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SAVANNAH RIVER LABORATORY
AIKEN, SOUTH CAROLINA 29801

(TWX 803 824-0018, TEL 803-824-6331, WU: AUGUSTA, GA.)

PERSONAL AND CONFIDENTIAL

718524

JUN 23 1969

June 6, 1969

Dr. Walter S. Snyder
Health Physics Division
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37830

Dear Dr. Snyder:

Attached is a review of a $^{238}Pu$ assimilation that occurred at the Savannah River Plant. Would you be kind enough to review the data and give me your expert opinion as to the estimate of the quantity assimilated, the critical organs involved, and the radiation dose?

Note that chelation has not been done since February 19, 1969. Current thinking calls for chelation again when a reliable estimation of plutonium assimilation is obtained and body chemistry appears stable.

If you would like further information regarding medical treatment, contact G. A. Poda, M. D., or J. C. Beard, M. D.; on questions regarding the analytical data contact W. P. Walke or E. C. Morris of the SRP Health Physics staff.

In addition to our own evaluation (S. M. Sanders, Jr.,) and yours, I am also asking the opinion of W. H. Langham.

Please note that for the present we are asking that you treat the information as confidential.

Yours very truly,

C. M. Patterson

C. M. Patterson, Research Manager
Radiological Sciences Division

CMP/aa

June 3, 1969

# PLUTONIUM-238 ASSIMILATION
# SAVANNAH RIVER PLANT
# NOVEMBER 29, 1968

PERSONAL AND CONFIDENTIAL

## Description of Injury

Two Maintenance mechanics were assigned to replace the gasket on a hot canyon sampler needle holder which is used in the sampling of plutonium-238 nitrate solution. The needle holder (Figure 1), containing two needles, was removed from the sampler and the gasket was replaced; when the injured employee was ready to reassemble the sampler, he turned towards the second mechanic to receive the needle holder and, in so doing, struck the needles which punctured his right index finger at the first (proximal interphalangeal) joint. The injury occurred at 11:00 AM, 11/29/68.

## Chronology of Treatment

Immediately following the accident, the mechanic's plastic suit was removed, a tourniquet applied, and the wound area flushed with cold running water for about five minutes. Flushing of the wound area was continued in the decontamination room, and decontamination of the exterior surface of the finger was started.

A blood swipe at the wound site indicated 12,000 d/m alpha. The mechanic was then taken to the regulated Medical facility where a wound monitor survey indicated approximately 2,000,000 d/m alpha at the site of the injury. A Plant physician excised tissue at the wound site to remove the radioactive contaminant. A wound survey, following excision and surgical repairs, indicated 150,000 d/m at the site, however, the Plant physician did not consider it advisable to attempt further surgical removal of contaminants at that time since the remaining material appeared to be in the joint capsule or the tendon. A second excision was performed on December 17, when it became apparent that the activity was localized in one small spot directly above the flexor tendon. As a result of this excision, the wound monitor count was reduced from 25,000 d/m to 12,500 d/m

A blood sample was taken from the left arm immediately after the initial tissue excision to determine the plutonium-238 concentration, and all excised tissue, surgical swabs and bandages were also collected for analysis. The mechanic was asked to collect all urine and fecal voidings until further notice and was released at 4:00 PM (11/29/68).

Analysis of the initial blood sample was completed at 1:00 PM on November 30, 1968; the concentration was 4.2 d/m alpha per ml. Because of the high alpha concentration in the blood stream, 250 mls of a 5% glucose-water solution containing 1 gram of a chelating agent, the trisodium salt of diethylenetetraamine pentaacetic acid (DTPA), was intravenously administered at 2:30 PM on November 30 and again on December 1, 1968.

The case was reviewed on Monday, December 2, by Maintenance, Medical, and Health Physics supervision, and the following program agreed on:

Chelation - Administer 250 mls of a 5% glucose-water solution containing 1 gram of chelating agent (DTPA) Monday, Tuesday, Thursday, and Friday of each week.

Urine - Collect and analyze all urine voidings until further notice.

Feces - Collect and analyze all fecal discharges during the first two weeks and one sample per week thereafter.

Blood - Take blood samples for analysis prior to each chelation.

Wound Monitor Surveys - Survey the wound site daily (Monday through Friday). Fabricate a hand mold to insure consistent positioning of the hand in successive surveys.

NOTE: If the needle penetrated the joint capsule and deposited plutonium within it, that plutonium would not be detected by the wound monitor.

Whole Body Counter Surveys - Survey the kidney and liver areas in an attempt to detect any concentration of radioactivity in these organs.

Laboratory Analyses - Analyze all excised tissue, surgical bandages, and swabs to determine the quantity of alpha contamination surgically removed. (Figure 2.)

Medical Laboratory Analysis - Analyze daily urine samples, Monday through Friday, for evidence of possible kidney damage from the DTPA treatment and for evidence of sulpha-compounds in the urine. (The employee has been taking sulphapyridine for the past three years for a skin condition.)

The program was followed, as planned, until February 19, with only two exceptions. The employee was on a 10-day vacation from December 21 to 30, 1968. During this period, the chelating agent was changed from DTPA to EDTA (calcium disodium salt of ethylene diamine tetraacetic acid) using a dosage of one 335 mg tablet four times a day. The use of EDTA, administered orally, was not as effective as intravenous DTPA in the removal of plutonium from the body. Chemical analysis of individual urine voidings to determine the fate of the EDTA indicated less than a 0.0005 molar concentration (minimum sensitivity of the analytical method). By contrast, DTPA was found in individual urine voidings up to nine hours following intravenous injection, Figure 3. (EDTA is known to be less effective than DTPA when given intravenously and particularly so when given orally.)

The second exception was when chelation was discontinued from January 15 to 27, 1969, in an effort to obtain a better estimate of the body burden of plutonium-238. During this period of no chelation, the employee's elimination of plutonium decreased from 500 - 1000 d/m/24 hours to 70 - 100 d/m per 24 hours.

The program was reviewed on February 19 and was changed as follows:

Chelation - Discontinue DTPA treatment to allow the elimination rate to stabilize and allow a better determination of the quantity of plutonium assimilated.

Feces - Collect no more fecal discharges.

Urine - Collect and analyze all urine voidings during one 24 hour period each week after February 24. This program was changed for the period of March 17 through May 11, 1969. All urine voidings were collected and analyzed for either two or three consecutive 24 hour sample periods each week.

Blood - Collect a blood sample every other Monday.

Wound Monitor Surveys - Survey the wound site every other Monday.

General information on the employee's physical condition is included in Figure 4. The employee's current rate of elimination in urine voidings as of 5-20-69 is approximately 6 d/m/24 hours. The present sampling program is two, 24 hour urine samples, taken on consecutive days, every other week. Blood samples will be taken on a monthly frequency.

Attachment:

Monitoring and Bioassay Data

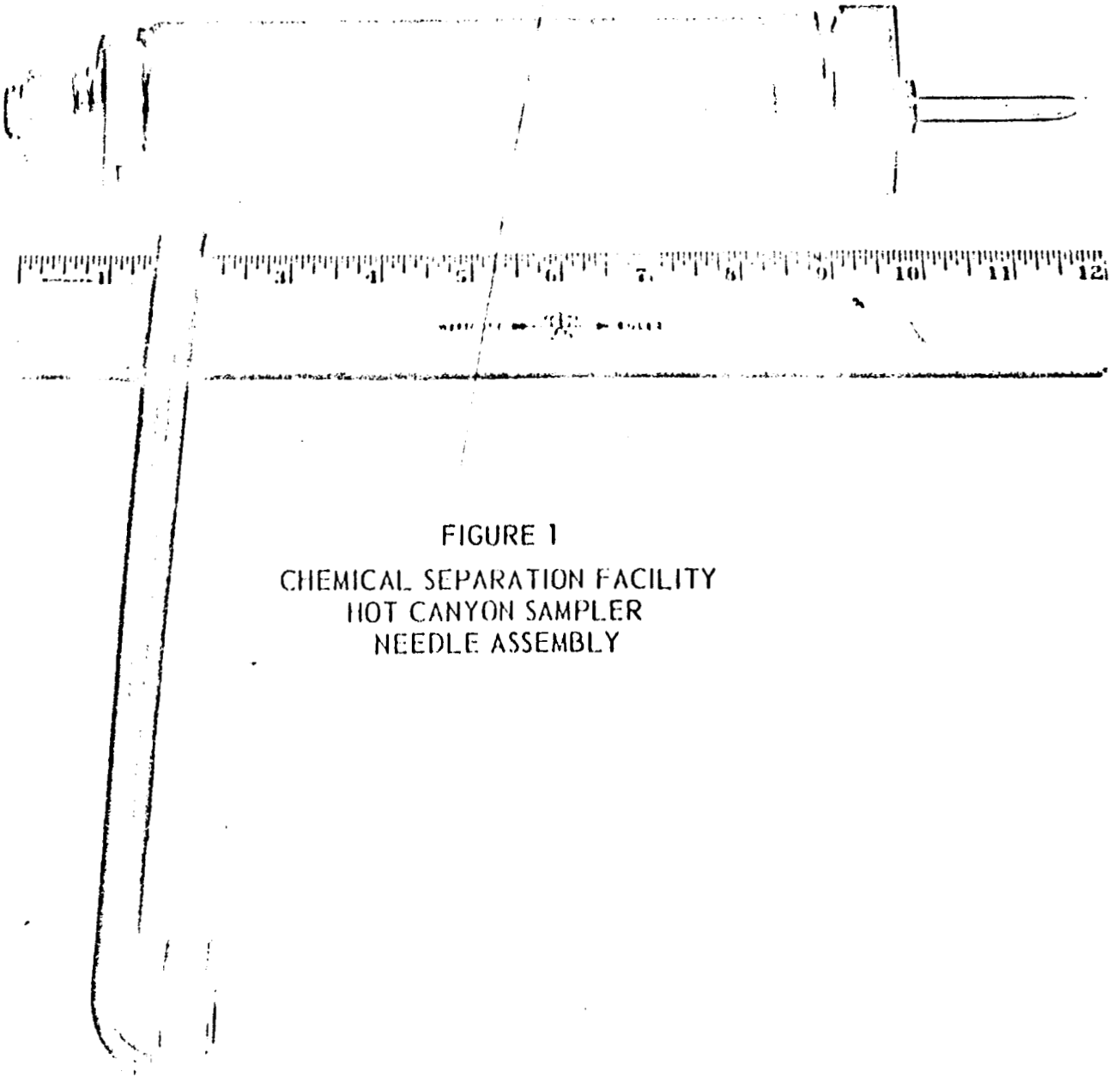

FIGURE 1

CHEMICAL SEPARATION FACILITY
HOT CANYON SAMPLER
NEEDLE ASSEMBLY

FIGURE 2

TISSUE AND SURGICAL DRESSING

PLUTONIUM CONTENT ANALYSIS

| ITEM | DATE (1968) | d/m | REMARKS |
|---|---|---|---|
| Tissue | 11/29 | 1,600,000 | First Excision |
| Tissue | 12/17 | 2,400 | Second Excision |
| Bandage and Blood | 11/29 | 125,000 | |
| Bandages | 11/30 | 5,850 | |
| Bandages | 12/1 | 325 | |
| Bandages (Blood Swipe) | 12/1 | 8,200 | |
| Bandages | 12/2 | 100 | |
| Bandages | 12/3 | 10 | |
| Bandages | 12/4 | 25 | |

FIGURE 3

DTPA IN URINE RETENTION STUDIES

| TEST | DATE | SAMPLE TIME | DTPA (molar) |
|---|---|---|---|
| 1 | 12/17/68 | 12:00 N | Administered |
| | | 2:40 PM | .0019 |
| | | 5:20 PM | .0031 |
| | | 7:00 PM | .0019 |
| | | 7:40 PM | .0012 |
| | 12/17/68 | 9:30 PM | $<$ .0005 * |
| | 12/19/68 | 7:40 PM | $<$ .0005 |
| 2 | 1/9/68 | 12:00 N | Administered |
| | | 3:00 PM | .0091 |
| | | 5:45 PM | .0043 |
| | | 8:30 PM | .0008 |
| | | 9:30 PM | .0003 |
| | 1/10/69 | 6:00 AM | $<$ .0002 |
| | | 8:10 AM | $<$ .0002 |
| | | 10:15 AM | $<$ .0002 |

* Minimum sensitivity, 13 samples. Results were all $<$ .0005 through 7:40 PM on 12/19/68.

FIGURE 4

PHYSICAL DATA

Male

Age: 39 Date of Birth: [redacted]

Weight: 162 pounds

Height: 6'

Blood Volume: 5370 cc (Estimated)

Urinalysis: Albumin -- Negative

Sugar -- Negative

Specific Gravity -- 1.005 to 1.018

Blood: Hemoglobin -- 13 grams/100 cc

Red Blood Cell Count -- $3.2 \times 10^6$ to $4.38 \times 10^6$

White Blood Cell Count -- $4.6 \times 10^3$ to $6.2 \times 10^3$

The Medical Department states that the employee's health is excellent. He has routinely taken sulfapyridine for the past three or four years for a chronic skin rash (dermatitis herpitiformis).

# MONITORING AND BIOASSAY DATA SHEET

| Date | Time | Wound Monitor d/m | Urine Samples & Analyses: Vol. (ml) | Total d/m | d/m ml | Accumulative d/m | Chelating Agent | Blood d/m ml | Fecal Samples and Analyses: Weight (gms) | Total d/m | Accumulative d/m | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 11-29 | 12:20 P | $1.94 \times 10^6$(1) | | | | | | | | | | (1) Survey before first excision |
| | 1:15 P | $1.6 \times 10^5$(2) | | | | | | | | | | (2) Survey after first excision |
| | 1:30 P | $6.5 \times 10^4$(3) | | | | | | | | | | (3) Survey through bandage |
| | 1:45 P | | | | | | | 4.2 | | | | |
| | 2:15 P | | 950 | 535 | 0.55 | 535 | | | | | | (4) Survey through bandage |
| 11-30 | 12 N | $7.8 \times 10^4$(4) | 900 | 2798 | 3.1 | 3,333 | | | | | | |
| | 2:30 P | | | | | | | 1.3 | | | | |
| | 3:00 P | | | | | | DTPA(5) | | | | | (5) One gram of DTPA in 250 cc of glucose solution administered intravenously. |
| | 6:30 P | | 460 | 5009 | 10.9 | 8,342 | | | 396(6) | 1374 | 1,374 | (6) Daily Samples |
| | 6:30 P | | | | | | | | | | | |
| 12-1 | 12 N | | 900 | 2432 | 2.7 | 10,774 | | | | | | |
| | 1:00 P | $1.4 \times 10^5$ | | | | | | 0.27 | | | | |
| | 2:30 P | | | | | | DTPA | | | | | |
| | 3:00 P | | | | | | | | | | | |
| | 7:00 P | | 250 | 2530 | 10.1 | 13,304 | | | 181 | 826 | 2,200 | |
| | 8:00 P | | | | | | | | | | | |
| 12-2 | 3:00 A | | 900 | 6652 | 7.4 | 19,956 | | 0.12 | | | | |
| | 8:30 A | | | | | | | | | | | |
| | 10:00 A | | 900 | 2402 | 2.7 | 22,359 | | | | | | |
| | 12 N | | 950 | 2594 | 2.7 | 24,952 | | | | | | |
| | 3:00 P | | | | | | DTPA | | 350 | 2950 | 5,150 | |
| | 5:30 P | | | | | | | | | | | |
| | 6:00 P | | 900 | 3330 | 3.7 | 28,282 | | | | | | |

# MONITORING AND BIOASSAY DATA SHEET

| Date | Time | Wound Monitor d/m | Urine Samples & Analyses: Vol. (ml) | Total d/m | d/m ml | Accumulative d/m | Chelating Agent | Blood d/m ml | Fecal Samples and Analyses: Weight (gms) | Total d/m | Accumulative d/m | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 12-16 | 7:45 A | | 850 | 195 | 0.23 | 83,452 | | | | | | |
| | 11:00 A | 3.0 x 10⁴ | | | | | | | | | | |
| | 12:30 P | | | | | | DTPA | Lost | | | | |
| | 2:00 P | | 150 | 690 | 4.6 | 84,142 | | | | | | |
| | 5:20 P | | 900 | 2200 | 2.4 | 86,342 | | | | | | |
| 12-17 | 1:00 A | | 400 | 600 | 1.5 | 86,942 | | | | | | |
| | 7:45 A | | 525 | 490 | 0.93 | 87,432 | | | | | | |
| | 11:00 A | 2.4 x 10⁴(7) | | | | | | | | | | (7) Survey before second excision |
| | 11:35 A | 4.3 x 10³(8) | | | | | | | | | | (8) Survey through the bandage after the second excision |
| | 1:45 P | | | | | | DTPA | 0.025 | | | | |
| | 2:40 P | | 330 | 420 | 1.3 | 87,852 | | | | | | |
| | 5:20 P | | 840 | 1460 | 1.7 | 89,312 | | | | | | |
| 12-18 | 5:45 A | | 600 | 815 | 1.4 | 90,127 | | | | | | |
| | 7:40 A | | 570 | 260 | 0.46 | 90,387 | | | | | | |
| | 12:30 P | 1.2 x 10⁴ | | | | | | | 108 | 1.6(9) (10) | | (9) 1.6 d/m considered invalid. Average of 3 prior and 3 subsequent samples was used for data during week of 12/16-22/68 - 96 d/m. |
| | 6:00 P | | 900 | 600 | 0.67 | 90,987 | | | | | | (10) Weekly sample program started during week of 12/16-22/68. Total d/m discharged for week is prorated from the one sample. |

1133861

# MONITORING AND BIOASSAY DATA SHEET

| Date | Time | Wound Monitor d/m | Urine Samples & Analyses: Vol. (ml) | Total d/m | d/m ml | Accumulative d/m | Chelating Agent | Blood d/m ml | Fecal Samples and Analyses: Weight (gms) | Total d/m | Accumulative d/m | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 12-9 | 8:10 A | | 550 | 422 | 0.77 | 59,752 | | | | | | |
| 10 | 1:00 P | | 675 | 2580 | 3.8 | 62,332 | | 0.19 | | | | |
| | 1:10 P | | | 2631 | | | DTPA | | | | | |
| | 2:00 P | 1.1 x 105 | | | | | | | | | | |
| | 5:45 P | | 950 | 2035 | 2.1 | 64,367 | | | | | | |
| | 8:15 P | | | | | | | | 83 | 80 | 8,116 | |
| 12-10 | 12:45 A | | 600 | 515 | 0.86 | 64,882 | | | | | | |
| 11 | 6:00 A | | 450 | 3220 | 7.2 | 68,102 | | | | | | |
| | 12:30 P | | | | | | DTPA | 0.071 | | | | |
| | 1:25 P | | 800 | 1110 | 1.4 | 69,212 | | | | | | |
| | 1:30 P | 1.1 x 105 | | 3025 | | | | | | | | |
| | 6:00 P | | 900 | 3025 | 3.4 | 72,237 | | | 230 | 250 | 8,356 | |
| 12-11 | 7:45 A | | 350 | 240 | 0.69 | 72,477 | | | | | | |
| | 12 N | | 250 | 547 | 2.2 | 73,024 | | | | | | |
| | 1:00 P | 9.6 x 104 | | 3517 | | | | | | | | |
| 12 | 6:00 P | | 950 | 193 | 0.20 | 73,217 | | | 273 | 60 | 8,426 | |
| | 11:30 P | | 250 | 366 | 1.5 | 73,583 | | | | | | |
| 12-12 | 7:45 A | | 975 | 423 | 0.43 | 74,006 | | | | | | |
| | 12:30 P | | | | | | DTPA | 0.034 | | | | |
| | 1:15 P | | 275 | 204 | 0.74 | 74,210 | | | | | | |
| | 2:30 P | 6.9 x 104 | | 7156 | | | | | | | | |
| | 5:15 P | | 910 | 2418 | 2.7 | 76,628 | | | | | | |
| | 6:30 P | | | | | | | | 275 | 150 | 8,576 | |
| | 11:00 P | | 190 | 648 | 3.4 | 77,276 | | | | | | |
| | | | 190 | 72 | 0.38 | 77,348 | | | | | | Spital 0.038 d/m/ml |
| 12-13 | 7:45 A | | | | | | | | | | | |
| | 11:00 A | 6.9 x 104 | | | | | DTPA | 0.044 | | | | |
| | 12:30 P | | | | | | | | | | | |
| | 5:10 P | | 910 | 2160 | 2.4 | 79,508 | | | | | | |
| | 7:20 P | | | 1365 | | | | | 96 | 230 | 8,806 | |
| 12-14 | 1:00 A | | 950 | 1360 | 1.4 | 80,868 | | | | | | |
| | 8:30 A | | 550 | 149 | 0.27 | 81,017 | | | | | | |
| | 12:15 P | | 930 | 920 | 1.0 | 81,937 | | | | | | |
| | 8:35 P | | 950 | 465 | 0.49 | 82,402 | | | | | | |
| 12-15 | 5:45 A | | 950 | 410 | 0.43 | 82,812 | | | | | | |
| | 12 N | | 950 | 445 | 0.47 | 83,257 | | | | | | |

1133862

# MONITORING AND BIOASSAY DATA SHEET

| Date | Time | Wound Monitor d/m | Urine Samples & Analyses: Vol. (ml) | Total d/m | d/m ml | Accumulative d/m | Chelating Agent | Blood d/m ml | Fecal Samples and Analyses: Weight (gms) | Total d/m | Accumulative d/m | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 12-3 | 9:00 A | | | | | | | 0.17 | | | | |
| | 11:00 A | 9.1 x 10⁴ | | | | | | | | | | |
| | 1:30 P | | 375 | 683 | 1.8 | 28,965 | | | | | | |
| | 5:00 P | | 700 | 841 | 1.2 | 29,806 | | | | | | |
| | 5:20 P | | | | | | | | 212 | 615 | 5,765 | |
| 12-4 | 9:00 A | | 360 | 156 | 0.43 | 29,962 | | | | | | |
| | 9:30 A | | | | | | | 0.24 | | | | |
| | 11:00 A | 9.1 x 10⁴ | | | | | | | | | | |
| | 2:30 P | | | | | | DTPA | | | | | |
| | 4:55 P | | 940 | 7299 | 7.8 | 37,261 | | | | | | |
| | 7:25 P | | 900 | 758 | 0.84 | 38,019 | | | | | | |
| | 8:00 P | | | | | | | | 215 | 700 | 6,465 | |
| 12-5 | 1:10 A | | 875 | 3429 | 3.9 | 41,448 | | | | | | Kidneys and liver surveyed with whole body counter on 12/5/68. No positive results from surveys of critical organs (12/5, 12/20, 1/8) |
| | 7:05 A | | | | | | | | 210 | 665 | 7,130 | |
| | 8:45 A | | | | | | | 0.062 | | | | |
| | 12:30 P | 1.2 x 10⁵ | | | | | | | | | | |
| | 1:50 P | | 750 | 1840 | 2.45 | 43,288 | | | | | | |
| | 5:10 P | | 950 | 883 | 0.93 | 44,171 | | | | | | |
| | 8:45 P | | 925 | 1657 | 1.8 | 45,828 | | | | | | |
| 12-6 | 6:30 A | | 560 | 1800 | 3.2 | 47,628 | | | | | | |
| | 10:30 A | 1.2 x 10⁵ | | | | | | | | | | |
| | 1:45 P | | 800 | 1230 | 1.5 | 48,858 | | | | | | |
| | 2:00 P | | | | | | | 0.27 | | | | |
| | 2:10 P | | | | | | DTPA | | | | | |
| | 5:30 P | | 950 | 4540 | 4.8 | 53,398 | | | | | | |
| | 6:30 P | | | | | | | | 557 | 127 | 7,257 | |
| 12-7 | 4:20 A | | 850 | 1852 | 2.2 | 55,250 | | | | | | |
| | 1:40 P | | 925 | 386 | 0.42 | 55,636 | | | | | | |
| | 11:00 P | | 950 | 961 | 1.0 | 56,597 | | | | | | |
| | 11:10 P | | | | | | | | 314 | 710 | 7,967 | |
| 12-8 | 8:30 A | | 700 | 605 | 0.86 | 57,202 | | | | | | |
| | 12:30 P | | 900 | 1509 | 1.68 | 58,711 | | | | | | |
| | 7:15 P | | 900 | 619 | 0.69 | 59,330 | | | | | | |
| | 7:30 P | | | | | | | | 171 | 69 | 8,036 | |

1133863

# MONITORING AND BIOASSAY DATA SHEET

| Date | Time | Wound Monitor d/m | Urine Samples & Analyses | | | | Chelating Agent | Blood | Fecal Samples and Analyses | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Vol. (ml) | Total d/m | d/m ml | Accumulative d/m | | d/m ml | Weight (gms) | Total d/m | Accumulative d/m | |
| 1969 | | | | | | | | | | | | |
| 3-18 | 12 N | | 1675 | 7.8 | 0.005 | 126,768 | | | | | | |
| 3-24 | 10:15 A | 1.9 x 10³ | | | | | | | | | | |
| | 12 N | | 1700 | 11 | 0.006 | | | | | | | |
| | 12:30 P | | | | | | | 0.014 | | | | |
| 3-25 | 12 N | | 2100 | 13 | 0.006 | | | | | | | |
| 3-26 | 12 N | | 1975 | 11 | 0.006 | 126,852 | | | | | | |
| 4-7 | 10:00 A | 1.9 x 10³ | | | | | | | | | | |
| | 12 N | | 1900 | 6 | 0.003 | | | | | | | |
| | 12:30 P | | | | | | | 0.007 | | | | |
| 4-8 | 12 N | | 1750 | 8.6 | 0.005 | | | | | | | |
| 4-9 | 12 N | | 1850 | 6.9 | 0.004 | 126,915 | | | | | | |
| 4-14 | 12 N | | 1790 | 8.1 | 0.005 | | | | | | | |
| 4-15 | 12 N | | 2150 | 7.6 | 0.004 | 126,971 | | | | | | |
| 4-21 | 10:15 A | 1.3 x 10³ | | | | | | | | | | |
| | 12 N | | 2100 | 5.9 | 0.003 | | | | | | | |
| | 12:30 P | | | | | | | 0.012 | | | | |
| 4-22 | 12 N | | 2025 | 5.0 | 0.002 | | | | | | | |
| 4-23 | 12 N | | 2000 | 6.4 | 0.003 | 127,008 | | | | | | |
| 4-28 | 12 N | | 1750 | 7.4 | 0.004 | | | | | | | |
| 4-29 | 12 N | | 2555 | 6.6 | 0.003 | 127,057 | | | | | | |
| 5-5 | 10:15 A | 890 | | | | | | | | | | |
| | 12 N | | 1550 | 7.7 | 0.005 | | | | | | | |
| | 12:30 P | | | | | | | Lost | | | | |
| 5-6 | 12 N | | 2175 | 5.6 | 0.002 | | | | | | | |
| 5-7 | 12 N | | 1925 | 5.6 | 0.003 | 127,101 | | | | | | |
| 5-19 | 12 N | | 2550 | 5.4 | 0.002 | | | | | | | |
| 5-20 | 12 N | | 1225 | 3.8 | 0.003 | 127,133 | | | | | | |

12.25 1675 5.2

1133864

| Date | Time | Wound Monitor d/m | Urine Samples & Analyses: Vol. (ml) | Total d/m | d/m ml | Accumulative d/m | Chelating Agent | Blood d/m ml | Fecal Samples and Analyses: Weight (gms) | Total d/m | Accumulative d/m | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1969 2-11 | 10:15 A | $2.5 \times 10^3$ | | | | | | | | | | |
| | 12 N | | 2825 | 305 | 0.11 | 124,513 | | | | | | |
| | 12:30 P | | | | | | DTPA(22) | 0.015 | | | | (22) Same as (17) |
| 2-12 | 12 N | | 2675 | 165 | 0.06 | 124,678 | | | | | | |
| | 6:00 P | | | | | | | | 137 | 22 | 12,086 | |
| 2-13 | 12 N | | 2200 | 340 | 0.15 | 124,018 | | | | | | |
| | 12:15 P | | | | | | | 0.020 | | | | |
| | 12:30 P | | | | | | DTPA | | | | | |
| 2-14 | 10:30 A | $1.8 \times 10^3$ | | | | | | | | | | |
| | 12 N | | 2825 | 295 | 0.1 | 125,313 | | | | | | |
| | 12:15 P | | | | | | | 0.016 | | | | |
| | 12:30 P | | | | | | DTPA | | | | | |
| 2-15 | 12 N | | 2675 | 130 | 0.05 | 125,443 | | | | | | |
| 2-16 | 12 N | | 1150 | 97 | 0.08 | 125,540 | | | | | | |
| 2-17 | 10:30 A | $2.0 \times 10^3$ | | | | | | | | | | |
| | 12 N | | 2250 | 265 | 0.12 | 125,805 | | | | | | |
| | 12:30 P | | | | | | | 0.016 | | | | |
| | 12:45 P | | | | | | DTPA | | | | | |
| 2-18 | 12 N | | 2000 | 265 | 0.13 | 126,070 | | | | | | |
| | 12:30 P | | | | | | | 0.013 | | | | |
| | 12:45 P | | | | | | DTPA(23) | | | | | (23) Chelation discontinued |
| 2-19 | 12 N | | 1650 | 112 | 0.07 | 126,182 | | | | | | |
| 2-20 | 10:30 A | $1.8 \times 10^3$ | | | | | | | | | | Chest, kidney, and liver surveyed with whole body counter on 2/20/69 |
| | 12 N | | 1900 | 82 | 0.04 | 126,264 | | | | | | |
| 2-21 | 12 N | | 1125 | 48 | 0.04 | 126,312 | | | | | | |
| 2-22 | 12 N | | 1500 | 51 | 0.03 | 126,363 | | | | | | |
| 2-23 | 12 N | | 1075 | 41 | 0.04 | 126,404 | | | | | | |
| 2-24 | 12:30 P | | | | | | | 0.027 | | | | |
| 3-3 | 12 N | | 2450 | 24 | 0.01 | 126,572 | | | | | | |
| 3-10 | 10:15 A | $1.8 \times 10^3$ | | | | | | | | | | |
| | 12 N | | 2225 | 16 | 0.07 | 126,684 | | | | | | |
| | 12:30 P | | | | | | | 0.02 | | | | |
| 3-17 | 12 N | | 2025 | 16 | 0.008 | | | | | | | |

| Date | Time | Wound Monitor d/m | Urine Samples & Analyses | | | | Che-lating Agent | Blood | Fecal Samples and Analyses | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Vol. (ml) | Total d/m | d/m ml | Accumu-lative d/m | | d/m ml | Weight (gms) | Total d/m | Accumu-lative d/m | |
| 1969 1-28 | 10:15 A | 3.3 x 10³ | | | | | | | | | | |
| | 12 N | | 3075 | 660 | 0.21 | 120,017 | | | | | | |
| | 12:30 P | | | | | | DTPA | 0.035 | | | | |
| 1-29 | 12 N | | 1600 | 177 | 0.11 | 120,194 | | | | | | |
| | 6:00 P | | | | | | | | 187 | 55 | 11,785 | |
| 1-30 | 12 N | | 2375 | 585 | 0.25 | 120,779 | | | | | | |
| | 12:30 P | | | | | | DTPA | 0.017 | | | | |
| 1-31 | 10:30 A | 2.7 x 10³ | | | | | | | | | | |
| | 11:30 A | | | | | | DTPA(17) | 0.009 | | | | (17) DTPA administered in saline solution instead of glucose |
| | 12 N | | 2200 | 550 | 0.25 | 121,329 | | | | | | |
| 2-1 | 12 N | | 1700 | 170 | 0.10 | 121,499 | | | | | | |
| 2-2 | 12 N | | 2700 | 157 | 0.06 | 121,656 | | | | | | |
| 2-3 | 10:30 A | 2.4 x 10³ | | | | | | | | | | |
| | 12 N | | 2900 | 590 | 0.20 | 122,246 | | | | | | |
| | 12:30 P | | | | | | DTPA | 0.033 | | | | |
| 2-4 | 10:30 A | 3.0 x 10³ | | | | | | | | | | |
| | 12 N | | 2375 | 400 | 0.17 | 122,646 | | | | | | |
| | 12:30 P | | | | | | DTPA(18) | 0.005 | | | | (18) Same as (17) |
| 2-5 | 10:30 A | 2.5 x 10³ | | | | | | | | | | |
| | 12 N | | 2100 | 185 | 0.09 | 122,831 | | | | | | |
| | 5:50 P | | | | | | | | 136 | 21 | 11,932 | |
| 2-6 | 10:30 A | 2.6 x 10³ | | | | | | | | | | |
| | 12 N | | 2300 | 350 | 0.15 | 123,181 | | | | | | |
| | 12:15 P | | | | | | DTPA(19) | 0.022 | | | | (19) Same as (17) |
| 2-7 | 10:30 A | 2.6 x 10³ | | | | | | | | | | |
| | 12 N | | 1950 | 290 | 0.15 | 123,471 | | | | | | |
| | 12:15 P | | | | | | DTPA(20) | 0.021 | | | | (20) Same as (17) |
| 2-8 | 12 N | | 1725 | 180 | 0.1 | 123,651 | | | | | | |
| 2-9 | 12 N | | 1980 | 97 | 0.05 | 123,748 | | | | | | |
| 2-10 | 12 N | | 2375 | 460 | 0.19 | 124,208 | | | | | | |
| | 12:30 P | | | | | | DTPA(21) | 0.037 | | | | (21) Same as (17) |

1133866

| Date | Time | Wound Monitor d/m | Urine Samples & Analyses | | | | Chelating Agent | Blood | Fecal Samples and Analyses | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Vol. (ml) | Total d/m | d/m ml | Accumulative d/m | | d/m ml | Weight (gms) | Total d/m | Accumulative d/m | |
| 1969 | | | | | | | | | | | | |
| 1-13 | 10:30 A | $4.4 \times 10^3$ | | | | | | | | | | |
| | 12 N | | 2000 | 810 | 0.41 | 116,320 | | | | | | |
| | 12:30 P | | | | | | DTPA | 0.038 | | | | |
| 1-14 | 10:30 A | $4.2 \times 10^3$ | | | | | | | | | | |
| | 12 N | | 2050 | 690 | 0.34 | 117,010 | | | | | | |
| | 12:30 P | | | | | | DTPA | 0.031 | | | | |
| 1-15 | 10:15 A | $3.8 \times 10^3$ | | | | | (16) | | | | | (16) Period of no chelation from 12 Noon on 1/15 to 12 Noon on 1/27/69 |
| | 12 N | | 1450 | 255 | 0.18 | 117,265 | | | | | | |
| | 6:00 P | | | | | | | | 105 | 76 | 10,756 | |
| 1-16 | 10:20 A | $3.7 \times 10^3$ | | | | | | | | | | |
| | 12 N | | 1650 | 205 | 0.12 | 117,470 | | | | | | |
| 1-17 | 10:30 A | $3.7 \times 10^3$ | | | | | | | | | | |
| | 12 N | | 1550 | 165 | 0.11 | 117,635 | | | | | | |
| | 12:30 P | | | | | | | 0.023 | | | | |
| 1-18 | 12 N | | 2550 | 155 | 0.06 | 117,790 | | | | | | |
| 1-19 | 12 N | | 1850 | 100 | 0.05 | 117,890 | | | | | | |
| 1-20 | 10:30 A | $3.6 \times 10^3$ | | | | | | | | | | |
| | 12 N | | 2200 | 87 | 0.04 | 117,977 | | | | | | |
| 1-21 | 10:20 A | $3.6 \times 10^3$ | | | | | | | | | | |
| | 12 N | | 2400 | 115 | 0.05 | 118,092 | | | | | | |
| | 12:30 P | | | | | | | 0.037 | | | | |
| 1-22 | 10:00 A | $3.7 \times 10^3$ | | | | | | | | | | |
| | 12 N | | 1540 | 80 | 0.05 | 118,172 | | | | | | |
| | 7:30 P | | | | | | | | 216 | 92 | 11,400 | |
| 1-23 | 12 N | | 1800 | 97 | 0.05 | 118,269 | | | | | | |
| 1-24 | 10:30 A | $4.0 \times 10^3$ | | | | | | | | | | |
| | 12 N | | 1410 | 73 | 0.05 | 118,342 | | | | | | |
| | 12:30 P | | | | | | | 0.027 | | | | |
| 1-25 | 12 N | | 1800 | 119 | 0.07 | 118,461 | | | | | | |
| 1-26 | 12 N | | 2450 | 156 | 0.06 | 118,617 | | | | | | |
| 1-27 | 12 N | | 3130 | 740 | 0.24 | 119,357 | | | | | | |
| | 12:30 P | | | | | | DTPA | 0.031 | | | | |

| Date | Time | Wound Monitor d/m | Urine Samples & Analyses: Vol. (ml) | Total d/m | d/m ml | Accumulative d/m | Chelating Agent | Blood d/m ml | Fecal Samples and Analyses: Weight (gms) | Total d/m | Accumulative d/m | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1969 1-7 | 1:36 A | | 565 | 150 | 0.27 | 111,215 | | | | | | |
| | 6:00 A | | 205 | 260 | 1.3 | 111,475 | | | | | | |
| | 7:40 A | | 175 | 30 | 0.18 | 111,505 | | | | | | |
| | 9:50 A | | 240 | 52 | 0.22 | 111,557 | | | | | | |
| | 10:30 A | $4.3 \times 10^3$ | | | | | | | | | | |
| | 11:55 A | | 91 | 45 | 0.50 | 111,602 | | | | | | |
| | 12:45 P | | | | | | DTPA | | | | | |
| | 1:00 P | | | | | | | 0.024 | | | | |
| | 1:40 P | | 2450 | 890 | 0.36 | 112,492 | | | | | | |
| 1-8 | 10:00 A | $5.0 \times 10^3$ (14) | | | | | | | | | | (14) Began routine use of Monitor #2 |
| | 12 N | | 1475 | 520 | 0.35 | 113,012 | | | | | | |
| | 7:15 P | | | | | | | | 184 | 30 | 10,224 | Right lung and kidney surveyed with whole body counter on 1/8/69 |
| 1-9 | 10:30 A | $4.9 \times 10^3$ | | | | | | | | | | |
| | 12:20 P | | | | | | DTPA | 0.026 | | | | |
| | 3:00 P | | 130 | 185 | 1.42 | 113,197 | | | | | | |
| | 5:45 P | | 107 | 252 | 2.4 | 113,449 | | | | | | |
| | 8:30 P | | 175 | 222 | 1.3 | 113,671 | | | | | | |
| | 9:30 P | | 95 | 53 | 0.56 | 113,724 | | | | | | |
| 1-10 | 6:00 A | | 680 | 312 | 0.46 | 114,036 | | | | | | |
| | 8:10 A | | 204 | 44 | 0.22 | 114,080 | | | | | | |
| | 10:15 A | | 146 | 49 | 0.34 | 114,129 | | | | | | |
| | 10:30 A | $4.7 \times 10^3$ | | | | | | | | | | |
| | 12 N (15) | | 2800 | 775 | 0.28 | 114,904 | | | | | | (15) 24 hour composite urine sample from this date until present |
| | 12:30 P | | | | | | DTPA | 0.024 | | | | |
| 1-11 | 12 N | | 1860 | 336 | 0.18 | 115,240 | | | | | | |
| 1-12 | 12 N | | 3000 | 270 | 0.09 | 115,510 | | | | | | |

| Date | Time | Wound Monitor d/m | Urine Samples & Analyses: Vol. (ml) | Total d/m | d/m ml | Accumulative d/m | Chelating Agent | Blood d/m ml | Fecal Samples and Analyses: Weight (gms) | Total d/m | Accumulative d/m | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 | | | | | | | | | | | | |
| 12-31 | 2:25 A | | 170 | 302 | 1.77 | 103,584 | | | | | | |
| | 7:35 A | | 475 | 315 | 0.66 | 103,899 | | | | | | |
| | 10:30 A | 6.6 x 103 | | 2317 | | | | | | | | |
| | 12:15 P | | | | | | DTPA | 0.039 | | | | |
| | 1:50 P | | 550 | 336 | 0.61 | 104,235 | | | | | | |
| | 6:45 P | | 900 | 835 | 0.93 | 105,070 | | | | | | |
| 1969 | | | | | | | | | | | | |
| 1-1 | 12:45 A | | 900 | 1100 | 1.22 | 106,170 | | | | | | |
| | 1:00 P | | 950 | 420 | 0.44 | 106,590 | | | | | | |
| | 9:45 P | | | | | | | | 93 | 25 | 10,014 | |
| | 10:30 P | | 900 | 163 | 0.18 | 106,753 | | | | | | |
| 1-2 | 7:45 A | | 900 | 158 | 0.18 | 106,911 | | | | | | |
| | 10:30 A | 7.2 x 103 | | | | | | | | | | |
| | 12:45 P | | | | | | DTPA | 0.05 | | | | |
| | 1:30 P | | 400 | 250 | 0.63 | 107,161 | | | | | | |
| | 6:15 P | | 800 | 670 | 0.84 | 107,831 | | | | | | |
| 1-3 | 7:45 A | | 425 | 160 | 0.38 | 107,991 | | | | | | |
| | 10:30 A | 6.0 x 103 | | [illegible] | | | | | | | | |
| | 12:15 P | | | | | | DTPA | | | | | |
| | 1:00 P | | | | | | | 0.033 | | | | |
| | 1:30 P | | 550 | 394 | 0.72 | 108,385 | | | | | | |
| | 5:30 P | | 950 | 590 | 0.62 | 108,975 | | | | | | |
| 1-4 | 1:40 A | | 925 | 195 | 0.21 | 109,170 | | | | | | |
| | 7:30 A | | 750 | 378 | 0.50 | 109,548 | | | | | | |
| | 2:00 P | | 925 | 262 | 0.28 | 109,810 | | | | | | |
| 1-5 | 10:30 A | | 925 | 156 | 0.17 | 109,966 | | | | | | |
| | 12:30 P | | 925 | 80 | 0.09 | 110,046 | | | | | | |
| | 9:40 P | | 850 | 137 | 0.16 | 110,183 | | | | | | |
| 1-6 | 7:40 A | | 525 | 71 | 0.14 | 110,254 | | | | | | |
| | 10:30 A | 5.8 x 103 | | | | | | | | | | |
| | 1:00 P | | | | | | DTPA | | | | | |
| | 1:20 P | | | | | | | 0.033 | | | | |
| | 1:30 P | | 475 | 104 | 0.22 | 110,358 | | | | | | |
| | 2:10 P | | 125 | 86 | 0.69 | 110,444 | | | | | | |
| | 4:09 P | | 150 | 234 | 1.6 | 110,678 | | | | | | |
| | 6:06 P | | 130 | 144 | 1.1 | 110,822 | | | | | | |
| | 7:55 P | | 170 | 115 | 0.68 | 110,937 | | | | | | |
| | 10:05 P | | 190 | 128 | 0.67 | 111,065 | | | | | | |

| Date | Time | Wound Monitor d/m | Urine Samples & Analyses: Vol. (ml) | Total d/m | d/m ml | Accumulative d/m | Chelating Agent | Blood d/m ml | Fecal Samples and Analyses: Weight (gms) | Total d/m | Accumulative d/m | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 12-19 | 6:00 A | | 250 | 140 | 0.52 | 91,127 | | | | | | Spital <0.01 d/m/ml |
| | 7:40 A | | 400 | 210 | 0.53 | 91,337 | | | | | | |
| | 11:00 A | 1.3 x 104 | | | | | | | | | | |
| | 12:30 P | | | | | | | 0.034 | | | | |
| | 1:20 P | | 450 | 937 | 2.1 | 92,274 | | | | | | |
| | 5:30 P | | 850 | 645 | 0.76 | 92,919 | | | | | | Spital <0.01 d/m/ml |
| 12-20 | 5:45 A | | 450 | 778 | 1.7 | 93,697 | | | | | | Liver & left kidney surveyed with whole body counter on 12/20/68 |
| | 7:40 A | | 900 | 403 | 0.45 | 94,100 | | | | | | |
| | 10:30 A | 1.3 x 104 | | | | | DTPA | 0.051 | | | | |
| | 12:30 P | | 225 | | | | | | | | | |
| | 2:00 P | | 450 | 523 | 1.16 | 94,623 | | | | | | |
| 12-21 | (11) | | (12) | 5930 | 0.36 | 100,553 | EDTA(13) | | | | | (11) Vacation (12-21 thru 12-30-68) (12) Urine discharge for vacation period collected in one bottle - 16,450 ml (13) Four 335 mg tablets (1.3 grams/day) of EDTA were taken at meals and bedtime. |
| 12-25 | 7:35 P | | | | | | | | 200 | 79 | 9,839 | |
| 12-30 | 7:30 A | | 750 | 49 | 0.07 | 100,602 | | | | | | |
| | 11:00 A | 1.0 x 104 | | | | | DTPA | 0.076 | | | | |
| | 12:30 P | | | | | | | | | | | |
| | 1:25 P | | 800 | 1130 | 1.41 | 101,732 | | | | | | |
| | 7:20 P | | 900 | 1550 | 1.72 | 103,282 | | | | | | |

Rec'd July 15, 1969

| 5-20 | Vol. | gal/min |
|---|---|---|
| 6-4 | 1800 | 4.2 |
| 6-5 | 2450 | 4.9 |
| 6-16 | 2600 | 2.7 |
| 6-17 | 1700 | 6.3 |

7-2

7-3

Feldman