

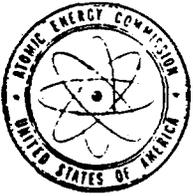
<b>REPOSITORY</b>	<b>DOE-OHRE</b>
<b>COLLECTION</b>	<b>PLUTONIUM INJECTION</b>
<b>BOX NO.</b>	<u>3</u>
<b>FOLDER</b>	<u>40-018/HP-12</u>

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← " " " "

PRIVACY ACT MATERIAL REMOVED

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← "Code"

PRIVACY ACT MATERIAL REMOVED



UNITED STATES  
ATOMIC ENERGY COMMISSION  
WASHINGTON, D.C. 20545

PRIVACY ACT MATERIAL REMOVED

July 15, 1974

Jon D. Anderson  
Director  
Division of Inspection

MEMORANDUM REPORT

DIVISION OF BIOMEDICAL AND ENVIRONMENTAL RESEARCH, HEADQUARTERS -  
REQUEST TO LOCATE MR. (21-2-347)

This investigation was predicated upon the request of Dr. James L. Liverman, Director, Division of Biomedical and Environmental Research, Headquarters, that an attempt be made to locate Mr. [redacted] who was employed by the J. A. Jones Construction Company, Oak Ridge, Tennessee, in 1945; and was admitted to the Oak Ridge Hospital on March 24, 1945, after an accident, where he became involved in a Clinical Testing Program, but was subsequently lost to follow-up.

RESULTS OF INQUIRY

Mrs. Marjorie A. Phillips, Security Clearance Process Supervisor, Personnel Security Branch, Security Division, Oak Ridge Operations Office, Oak Ridge, advised that her records reflect only that an [redacted] born in Macon, Georgia, on [redacted] was employed by the J. A. Jones Construction Company, at the Clinton Engineering Works in Oak Ridge. She furnished a copy of this record, which is attached as Exhibit A.

Mr. Floyd F. Beets, Jr., Records Officer, Office Services Branch, Supply Division, Oak Ridge Operations Office, advised that the hospital in Oak Ridge was operated by Management Services, Inc., prior to being given to the Methodist Church in about 1959. He stated that most of the hospital financial records and patient files were destroyed by fire in the early 1960's. It may be noted that no information could be located in Mr. Beets' records on Mr. [redacted].

Ms. Silvia Aliberti, Director, Medical Records Department, Methodist Hospital of Oak Ridge, Oak Ridge, Tennessee, advised that the only record she has been able to locate on Mr. [redacted] is an index card, which she gave to Ms. Marcia Rice, Employee, University of Pittsburgh, Oak Ridge, who is doing contract work for AEC.

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Jon D. Anderson

- 2 -

July 15, 1974

Ms. Rice displayed card number 74691 which contained a name ' the date of March 24, 1945, and listed his address as Street, Harriman, Tennessee. She confirmed that she had obtained the above-mentioned card from Ms. Aliberti, and stated that it is the only information she has on ' She stated that the date of "March 24, 1945," is possibly the date that Mr entered the hospital.

Mr. and Mrs. Harriman, advised that resided in a house across the street from them when he worked for the J. A. Jones Construction Company; that he had no local relatives; but that one of his close friends, Mr. now lives between Harriman and Kingston, Tennessee. They added that they understand that Mr. is now deceased.

was located and he advised that he was employed by the J. A. Jones Construction Company in Oak Ridge on or about August 3, 1943. after being discharged by the U. S. Army. He stated that , and , who are brothers, were already employed by this company when he went to work and that all four of them resided at Street in Harriman.

Mr advised that he was involved in an automobile accident at exactly 6:40 a.m. on March 24, 1945, while enroute to the Oak Ridge Gaseous Diffusion Plant. He stated that Messrs. and and another man and his wife were riding with him at that time; that they had displayed their badges at the guard shack on Blair Road when entering the project area; and that the accident occurred on this road about 1-1/2 to 2 miles from the Oak Ridge Gaseous Diffusion Plant. He explained that a Government-owned carryall, with one of its rear wheels jacked up, was parked beside the road, apparently blocking part of the highway; and that another Government-owned dump truck coming towards him pulled around the carryall just as he approached, and collided head-on with him.

Mr. advised that both of legs were broken; that all six of them were taken to the hospital in Oak Ridge; that he ( ) remained in the hospital for approximately nine months; and that was hospitalized for more than 4 months. Mr. Smith advised that wife, Mrs. visited her husband a number of times while he was hospitalized and that she took him home when he was discharged from this institution, which was the last time he saw him. He said that he believed that and returned to Greensboro, North Carolina, where they had a home. He further stated that he believed that died about 13 years ago.

Mr. advised that he believes all 3 of the brothers came to Oak Ridge from Hickory, North Carolina, that and returned to Hickory from Oak Ridge; and that who had gone from Hickory to Greensboro, North Carolina, to make his home, was returned to that location by Mrs. when he was released from the Oak Ridge Hospital.

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July 15, 1974

Attached to this report as Exhibit B is a copy of a Certificate of Death for \_\_\_\_\_ which was furnished by Mrs. Eleanor S. Overton, Supervisor, Certification Unit, Vital Records Branch, Division of Health Services, State of North Carolina, 225 McDowell Street, Raleigh, North Carolina. By reference to this exhibit, it will be noted that Mr. \_\_\_\_\_ died in Greensboro on April 13, 1953, of heart failure, as certified by Dr. Alvin V. Blount, Jr., 914 Gorrell Street, Greensboro; and that he was buried in Cemetery in Greensboro on April 19, 1953. It may be noted that Mrs. \_\_\_\_\_ is listed on this exhibit under "Informant's Name and Address." It may also be noted that Mr. \_\_\_\_\_ date of birth \_\_\_\_\_ is shown on this exhibit as being \_\_\_\_\_ and on Exhibit A, previously attached, as being \_\_\_\_\_

Mrs. Overton advised that North Carolina State law requires that a Certificate of Death be filed with the vital records branch for every person who dies within the State. She stated that her records do not show that a Certificate of Death has been filed for Mrs. \_\_\_\_\_ although they would not have such a record if she had died outside of the State.

Examination of microfilm records of The News and Observer, 215 South McDowell Street, Raleigh; and The Greensboro Daily News and The Greensboro Daily Record, both located at 200 North Davie Street, Greensboro, for the inclusive period from Mr. \_\_\_\_\_ death on April 13, to his burial on April 19, 1953, failed to disclose that his obituary had been published in these newspapers.

Examination of the South Central Bell Telephone Directory for Greensboro, dated February, 1974, disclosed that it contained the following listings:

Phone: 272-\_\_\_\_\_

A. V. Blount, Jr., Surgery  
107 North Murrow Boulevard  
Phone: 272-8151  
If no answer call 272-3242 or  
275-0581

PRIVACY ACT MATERIAL REMOVED

It may be noted that Mrs. \_\_\_\_\_ was the only person with this last name listed in the above telephone directory. It may also be noted there were no listings for \_\_\_\_\_ Funeral Home and the \_\_\_\_\_ Cemetery both identified on the Certificate of Death.

Ms. Jackie Brady, Employee, Real Estate Department, City of Greensboro, 1 Government Plaza, Greensboro, advised telephonically that \_\_\_\_\_ Cemetery is owned by the City of Greensboro; and that she believes it is located on \_\_\_\_\_ Street, although she would have to check the

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~~CONFIDENTIAL~~

Name \_\_\_\_\_ (First) \_\_\_\_\_ (Middle)  
 Address UNKNOWN  
 Employer J. A. JONES CONST. CO., INC. Unit \_\_\_\_\_  
 Location CLINTON ENG. WORKS, OAK RIDGE, TENN.  
 Birthplace MACON, GA. Date of Birt \_\_\_\_\_  
 Citizenship U. S. Reg. No. (If Alien) \_\_\_\_\_

DO NOT USE THIS SPACE MAR 28 1944

Clearance Status:  
 Submitted to \_\_\_\_\_ SC DI  PMG  D & E  Date \_\_\_\_\_  
 Restricted \_\_\_\_\_ Report Rec'd \_\_\_\_\_  
 Restriction Removed \_\_\_\_\_  
 Termination or Transfer \_\_\_\_\_  
 (OVER)

PRIVACY ACT MATERIAL REMOVED

*Jan 20 7 4-4-45*

CLASSIFICATION CANCELLED

Date 7-5-74  
 L. R. Michener, USAEC ORO  
 Research & Technical Support Div.

8006068

Exhibit A

delete  
177 1

PRIVACY ACT MATERIAL REMOVED

8006069

PRIVACY ACT MATERIAL REMOVED

Name

Hospital No. Oak Ridge Hospital - East

Date of birth

Date of injection - Apr. 10, 1945

4.7  $\mu$ g <sup>239</sup>Pu (IV) citrate

Age at injection

Date of death

Age at death

Some after injection

Death certificate

LA-1151

Hp-12

This patient, a fifty-three year old colored male, was hospitalized on March 25, 1945, following an automobile accident in which he sustained comminuted fractures of the left femur and right patella and a transverse fracture of the right radius and ulna. Physical findings of note included a left lenticular cataract and marked hypertrophic and atrophic arthritic changes in both knees, together with osteochondromatosis of the left knee.

PRIVACY ACT MATERIAL REMOVED

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8006071

OAK RIDGE NATIONAL LABORATORY

OPERATED BY  
UNION CARBIDE CORPORATION  
NUCLEAR DIVISION



POST OFFICE Bpx X  
OAK RIDGE, TENNESSEE 37830

January 24, 1972

PRIVACY ACT MATERIAL REMOVED

Patricia W. Durbin, Ph.D.  
University of California  
Lawrence Radiation Laboratory  
Berkeley, California 94720

Dear Dr. Durbin:

I have attempted to get more information on I talked  
to Dr. Shoup of the Oak Ridge Operations of the AEC, and he looked in  
the early security records and found a man with a name very similar.  
The name they have was and we assume this stood for  
His age was essentially the same, although no birth date was recorded.  
He was employed by the J. A. Jones Construction Company, but they have  
no information in the AEC about his Social Security number. Unfortunately,  
the hospital records have been lost. During the construction of our new  
hospital, about 12 or 13 years ago, some records from the old hospital  
were stored in a wooden building, and some children got in there and  
started a fire. The physician and nurses records were sufficiently burned  
that they were destroyed. All that remained was the admission cards,  
which Miss Aliberti, record librarian of the Oak Ridge Hospital, says  
have been transferred to the AEC.

Sam Shoup has contacted the J. A. Jones Company Personnel Department,  
and they say they have no records. Sam has been unsuccessful in find-  
ing any hospital information in AEC files. The Mancuso study has no in-  
formation.

There was no service-supported dental clinic. Several private dentists  
practiced in a single "Dental Health" building, but they are all gone.

So I am afraid we "struck out".

Sincerely,

  
T. A. Lincoln, M.D.  
Medical Director

TAL:ph

8006072

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" - " "  
" - " "

PRIVACY ACT MATERIAL REMOVED

8006073

UNIVERSITY OF CALIFORNIA

HP 121

LAWRENCE RADIATION LABORATORY  
BERKELEY, CALIFORNIA 94720

January 3, 1972

Dr. T. A. Lincoln, M.D.  
Health Division  
Oak Ridge National Laboratory  
Oak Ridge, Tennessee

PRIVACY ACT MATERIAL REMOVED

Dear Dr. Lincoln,

Thank you for your interest in the follow-up of the Pu-injected people. Your help will be both welcome and valuable. Here are all the particulars I have on the case injected at Oak Ridge Hospital.

The man's name is . Spelling not certain, the last name could also be Cabe. Neither Dr. Howland nor Dr. Langham was absolutely certain, but seemed right. He was found on the project grounds after a serious vehicle accident, no-one can recall whether it was an auto or a truck. He suffered multiple fractures, and had lost much blood. He was taken to Oak Ridge Hospital on March 25, 1945. He was 53 years old, a Negro male already suffering from one cataract and arthritis. Blood counts were taken on April 4, 1945 and July 3, 1945. He was injected with Pu citrate on April 10, 1945. On April 15, 1945, 5 days after the injection he was taken to surgery to repair his comminuted fractures. Excretion samples were obtained for 58 days -- taking us to early June 1945.

Neither Dr. Howland who was working as a physician at Oak Ridge Hospital (U.S. Army Medical Corps) nor Dr. Langham recall whether Mr. was a laboratory employee or a local resident who was working for one of the construction contractors. The fact that he was cared for at Oak Ridge Hospital -- constructed for Lab employees and their families seems significant to me. If he were a Lab employee, he did not return to work for very long-- perhaps it was a temporary job -- because he left the area not long after he was released from the hospital and was last heard from 1 to 2 years later in Atlanta. By that time he had developed a cataract on the other eye and suffered recurrent symptoms of venereal disease (no-one remembers specifics). La-1151, the sole source of published information about this man indicates that 7 teeth were obtained "at a later date". Did Oak Ridge Hospital also have a dental clinic? Can we follow-up on this too. I will ask Dr. Langham for additional information, if he can recall it or find it.

I certainly hope your searching will be successful.

Sincerely,

*Patricia W. Durbin*  
Patricia W. Durbin, Ph. D.

8006074 H. Langham

make some  
deletions  
in document  
in patient's  
file in  
Box 1

NORTH CAROLINA STATE BOARD OF HEALTH  
BUREAU OF VITAL STATISTICS

**CERTIFICATE OF DEATH**

PRIVACY ACT MATERIAL REMOVED (4063)

Birth No. 132  
MAY 7 1953

REGISTRATION DISTRICT NO. \_\_\_\_\_ REGISTRAR'S CERTIFICATE NO. \_\_\_\_\_

1. PLACE OF DEATH a. COUNTY <b>Guilford</b>		b. TOWNSHIP <b>Gilmer</b>		c. LENGTH OF STAY (in this place)		2. USUAL RESIDENCE (Where deceased lived. If institution: residence before admission) a. STATE <b>North Car.</b> b. COUNTY <b>Guilford</b>					
d. CITY OR TOWN <b>Greensboro, N. C.</b>		Is Place of Death Within City Limits? YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>		e. CITY OR TOWN <b>Greensboro N. C.</b>		Is Place of Residence Within City Limits? YES <input type="checkbox"/> NO <input type="checkbox"/>					
3. FULL NAME OF HOSPITAL OR INSTITUTION <b>740 Law Street</b>				d. STREET ADDRESS OR R. F. D. NO. <b>740 Law St. 433</b>							
3. NAME OF DECEASED a. (First) b. (Middle) c. (Last)			4. DATE OF DEATH (Month) (Day) (Year) <b>4 - 13 - 53</b>			5. SEX <b>Male</b>			6. COLOR OR RACE <b>Colored</b>		
7. MARRIED, NEVER MARRIED, WIDOWED, DIVORCED (Specify) <b>Married</b>			8. DATE OF BIRTH			9. AGE (In years last birthday) <b>63</b>			IF UNDER 1 YEAR: Months Days Hours Min.		
10a. USUAL OCCUPATION (Give kind of work done during most of working life even if retired) <b>Laborer</b>				10b. KIND OF BUSINESS OR INDUSTRY <b>Heating &amp; Plumb. Co</b>				11. BIRTHPLACE (State or foreign country) <b>Georgia</b>		12. CITIZEN OF WHAT COUNTRY?	
13. FATHER'S NAME				14. MOTHER'S MAIDEN NAME <b>Carrie-Unknown</b>							
15. WAS DECEASED EVER IN U.S. ARMED FORCES? (Yes, no, or unknown) (If yes, give war or dates of service)				16. SOCIAL SECURITY NO.				17. INFORMANT'S NAME AND ADDRESS <b>Greensboro, N.C.</b>			
18. CAUSE OF DEATH Enter only one cause per line for (a), (b), and (c)		MEDICAL CERTIFICATION I. DISEASE OR CONDITION DIRECTLY LEADING TO DEATH* (a) <b>Heart Failure</b>						INTERVAL BETWEEN ONSET AND DEATH <b>3 hrs.</b>			
*This does not mean the mode of dying, such as heart failure, asthma, etc. It means the disease, injury, or complication which caused death.		II. ANTECEDENT CAUSES DUE TO (b) <b>auricular fibrillation</b>						3 hrs.			
		DUE TO (c)									
		III. OTHER SIGNIFICANT CONDITIONS Conditions contributing to the death but not related to the disease or condition causing death.									
19a. DATE OF OPERATION		19b. MAJOR FINDINGS OF OPERATION						20. AUTOPSY? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>			
21a. ACCIDENT SUICIDE HOMICIDE (Specify)		21b. PLACE OF INJURY (e.g., in or about home, farm, factory, street, office bldg., etc.)		21c. (CITY, TOWN, OR TOWNSHIP)		(COUNTY)		(STATE)			
21d. TIME OF INJURY (Month) (Day) (Year) (Hour)		21e. INJURY OCCURRED WHILE AT WORK <input type="checkbox"/> NOT WHILE AT WORK <input type="checkbox"/>		21f. HOW DID INJURY OCCUR?							
22. I hereby certify that I attended the deceased from _____, 19____, to _____, 19____, that I last saw the deceased alive on _____, 19____, and that death occurred at _____ m., from the causes and on the date stated above.											
22a. SIGNATURE <i>[Signature]</i>				22b. ADDRESS <i>[Address]</i>				22c. DATE SIGNED <i>[Date]</i>			
23a. BURIAL, CREMATION, REMOVAL (Specify) <b>Burial</b>		23b. DATE <b>4-14-53</b>		23c. NAME OF CEMETERY OR CREMATORY <b>Greensboro,</b>		23d. LOCATION (City, town, or county) (State) <b>N. C.</b>					
DATE REC'D BY LOCAL REG. <b>4-27-53</b>		REGISTRAR'S SIGNATURE <i>[Signature]</i>				23a. FUNERAL DIRECTOR		ADDRESS			

9743

I certify that this is a true photocopy of the original record filed in the Vital Records Branch, North Carolina Department of Human Resources.

Volume 53 Page 09063

Date Issued 7-1-74

*Jacob Loomer*  
Deputy State Registrar

PRIVACY ACT MATERIAL REMOVED

Exhibit B

800607b

delet  
"4-13-53"

PRIVACY ACT MATERIAL REMOVED

8006077

7/11/74

51  
June of death -

PRIVACY ACT MATERIAL REMOVED

D. Cert. 4-13-53  
Kaufman County  
Greensboro, N.C.  
740 Law St

heart failure

Delete

~~XXXXXXXXXX~~

PRIVACY ACT MATERIAL REMOVED

8006079

Nelson Edmunds

" " in cemetery, in Greensboro, N.C.

PRIVACY ACT MATERIAL REMOVED

Delete

"... , ..."

PRIVACY ACT MATERIAL REMOVED

8006081

CENTER FOR HUMAN RADIOBIOLOGY

40-018

RI

MICROFILM

B

CHR Exams

PRIVACY ACT MATERIAL REMOVED

Medical Reports from Physicians and Hospitals

Correspondence

\_\_\_ ANL

\_\_\_ MIT

\_\_\_ NJRRP

8006082

Delet

PRIVACY ACT MATERIAL REMOVED

8006083

40-018

CHR RECORDS  
MAR 1 1974  
MICROFILMED

CHR Exams

PRIVACY ACT MATERIAL REMOVED

Medical Reports from Physicians and Hospitals

Correspondence

\_\_\_ ANL

\_\_\_ MIT

\_\_\_ NJRRP

8006084

**TABLE 2**

**CLINICAL DATA ON SUBJECTS RECEIVING INTRAVENOUS INJECTION OF APPROXIMATELY 5 µg OF PLUTONIUM AS Pu<sup>+4</sup> CITRATE**

PATIENT CODE	SEX	AGE	WT. Kg.	Pu ADMIN		LABORATORY STUDIES*											
				AMT. µg	DATE	DATE	HGB g %	RBC x 10 <sup>-6</sup>	WBC x 10 <sup>-3</sup>	PMN %	LYMPHS %	EOS. %	BASO. %	MONO. %	UREA Cl. %	BUN	NPN
Hp-1	M	67	70.3	4.6	10/16	10/4 10/19	13.9 13.7	4.47 4.55	7.1 7.0	71 54	19 34	1 4	0 1	9 7	96 90	21 23	-
Hp-2	M	49	69.0	5.1	10/23	10/6 11/7	15.0 14.5	4.7 4.1	9.05 7.85	57 68	28 22	8 8	0 0	2 2	58 48	25 23	-
Hp-3	F	49	69.9	4.9	11/27	11/2 12/16	14.5 -	4.3 5.6	5.7 6.8	59 69	39 25	2 0	0 1	0 5	70 -	-	34 31
Hp-4	F	18	55.5	4.9	11/27	10/30 3/21	15.0 16.0	5.3 -	10.0 6.9	77 74	20 22	0 0	1 0	2 4	-	-	-
Hp-7	F	59	68.0	6.3	2/8	1/23 2/20	12.6 -	3.26 -	4.75 5.25	64 64	24 25	3 0	0 0	6 9	94 -	-	26
Hp-8	F	41	54.4	6.5	3/9	2/22 8/21	13.9 14.5	4.7 4.05	9.5 11.9	71 88	22 12	0 0	0 0	13 0	85 -	10 -	30
Hp-9	M	66	63.0	6.3	4/3	3/13 1/25	12.3 12.3	3.9 4.1	6.25 7.3	70 61	17 9	0 12	0 1	13 17	72 -	-	-
Hp-10	M	52	71.0	6.1	7/16	7/9 8/13	13.3 -	5.5 -	5.65 -	31 42	52 45	5 3	2 2	7 8	87 82	11 -	22
Hp-12	M	53	-	4.7	4/9	4/4 7/3	8.9 13.5	2.85 4.51	5.6 4.3	74 32	18 64	- -	- -	6 4	-	30 12	44 37

\*Explanation of Symbols: HGB = Hemoglobin; RBC = Red Blood Cell Count; WBC = White Blood Cell Count; PMN = Polymorphonuclear Cells; LYMPHS = Lymphocytes; EOS. = Eosinophiles; BASO. = Basophiles; MONO. = Monocytes; BUN = Blood Urea Nitrogen; NPN = Non-Protein Nitrogen; UREA Cl. = Urea Excretion in Per Cent of Normal at One Hour.

subjects before plutonium injection and at frequent intervals thereafter. All tissue samples were analyzed for plutonium by the cupferron extraction procedure subsequent to ashing.

The data in Table 3 show the results of analyses of the various samples for plutonium. The results obtained by Russell and Nickson (13) (referred to as Chi. I, II, III) and Hamilton et al (14) (referred to as Cal. I) are presented also. Two important points must be kept in mind when considering these data: (1) The samples of human tissues were, for obvious reasons, rather unsatisfactory. In most cases they were too small, poorly representative and were usually what could be obtained under the circumstances rather than what were desired; (2) The subjects were chronically ill and/or elderly and the results may not represent exactly the distribution of plutonium in tissues of healthy persons of average working age. These data, however, are all that are available and, therefore, must provide the basis for our present concept of the distribution of plutonium in the organs and tissues of man. They must also provide a basis for comparison with the results obtained from the numerous studies of plutonium deposition in experimental animals.

1. Deposition in the Skeleton

Animal experiments (1), (2) reveal that approximately 60 per cent of plutonium injected as PuO<sub>3</sub> and Pu<sup>+4</sup>-citrate is localized in bone. If the vertebra, sternum and whole rib are taken as representative bones of the skeleton, and the average plutonium content (.00557%/g),

Declassified as part of /

CIS Document No. 70/330  
 By John H. Stedman 5/17/71  
 Declassification Authority JR Gatter KA/BN  
 Date 5/17/71

14 bone specimens  $\text{Avg} = .00106 \times 7000 = 0.74$

Radius head  
patella  
rib whole  
rib cortex  
vertebra  
sternum

~~CONFIDENTIAL~~

Date 5-17-71

701330

Per Rth Dtd 5-17-71  
J.R. Cottrell

Verified/unclassified D.H. 6/14/79  
Date 5-17-71

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 Affinity (3)	Org. Wt./g (4)	Calc. %/Organ
	151 Hp-5	456 Hp-9	155 Hp-11	155 Chi. I	16 Chi. II	53 Hp-12	44 Cal. I	Avg. %/g			
Bone Marrow	--	--	.0096	.0153	.0210	.0187	.0290	.0187	13.3	3,000	(56.1) <sup>(6)</sup>
Radius (Frag. head)	--	--	--	--	--	.0187	--	--	--	--	--
Liver	.0320	.0144	.0352	.0139	.0324	--	--	.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	--	--
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	.0305	--	.0018	.0006	.0018	--	--	.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 <sup>(8)</sup>
Balance	--	--	--	--	--	--	--	.0001 <sup>(7)</sup>	--	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 = 8.5 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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TABLE 5

**PLUTONIUM CONTENT OF BLOOD SAMPLES\* FOLLOWING INTRAVENOUS INJECTION OF APPROXIMATELY 5  $\mu$ g OF PLUTONIUM AS Pu<sup>+4</sup>-CITRATE**

DAYS AFTER INJECTION	PATIENT CODE AND PERCENT OF INJECTED DOSE IN TOTAL BLOOD VOLUME*											AVERAGE	
	Hp-1	Hp-2	Hp-3	Hp-4	Hp-5	Hp-6	Hp-7	Hp-8	Hp-9	Hp-10	Hp-12		
1/6	46.02	-	28.32	83.31	31.51	36.70	32.57	37.64	40.83	51.57	5.31	33.7	44.2
1	21.83	19.35	-	-	6.23	10.97	16.40	14.51	12.39	24.66	-	15.7	
2	-	8.38	11.56	-	-	-	-	-	-	-	-	9.97	
3	-	10.03	-	16.64	1.16	2.94	6.97	4.94	6.22	20.06	-	8.62	
4	-	-	4.22	-	-	-	-	-	-	-	-	4.9	
5	-	-	-	-	0.66	-	-	-	-	-	-	-	
6	3.30	4.25	2.17	6.14	-	1.00	2.96	2.07	3.91	4.91	-	3.4	
8	-	2.32	1.42	-	-	-	-	-	-	-	-	1.9	
9	-	-	-	4.60	-	-	-	-	-	-	-	-	
10	1.42	-	-	-	0.39	0.38	1.13	1.37	2.21	1.72	-	1.2	
13	-	-	0.61	2.34	-	-	-	-	-	-	-	1.5	
15	-	-	-	-	0.11	0.26	0.66	0.71	1.42	1.02	-	1.70	
17	-	-	0.51	1.45	-	-	-	-	-	-	-	1.0	
22	-	0.70	-	-	0.18	0.25	-	-	-	-	-	0.38	
23	-	-	0.25	0.72	-	-	-	-	-	-	-	0.48	
29	-	-	-	-	-	-	0.37	-	-	-	-	-	
30	-	-	-	-	-	-	-	-	-	0.36	-	-	
31	-	-	-	-	-	-	-	-	-	-	0.51	-	
36	-	-	-	-	-	-	-	-	0.42	-	-	-	
42	-	-	-	-	-	-	-	0.17	-	-	-	-	
46	-	-	-	-	-	-	-	-	-	-	0.45	-	

\*Total Weight of Blood Taken as 7.71% of Total Body Weight.

**C. Excretion of Plutonium**

**1. Urinary Excretion**

The urinary excretion of plutonium was studied in eleven of the subjects following the intravenous injection of approximately 5  $\mu$ g of plutonium as Pu<sup>+4</sup> in 0.4 per cent solution of sodium citrate-2H<sub>2</sub>O. With the exception of the first day, urine from all subjects was collected in 24 hour samples through 22 days post injection. After 22 days the collection of 24 hour urine samples was continued as long as the patients were available for study. It was not possible to retain the subjects as long as was desired and the major weakness in these results is the short time interval over which the studies were continued. Two subjects were followed 22 days, one for 23 days, one for 27, and the remainder for 30 days or longer after injection. The Chicago cases (13) were followed for 16, 40, and 163 days and the California case (14) was followed for a period of 341 days. Because of the great importance of measurements at longer time intervals, the Chicago and California data have been incorporated with

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TABLE 6

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

INDIVID

DAYS POST INJECTION	PER CENT OF INJECTED DOSE EXCRETED PER DAY														Ca-226	Ca-228	Ca-229
	Hp-1	Hp-2	Hp-3	Hp-4	Hp-5	Hp-6	Hp-7	Hp-8	Hp-9	Hp-10	Hp-11	Hp-12	Zn-65	Ca-40			
1	.181	.472	.569	.440	.295	-	.217	.377	.150	.44	.104	.257	2.531*	.152	.480		
2	.146	.294	.289	.236	.155	.215	.212	.232	.055	.330	.103	.182	.153	.167	.150		
3	.114	.174	.112	.221	.077	.127	.137	.123	.059	.218	.088	.062	.184	.067	.120		
4	.094	.123	.107	.132	.052	.111	.095	.140	.066	.170	.078	.077	.133	.033	.031		
5	.069	.116	.078	.116	.030	.076	.069	.083	.047	.059	.058	.026	.032	.042	.037		
6	.066	.081	.043	.119*	.020	.057	.059	.073	.052	.060	.044	.0256	.029	.042	-		
7	.062	.062	.043	.077	.033	.044	.045	.056	.050	.079	.059	.0234	.024	.024	-		
8	.055	.048	.049	.081	.026	.043	.057	.057	.032	.065	.036	.0227	.023	.025	.015		
9	.051	.048	.022	.095*	.027	.032	.023	.047	.032	.051	.043	-	.027	.019	.069		
10	.045	.038	.027	.081*	.022	.031	.023	.059	.035	.044	.038	.0052*	.034	.020	.026		
11	.040	.048	.027	.075*	.021	-	.018	.044	.026	.041	.038	.0097	.047	.019	.056		
12	.038	.039	.015	.072*	.026	.024	.019	.023	.030	.038	.027	.0055	.047	.014	.029		
13	.034	.045	.020	.057*	.023	.023	.019	.037	.027	.029	.030	.0226	.018	.034	-		
14	.035	.036	.020	.055*	.018	.020	.013	.035	.030	.029	.039	.007	.034	.009	-		
15	.034	.039	.028	.050	.015	.022	.012	.035	.030	.025	.029	.0059	.026	.015	.013		
16	.028	.024	.024	.033	.020	.017	.012	.035	.049*	.021	.023	.0109	.012	.004	.016		
17	.027	.027	.021	.032	.020	.013	.011	.032	.038	.023	.029	-	.028	-	.0056		
18	.026	.020	.017	.037	.020	.015	.011	.029	.027	.021	.026	-	.026	-	.010		
19	.025	.019	.015	.032	.018	.015	.010	.031	.029	.017	.029	.0022	.015	-	.006		
20	.017	.021	.012	.025	.021	.013	.008	.032	.029	.018	.032	.0093	.023	-	.0048		
21	.017	.017	.015	.029	.020	.012	.010	.029	.032	.022	.025	.0076	.032	-	.0017		
22	.016	.015	.014	.033	.018	.012	.013	.021	.032	.016	.025	.0145	.027	-	.0050		
23	.025	.018	.014	.014	-	-	.003	.021	.032	.015	.039	.0151	.029	-	.0091		
24	.021	.014	-	-	-	-	.008	.025	.032	.016	.023	.0128	.020	-	.0078		
25	.013	.014	-	.011	-	-	.008	.023	.029	.016	.021	.0123	.048*	-	.011		
26	-	.017	-	.011	-	-	.007	.022	.032	.016	.023	.0175	.024	-	.0022		
27	-	.008	-	.008	-	-	.008	.028	.032	.014	.017	.0151	.043*	-	.0044		
28	-	.009	-	-	-	-	.008	.023	.024	.013	.024	.0197	.034	-	.0074		
29	-	.009	-	-	-	-	.008	.019	.025	.014	.023	.0133	.022	-	.0043		
30	-	.008	-	-	-	-	.006	.021	.023	.014	.021	.0131	.024	-	.0065		
31	-	.007	-	-	-	-	.005	.017	.025	-	.021	.019	.027	-	.0077		
32	-	.007	-	-	-	-	.007	.016	.024	-	.012	.010	.020	-	.0063		
33	-	.009	-	-	-	-	.006	.045	.022	-	.037*	.017	.011	-	.0073		
34	-	.009	-	-	-	-	.005	.015	.020	-	.020	.0139	.008	-	.0084		
35	-	-	-	-	-	-	.006	-	.022	-	.026	.0127	.009	-	.0069		
36	-	-	-	-	-	-	.005	.015	.022	-	.018	.0165	.015	-	.0079		
37	-	-	-	-	-	-	.006	.011	-	-	.023*	.0111	.011	-	.0063		
38	-	-	-	-	-	-	-	.016	-	-	.018	.0174	.009	-	.0085		
39	-	-	-	-	-	-	-	.012	-	-	.021	.0112	.009	-	.0064		
40	-	-	-	-	-	-	-	.017	-	-	.019	.0072	.009	-	.0072		
41	-	-	-	-	-	-	-	.019	-	-	.013	.0062	.011	-	.0080		
42	-	-	-	-	-	-	-	.014	-	-	.013	.0127	-	-	.0081		
43	-	-	-	-	-	-	-	.016	-	-	.015	.0095	.017	-	.0076		
44	-	-	-	-	-	-	-	.014	-	-	.015	.0031	-	-	.0055		
45	-	-	-	-	-	-	-	.013	-	-	.017	.013	.018	-	.0063		
46	-	-	-	-	-	-	-	.015	-	-	-	.012	-	-	.0073		
47	-	-	-	-	-	-	-	.014	-	-	.015	-	.020	-	.0059		
48	-	-	-	-	-	-	-	.014	-	-	.017	.0064	-	-	.0059		
49	-	-	-	-	-	-	-	.018	-	-	.015	.0063	-	-	.0053		
50	-	-	-	-	-	-	-	.014	-	-	-	.0054	.018	-	.0078		
51	-	-	-	-	-	-	-	.013	-	-	-	.007	-	-	.0082		
52	-	-	-	-	-	-	-	-	-	-	.035	.0073	-	-	.0098		
53	-	-	-	-	-	-	-	.013	-	-	.019	.0023	-	-	.0074		
54	-	-	-	-	-	-	-	.013	-	-	.043	-	-	-	.0077		
55	-	-	-	-	-	-	-	.015	-	-	.043*	.0073	.014	-	.0098		
56	-	-	-	-	-	-	-	.013	-	-	.036	.002	-	-	.0054		
57	-	-	-	-	-	-	-	.012	-	-	.018	.0075	-	-	.0050		
58	-	-	-	-	-	-	-	.013	-	-	.036	.0094	-	-	.0058		
59	-	-	-	-	-	-	-	.012	-	-	.011	-	-	-	.0098		
60	-	-	-	-	-	-	-	.011	-	-	-	.0063	.022	-	.0067		
61	-	-	-	-	-	-	-	.012	-	-	-	.0063	-	-	.0066		
62	-	-	-	-	-	-	-	.010	-	-	-	.0092	-	-	.0058		
63	-	-	-	-	-	-	-	.009	-	-	-	.0054	-	-	.0077		
64	-	-	-	-	-	-	-	.012	-	-	-	.0071	-	-	.0042		
65	-	-	-	-	-	-	-	.011	-	-	-	.0050	.024	-	.0042		
66	-	-	-	-	-	-	-	-	-	-	-	.014	-	-	.0047		
67	-	-	-	-	-	-	-	-	-	-	-	.014	-	-	.0064		
68	-	-	-	-	-	-	-	-	-	-	-	.011	-	-	.0068		
69	-	-	-	-	-	-	-	-	-	-	-	.011	-	-	.0070		
70	-	-	-	-	-	-	-	-	-	-	-	.014	-	-	.0100		
71	-	-	-	-	-	-	-	-	-	-	-	.0056	-	-	.0072		
72	-	-	-	-	-	-	-	-	-	-	-	.0029	.014	-	.0092		
73	-	-	-	-	-	-	-	-	-	-	-	.0023	-	-	.0069		

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TABLE 9

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

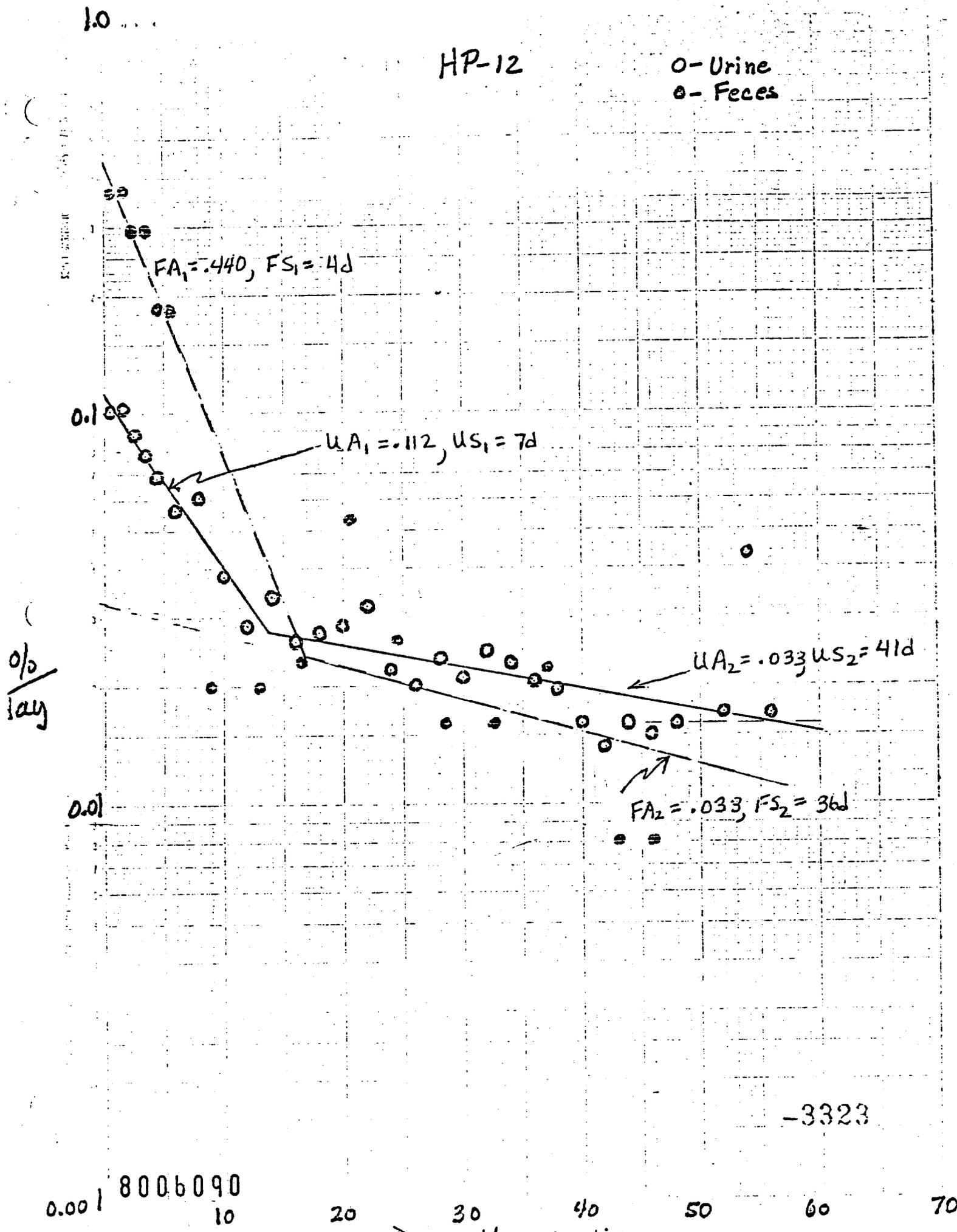
DAYS POST INJECTION	PER CENT OF INJECTED DOSE EXCRETED PER DAY											
	Hp-1	Hp-2	Hp-3	Hp-4	Hp-5	Hp-6	Hp-7	Hp-8	Hp-9	Hp-10	Hp-12	Ch-1 <sup>(2)</sup>
1	.052*	.204	.018*	.134	.004*	.085	.147	.178	.333	.087	.370	.258
2	.221	.204	.157	.274	.311	.035	.120	.266	.339	.037	.370	.435
3	.241	.204	.157	.274	.311	.179	.037	.210	.339	.037	.297	.234
4	.050	.317	.095	.366	.185	.179	.080	.080	.131	.110	.297	.300
5	.105	.317	.099	.366	.110	.179	.055	.080	.131	.110	.183	.223
6	.046	-	.070	.126	.110	.179	.055	.080	.131	.110	.163	.116
7	.021	-	.070	.126	.110	.037	.055	.080	.131	.110	.020	.033
8	.021	.120	.070	.126	.034	.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	.035	.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	.084
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	.023	.017	.015	.016	.025	.055	.012	.053	.027
20	.015	.055	.016	.023	.020	.015	.016	.025	.055	.012	.053	.019
21	.015	.055	.016	.023	.020	.010	.003	.025	.055	.012	.053	.019
22	.015	.022	.003	.023	.020	.010	.003	.045	.055	.012	.053	.018
23	.017	.022	.003	.026	-	-	.003	.045	.052	.012	.026	.010
24	.017	.022	-	-	-	-	.003	.039	.032*	.012	.026	.023
25	-	.022	-	-	-	-	.011	.009	.052*	.003	.026	.013
26	-	.021	-	-	-	-	.011	.009	.052*	.003	.026	.023
27	-	.021	-	-	-	-	.011	.009	.043*	.003	.016	.0333
28	-	-	-	-	-	-	.011	.009	.043*	.003	.016	.0069
29	-	-	-	-	-	-	-	.009	.043	.006	.016	.0153
30	-	-	-	-	-	-	-	.018	.043	.008	.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	.0031
36	-	-	-	-	-	-	-	.018	-	-	.022	.0031
37	-	-	-	-	-	-	-	.023	-	-	.022	.0059
38	-	-	-	-	-	-	-	.023	-	-	.022	.0042
39	-	-	-	-	-	-	-	.011	-	-	-	.0047
40	-	-	-	-	-	-	-	.011	-	-	-	.0033
41	-	-	-	-	-	-	-	.011	-	-	-	.0031
42	-	-	-	-	-	-	-	.011	-	-	-	.0053
43	-	-	-	-	-	-	-	.011	-	-	.003	.0047
44	-	-	-	-	-	-	-	.011	-	-	.003	.0032
45	-	-	-	-	-	-	-	.011	-	-	.006	.0042
46	-	-	-	-	-	-	-	.011	-	-	.003	.0033
47	-	-	-	-	-	-	-	.011	-	-	-	.0023

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