
13. STD. ERROR(COUNTS+SYS)	PCI	4.712E-02	4.450E-02
14. CONCENTRATION 239PU	PCI/GMA	15.579	15.684
15. STD. ERROR(CNT+SYS)	PCI/GMA	0.206	0.215
16. REFERENCES-CHR DOCS.		R112RO	R112RO

****
* RESULTS: AT TIME OF FIRST MEASUREMENT *
****

1. PU CONCENTRATION OR RATE(WTD. MEAN)	15.629	PCI/GMA
2. STD.ERROR(EXTERNAL)	0.052	PCI/GMA
3. STD. ERROR(INTERNAL)	0.149	PCI/GMA
4. VARIANCE RATIO,F	0.124	
5. FRACTIONAL STD. ERROR	0.0095	

6. PU (MEAN) IN ALIQ #1 : 3.578 + 0.034 PCI

****
* RESULTS: AT TIME OF EVENT *
****

PU CONCENTRATION OR RATE: 15.644 ± 0.149 PCI/GMA

ANALYZED BY: SMM CHECKED: 11/11/81 REVIEWED BY/DATE: RDO 11/13/81

COMMENTS AND REFERENCES:

TC (BY/DATE): CHR FILE:_____SR FORM:_____SA CARD:_____CHEM FILE:_____

CHR FORM 10/14/77(HFL)

PRIVACY ACT MATERIAL REMOVED

8000490

DETAILED RESULTS: 43-30. -68 PU239 (NEW) 780523

239PU (PLUTONIUM) PRIVACY ACT MATERIAL REMOVED
****

NAME: *CASE NO.: 43-104 *SAMPLE NO.: K6

EVENT: DEATH/E *DATE OF EVENT: 451002 *LAB NO.: 2990

TYPE :60 SAMPLE DESCRIPTION: VERTEBRAE

ITEM	UNIT	----------ANALYSIS NUMBER---------- 1
1. SAMPLE SUB-NUMBER		K6B0
2. METHOD		C8I
3. DATE REQUESTED		770812
4. DATE ANALYZED		780524
5. SAMPLE SIZE	GMA	0.156
6. ALIQUOT (FRACTION)		1.000
7. SAMPLE SIZE MEASURED	GMA	0.156
8. 242 PU SPIKE	DPM	42.740
9. STD. ERROR OF ITEM 8	DPM	0.380
10. 242 PU SAMPLE COUNTS	CTS	13396
11. 239 PU SAMPLE COUNTS	CTS	1070
12. 239 PU IN SAMPLE	PCI	1.538
13. STD. ERROR(COUNTS+SYS)	PCI	5.073E-02
14. CONCENTRATION 239PU	PCI/GMA	9.882
15. STD. ERROR(CNT+SYS)	PCI/GMA	0.326
16. REFERENCES-CHR DOCS.		R 1050

****
* RESULTS: AT TIME OF FIRST MEASUREMENT *
****

1. PU CONCENTRATION OF RATE(WTD. MEAN)	9.882	PCI/GMA
2. STD.ERROR(EXTERNAL)	0.000	PCI/GMA
3. STD. ERROR(INTERNAL)	0.326	PCI/GMA
4. VARIANCE RATIO,F	0.000	
5. FRACTIONAL STD. ERROR	0.0330	

6. PU (MEAN) IN ALIQ #1 : 1.538 + 0.051 PCI

****
* RESULTS: AT TIME OF EVENT *
****

PU CONCENTRATION OF RATE: 9.892 ± 0.326 PCI/GMA

ANALYZED BY: CGC CHECKED: RDO 7/25/78 REVIEWED BY/DATE: RPL 7/25/78

COMMENTS AND REFERENCES:

TO (BY/DATE): CHR FILE:______SR FORM:______SA CARD:______CHEM FILE:______

CHR FORM 10/14/77(RFL)

PRIVACY ACT MATERIAL REMOVED

8000492

DETAILED RESULTS:

239PU (PLUTONIUM) PRIVACY ACT MATERIAL REMOVED

NAME: *CASE NO.: 40-004 *SAMPLE NO.:

EVENT: DEATH/E *DATE OF EVENT: 451003 *LAB NO.: 2991

TYPE :BC SAMPLE DESCRIPTION: BLBLTPMI

ITEM	UNIT	ANALYSIS NUMBER 1
1. SAMPLE SUB-NUMBER		R7B2
2. METHOD		CRI
3. DATE REQUESTED		770812
4. DATE ANALYZED		780524
5. SAMPLE SIZE	GMA	0.200
6. ALIQUOT (FRACTION)		1.000
7. SAMPLE SIZE MEASURED	GMA	0.200
8. 242 PU SPIKE	DPM	42.740
9. STD. ERROR OF ITEM 8	DPM	0.380
10. 242 PU SAMPLE COUNTS	CTS	45837
11. 239 PU SAMPLE COUNTS	CTS	5222
12. 239 PU IN SAMPLE	PCI	2.194
13. STD. ERROR(COUNTS+SYS)	PCI	3.751E-02
14. CONCENTRATION 23900	PCI/GMA	10.968
15. STD. ERROR(CNT+SYS)	PCI/GMA	0.188
16. REFERENCES-CHR DOCS.		R 105C

****
* RESULTS: AT TIME OF FIRST MEASUREMENT *
****

1. PU CONCENTRATION OR RATE(WTD. MEAN)		10.968	PCI/GMA
2. STD.ERROR(EXTERNAL)		0.000	PCI/GMA
3. STD. ERROR(INTERNAL)		0.188	PCI/GMA
4. VARIANCE RATIO, F		0.000	
5. FRACTIONAL STD. ERROR		0.0171	
6. PU (MEAN) IN ALIQ #1 :	2.194 ±	0.038	PCI

****
* RESULTS: AT TIME OF EVENT *
****

PU CONCENTRATION OR RATE: 10.978 ± 0.188 PCI/GMA

ANALYZED BY: CGC CHECKED: RPC 7/25/78 REVIEWED BY/DATE: RPC 7/25/78

COMMENTS AND REFERENCES:

TO (BY/DATE): CHR FILE:_____SR FORM:_____SA CARD:_____CHEM FILE:_____

CHR FORM 10/14/77 (HFL) PRIVACY ACT MATERIAL REMOVED

8000493

DETAILED RESULTS:

PRIVACY ACT MATERIAL REMOVED

239PU (PLUTONIUM)
****

NAME:

*CASE NO.: 40-004 *SAMPLE NO.: L3

EVENT: DEATH/F *DATE OF EVENT: 451003 *LAB NO.: 2992

TYPE :BO SAMPLE DESCRIPTION: TAIUSIF

ITEM	UNIT	ANALYSIS NUMBER 1
1. SAMPLE SUB-NUMBER		L31
2. METHOD		CRI
3. DATE REQUESTED		770812
4. DATE ANALYZED		780525
5. SAMPLE SIZE	GMA	0.149
6. ALIQUOT (FRACTION)		1.000
7. SAMPLE SIZE MEASURED	GMA	0.149
8. 242 PU SPIKE	DPM	42.740
9. STD. ERROR OF ITEM 8	DPM	0.380
10. 242 PU SAMPLE COUNTS	CTS	40489
11. 239 PU SAMPLE COUNTS	CTS	3649
12. 239 PU IN SAMPLE	PCI	1.735
13. STD. ERROR(COUNTS+SYS)	PCI	3.373E-02
14. CONCENTRATION 239PU	PCI/GMA	11.670
15. STD. ERROR(CNT+SYS)	PCI/GMA	0.227
16. REFERENCES-CHP DOCS.		R 105C

****
* RESULTS: AT TIME OF FIRST MEASUREMENT *
****

1. PU CONCENTRATION OR RATE(WTD. MEAN)	11.670	PCI/GMA	
2. STD.ERROR(EXTERNAL)	0.000	PCI/GMA	
3. STD. ERROR(INTERNAL)	0.227	PCI/GMA	
4. VARIANCE RATIO,F	0.000		
5. FRACTIONAL STD. ERROR	0.0194		
6. PU (MEAN) IN ALIQ #1 :	1.735 ±	0.034	PCI

****
* RESULTS: AT TIME OF EVENT *
****

PU CONCENTRATION OR RATE: 11.680 ± 0.227 PCI/GMA

ANALYZED BY: CGC CHECKED: RDO 7/25/78 REVIEWED BY/DATE: CPL 7/25/78

COMMENTS AND REFERENCES:

TO (BY/DATE): CHP FILE:_____SE FORM:_____SA CARD:_____CHEM FILE:_____

CHP FORM 10/14/77(HFL)

PRIVACY ACT MATERIAL REMOVED

8000494

DETAILED RESULTS: PRIVACY ACT MATERIAL REMOVED 40-004 Q5AC PU239 (NEW) 811

239PU (PLUTONIUM)
****

NAME: *CASE NO.: 40-004 *SAMPLE NO.:

EVENT: DEATH/E *DATE OF EVENT: 451003 *LAB NO.: 3687

TYPE :BO SAMPLE DESCRIPTION: VERT4THBO CORT PORTION OF Q5A1

ITEM	UNIT	ANALYSIS NUMBER 1
1. SAMPLE SUB-NUMBER		Q5ACA
2. METHOD		CRI
3. DATE REQUESTED		790515
4. DATE ANALYZED		790622
5. SAMPLE SIZE	GMA	0.404
6. ALIQUOT (FRACTION)		0.040
7. SAMPLE SIZE MEASURED	GMA	1.617E-02
8. 242 PU SPIKE	DPM	37.400
9. STD. ERROR OF ITEM 8	DPM	0.130
10. 242 PU SAMPLE COUNTS	CTS	16380
11. 239 PU SAMPLE COUNTS	CTS	1696
12. 239 PU IN SAMPLE	PCI	1.745
13. STD. ERROR(COUNTS+SYS)	PCI	4.491E-02
14. CONCENTRATION 239PU	PCI/GMA	107.900
15. STD. ERROR(CNT+SYS)	PCI/GMA	2.778
16. REFERENCES-CHR DOCS.		R121RO

****
* RESULTS: AT TIME OF FIRST MEASUREMENT *
****

1. PU CONCENTRATION OR RATE(WTD. MEAN)		107.900	PCI/GMA
2. STD.ERROR(EXTERNAL)		0.000	PCI/GMA
3. STD. ERROR(INTERNAL)		2.778	PCI/GMA
4. VARIANCE RATIO,F		0.000	
5. FRACTIONAL STD. ERROR		0.0257	
6. PU (MEAN) IN ALIQ #1 :	1.745 ±	0.045	PCI

****
* RESULTS: AT TIME OF EVENT *
****

PU CONCENTRATION OR RATE: 108.004 ± 2.780 PCI/GMA

ANALYZED BY: SMM CHECKED: 11/16/87 REVIEWED BY/DATE: RDO 11/13/87

COMMENTS AND REFERENCES:

TO (BY/DATE): CHR FILE:_____SR FORM:_____SA CARD:_____CHEM FILE:_____

CHR FORM 10/14/77 (HFL) PRIVACY ACT MATERIAL REMOVED

8000495

DETAILED RESULTS: PRIVACY ACT MATERIAL REMOVED 40-004 Q5AI PU239 (NEW) 811

239PU (PLUTONIUM)
****

NAME: *CASE NO.: 40-004 *SAMPLE NO.:

EVENT: DEATH/E *DATE OF EVENT: 451003 *LAB NO.: 3688

TYPE :BO SAMPLE DESCRIPTION: VERT4THBO MIX OF CORT + TRAB OF Q5A1

ITEM	UNIT	ANALYSIS NUMBER 1
1. SAMPLE SUB-NUMBER		Q5AIA
2. METHOD		CRI
3. DATE REQUESTED		790515
4. DATE ANALYZED		790622
5. SAMPLE SIZE	GMA	1.127
6. ALIQUOT (FRACTION)		0.010
7. SAMPLE SIZE MEASURED	GMA	1.127E-02
8. 242 PU SPIKE	DPM	37.400
9. STD. ERROR OF ITEM 8	DPM	0.130
10. 242 PU SAMPLE COUNTS	CTS	15608
11. 239 PU SAMPLE COUNTS	CTS	2172
12. 239 PU IN SAMPLE	PCI	2.345
13. STD. ERROR(CCUNTS+SYS)	PCI	5.431E-02
14. CONCENTRATION 239PU	PCI/GMA	208.044
15. STD. ERROR(CNT+SYS)	PCI/GMA	4.819
16. REFERENCES-CHR DOCS.		R121RO

****
* RESULTS: AT TIME OF FIRST MEASUREMENT *
****

1. PU CONCENTRATION OR RATE(WTD. MEAN)	208.044	PCI/GMA	
2. STD.ERROR(EXTERNAL)	0.000	PCI/GMA	
3. STD. ERROR(INTERNAL)	4.819	PCI/GMA	
4. VARIANCE RATIO,F	0.000		
5. FRACTIONAL STD. ERROR	0.0232		
6. PU (MEAN) IN ALIQ #1 :	2.345 ±	0.054	PCI

****
* RESULTS: AT TIME OF EVENT *
****

PU CONCENTRATION OR RATE: 208.244 ± 4.824 PCI/GMA

ANALYZED BY: SMM CHECKED: 11/16/81 REVIEWED BY/DATE: RDC 11/19/81

COMMENTS AND REFERENCES:

TO (BY/DATE): CHR FILE:_____SR FORM:_____SA CARD:_____CHEM FILE:_____

CHR FORM 10/14/77 (HFL) PRIVACY ACT MATERIAL REMOVED

8000496

DETAILED RESULTS: 40-004 Q5AT PU239 (NEW) 8111(

PRIVACY ACT MATERIAL REMOVED

239PU (PLUTONIUM)
****

NAME: *CASE NO.: 40-004 *SAMPLE NO.: Q5

EVENT: DEATH/E *DATE OF EVENT: 451003 *LAB NO.: 3689

TYPE :BO SAMPLE DESCRIPTION: VERT4THBO TRAB PORTION OF Q5A1

ITEM	UNIT	ANALYSIS NUMBER 1
1. SAMPLE SUB-NUMBER		Q5ATA
2. METHOD		CRI
3. DATE REQUESTED		790515
4. DATE ANALYZED		790622
5. SAMPLE SIZE	GMA	0.236
6. ALIQUOT (FRACTION)		0.040
7. SAMPLE SIZE MEASURED	GMA	9.452E-03
8. 242 PU SPIKE	DPM	37.400
9. STD. ERROR OF ITEM 8	DPM	0.130
10. 242 PU SAMPLE COUNTS	CTS	12741
11. 239 PU SAMPLE COUNTS	CTS	1680
12. 239 PU IN SAMPLE	PCI	2.222
13. STD. ERROR(COUNTS+SYS)	PCI	5.818E-02
14. CONCENTRATION 239PU	PCI/GMA	235.043
15. STD. ERROR(CNT+SYS)	PCI/GMA	6.155
16. REFERENCES-CHR DOCS.		R121RO

****
* RESULTS: AT TIME OF FIRST MEASUREMENT *
****

1. PU CONCENTRATION OR RATE(WTD. MEAN)	235.043	PCI/GMA	
2. STD.ERROR(EXTERNAL)	0.000	PCI/GMA	
3. STD. ERROR(INTERNAL)	6.155	PCI/GMA	
4. VARIANCE RATIO,F	0.000		
5. FRACTIONAL STD. ERROR	0.0262		

6. PU (MEAN) IN ALIQ #1 : 2.222 + 0.058 PCI

****
* RESULTS: AT TIME OF EVENT *
****

PU CONCENTRATION OR RATE: 235.269 ± 6.161 PCI/GMA

ANALYZED BY: SMM CHECKED: AS 11/29/87 REVIEWED BY/DATE: RDO 11/17/87

COMMENTS AND REFERENCES:

TC (BY/DATE): CHR FILE:_____SR FORM:_____SA CARD:_____CHEM FILE:_____

PRIVACY ACT MATERIAL REMOVED

CHR FORM 10/14/77(HFL)

8000497

DETAILED RESULTS: 40-004 010 CAST3 (NEW) 780712

CALCIUM
****

PRIVACY ACT MATERIAL REMOVED

NAME: _____ *CASE NO.: 40-004 *SAMPLE NO.: 010

EVENT: DEATH/E *DATE OF EVENT: 451003 *LAB NO.: 2930

TYPE: BC *SAMPLE DESCRIPTION: RIB

ITEM	UNIT	ANALYSIS NUMBER 1	ANALYSIS NUMBER 2
1. SAMPLE SUB-NUMBER		010C	010C
2. METHOD		CHA	CHA
3. DATE REQUESTED		770812	770812
4. DATE ANALYZED		780630	780705
5. SAMPLE SIZE	GMA	0.245	0.245
6. ALIQUOT FRACTION		0.200	0.200
7. VOL. OF ALIQUOT	ML	25.000	25.000
8. VOL. MEASURED	ML	0.025	0.025
9. ALIQUOT FACTOR		2.000E-04	2.000E-04

4?-?? (??) ???? (???) 790822

DETAILED RESULTS:

2?9PU (PLUTONIUM) PRIVACY ACT MATERIAL REMOVED
****

*CASE NO.: 40-?04 *SAMPLE NO.: 01

NAME:

EVENT: DEATH/E *DATE OF EVENT: 451??? *LAB NO.: 2?3?

TYPE :30 SAMPLE DESCRIPTION: RIB

ITEM	UNIT	ANALYSIS NUMBER 1	2
1. SAMPLE SUB-NUMBER		010B	010D
2. METHOD		CRI	CRI
3. DATE REQUESTED		770812	770812
4. DATE ANALYZED		780804	780823
5. SAMPLE SIZE	GMA	0.109	0.130
6. ALIQUOT (FRACTION)		1.000	1.000
7. SAMPLE SIZE MEASURED	GMA	0.109	0.130
8. 242 PU SPIKE	DPM	42.740	43.770
9. STD. ERROR OF ITEM 8	DPM	0.380	0.290
10. 242 PU SAMPLE COUNTS	CTS	25084	10882
11. 239 PU SAMPLE COUNTS	CTS	15704	7931
12. 239 PU IN SAMPLE	PCI	12.054	14.371
13. STD. ERROR(COUNTS+SYS)	PCI	0.163	0.233
14. CONCENTRATION 239PU	PCI/GMA	110.489	110.888
15. STD. ERROR(CNT+SYS)	PCI/GMA	1.493	1.794
16. REFERENCES-CHR DOCS.		E111E*	E111E*

****
* RESULTS: AT TIME OF FIRST MEASUREMENT *
****

1. PU CONCENTRATION OF BASE(WTD. MEAN) 110.652 PCI/GMA
2. STD.PREC.(EXTERNAL) 0.196 PCI/GMA
3. STD. ERROR(INTERNAL) 1.148 PCI/GMA
4. VARIANCE RATIO,F 0.029
5. FRACTIONAL STD. ERROR 0.0104

6. PU (MEAN) IN ALIQ #1 : 12.072 ± 0.125 PCI

****
* RESULTS: AT TIME OF EVENT *
****

PU CONCENTRATION OF BASE: 110.755 ± 1.149 PCI/GMA

ANALYZED BY: BEW CHECKED: RDD 7/25/78 REVIEWED BY/DATE: RPL 7/25/78

COMMENTS AND REFERENCES:

TO (BY/DATE): CHR FILE:______SA FORM:______SA CARD:______CHEM FILE:______

CHR FORM 10/14/77(HEL) PRIVACY ACT MATERIAL REMOVED

8000499

RADIOCHEMISTRY

SAMPLE ANALYSIS FOR THIS CASE IS IN PROGRESS

8000500

PRIVACY ACT MATERIAL REMOVED THIS IS A NON-RESIDENT DEA[illegible] PLEASE ALLOCATE TO PLACE OF RESIDENCE OF DEC[illegible]SED.

FILL IN THIS FORM (except signa.) WITH TYPEWRITER OR LEGIBLE PRINTING

N/R.

STATE OF ILLINOIS — ORIGINAL

DEPARTMENT OF PUBLIC HEALTH—DIVISION OF VITAL STATISTICS

CERTIFICATE OF DEATH

1. PLACE OF DEATH. Registration Dist. No.

County of COOK

CHICAGO *Village *City *Township *Road Dist. Primary Dist. No.

*(Cancel the three terms not applicable—Do not enter "R. R.", "R. F. D.," or other P. O. address)

Registered No. (Consecutive No.)

Street and Number, No. 950-E59 St. 5 Ward A.M. BILLINGS Hospital.

(If death occurred in a hospital or institution, give its NAME instead of street and number.)

LENGTH OF TIME AT PLACE WHERE DEATH OCCURRED? ___ yrs. 6 mos. ___ ds.

2. PLACE OF RESIDENCE: STATE TEXAS County ___ Township ___ Road Dist. ___

(Usual place of abode—Do not enter "R. R.," "R. F. D.," or other P. O. address) Street and Number ___

City or Village AUSTIN

19. LIST NO. 53

3 (a) PRINT FULL NAME ___

3 (b) If veteran, name war NO

3 (c) Social Security No. NONE

4. Sex MALE

5. Color or race WHITE

6 (a) Single, widowed, married, divorced MARRIED

6 (b) Name of husband or wife ___

6 (c) Age of husband or wife if alive 59 years

7. Birth date of deceased (Month) (Day) (Year)

8. AGE: Years 68 Months 6 Days 3 If less than one day ___ hr. ___ min.

9. Birthplace PITTSBURGH (City, town, or county) PENNSYLVANIA (State or foreign country)

10. Usual occupation GENERAL MERCHANT

11. Industry or business SELF

FATHER 12. Name ___

13. Birthplace (City, town, or county) (State or foreign country)

MOTHER 14. Maiden name ___

15. Birthplace PITTSBURGH (City, town, or county) PENNSYLVANIA (State or foreign country)

16. INFORMANT ad Hosp Rec. (personal signature with pen and ink)

P. O. Address 950-E59St

17. PLACE OF BURIAL Cremation or Removal Local (b) DATE 10/4 1945

(a) Cemetery ___

Location AUSTIN TEXAS (Township, Road Dist., Village or City)

County ___ State TEXAS

18. Funeral director ___ ADDRESS 4381 ___

(personal signature with pen and ink) License No. [illegible]

(firm name, if any)

MEDICAL CERTIFICATE OF DEATH

20. Date of death: Month OCTOBER day 3 year 1945 hour 2 minute 15 AM

21. I hereby certify that I attended the deceased from MARCH 29, 1945 to OCTOBER 3 1945 that I last saw h[illegible] alive on OCTOBER 3rd 1945 and that death occurred on the date and hour stated above.

Immediate cause of death RECURRENCE OF CANCER OF JAW AND METASTASIS TO LUNGS. Duration 1 YR

Associated diseases ___

Other conditions (Include pregnancy within 3 months of death)

THIS COPY FOR RESEARCH PURPOSES — ILLINOIS DEPARTMENT OF PUBLIC HEALTH

22. Was an operation performed? Yes Date of 4/11/45, 4/28/45

For what disease or injury? CANCER OF JAW

Was there an autopsy? Yes

Findings? PASSIVE CONGESTION, METASTASIS TO LUNGS, RECURRENCE CANCER OF JAW, BRONCHOPNEUMONIA

23. If a communicable disease; where contracted? No

Was disease in any way related to occupation of deceased? No

If so, specify how: —

24. (Signed) Paul W. Schafer M.D.

Address 950 E. 59TH

Date 10-3- 1945 Telephone MID. [illegible]

*N. B.—State the disease causing death. All cases of death from "violence, casualty, or any undue means" must be referred to the coroner. (See Section 10, Coroner's Act.)

25. Filed 1945 OCT 4 AM 8 40 Registrar.

P. O. Address

Wrote re: c/d 12/3/45

PRIVACY ACT MATERIAL REMOVED

8000502

PRIVACY ACT MATERIAL REMOVED

MAR 2 6 1975

To Whom It May Concern:

I, _____ (_____) of Corpus Christi, Texas,
(name) (city and state)
being the next-of-kin of _____, do
(name)
hereby authorize the disinterment and examination of the remains of my late father _____, _____, under
(relationship) (name)
the direction of the Center for Human Radiobiology of the Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439, or its scientific successors, such disinterment and examination to be for the purposes of advancing medical and scientific research and education. I authorize the transportation of said remains to Argonne National Laboratory for the purpose of carrying out such examination and to retain such bone specimens as the scientific personnel may deem fit. Following examination, the remains will be returned for reinterment. The grave site will be restored to its original condition after disinterment and again after reinterment. All the above procedures will be accomplished at no cost to me.

RECEIVED
APR 02 '75
CHR RECORDS

Signature _____

_____ Corpus Christi, Texas 78404
Address City, State

Mar. 20, 1975
Date

PRIVACY ACT MATERIAL REMOVED

Witness:

_____ Corpus Christi, Texas
Name Address City, State

8000503

PRIVACY ACT MATERIAL REMOVED

MAR 2 6 1975

To Whom It May Concern:

I, _____ (name) of Gretna, Louisiana (city and state),
being the next-of-kin of _____ (name), do
hereby authorize the disinterment and examination of the remains of my
late father (relationship), _____ (name), under
the direction of the Center for Human Radiobiology of the Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439, or its scientific successors, such disinterment and examination to be for the purposes of advancing medical and scientific research and education. I authorize the transportation of said remains to Argonne National Laboratory for the purpose of carrying out such examination and to retain such bone specimens as the scientific personnel may deem fit. Following examination, the remains will be returned for reinterment. The grave site will be restored to its original condition after disinterment and again after reinterment. All the above procedures will be accomplished at no cost to me.

Signature _____

RECEIVED
APR 02'75
CHR RECORDS

_____, Gretna, La. 70053
Address City, State

March 18, 1975
Date

800050H

Witness:

PRIVACY ACT MATERIAL REMOVED

_____ _____ Gretna LA.
Name Address City, State

PRIVACY ACT MATERIAL REMOVED

If it can be done conveniently I would like to be advised if and where the results of your findings become available for review.

AES
JEF

To Whom It May Concern:

MAR 2 6 1975

I, _____ of Arlington, Texas,
(name) (city and state)
being the next-of-kin of _____, do
(name)
hereby authorize the disinterment and examination of the remains of my late father, _____, under
(relationship) (name)
the direction of the Center for Human Radiobiology of the Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439, or its scientific successors, such disinterment and examination to be for the purposes of advancing medical and scientific research and education. I authorize the transportation of said remains to Argonne National Laboratory for the purpose of carrying out such examination and to retain such bone specimens as the scientific personnel may deem fit. Following examination, the remains will be returned for reinterment. The grave site will be restored to its original condition after disinterment and again after reinterment. All the above procedures will be accomplished at no cost to me.

Signature _____

RECEIVED
APR 02 '75
CHR RECORDS

_____ Arlington Texas 76010
Address City, State

March 18, 1975
Date

Witness: PRIVACY ACT MATERIAL REMOVED

_____ Arlington, Texas
Name Address City State

8000505

To Whom It May Concern: PRIVACY ACT MATERIAL REMOVED MAR 15 1975

I, _____ (name) of Austin Texas (city and state),

being the next-of-kin of _____ (name), do

hereby authorize the disinterment and examination of the remains of my

late father (relationship), _____ (name), under

the direction of the Center for Human Radiobiology of the Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439, or its scientific successors, such disinterment and examination to be for the purposes of advancing medical and scientific research and education. I authorize the transportation of said remains to Argonne National Laboratory for the purpose of carrying out such examination and to retain such bone specimens as the scientific personnel may deem fit. Following examination, the remains will be returned for reinterment. The grave site will be restored to its original condition after disinterment and again after reinterment. All the above procedures will be accomplished at no cost to me.

Signature _____

_____ Address _____ Ar Austin Tex. City, State 78764

3-7-75 Date

RECEIVED MAR 20 '75 CHR RECORDS

PRIVACY ACT MATERIAL REMOVED

Witness:

_____ Name

The Cambridge School Rte Lane Address

Philadelphia PA City, State

8000506

To Whom It May Concern: PRIVACY ACT MATERIAL REMOVED

MAR 1 5 1975

I, ____________ (name) of Austin Texas (city and state)

being the next-of-kin of ____________ (name)

hereby authorize the disinterment and examination of the remains of my late Father (relationship), ____________ (name) under the direction of the Center for Human Radiobiology of the Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439, or its scientific successors, such disinterment and examination to be for the purposes of advancing medical and scientific research and education. I authorize the transportation of said remains to Argonne National Laboratory for the purpose of carrying out such examination and to retain such bone specimens as the scientific personnel may deem fit. Following examination, the remains will be returned for reinterment. The grave site will be restored to its original condition after disinterment and again after reinterment. All the above procedures will be accomplished at no cost to me.

Signature ____________

____________ Austin, Texas
Address City, State

March 7, 1975
Date

RECEIVED MAR 20 '75 CHR RECORDS

Witness:

PRIVACY ACT MATERIAL REMOVED

____________ The Cambridge School [illegible]
Name Address City, State
Philadelphia Pa 1917

L000508

XC AFS

To Whom It May Concern: PRIVACY ACT MATERIAL REMOVED

MAR 1 5 1975

I, ______________ (name) of Austin, Texas (city and state), being the next-of-kin of ______________ (name), do hereby authorize the disinterment and examination of the remains of my late Father (relationship), ______________ (name), under the direction of the Center for Human Radiobiology of the Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439, or its scientific successors, such disinterment and examination to be for the purposes of advancing medical and scientific research and education. I authorize the transportation of said remains to Argonne National Laboratory for the purpose of carrying out such examination and to retain such bone specimens as the scientific personnel may deem fit. Following examination, the remains will be returned for reinterment. The grave site will be restored to its original condition after disinterment and again after reinterment. All the above procedures will be accomplished at no cost to me.

Signature ______________

______________ Austin, Texas
Address City, State

March 7th, 1975
Date

PRIVACY ACT MATERIAL REMOVED

RECEIVED MAR 20 '75 CHR RECORDS

Witness:

______________ Name The Cambridge School, [illegible] Phila PA
Address City State

8050008

ARGONNE NATIONAL LABORATORY — CENTER FOR HUMAN RADIOBIOLOGY

PROPOSAL FOR EXHUMATION	Proposed by MMS (JEF)	Date 4/3/75

PROSPECTIVE CASE DATA

Name	Case No.	Date of birth
CHI-1	40-004	

Date of death	Place of death	Autopsy?	Remains
10/3/45	Chicago, Il.	X Yes __ No	X Normal __ Cremains

RADIOACTIVITY DATA

EXPOSURE:	Company, Hospital, M.D., etc. U of C Billings Hosp.			Type Pu
INTAKE:	Radionuclide, Amount (if known) Pu^{239} (VI) citrate 0.40 μCi		Dates From April 26, 1945	To
RESIDUAL:	Nuclide Amt. Date Lab		Nuclide Amt. Date Lab	

REASONS FOR POST-MORTEM STUDIES

__ Unknown body burden X Priority group __ Known intake __ Medical
__ Calibration comparison __ Ra-228/Ra-226 X Distribution __ Other

EXPLANATION PRIVACY ACT MATERIAL REMOVED

PROPOSED ANALYSES Microradiography, Autoradiographic distribution of Pu in bone.
Radiochem., Pathology micros & X-rays.

REVIEW AND AUTHORIZATION

Number of known relatives 6	Estimated number of consents needed 6	Court action anticipated __ Yes X No
Cemetery —	Address Austin, Texas	Cooperative? __ Yes __ No X Never used
Funeral Home ?	Address Chicago, Il.	__ Yes __ No X Never used
Prognosis of suitable remains __ Good X Fair __ Poor	Reason: Expect some erosion	By JEH Date 4/3/75

Comments:

PRIVACY ACT MATERIAL REMOVED

RECOMMENDATION: __ Yes __ No __ Cannot say _____ Scientific Reviewer _____ Date

Comments: Authorized for exhumation in A.F. Stehney memo to M.M. Hanahan 3/24/73

Assignment of responsibilities for permits

APPROVAL? __ Yes __ No __ Defer _____ Director of CHR _____ Date

8U5UUU8

TEXAS STATE DEPARTMENT OF HEALTH
BUREAU OF VITAL STATISTICS

BURIAL–TRANSIT PERMIT

PERMIT NUMBER 0 079

PERSONAL DATA ON DECEASED	1. Full name of deceased			2. Date of death (month, day, and year) October 3, 1945	3. Death due to communicable disease YES NO	
	4. Sex Male	5. Color or race	6. Age in years	7. ~~Place of death~~ (city or precinct no.) FROM: Austin,	(county) Travis,	(state) Texas
MANNER AND PLACE OF DISPOSAL	Method of disposal: Burial ☐ Cremation ☐ Removal ☐ Disinterment XX			Place of burial removal or disposal (name of cemetery or crematorium)	(city or town) Chicago	(state) Illino
	Name of funeral director			License number 6220	Business address	Austin, Tex
	Name of embalmer (If none, write none)			License number	Business address	
AUTHORIZATION TO DISPOSE OF BODY	A certificate of death having been filed as required by the laws of Texas and all laws and regulations governing the preparation and disposal of dead bodies having been complied with, permission is hereby given to dispose of the body as identified above.					
	Signature of local registrar			District	(city or precinct no.) AUSTIN, TEXAS	(county) TRAVIS Date 6-9-1975
DISPOSITION OF BODY	Body was Buried ☐ Cremated ☐	Date		Name of cemetery or crematory		
	Location (city or town)	(county)	(state)	Name of sexton or person in charge		

PRIVACY ACT MATERIAL REMOVED

8000510

ARGONNE
NATIONAL
LABORATORY

PRIVACY ACT MATERIAL REMOVED

INTRA-LABORATORY MEMO

June 13, 1975

TO: CHR-RR

FROM: J. E. Farnham

SUBJECT: Disinterment of (40-004)

My contact with the Funeral Home was a , associate manager. obtained the necessary disinterment and transit permits and made the arrangements with the Cemetery staff to do the exhumation.

Upon my arrival in Austin at 5:00 p.m. on June 9, 1975, I contacted the funeral home and was told that Mr. would be working with me at the cemetery. Mr. explained that the exhumation was scheduled to begin at 8:00 a.m. on June 10, 1975. He also gave me directions for driving to the Cemetery (records of burials in Cemetery are here) and the Cemetery. I drove to Cemetery and checked the records and then went to the motel.

I drove to the Cemetery early the next morning, June 10, 1975, arriving at 7:30 a.m. There was no office building in the cemetery. Upon seeing a man sitting in a parked car I went over and asked if he worked for the cemetery. He said, "Yes! I am a caretaker." We sat in his car, out of the rain, and waited for Mr. and the diggers. When the diggers did arrive I saw that they only carried shovels. I suggested that since it was raining so hard they should go get a tent to cover the grave.

Mr. arrived while the digging crew was out getting a tent. Also during this period there was a break in the rain, which allowed me to photograph the grave site and the headstone (the name and dates checked with the records). When the diggers returned we mounted a canvas cover over the grave site area, see photographs. The two Mexican laborers began digging the grave with the shovels. The first 6 in. depth was of rich black soil but turned quickly into a mixture with sand. The deeper soil was a mixture of sand, large stone and clay. This soil was very wet right down to a depth of 3 ft. At this depth we encountered the ground water table.

After removing another 6 in. of soil the men found themselves standing in 6 in.of water. I asked to go get a sump pump. He returned

PRIVACY ACT MATERIAL REMOVED

8000513

ANL-26 (11-68)

PRIVACY ACT MATERIAL REMOVED

unsuccessful, but brought a 5 gal pail. This proved to be too big to use as a bail. The caretaker came with an empty plastic antifreeze container which I cut the top off and this was used to bail the water into the larger bucket. In this manner the 6 in. of water was removed.

I then requested the diggers to keep the foot of the grave deeper than the rest. This allowed all water to fill in the lowest cavity and we were able to bail from this area. I kept sifting through each shovel-full of mud with my gloved hands as it was removed from the grave. The mud was removed in layers of 2 to 3 in. at a time. Finally, the left side of a wooden box was uncovered and we knew we were at the level of the casket. The right side and ends of the box were uncovered; no top was found.

The diggers continued to remove the mud and rock from within the box. As I sifted through each shovel-full I began to find pieces of glass and metal. This appeared to be the remains of a metal casket which had a glass viewing window. Eventually I began to locate pieces of very eroded bone. I found a few of the larger foot bones, then the tibiae, femora, innominates, ulna and radii, the humeri, some rib and vertebrae fragments and pieces of skull bone. We were unable to find the mandible or any hand bones. We completely removed all mud and water from the interior of the wood box. In fact, no bottom was found for this box and we dug deeper than the side walls extended.

I packed the skeletal remains in plastic bags. Earlier I had asked Mr. to see if he could buy a cheap suitcase which I could put the bones and transit permit into and thus bring bard back to ANL with me. He came back unsuccessful. As it was late and I had only 30 minutes left to catch my flight, I changed clothes in the car, washed at the garden hose faucet, requested Mr. to ship the remains as biological specimens via Air Express, and then quickly left for the airport.

Early Wednesday morning called me here at Argonne to explain that the airline said he must ship in the Ziegler case. He had, therefore, packed the remains in the case and delivered them to Braniff Air Lines for shipment to ANL on Flight #126 on June 12, 1975. Mr. Victor Markiewicz picked up the remains at O'Hare Airport and delivered them to me here at Argonne.

JEF:frc

PRIVACY ACT MATERIAL REMOVED

PRIVACY ACT MATERIAL REMOVED

AUSTIN, TEXAS 78752, 512/454-5611

For the Funeral Expenses of:

This statement is being sent at this time in order that you may verify the details.

If there are any items not according to our mutual understanding, please call it to our attention.

To: Mr. Joseph E. Farnham
Center for Human Radiobiology
Argonne National Laboratory
Argonne, Ill. 60439

Date April 18, 1978

For the Funeral Expenses of: 40-004

Reinterment of

Professional services of staff	$ 100 00
Facilities and equipment	
Auto equipment	
Casket as selected	
Outside container	
Clothing	
Sales tax	
CASH DISTRIBUTED FOR YOUR CONVENIENCE	
_____Extra cars	
Equipment, Opening and Closing grave	
_____Certified copies of death certificate	100 00
Flowers, tax included	
Clergy honorarium	
Cemetery spaces	
Transportation	
Obituary notices _____	
	$ 200 00

approved for payment
4/25/78 J. E. Farnham
Original to file, copies to purchasing and accounting.

FUNERAL HOME

AUSTIN, TEXAS 78752

Paid In Full _____

_____

8000515

PRIVACY ACT MATERIAL REMOVED

TO:

FROM:

PRIVACY ACT MATERIAL REMOVED

UNIFORM AIRBILL NON-NEGOTIABLE
SUBJECT TO CONDITIONS OF CONTRACT ON BACK OF SHIPPERS COPY OF THE AIRBILL

AIRBILL NUMBER

CARRIER 002- ORIGIN AUS 0 163 1206

DATE DAY | MO. | YR.

TC | CHGS. | FLIGHT DATE | FLIGHT DATE | DECLARED VALUE: NVD | CUBIC INCH

ROUTING: Airline routing applies unless shipper inserts specific routing here.

Flt 126/12

☒ PREPAID ☐ COLLECT

BRANIFF INTERNATIONAL
DALLAS, TEXAS

TO	VIA	TO	VIA	TO	VIA	TO	VIA
1/ ORD	BN						

2/ CONSIGNEE'S ACCOUNT NUMBER

CONSIGNEE

NAME

STREET ADDRESS ~~Funeral Home~~ Street

CITY Mount Vernon STATE Illinois ZIP CODE

3/ DEL. ZONE | SPECIAL INSTRUCTIONS, INCLUDING CUSTOMER REFERENCE NUMBER

CHARGES CODES:

PX-PREPAID CREDIT
PP-PREPAID CASH
CC-COLLECT
CG-COLLECT G.B.L.
CP-COLLECT CASH
CX-COLLECT CREDIT
MX-PART PREPAID PARTIAL COLLECT CREDIT
MP-PART PREPAID PARTIAL COLLECT CASH
PG-PREPAID GBL AND/OR GTR

A-ASSEMBLY
B-CLEARANCE HANDLING
C-CONTAINER/KENNEL
D-DISTRIBUTION
E-INSURANCE
G-SIGNATURE SERVICE
H-SEPARATE/EARLY RELEASE
M-MISCELLANEOUS SERVICE CHARGE
P-PACKAGING
S-STORAGE
T-STATE SALES TAX
X-UNASSIGNED
RFC-REMITTANCE FOLLOWING COLLECTION

CARRIER USE ONLY

	RATE	CHARGES
A WEIGHT CHARGES		
B PICK UP		
C DELIVERY		
D EXCESS VALUE		
E ADVANCES		
F OTHER		
G SHIPPER'S C.O.D.		
H C.O.D. FEE		
I TAX		
T TOTAL CHARGES		33.29

4/ SHIPPER'S ACCOUNT NUMBER

SHIPPER

NAME

STREET ADDRESS ~~Funeral Home~~

CITY STATE ZIP CODE

PC/PKG | LENGTH | WIDTH | DEPTH | CUBIC INCH

DIMENSIONAL WGT.—LBS.

C.O.D. SHIPMENT
if amount entered here by Shipper

5/ PICK UP ZONE | ORIG. ADV. CHGS. | DESCRIPTION OF ORIGIN ADV. CHARGES | DEST. ADV. CHARGES | DESCRIPTION OF DESTINATION ADV. CHGS.

6/ OTHER CHGS. | DESCRIPTION OF OTHER CHARGES | G.B.L. NUMBER

NO. PCS.	WEIGHT	DESCRIPTION OF PIECES AND CONTENTS PACKING, MARKS, NUMBER	CARRIER COMM'TY GROUP NO.	CARRIER COMM'TY GROUP NO.	CARRIER COMM GROUP NO.
7/ 1	75	Remains said to be			
–		Metal Sealed Ziegler Case Has Handles			
–		Attached			
–					

8/ A WEIGHT CHARGES 31.70 | B PICK UP | C DELIVERY | D EXCESS VALUE | E ADVANCES | F OTHER | G SHIPPER'S C.O.D. | H C.O.D. FEE

I TAX 1.59 | T TOTAL CHARGES 33.29 | 1ST RATE | 2ND RATE 6091 | 3RD RATE | ITEMS PREPAID | SHIPPER PAYS

EXECUTED AT/BY: Dallas | DATE 6-12-71 | TIME 0845 | ITEMS COLLECT | CONSIGNEE PAYS

CARRIER 002- | ORIGIN AUS | SERIAL NUMBER 0163 1206

⑤ CONSIGNEE MEMO

PRIVACY ACT MATERIAL REMOVED

8000516

PRIVACY ACT MATERIAL REMOVED

MICROFILMED

APR 27 1976

AUSTIN, TEXAS 78752 512/454-5011 CHR RECORDS

AUG 11 1975

August 7, 1975

Re:

Disinterment and shipping

SNOP CODED

Balance on account: $ 403.29

MAR 1977

PRIVACY ACT MATERIAL REMOVED

FUNERAL HOME

J.E.F. advised of this followup.
H.A.S.

RECEIVED

AUG 19'75

CHR RECORDS

8000517

PRIVACY ACT MATERIAL REMOVED

FUNERAL HOME

PHONE (312) • LEMONT, ILLINOIS 60439

Argonne National Laboratory
c/o Mr. Joseph E. Farnham
Argonne, Ill.

-15-75	Transporting remains of from O'Hare to Argonne	(05-044)	50.00
-21-75		(05-555)	50.00
12-75		(40-004)	50.00
	Total		$150.00

Approved for payment 7/18/75

RECEIVED
JUL 21 '75
CHR RECORDS

PRIVACY ACT MATERIAL REMOVED

8000518

File type = PDS

PRIVACY ACT MATERIAL REMOVED

Description	Case #								
recurrence of cancer of chin sc	@M, 40-004	@A,T, Y021	M, 8005	E, 0000	F, 0000	D, 4510C ;;
and metastases to lungs pc	@M,	@A,T, 2800B	M, 8006	E,	F,	D, 4510C ;;
recurrent epidermoid ca - mouth	@M,	@A,T, 5100	M, 8075	E,	F,	D, 4510A ;;
resection - mandible and associated	@M,	@A,T, 1118	M, 1500	E,	F,	D, ;;
soft parts of floor of mouth &	@M,	@A,T, 5120	M, 1514	E,	F,	D, ;;
pedicle graft reconstruction not complete	@M,	@A,T,	M,	E,	F,	D, ;;
healed patent gastrostomy	@M,	@A,T, 2800	M, 1530	E, 0000	F, 0000	D, 4510A ;;
carcinomatous invasion - ant. neck	@M,	@A,T, Y060	M, 8018	E,	F,	D, ;;
metastases - lungs, some assoc &	@M,	@A,T, 2800B	M, 8076	E,	F,	D, ;;
vascular thrombosis, cavitation,	@M,	@A,T, 4400 2800	M, 3700 4174	E, 0000	F, 0000	D, 4510A ;;
and abscess formation	@M,	@A,T, 2800	M, 4620	E,	F,	D, ;;
pulmonary - pleural carcinomatous abscess - L	@M,	@A,T, 2920	M, 8076	E,	F,	D, ;;
carcinomatous invasion of L pleural	@M,	@A,T, 2920	M, 4824	E,	F,	D, ;;
adhesions and of the contiguous	@M,	@A,T, Y215	M, 8076	E,	F,	D, ;;
thoracic wall	@M,	@A,T,	M,	E,	F,	D, ;;
pulmonary edema	@M,	@A,T, 2900	M, 9340	E, 0000	F, 0000	D, 4510A ;;
" hyperemia	@M,	@A,T, 2800	M, 9311	E,	F,	D, ;;
acute bronchopneumonia - L lower lobe	@M,	@A,T, 2870	M, 4101	E,	F,	D, ;;
focal, dis proliferative, aspirative bronchopneum	@M,	@A,T, 2800 2800	M, 4301 4028	E,	F,	D, ;;

PRIVACY ACT MATERIAL REMOVED

Abstracted by AA Date 9/4/77 Coded by AA Date 9/7/77

8000519

File type = PDS

PRIVACY ACT MATERIAL REMOVED

Description	Case #	@M,	@A,T,	M,	E,	F,	D,
severe parenchymatous + sl fatty deg - liver	40-004	@M,	5600	M, 5100	E, 0000	F, 0000	D, 4510A ;
		@M,	5600	M, 5521	E, 0000	F, 0000	D, ;
myocardial hypertrophy and		@M,	3301	M, 7200	E,	F,	D, ;
disseminated myofibrosis		@M,	3301	M, 4815	E,	F,	D, ;
chr. pericholangitis		@M,	5300	M, 4300	E,	F,	D, ;
chr atrophic gastritis		@M,	6300	M, 7168	E,	F,	D, ;
benign prostatic hypertrophy;		@M,	7710	M, 7300	E,	F,	D, ;
hyperplastic nodules - lateral lobes		@M,		M,	E,	F,	D, ;
mild chr. pyelonephritis		@M,	7100	M, 4302	E, 0000	F, 0000	D, 4510A ;
sl erosive peptic esophagitis		@M,	6200	M, 4610	E, 0000	F,	D, ;
abscess - horizontal ramus of mandible		@M,	1118	M, 1524	E, 9003	F,	D, ;
- musculature - ant. neck		@M,	1330	M, 1524	E,	F,	D, ;
- sublingual salivary gland		@M,	5720	M, 1500	E,	F,	D, ;
- thorax		@M,	5530	M,	E,	F,	D, ;
- lymph glands		@M,	0320	M,	E,	F,	D, ;
cancer - lower neck		@M,	Y060	M, 4621	E, 0000	F,	D, ;
cancerous involvement - base of tongue		@M,	5318	M, 8078	E,	F,	D, ;
adenotubular mucin		@M,	5400	M, 1500	E,	F,	D, ;
		@M,		M,	E,	F,	D, ;

PRIVACY ACT MATERIAL REMOVED

Abstracted by CA Date 3/4/77 Coded by CA Date 3/4/77

8000520

file type = PDS

PRIVACY ACT MATERIAL REMOVED

Description		Case #											
hyperemic mucosa - trachea	@M,	40-004	, @A,T,	2501	, M,	3811	, E,	0000	, F,	0000	, D,	4510A	,;
- bronchi	@M,		, @A,T,	2601	, M,	3811	, E,		, F,		, D,		,;
ulceration(s) (cardiac) esophagus	@M,		, @A,T,	6230	, M,	4005	, E,		, F,		, D,		,;
atherosclerosis - aorta	@M,		, @A,T,	4200	, M,	5210	, E,		, F,		, D,		,;
min. coronary arteriosclerosis	@M,		, @A,T,	4300	, M,	5200	, E,		, F,		, D,		,;
hyperemic lungs	@M,		, @A,T,	2500B	, M,	3811	, E,		, F,		, D,		,;
cancerous diseases - lungs (already coded)	@M,		, @A,T,		, M,		, E,		, F,		, D,		,;
calcified - peribronchial glands	@M,		, @A,T,	0833	, M,	5011	, E,		, F,		, D,		,;
anthracotic pigment	@M,		, @A,T,	0233	, M,	5603	, E,		, F,		, D,		,;
congestion: liver surface	@M,		, @A,T,	5600	, M,	3810	, E,		, F,		, D,		,;
ulcerating lower jaw, not at	@M,		, @A,T,	4022	, M,	8003	, E,		, F,		, D,	4445P	,;
ext of lesion (squamous cell ca) cal'44	@M,		, @A,T,	4022	, M,	1528	, E,		, F,		, D,	4445P	,;
x-ray treatment	@M,		, @A,T,	4022	, M,	0000	, E,	9824	, F,		, D,		,;
tumor recurred, was operated on Dec 1944	@M,		, @A,T,	4022 4022	, M,	8075 1528	, E,	0000 0000	, F,	0000 0000	, D,	4445P	,;
systolic murmur	@M,		, @A,T,	3500	, M,	0000	, E,		, F,	7031	, D,	4545R	,;
? anemia	@M,		, @A,T,	[illegible]	, M,	7725	, E,		, F,	0000	, D,		,;
Pezzer catheter gastrostomy	@M,		, @A,T,	6200	, M,	1530	, E,		, F,		, D,		,;
radical excision lower jaw and	@M,		, @A,T,	4022	, M,	1521	, E,		, F,		, D,		,;
partial reconstruction c bone plate	@M,		, @A,T,	4022	, M,	1511	, E,		, F,		, D,		,;

PRIVACY ACT MATERIAL REMOVED

Abstracted by [illegible] Date [illegible] Coded by [illegible] Date [illegible]

8000521

file type = PDS

PRIVACY ACT MATERIAL REMOVED

Description	Case #	@A,T	M	E	F	D
enlargement of sinuses - lower neck (notochord)	40-004					
mild focal interstitial nephritis; prob. n. pyelonephritis		7100	4024	0000	0000	4510A
mild arterio sclerosis - kidneys		7150	5200			
parenchymatous deg. - tubules		7130	5100			
hyaline and calcified casts - kidneys		7100B	3501			
congested and hemorrhagic red pulp spleen		0704	3810	0000	0000	4510A
		0704	3850			
hyperplasia - tracheobronchial lymph nodes		0833	2200			
lungabscess - hemolytic staph aureus		2800	4174	1601		
" strep		2900	4174	1621		
plutonium injections 4504		0001	1908	0000	0000	4545J

PRIVACY ACT MATERIAL REMOVED

Abstracted by cA Date 9/4/77 Coded by cA Date 9/4/77

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