PALOMARES NUCLEAR WEAPONS ACCIDENT





REVISED DOSE EVALUATION REPORT

Volume II Appendix C – Draft Individual Dose Estimates Appendix C.1 – High 26 Cases

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Prepared For: Radiation Protection Division

Air Force Medical Operations Agency

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APPENDIX C PRELIMINARY INDIVIDUAL DOSE ESTIMATES

Portions of this report have been designated records subject to the restriction of the Privacy Act, 5 U.S.C. 552(a) and are so marked.



This appendix contains the results of evaluating the intakes and committed effective doses for the participants involved in the Palomares Nuclear Weapons Accident response whose records were provided for this study. The appendix contains four sections corresponding to the four main groups of cases evaluated – High 26 Cases, Repeat Analysis cases, below the Contamination Cutoff Cases, and Remaining Cases as explained in the body of this report. Because of their size, Appendix C.1 and Appendix C.2 are contained in separate binders labeled Volume II and Volume III.

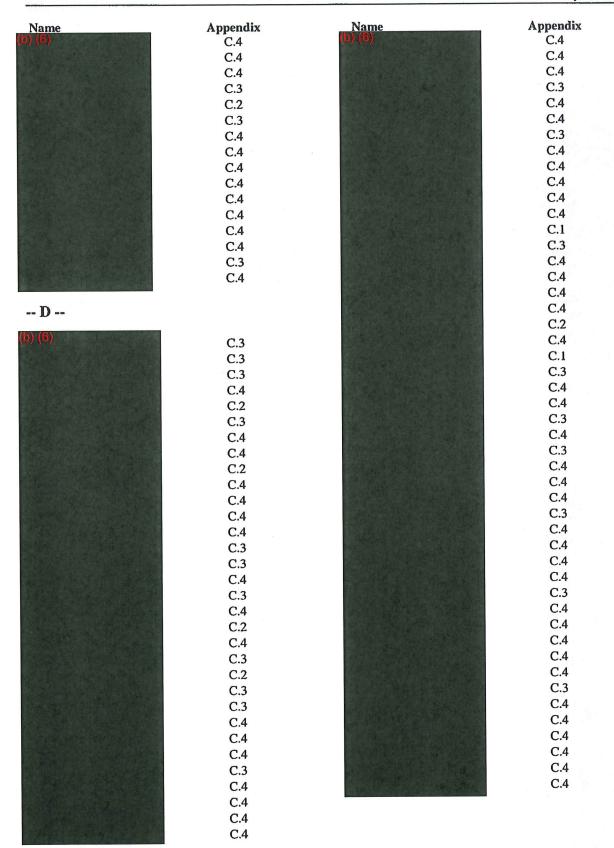
The following pages contain a directory of all individuals included in the effort, listed alphabetically by last name with the appendix containing that person's records.

			April 2
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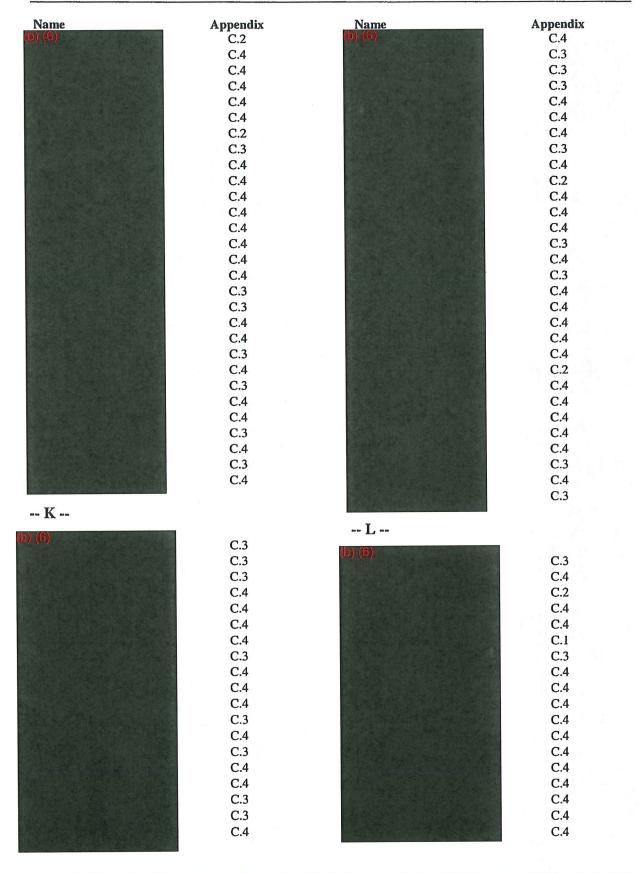


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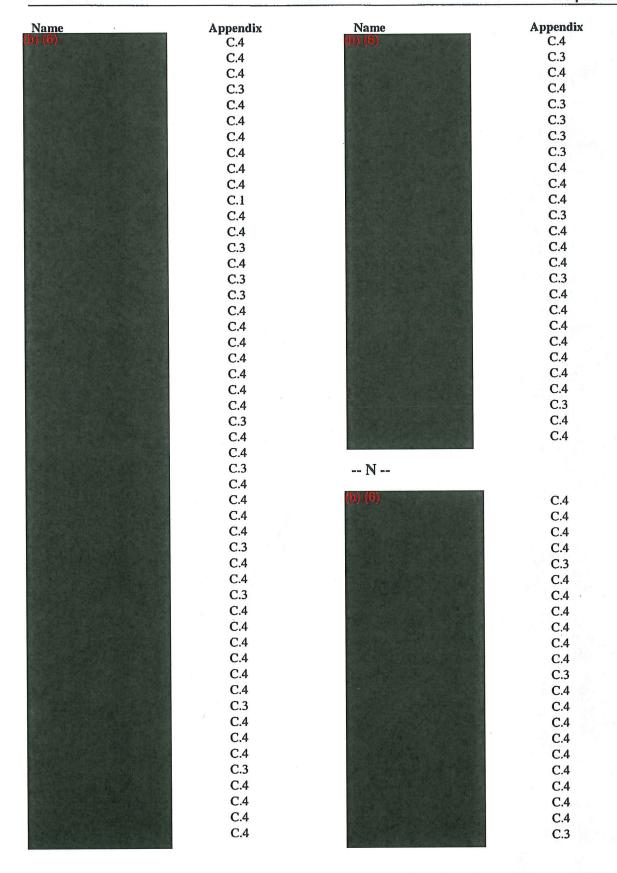
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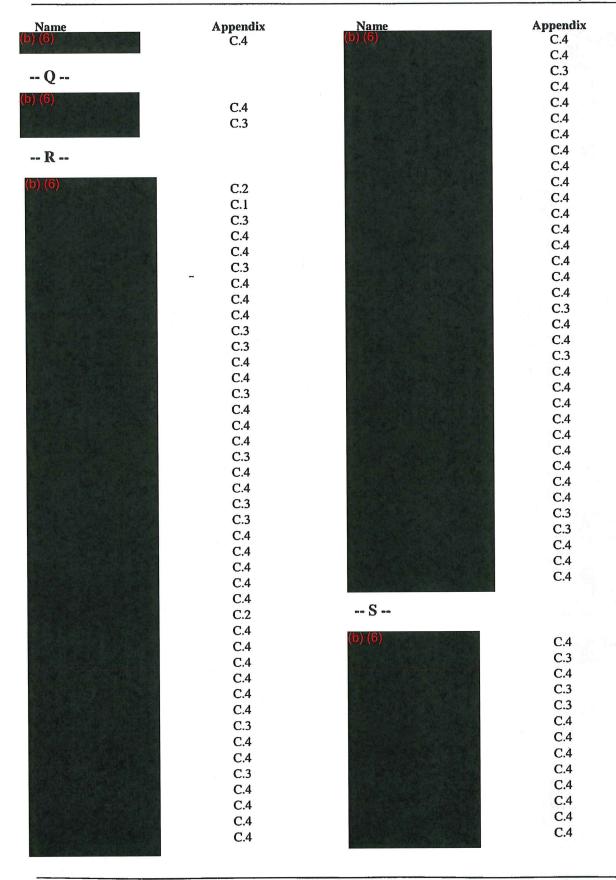
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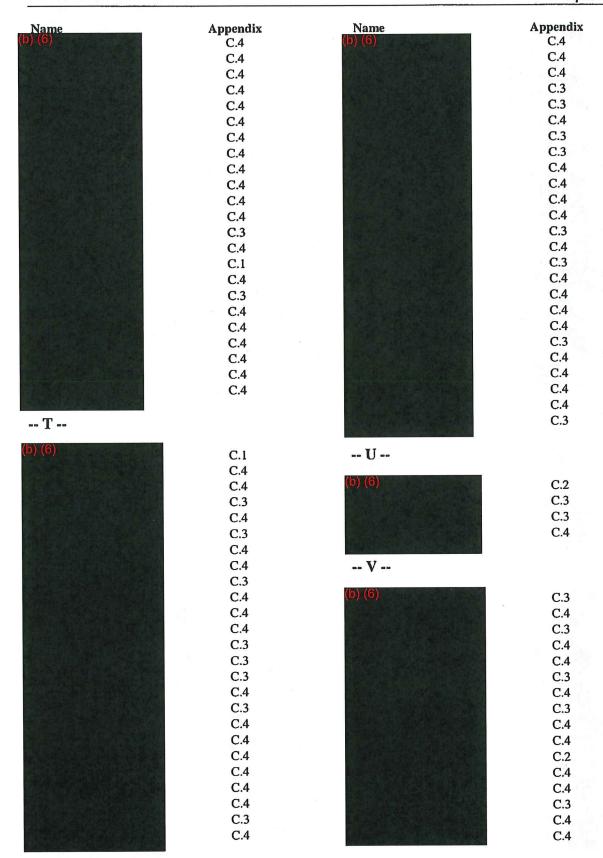


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PALOMARES NUCLEAR **WEAPONS ACCIDENT**



DRAFT



PRIVACY ACT INFORMATION

FOR OFFICIAL USE ONLY

NOT TO BE DISSEMINATED

Date: **April 2001**

Contract: Contract: GS-35F-4813G

Task Order: WFZ578410

T0799BG0031

Prepared For: Radiation Protection Division

Air Force Medical Operations Agency

Bolling AFB, DC 20332-7050

Prepared By: LABAT-ANDERSON INCORPORATED

8000 West Park Drive, Suite 400

McLean, VA 22102

APPENDIX C.1

HIGH 26 CASES

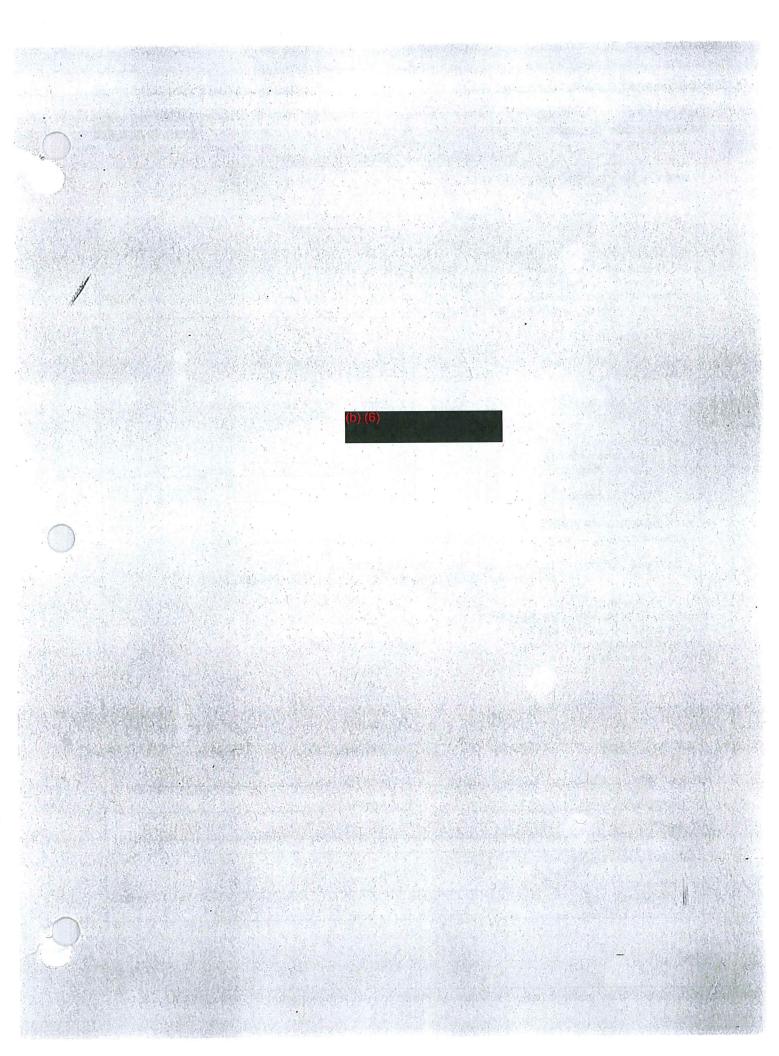
Portions of this report have been designated records subject to the restriction of the Privacy Act, 5 U.S.C. 552(a) and are so marked.

APPENDIX C.1 HIGH 26 CASES

This appendix contains the results of evaluating the intakes and committed effective dose equivalents for the 26 individuals referred to as the "High 26" during the assessments at the time of and after the accident. The results for each individual are reported in a case file containing a Summary Sheet, a narrative discussion of the case evaluation, and the records available-urinalysis results, notes, and correspondence.

Results are presented for the following individuals.





(b) (6)

(b) (6)

Internal D	osimetry Evaluation Form
NAME: (6) (6)	SSN: (b) (6)
MODE OF INTAKE: Inhalation	on 1/29/66 assumed start. Pu/100% Class Y/1 μm AMAD from 10/07/66 to 08/14/67
EVALUATION DATA: Air Sampling	ed
Skin Decontamination: Skin Decorporation: Yes Catharsis: Surgical excision: Yes	⊠ No Date: ⊠ No Agent: Date: ⊠ No Agent: Date: ⊠ No Date: Date:
Assumptions: Acute inhalation intake of ²³⁹ Pu, 10 Code/Model used for: Intake Estimate: CINE Dose Estimate: CINE	
RESULTS SUMMARY Estimated Intake Activity (pCi): 68,000 50 YR CEDE (rem): 21 (0.21 Sv) Organ Dose Equivalent Summary Bone Surface Lung Liver Red Marrow Other Testes	50 YR CDE (rem/Sv) 210/2.1 78/0.78 38/0.38 16/0.16 3.6/0.036 3.0/0.030
DOSE ASSESSOR: DATE:	PEER REVIEWER: DATE:
Signature: Print Name: SSN:	Signature: Print Name: SSN:
RECOMMENDATIONS: Additional Bioassay Required Suggested Sampling Frequency: Work Restrictions: N/A	☐ Urinalysis ☐ Fecal ☐ In Vivo



(b)(6)

Preliminary Internal Dosimetry Case Narrative

Identification:

Name: SSN:



Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. One urine sample data card indicated an exposure of 29 January 1966. Other cards indicated exposure during January – March 1966. An exposure date of 29 January 1966 corresponding to the start of the exposure period was chosen as most conservative (see report).

Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

Date	% Body Burden
10/7/66	16
1/20/67	0
4/10/67	0
8/14/67	0

Radionuclide(s): 239Pu.

Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1 μm AMAD particle size on 1/29/66. The date is the first day of the period on station from 1/29/66 to 2/19/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.



(b) (6)

b) (6)

Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

_	Sample	*Analysis	Date	Elapsed Days	Result (pCi/day)	Error (pCi/day)	Included
	66-4942	AS	10/07/66	251	0.212	0.11	√
	67-0364	AS	01/20/67	356	ND		✓
	67-1298	AS	04/10/67	436	0.00562	0.00563	✓
	67-3976	AS	08/14/67	562	ND	0.00505	✓

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	68,000	21/0.21
LUDEP	22,000	1.6/0.016

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results.

			Weighted Organ
	Dose Equivalent	Weighting	Dose Equivalent
Organ	(rem/Sv)	Factors	(rem/Sv)
Testes	3.0E+00/3.0E-02	2.5E-01	7.6E-01/7.6E-03
Breast	1.0E-04/1.0E-06	1.5E-01	1.5E-05/1.5E-07
Red Marrow	1.6E+01/1.6E-01	1.2E-01	2.0E+00/2.0E-021
Lung	7.8E+01/7.8E-01	1.2E-01	9.3E+00/9.3E-02
Thyroid	9.5E-05/9.5E-07	3.0E-02	2.8E-06/2.8E-08
Bone Surface	2.1E+02/2.1E+00	3.0E-02	6.4E+00/6.4E-02
Liver	3.8E+01/3.8E-01	6.0E-02	2.3E+00/2.3E-02
Other	3.6E+00/3.6E-02	6.0E-02	2.2E-01/2.2E-03
Lower Large Intestine	7.7E-03/7.7E-05	6.0E-02	4.6E-04/4.6E-06
Upper Large Intestine	2.6E-03/2.6E-05	6.0E-02	1.6E-04/1.6E-06
Small Intestine	5.3E-04/5.3E-06	6.0E-02	3.2E-05/3.2E-07
Effective Dose Equivaler	nt		2.1E+01/2.1E-01

Four urine samples were analyzed by alpha spectrometry. Three of those were reported as NDA (no detectable activity) and one was reported with a positive result. One of those reported as NDA contained a



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(b) (6)

(b) (6)

calculated result of 0.00562 +/- 0.00563 (1 sigma). The four values were fit using CINDY and the Jones excretion model to estimate an intake (68,000 pCi), organ doses, and a CEDE (21 rem/0.21 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 22,000 pCi and a CEDE (ICRP-60) of 1.6 rem (0.016 Sv).

Conclusion:

Based on the results of intake estimates and dose calculations, this individual received an intake of 22,000 to 68,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 1.6 to 21 rem (0.016 to 0.21 Sv). In general, serious health consequences are not associated with these dose levels. The LUDEP dose is well below the annual occupational limit (5 rem) while the CINDY dose is about four times that limit. Also, it is about one half the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). Serious health effects are not normally associated with these dose levels.

Prepared By:	
Name:	
Signature:	Date:
Peer Reviewed By:	
Name:	
Signature:	Date:

AFSN:	INTER	HAL DOSE DATA	
HAME (LAST, FIRST, M.I.) (1	1 • 20) SOC. 5		MPLE (30) TYPE AHAL. (31-32)
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SAMPLE NO. (33-38)	SAMPLE DATE (39 - 44)	19 FeB 6 6	EXPOSURE
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BASE (57-60)	OCCUPATION (61 - 62)	REQUESTED BY	
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	SAMPLE VOLUME	1000 ml	DATE ARACTEC
3 March 1966		-1 1000 MZ-	
TECHNICIAN (SIGNATURE A	ND DATE)		
		RADON	FECES/BLOOD
URINE			Counter Number
Counter Number		Chamber Number	
Counter Bkg. (cpm)		Cham. Bkg. (mv/sec)	Counter Bkg.
Counter Eff. (%)		Counter Eff. (%)	Counter Eff.
Date/Time - Start		Millivolt - Start	Date/Time - Start
-Stop		Millivolt - Stop	- Stop
Total Counts		Total Millivots	Total Counts
Counting Time		Total Drift Time	Counting Time
Gross cpm		Gross my/sec	Gross cpm
Bkg. Cpm		Bkg. My/sec	Bkg. cpm
Net cpm		Not my/soc	net cpm
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dpm/24 hr. (69 - 74)		litter (69 - 74)	dps/cc
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D(q) (63 · 68)			D(q) (63-68)

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Dose Evaluation Report April 28, 2000

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OTHER DATA)		
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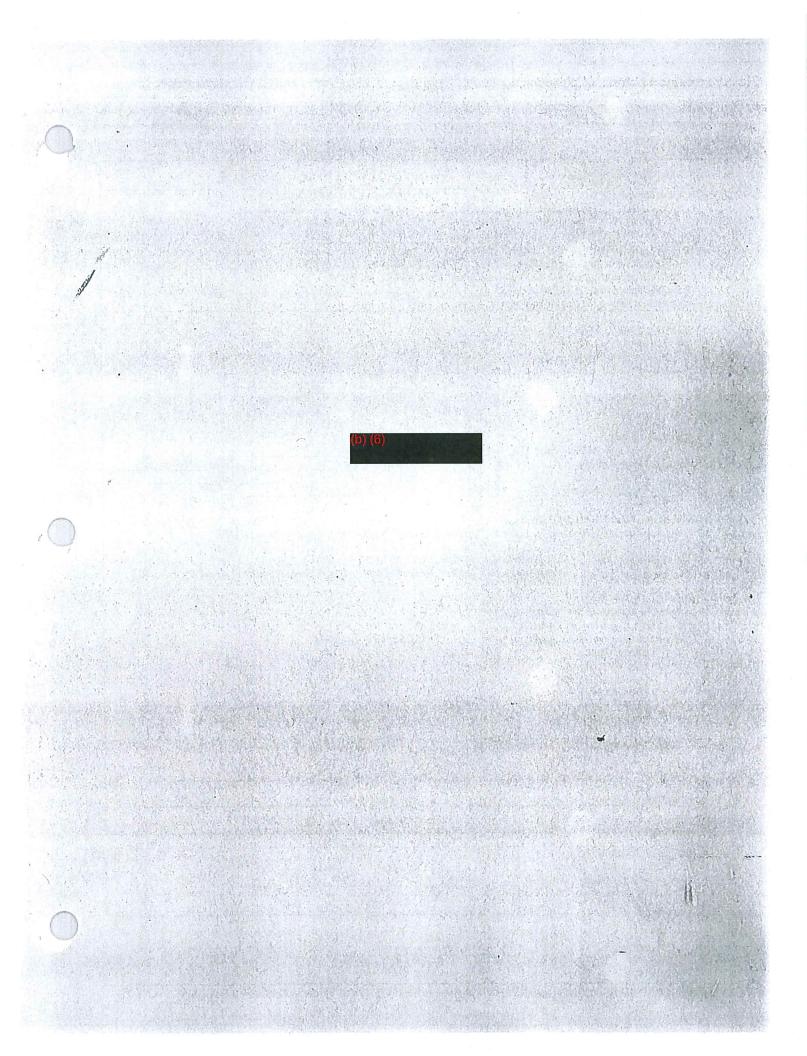
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DEPARTMENT OF THE AIR FORCE USAF RADIOLOGICAL HEALTH LABORATORY INFLCT WRIGHT-PATTERSON AIR FORCE BASE OHIO 45433 .7 Dec 1967 SGHW Long-Term Medical Föllow-Up, Palomares Operation Urine
Studies for Pu. 523 AF Band March AFB CA 92508 17 523 AF Band March AFB CA 92508

The Assacresult of your splendid cooperation in this program, and the special cooperation of the special coop Our files show that three sample bottles were sample samples were returned for analysis.

(b) (6) Chief



RECOMMENDATIONS:

Work Restrictions:

Additional Bioassay Required

Suggested Sampling Frequency:

Internal Dosimetry Evaluation Form NAME SSN: MODE OF INTAKE: INTAKE DATE OR PERIOD: **☒** Inhalation ☐ Injection 01/18/66 through 02/04/66 on site ■ Ingestion ☐ Absorption 1/18/66 assumed start date. Unknown ☐Not applicable SUMMARY OF EXPOSURE CONDITIONS: Radionuclides/Respiratory Class/Particle Size: 239Pu/100% Class Y/1 µm AMAD Date or Period of Evaluated Data: 5 urine samples from 02/04/66 to 08/12/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain **EVALUATION DATA:** Air Sampling □ Unavailable ☐ Attached In Process ☐ In Process☐ In Process Health Physics Survey Data ☐ Attached ☑ Unavailable Bioassay - Urinalysis ☐ Unavailable Fecal ☐ Attached In Process □ Unavailable **Nasal Smears** In Process □ Unavailable ☐ Attached In Vivo ☐ Attached ☐ In Process **⊠** Unavailable Medical Treatment: Skin Decontamination: ☐ Yes ⊠ No ☐ Yes Decorporation: ☑ No Agent: _ ☐ Yes ☐ Yes Agent: Catharsis: ⊠ No Date: Surgical excision: ⊠ No Date: **EVALUATION METHODOLOGY:** Assumptions: Acute inhalation intake of ²³⁹Pu, 100% Class Y, 1 µm AMAD particle size on 1/18/66. Code/Model used for: Intake Estimate: CINDY, Ver. 1.4/JONES Dose Estimate: CINDY, Ver. 1.4/ICRP 30, Part 4, General Systemic Model RESULTS SUMMARY Estimated Intake Activity (pCi): 86,000 **50 YR CEDE (rem):** 26 (0.26 Sv) **Organ Dose Equivalent Summary** 50 YR CDE (rem/Sv) **Bone Surface** 270/2.7 Lung 98/0.98 Liver 48/0.48 Red Marrow 21/0.21 Other 4.5/0.045 Testes 3.8/0.038 DOSE ASSESSOR: DATE: PEER REVIEWER: DATE: Signature: _ Signature: _ **Print Name:** Print Name: SSN:

Urinalysis

☐ Fecal

☐ In Vivo



Preliminary Internal Dosimetry Case Narrative

Identification:

Name: SSN:



Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. One urine sample data card indicated an exposure of 18 January 1966. Other cards indicated exposure during February 1966. An exposure date of 18 January 1966 corresponding to the start of the exposure period was chosen as most conservative (see report).

Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

Date	% Body Burden
2/4/66	-
6/14/66	9
1/19/67	3
4/24/67	0
8/12/67	0

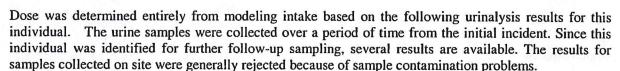
Radionuclide(s): ²³⁹Pu.

Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1 μ m AMAD particle size on 1/18/66. The date is the first day of the period on station from 1/18/66 to 2/4/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.





Sample	*Analysis	Date	Elapsed Days	Result (pCi/day)	Error (pCi/day)	Included
66-367	G	02/04/66	17	4.2	1.38	
66-3816	AS	06/14/66	147	0.231	0.078	✓
67-0436	AS	01/19/67	366	0.0443	0.0222	✓
67-2157	AS	04/24/67	461	ND		✓
67-5648		08/12/67	571	ND		✓

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	86,000	26/0.26
LUDEP	210,000	15/0.15

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

			Weighted Organ
	Dose Equivalent	Weighting	Dose Equivalent
Organ	(rem)	Factors	(rem)
Testes	3.8E+00/3.8E-02	2.5E-01	9.6E-01/9.6E-03
Breast	1.3E-04/1.3E-06	1.5E-01	1.9E-05/1.9E-07
Red Marrow	2.1E+01/2.1E-01	1.2E-01	2.5E+00/2.5E-02
Lung	9.8E+01/9.8E-01	1.2E-01	1.2E+01/1.2E-01
Thyroid	1.2E-04/1.2E-06	3.0E-02	3.6E-06/3.6E-08
Bone Surface	2.7E+02/2.7E+00	3.0E-02	8.0E+00/8.0E-02
Liver	4.8E+01/4.8E-01	6.0E-02	2.9E+00/2.9E-02
Other	4.5E+00/4.5E-02	6.0E-02	2.7E-01/2.7E-03
Lower Large Intestine	9.8E-03/9.8E-05	6.0E-02	5.9E-04/5.9E-06
Upper Large Intestine	3.3E-03/3.3E-05	6.0E-02	2.0E-04/2.0E-06
Small Intestine	6.7E-04/6.7E-06	6.0E-02	4.0E-05/4.0E-07
Effective Dose Equivale	2.6E+01/2.6E-01		



Revised Dose Evaluation Report April 2001

(b) (6)

(b) (6)

Four urine samples were analyzed by alpha spectrometry and one early sample by gross alpha counting. The gross alpha reported 4.2 +/- 1.38 pCi/day; however this was not used in our analysis because of suspected contamination from on-site collection of the samples. Two of four analyzed by alpha spectrometry were reported as NDA (no detectable activity) and two were reported with a positive result The four values were fit using CINDY and the Jones excretion model to estimate an intake (86,000 pCi), organ doses, and a CEDE (26 rem/0.26 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 207,000 pCi and a CEDE (ICRP-60) of 15 rem (.15 Sv).

Conclusion:

Prepared By:

Based on the results of intake estimates and dose calculations, this individual received an intake of 86,000 to 207,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 15 to 26 rem (0.15 to 0.26 Sv). The LUDEP and CINDY doses agree within a factor of two which is acceptable for this situation. The dose range is up to one-half the working lifetime guideline of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). Serious health consequences are not normally associated with these dose levels.

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Signature:	Date:
Peer Reviewed By:	
Name:	
Signature:	Date:

FEB 7 1966

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Dose Evaluation Report April 28, 2000

Palomares Nuclear Weapons Accident

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ablets of Alestranol stranol and 2 mg.

al Contraception

C-Quens®

Sequential folder containing fifteen 80-mcg. tablets of mestranol plus five tablets each combining 80 mcg. mestranol and 2 mg. chlormadinone acetate.

A More Physiological Approach to Oral Contraception

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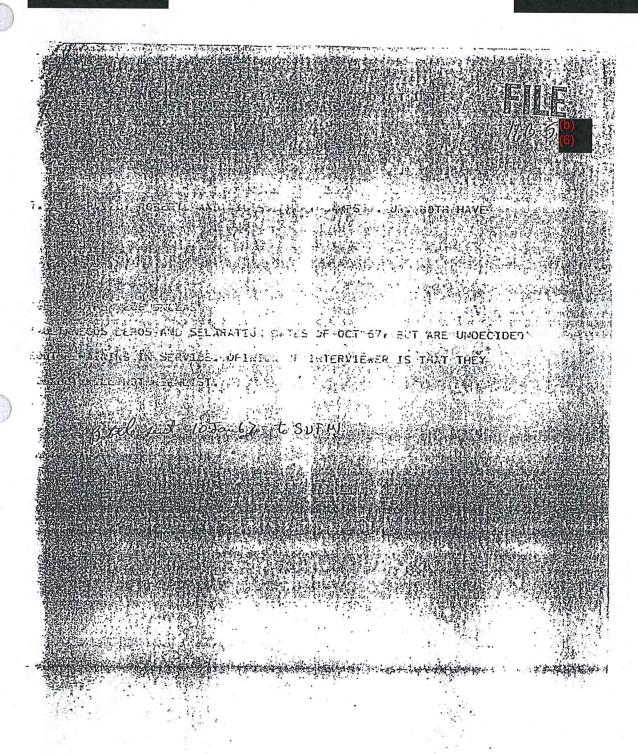
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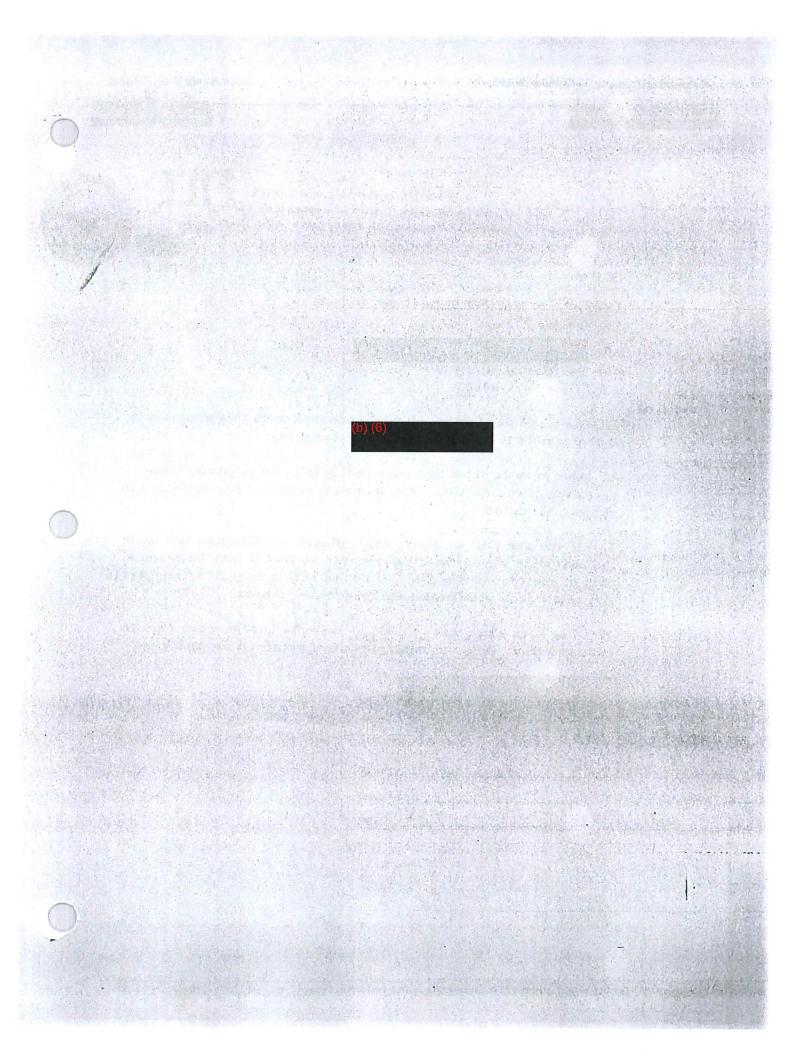
REPLY TO SGHW 7 Dec 1967

Long-Term Medical Follow-Up, Palomares Operation Urine SUBJECT Studies for 239 Pu.

> AZC 401 Tac Hosp (MSMH) APO New York 09283

- As a result of your splendid cooperation in this program, it is possible to discontinue further sampling.
- Our results show that your health is in no jeopardy from retention of radioactive materials as a result of participation in subject operation.
- If you are still on active duty, please present this letter to the custodian of your medical records so that it may be made a part of your permanent file. If not on active duty, it is suggested you retain it in your permanent personal records.
- sample bottles were sent to Our files show that three samples were returned for analysis. you, and that three

LtCol, USAF, MC







(b) (6)

Internal Dosimetry Evaluation Form SSN NAME INTAKE DATE OR PERIOD: MODE OF INTAKE: 01/18/66 through 03/20/66 on site ☐ Injection Absorption 1/18/66 assumed start. ■ Ingestion Unknown ☐Not applicable SUMMARY OF EXPOSURE CONDITIONS:
Radionuclides/Respiratory Class/Particle Size: 239Pu/100% Class Y/1 µm AMAD Date or Period of Evaluated Data: 5 urine samples from 03/20/66 to 04/30/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain **EVALUATION DATA:** □ Unavailable ☐ Attached Air Sampling ☐ In Process ☑ Unavailable ☐ In Process Health Physics Survey Data Attached Unavailable In Process Bioassay - Urinalysis □ Unavailable ☐ Attached ☐ In Process Fecal ☐ In Process☐ In Process Attached
Attached **⊠** Unavailable Nasal Smears **⊠** Unavailable In Vivo Medical Treatment: Skin Decontamination: Yes ⊠ No Date: ___ ☐ Yes ⊠ No Agent: Decorporation: ⊠ No Agent: _____ Date: ___ Catharsis: ☐ Yes Yes No No Date: Surgical excision: **EVALUATION METHODOLOGY:** Assumptions: Acute inhalation intake of ²³⁹Pu, 100% Class Y, 1 µm AMAD particle size on 1/18/66 Intake Estimate: CINDY, Ver. 1.4/JONES Code/Model used for: Dose Estimate: CINDY, Ver. 1.4/ICRP 30, Part 4, General Systemic Model RESULTS SUMMARY Estimated Intake Activity (pCi): 62,000 50 YR CEDE (rem): 19 (0.19 Sv) 50 YR CDE (rem/Sv) **Organ Dose Equivalent Summary** 190/1.9 **Bone Surface** 71/0.71 Lung 35/0.35 Liver 15/0.15 Red Marrow 3.3/0.033 Other 2.8/0.028 Testes DATE: DATE: PEER REVIEWER: DOSE ASSESSOR: Signature: Signature: Print Name: Print Name: SSN: **RECOMMENDATIONS:** ☐ In Vivo ☐ Urinalysis ☐ Fecal Additional Bioassay Required Suggested Sampling Frequency: Work Restrictions: N/A

Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

Sample	*Analysis	Date	Elapsed Days	Result (pCi/day)	Error (pCi/day)	Included
66-2302	G	03/02/66	61	0.411	0.201	
66-3210	G	05/17/66	119	0.11	0.072	
66-4976	AS	09/20/66	245	0.129	0.083	1
67-0649	AS	02/21/67	399	0.02	0.01	1
67-1504	AS	04/30/67	467	ND		✓

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	62,000	19/0.19
LUDEP	77,000	5.4/0.054

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

			Weighted Organ	
	Dose Equivalent	Weightin	Dose Equivalent	
Organ	(rem/Sv)	g Factors	(rem/Sv)	
Testes	2.8E+00/2.8E-02	2.5E-01	6.9E-01/6.9E-03	
Breast	9.2E-05/9.2E-07	1.5E-01	1.4E-05/1.4E-07	
Red Marrow	1.5E+01/1.5E-01	1.2E-01	1.8E+00/1.8E-02	
Lung	7.1E+01/7.1E-01	1.2E-01	8.5E+00/8.5E-02	
Thyroid	8.7E-05/8.7E-07	3.0E-02	2.6E-06/2.6E-08	
Bone Surface	1.9E+02/1.9E+00	3.0E-02	5.8E+00/5.8E-02	
Liver	3.5E+01/3.5E-01	6.0E-02	2.1E+00/2.1E-02	
Other	3.3E+00/3.3E-02	6.0E-02	2.0E-01/2.0E-03	
Lower Large Intestine	7.0E-03/7.0E-05	6.0E-02	4.2E-04/4.2E-06	
Upper Large Intestine	2.4E-03/24E-05	6.0E-02	1.4E-04/1.4E-06	
Small Intestine	4.8E-04/4.8E-06	6.0E-02	2.9E-05/2.9E-07	
Effective Dose Equivale	nt		1.9E+01/1.9E-01	_

DRAFT

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Three urine samples were analyzed by alpha spectrometry and two by gross alpha counting. The gross alpha results were 0.411 +/- 0.201 pCi/d and 0.110 +/- 0.072 pCi/day; however these were not used in our analysis because of suspected contamination from on-site collection of the samples. One of three analyzed by alpha spectrometry was reported as NDA (no detectable activity) and two were reported with a positive result. The three values were fit using CINDY and the Jones excretion model to estimate an intake (62,000 pCi), organ doses, and a CEDE (19 rem/0.19 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 77,000 pCi and a CEDE (ICRP-60) of 5.4 rem (0.054 Sv).

Conclusion:

Prepared By:

Based on the results of intake estimates and dose calculations, this individual received an intake of 27,000 to 62,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 5.4 to 19 rem (0.054 to 0.19 Sv). That dose is more than the cumulative dose (7 rem) from a lifetime (70 years) of exposure at the current level (0.100 rem) for members of the public. It is less than one-half the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). Serious health consequences are not associated with this dose level.

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Name:		
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Torrejon		OCCUPATION (61-62) Searcher		REQUESTED BY		DATE 18 Mar 66YPE		PE	
31 May 196	6	SAMPLE VOLUME		VOLUME ANALYZED 590 ml		DATE ANALYZ	DATE ANALYZED		
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let cpm	12-14			Bkg. My/sec Net my/sec	-	Bkg. cpm	6.	0.41.75
pm/24 hr. (69-74)	6451 +	0.223		curies/my		net cpm dpm		NSBB
40 Correction	Total M			litter (69 - 74)		dps/cc		
el Berg G/Sal	0.411 +	0.201		D(q) (63-68)	-	Neutron Dose	(rads) (63-	(8)
(q) (63-66)			Da	= 3.85 ×10-3		D(q) (63.68)		

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Torrejon AB

APO 09823-N.Y.
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C-Quens®

Burney, I

Sequential folder containing fifteen 80-mcg. tablets of mestranol plus five tablets each combining 80 mcg. mestranol and 2 mg. chlormadinone acetate.

A More Physiological Approach to Oral Contraception

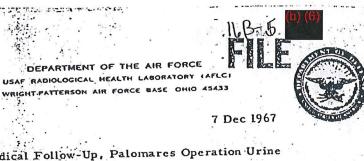
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SGHW

Long-Termi Medical Follow-Up, Palomares Operation Urine Studies for ²³⁹ Pu.

Sgt (b) (6) 3201 Supply Sq Eglin AFB Fla 32542

- 1. As a result of your splendid cooperation in this program, it is possible to discontinue further sampling.
- 2. Our results show that your health is in no jeopardy from retention of radioactive materials as a result of participation in subject operation.
 - If you are still on active duty, please present this letter to the custodian of your medical records so that it may be made a part of your permanent file. If not on active duty, it is suggested you retain it in your permanent personal records.

 141 Our files show that wwo sample bottles were sent to

Dose Evaluation Report April 28, 2000





REPLYTO

ATTH OF: PGDE

3 February 1967

SUBJECT: Long Term Studies on Selected Participants of Palomares Incident

To: USAF Radiological Health Laboratory (SGHW)

- 1. Present base of assignment of AlC (b) (6) 3201 Supply Squadron, is verified.
- 2. The individual seems well motivated for continued participation in the following study of the Palomares incident. He informed me that he had previously collected 24 hour urine samples while in Spain. The only evidence of emotional instability in his record was an acute anxiety attack one year ago following excessive fatigue secondary to an emergency situation of 48 hour duration. He concurrently contracted rubella which probably contributed to his agitation. There has been no recurrence and he is on no medications.

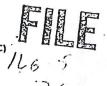
FOR THE COMMANDER

Captain, USAF, NC Flight Medical Officer

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UT 13 167

DEPARTMENT OF THE AIR FORCE HEADQUARTERS USAF HOSPITAL EGLIN (AFSC) EGLIN AIR FORCE BASE, FLORIDA 32542





REPLYTO

ATTN OF:

PGDF

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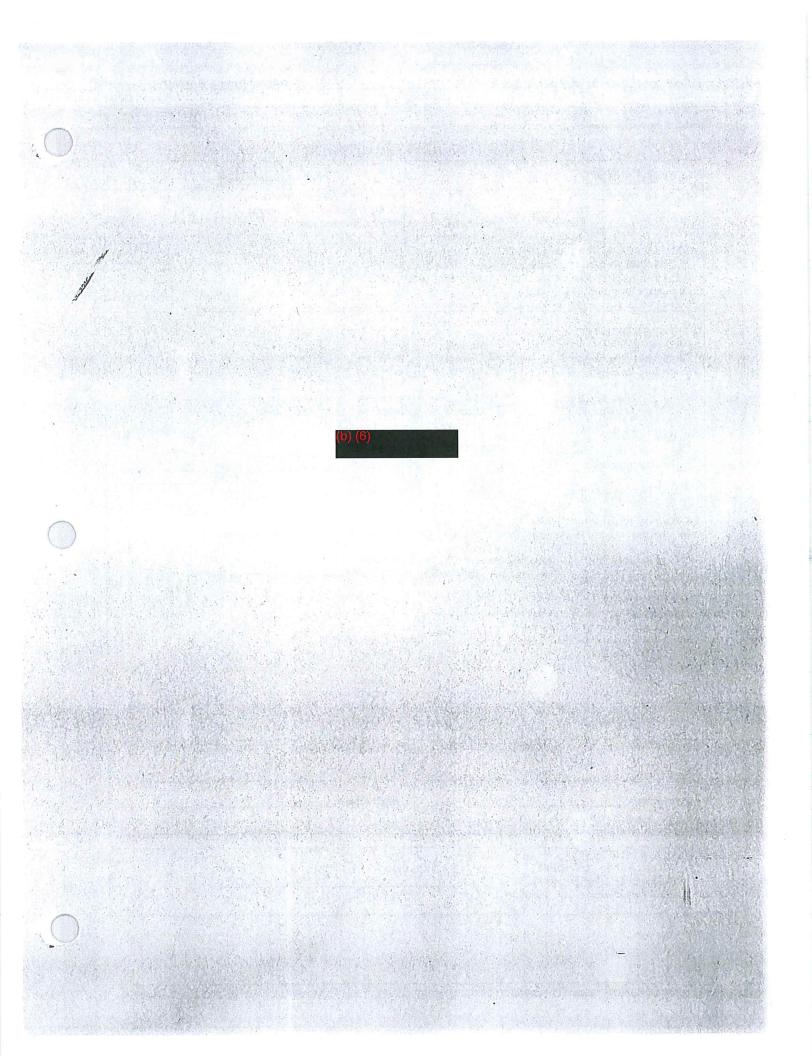
SUBJECT: Long Term Followup of Individuals Exposed to Bomb Fragments after the Palomares Incident

vo: USAF Radiological Health Lab Wright-Patterson AFB OH 45433

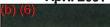
- 1. It has recently come to my attention that AIC (now Airman Basic) is being considered for an administrative discharge with concurrence by the Department of Psychiatry; diagnosis: character disorder. He apparently uses alcohol to excess and resents any authority figure to such a degree that he is unable to perform his duties adequately.
- 2. Perhaps he will be here long enough for a final 24 hour urine collection, but I expect his papers will be processed within the next month.
- 3. I regret having "cleared" him as a reliable individual last year when the study began. His problem was not apparent at the time.

Captain, USAF, MC, FMO Chief, Aerospace Medicine Services

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The second secon	internal Dosim	etry Evaluation Form		
NAME:(b) (6)		SSN: (b) (5)	
MODE OF INTAKE: Inhalation Ingestion Unknown	☐ Injection ☐ Absorption ☐Not applicable	INTAKE DATE OR PER 1/24/66 through 2/14/66 on 1/24/66 assumed start.		
SUMMARY OF EXPOSURE CON Radionuclides/Respiratory Class/Par Date or Period of Evaluated Data: 7 Duration of Exposure: Unknown Location of Exposure: Camp Wilson	DITIONS: rticle Size: ²³⁹ Pu/100 urine samples from 0	4/04/66 to 10/10/67		
EVALUATION DATA: Air Sampling Health Physics Survey Data Bioassay – Urinalysis Fecal Nasal Smears In Vivo	☐ Attached☐ Att	☐ In Process ☐ Unavailab	ole ole ole ole	
Medical Treatment: Skin Decontamination: Decorporation: Catharsis: Surgical excision:	☐ Yes ☐ Yes ☐ Yes ☐ Yes	☒ No Date: ☒ No Agent: ☒ No Agent: ☒ No Date:	Date: Date:	
Dose Es	Estimate: CINDY, Ve stimate: CINDY, Ve			
Estimated Intake Activity (pCi): 6 50 YR CEDE (rem): 19 (0.19 Sv) Organ Dose Equivalent Summary Bone Surface Lung Liver Red Marrow Other Testes		50 YR CDE (rem/Sv) 200/2.0 72/0.72 35/0.35 15/0.15 3.3/0.033 2.8/0.028		
DOSE ASSESSOR: DAT	re:	PEER REVIEWER:	DATE:	
Signature:		Signature:	man in the second	
Print Name:		Print Name:		
SSN:		SSN:		
RECOMMENDATIONS: Additional Bioassay Required Suggested Sampling Frequency: Work Restrictions: N/A		Irinalysis	☐ In Vivo	



Preliminary Internal Dosimetry Case Narrative

Identification:

Name: SSN:



Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

According to the most detailed data card, this individual was exposed during 24 January 1966 through 14 February 1966. An exposure date of 24 January 1966 corresponding to the start of the exposure period was chosen as most conservative (see report).

Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

Date	% Body Burden
4/4/66	-
7/20/66	0
1/28/67	8
4/21/67	0
10/10/67	0

Radionuclide(s): 239Pu.

Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1 μ m AMAD particle size on 1/24/66. The date is the first day of the period on station from 1/24/66 to 4/4/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.

Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

				Elapsed	Result	Error		
	Sample	*Analysis	Date	Days	(pCi/day)	(pCi/day)	Include	d
•	66-2868	G	4/04/66	1500	3.22	0.46	/	
	66-4097	AS	07/20/66	1750	0.0861	0.142	✓	
	66-4097B	AS	07/20/66	1750	ND		✓	
	66-4097C	AS	07/20/66	1750	0.204	0.207	1	
	67-0434	AS	01/28/67	2000	0.0045	0.01	✓	
	67-2156	AS	04/21/67	2460	ND		✓	
	67-5818	AS	10/10/67	1590	ND		✓	

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

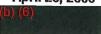
Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	63,000	19/0.19
LUDEP	19.000	1.3/0.013

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

Organ	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent (rem/Sv)	
Testes	2.8E+00/2.8E-02	2.5E-01	7.0E-01/7.0E-03	
Breast	9.3E-05/9.3E-07	1.5E-01	1.4E-05/1.4E-07	
Red Marrow	1.5E+01/1.5E-01	1.2E-01	1.8E+00/1.8E-02	
Lung	7.2E+01/7.2E-01	1.2E-01	8.6E+00/8.6E-02	
Thyroid	8.8E-05/8.8E-07	3.0E-02	2.6E-06/2.6E-08	
Bone Surface	2.0E+02/2.0E+00	3.0E-02	5.9E+00/5.9E-02	
Liver	3.5E+01/3.5E-01	6.0E-02	2.1E+00/2.1E-02	
Other	3.3E+00/3.3E-02	6.0E-02	2.0E-01/2.0E-03	
Lower Large Intestine	7.2E-03/7.2E-05	6.0E-02	4.3E-04/4.3E-06	
Upper Large Intestine	2.4E-03/2.4E-05	6.0E-02	1.4E-04/1.4E-06	
Small Intestine	4.9E-04/4.9E-06	6.0E-02	2.9E-05/2.9E-07	
Effective Dose Equivale	1.9E+01/1.9E-01			



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b) (6)	1-201				YPE SAMPLE (30) TYPE ANAL. (31-32)		
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URINE				RADON	T	FECES/BLOOD	
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Counter Bkg. (cpm)	1:03 God			Cham. Bkg. (mv/sec	1	Counter Bkg.	-
Counter Eff. (%)	5-1		10	Counter Eff. (%)		Counter Eff.	
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-Stop	/			Millivolt - Stop		- Stop	-
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Pross cpm	3:67	h= Maa	wole	Gross my/sec	12	Gross cpm	1.55 PC
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pm/24 hr. (69-74)				litter (69 - 74)		dps/cc	
40 Correction						Neutron Dose (rads) (63-68)
lat Bets sei Son	1.3.12:	10.46		D(q) (63-68)		uc/mg (69-74)	
(4) (63 ¹ (68)	1					D(q) (63-68)	
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(b) (6) MSCT	(b) (6	Uri.	
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TOTAL (SIGNATURE AND DATE)			
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Date/Time - Start		Counter Eff. (%)	Counter Eff.
-Stop		Millivolt - Start	Date/Time - Start
Total Counts		Millivolt - Stop	- Stop
		Total Millivots	Total Counts
Counting Time		Total Drift Time	Counting Time
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Bkg. Cpm		Bkg. Mv/sec	Bkg. cpm
Net cpm		Net my/sec	net cpm
dpm		curies/mv	dpm
dpm/24 hr. (69-74)		litter (69 - 74)	dps/cc
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DRAFT

Revised Dose Evaluation Report April 2001

(b) (6)

b) (6)

Four urine samples were analyzed by alpha spectrometry and one early sample by gross alpha counting. One of the alpha spectrometry samples (66-4097) was repeated three times. The gross alpha reported 3.22 +/- 0.46 pCi/day; however this was not used in our analysis because of suspected contamination from on-site collection of the samples. Three of the six alpha spectrometry results were reported as NDA (no detectable activity) and three were reported with a positive result. The six values were fit using CINDY and the Jones excretion model to estimate an intake (63,000 pCi), organ doses, and a CEDE (19 rem/0.19 Sv); ICRP-30) as shown above. LUDEP was also used to estimate an intake of 19,000 pCi and a CEDE (ICRP-60) of 1.3 rem (0.013 Sv).

Conclusion:

Based on the results of intake estimates and dose calculations, this individual received an intake of about 19,000 to 63,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 1.3 to 19 rem (0.013 to 0.19 Sv). The difference in estimates from LUDEP and CINDY reflect the variation in the urine data. Nevertheless, the dose range represents less than the annual occupational limit (5 rem) to almost four years of exposure at the limit. It is well below the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). Serious health consequences are not associated with these dose levels.

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Peer Reviewed By:			
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Sequential folder containing fifteen plus five tablets each combining

plus five tablets each combining 80 mcg, mestranol and 2 mg chlormadinone acetate.

A More Physiological Approach to Oral Contraception

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DEPARTMENT OF THE AIR FORCE
USAF RADIOLOGICAL HEALTH LABORATORY (AFLC)
WRIGHT-PATTERSON AIR FORCE BASE OHIO 45433

ATTN OF SGHW

TO

7 Dec 1967

Long-Term Medical Follow-Up, Palomares Operation Urine Studies for 255 Pu.

Committee and Colorest at a

MSgt

Keesler Tech Tng Center

Keesler AFB Miss 39534

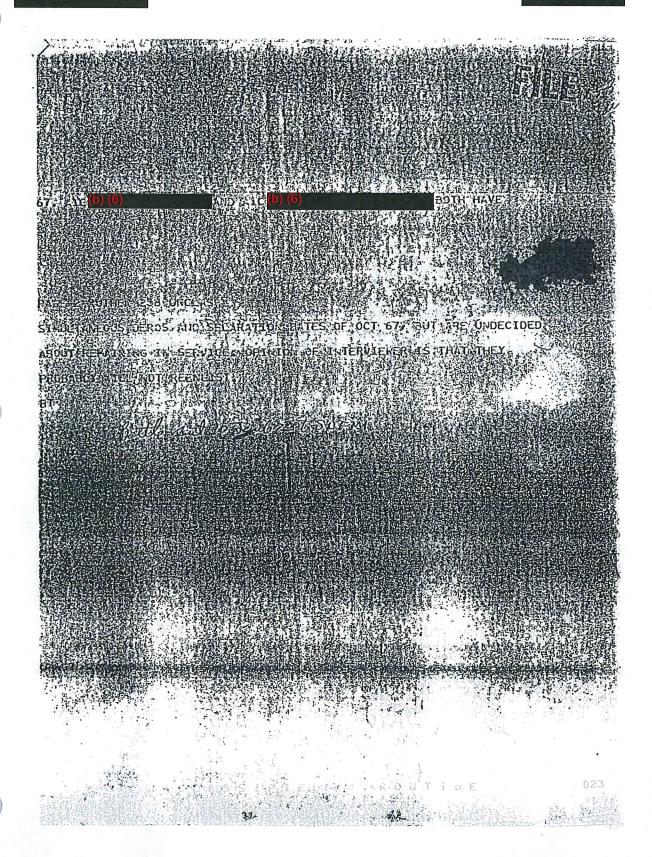
- 1. As a result of your splendid cooperation in this-program, it is possible to discontinue further sampling.
- 2. Our results show that your health is in no jeopardy from retention of radioactive materials as a result of participation in subject operation.
- 3. If you are still on active duty, please present this letter to the custodian of your medical records so that it may be made a part of your permanent file. If not on active duty, it is suggested you retain it in your permanent personal records.
- 4. Our files show that three sample bottles were sent to you, and that three samples were returned for analysis.

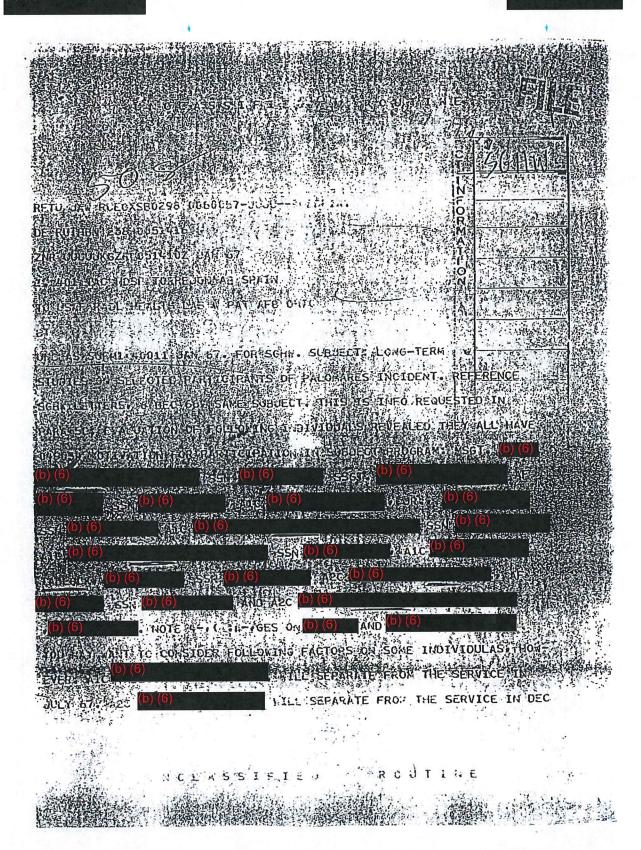
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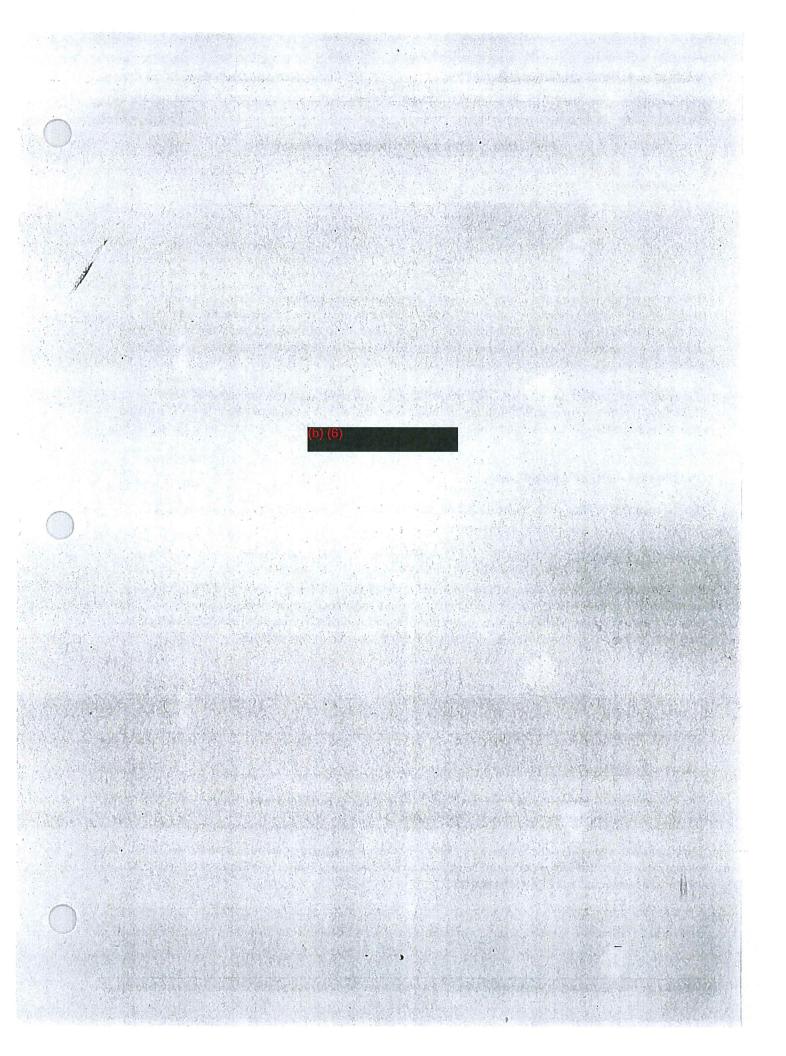
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Preliminary Internal Dosimetry Case Narrative

Identification:

Name: (b) (b) SSN:

Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response and had a recorded exposure period of 6 February 1966 until the first sample on 28 February 1966 that was analyzed by gross alpha counting. The period on station was assumed as 1/18/66 through 2/6/66 and the exposure date was selected as 1/18/66, the first day on station.

Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

Date % **Body Burden** 2/28/66 - 6/22/66 16

Radionuclide(s): ²³⁹Pu.

Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1 μ m AMAD particle size on 2/06/66. The date is the first day of the period on station from 1/18/66 to 2/6/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.

Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this

April 2001

individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

Sample	*Analysis	Date	Elapsed Days	Result (pCi/day)	Error (pCi/day)	Included
66-1394	G	02/28/66	22	1.03	0.258	
66-3917	AS	06/22/66	136	0.393	0.187	✓
66-3917B	AS	06/22/66	136	1.23	0.29	✓

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	560,000 to 1,200,000	170 to 370/1.7 to 3.7
LUDEP	2,600,000	180/1.8

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

Organ	Dose Equivalent (rem/Sv) Low	Dose Equivalent (rem/Sv) High	Weighting Factors	Weighted Organ Dose Equivalent (rem/Sv) Low	Weighted Organ Dose Equivalent	
					(rem/Sv) High	
Testes	2.5E+01/2.5E-01	5.4E+01/0.54	2.5E-01	6.2E+00/6.2E-02	1.3E+01/1.3E-01	
Breast	8.3E-04/8.3E-06	1.8E-03/1.8E-05	1.5E-01	1.2E-04/1.2E-06	2.7E-04/2.7E-06	
Red Marrow	1.3E+02/1.3E+00	2.9E+02/2.9E+00	1.2E-01	1.6E+01/1.6E-01	3.5E+01/3.5E-01	
Lung	6.4E+02/6.4E+00	1.4E+03/1.4E+01	1.2E-01	7.7E+01/7.7E-01	1.6E+02/1.6E+00	
Thyroid	7.8E-04/7.8E-06	1.7E-03/1.7E-05	3.0E-02	2.3E-05/2.3E-07	5.0E-05/5.0E-07	
Bone Surface	1.7E+03/1.7E+01	3.7E+03/3.7E+01	3.0E-02	5.2E+01/5.2E-01	1.1E+02/1.1E+00	
Liver	3.1E+02/3.1E+00	6.7E+02/6.7E+00	6.0E-02	1.9E+01/1.9E-01	4.0E+01/4.0E-01	
Other	3.0E+01/3.0E-01	6.3E+01/6.3E-01	6.0E-02	1.8E+00/1.8E-02	3.8E+00/3.8E-02	
Lower Large	6.4E-02/6.4E-04	1.4E-01/1.4E-03	6.0E-02	3.8E-03/3.8E-05	8.2E-03/8.2E-05	
Intestine		4				
Upper Large	2.1E-02/2.1E-04	4.6E-02/4.6E-04	6.0E-02	1.3E-03/1.3E-05	2.7E-03/2.7E-05	
Intestine						
Small	4.4E-03/4.4E-05	9.4E-03/9.4E-05	6.0E-02	2.6E-04/2.6E-06	5.6E-04/5.6E-06	
Intestine						
Effective Dose	e Equivalent			1.7E+02/1.7E+00	3.7E+02/3.7E+00	

One follow-up sample was taken after leaving the site. That urine sample was analyzed by alpha spectrometry in duplicate. The gross alpha reported 1.03 +/- 0.258 pCi/day; however this was not used in our analysis because of suspected contamination from on-site collection of the samples. The replicate

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analysis by alpha spectrometry reported positive results. These results (0.39 and 1.23 pCi/day) differ by more than a factor of 3, casting doubt about the validity of at least one of the results. Further more, 1.23 pCi/day is higher than the initial gross alpha result taken 114 days earlier. The two values were fit using CINDY and the Jones excretion model to estimate an intake (560,000 to 1,200,000 pCi), organ doses, and a CEDE (170 tp 370 rem/1.7 to 3.7 Sv; ICRP-30) as shown above. The lower values from CINDY were obtained by eliminating the higher urine result (sample 66-3917B). LUDEP was also used to estimate an intake of 2,600,000 pCi and a CEDE (ICRP-60) of 180 rem (1.8 Sv). These are quite high. The analysis was limited by replicate results on only one elapsed time. For other analyses that included the gross alpha result, CINDY produced an estimated intake and CEDE of 1,800,000 pCi and 550 rem (5.5 Sv), and LUDEP estimated 3,100,000 pCi and 210 rem (2.1 Sv) CEDE.

Conclusion:

Prepared By:

The results of intake estimates and dose calculations indicate an intake of about 560,000 to 2,600,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 170 to 370 rem (1.7 to 3.7 Sv). If accurate, this is a very high dose range. However, the one follow-up sample produced low analytical precision. Furthermore, attempts to obtain samples at later times were apparently unsuccessful. This case could benefit from follow-up urine samples today using more sensitive analytical techniques to provide additional data.

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Name:		
Signature:	<u> </u>	Date:
Peer Reviewed By:		
Name:		
Signature:		Date:

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SAMPLE NO. (33-38)	462	DATE	(b) (6) (39 - 44)			
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OCCUPATION ANALYSIS DESIRED

DATE ANALYZED (51,788)

DATE COUNTED

WEIGHT/VOLUME ANALYZED

168-5-6

500 nl

DATE COLLECTED

22 Jun 66

988

3973 SOCIAL REGURITY NUMBER

AFLC FORM 1165 FC 5400

BIOLOGICAL SAMPLES
COUNTER & EFFICIENCY
TOTAL COUNTS & MINUTES

GROSS CPM

NAME OR REQUESTOR'S ID (1-20)
(D) (G)

TYPE SAMPLE (23-32)

DATE RECEIVED (37-42)

SAMPLE WEIGHT/VOLUME

ENVIRONMENTAL SAMPLES
COUNTER & EFFICIENCY TOTAL COUNTS & MINUTES GROSS CPM BKG CPM & MINUTES NET CPM

AFLC-WPAFB-MAY 66 4500

23

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AIR FORCE BASE (68-71)

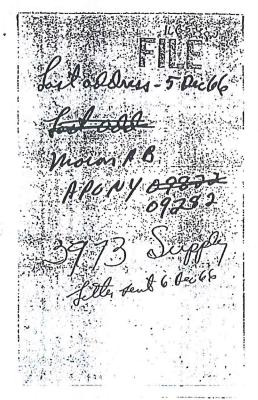
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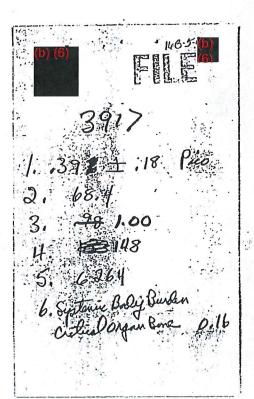
Palomares Nuclear Weapons Accident

Dose Evaluation Report April 28, 2000

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Follow-up TWX
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As sample was not received

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ROUTINE

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FM 870USAFHOSP APO NEW YORK 09284

TO USAFRADL HEALTH LAB WPAFB OHIO

UNCLAS SUAT 01995 DEG 66

FOR: SGHW. SUBJ: LONG TERM STUDIES ON SELECTED PARTICIPANTS OF PALOMARES INCIDENT.

1. A2C (b) (6)

FROM THE SERVICE: HOME ADDRESS IS RACCOON, KENTUCKY.

2. A2C (b) (6)

PCS TO 810TH STRAT AEROSPACE DIV, MINOT AFB, N. DAK.

A1C (b) (6)

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APO NEW YORK 09282: STATIONED AT THIS BASE AND HAS CONSENTED TO SUBMIT REQUIRED SPECIMENS UNTIL PROJECTED DOS: 1 JUN 67.

BT

Bottle sent 10 Jun 67 - 16 SUAI

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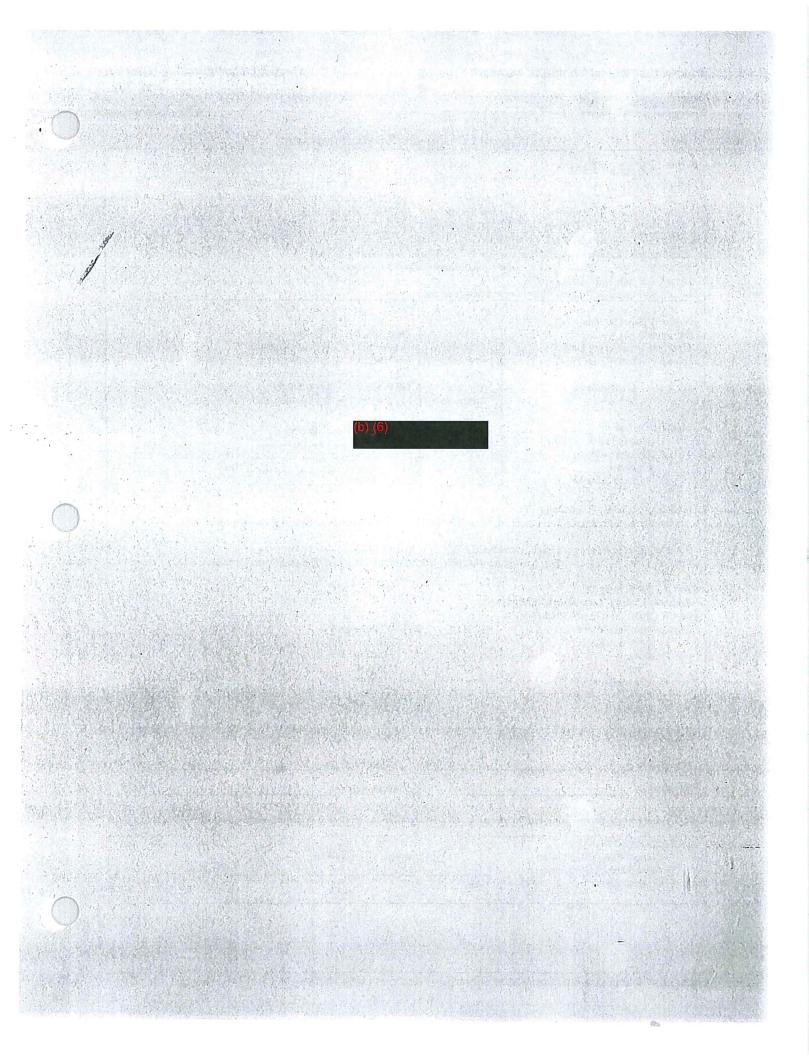
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Internal Dosimetry Evaluation Form NAME: INTAKE DATE OR PERIOD: MODE OF INTAKE: ☐ Injection 01/29/66 through 02/19/66 on-site ☐ Ingestion Absorption 1/29/66 assumed start. ■Not applicable ■ Unknown **SUMMARY OF EXPOSURE CONDITIONS:** Radionuclides/Respiratory Class/Particle Size: 239Pu/100% Class Y/1 µm AMAD Date or Period of Evaluated Data: 5 urine samples from 04/21/66 to 08/06/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain **EVALUATION DATA:** □ Unavailable ☐ Attached ☐ In Process Air Sampling ☑ Unavailable Health Physics Survey Data ☐ Attached In Process Bioassay - Urinalysis ★ Attached In Process ☐ Unavailable □ Unavailable Fecal Attached ☐ In Process **Unavailable** Attached ☐ In Process **Nasal Smears** In Vivo ☐ Attached In Process □ Unavailable Medical Treatment: ⊠ No Skin Decontamination: Yes Yes Date: ⊠ No ⊠ No Yes Decorporation: Agent: Date: Agent: ____ Yes Catharsis: Date: Surgical excision: Yes ⊠ No **EVALUATION METHODOLOGY:** Assumptions: Acute inhalation intake of ²³⁹Pu, 100% Class Y, 1 µm AMAD particle size on 1/29/66 Intake Estimate: CINDY, Ver. 1.4/JONES Code/Model used for: Dose Estimate: CINDY, Ver. 1.4/ICRP 30, Part 4, General Systemic Model RESULTS SUMMARY Estimated Intake Activity (pCi): 65,000 50 YR CEDE (rem): 20 (0.20 Sv) 50 YR CDE (rem/Sv) **Organ Dose Equivalent Summary Bone Surface** 200/2.0 Lung 74/0.74 36/0.36 Liver Red Marrow 16/0.16 3.4/0.034 Other **Testes** 2.9/0.029 PEER REVIEWER: DOSE ASSESSOR: DATE: DATE: Signature: ___ Signature: ___ Print Name: _ RECOMMENDATIONS: ☐ Fecal ☐ Urinalysis ☐ In Vivo Additional Bioassay Required Suggested Sampling Frequency: Work Restrictions: N/A

Preliminary Internal Dosimetry Case Narrative

Identification:

Name: SSN:



Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. One sample card (66-3129, received 17 May 66) noted the exposure dates as 29 January – 19 February 1966 an exposure date of 29 January 1966 corresponding to the start of the exposure period was chosen as most conservative (see report).

Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

Dates	% Body Burden
4/21/66	-
9/08/66	8
1/15/67	0
4/11/67	0
8/06/67	0

Radionuclide(s): ²³⁹Pu.

Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1 µm AMAD particle size on 1/29/66. The date is the first day of the period on station from 1/29/66 to 2/19/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.

Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

Sample	*Analysis	Date	Elapsed Days	Result (pCi/day)	Error (pCi/day)	Included
66-3129	G	04/21/66	82	0.664	0.171	
66-3826	AS	09/08/66	22	0.209	0.097	✓
67-0317	AS	01/15/67	351	ND		✓
67-1266	AS	04/11/67	437	ND		1
67-3682	AS	08/06/67	554	ND		1

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	65,000	20/0.20
LUDEP	790,000	55/0.55

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

Organ	Dose Equivalent (remSv)	Weighting Factors	Weighted Organ Dose Equivalent (rem/Sv)
Testes	2.9E+00/2.9E-02	2.5E-01	7.3E-01/7.3E-03
Breast	9.6E-05/9.6E-07	1.5E-01	1.4E-05/1.4E-07
Red Marrow	1.6E+01/1.6E-01	1.2E-01	1.9E+00/1.9E-02
Lung	7.4E+01/7.4E-01	1.2E-01	8.9E+00/8.9E-02
Thyroid	9.1E-05/9.1E-07	3.0E-02	2.7E-06/2.7E-08
Bone Surface	2.0E+02/2.0E+00	3.0E-02	6.1E+00/6.1E-02
Liver	3.6E+01/3.6E-01	6.0E-02	2.2E+00/2.2E-02
Other	3.4E+00/3.4E-02	6.0E-02	2.1E-01/2.1E-03
Lower Large Intestine	7.4E-03/7.4E-05	6.0E-02	4.4E-04/4.4E-06
Upper Large Intestine	2.5E-03/2.5E-05	6.0E-02	1.5E-04/1.5E-06
Small Intestine	5.1E-04/5.1E-06	6.0E-02	3.0E-05/3.0E-07
Effective Dose Equivale	nt		2.0E+01/2.0E-01

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Revised Dose Evaluation Report April 2001

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b) (6)

Four urine samples were analyzed by alpha spectrometry and one early sample by gross alpha counting. The gross alpha reported .664 +/- .171 pCi/day; however this was not used in our analysis because of suspected contamination from on-site collection of the samples. Three of the four analyzed by alpha spectrometry were reported as NDA (no detectable activity) and one was reported with a positive result The four values were fit using CINDY and the Jones excretion model to estimate an intake (65,000 pCi), organ doses, and a CEDE (20 rem/0.20 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 790,000 pCi and a CEDE (ICRP-60) of 55 rem (0.55 Sv).

Conclusion:

Prepared By:

Based on the results of intake estimates and dose calculations, this individual received an intake of 65,000 to 790,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 20 to 55 rem (0.20 to 0.55 Sv). Those intakes and doses are quite high and result from an uncharacteristic excretion behavior. The result of 8 September 1966 may be uncharacteristically high, especially since subsequent samples detected no-activity. This case could benefit from additional follow-up sampling today to provide additional assessment.

Nama		
Name:		
Signature:	Date:	* E2
Peer Reviewed By:		
Name:		
Signature:	Date:	

AFSN: (b) (6)	INTERN	AL DOSE DAT	A			
NAME (LAST, FIRST, M.I.) (1-20) (b) (6) A2C	(b) (6	NO. (21-29)	TYPE SAM Urine	1 2.1		
SAMPLE NO. (33-36) 66-1194 BASE (57-60)	FROM 29 Jan 66	19 FZ/3	66	DATE 2	JAN 66 TYPE	
	30450 SAMPLE VOLUME	REQUESTED BY		Average and a	The Book of the Control of the Contr	
San Pablo DATE RECEIVED 3 March 1966	7/0 ND	738	M	DATE ANALYZ	.EO	
TECHNICIAN (SIGNATURE AND DATE)						
URINE		RADON		FECES/BLOOD		
Counter Number		Chamber Number		Counter	Number	
Counter Bkg. (cpm)		Cham. Bkg. (my/sec)		Counter	Bkg.	
Counter Eff. (%)		Counter Eff. (%)	New York	Counter	Eff.	
Date/Time - Start		Millivolt - Start		Date/Ti	me - Stort	
-Stop		Millivolt - Stop		3 72	- Stop	
Total Counts		Total Millivots	di i	Total C	ounts	
Counting Time		Total Drift Time		Countin	g Time	
Geoss cpm		Gross my/sec		Gross ç	pm	
Bkg. Cpm		Bkg. My/sec		Bkg. cp	m ·	
Net cpm		Net my/sec		·net cpm		
dpm	-	curies/mv		dpm .	177	
dpm/24 hr. (69-74)		litter (69-74)		dps/co	100	
K 40 Correction				Neutron	Dose (rads) (63-68)	
Net Beta		D(q) (63-68)			(69-74)	
D(q) (63-68)				D(q) (e	(3 - 68)	

AFSN: (b) (6)	32000		- INTERN	AL DOSE DAT			115	n • 1		
NAME (LAST, FIRST, L	4.1.) (1-20)		SOC. SEC	, NO. (21-29)	TYPE SAM		1			
(b) (6)	A2C		(D) (C	9)	Ur	ine	1			
SAMPLE NO. (33-38)		SAMPLE DAT	E (39 - 44)		DATE 19 Feb 66TYPE					
66-3129 FROM Not Submitted						DATE 19	reb botyp	E .		
BASE (57-60)		OCCUPATION		REQUESTED BY			9			
San Fablo		3045	50			TOATE ANALYZ	50 5			
		VOLUME ANALY	VOLUME ANALYZED DATE							
17 May 1966		990	m	1 970 m		1	.17,-			
	SSat M C	Edward	S	USAF		NUL S	1966			
URINE				RADON		FEC	ES/BLOOD			
Counter Number	D	1.		Chamber Number	7-14	Counter	Number			
Counter Bkg. (cpm)	2/ (899	1)		Cham. Bkg. (mv/s	ec)	Counter	Bkg.	d W/A		
Counter Eff. (%)	7/01	1	t: 62	Counter Eff. (%)		Counter	Eff.			
Date/Time - Start	2 June		400	Millivolt - Start		Date/TI	me - Start			
-Stop	Just		1	Millivolt - Stop			- Stop	1./		
Total Counts	66			Total Millivots		Total C	shuo	1		
Counting Time	120	<u> </u>		Total Drift Time		Countin	g Time			
Gross cpm	1/20	of the		Gross my/sec		Gross c	pm :==			
				Bkg. My/sec	11 1	Bkg. cp	m	0.67		
Bkg. Cpm				Net my/sec		not com	Al-Hill	0.1888		
April Cillia	0.671 ±	0.173		curies/mv		dpm				
dpm/24 hr. (69-74)	10.011 -	7.7.	1	litter (69-74)		dps/co				
K 40 Correction,		-	1			Nautron	Dose (rads) (63-68)		
Het Besper / bol	0.664 I	0. 171	1	D(q) (63-68)			(69 - 74)			
D(q) (63-68)	1.667 =	15.77	•	1 : 11: 12: 23		D(q) (63 - 68)	W		

ates biological and a second		RADIO	OGICAL SA	MPLE DATA	- A	清景 片	-1613-5-1	
(b) (6)	-20)	GRADE A2C	(b) (6)	The second second second	SECUDITY THE	and the Contract of the Contra	BHL 6638	26
TYPE SAMPLE (23-32) Unino DATE RECEIVED (37-42)	OCCUPATION (34-35)	ANALYSIS DESIRE Pu 239	D	REQUESTED BY SGHW		AIR FO	Pablo AB	<u>کردہا ہ</u>
	DATE ANSLYZ	(50 (51-56) DA	TE COUNTED 1 3 SEP 1966	DATE	COLLECTED		EXPOSURE DATE	-орыли
SAMPLE WEIGHT/VOLUME	000ml		ME ANALYZED	ome.	(b) (6)			
OTHER DATA	22.277.4			C Day	(S) u	12	D. P.D	
ENVIRONMENTAL SAMPLES				9000	100	your.	The Manual	
COUNTER & EFFICIENCY	Large Grands				111		THE WALL TO SERVICE	
TOTAL COUNTS & MINUTES					14	7		
GROSS CPM				201		-	-	1 1
BKG CPM & MINUTES				7	Toler !	THE PERSON	Charles Line	-
NET CPM					1000	and the second	1000	AL ALCOHOLD
YIELD			- 1		11/	10	10	
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					Colorest Colorest	-0		
	-							
								12,100
BIOLOGICAL SAMPLES		151				4.00	7.00	- 1
COUNTER & EFFICIENCY	DALC	45/2		39	RADON		and Armen Control	12.1
TOTAL COUNTS & MINUTES	100	7 4/17	. 3/	. 8	C	51	1,000	- 100 - 17
GROSS CPM	100	03	-	5	53	85	1 ¹⁰	
BKG CPM & MINUTES	PLIA	0.630						
NET CPM	300	3 0.00:	57 0	4	5806	225		
YIELD		0.626	3					1.4.1
TIELD								
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SUMMARY OF RESULTS: PL		209 = 0,097	% Le	= 59.2	· 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
SUMMARY OF RESULTS: R		209= 0.097	% Lec	= 59.2				
UMMARY OF RESULTS: PL		209± 0, 0 97	% Rec Balu	= 59.2 Burden =	0.060			

		RAI	DIOLOGICAL	SAMPLE		. H II lis	E 670317	10.
ME OR REQUESTOR'S ID (-20)	GRADE	2C (b) (6)		(b) (6)	SECURITY NUMBER	RHL SAMPLE NUMBER	1
PE SAMPLE (23-32) Urine NO. 1	OCCUPATION (34-35)	ANALYSIS C	P 229	REQUES	SGHW		AIR FORCE BASE (68-7)	0
ATE RECEIVED (37-42)	DATE ANALYZ	ED (51-56)	073 FEL	67	DATEC	Jan 67	EXPOSURE DATE	-
werene luce mee	60 me	WEIGHT	30 ME			(b) (6)		
THER DATA					C			
NVIRONMENTAL SAMPLES	- 200 4864					and the second		_
OUNTER & EFFICIENCY	a 1502 billion		the se Wheel I want		_	A HARACON DOMESTIC		+
OTAL COUNTS & MINUTES			And the second					
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OUNTER & EFFICIENCY OTAL COUNTS & MINUTES	Sue Jos	256 27 568	0	1		RADON		
BKG CPM & MINUTES	800	10	- 0				and the same and here	BEG.
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	7/9			11 11 11	H.J.			7
SUMMARY OF RESULTS: Tot Vol	upl-7. ANAL-0	NOA 66			Pody	137-lb	57	
		- N				A ==	LC-WPAFB-MAY 66	ARC

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1	RAI	DIOLOGICA	L SAMPLE	DATA		671266
				ASS NO.	SECURITY WILLIAM	TO GAT TRHL SAMPLE NUMBER
^(b) (6)	GRADE.) (6)			AIR FORCE BASE (68-71)
URINE (34-35)	ANALYSIS D	FEIRED		CHU	5	SYNOGUE DATE
ATE RECEIVED (37-42) DATE ANA	LYZED (51-56)	DATE COUNT	apr67	/ Ó·/	LAPIZ 67	EXPOSURE DATE
12 DEC 67	WEIGHT	VOLUME ANAL	725D	me	TECHNICIAN (b) (6)	1
OTHER DATA	m					
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COUNTER & EFFICIENCY						
TOTAL COUNTS & MINUTES						
GROSS CPM						
BKG CPM & MINUTES						
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1140						
	23	6	259	_	RADON	
BIOLOGICAL SAMPLES					- RADUR	
COUNTER & EFFICIENCY SUECEY	24	~				
TOTAL COUNTS & MINUTES 40	46	7				
GROSS CPM			0 5			
BKG CPM & MINUTES	00 0					
NET CPM				Ç.	-	
YIELD					-	
						1
					0-2	
	900	PA			To ree.	=85,7
	970	PA			To ree.	= 85,7
	7 90	PA			To rec.	= 85,7 veden =
SUMMARY OF RESULTS: activity for 24 kx 5, Total Val = 3.46 h,	974	PA			To rec.	= 85,7 Veden =
SUMMARY OF RESULTS: activity for 24 kx 5, Total Val = 2.46 h,	972	PA			To rec: Body Bu	= 85,7 veden = unted = 250pz67
	976	P.A.			To rec. Body Bu	= 85,7 Vesten = United = 2500x67 AFLC-WPAFB-MAY 66 450

EDENTIFICATION (6)	•		119					163.5	b) ==	1			f. 65 3682	3,00
(b) (6)						TYPE	SPINE		RH	ניאליי	لند فننك	67	3682	K
b) (6)			ZUEMIT	56	HW									
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LO AUG 67 ANALYSIS DESIRED	234	ie.	3 47				(b) (6	WW.	Lom			[7]	O MC	
TYPE OF ANALYSIS		<u>s</u>	230	7	236			·1				\top		-
COUNTER AND EFF	#	4-	- 24	<u>, </u>	0.74							+		- 10
TOTAL CTS AND TIME	100	0-	1		167				20			+		1
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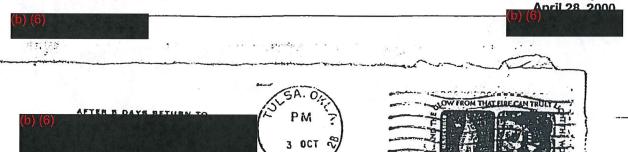
UNCLASSIFIED RFTU JAN RUEOESE0392 3631758-UUUU--RUEDFIA. DE RUTHAG 47 3631525 ZNR UUUUU R 291500Z DEC 66 FM 870USAFHOSP APO NEW YORK 09284 TO USAFRADL HEALTH LAB WPAFB OHIO àТ UNCLAS SUA1 01995 DEC 66 FOR: SGHW. SUBJ: LONG TERM STUDIES ON SELECTED PARTICIPANTS PALOMARES INCIDENT. 16 A2C (b) (6) DISCHARGED FROM THE SERVICE; HOME ADDRESS IS RACCOON, KENTUCKY. 2. A2C (b) (6) SSN HAS DEPARTED PCS TO 810TH STRAT AEROSPACE DIV, MINOT AFB, N. DAK. 3. A1C 7473 MATRON, APO NEW YORK 09282: STATIONED AT THIS BASE AND HAS CONSENTED TO SUBMIT REQUIRED SPECIMENS UNTIL PROJECTED DOS: 1 JUN 67. BT

 $\forall NNNN \neq$

UNCLASSIFIED

ROUTINE

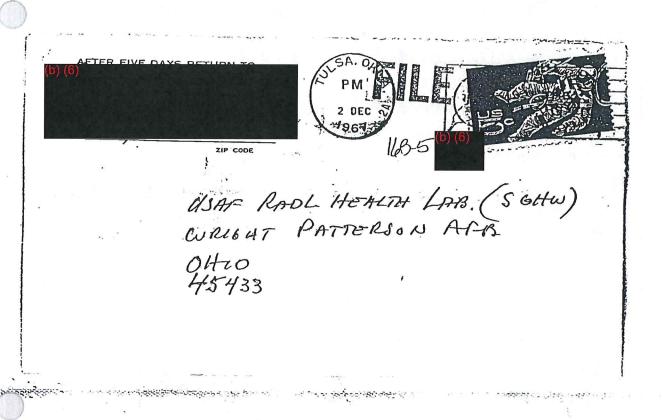
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1967

Department of the air Force USAF Radiological Health Lat (AFLC) Wright Patterson AFB, Ohio 45433

ATTN: SGHW



2 DEC 1967 Tulsa OKLA.

NSAF RADI HEALTH LAB. (SGHW) WRIGHT PATTERSON AFB, OHIO 45453

165 (b)

DEAR Sips:

MAILING ADDRESS, IN PERATION TO THE
PALOMARGE PROBRAM.

I AM NOW RESIDING AT



Jours Truly
(b) (6)

b) (6

(b) (6)

Dept. og the air Force USAF Radl. Health Fab (AFIC) Wright Patterson AFB, Phio 45433 Attn: SGHW

0

Dear Sir:

This is to advise you in change of
my mailing a ddress. I am now residing

(b) (6)

Very Truly yours,

b) (6)

April 20, 20 (b) (6)



Date 8 January 1967

USAF Radl Health Lab (SGHW) Wright-Patterson AFB Ohio 45433

I agree to participate in your program, if at no cost to me, and provided sample containers are received. In the event I move during the next year, I will notify you of my new address.

(b) (6)
Signéd:(b) (6)

Present Address:

Bottle sent 12 Feb 65

b) (6)

DEPARTMENT OF THE AIR FORCE
USAF RADIOLOGICAL HEALTH LABORATORY (AFLC)
WRIGHT-PATTERSON AIR FORCE BASE OHIO 45433

16-5-(6)(6)

REPLY TO

SGHW

7 Dec.1967

SUBJECT

Long-Term Medical Follow-Up, Palomares Operation Urine Studies for 289 Pu.

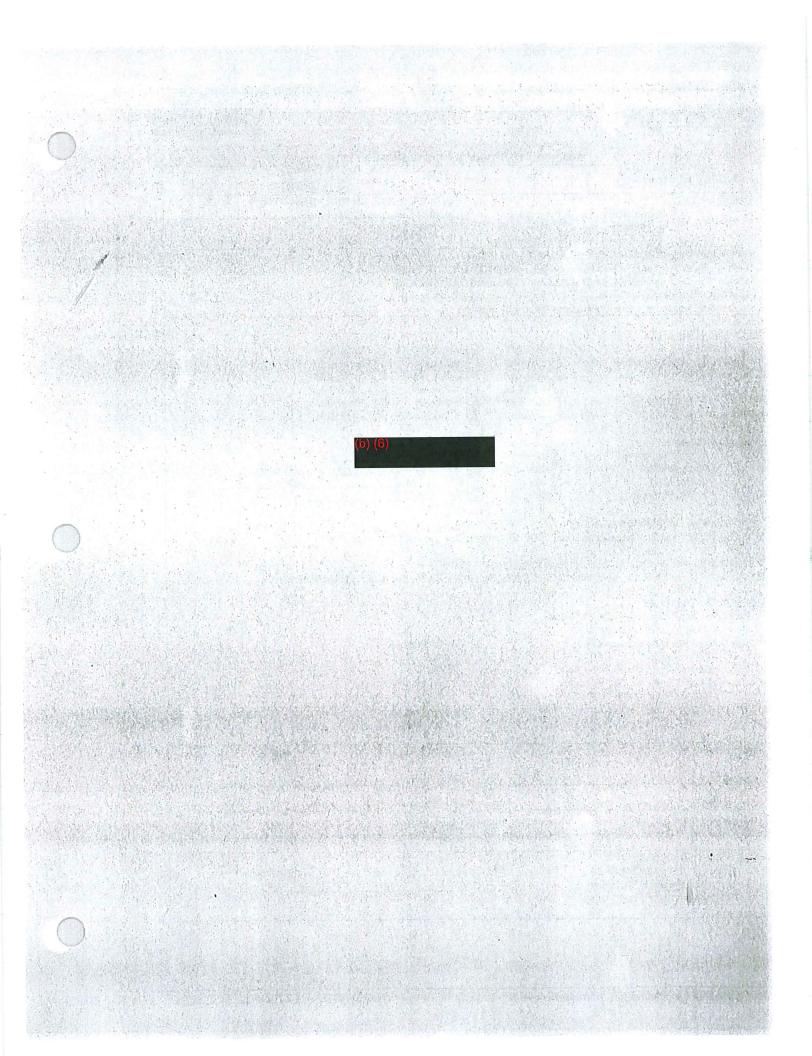
(b) (6)

- 1. As a result of your splendid cooperation in this program, it is possible to discontinue further sampling.
- 2. Our results show that your health is in no jeopardy from retention of radioactive materials as a result of participation in subject operation.
- 3. If you are still on active duty, please present this letter to the custodian of your medical records so that it may be made a part of your permanent file. If not on active duty, it is suggested you retain it in your permanent personal records.
- 4 Our files show that three sample bottles were sent to your and that three samples were returned for analysis.

(b) (6)

tool, USAF, MC

Chief



Interi	ial Dosimetry Evaluation Form
NAME: (b) (6)	SSN: (b) (6)
MODE OF INTAKE:	INTAKE DATE OR PERIOD:
☑ Inhalation ☐ In	ection 01/18/66 through 02/06/66 on-site
	sorption 1/18/66 assumed start.
	t applicable
SUMMARY OF EXPOSURE CONDITION	vs.
Radionuclides/Respiratory Class/Particle Size	
Date or Period of Evaluated Data: 3 urine sa	mples from 02/06/66 to 02/28/67
Duration of Exposure: Unknown	imples from 02/00/00 to 02/26/07
Location of Exposure: Camp Wilson, near P	olomoros Casia
Location of Exposure. Camp wilson, near P	aiomaies, Spain
EVALUATION DATA:	
	A
	Attached In Process Unavailable
	Attached In Process Unavailable
	Attached
	Attached In Process Unavailable
The state of the s	Attached In Process In Unavailable
In Vivo	Attached In Process In Unavailable
Medical Treatment:	The second secon
Skin Decontamination:	Yes No Date:
Decorporation:	Yes No Agent: Date:
Catharsis:	Yes No Agent: Date:
Surgical excision:	Yes No Date:
Code/Model used for: Intake Estimate:	⁹ Pu, 100% Class Y, 1 μm AMAD particle size on 1/18/66 CINDY, Ver. 1.4/JONES CINDY, Ver. 1.4/ICRP 30, Part 4, General Systemic Model
Bone Surface	
Lung	500/5 180/1.8
Liver	89/0.89
Red Marrow	
Other	39/0.39
	8.5/0.085
Testes	7.1/0.071
DOSE ASSESSOR: DATE:	PEER REVIEWER: DATE:
Signature:	Signature:
Print Name:	
	Trine Name:
SSN:	SSN:
RECOMMENDATIONS:	
Additional Bioassay Required	Differential District
	☐ Urinalysis ☐ Fecal ☐ In Vivo
Suggested Sampling Frequency:	
Work Restrictions: N/A	
	The second secon

(b) (6)

DRAFT

Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

C1-	* A maluais	Date	Elapsed Davs	Result (pCi/day)	Error (pCi/day)	Included
Sample	*Analysis			<u> </u>	0.81	Motore
66-521	\mathbf{G}	02/06/66	19	2.59		10.00
66-4909B	AS	09/28/66	253	0.225	0.125	V
67-0699	AS	02/28/67	406	0.03	0.02	✓

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	160,000	49/0.49
LUDEP	130,000	8.8/0.088

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

Organ	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent (rem/Sv)
Organ Testes	7.1E+00/7.1E-02	2.5E-01	1.8E+00/1.8E-02
Breast	2.4E-04/2.4E-06	1.5E-01	3.6E-05/3.6E-07
Red Marrow	3.9E+01/3.9E-01	1.2E-01	4.6E+00/4.6E-02
	1.8E+02/1.8E+00	1.2E-01	2.2E+01/2.2E-01
Lung Thyroid	2.2E-04/2.2E-06	3.0E-02	6.7E-06/6.7E-08
Bone Surface	5.0E+02/5.0E+00	3.0E-02	1.5E+01/1.5E-01
Liver	8.9E+01/8.9E-01	6.0E-02	5.4E+00/5.4E-02
Other	8.5E+00/8.5E-02	6.0E-02	5.1E-01/5.1E-03
Lower Large Intestine	1.8E-02/1.8E-04	6.0E-02	1.1E-03/1.1E-05
Upper Large Intestine	6.1E-03/6.1E-05	6.0E-02	3.7E-04/3.7E-06
Small Intestine	1.2E-03/1.2E-05	6.0E-02	7.5E-05/7.5E-07
Effective Dose Equivale			4.9E+01/4.9E-01

(b) (6)

(b) (6)

Two urine samples were analyzed by alpha spectrometry and one early sample by gross alpha counting. The gross alpha reported 2.59+/- 0.81 pCi/day; however this was not used in our analysis because of suspected contamination from on-site collection of the samples. The two samples analyzed by alpha spectrometry were reported with a positive result. The two values were fit using CINDY and the Jones excretion model were used to estimate an intake (160,000 pCi), organ doses, and a CEDE (49 rem/0.49 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 130,000 pCi and a CEDE (ICRP-60) of 8.8 rem (0.088 Sv). The drop in urine content by almost a factor or 10 from 28 September 1966 to 28 February 1967 is not characteristic of Class Y plutonium.

Conclusion:

Based on the results of intake estimates and dose calculations, this individual received an intake of about 130,000 to 160,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 8.8 to 49 rem (0.088 to 0.49 Sv). That dose range is more than the cumulative dose (7 rem) from a lifetime (70 years) of exposure at the current level (0.100 rem) for members of the public. It ranges up to the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). This case represents substantial intake and dose based on limited urine excretion data. Additional testing now using modern sensitive techniques could provide additional information for further assessment.

Prepared By:	
Name:	
Signature:	Date:
Peer Reviewed By:	
Name:	
Signature:	Date:

FEB 1 0 1966

NAME (LAST, FIRST, M	.1.) (1-20)	SOC. SEC	NO. (21 - 29)	TYPE SAMP	LE (30)	TYPE ANAL. (31-3
b) (6)		A2C (b) (6)	A COL	URI		GROSS ALPH
AMPLE NO. (33-38)		SAMPLE DATE (39-44)			EXPOSURE	
66.	.521	PROMI B FEER 1966	то		DATE 8 JA	1 1966 TYPE
ASE (57-60)		OCCUPATION (61-62)	REQUESTED BY	181		
SAMPLE NO. (33-36) 66- 9ASE (57-60) ADAM AB DATE RECEIVED EED 1 0 191	SPAIN	,				
DATE RECEIVED	00	SAMPLE VOLUME .	VOLUME ANALYZ	ED	DATE ANALYZ	E D
LED TO 12	00	625 ml.	200 mel.			
TECHNICIAN (SIGNA	TURE AND DATE)	(b) (6)		1	5 FEB 1966	
URINE		S\$GT.	KASON			S/BLOOD
Counter Number	C		Chamber Number		. Counter I	Number
Counter Bkg. (cpm)	01/3		Cham. Bkg. (mv/se	c)	Counter E	Skg
Counter Eff. (%)	5-1		Counter Eff. (%)		Counter	ff.
Date/Time - Start 1	5 FEB 1966		Millivolt - Start		Date/Tin	ne - Start
-Stop	e* -		Millivolt - Stop			- Stop
Total Counts	59		Total Millivots		Total Co	unts
Counting Time	55		Total Drift Time		Counting	Time
ross cpm	1.07		Gross my/sec		Gross cp	m
Bkg. Cpm	0.13		Bkg. Mv/sec		Bkg. cpm	
Net cpm	0.13		Net my/sec		net cpm	
sport Pcill	4.15 1.3	b	curies/my		dpm	
dpm/24 hr. (69-74)			litter (69 - 74)		dps/cc	
K 40 Correction					Neutron I	Dose (rads) (63-68)
Not Beto Ril 91	2.59 + 0.8		D(q) (63-68)		uc/mg	(69 - 74)
D (q) (63 - 68)		On: 1.52 K	10-5 34		17 Feb 66	- 68)

			HOLLOGI	CAL SAMPL	Leocial	SECURITY N	IMBER	RHL SAMPLE N	UMBER
ME OR REQUESTOR'S ID (1-2	010	. GRADE		(b) (6)		ACCURITY N			001
YPE SAMPLE (23-32) () Urine	OCCUPATION (34-35)	ANALYSIS D			SCHW				NOT AFE
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						230	6	1238	2.79
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SUMMARY OF RESULTS:							1	ecour	

(b) (6)

7		RADIOLO	OGICAL SA	MPLE DA	TA L		1108-5-1	(6)
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YPE SAMPLE (23-32)	OCCUPATION	ANALYSIS DESIRED	-	REQUESTED		AIR FO	ORCE BASE (68-71)	
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		236	7	238	RADON	9		
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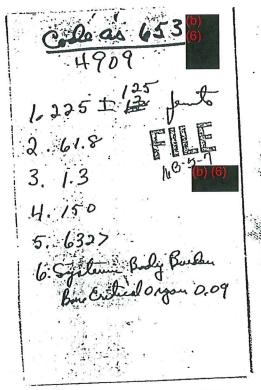
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•	•	RAD	OLOGICAL SAMPL	F DATA N MM	E 670699 K
OR REQUESTOR'S ID (1-	-20)	GRADE	AFSN	SOCIAL SECURITY WIL	
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		236			ALCOHOL STREET
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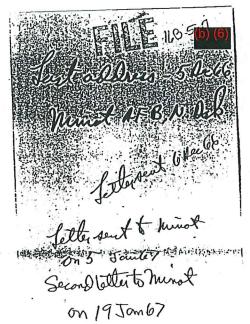
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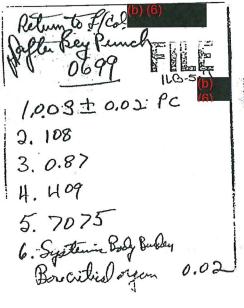
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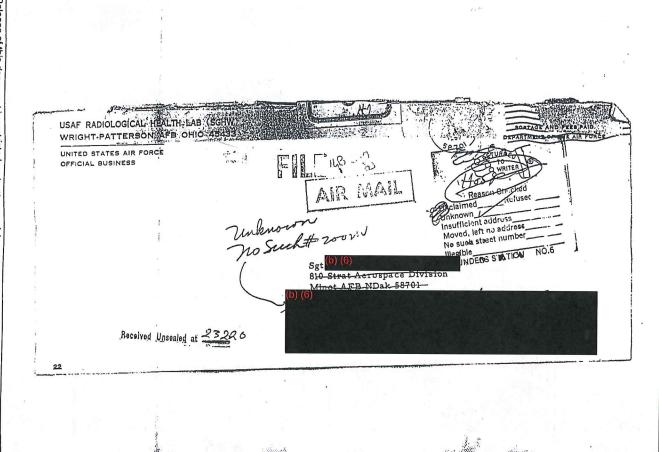
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ROUTINE

0 RFTU JAW RUEOESE0392 3631758-UUUU--RUEDFIA. 0 DE RUTHAG 47 3631525 0 ZNR UUUUU 0 R 291500Z DEC 66 FM 870USAFHOSP APO NEW YORK 09284 3 TO USAFRADL HEALTH LAB WPAFB OHIO G BT UNCLAS SUA1 01995 DEC 66 E. FOR: SGHW. SUBJ: LONG TERM STUDIES ON SELECTED PARTICIPANTS OF 0 PALOMARES INCIDENT. A2C (6) (6) DISCHARGED SSN FROM THE SERVICE! HOME ADDRESS IS SSN HAS DEPARTED PCS TO 810TH STRAT AEROSPACE DIV. MINOT AFB. N. DAK. 0 APO NEW YORK 09282: STATIONED AT THIS BASE AND HAS CONSENTED TO SUBMIT REQUIRED SPECIMENS UNTIL PROJECTED DOS: 1 JUN 67. BT HNNN# ()

UNCLASSIFIED

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DEPARTMENT OF THE AIR FORCE USAF RADIOLOGICAL HEALTH LABORATORY (AFLC) WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433



REPLY TO

SGHW

7 Dec 1967

Tr :

Long-Term Medical Follow-Up, Palomares Operation Urine Studies for 200 Pu.

Sgt (b) (6)

810 Strat Aerospace Division
Minot AFB NDak 58701

- 1. As a result of your splendid cooperation in this program, it is possible to discontinue further sampling.
- 2. Our results show that your health is in no jeopardy from retention of radioactive materials as a result of participation in subject operation.
- 3. If you are still on active duty, please present this letter to the custodian of your medical records so that it may be made a part of your permanent file. If not on active duty, it is suggested you retain it in your permanent personal records.
- you retain it in your permanent personal records.

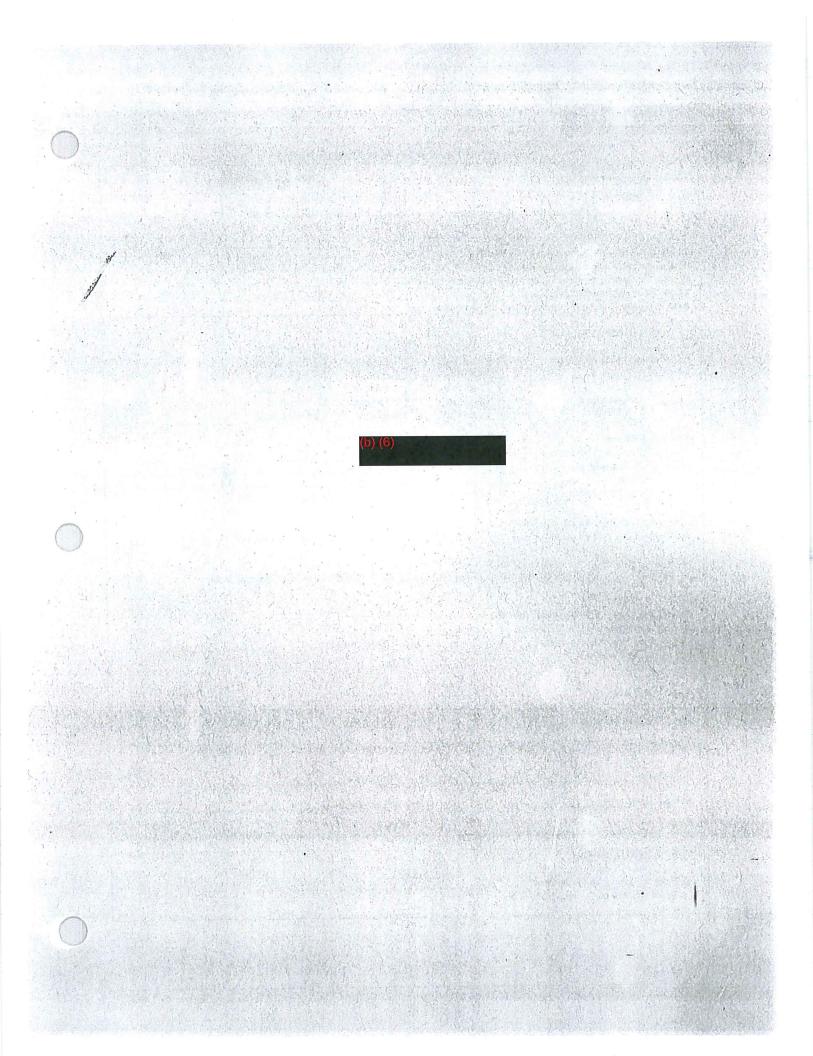
 4. Our files, show that three sample bottles were sent to you and that one samples were returned for analysis.

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o) (6)

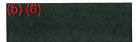
(b) (6)

- 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	nternal Dosime	etry Evaluation	on Form	
NAME: (b) (6)			SSN: (b) (6)	
MODE OF INTAKE: Inhalation Ingestion Unknown SUMMARY OF EXPOSURE COND Radionuclides/Respiratory Class/Part Date or Period of Evaluated Data: 7 to Duration of Exposure: Unknown Location of Exposure: Camp Wilson,	icle Size: ²³⁹ Pu/1009 trine samples from 04	1/18/66 throu 1/18/66 assur % Class Y/I µm A 1/02/66 to 09/14/6	MAD):
EVALUATION DATA: Air Sampling Health Physics Survey Data Bioassay – Urinalysis Fecal Nasal Smears In Vivo	☐ Attached ☐ Attached ☑ Attached ☐ Attached ☐ Attached ☐ Attached	In Process	 ✓ Unavailable 	
Medical Treatment: Skin Decontamination: Decorporation: Catharsis: Surgical excision: EVALUATION METHODOLOGY:	☐ Yes ☐ Yes	X No Agent: _ X No Agent: _		Date:
Assumptions: Acute inhalation intak Code/Model used for: Intake Est Dose Esti	ke of ²³⁹ Pu, 100% Cla limate: CINDY, Ver. mate: CINDY, Ver.	1.4/JONES		
RESULTS SUMMARY Estimated Intake Activity (pCi): 110 50 YR CEDE (rem): 34 (0.34 Sv) Organ Dose Equivalent Summary Bone Surface Lung Liver Red Marrow Other Testes		0 YR CDE (rem/ 340/3.4 130/1.3 61/0.61 26/0.26 5.8/0.058 4.9/0.049	Sv)	
DOSE ASSESSOR: DA' Signature:			The second secon	
Print Name:SSN:		Print Name: SSN:		47
RECOMMENDATIONS: Additional Bioassay Required Suggested Sampling Frequency: Work Restrictions: N/A	Uri	nalysis 🔲 F	ecal I	n Vivo

Preliminary Internal Dosimetry Case Narrative

Identification:

Name: SSN:



Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. Several sample data cards indicate that exposure occurred in January 1966; however no specific date was noted. One sample was collected on 2 April 1966; about one week before Camp Wilson Operation closed. Marking other information his exposure formally assumed to end on 1 April 1966. An exposure date of 18 January 1966 corresponding to the first day of the response was chosen as most conservative.

Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

Dates	% Body Burder
4/02/66	
9/26/66	7
1/19/67	3
4/17/67	0
9/14/67	0

Radionuclide(s): 239Pu.

Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1 μ m AMAD particle size on 1/18/66. The date is the first day of the period on station from 1/18/66 to 4/01/66.

April 2001

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.

Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

Sample	*Analysis	Date	Elapsed Days	Result (pCi/day)	Error (pCi/day)	Included
66-2882	G	04/02/66	74	1.76	0.34	
66-4982	AS	09/26/66	251	0.113	0.069	1
66-4982B	AS	09/26/66	251	0.356	0.201	✓
67-0438	AS	01/19/67	366	0.0371	0.0186	1
67-2153	AS	04/17/67	454	ND		✓
67-2153B	AS	04/17/67	454	0.014	0.014	1
67-5651	AS	09/14/67	604	ND	,	1

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	110,000	34/0.34
LUDEP	92,000	6.5/0.065

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the results in the table below.

Four urine samples were analyzed by alpha spectrometry and one early sample by gross alpha counting. The gross alpha reported 1.76+/- 0.34 pCi/day; however this was not used in our analysis because of suspected contamination from on-site collection of the samples. Two of four samples analyzed by alpha spectrometry were performed in duplicate. Two of the four reported as NDA (no detectable activity) and two reported four positive results. The four values were fit using CINDY and the Jones excretion model to estimate an intake (110,000 pCi), organ doses, and a CEDE (34 rem/0.34 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 92,000 pCi and a CEDE (ICRP-60) of 6.5 rem (0.065 Sv).



	Dose Equivalent	Weighting	Weighted Organ Dose Equivalent
Organ	(rem/Sv)	Factors	(rem/Sv)
Testes	4.9E+00/4.9E-02	2.5E-01	1.2E+00/1.2E-02
Breast	1.6E-04/1.6E-06	1.5E-01	2.4E-05/2.4E-07
Red Marrow	2.6E+01/2.6E-01	1.2E-01	3.2E+00/3.2E-02
Lung	1.3E+02/1.3E+00	1.2E-01	1.5E+01/1.5E-01
Thyroid	1.5E-04/1.5E-06	3.0E-02	4.6E-06/4.6E-08
Bone Surface	3.4E+02/3.4E+00	3.0E-02	1.0E+01/1.0E-01
Liver	6.1E+01/6.1E-01	6.0E-02	3.7E+00/3.7E-02
Other	5.8E+00/5.8E-02	6.0E-02	3.5E-01/3.5E-03
Lower Large Intestine	1.2E-02/1.2E-04	6.0E-02	7.5E-04/7.5E-06
Upper Large Intestine	4.2E-03/4.2E-05	6.0E-02	2.5E-04/2.5E-06
Small Intestine	8.6E-04/8.6E-06	6.0E-02	5.1E-05/5.1E-07
Effective Dose Equivale	nt		3.4E+01/3.4E-01

Conclusion:

Based on the results of intake estimates and dose calculations, this individual received an intake of 92,000 to 110,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 6.5 to 34 rem (0.065 to 0.34 Sv). That dose range from the cumulative dose (7 rem) from a lifetime (70 years) of exposure at the current level (0.100 rem) for members of the public to almost five times that level. It is more than one-half the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). Significant health consequences are not associated with this dose level.

Prepared By:	
Name:	
Signature:	Date:
Peer Reviewed By:	
Name:	
Signature:	Date:



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C	B1	SAMPLE DA	TE (39-44				(31.5
66-2882			00 1 Apr	TO :0700 2 Apr	EXI	OSURE	-
BASE (57-60)		OCCUPATIO	N (61 - 62)	REQUESTED BY	66 4	DATE	YPE
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		SAMPLE YO	LUME	VOLUME ANALYZED	Carlo de la Carlo	Chicken - in -2	٠
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URINE	-			RADON 均高等	LINE AND AND		
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Counter Bkg. (cpm)	0.03 (900)		1	Chamber Number	1 2 2 2	Counter Number	T
Counter Eff. (%)	51		t= 45	Cham. Bkg. (mv/sec)	では、日本の一年の一年の一年の一年の一年の一年の一年の一年の一年の一年の一年の一年の一年の	Counter Bkg.	_
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Net cpm	1.99	127700	14 Hample	Bkg. Mv/sec	Accession.	Bkg. cpm	064
tom peil	1.08	# 0.21		Net my/sec has	A Proposition of the	net cpm	
dpm/24 hr. (69-74)		0.57		curies/my " : ****** and	अभून्यकार सम्बद्ध	dpm	0.140
K 40 Correction				litter (69 - 74) 3344	goden on	dps/cc	+
Hat Boto per / Sul	1.76 +	0.34		and suffering a light	the second	Neutron Dose (rods) (6	2 (0)
D(q) (63-68)		2.37		D(q) (63 · 68)	-17.7 Per -	uc/mg (69-74)	3-68)
				1	- 1	D(q) (63-68)	

	0)	GRA	IDE	AFSN		SOCIAL	SECURITY NUMBER		66-2882
PE SAMPLE (23-32)	OCCUPATION (34-35)	ANALY	SIS DESIRED		REQUES	STED BY			ORCE BASE (68-71)
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NAME OF REQUESTOR'S ID (1-	Petro College		SSGT	AFSN (b) (6))	AIR FORCE BAS	LE HUMBER
TYPE SAMPLE (23-32) Urine	OCCUPATION (34-35)	ANALYSIS D	u 239		REQUEST	SGE		Torre	ion Spain
20 Sept 66	DATE ANALYZED			OV 66			26 Sept 66	Jon (
	- U5 ALI	n WEIGHT.	VOLUME A	NALYZED	4501	ne	26 Sep t 66 (b) (6)		
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ENVIRONMENTAL SAMPLES									
COUNTER & EFFICIENCY				-		_			
TOTAL COUNTS & MINUTES				-					
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and the second of	10								
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(b) (6)		GRADE		AFSN		SOCIAL	SECURITY HUM		CATTOOS - F
TYPE SAMPLE (23-32)	(34-35)	ANALYSIS	DESIRED		REQUEST	ED BY		AIR F	ORCE BASE (66-71)
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	rec 3	71/ 5					RADON		
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GROSS CPM	100	30		4					
KG CPM & MINUTES	800	0		2					
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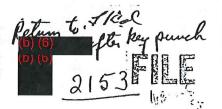
AFLC FORM 1165

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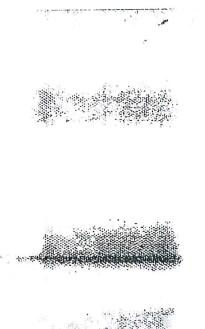
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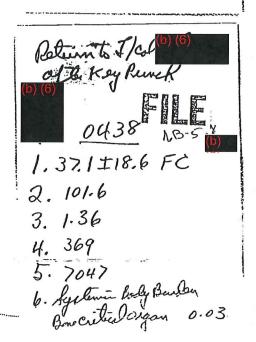


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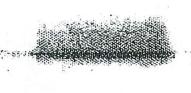
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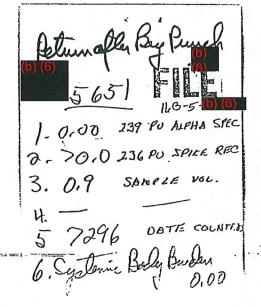
C-Quens®

Sequential folder containing fifteen 80-mcg, tablets of mestranol plus five tablets each combining 80 mcg, mestranol, and 2 mg, chlormadinone acetate.

A More Physiological Approach to Oral Contraception

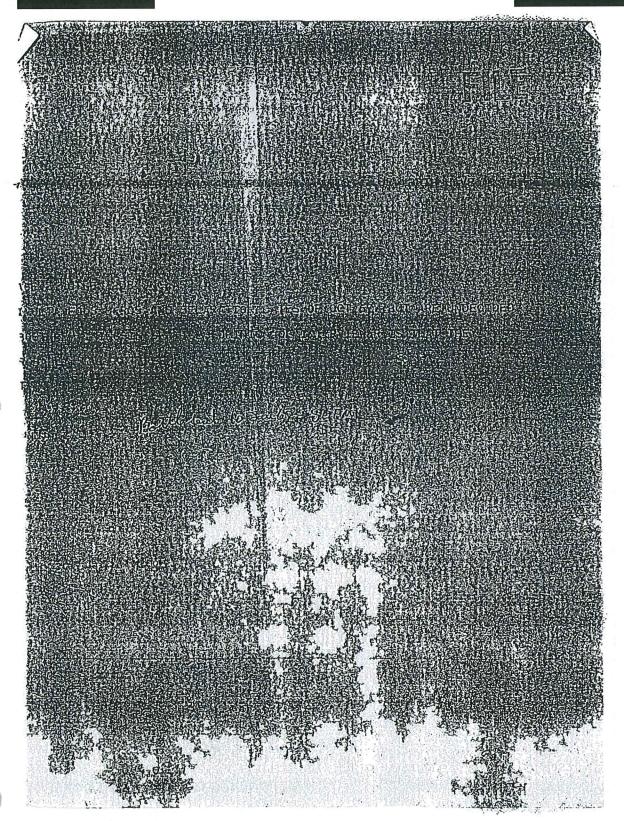






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DEPARTMENT OF THE AIR FORCE USAF RADIOLOGICAL HEALTH LABORATORY (AFLC WRIGHT-PATTERSON AIR FORCE BASE OHIO 45433

7 Dec 1967

Long-Term Medical Follow-Up, Palomares Operation Urine Studies for 239 Pu.

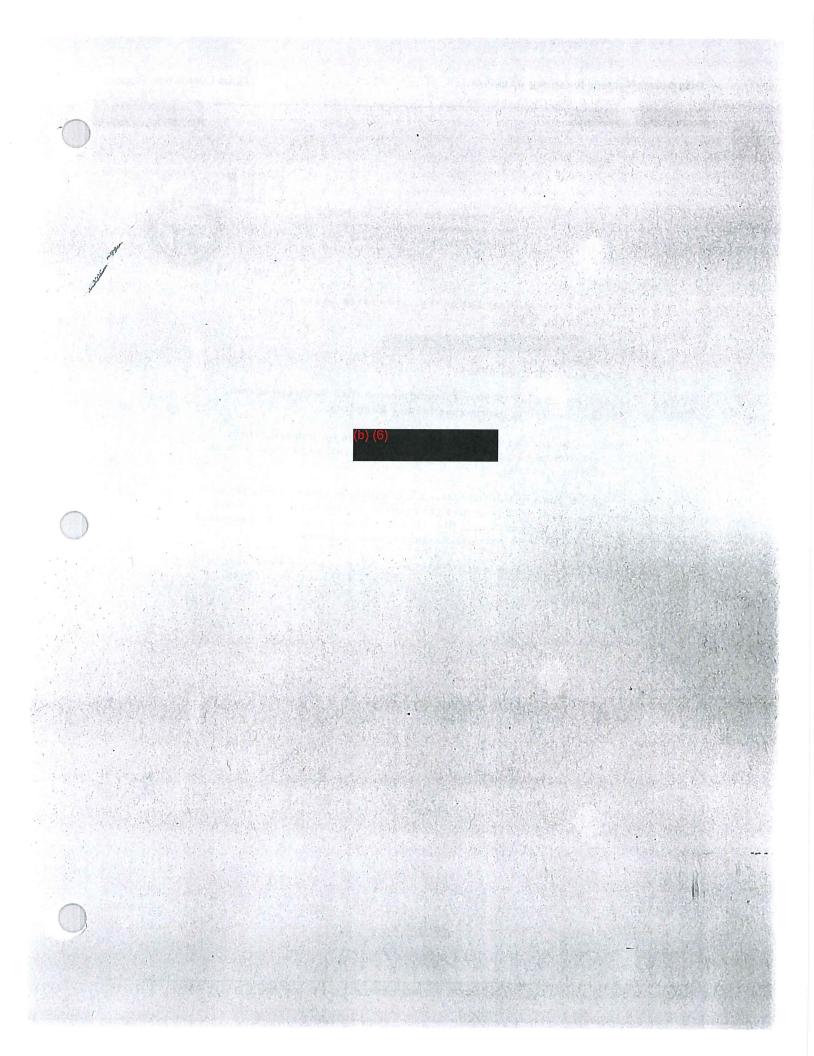
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63 Svc Sq

Norton AFB Calif 92409

- As a result of your splendid cooperation in this program, it is possible to discontinue further sampling.
- 2. Our results show that your health is in no jeopardy from retention of radioactive materials as a result of participation in subject operation.
- 3. If you are still on active duty, please present this letter to part of your permanent file. If not on active duty, it is suggested you retain it in your permanent personal records.

 4 Ourstiles show that three sample bottles were sent to
 - ndgiar three seamples were returned forganalysis.







Interna	il Dosimetry Evaluation	1 FORM
NAME: (6)		SSN: (b) (6)
	ction 01/18/66 throu 1/18/66 assume applicable S: 239 Pu/100% Class Y/1 µm AM nples from 02/05/66 to 09/07/67	
Health Physics Survey Data Bioassay – Urinalysis Fecal Nasal Smears In Vivo Medical Treatment:	Attached	 ☑ Unavailable ☑ Unavailable ☐ Unavailable ☑ Unavailable ☑ Unavailable ☑ Unavailable ☑ Unavailable
Decorporation:	les ⊠ No Agent: _ les ⊠ No Agent: _	Date: Date:
Code/Model used for: Intake Estimate:	⁹ Pu, 100% Class Y, 1 μm AMAI CINDY, Ver. 1.4/JONES CINDY, Ver. 1.4/ICRP 30, Par	
RESULTS SUMMARY Estimated Intake Activity (pCi): 42,000 50 YR CEDE (rem): 13 (0.13 Sv) Organ Dose Equivalent Summary Bone Surface Lung Liver Red Marrow Other Testes	50 YR CDE (rem/ 130/1.3 48/0.48 23/0.23 10/0.10 2.2/0.022 1.9/0.019	'Sv)
DOSE ASSESSOR: DATE:	PEER REVIE	WER: DATE:
Signature:Print Name:		
SSN:	SSN:	
RECOMMENDATIONS: Additional Bioassay Required Suggested Sampling Frequency: Work Restrictions: N/A	☐ Urinalysis ☐	Fecal In Vivo





Preliminary Internal Dosimetry Case Narrative

Identification:

Name: SSN:



Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. Two urine sample data cards indicated exposures on 17 and 18 January 1966. An exposure date of 18 January 1966 corresponding to the first day of the response was chosen as most conservative.

Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as show below.

Dates	% Body Burden
2/5/66	-
7/28/66	7
2/22/67	2
5/2/67	0
9/7/67	0

Radionuclide(s): 239Pu.

Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1 μm AMAD particle size on 1/18/66. The date is the first day of the period on station from 1/18/66 to 2/25/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.

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Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

			Elapsed	Result	Error	
Sample	*Analysis	Date	Days	(pCi/day)	(pCi/day)	Included
66-921	G	02/05/66	18	1.95	0.072	
66-4302	AS	07/28/66	191	0.140	0.0052	✓
67-0652	AS	02/22/67	400	0.03	0.001	✓
67-1638	AS	05/02/67	469	ND		✓
67-4859	AS	09/07/67	597	ND		✓
67-4859B	AS	09/07/67	597	ND		✓

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	42,000	13/0.13
LUDEP	140,000	9.5/0.095

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

	Dose Equivalent	Weighting	Weighted Organ Dose Equivalent
Organ	(rem/Sv)	Factors	(rem/Sv)
Testes	1.9E+00/1.9E-02	2.5E-01	4.7E-01/4.7E-03
Breast	6.2E-05/6.2E-07	1.5E-01	9.3E-06/9.3E-08
Red Marrow	1.0E+01/1.0E-01	1.2E-01	1.2E+00/1.2E-02
Lung	4.8E+01/4.8E-01	1.2E-01	5.8E+00/5.8E-02
Thyroid	5.9E-05/5.9E-07	3.0E-02	1.8E-06/1.8E-08
Bone Surface	1.3E+02/1.3E+00	3.0E-02	3.9E+00/3.9E-02
Liver	2.3E+01/2.3E-01	6.0E-02	1.4E+00/1.4E-02
Other	2.2E+00/2.2E-02	6.0E-02	1.3E-01/1.3E-03
Lower Large Intestine	4.8E-03/4.8E-05	6.0E-02	2.9E-04/2.9E-06
Upper Large Intestine	1.6E-03/1.6E-05	6.0E-02	9.6E-05/9.6E-07
Small Intestine	3.3E-04/3.3E-06	6.0E-02	2.0E-05/2.0E-07
Effective Dose Equivale		1.3E+01/1.3E-01	



Revised Dose Evaluation Report April 2001

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Four urine samples (one in duplicate) were analyzed by alpha spectrometry and one early sample by gross alpha counting. The gross alpha reported 1.95 +/- 0.84 pCi/day; however this was not used in our analysis because of suspected contamination from on-site collection of the samples. Two of four samples analyzed by alpha spectrometry were reported as NDA (no detectable activity) and two were reported with a positive result. The four values were fit using CINDY and the Jones excretion model to estimate an intake (42,000 pCi), organ doses, and a CEDE (13 rem/0.013 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 140,000 pCi and a CEDE (ICRP-60) of 9.5 rem (0.095 Sv).

Conclusion:

Based on the results of intake estimates and dose calculations, this individual received an intake of 42,000 to 140,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 9.5 to 13 rem (0.095 to 0.13 Sv). That dose level is more than the cumulative dose (7 rem) from a lifetime (70 years) of exposure at the current level (0.100 rem) for members of the public. It is less than one-half the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). Serious health consequences are not associated with this dose level.

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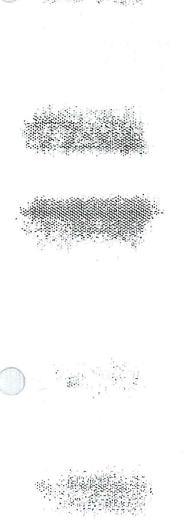
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Torrigon, Spain.

Segar parties

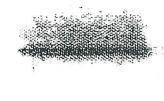
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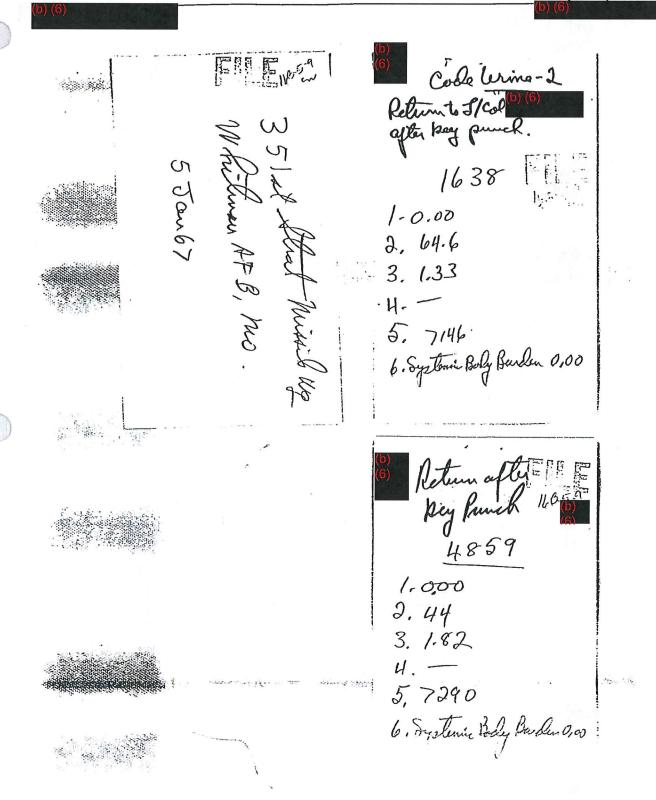
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C-Quens

Sequential folder containing fifteen 80-mcg. tablets of mestranol plus five tablets each combining 80 mcg. mestranol and 2 mg. chlormadinone acetate.

A More Physiological Approach to Oral Contraception







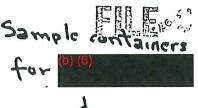
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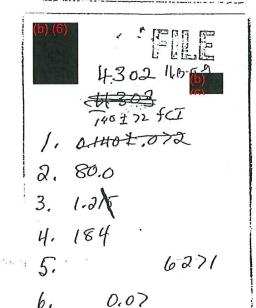




(Resample Program) sent 13 Feb 67



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DEPARTMENT OF THE AIR FORCE

USAF RADIOLOGICAL HEALTH LABORATORY LAFLED

WRIGHT-PATTERSON AIR FORCE BASE OHIO 45433

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7 Dec 1967

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Long-Term Medical Follow Up & Palomares, Operation Urine Studies for 22 Pu.

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it is possible to discontinue further sampling.

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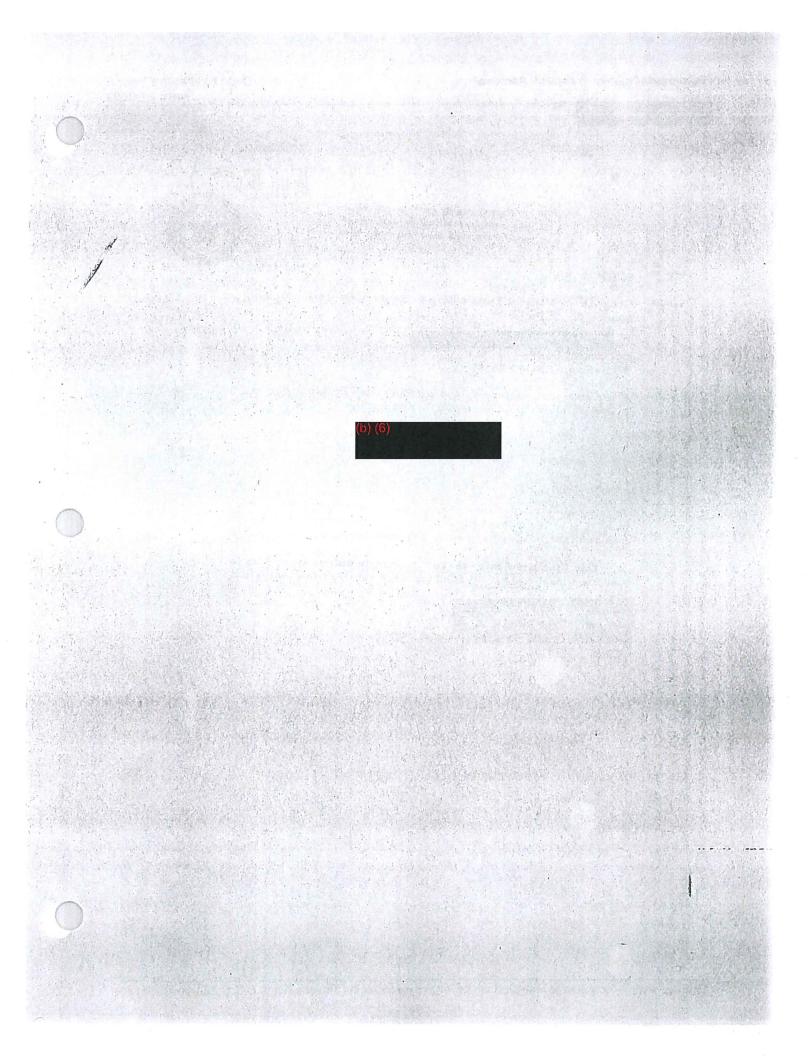
33 If two ware still on active duty. please present this letter to the custodian of your medical records so that it may be made a part of your permanent file. If not on active duty, it is suggested you retain it in your permanent personal records.

4. Our files show that three sample bottles were sent to you, and that three samples were returned for analysis.

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LtCol, USAF, MC

Chief



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Internal Dosimetry Evaluation Form NAME: SSN: MODE OF INTAKE: INTAKE DATE OR PERIOD: ☐ Injection 1/18/66 through 2/19/66, assumed ☐ Ingestion ☐ Absorption ☐ Not applicable 1/18/66 assumed start. Unknown SUMMARY OF EXPOSURE CONDITIONS: Radionuclides/Respiratory Class/Particle Size: ²³⁹Pu/100% Class Y/1 µm AMAD Date or Period of Evaluated Data: 5 urine samples from 02/20/66 to 08/25/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain **EVALUATION DATA:** Air Sampling ☐ Attached ☐ In Process □ Unavailable Attached □ Unavailable Health Physics Survey Data ☐ In Process ☐ In Process Bioassay - Urinalysis Unavailable In Process Fecal ☐ Attached ☑ Unavailable☑ Unavailable Nasal Smears Attached In Process In Vivo ☐ Attached ☐ In Process Medical Treatment: Skin Decontamination: ☐ Yes Date: Decorporation: ☐ Yes ☑ No Agent: Catharsis: Yes Yes ⊠ No Agent: Date: Surgical excision: ☐ Yes X No Date: **EVALUATION METHODOLOGY:** Assumptions: Acute inhalation intake of ²³⁹Pu, 100% Class Y, 1 µm AMAD particle size on 1/18/66 Code/Model used for: Intake Estimate: CINDY, Ver. 1.4/JONES Dose Estimate: CINDY, Ver. 1.4/ICRP 30, Part 4, General Systemic Model **RESULTS SUMMARY** Estimated Intake Activity (pCi): 64,000 50 YR CEDE (rem): 20 (0.20 Sv) **Organ Dose Equivalent Summary** 50 YR CDE (rem/Sv) **Bone Surface** 200/2.0 Lung 73/0.73 Liver 36/0.36 Red Marrow 15/0.15 Other 3.4/0.034 Testes 2.9/0.029 DOSE ASSESSOR: DATE: PEER REVIEWER: DATE: Signature: _ Signature: __ **Print Name:** Print Name: SSN: SSN: RECOMMENDATIONS: Additional Bioassay Required ☐ Urinalysis ☐ Fecal ☐ In Vivo Suggested Sampling Frequency: Work Restrictions:



Preliminary Internal Dosimetry Case Narrative

Identification:

Name: SSN:

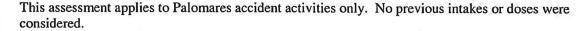


Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. One urine sample data card indicated an exposure of January 1966. An exposure date of 18 January 1966 corresponding to the first day of the response was chosen as most conservative. One urine sample was collected on-site on 20 February 1966. The exposure date was assumed to end on 10 February 1966.

Previous Intake/Dose Assessments:



Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

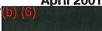
Dates	% Body Burden
2/20/66	-
6/9/66	7
1/21/67	2
4/25/67	0
8/25/67	0

Radionuclide(s): 239Pu.

Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1 μ m AMAD particle size on 1/18/66. The date is the first day of the period on station from 1/18/66 to 2/19/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.



Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

	Ü.		Elapsed	Result	Error	
Sample	*Analysis	Date	Days	(pCi/day)	(pCi/day)	Included
66-1037	G	02/20/66	33	2.38	1.64	
66-3405B	AS	06/09/66	142	0.174	0.125	✓
67-0349	AS	01/21/67	368	0.0218	0.0157	✓
67-1495	AS	04/25/67	462	0.00721	0.00723	✓
67-4316	AS	08/25/67	584	ND		✓

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	64,000	20/0.20
LUDEP	37,000	2.6/0.026

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

	Dose Equivalent	Weighting	Weighted Organ Dose Equivalent
Organ	(rem/Sv)	Factors	(rem/Sv)
Testes	2.9E+00/2.9E-02	2.5E-01	7.1E-01/7.1E-03
Breast	9.5E-05/9.5E-07	1.5E-01	1.4E-05/1.4E-07
Red Marrow	1.5E+01/1.5E-01	1.2E-01	1.8E+00/1.8E-02
Lung	7.3E+01/7.3E-01	1.2E-01	8.8E+00/8.8E-02
Thyroid	8.9E-05/8.9E-07	3.0E-02	2.7E-06/2.7E-08
Bone Surface	2.0E+02/2.0E+00	3.0E-02	6.0E+00/6.0E-02
Liver	3.6E+01/3.6E-01	6.0E-02	2.1E+00/2.1E-02
Other	3.4E+00/3.4E-02	6.0E-02	2.0E-01/2.0E-03
Lower Large Intestine	7.3E-03/7.3E-05	6.0E-02	4.4E-04/4.4E-06
Upper Large Intestine	2.4E-03/2.4E-05	6.0E-02	1.5E-04/1.5E-06
Small Intestine	5.0E-04/5.0E-06	6.0E-02	3.0E-05/3.0E-07
Effective Dose Equivale	nt		2.0E+00/2.0E-02



Revised Dose Evaluation Report April 2001

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(b) (6)

Four urine samples were analyzed by alpha spectrometry and one early sample by gross alpha counting. The gross alpha reported 2.38 +/- 1.64 pCi/day; however this was not used in our analysis because of suspected contamination from on-site collection of the samples. One of four samples analyzed by alpha spectrometry was reported as NDA (no detectable activity) and three were reported with a positive result. The four values were fit using CINDY and the Jones excretion model to estimate an intake (64,000 pCi), organ doses, and a CEDE (20 rem/0.20 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 37,000 pCi and a CEDE (ICRP-60) of 2.6 rem (0.026 Sv).

Conclusion:

Prepared By:

Based on the results of intake estimates and dose calculations, this individual received an intake of ranges from 37,000 to 64,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 2.6 to 20 rem (0.026 to 0.20 Sv). That dose ranges from over one-half of the cumulative dose (7 rem) from a lifetime (70 years) of exposure at the current level (0.100 rem) for members of the public to about three times the level. It also ranges to about one-half the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). Significant health consequences are not associated with these dose levels.

Name:		
Signature:	Date:	
Peer Reviewed By:		
Name:		
Signature:	Date:	- <u> </u>

Bkg. Mv/sec

Net my/sec

litter (69 - 74)

D(q) (63-68)

Di: 1.27 × 10-34

curies/my

Bkg. cpm

net cpm

dps/cc

uc/mg (69-74)

D(q) (63-68)

Neutron Dose (rads) (63-68)

dpm

Release of this document is restricted under the provisions of the Privacy Act, 5 U.S.C. 552(a). C.1-138

Net cpm

dpm/24 hr. (69-74) K 40 Correction

Not Bett 124/16/ 2.38±1.64 D(q) (63.68)

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Dose Evaluation Report April 28, 2000

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AFSN: (b) (6)	INTER	HAL DOSE DATA	160 5	h BLE
NAME (LAST, FIRST, M.L.) (1-	20) SOC. S	EC. NO. (21-29) TYPE	SAMPLE (30)	TYPE ANAL. (31-32)
(b) (6)	Lt Col	1(0)	Urine	
SAMPLE NO. (33-36)	SAMPLE DATE (39-44)		EXPOSURE	
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Westover AFB, M	SAMPLE VOLUME	VOLUME ANALYZED	DATE ANALYZ	FD
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		Counter Eff. (%)	Counter	
Counter Eff. (%) Date/Time - Start		Millivolt — Start		me — Start
-Stop		Millivolt — Start Millivolt — Start	Date/Li	— Stop
Total Counts		Total Millivots	Total Co	
Counting Time		Total Drift Time	Counting	
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ATE RECEIVED (37-42)	DATE ANALYZE	D (51-56)	13 7e	267	DATE	an 67	EXPOSORE DATE	
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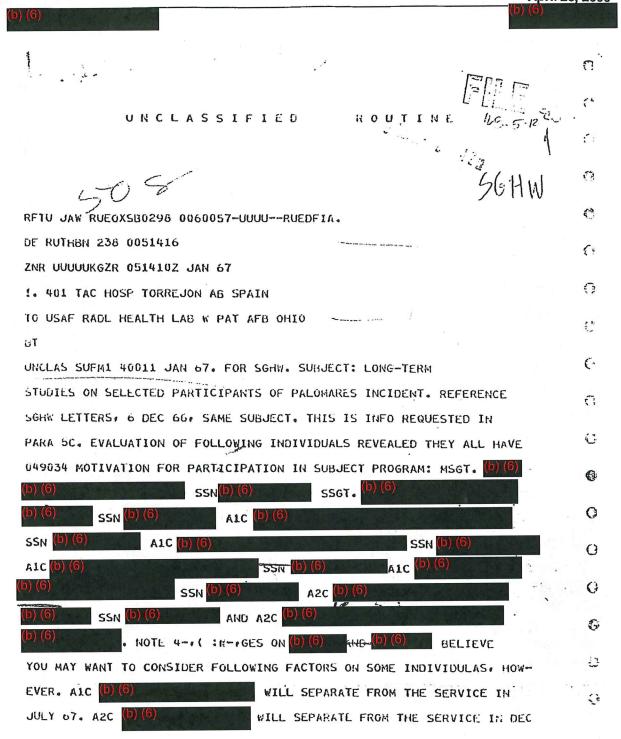
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UNCLASSIFIED ROUTIRE FTU JAK RUEOXSB0296 0060057-UUUU--RUEDFIA. 13 : RUTHBN 238 0051416 THE UUUUUKGZR 051410Z JAN 67 . 401 TAC HOSP TORREJON AB SPAIN USAF RADL HEALTH LAB W PAT AFB OHIO CLAS SUFMI 40011 JAN 67. FOR SGHW. SUBJECT: LONG-TERM (SUDIES ON SELECTED PARTICIPANTS OF PALOMARES INCIDENT. REFERENCE :: AW LETTERS, 6 DEC 66, SAME SUBJECT. THIS IS INFO REQUESTED IN HA SC. EVALUATION OF FOLLOWING INDIVIDUALS REVEALED THEY ALL HAVE 49034 MOTIVATION FOR PARTICIPATION IN SUBJECT PROGRAM: MSGT. 6 SSGT. SSN (b) (6) 0 ALC SSN 0 SSN (AND A2C (b) (6) E. NOTE 4- (: 15- GES ON (b) (6) AND (D) (6) BELIEVE . J MAY WANT TO CONSIDER FOLLOWING FACTORS ON SOME INDIVIDULAS. HOW-

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DEPARTMENT OF THE AIR FORCE
USAF RADIOLOGICAL HEALTH LABORATORY (AFLC)
WRIGHT PATTERSON AIR FORCE BASE OHIO 43433



SGHW

7 Dec 1967

Long Term Medical Follow Up, Palomares Operation Urine

A2C(b) (6)

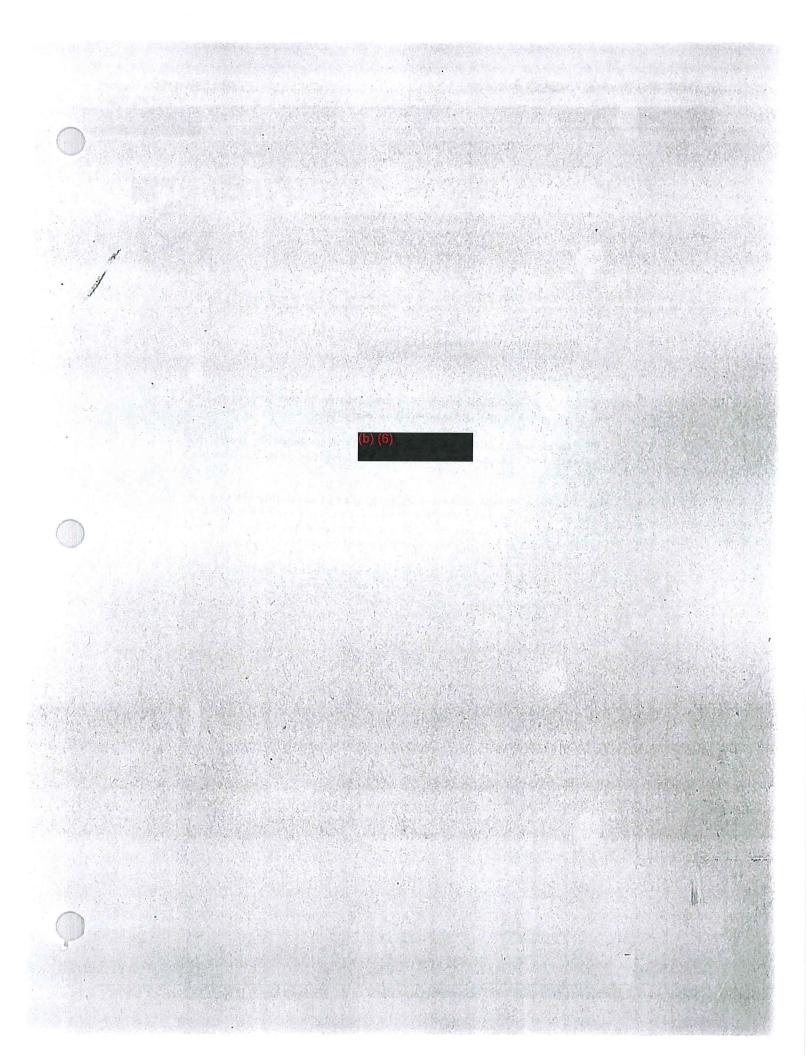
401 Tac Hosp (MSMH)
APO New York 09283

- 1. . As a result of your splendid cooperation in this program, rit is possible to discontinue further sampling.
- 2. Our results show that your health is in no jeopardy from retention of radioactive materials as a result of participation in subject operation.
- 3. If you are still on active duty, please present this letter to the custodian of your medical records so that it may be made a part of your permanent file. If not on active duty, it is suggested you retain it in your permanent personal records.
 - you retail the sample bottles were sent to sample bottles were sent to solve and that three samples were returned for analysis.

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Internal I	Oosimetry Evaluation	Form
NAME: (b) (6)		SSN: (b) (6)
MODE OF INTAKE: Inhalation	ion 1/18/66 assumed icable 1/18/66 assumed 1/	n 02/13/66 on-site start.
EVALUATION DATA: Air Sampling	hed	☑ Unavailable
Catharsis: Yes Surgical excision: Yes	No Agent:	Date:
EVALUATION METHODOLOGY: Assumptions: Acute inhalation intake of ²³⁹ Pu, Code/Model used for: Intake Estimate: Cli Dose Estimate: Cli	100% Class Y, 1 μm AMAD NDY, Ver. 1.4/JONES NDY, Ver. 1.4/ICRP 30, Part 4	
RESULTS SUMMARY Estimated Intake Activity (pCi): 76,000 50 YR CEDE (rem): 23 (0.23 Sv) Organ Dose Equivalent Summary Bone Surface Lung Liver Red Marrow Other Testes	50 YR CDE (rem/S ⁻ 240/2.4 87/0.87 42/0.42 18/0.18 4.0/0.040 3.4/0.034	
DOSE ASSESSOR: DATE:	PEER REVIEW	ER: DATE:
Signature:	Signature:	
Print Name:	Print Name:	
SSN:	SSN:	
RECOMMENDATIONS: Additional Bioassay Required Suggested Sampling Frequency: Work Restrictions: N/A	☐ Urinalysis ☐ Fe	ecal In Vivo





Preliminary Internal Dosimetry Case Narrative

Identification:

Name: SSN:



Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. One urine sample data card indicated exposure during Jan 66. An exposure date of 18 Jan 66 corresponding to the first day of the response was chosen as most conservative. The sample taken on 7 March 1966 is assumed to end exposure on 6 March 1966.

Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

Dates	% Body Burden
1/21/66	-
5/27/66	7
1/20/67	3
4/17/67	0
8/10/67	0

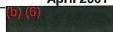
Radionuclide(s): ²³⁹Pu.

Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1 μ m AMAD particle size on 1/18/66. The date is the first day of the period on station from 1/18/66 to 2/13/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.





Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

Sample	*Analysis	Date	Elapsed Days	Result (pCi/day)	Error (pCi/day)	Included
66-244	G	01/21/66	3	0.796	0.788	
66-3263	AS	05/27/66	129	0.206	0.078	✓
67-0351	AS	01/20/67	367	0.0348	0.0206	✓
67-1665	AS	04/17/67	454	ND		✓
67-3859	AS	08/10/67	569	ND		✓

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	76,000	23/0.23
LUDEP	160,000	11/0.11

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

Orese	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent (rem/Sv)		
Organ					
Testes	3.4E+00/3.4E-02	2.5E-01	8.5E-01/8.5E-03		
Breast	1.1E-04/1.1E-06	1.5E-01	1.7E-05/1.7E-07		
Red Marrow	1.8E+01/1.8E-01	1.2E-01	2.2E+00/2.2E-02		
Lung	8.7E+01/8.7E-01	1.2E-01	1.0E+01/1.0E-01		
Thyroid	1.1E-04/1.1E-06	3.0E-02	3.2E-06/3.2E-08		
Bone Surface	2.4E+02/2.4E+00	3.0E-02	7.1E+00/7.1E-02		
Liver	4.2E+01/4.2E-01	6.0E-02	2.5E+00/2.5E-02		
Other	4.0E+00/4.0E-01	6.0E-02	2.4E-01/2.4E-03		
Lower Large Intestine	8.6E-03/8.6E-05	6.0E-02	5.2E-04/5.2E-06		
Upper Large Intestine	2.9E-03/2.9E-05	6.0E-02	1.7E-04/1.7E-06		
Small Intestine	5.9E-04/5.9E-06	6.0E-02	3.6E-05/3.6E-07		
Effective Dose Equivale	ent		2.3E+01/2.3E-01		



Revised Dose Evaluation Report
April 2001

(b) (6)

Four urine samples were analyzed by alpha spectrometry and one early sample by gross alpha counting. The gross alpha reported 0.796 +/- 0.788 pCi/day; however this was not used in our analysis because of suspected contamination from on-site collection of the samples. Two of four analyzed by alpha spectrometry were reported as NDA (no detectable activity) and two were reported with a positive result. The four values were fit using CINDY and the Jones excretion model to estimate an intake (76,000 pCi), organ doses, and a CEDE (23 rem/0.23 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 160,000 pCi and a CEDE (ICRP-60) of 11 rem (0.11 Sv).

Conclusion:

Based on the results of intake estimates and dose calculations, this individual received an intake of 76,000 to 160,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 11 to 23 rem (0.11 to 0.23 Sv). That dose range is more than the cumulative dose (7 rem) from a lifetime (70 years) of exposure at the current level (0.100 rem) for members of the public. It is less than one-half the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). This dose level represents slightly more than three years at the current limit (5 rem) for workers and is not associated with significant effects on health.

repared by.	
Name:	
Signature:	Date:
Peer Reviewed By:	
Name:	<u> </u>
Signature:	Date:April 28 2000

(b) (6)

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FIRST REPORT OF THE 2 STATE THE WAY			The second of				
	•:	RESAMP	LE	JUN 6	1966	3	263
FR 1333				AL DOSE DATA		168	//21
(b) (6)	sta a	el.	(b) (6)	C. NO. (21-29) TYF	Urine	Spain	
SAMPLE NO. (33-36)	6-3263	SAMPLE DAT	E (39-44) May 1966	TO 27 May 1966 DATE TYPE			e e
BASE (57-60)	1	OCCUPATION	1 (61 - 62)	TO 27 May 1960	<u> </u>		
BO97 Kertland		Capt Sheets —					
DATE RECEIVED SAMPLE VOLUME		VOLUME ANALYZED DATE ANALYZED					
W JUNE	1966	19	60 M	1370 ml	-	- 0 1	
TECHNICIAN (SIGNA	TURE AND DATE)		,		NMC	checked of h	wellsteil
URINE	236	239		- RADON	P	FECES/BUOOD	
Counter Number	Spec	Sne		Chamber Number	A-51	. Counter Number	
Counter Bkg. (cpm) 80		1		Chem. Bkg. (mv/sec)	908-32	Counter Bkg.	
Counter Eff. (%)	3-15 3/		1=123	Counter Eff. (%)		Counter Eff.	
Date/Time - Start	15Ep 66	0813	1=1	Millivolt — Start	55-93	Date/Time - Start	
-Stop				Millivolt - Stop	24 57 6	- Stop	
Total Counts	83	8		Total Millivots		Total Counts	
Counting Time	100	100		Total Drift Time	2 to 10 to	Counting Time	
Pross cpm	0163	0.08		Gross my/sec		Gross cpm	1./
Bkg. Cpm			-	Bkg. Mv/sec		Bkg. cpm	
Net cpm Ipes: % REC	742	 		Net my/sec	96,6	net cpm	
	1777	 		litter (69-74)	1616	dpm dps/cc	1
dpm/24 hr. (69-74) K 40 Correction				mier (07-74)		Neutron Dose (rads) (63-68)
NEL BASE PC/SPA	0,206±	0,078	-6	D(q) (63-68)		uc/mg (69-74)	
D(q) (63-68)	1		•	1		D(q) (63-68)	
	es ·	Δ.					
NAME:				SOCIAL SECURITY NUM	BER:	SAMPLE NU	MBER:
(b) (6)				(b) (6)			• •
AIR FORCE BASE	D007						
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RESULTS OF ANALYSIS - 0.206 ± 0.078 4/0 Rec - 74,2 Tital Vol - 1960 Body Bucker - 0.07			1.68 90/2				
Tital Vol - 1960 Arty Bueden - 0.00							
Vd ANTL - 1370			0.2588				
	ample for the fo						
() Signific	cant activity in	recently analyz	ed sample(s)				
() Data re	equired to establ	lish dose					
() Improp	er flask used						
() Other							
					non-	*	
() Sugges	sted sampling sc	hedule			DATE:		
SIGNATURE:					DATE:		
LIW FORM O			T	nc 00001 cz-		A E.	WP-O-MAY 62 5M

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NAME (LAST, FIRST, M.I.) (1-20) SOC, SE (b) (6) (b) (6)		URINE		UE				
SAMPLE NO 33-38		JAMP LE DATE	(39 - 44)			EXPOSURE		
BASE (57-60) FROM OCCUPATION TORRETON AND EVOL			то		DATE	TYPE		
BASE (57-60)		OCCUPATION	(61 - 62)	REQUESTED BY				
TORRE	TON			WOLLINE ANALYZED		TOATE ANALYZ	ED	
JAN 25 1966 730 ml		ME	200 ml					
		130 h	re_	1 20-71		<u> </u>		
TECHNICIAN (SIGNA	TURE AND DATE)							
URINE GROSS ALPHA			RADON		FEC	FECES/BLOOD		
	A			Chamber Number		. Counter	Number	
Counter Number	(6)			Cham. Bkg. (mv/sec)		Counter	Bkg.	
Counter Bkg. (cpm)	5/0/0			Counter Eff. (%)		Counter	Eff.	
Counter Eff. (%)	1770			Millivolt - Start		Date/T1	me - Stort	
Date/Time - Start				Millivolt - Stop			- Stop	
Total Counts	32.			Total Millivots		Total C	Total Counts	
	55			Total Drift Time	T	Countin	Counting Time	
Counting Time	0,582			Gross my/sec		Gross c	Gross cpm	
Gross cpm	0.236			Bkg. Mv/sec		Bkg. cp	Bkg. cpm	
Bkg. Cpm	0,246			Net my/sec		net cpm	net cpm	
Net cpm	0,7.0			curles/my	14	dpm	the second second	
dpm/24 hr. (69 • 74)	-			litter (69 - 74)	No.	/ dps/cc		
K 40 Correction				10	1		Dose (rads) (6	3-68)
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D(q) (63-68)	-	1.08 1	10/1	(LESS THAN	100	/2) D(q) (3-68) 27 Jan 6	

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. Palomares Nuclear Weapons Accident

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		RAD	IOLOGICAL S	SAMPLE	DATA		INDI.
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TE RECEIVED (37-42)	DATE ANALYZE	(B1-84)	DATE COUNTED	67	Jan 20 67	EXPOSURE	
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ROSS CPM			1				
KG CPM & MINUTES				371			per per de s
TET CPM			- 4	371			
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		1000000					-
HOLOGICAL SAMPLES	44 . 4	24.3			RADON		
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ET CPM	100	'	/				
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Palomares Nuclear Weapons Accident

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TYPE SAMPLE (23-32)	OCCUPATION	ANALYSIS			(b) (6)		AND SAMPLE NUMBER
DATE RECEIVED (37-42)	(34-35)	Po	235	REQUES	TED BY		AIR FORCE BASE (68-71)
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COUNTER & EFFICIENCY 5	Pecti	21		239		S. Miller II. San	
TOTAL COUNTS & MINUTES	200	150		0	1 110		
BKG CPM & MINUTES							
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DEPARTMENT OF THE AIR FORCE
UNITED STATES AIR FORCE HOSPITAL WIESBADEN
APO NEW YORK 09220



REPLY TO ATTN OF:

MSMH

SUBJECT:

Long-Term Studies on Selected Participants of Palomares Incident

10:

USAF Radl Health Lab (SGHW) Wright-Patterson AFB, Ohio 45433

Contact has been made with Lt Colonel (6) (6) concerning the subject matter. He has agreed to participate in this program and arrangements were made for collection of samples. Request sample containers and further instructions be forwarded at your convenience.

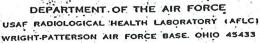
b) (6)

(b) (6)

lst Lt, USAF, BSC

Bio-Environmental Engineer

Both sent 12 Jam 67





ATTH OF SGHW

Long-Term Medical Follow-Up, Palomares Operation Urine Studies for 200 Pu.

LtCol<mark>(b) (6)</mark> USAF Hosp APO New York 09220

1. As a result of your splendid cooperation in this program, it is possible to discontinue further sampling.

- - - - Book of the man was a superior of the superior and the superior an

- 2. Our results show that your health is in no jeopardy from retention of radioactive materials as a result of participation in subject operation.
- 3. If you are still on active duty, please present this letter to the custodian of your medical records so that it may be made a part of your permanent file. If not on active duty, it is suggested you retain it in your permanent personal records.
- 4. Our files show that three sample bottles were sent to you, and that three samples were returned for analysis.

b) (6)

(b) (6

LtCol, USAF, MC

Robinsofter Bey Rewell	(b) (6)	3263	ROY!
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4.3>0 5.7044 6. Systemic Boly Bordy Box citics Organ 0.03

C-Quens

Sequential folder containing fifteen 80-mcg. tablets of mestranol plus five tablets each combining 80 mcg. mestranol and 2 mg. chlormadinone acetate.

A More Physiological Approach to Oral Contraception

letter prepared 3aps

Last address. 5 Ar 66

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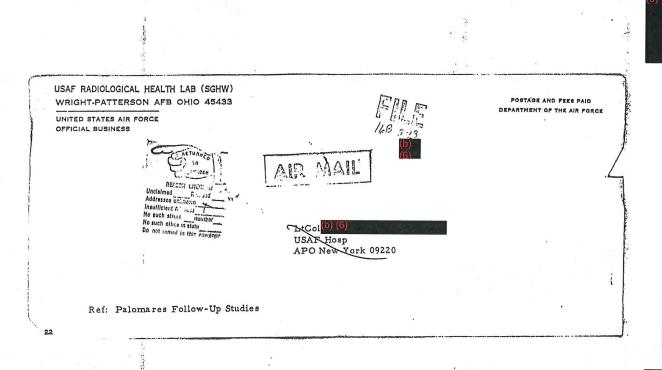
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Palomares Nuclear Weapons Accident



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DESIGNED TO VERIFY RESULTS: OF PREVIOUS JURINALYSIS AND LONG TERM	. 6
FIFETS OF 239 PLUTONIUM; IS ASSIGNED TO THIS BASE. THIS PERSON! ASSON: DY AND VILL RETURN ON 5 JAN 67.	. 6
- II COLONEL (b) (6) WILL BE CONTACTED AS SOON AS POSSIBLE TO SOLICIT	
WIS COOPERATION IN THIS PROGRAM.	0

UNCLASSIFIED She is 22 254 RTTU JAW RUWJFNA0611 3432147-UUUU--RUEDFIA. 0 ZNR UUUUU 0 R 092025Z DEC 66 FM 4900USAFDISP KIRTLAND AFB NMEX (3 TO USAF RADL HEALTH LAB WPAFB OHIO 0 BT UNCLAS SWD 35085 DEK 66 G REFERENCE YOUR LTR. LONG-TEJM STUDIES ON SELECTED PARTICIPANTS OF 0 PALOMARES INCIDENT (LT COL(b) (6) . 6 DEK 1966. RECORDS INDICATE THAT COL (6) (6) WAS TRANSFERRED PCS ON 8 JULY U 1966 TO APO 09633. YOUR LETTE BEING FORWARDED TO THAT ADDRESS. BT O

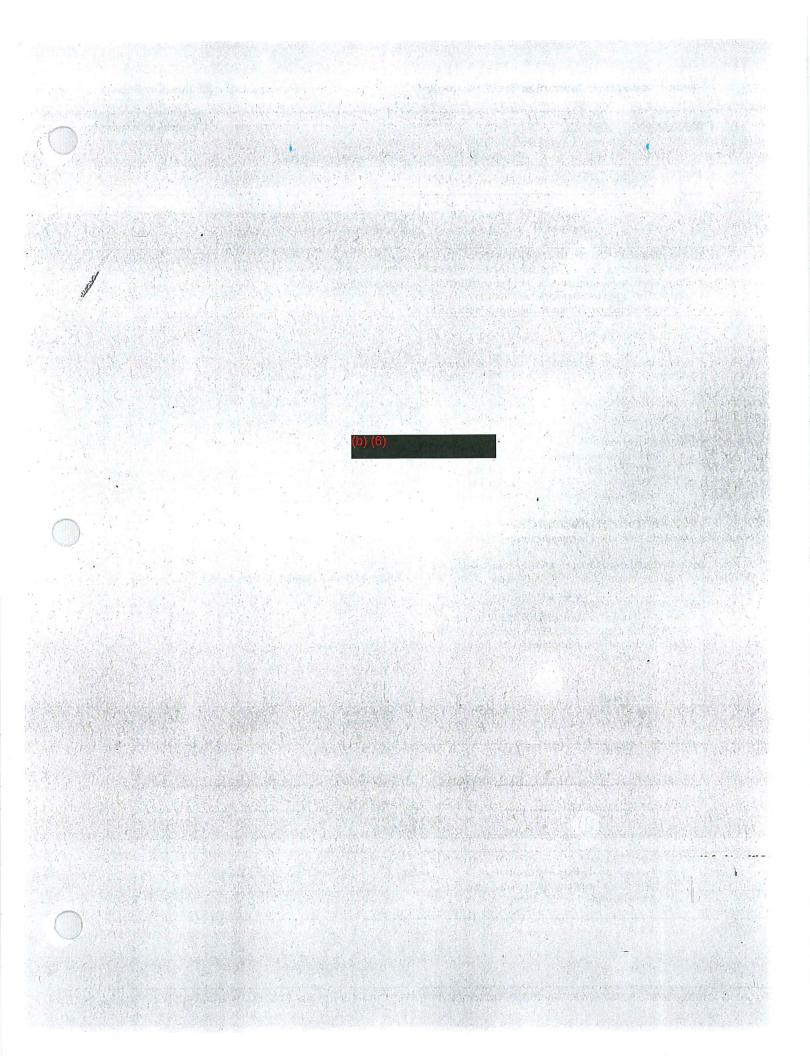
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ROUTINE

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(b) (6)

Internal Do	simetry Evaluation Form
NAME:(b) (6)	SSN: (b) (6)
MODE OF INTAKE:	INTAKE DATE OR PERIOD:
	2/01/66 through 4/02/66 on-site
☐ Ingestion ☐ Absorption	
☐ Unknown ☐ Not applica	ble
SUMMARY OF EXPOSURE CONDITIONS:	
Radionuclides/Respiratory Class/Particle Size: ²³⁹ Pi	
Date or Period of Evaluated Data: 4 urine samples fr	om 08/30/66 to 08/23/67
Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomare.	Casia
Exposure: Camp wilson, near Paromare	s, Spain
EVALUATION DATA:	
Air Sampling Attached	☐ In Process ☐ Unavailable
Health Physics Survey Data Attached	
Bioassay - Urinalysis Attached	
Fecal Attached	☐ In Process ☐ Unavailable
Nasal Smears	
In Vivo Attached	☐ In Process ☐ Unavailable
Medical Treatment:	
Skin Decontamination: Yes	No Date:
Decorporation: Yes	☒ No Date: ☒ No Agent: Date:
Catharsis:	No Agent: Date:
Surgical excision: Yes	No Date:
EVALUATION METHODOLOGY:	
Assumptions: Acute inhalation intake of ²³⁹ Pu, 100	¹ % Class Y, I μm AMAD particle size on 2/01/66
Code/Model used for: Intake Estimate: CIND)	/ Ver 1 //IONES
	/, Ver. 1.4/ICRP 30, Part 4, General Systemic Model
RESULTS SUMMARY	
Estimated Intake Activity (pCi): 72,000	
50 YR CEDE (rem): 22 (0.22 Sv)	and price from the second
Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)
Bone Surface	220/2.2
Lung Liver	82/0.82
Red Marrow	40/0.40 17/0.17
Other	3.8/0.038
Testes	3.2/0.032
1000	3.2 0.032
DOSE ASSESSOR: DATE:	PEER REVIEWER: DATE:
Q1	
Signature:	Signature:
Print Name:	Print Name:
SSN:	SSN:
DECOMBIEND A TYONIC	
RECOMMENDATIONS:	
Additional Bioassay Required Suggested Sampling Frequency:	☐ Urinalysis ☐ Fecal ☐ In Vivo
Work Restrictions: N/A	
17/1	

Preliminary Internal Dosimetry Case Narrative

Identification:

Name: SSN:



Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. One urine sample data card indicated an exposure of February. An exposure date of 1 February 1966 corresponding to the first day on-site exposure was chosen as most conservative. It was assumed that the individual left on 4 April 1966 ending the exposure period on 2 April 1966.

Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

Dates	% Body Burder
8/30/66	7
1/13/67	4
5/14/67	0
8/23/67	0

Radionuclide(s): ²³⁹Pu.

Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1 μ m AMAD particle size on 2/01/66. The date is the first day of the period on station from 2/01/66 to 4/02/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.

Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

			Elapsed	Result	Error	
Sample	*Analysis	Date	Days	(pCi/day)	(pCi/day)	Included
66-4565	AS	08/30/66	210	0.174	0.125	√
67-0375	AS	01/13/67	346	0.0478	0.0218	✓
67-1788B	AS	05/14/67	467	0.01	0.01	✓
67-4417	AS	08/23/67	568	ND		✓

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	72,000	22/0.22
LUDEP	62,000	4.4/0.044

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

			Weighted Organ
	Dose Equivalent	Weighting	Dose Equivalent
Organ	(rem/Sv)	Factors	(rem/Sv)
Testes	3.2E+00/3.2E-02	2.5E-01	8.0E-01/8.0E-03
Breast	1.1E-04/1.1E-06	1.5E-01	1.6E-05/1.6E-07
Red Marrow	1.7E+01/1.7E-01	1.2E-01	2.1E+00/2.1E-02
Lung	8.2E+01/8.2E-01	1.2E-01	9.9E+00/9.9E-02
Thyroid	1.0E-04/1.0E-06	3.0E-02	3.0E-06/3.0E-08
Bone Surface	2.2E+02/2.2E+00	3.0E-02	6.7E+00/6.7E-02
Liver	4.0E+01/4.0E-01	6.0E-02	2.4E+00/2.4E-02
Other	3.8E+00/3.8E-02	6.0E-02	2.3E-01/2.3E-03
Lower Large Intestine	8.2E-03/8.2E-05	6.0E-02	4.9E-04/4.9E-06
Upper Large Intestine	2.7E-03/2.7E-05	6.0E-02	1.6E-04/1.6E-06
Small Intestine	5.6E-04/5.6E-06	6.0E-02	3.4E-05/3.4E-07
Effective Dose Equivale	ent		2.2E+01/2.2E-01

Palomares Nuclear Weapons Accident

DRAFT

Revised Dose Evaluation Report
April 2001

(b) (6)

(b) (6)

Four urine samples were analyzed by alpha spectrometry. One of the four samples analyzed by alpha spectrometry was reported as NDA (no detectable activity) and three were reported with a positive result. The four values were fit using CINDY and the Jones excretion model to estimate an intake (72,000 pCi), organ doses, and a CEDE (22 rem/0.22 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 62,000 pCi and a CEDE (ICRP-60) of 4.4 rem (0.044 Sv).

Conclusion:

Based on the results of intake estimates and dose calculations, this individual received an intake of 62,000 to 72,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 4.4 to 22 rem (0.044 to 0.22 Sv). That dose ranges from less than to about three times the cumulative dose (7 rem) from a lifetime (70 years) of exposure at the current level (0.100 rem) for members of the public. It is less than one-half the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). Significant health consequences are not associated with this dose level.

Pr	epared By:		
Na	me:		
Sig	gnature:	Date:	
Pe	er Reviewed By:		
Na	me:		
Sig	gnature:	Date: _	

Palomares Nuclear Weapons Accident

OR REQUESTOR'S ID (1-			RADIOLOGI				SECURITY NUMBER	1	SAMPLE NUMBER
OR REQUESTOR'S ID (1-			MAS	(b) (6)	Televisi	(b) (6)	SECORITY NOMBER	RHL	SAMPLE NUMBER
AMPLE (23-32)	OCCUPATION		IS-DESIBED 2		REQUEST	ED BY		AIR FORC	E BASE (68-71)
RINE	(34-35)			ר כ	>	- H -			P-45
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AFLC FORM 1165			PREVIOU				OLOGIC				<u> </u>	1		

Palomares Nuclear Weapons Accident

PE SAMPLE (23-32)		- 1	GRADE		(b) (6)	E DATA	L SECURITY HUMBE	1	HL SAMPLE NUMBER
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Se Ralomares Nuclear Weapons Accident

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HE OF DECISE TORIS IN CL	201	GRADE	AFSN		AL SECURITY NUMBER	T Dans	L SAMPLE NUMBER
PE SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED		REQUESTED BY SOHW	<u>.</u>	AIR FOR	CE BASE (68-71) Tus AB, Libys
Urine	DATE ANALYZED	Pu 239	COUNTED SOCT 6C		30 Aug 66		POSURE DATE eb 1966
12 Sept 66	1950m	I was our from the	ANALYZED	me	TECHNICIAN		
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KG CPM & MINUTES			100				
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Ralomares Nuclear Weapons Accident

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OR REQUESTOR'S ID (1-	-20)	GRADE		AFSN			SECURITY NUMBER	-	RHL SAMPL NUMBER
AMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DE	SIRED 9		REQUEST	TED BY		AIR F	ORCE BATE (68-71)
ATE RECEIVED (37-42)	DATE ANALYZED	P	DATE COL	UNTED		DATE	COLLECTED	T	EXPOSURE DATE
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(b) (6)

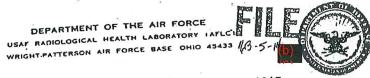
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7 Dec 1967

SGHW

PABLICE

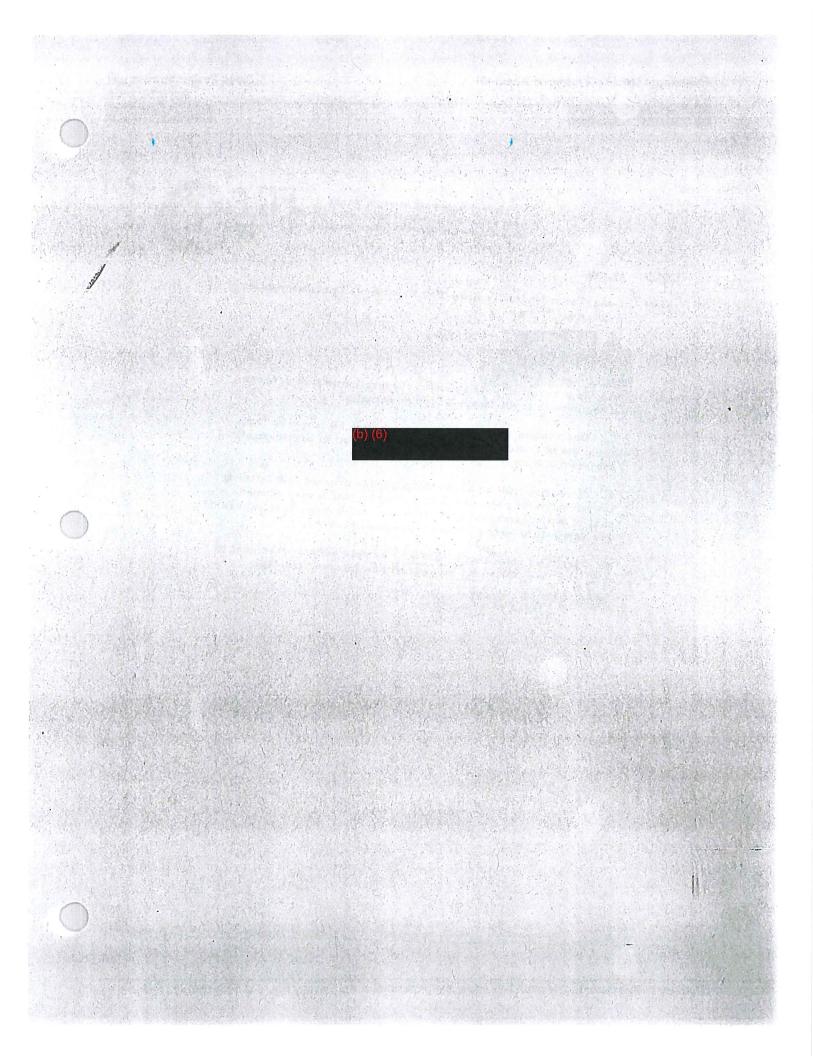
Long-Term Medical Follow-Up, Palomares Operation Urine Studies for 239 Pu.

USAF (Ret) Maj

- 1. As a result of your splendid cooperation in this program, it is possible to discontinue further sampling.
- 2. Our results show that your health is in no jeopardy from retention of radioactive materials as a result of participation in subject operation.
- 3. If you are still on active duty, please present this letter to the custodian of your medical records so that it may be made a part of your permanent file. If not on active duty, it is suggested you retain it in your permanent personal records.

4. Our files show that three sample bottles were sent to you, and that three samples were returned for analysis.





Internal Dosimet	ry Evaluation Form
NAME (b) (6)	SSN: (b) (6)
MODE OF INTAKE: Inhalation	08/66 to 01/26/67
EVALUATION DATA: Air Sampling	In Process
Skin Decontamination: Yes Decorporation: Yes Catharsis: Yes	No Date: No Agent: Date: No Agent: Date:
EVALUATION METHODOLOGY: Assumptions: Acute inhalation intake of ²³⁹ Pu, 100% Class Code/Model used for: Intake Estimate: CINDY, Ver. 1 Dose Estimate: CINDY, Ver. 1	
RESULTS SUMMARY Estimated Intake Activity (pCi): 180,000 50 YR CEDE (rem): 55 (0.55 Sv) Organ Dose Equivalent Summary Bone Surface Lung Liver Red Marrow Other Testes	YR CDE (rem/Sv) 560/5.6 210/2.1 100/1.0 43/0.43 9.5/0.095 8.0/0.080
DOSE ASSESSOR: DATE:	PEER REVIEWER: DATE:
Signature: Print Name: SSN:	Signature: Print Name: SSN:
RECOMMENDATIONS: Additional Bioassay Required Suggested Sampling Frequency: Work Restrictions: N/A	





Preliminary Internal Dosimetry Case Narrative

Identification:

Name: SSN:



Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

One urine sample data card indicated an exposure of 31 Jan 66. Other cards indicated exposure during January 1966. An exposure date of 31 January 1966 corresponding to the first day of his on-site activities was chosen as most conservative.

Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

Dates	% Body Burden
3/08/66	=
6/01/66	9
1/26/67	2

Radionuclide(s): ²³⁹Pu.

Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1 μ m AMAD particle size on 1/31/66. The date is the first day of the period on station from 1/31/66 to 3/8/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.

Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this

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00. SEC. NO.		SUBM					17/1,30	17740	יה את	. \ 0	2 <001 0	F
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15 APIZ 67	271	APR C	,7					1490	ml	129	5 ML AKA	1/4
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TYPE OF ANALYSIS		236	-	J 39								
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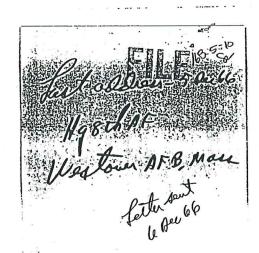
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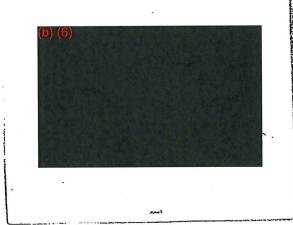
2 nd sample

letter proposed

3 apr 67

NEW ADDRESS





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Return 57/00 (6)

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2405 1. 0.17\$ t = 15 PC 2. 69.6 3. 1.92 4. 135 5. 6278

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13 PC Determ to \$1/20 (6)

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6. Systemic body Benden

Box cirtical organ 0.02

DEPARTMENT OF THE AIR FORCE -

814TH MEDICAL GROUP (SAC)
WESTOYER AIR FORCE BASE, MASSACHUSETTS 01022



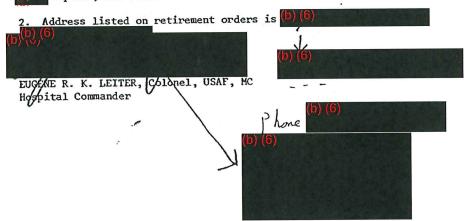
REPLY TO MS

20 December 1966

SUBJECT; Long-Term Studies on Selected Participants of Palomares Incident

USAF Radiological Health Laboratory (AFLC)
Lt Col USAF, MC (SGHW)
Wright-Patterson AFB, Ohio 45433

1. In accordance with your request, dated 6 December 1966, for assistance in locating personnel associated with subject incident our records indicate that Lt Col (b) (6) SSN (b) (6) SSN (b) (6) SSN (c) (6) SSN



will cooperate-

Bottle sent 10 tou 6>

Peace . . . is our Profession

(b)(6)



KS

20 December 1966

Long-Term Studies on Selected Participants of Palomares Incident

USAF Radiological Health Laboratory (AFLC)
Lt Col (D) (6) USAF, MC (SGHW)
Wright-Patterson AFB, Ohio 45433

- 1. In accordance with your request, dated 6 December 1966, for assistance in locating personnel associated with subject incident our records indicate that Lt Col (6) (6) SSN (5) (6) (6) Hq 8AF, was retired from active service on 31 July 1966.
- 2. Address listed on retirement orders is (b) (6)

EUGENE R. K. LEITER, Colonel, USAF, MC Hospital Commander

(b) (6)

DEPARTMENT OF THE AIR FORCE
USAF RADIOLOGICAL HEALTH LABORATORY IAFLES
WRIGHT PATTERSON AIR FORCE BASE OHIO 45433



REPLY TO SCHW

7 Dec 1967

Long-Term Medical Follow-Up, Palomares Operation Urine Studies for 233 Pu.

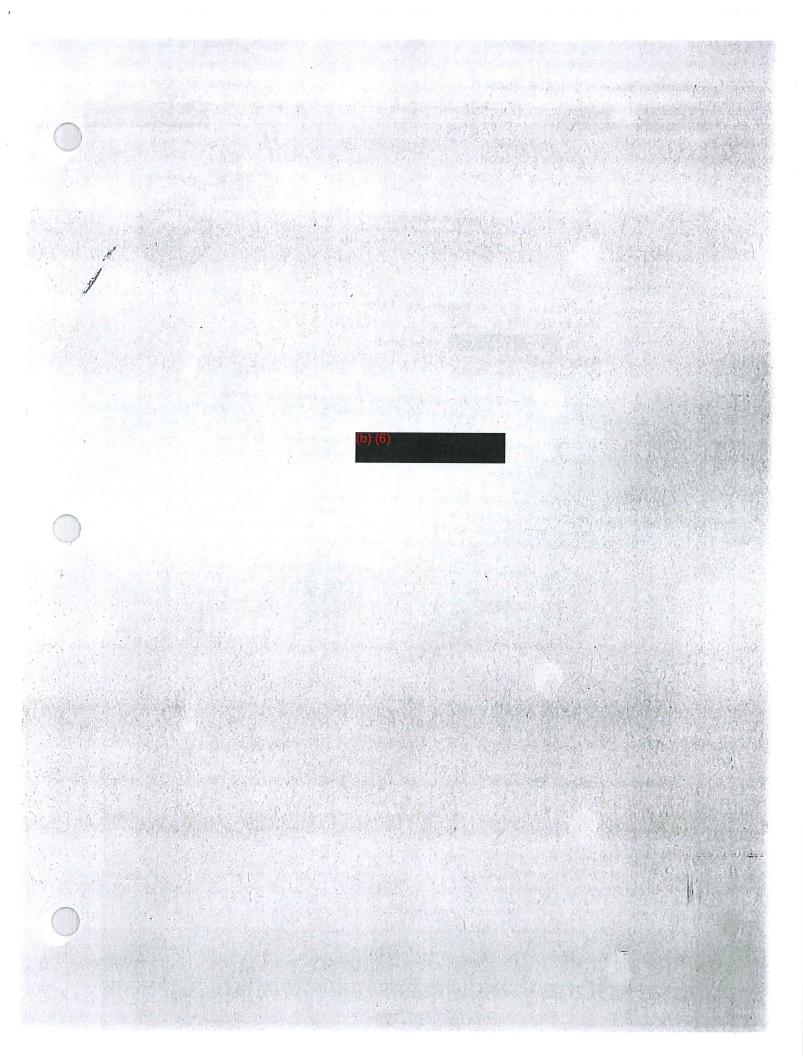
LtCol (b) (6)
11634 Temptation Drive
San Antonio, Tex 78216

- 1. As a result of your splendid cooperation in this program, it is possible to discontinue further sampling.
- 2. Our results show that your health is in no jeopardy from retention of radioactive materials as a result of participation in subject operation.
- 3. If you are still on active duty, please present this letter to the custodian of your medical records so that it may be made a part of your permanent file. If not on active duty, it is suggested you retain it in your permanent personal records.

4 Our files show that three sample bottles were sent to you and that three samples were returned for analysis.

(D) (O)

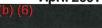
(D) (b)





	Internal Dosimetr	y Evaluation Form	one, all	
NAME: (b) (6)		SSN: (b) (6)	
MODE OF INTAKE: Inhalation Ingestion Unknown SUMMARY OF EXPOSURE CON Radionuclides/Respiratory Class/Par Date or Period of Evaluated Data: 5 Duration of Exposure: Unknown Location of Exposure: Camp Wilson	rticle Size: ²³⁹ Pu/100% (urine samples from 02/2	INTAKE DATE OR PERI 02/06/66 through 02/28/66 or 2/6/66 assumed start. Class Y/1 µm AMAD 8/66 to 08/04/67		
EVALUATION DATA: Air Sampling Health Physics Survey Data Bioassay – Urinalysis Fecal Nasal Smears In Vivo Medical Treatment: Skin Decontamination: Decorporation: Catharsis: Surgical excision:	Attached Attached Attached Attached Attached Attached Yes Yes Yes	In Process Unavailab On Opate:	le le le le Date:	
	take of ²³⁹ Pu, 100% Class Estimate: CINDY, Ver. 1			
RESULTS SUMMARY Estimated Intake Activity (pCi): 50 YR CEDE (rem): 17 (0.17 Some of the content	<i>i</i>)	YR CDE (rem/Sv) 170/1.7 63/0.63 31/0.31 13/0.13 2.9/0.029 2.5/0.025		
DOSE ASSESSOR:	DATE:	PEER REVIEWER:	DATE:	
Signature: Print Name: SSN:	r	Signature: Print Name: SSN:		
RECOMMENDATIONS: Additional Bioassay Required Suggested Sampling Frequency Work Restrictions:	Uri:	nalysis	☐ In Vivo	





Preliminary Internal Dosimetry Case Narrative

Identification:

Name: SSN:



Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. One urine sample data card indicated an exposure of 2 February 1966. An exposure date of 2 February 1966 corresponding to the first day of recorded exposure was chosen as most conservative. One sample was collected on 28 February 1966. An end date of exposure was assumed on 27 February 1966.

Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

Dates	% Body Burden
2/28/66	-
9/04/66	7
1/13/67	2
4/08/67	2
8/04/67	0

Radionuclide(s): ²³⁹Pu.

Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1 μ m AMAD particle size on 2/06/66. The date is the first day of the period on station from 2/6/66 to 2/28/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.





Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

				Elapsed	Result	Error	
San	ple *A	nalysis	Date	Days	(pCi/day)	(pCi/day)	Included
66-1	391	G	02/28/66	22	1.52	0.38	
66-4	527	AS	09/04/66	210	0.130	0.0879	✓
67-0	286	AS	01/13/67	341	0.0229	0.0166	✓
67-1	263	AS	04/08/67	426	0.024	0.017	✓
67-3	659	AS	08/04/67	544	ND		✓

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	55,000	17/0.17
LUDEP	91,000	6.4/0.064

* G means gross alpha counting; AS means alpha spectrometry.

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

	Dose Equivalent	Weighting	Weighted Organ Dose Equivalent
Organ	(rem/Sv)	Factors	(rem/Sv)
Testes	2.5E+00/2.5E-02	2.5E-01	6.1E-01/6.1E-03
Breast	8.1E-05/8.1E-07	1.5E-01	1.2E-05/1.2E-07
Red Marrow	1.3E+01/1.3E-01	1.2E-01	1.6E+00/1.6E-02
Lung	6.3E+01/6.3E-01	1.2E-01	7.5E+00/7.5E-02
Thyroid	7.7E-05/7.7E-07	3.0E-02	2.3E-06/2.3E-08
Bone Surface	1.7E+02/1.7E+00	3.0E-02	5.1E+00/5.1E-02
Liver	3.1E+01/3.1E-01	6.0E-02	1.8E+00/1.8E-02
Other	2.9E+00/2.9E-02	6.0E-02	1.7E-01/1.7E-03
Lower Large Intestine	6.2E-03/6.2E-05	6.0E-02	3.7E-04/3.7E-06
Upper Large Intestine	2.1E-03/2.1E-05	6.0E-02	1.3E-04/1.3E-06
Small Intestine	4.3E-04/4.3E-06	6.0E-02	2.6E-05/2.6E-07
Effective Dose Equivale	ent		1.7E+01/1.7E-01



Revised Dose Evaluation Report April 2001

(b) (6)



Four urine samples were analyzed by alpha spectrometry and one early sample by gross alpha counting. The gross alpha reported 1.52 +/- 0.38 pCi/day; however this was not used in our analysis because of suspected contamination from on-site collection of the samples. One of four samples analyzed by alpha spectrometry was reported as NDA (no detectable activity) and three were reported with a positive result. The four values were fit using CINDY and the Jones excretion model to estimate an intake (55,000 pCi), organ doses, and a CEDE (17 rem/0.17 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 91,000 pCi and a CEDE (ICRP-60) of 6.4 rem (0.064 Sv).

Conclusion:

Based on the results of intake estimates and dose calculations, this individual received an intake of about 55,000 to 91,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 6.4 to 17 rem (0.064 to 0.17 Sv). That dose ranges more than the cumulative dose (7 rem) from a lifetime (70 years) of exposure at the current level (0.100 rem) for members of the public. It is less than one-half the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and measurements (NCRP). Significant health consequences are associated with these dose levels.

Prepared By:		
Name:		
Signature:	Date:	
Peer Reviewed By:		
Name:		
Signature:	Date:	ya.

			M	IAR 9 1966	
AESN: 10) (6)	1963.3	INTERN	AL DOSE DATA	
(b) (6)	9.1.1 (1.2%)	SAMPLE DAT			SAMPLE (30) TYPEROSS (ALPHA EXPOSURE
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BASE (57-60)				REQUESTED BY	
TOPPETO	<i>s</i>	SAMPLE YOU	10	<u> </u>	
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9 MAR O	6		<u>U : </u>	946	
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URINE	T	Γ		RADON	FECES/BLOOD
Counter Number	C			Chamber Number	, Counter Number
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Counter Eff. (%)	57	-		Counter Eff. (%)	Counter Eff.
Date/Time - Start	8 APR 1966			Millivolt - Start	Date/Time - Start
-Stop	70-7		127	Millivolt - Stop	- Stop
Total Counts	235.			Total Millivots	Total Counts
Counting Time	100			Total Drift Time	Counting Time
Pross cpm	235			Gross my/sec	Gross cpm
Bkg. Cpm	0.05			Bkg. Mv/sec	Bkg. cpm
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dpm/24 hr. (6) -14)	1.677		Δ'_{α}	litter (69 - 74)	dps/cc
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COUNTER & EFFICIENCY STATE COUNTS & MINUTES GROSS CPM BKG CPM & MINUTES NET CPM	400	24	4.3			9		RADON					
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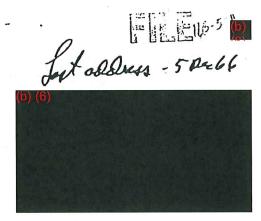
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6. System Koly Benden Bone critical organ 0.02

C-Quens

Sequential folder containing fifteen 80-mcg, tablets of mestranol plus five tablets each combining 80 mcg, mestranol and 2 mg, chlormadinone acetate.

A More Physiological Approach to Oral Contraception

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DEPARTMENT OF THE AIR FORCE
USAF RADIOLOGICAL HEALTH LABORATORY (AFLC)
WRIGHT-PATTERSON AIR FORCE BASE OHIO 45433



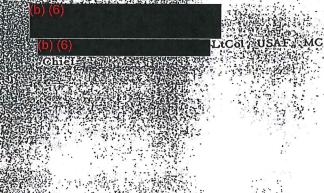
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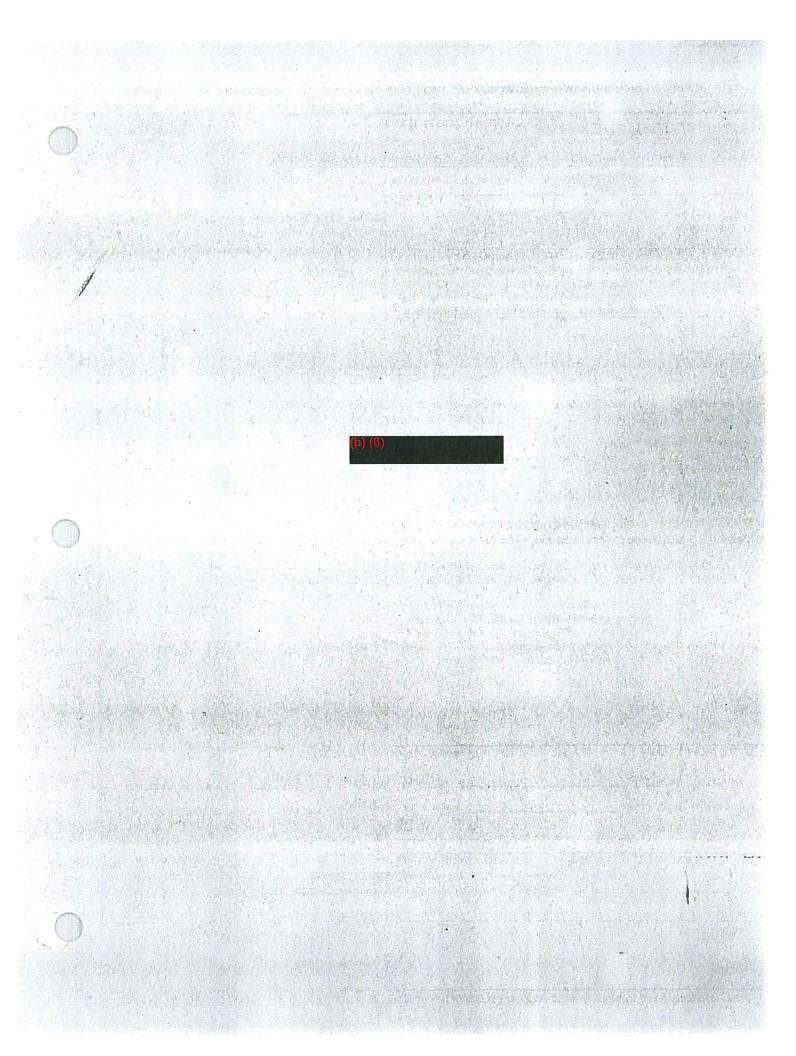
7 Dec 1967

Long-Term Medical Follow-Up, Palomares Operation Urine Studies for ²³Pu.



- As a result of your splendid cooperation in this program, it is possible to discontinue further sampling.
 - 2. Our results show that your health is in no jeopardy from retention of radioactive materials as a result of participation in subject operation.
- 3. If you are still on active duty, please present this letter to the custodian of your medical records so that it may be made a part of your permanent file. If not on active duty, it is suggested you retain it in your permanent personal records.
 - Our files show that three sample bottles were sent to you, and that three samples were returned for analysis.







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NAME: (b) (6)		ss	N: (b) (6)	
MODE OF INTAKE: Inhalation Ingestion Unknown	☐ Injection ☐ Absorption ☐Not applicable	INTAKE DATE (01/18/66 through 0 1/18/66 assumed st	2/11/66 on-site	
SUMMARY OF EXPOSURE CON	DITIONS:			
Radionuclides/Respiratory Class/Par Date or Period of Evaluated Data: 5 Duration of Exposure: Unknown Location of Exposure: Camp Wilson	ticle Size: 239Pu/10 urine samples from	02/11/66 to 08/16/67		
EVALUATION DATA: Air Sampling Health Physics Survey Data Bioassay – Urinalysis Fecal Nasal Smears In Vivo Medical Treatment:	☐ Attached ☐ Attached ☑ Attached ☐ Attached ☐ Attached ☐ Attached ☐ Attached	☐ In Process ☐ In	Unavailable Unavailable Unavailable Unavailable Unavailable Unavailable	
Skin Decontamination: Decorporation: Catharsis: Surgical excision:	☐ Yes ☐ Yes ☐ Yes ☐ Yes	No Date:	Date:	
Dose Es RESULTS SUMMARY	,	er. 1.4/ICRP 30, Part 4, G	eneral Systemic Mod	del
Estimated Intake Activity (pCi): 4 50 YR CEDE (rem): 14 (0.14 Sv)	4,000			
Organ Dose Equivalent Summary		50 YR CDE (rem/Sv)		
Bone Surface		140/1.4		
Lung		50/0.50		
Liver Red Marrow		25/0.25		
Other		11/0.11 2.3/0.023		
Testes		2.0/0.020		
OSE ASSESSOR: DA	ATE:	PEER REVIEWER	: DA	TE:
Signature:		Signature:		
Print Name:		Print Name:		
SSN:		SSN:		
ECOMMENDATIONS: Additional Bioassay Required Suggested Sampling Frequency:		Jrinalysis	☐ In Vivo	

Preliminary Internal Dosimetry Case Narrative

Identification:

Name: SSN:



Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. One urine sample data card indicated an exposure of 18 January 1966. Other cards indicated exposure during January 1966. An exposure date of 18 January 1966 corresponding to the first day of the response was chosen as most conservative. A sample taken on 11 February 1966 was assumed to end exposure on 10 February 1966.

Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

Dates	% Body Burden
2/11/66	-
9/01/66	8
1/20/67	0
4/17/67	0
8/16/67	0

Radionuclide(s): ²³⁹Pu.

Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1 μ m AMAD particle size on 1/18/66. The date is the first day of the period on station from 1/18/66 to 2/11/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.





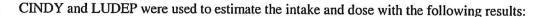
Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

Sample	*Analysis	Date	Elapsed Days	Result (pCi/day)	Error (pCi/day)	Included
66-762	G	02/11/66	24	1.09	0.69	
66-4665	AS	09/01/66	226	0.136	0.07	✓
67-0439	AS	01/20/67	367	0.00498	0.0111	1
67-2154	AS	04/17/67	454	ND	7777	✓
67-5647	AS	08/16/67	575	ND		1

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:



Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	44,000	14/0.14
LUDEP	29,000	2.0/0.020

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

			Weighted Organ
	Dose Equivalent	Weighting	Dose Equivalent
Organ	(rem/Sv)	Factors	(rem/Sv)
Testes	2.0E+00/2.0E-02	2.5E-01	4.9E-01/4.9E-03
Breast	6.5E-05/6.5E-07	1.5E-01	9.8E-06/9.8E-08
Red Marrow	1.1E+01/1.1E-01	1.2E-01	1.3E+00/1.3E-02
Lung	5.0E+01/5.0E-01	1.2E-01	6.0E+00/6.0E-02
Thyroid	6.1E-05/6.1E-07	3.0E-02	1.8E-06/1.8E-08
Bone Surface	1.4E+02/1.4E+00	3.0E-02	4.1E+00/4.1E-02
Liver	2.5E+01/2.5E-01	6.0E-02	1.5E+00/1.5E-02
Other	2.3E+00/2.3E-02	6.0E-02	1.4E-01/1.4E-03
Lower Large Intestine	5.0E-03/5.0E-05	6.0E-02	3.0E-04/3.0E-06
Upper Large Intestine	1.7E-03/1.7E-05	6.0E-02	1.0E-04/1.0E-06
Small Intestine	3.4E-04/3.4E-06	6.0E-02	2.1E-05/2.1E-07
Effective Dose Equivale		1.4E+01/1.4E-01	



Revised Dose Evaluation Report April 2001

(b) (6)

Four urine samples were analyzed by alpha spectrometry and one early sample by gross alpha counting. The gross alpha reported 1.09 +/- 0.69 pCi/day; however this was not used in our analysis because of suspected contamination from on-site collection of the samples. Two of four analyzed by alpha spectrometry were reported as NDA (no detectable activity) and two were reported with a positive result. The four values were fit using CINDY and the Jones excretion model to estimate an intake (44,000 pCi), organ doses, and a CEDE (14 rem/0.14 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 29,000 pCi and a CEDE (ICRP-60) of 2 rem (0.020 Sv).

Conclusion:

Based on the results of intake estimates and dose calculations, this individual received an intake of about 29,000 to 44,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 2 to 14 rem (0.020 to 0.14 Sv). That dose ranges from about one-third to two times the cumulative dose (7 rem) from a lifetime (70 years) of exposure at the current level (0.100 rem) for members of the public. It is well below the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). Serious health consequences are not normally associated with these dose levels.

Prepared By:	
Name:	
Signature:	Date:
Peer Reviewed By:	
Name:	
Signature:	Date:

A)((b) (6)	E1401-17811		INTERN	AL DOSE DATA			
NAME (LAST, FIRST, ID) (6)				C. NO. (21 - 29) TYF	ORING TEXPOS	TYRE	MAS-A21-321
SAMPLE NO. (33-30		FROM 10		TO 11 - FULL 6	EXPOS	E1824N 101	JYPE ;
BASE (57 - 60)	SPAIN	2935	0			1 11 11	
DATE RECEIVED		SAMPLE VOL		200 ml	DATE	ANALYZED	:
TECHNICIAN (SIGN)) (6)	25	FEB 1965				
URINE	GROSS AL	MA		RADON		FECES/BLO	OD
Counter Number	Now G			Chamber Number		Counter Number	
Counter Bkg. (cpm)	a 56			Cham. Bkg. (mv/sec)		Counter Bkg.	
Counter Eff. (%)	0.51			Counter Eff. (%)		Counter Eff.	
Date/Time - Start 2				Millivolt - Start		Date/Time - Star	•
-Stop				Millivolt - Stop		- Stop	
Total Counts	61			Total Millivots .		Total Counts	
Counting Time	55			Total Drift Time		Counting Time	
Gross cpm	1111			Gross my/sec		Gross cpm	
Bkg. Cpm	0-56			Bkg. Mv/sec		Bkg. cpm	
Net cpm	0.55			Net my/sec		net cpm	
don't Ris/L	2-43 t1.55			curies my		dpm	
dpm/24 hr. (69 - 74)				litter (69 - 74)		dps/cc	
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D(q) (63-68)			1.10 XI	-2		D(q) (63-68)_	

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		#			FRA	11.8:5	(b) (b)
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(b) (G) TYPE SAMPLY (23-32)	OCCUPATION	GRADE /2	(b) (6)	(h) (l	AL SECURITY NUMB	AIR FORCE BASE AIR FORCE BASE FOR JULY SO EXPOSURE ATTAN	11/67
SALLE 10 7	DATE ANALYZED		DATE COUNTED	DATI	COLLECTED	EXPOSURE	DATE
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(b) (6)	27))	GRADE A2C		AFSN (b) (6)	8 72 M	(b) (6)	ECURITY NUMBER	RHL	SAMPLE NUMBER	
SAMPLE (23-32) Urine	OCCUPATION (34-35)	ANALYSIS I	239		REQUES	SGHV		Torr	e BASE (68-71)	
ATE RECEIVED (37-42)	DATE ANALYZ		DATECO	Zac	57	DATE CO	O Jan 67	EXP	66 DATE	
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EXPOSURE DATE
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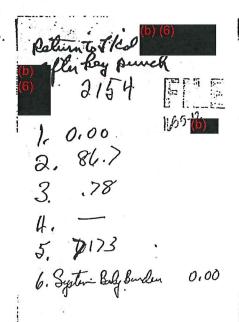
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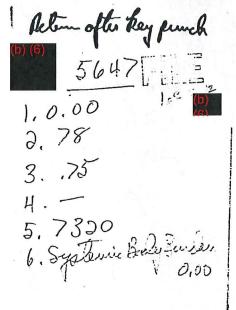
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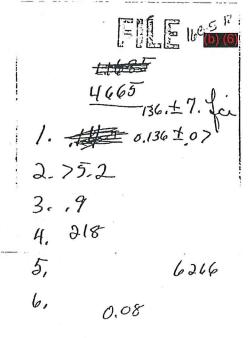
C-Quens®

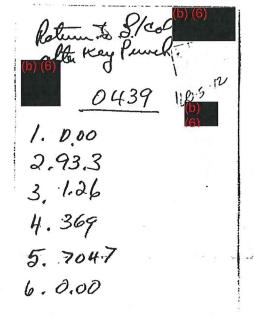
Sequential folder containing fifteen 80-mcg. tablets of mestranol plus five tablets each combining 80 mcg. mestranol and 2 mg. chlormadinone acetate.

A More Physiological Approach to Oral Contraception











individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

			Elapsed	Result	Error	
Sample	*Analysis	Date	Days	(pCi/day)	(pCi/day)	Included
66-2504	G	03/08/66	36	0.77	0.193	
66-3275	AS	06/01/66	121	0.244	0.094	✓
67-0363	AS	01/26/67	360	0.0182	0.0129	✓

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	180,000	55/0.55
LUDEP	79,000	5.6/0.056

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

			Weighted Organ
	Dose Equivalent	Weighting	Dose Equivalent
Organ	(rem/Sv)	Factors	(rem/Sv)
Testes	8.0E+00/8.0E-02	2.5E-01	2.0E+00/2.0E-02
Breast	2.7E-04/2.7E-06	1.5E-01	4.0E-05/4.0E-07
Red Marrow	4.3E+01/4.3E-01	1.2E-01	5.2E+00/5.2E-02
Lung	2.1E+02/2.1E+00	1.2E-01	2.5E+01/2.5E-01
Thyroid	2.5E-04/2.5E-06	3.0E-02	7.5E-06/7.5E-08
Bone Surface	5.6E+02/5.6E+00	3.0E-02	1.7E+01/1.7E-01
Liver	1.0E+02/1.0E+00	6.0E-02	6.0E+00/6.0E-02
Other	9.5E+00/9.5E-02	6.0E-02	5.7E-01/5.7E-03
Lower Large Intestine	2.0E-02/2.0E-04	6.0E-02	1.2E-03/1.2E-05
Upper Large Intestine	6.9E-03/6.9E-05	6.0E-02	4.1E-04/4.1E-06
Small Intestine	1.4E-03/1.4E-05	6.0E-02	8.4E-05/8.4E-07
Effective Dose Equivale		5.5E+01/5.5E-01	

Two urine samples were analyzed by alpha spectrometry and one early sample by gross alpha counting. The gross alpha reported 0.77 +/- 0.192 pCi/day; however this was not used in our analysis because of suspected contamination from on-site collection of the samples. The two samples analyzed by alpha



b) (6)

(b) (6)

spectrometry were reported with a positive result. The two values were fit using CINDY and the Jones excretion model to estimate an intake (180,000 pCi), organ doses, and a CEDE (55 rem/0.55 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 79,000 pCi and a CEDE (ICRP-60) of 5.6 rem (0.056 Sv).

Conclusion:

Based on the results of intake estimates and dose calculations, this individual received an intake of about 79,000 to 180,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 5.6 to 55 rem (0.056 to 0.55 Sv). That dose ranges from about the cumulative dose (7 rem) from a lifetime (70 years) of exposure at the current level (0.100 rem) for members of the public to less than one-half the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). The varied and limited urinary excretion data limit the accuracy of this estimate. While these dose levels represent the upper end of guidelines for acceptable exposure from work, additional testing now could provide further assessment.

Prepared By:		
Name:		
Signature:	Date:	-
Peer Reviewed By:		
Name:		
Signature:	Date:	

MY: (b) (6)	soc. se (b) (6	C. NO. (21-29) TYPE SAMP Urine		
6) E-3			DATE31 Jan 66 TYPE	
PLE NO. (33-30)		TO	1	
-2504	OCCUPATION (61 - 62)	REQUESTED BY		
SE (57-60)	57E20	VOLUME ANALYZED	DATE ANALYZED	
essen	57E20	VOLUME ANALIZATI		
TE RECEIVED	1550	1550		
1066				
CHNICIAN (SIGNATURE AND DATE)	T ₁		FECES/BLOOD	
1000 00 31-11		RADON	. Counter Number	
URINE		Chamber Number	Counter Bkg.	
water Number Pa-36# 1		Cham. Bkg. (mv/sec)	Counter Eff.	
mates Bkg. (cpm) 0.03		Counter Eff. (%)	Date/Time - Start	
ounter Eff. (%) 55		Millivolt - Start	- Stop	
ste/Time - Start 4- 50		Millivolt - Stop	Total Counts	
-Stop 5- /		Total Millivots	Time	1
1110		Total Drift Time	Gross cpm Olo	Spect
ofal Counts		Gross my/sec	Bkg. cpm	0,525
ounting Time 968		Bkg. Mv/sec	net cpm	0.163
ross cpm		Net my/sec	dpm	
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Ver com	Sonke Value com	litter (69 · 74)	Neutron Dose (rods) (63-68)
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A More Physiological Approach to Oral Contraception

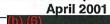
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TO DEPARTMENT OF THE AIR FORCE USAF RADIO	
AFLC WRIGHT PATTERSON AIR FORCE BASE OHIO	0
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UNCLAS E F T O NM-6356-1	
SUBJECT: LONG-TERM STUDIES ON SELECTED PA	ARTICIPANTS OF
PALOMORES INCIDENT (b) (6) SP4	4 (E4)
US 55786451	*
1. REFERENCE PARAGRAPH 5 YOUR 6 DECEMBER	1966 TRANSMISSION,
ABOVE SUBJECT. THE FOLLOWING INFORMATION	IN REFERENCE TO APRAS 5A
AND 5C IS SUBMITTED.	
A. 5A-CURRENT DUTY ASSIGNMENT IS CORRECT.	EM WILL ROTATE
ON 19 FED 67 FOR SEPARATION FROM SERVICE	UPON RETURN TO CONUS.
8. 5C-EM WELL MOTIVATED AND WILLING TO PA	ARTICIPATE IN
THE PROGRAM.	,
2. REQUEST CONFIRMATION OF ACCEPTANCE OF	INDIVIDUAL AS HE IS
WILLIM TO CONTINUE IN PROGRAM AFTER SEPAR	
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Internal Dosimeti	ry Evaluation Form				
NAME: (b) (6)	SSN: (b) (6)				
MODE OF INTAKE:	INTAKE DATE OR PERIOD: 01/18/66 through 03/04/66 on-site 1/18/66 assumed start				
SUMMARY OF EXPOSURE CONDITIONS: Radionuclides/Respiratory Class/Particle Size: 239 Pu/100% Class Y/1 µm AMAD Date or Period of Evaluated Data: 5 urine samples from 02/04/66 to 06/20/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain					
Health Physics Survey Data ☐ Attached ☐ Bioassay — Urinalysis ☐ Attached ☐ Fecal ☐ Attached ☐ Atta	In Process ☑ Unavailable In Process ☑ Unavailable In Process ☑ Unavailable In Process ☒ Unavailable In Process ☒ Unavailable In Process ☒ Unavailable Unavailable ☒ Unavailable				
Decorporation: ☐ Yes ☐	No Date:				
EVALUATION METHODOLOGY: Assumptions: Acute inhalation intake of ²³⁹ Pu, 100% Class Y, 1 µm AMAD particle size on 1/18/66 Code/Model used for: Intake Estimate: CINDY, Ver. 1.4/JONES Dose Estimate: CINDY, Ver. 1.4/ICRP 30, Part 4, General Systemic Model					
RESULTS SUMMARY Estimated Intake Activity (pCi): 210,000 50 YR CEDE (rem): 65 (0.65 Sv) Organ Dose Equivalent Summary Bone Surface Lung Liver Red Marrow Other Testes	9 YR CDE (rem/Sv) 650/6.5 240/2.4 120/1.2 51/0.51 11/0.11 9.4/0.094				
DOSE ASSESSOR: DATE:	PEER REVIEWER: DATE:				
Signature:	Signature:				
Print Name:	Print Name:				
SSN:	SSN:				
RECOMMENDATIONS: Additional Bioassay Required					





Preliminary Internal Dosimetry Case Narrative

Identification:

Name: SSN:



Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. One urine sample data card indicated an exposure period of 18 January 1966 to 7 February 1966. Another card indicated exposure during January 1966. An exposure date of 18 January 1966 corresponding to the first day of the response was chosen as most conservative. The sample on 7 March 1966 indicated the end of exposure on that date.

Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

Dates	% Body Burden
2/04/66	-
3/04/66	-
10/16/66	23
6/20/67	0

Radionuclide(s): ²³⁹Pu.

Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1 µm AMAD particle size on 1/18/66. The date is the first day of the period on station from 1/18/66 to 3/4/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.

(b) (6)

Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

Sample	*Analysis	Date	Elapsed	Result	Error	Tu aluuda d
	Allalysis	Date	Days	(pCi/day)	(pCi/day)	Included
66-343	G	02/04/66	17	35.1	2.2	
66-1644	G	03/04/66	45	1.51	0.378	
66-4975	AS	10/16/66	271	0.351	0.14	✓
	AS	10/16/66	271	0.15	0.07	✓
67-2639	AS	06/20/67	518	ND		✓

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	210,000	65/0.65
LUDEP	700,000	49/0.49

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

Organ	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent (rem/Sv)
Testes	9.4E+00/9.4E-02	2.5E-01	2.3E+00/2.3E-02
Breast	3.1E-04/3.1E-06	1.5E-01	4.7E-05/4.7E-07
Red Marrow	5.1E+01/5.1E-01	1.2E-01	6.1E+00/6.1E-02
Lung	2.4E+02/2.4E+00	1.2E-01	2.9E+01/2.9E-01
Thyroid	2.9E-04/2.9E-06	3.0E-02	8.8E-06/8.8E-08
Bone Surface	6.5E+02/6.5E+00	3.0E-02	2.0E+01/2.0E-01
Liver	1.2E+02/1.2E+00	6.0E-02	7.0E+00/7.0E-02
Other	1.1E+01/1.1E-01	6.0E-02	6.7E-01/6.7E-03
Lower Large Intestine	2.4E-02/2.4E-04	6.0E-02	1.4E-03/1.4E-05
Upper Large Intestine	8.0E-03/8.0E-05	6.0E-02	4.8E-04/4.8E-06
Small Intestine	1.6E-03/1.6E-05	6.0E-02	9.8E-05/9.8E-07
Effective Dose Equivale	ent	112	6.5E+01/6.5E-01

DRAFT

Revised Dose Evaluation Report April 2001

(b) (6)

Two urine samples were analyzed by alpha spectrometry (one in duplicate) and two by gross alpha counting. The gross alpha reported 35.1 +/- 2.2 pCi/day and 1.51 +/- 0.377 pCi/day; however these were not used in our analysis because of suspected contamination from on-site collection of the samples. One of the two samples analyzed by alpha spectrometry was reported as NDA (no detectable activity) and one was reported with a positive result. The three values were fit using CINDY and the Jones excretion model to estimate an intake (210,000 pCi), organ doses, and a CEDE (65 rem/0.65 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 700,000 pCi and a CEDE (ICRP-60) of 49 rem (0.49 Sv).

Conclusion:

Prepared By:

The analysis produced an estimated intake of 210,000 to 700,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 49 to 65 rem (0.49 to 0.65 Sv). That dose is slightly more than the National Council on Radiation Protection and Measurements guideline for total dose during a 50-year working lifetime (50 rem). The urine excretion pattern is somewhat unconventional. Unfortunately, sampling was not continued in 1967 and 1968. Additional testing should be considered today using more sensitive analytical techniques and may allow further assessment of this exposure.

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Long-Term:Medical-Follow-Up; Palomares Operation Urine
Studies for Pu.

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USAF Rctg Office

10 South 7th Street, Columbia MO 65201

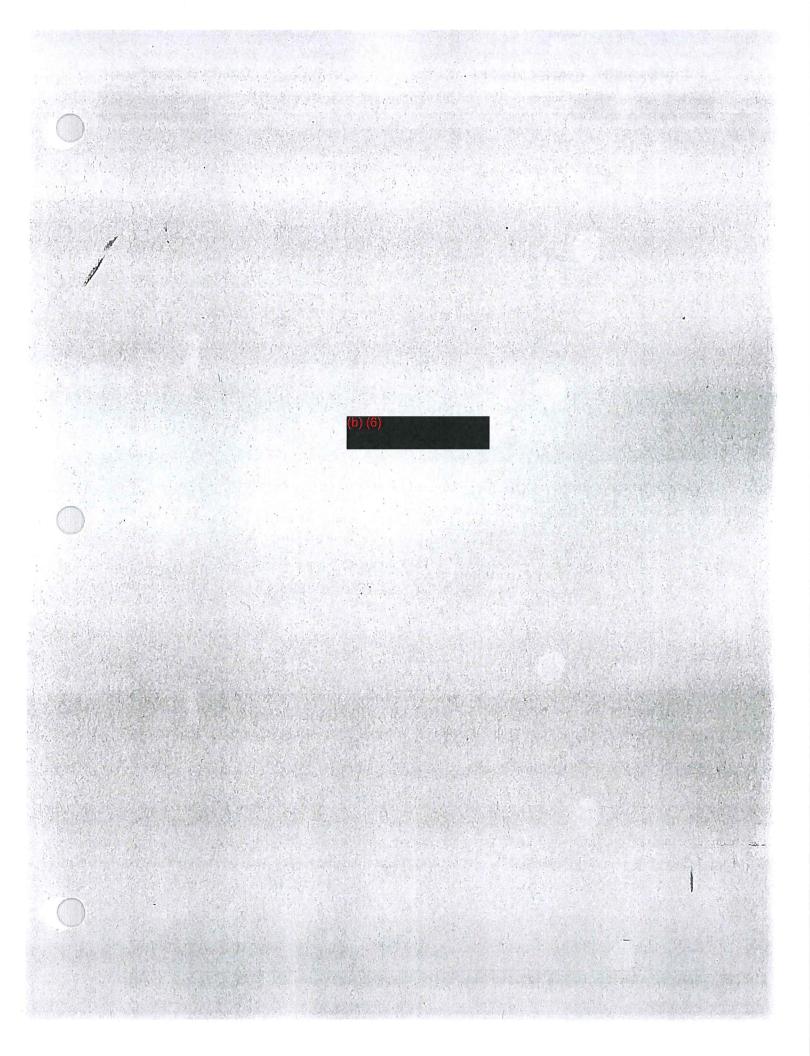
- 1 As a result of your splendid cooperation in this program, it is possible to discontinue further sampling.
- Z. Our results show that your health is in no jeopardy from retention of radioactive materials as a result of participation in subject operation.
- 3. If you are still on active duty please present this letter to the custodian of your medical records so that it may be made a part of your permanent file. If not on active duty sit is suggested you retain it in your permanent personal records.
- 4 Corrives show that three sample bottles were gent to you and that some reamples were returned for analysis.

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Internal Dosimetr	y Evaluation Form
NAME. (6) (6)	SSN: (b) (6)
MODE OF INTAKE: Inhalation	INTAKE DATE OR PERIOD: 01/18/66 through 02/03/66 on-site 1/18/66 assumed start. Class Y/I µm AMAD 1/66 to 08/17/67
Location of Exposure: Camp Wilson, near Palomares, Spain	2 12
Health Physics Survey Data Bioassay – Urinalysis Fecal Nasal Smears Attached Attached Attached	In Process Unavailable
Decorporation: Yes Z Catharsis: Yes	No Date: No Agent: Date: No Agent: Date:
EVALUATION METHODOLOGY: Assumptions: Acute inhalation intake of ²³⁹ Pu, 100% Class Code/Model used for: Intake Estimate: CINDY, Ver. 1 Dose Estimate: CINDY, Ver. 1	
Bone Surface Lung Liver Red Marrow Other Testes	YR CDE (rem/Sv) 210/2.1 75/0.75 37/0.37 16/0.16 3.5/0.035 2.9/0.029
DOSE ASSESSOR: DATE:	PEER REVIEWER: DATE:
Signature:	Signature:
Print Name:	Print Name:
SSN:	SSN:
RECOMMENDATIONS: Additional Bioassay Required Suggested Sampling Frequency: Work Restrictions: N/A	

Preliminary Internal Dosimetry Case Narrative

Identification:

Name: SSN:

Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. One urine sample data card indicated an exposure period of 18 - 31 January 1966. Other cards indicated exposure during January 1966. An exposure date of 18 January 1966 corresponding to the first day of the response was chosen as most conservative.

Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

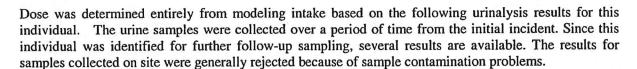
Dates	% Body Burden
2/01/66	17
2/04/66	7
6/06/67	2
1/23/67	0
5/09/67	-
8/17/67	0

Radionuclide(s): ²³⁹Pu.

Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1 µm AMAD particle size on 1/18/66. The date is the first day of the period on station from 1/18/66 to 2/4/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.



			Elapsed	Result	Error	
Sample	*Analysis	Date	Days	(pCi/day)	(pCi/day)	Included
66-410	G	02/01/66	14	ND		
66-566	G	02/04/66	17	3.09	2.56	
66-3414	AS	06/06/66	139	0.184	0.079	✓
67-0366	AS	01/23/67	370	0.0279	0.0202	✓
67-2268	AS	05/09/67	476	ND		✓
67-4068	AS	08/17/67	576	ND		✓

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	66,000	20/0.20
LUDEP	130,000	9.3/0.093

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

	Dose Equivalent	Weighting	Weighted Organ Dose Equivalent
Organ	(rem/Sv)	Factors	(rem/Sv)
Testes	2.9E+00/2.9E-02	2.5E-01	7.4E-01/7.4E-03
Breast	9.8E-05/9.8E-07	1.5E-01	1.5E-05/1.5E-07
Red Marrow	1.6E+01/1.6E-01	1.2E-01	1.9E+00/1.9E-02
Lung	7.5E+01/7.5E-01	1.2E-01	9.0E+00/9.0E-02
Thyroid	9.2E-05/9.2E-07	3.0E-02	2.8E-06/2.8E-08
Bone Surface	2.1E+02/2.1E+00	3.0E-02	6.2E+00/6.2E-02
Liver	3.7E+01/3.7E-01	6.0E-02	2.2E+00/2.2E-02
Other	3.5E+00/3.5E-02	6.0E-02	2.1E-01/2.1E-03
Lower Large Intestine	7.5E-03/7.5E-05	6.0E-02	4.5E-04/4.5E-06
Upper Large Intestine	2.5E-03/2.5E-05	6.0E-02	1.5E-04/1.5E-06
Small Intestine	5.1E-04/5.1E-06	6.0E-02	3.1E-05/3.1E-07
Effective Dose Equivale	ent		2.0E+01/2.0E-01

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(b) (6)

Four urine samples were analyzed by alpha spectrometry and two by gross alpha counting. The first gross alpha sample was not reported because of laboratory error. The second reported 3.09 +/- 2.56 pCi/day; however this was not used in our analysis because of suspected contamination from on-site collection of the samples. Two of four analyzed by alpha spectrometry were reported as NDA (no detectable activity) and two were reported with a positive result. The four values were fit using CINDY and the Jones excretion model to estimate an intake (66,000 pCi), organ doses, and a CEDE (20 rem/0.20 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 130,000 pCi and a CEDE (ICRP-60) of 9.3 rem (0.093 Sv).

Conclusion:

Prepared By:

Based on the results of intake estimates and dose calculations, this individual received an intake of 66,000 to 130,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 9.3 to 20 rem (0.093 to 0.20 Sv). That dose range is more than the cumulative dose (7 rem) from a lifetime (70 years) of exposure at the current level (0.100 rem) for members of the public. It is also less than one-half the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). Serious health consequences are not associated with this dose level.

Name:			
Signature:	Da	ite:	
Peer Reviewed By:			
Name:	a ka		
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Dose Evaluation Report
April 28, 2000

(b) (6)		T/sot IN	TERNA	AL DOSE DATA		
b) (6)	(10 1) -20)	(6	(6)		AMPLE (3	1 275
66-410		FROM 1900 31	in 66	TO 1900/ Fel 66		ATE TYPE
ASE (57-60)	Les.	- T	2)			
DATE RECEIVED		2.580		200	DATE ANALYZED	
TECHNICIAN (SIGN)	TURE AND DATE)	(b) (6)			11	FEB 1966
URINE .	ROSS ALPH	ssgt.		USAFON		FECES/BLOOD
Counter Number	1	3334		Chamber Number		. Counter Number
Counter Bkg. (cpm)	0.33			Cham. Bkg. (mv/sec)		Counter Bkg.
Counter Eff. (%)	51			Counter Eff. (%)		Counter Eff.
ate/Time - Start				Millivolt - Start		Date/Time - Start
-Stop	FEB 1966			Millivolt - Stop		- Stop
Total Counts	22			Total Millivots		Total Counts
Counting Time	55	19 1 1 1 1		Total Drift Time		Counting Time
Gross cpm	0.40		-04	·Gross my/sec		Gross cpm
3kg. Cpm	0.33	100000000000000000000000000000000000000		Bkg. Mv/sec		Bkg. cpm
Net cpm	0.07			Net my/sec		net cpm
lpm				curies/mv		dpm
Jpm/24 hr. (69 • 74)	NO			litter (69 - 74)		dps/cc
K 40 Correction	Detectable					Neutron Dose (rads) (63-68)
Net Beta	Activity			D(q) (63-68)		uc/mg (69-74)
D(q) (63-68)	12001.9	I		15 Feb	"	D(q) (63-68)

FEB 11 1966 INTERNAL DOSE DATA TYPE ANAL. (31-32) NAME (LAST, FIRST, M.I.) (1-20) TYPE SAMPLE (30) FROM 2 Fello OCCUPATION (61-62) EXPOSURE TO 3 FEL REQUESTED BY 66-560 TYPE DATE /8-30 BASE (57 - 60) Rem 2 SAMPLE VOLUME DATE ANALYZED FFB 1 1 1966 TECHNICIAN (SIGNATURE AND DATE) 200 ml. 1420 ml 1 5 FEB 1966 WALTER G. EDWARDS GROSS ALPHA SSGT. URINE FECES/BLOOD USADON Counter Number NMC A Chamber Number Counter Number Counter Bkg. (cpm) 0.18 Chom. Bkg. (mv/sec) Counter Bkg. Counter Eff. (%) 51 Counter Eff. (%) Counter Eff. Date/Time - Start 1 FEB 1966 Millivolt - Start Date/Time - Start Millivolt - Stop Total Counts Total Millivots **Total Counts** 55 Counting Time Total Drift Time Counting Time Gross cpm Gross my/sec Gross cpm 0.18 Bkg. Cpm Bkg. cpm Bkg. Mv/sec 0.51 2.25±1.10 Net cpm Net my/sec net cpm dpm /21/L dpm/24 hr. (69-74) curies/mv dpm litter (69-74) dps/cc K 40 Correction Neutron Dose (rads) (63-68) HerBeto PCI D(q) (63-68) 3.20+1.51 D(q) (63-68) uc/mg (69-74) D(q) (63-68)

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			FEB	11 1900			
	(b) (6)	10.66	INTERNA	AL DOSE DATA			10. 40
(b) (6)	(1-20)	T SAY	SOC. SEC (b) (6)	. NO. (21 - 29) TYPE	SAMPLE (30)	GROSS AL	PHA
SAMPLE NO. (33-36)	4 - 566	FROM 3	Calo (C	TO 4 6 66	DATE	18.31 Jan GtpE	
BASE (57 - 60)	/	OCCUPATIO)H (61 - 62)	REQUESTED BY			<u> </u>
DATE RECEIVED FEB 1 1 1	066	SAMPLE VO		2 00 mel	DATE AN	ALYZED	Ŷ
TECHNICIAN (SIGNA				. EDWAND.	1 5 F	ED 1966	
URINE	GROSS AL	PHA	SSGT.	RADON		FECES/BLOOD	
Counter Number	Nnc &		N.	Chamber Number		ounter Number	
Counter Bkg. (cpm)	0.49			Cham. Bkg. (mv/sec)		ounter Bkg.	
Counter Eff. (%)	57		4	Counter Eff. (%) Millivolt — Start		ate/Time - Start	7
Date/Time - Start 1	5 FEB 1966		 	Millivolt - Stop		- Stop	
Total Counts	118	4 1		Total Millivots	To	otal Counts	
Counting Time	55min		1 -	Total Drift Time		ounting Time	
Gross cpm	0.87			Gross mv/sec		ross cpm	-
Bkg. Cpm	0.49			Bkg. Mv/sec		kg. cpm	·
Net cpm /	0.38			Net mv/sec		ot cpm	-
An POIL	1.68+1.3	9		curies/mv *	dr		4
dpm/24 Hr. (69 - 74)				litter (69 - 74)		os/cc	
K 40 Correction	, ,	-		1 11 11 10		eutron Dose (rads) (6	3-00/1
HELLAS PEISO	43.091 2	106		D(q) (63 · 68)		c/mg (69-74)	
D(q) (63-68)		Dn	: 7.74.2	10 Juic 17	17 17	(g) (63-68) eb 00	-

FEB 1 1 1966

(b) (6)

	-		RE	SAMPLE JUI	14 1966		3414
(b) (6)	AND THE RESERVE		The second lines with	AL DOSE DATA	30 G+	EN 1-165	3
AFSN:	(.1.) (1-20)			C. NO. (21-29) TY	PE SAMPLE (30	TYPE ANAL	. (31-32)
(b) (6)	TSgt		(b) (d)	6)	Urine		
SAMPLE NO. (33-30)		SAMPLE DAT				SURE	-
66-3414		FROM 060		TO 0559 6 Jur	166 04	TE Jan 66 TYP	E
BASE (57 - 60)	1	OCCUPATION	(61 - 62)	REQUESTED BY			
Ramstein		SAMPLE VOL	11ME	VOLUME ANALYZED	. IDATE	ANALYZED .	
DATE-RECEIVED			10 me	4350	I	Λ.	
14 June 1966			0 /1100	1 1 2 2 .		11111	1 1 1
TECHNICIAN (SIGNA	SPE	ec as	Lot-	1 N	Che	1. Ed gl had	a het.
URINE	236	239		RADON		FECES / BLOOD	
Counter Number			1	Chamber Number	Me D-51	Counter Number	
Counter Bkg. (cpm)	800- 3		17/30	Cham. Bkg. (mv/sec)	908-22	Counter Bkg.	20 E-17 E-17 E-17 E-17 E-17 E-17 E-17 E-17
Counter Eff. (%)	3/:8	31.8	V'	Counter Eff. (%)		Counter Eff.	At the second second
Date/Time - Stort				Millivolt - Start	55-118	Date/Time - Stort	(2) (a) (b) (a) (b) (b) (b) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c
-Stop				Millivolt - Stop	2.15	- Stop	914
Total Counts	97	6		Total Millivots	102	Total Counts	-
Counting Time	100	100	<u> </u>	Total Drift Time	2.13	Counting Time	1
Gross cpm				Gross my/sec	4118dpm	Gross cpm	1
Bkg. Cpm	1, 10, 10			Bkg. Mv/sec	730	Bkg. cpm	
Net cpm	- 0	-	<u> </u>	Net mv/sec	-	dpm	196
dpm To Rec	- 90	<i></i>		litter (69 - 74)		dps/cc	
dpm/24 hr. (69-74)	1		-	1(mer (69 - 74)		Neutron Dose (rads) (63-68)
K 40 Correction	C./84± 0.07	0	-	D(q) (63-68)	124.407.60	(yc/mg (69-74)	
Net Beto Pei/Sal	0.7841 0.07	17	•	Yo Rec =		D(q) (63-68)	
D(q) (63-68)	-1 -			10222			
				4			
NAME:				SOCIAL SECURITY NUI	MBER:	SAMPLE NUM	BER:
		,					
AIR FORCE BASE					lo.		
RESULTS OF ANAL	YSIS	079	O/a Rec	- 90.7 Burden - 0.07		Premious Resu	ely
Pci/Spl	- 0.184±0		21	6 1 0.07		1.68 Pell	0.1788
Tolul 1	1-870MG		Body	oursen -		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
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AME OR REQUESTOR'S ID (1	(-20)	TSGT .	(b) (6)	(b) (6)	NITY NUMBER	RHL SAMPLE NUMBER
TYPE SAMPLE (23-32) Urine	OCCUPATION (34-35)	ANALYSIS DESIRE	D REQUE	SCHW		r FORCE BASE (68-71)
ATE RECEIVED (37-42) 20 Jan 67	DATE ANALYZED		FEBE?	DATE COLLECT	TED	EXPOSURE DATE
SAMPLE WEIGHT/VOLUME +	78 ACID	WEIGHT/VOLU	O ME	TE	CHNICIAN	(b) (6)
OTHER DATA		11.	The second secon		1	5.71
NVIRONMENTAL SAMPLES					20. 17	7.7
OUNTER & EFFICIENCY						
OTAL COUNTS & MINUTES		St. 26 18 2				
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KG CPM & MINUTES			الريلا			
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	34.17 (3)	236	259			
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OUNTER & EFFICIENCY 5		24.3				
OTAL COUNTS & MINUTES	400 4	6/	3			
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	900					
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ET CPM	1/4/1-27.	9±20.2	9	6Rec: 8	3: 2	
ET GPM	i/dal- 27.	9±20.2	9	o Rec = 8 dy Busde	23:2	
ET GPM	i/dal-27. of-1.32di	9±20.2	99	6 Rec = 8	3.2	
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ET GPM	i/Spl-27. of-1.32.li	9±20.2	99	o Rec: 8 dy Bude	ADMINISTRAÇÃO POR PROPERTOR DE COMPANSA DE	-WPAFB-MAY 66 4500
ET CPM IELD I UMMARY OF RESULTS: FC Tot U Vol Qoe FLC FORM 1165	The second section is a second section in the second section in the second section is a second section in the second section in the second section is a second section in the second section in the second section is a second section in the second section in the second section is a second section in the second section in the second section is a second section in the second section in the second section is a second section in the second section in the second section is a second section in the second section in the second section is a second section in the second section in the second section is a second section in the second section in the second section is a second section in the second section in the second section is a second section in the second section in the second section is a second section in the second section in the second section is a second section in the second section in the second section is a second section in the second section in the second section is a second section in the second section in the second section is a second section in the second section in the second section is a second section in the second section in the second section is a section section in the section is a section section in the section section in the section section is a section section section in the section section section section in the section s	Augusta and delegated and	99 23 87	6 Rec: 8 Burden	ADMINISTRAÇÃO POR PROPERTOR DE COMPANSA DE	ASS AND SEC. 1
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ET CPM ELD II II II II II II II II II	The second section of the second	1 M.	97.	ORE: 8 dy Bude	ADMINISTRAÇÃO POR PROPERTOR DE COMPANSA DE	-WPAFB-MAY 66 4500
ET CPM ELD II II II II II II II II II	The second section of the second	1 M.	99 B3 87	lo Roc: 8 dy Bude.	ADMINISTRAÇÃO POR PORTO DE POR	ASS AND SEC. 1
ET CPM	The second section of the second	1 M.	99 25.	lo Rec = 8 dy Bushe	ADMINISTRAÇÃO POR PORTO DE POR	ASS AND SEC. 1
ET CPM	The second section of the second	1 M.	9/ B. 87	o Rec = 8 dy Bude ich 67	ADMINISTRAÇÃO POR PORTO DE POR	ASS AND SEC. 1
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ET CPM	The second section of the second	1 M.	99 23.	O Rec: 8 dy Bude	ADMINISTRAÇÃO POR PORTO DE POR	ASS AND SEC. 1
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IT CPM IL II II II II II IMMARY OF RESULTS: FC Vol Qoe	The second section of the second	1 M.	99 25.	lo Rec : 8 dy Bushe	ADMINISTRAÇÃO POR PORTO DE POR	ASS AND SEC. 1

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		RAD	IOLOGICAL	SAMPLE		E3 14 13	The second second	HL SAMPLE HUMBER	All
ME OR REQUESTOR'S ID (1-2	0)	GRADE 759	7 . AFSI	(6)	(b) (6)	SECURITY NUMB	Aug		VO
(PE SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DE			C/tec		867	RCE BASE (68-71) AC /JOSP AI EXPOSURE DATE	20. N. 11
ATE RECEIVED (37-42)	DATE ANALYZED		DATE COUNTED		DATE C	MAI 6		EXPOSURE DATE	
AMPLE WEIGHT/VALUME 7	ne	WEIGHT	YOLUME ANALYZE	9 0		(b) (6)			
THER DATA									
NVIRONMENTAL SAMPLES									
OUNTER & EFFICIENCY									
OTAL COUNTS & MINUTES									168.5
ROSS CPM									- 6.
KG CPM & MINUTES									64
YET CPM									
TIELD									
									-,
				70.00					
		2 3		239					
		a_	0			RADON			1
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BIOLOGICAL SAMPLES									
COUNTER & EFFICIENCY	Specty	27	9	20		27			
DIOLOGICAL SAMPLES COUNTER & EFFICIENCY TOTAL COUNTS & MINUTES	50000	25	8	0					
COUNTER & EFFICIENCY TOTAL COUNTS & MINUTES GROSS CPM	200	25	8	, , ,					-
COUNTER & EFFICIENCY TOTAL COUNTS & MINUTES	200	2.5	8	.9 .					+
COUNTER & EFFICIENCY TOTAL COUNTS & MINUTES GROSS CPM	200	2.5	8	, , ,					+
COUNTER & EFFICIENCY TOTAL COUNTS & MINUTES GROSS CPM BKG CPM & MINUTES	200	2.5%	8	, , ,					
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COUNTER & EFFICIENCY TOTAL GOUNTS & MINUTES GROSS CPM BKG CPM & MINUTES NET CPM YIELD	200		8	, , ,		Q.			
COUNTER & EFFICIENCY TOTAL COUNTS & MINUTES GROSS CPM BKG CPM & MINUTES NET CPM	200	2 \$ 0 0 70	× × × × × × × × × × × × × × × × × × ×	, , ,		Опожае	= q3	E . 8	
COUNTER & EFFICIENCY TOTAL GOUNTS & MINUTES GROSS CPM BKG CPM & MINUTES NET CPM YIELD SUMMARY OF RESULTS:	200	70,	¥	, , ,		Отоме	= \psi_3	£. 8	
COUNTER & EFFICIENCY TOTAL GOUNTS & MINUTES GROSS CPM BKG CPM & MINUTES NET CPM YIELD SUMMARY OF RESULTS:	200	70,	ž	, , ,		Опоме	<i>E</i> 9 3	5.8	
COUNTER & EFFICIENCY TOTAL GOUNTS & MINUTES GROSS CPM BKG CPM & MINUTES NET CPM YIELD SUMMARY OF RESULTS:	200 200 200 Val=2, 80	. 70,	¥	, , ,		Отоме	= \psi_3	3-8	
COUNTER & EFFICIENCY TOTAL GOUNTS & MINUTES GROSS CPM BKG CPM & MINUTES NET CPM YIELD SUMMARY OF RESULTS:	200	. 70,	¥	, , ,		Force Date	= 43	5. 8 led 2 Jan	67

TYPE SPL (IKIN)= TIFICATION P-653 SCHW WT OR YOL ANALYZED DATE RECD EXPOSURE DATE(S) TOTAL WT OR VOL DATE COLLECTED PU 237 17945 67 2060. me 1030 me TYPE OF ANALYSIS 239 226 COUNTER AND EFF Spec#1 TOTAL CTS AND TIME 200-2 152 BK CTS AND TIME 900 - 1 4 NET CTS PER MIN 12 lept 67 5,20 43 1 20 22 33 35 43 33 35 20 22 GR ALPHA DIS GR ALPHA GR ALPHA PER 24 HR DATE CTD GR BETA DIS GR BETA GR BETA PER 24 HR DATE CTD -GR ALPHA SUS DATE CTD ACTIVITY NUCLIDE GR BETA SUS 239 DATE CTD NET BETA PER 24 HR 1 **SEP 1967** SAMPLE WT DIS SAMPLE WT SUS SAMPLE VOL RECOVERY 66 ELAPSED TIME SYSTEMIC BODY CRITICAL ORGAN AFLC JUL 67 1165 PREVIOUS EDITION RADIOLOGICAL SAMPLE DATA AFLC-WPAFB-JUL 67 3M FC 5400

Dose Evaluation Report April 28, 2000

(b) (6)					(b) (6)	
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APO	TAC	0901	2	,	•	
410 #5	(b) (6)		74s1	TSI		÷
	1900	3/	JAN -	1900	IFEB.	
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-TOTAL SAMPLE VOL. 2,580 ML AMT USED 200 ML WITRIC ACID, 50 ML Relunt flood (b) (6)
ofter key punch
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· Physiological Approach to Oral Contraception

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DEPARTMENT OF THE AIR FORCE
USAF RADIOLOGICAL HEALTH LABORATORY (AFLC)
WRIGHT PATTERSON AIR FORCE BASE OHIO 45433



SGHW

7 Dec 1967

sue ter Long-Term Medical Follow-Up, Palomares Operation Urine

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APO New York 09012

1 As a result of your splendid cooperation in this program, it is possible to discontinue further sampling.

2. Our results show that your health is in no jeopardy from retention of radioactive, materials as a result of participation in subject operations in

Involvance still on active duty please present this letter to the custodian of your medical records of that it may be made part of your permanent files it moved a cure duty it is suggety our retain it in your permanent personal records

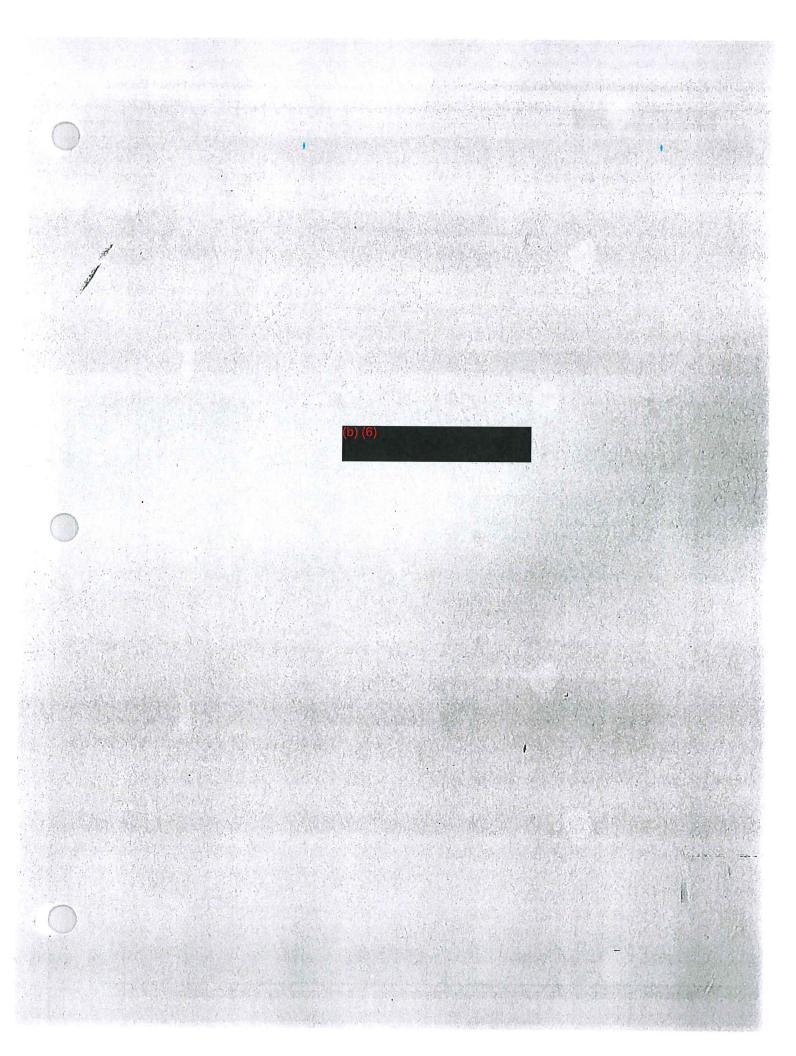
4. Our files show that three sample bottles were sent to you, and that three samples were returned for analysis.

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Internal Dosimetry Evaluation Form SSN: NAME: INTAKE DATE OR PERIOD: MODE OF INTAKE: 1/18/66 through 2/15/66 on-site ☐ Injection ☐ Absorption 1/18/66 assumed start. ☐ Ingestion ☐Not applicable ☐ Unknown SUMMARY OF EXPOSURE CONDITIONS: Radionuclides/Respiratory Class/Particle Size: 239Pu/100% Class Y/1 µm AMAD Date or Period of Evaluated Data: 5 urine samples from 02/16/66 to 08/09/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain **EVALUATION DATA:** ☐ In Process☐ In Process☐ In Process☐ □ Unavailable ☐ Attached Air Sampling Health Physics Survey Data □ Unavailable Attached ☐ Unavailable Bioassay - Urinalysis Attached Unavailable ☐ Attached In Process Fecal ☐ Attached ☐ In Process Nasal Smears **⊠** Unavailable ☐ In Process In Vivo ☐ Attached Medical Treatment: Skin Decontamination: Yes Yes No Date: ☐ Yes ☐ Yes ⊠ No Agent: _____ Date: Decorporation: ⊠ No Agent: Date: Catharsis: **⊠** No Date: ☐ Yes Surgical excision: **EVALUATION METHODOLOGY:** Assumptions: Acute inhalation intake of ²³⁹Pu, 100% Class Y, 1 µm AMAD particle size on 1/18/66 Intake Estimate: CINDY, Ver. 1.4/JONES Code/Model used for: Dose Estimate: CINDY, Ver. 1.4/ICRP 30, Part 4, General Systemic Model **RESULTS SUMMARY** Estimated Intake Activity (pCi): 68,000 50 YR CEDE (rem): 21 (0.21 Sv) 50 YR CDE (rem/Sv) **Organ Dose Equivalent Summary** 210/2.1 **Bone Surface** 78/0.78 Lung 38/0.38 Liver 16/0.16 Red Marrow 3.6/0.036 Other 3.0/0.030 **Testes** DATE: PEER REVIEWER: DOSE ASSESSOR: DATE: Signature: ___ Signature: Print Name: ___ Print Name: SSN: RECOMMENDATIONS: ☐ Urinalysis ☐ Fecal ☐ In Vivo Additional Bioassay Required Suggested Sampling Frequency: Work Restrictions: N/A



Preliminary Internal Dosimetry Case Narrative

Identification:

Name: SSN:



Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. One urine sample data card indicated an exposure period of Jan uary—February 1966. An exposure date of 18 January 1966 corresponding to the first day of the response was chosen as most conservative. One sample was taken on 16 February 1966 and was assumed to be the day after exposure ended, 15 February 1966.

Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

Dates	% Body Burder
2/16/66	-
10/06/66	11
3/09/67	0
4/13/67	5
8/09/67	0

Radionuclide(s): 239Pu.

Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1 μ m AMAD particle size on 1/18/66. The date is the first day of the period on station from 1/18/66 to 2/16/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.





Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

			Elapsed	Result	Error	
Sample	*Analysis	Date	Days	(pCi/day)	(pCi/day)	Included
66-958	G	02/16/66	29	1.2	0.97	
66-4943	AS	10/06/66	261	0.17	0.09	✓
67-0478	AS	03/09/67	415	0.004	0.004	✓
67-1295	AS	04/13/67	450	0.047	0.023	✓
67-3977	AS	08/09/67	568	ND		✓

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	68,000	21/0.21
LUDEP	20,000	1.4/0.014

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

	Dose Equivalent	Weighting	Weighted Organ Dose Equivalent
Organ	(rem/Sv)	Factors	(rem/Sv)
Testes	3.0E+00/3.0E-02	2.5E-01	7.6E-01/7.6E-03
Breast	1.0E-04/1.0E-06	1.5E-01	1.5E-05/1.5E-07
Red Marrow	1.6E+01/1.6E-01	1.2E-01	2.0E+00/2.0E-02
Lung	7.8E+01/7.8E-01	1.2E-01	9.3E+00/9.3E-02
Thyroid	9.5E-05/9.5E-07	3.0E-02	2.8E-06/2.8E-08
Bone Surface	2.1E+02/2.1E+00	3.0E-02	6.4E+00/6.4E-02
Liver	3.8E+01/3.8E-01	6.0E-02	2.3E+00/2.3E-02
Other	3.6E+00/3.6E-02	6.0E-02	2.2E-01/2.2E-03
Lower Large Intestine	7.7E-03/7.7E-05	6.0E-02	4.6E-04/4.6E-06
Upper Large Intestine	2.6E-03/2.3E-05	6.0E-02	1.6E-04/1.6E-06
Small Intestine	5.3E-04/5.3E-06	6.0E-02	3.2E-05/3.2E-07
Effective Dose Equivale	ent		2.1E+01/2.1E-01

DRAFT

Revised Dose Evaluation Report April 2001

(b) (6)



Four urine samples were analyzed by alpha spectrometry and one early sample by gross alpha counting. The gross alpha reported 1.2 +/- 0.97 pCi/day; however this was not used in our analysis because of suspected contamination from on-site collection of the samples. One of the four samples analyzed by alpha spectrometry was reported as NDA (no detectable activity) and two were reported with a positive result. The four values were fit using CINDY and the Jones excretion model to estimate an intake (68,000 pCi), organ doses, and a CEDE (21 rem/0.21 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 20,000 pCi and a CEDE (ICRP-60) of 1.4 rem (0.014 Sv).

Conclusion:

Prepared By:

Based on the results of intake estimates and dose calculations, this individual received an intake of about 20,000 to 68,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 1.4 to 21 rem (0.014 to 0.21 Sv). That dose ranges from well below to three times the cumulative dose (7 rem) from a lifetime (70 years) of exposure at the current level (0.100 rem) for members of the public. It is also about one-half the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). Serious health consequences are not associated with these dose levels.

Date:	
Date:	- 7

FEB ? 1 1966 SOC. SEC. NO. (21-29) GROSS ALPHA Unn XPOSURE 16 Feb. 16 DATE TO SUBMITTY PE FROM OCCUPATION (61 - 62) REQUESTED BY TANKAM TE RECEIVED PES 21 806 DATE ANALYZED SAMPLE VOLUME. TECHNICIAN (SIGNATURE AND DATE) 1 MAR 1966 FECES/BLOOD RADON GKUSS A PHA URINE Counter Number Chamber Number Counter Number Counter Bkg. 0118 Cham. Bkg. (mv/sec) Counter Bkg. (cpm) Counter Eff. Counter Eff. (%) 0,51 Counter Eff. (%) Date/Time - Stort Millivolt - Start Date/Time - Start 1 MAR 1956 - Stop -Stop Millivolt - Stop Total Counts Total Millivots Counting Time Total Drift Time Counting Time Gross cpm Gross my/sec Gross cpm Bkg. Mv/sec Bkg. cpm Bkg. Cpm net cpm Net my/sec Net cpm dpm curies/mv dpm/24 hr. (69.74) 1.15 \$ 0.93 dps/cc litter (69 - 74) Neutron Dose (rads) (63-68) K 40 Correction uc/mg (69-74) D(q) (63-68) the par /ci/c D(q) (63-68) Dx = 6,52 x 10 10 ,15 D (q) (63-68) # = 23 D

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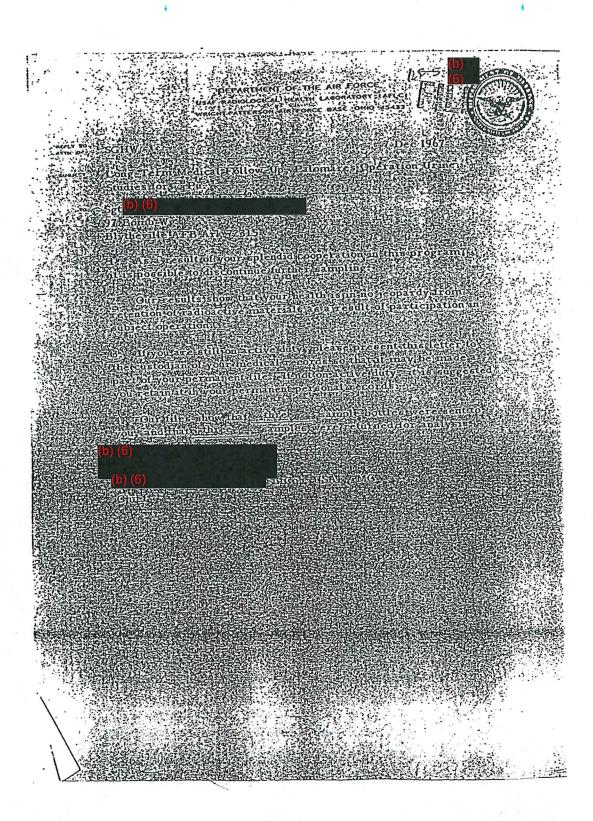
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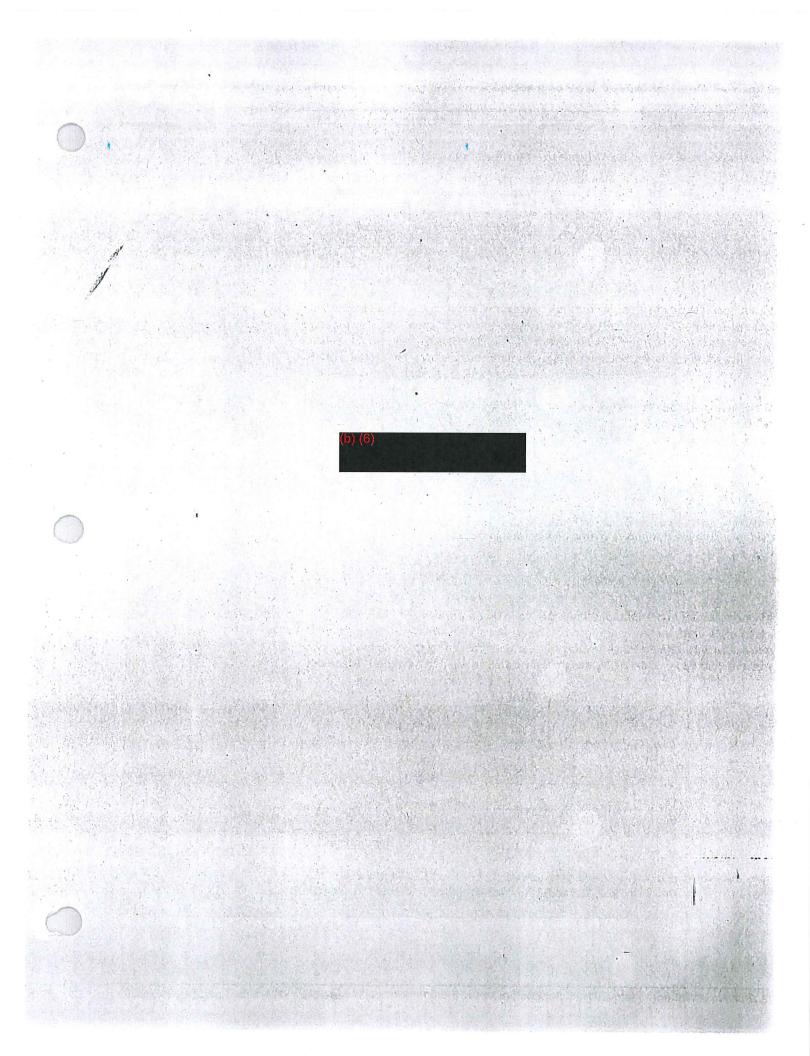
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	y Evaluation Form
NAME: (b) (6)	SSN: (b) (6)
MODE OF INTAKE: Inhalation	1/66 to 08/13/67
Health Physics Survey Data Bioassay — Urinalysis Fecal Nasal Smears In Vivo Medical Treatment: Skin Decontamination: Decorporation: Catharsis: Attached Attached Attached Attached Yes Catharsis:	In Process Unavailable No Date:
EVALUATION METHODOLOGY: Assumptions: Acute inhalation intake of ²³⁹ Pu, 100% Clas Code/Model used for: Intake Estimate: CINDY, Ver.	s Y, 1 μm AMAD particle size on 1/18/66
RESULTS SUMMARY Estimated Intake Activity (pCi): 69,000 50 YR CEDE (rem): 21 (0.21 Sv) Organ Dose Equivalent Summary Bone Surface Lung Liver Red Marrow Other Testes	9 YR CDE (rem/Sv) 220/2.2 79/0.79 38/0.38 17/0.17 3.6/0.036 3.1/0.031
DOSE ASSESSOR: DATE:	PEER REVIEWER: DATE:
Signature: Print Name: SSN:	Signature: Print Name: SSN:
RECOMMENDATIONS: Additional Bioassay Required Uri Suggested Sampling Frequency: Work Restrictions: N/A	nalysis



April 2001

Preliminary Internal Dosimetry Case Narrative

Identification:

Name: SSN:



Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. None of the urine sample data cards indicated an exposure period or date. However, the first sample from him was received at the laboratory on 25 January 1966. This indicates he was one of the early responders and was included in the first samples collected on 21 January 1966. An exposure date of 18 January 1966 corresponding to the first day of the response was chosen as most conservative.

Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

Dates	% Body Burden
1/21/66	-
6/18/66	8
2/12/67	2
4/09/67	_
8/13/67	0

Radionuclide(s): ²³⁹Pu.

Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1 µm AMAD particle size on 1/18/66. The date is the first day of the period on station from 1/18/66 to 1/21/66.

(b) (6)

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.

Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

			Elapsed	Result	Error	
Sample	*Analysis	Date	Days	(pCi/day)	(pCi/day)	Included
66-254	G	01/21/66	3	1.77	0.799	
66-3838	AS	06/18/66	151	0.201	0.079	✓
67-0526B	AS	02/12/67	390	0.02	0.01	✓
67-1265	AS	04/09/67	446	ND		✓
67-3936	AS	08/13/67	572	ND		✓

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	69,000	21/0.21
LUDEP	82,000	5.7/0.057

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the results in the table below.

Four urine samples were analyzed by alpha spectrometry and one early sample by gross alpha counting. The gross alpha reported 1.77 +/- 0.799 pCi/day; however this was not used in our analysis because of suspected contamination from on-site collection of the samples. Two of the four samples analyzed by alpha spectrometry were reported as NDA (no detectable activity) and two were reported with a positive result. The four values were fit using CINDY and the Jones excretion model to estimate an intake (69,000 pCi), organ doses, and a CEDE (21 rem/0.21 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 82,000 pCi and a CEDE (ICRP-60) of 5.7 rem (0.057 Sv).

b) (6) April 2



			Weighted Organ	
	Dose Equivalent	Weighting	Dose Equivalent	
Organ	(rem/Sv)	Factors	(rem/Sv)	
Testes	3.1E+00/3.1E-02	2.5E-01	7.7E-01/7.7E-03	•
Breast	1.0E-04/1.0E-06	1.5E-01	1.5E-05/1.5E-07	
Red Marrow	1.7E+01/1.7E-01	1.2E-01	2.0E+00/2.0E-02	
Lung	7.9E+01/7.9E-01	1.2E-01	9.5E+00/9.5E-02	
Thyroid	9.6E-05/9.6E-07	3.0E-02	2.9E-06/2.9E-08	
Bone Surface	2.2E+02/2.2E+00	3.0E-02	6.5E+00/6.5E-02	
Liver	3.8E+01/3.8E-01	6.0E-02	2.3E+00/2.3E-02	
Other	3.6E+00/3.6E-02	6.0E-02	2.2E-01/2.2E-03	
Lower Large Intestine	7.8E-03/7.8E-05	6.0E-02	4.7E-04/4.7E-06	
Upper Large Intestine	2.6E-03/2.6E-05	6.0E-02	1.6E-04/1.6E-06	
Small Intestine	5.4E-04/5.4E-06	6.0E-02	3.2E-05/3.2E-07	
Effective Dose Equivale	ent		2.1E+01/2.1E-01	•

Conclusion:

Based on the results of intake estimates and dose calculations, this individual received an intake of 69,000 to 82,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 5.7 to 21 rem (0.057 to 0.21 Sv). That dose ranges from slightly less than to three times the cumulative dose (7 rem) from a lifetime (70 years) of exposure at the current level (0.100 rem) for members of the public. It is less than one-half the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). Serious consequences in health are not associated with this dose level.

Prepared By:		
Name:	÷	
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Peer Reviewed By:		
Name:		
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	()	INTE	RNAL DOSE DATA				
(b) (6)		soc (b) (URIU.	(i) T	GROSS ALPH	
SAMPLE NOT 133 - 38	17 , 1	SAMPLE DATE (39-44)	The same of the sa	EXP	OSURE		
66-254)		FROM	то	٥	ATE	TYPE	
TORRE	JON	OCCUPATION (61 - 62)	REQUESTED BY				
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TECHNICIAN (SIGN	ATURE AND DATE)				-		
URINE G	ROSS ALPHA		RADON		FECES	/BL000	
Counter Number	16		Chamber Number		. Counter Nu	mber	
Counter Bkg. (cpm)			Cham. Bkg. (mv/sec)	Counter Bk	9.	
Counter Eff. (%)	5/5/6		Counter Eff. (%)		Counter Ef	1.	
Date/Time - Start			Millivolt - Start		Date/Time	- Start	
-Stop		8	Millivolt - Stop			- Stop	
Total Counts	.76		Total Millivots .		Total Coun	ts	
Counting Time	55		Total Drift Time		Counting T	Ime	
Gross cpm	0.659		Gross mv/sec		Gross cpm		
Bkg. Cpm	0,127		Bkg. Mv/sec		Bkg. cpm		
Net cpm	0502		Net mv/sec		net cpm	1	
dpm			curies/mv		dpm		
dpm/24 hr. (69 - 74)			litter (69 - 74)		dps/cc		
K 40 Correction					Neutron Do	se (rads) (63-68)	
Net Beta	Y 7 4 1 W		D(q) (63-68)		uc/mg (69		
D(q) (63-68)	725	# 1.06 PC/L	27 J	Tan 1966	D(q) (63.	68)	

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TYPE SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS D			AF Red	7.0		PO ION	(00-71) (65
DATE RECEIVED (37-42)		Pu 2	DATE COM	VTED US				EXPOSURE I	ATT
DATE RECEIVED (37-42)	DATE ANALYZE		14 S		18 Ju	in 66		OF	FUT
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THE OR BLOWSTONE IN /+	***	-	DIOLOG	ICAL SA	MPLE	DATA			B-5		
o) (6)		GRADE		AFSN		SOCIAL SEC	HAITY WUNDE	RESTRICTED	2 370	5 5 C	9
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) (6)	201	GRADE	07	b) (6)		BECORITI NOME		RCE BASE (68-71)	
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Sequential folder containing fifteen 80-mcg. tablets of mestranol plus five tablets each combining 80 mcg. mestranol and 2 mg. chlormadinone acetate.

A More Physiological Approach to Oral Contraception

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A More Physiological Approach to Oral Contraception

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DEPARTMENT OF THE AIR FORCE
USAF RADIOLOGICAL HEALTH LABORATORY (AFLC)
WRIGHT PATTERSON AIR FORCE BASE OHIO 45433

April 2 2 2000 17-66-2978 (b) (b)

SGHW

7 Dec 1967

Long-Term Medical Follow-Up, Palomares Operation Urine Studies for ²³⁹ Pu.

Maj^(b) (6)

DCS Bioastronautics Hq AFSC, Andrews AFB, Wash DC 20331

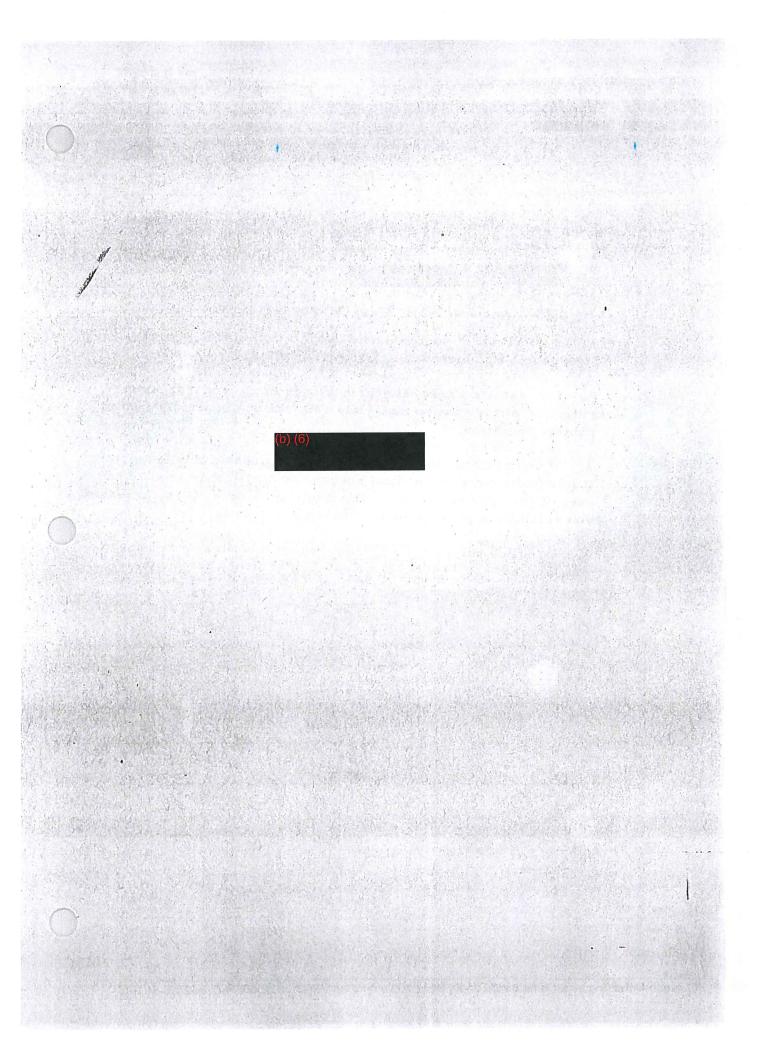
- l. As a result of your splendid cooperation in this program, it is possible to discontinue further sampling.
- 2. Our results show that your health is in no jeopardy from retention of radioactive materials as a result of participation in subject operation.
- 3. If you are still on active duty, please present this letter to the custodian of your medical records so that it may be made a part of your permanent file. If not on active duty, it is suggested you retain it in your permanent personal records.
- 4. Our files show that three sample bottles were sent to you, and that three samples were returned for analysis.

b) (6)

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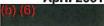
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Internal Dosimetry Evaluation Form

Hitel Hai Dusiiii	etry Evaluation Form								
NAME. (6)	SSN: (b) (6)								
MODE OF INTAKE:	INTAKE DATE OR PERIOD:								
☐ Inhalation ☐ Injection☐ Ingestion ☐ Absorption	01/20/66 through 2/11/66 on-site 1/20/66 assumed start.								
☐ Ingestion ☐ Absorption ☐ Unknown ☐ Not applicable	1/20/00 assumed start.								
SUMMARY OF EXPOSURE CONDITIONS:									
Radionuclides/Respiratory Class/Particle Size: 239 Pu/100% Class Y/1 µm AMAD Date or Period of Evaluated Data: 3 urine samples from 01/24/67 to 08/10/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain									
ENVAR ALAMPAONI TO A TO A									
EVALUATION DATA: Air Sampling	☐ In Process ☑ Unavailable								
Health Physics Survey Data Attached	☐ In Process ☐ Unavailable								
Bioassay – Urinalysis 🛛 Attached	☐ In Process ☐ Unavailable								
Fecal Attached	☐ In Process ☐ Unavailable								
Nasal Smears	☐ In Process ☐ Unavailable								
In Vivo Attached	☐ In Process ☐ Unavailable								
Medical Treatment:									
Skin Decontamination: Yes	No Date:								
Decorporation: Yes	No Agent: Date:								
Catharsis:	No Agent: Date:								
Surgical excision: Yes	☑ No Date:								
Code/Model used for: Intake Estimate: CINDY, V	Assumptions: Acute inhalation intake of ²³⁹ Pu, 100% Class Y, 1 µm AMAD particle size on 1/20/66								
RESULTS SUMMARY Estimated Intake Activity (pCi): 34,000 50 YR CEDE (rem): 10 (0.10 Sv) Organ Dose Equivalent Summary Bone Surface 110/1.1 Lung 39/0.39 Liver 19/0.19 Red Marrow 8.2/0.089 Other 1.8/0.018 Testes 1.5/0.015									
DOSE ASSESSOR: DATE:	PEER REVIEWER: DATE:								
Signature:	Signature:								
Print Name:	Print Name:								
SSN:	SSN:								
RECOMMENDATIONS: Additional Bioassay Required Suggested Sampling Frequency: Work Restrictions: N/A Urinalysis Fecal In Vivo									





Preliminary Internal Dosimetry Case Narrative

Identification:

Name: SSN:



Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. A 28 December 1966 letter from the 48th TAC Hospital, APO New York 09179 stated that his TDY period was 20 January – 11 February 1966. An exposure date of 20 January 1966 corresponding to the first day of the response was chosen as most conservative.

Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

Dates	% Body Burden
1/24/67	6
4/26/67	1
8/10/67	0

Radionuclide(s): 239Pu.

Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1 μ m AMAD particle size on 1/20/66. The date is the first day of the period on station from 1/20/66 to 2/11/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.



April 2001 (6)

Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

			Elapsed	Result	Error	
Sample	*Analysis	Date	Days	(pCi/day)	(pCi/day)	Included
67-0365	AS	01/24/67	357	0.0738	0.0263	✓
67-1499	AS	04/26/67	449	0.01	0.01	✓
67-3860	AS	08/10/67	555	ND		√

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	34,000	10/0.10
LUDEP	65,000	4.5/0.045

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

Organ Testes	Dose Equivalent (rem/Sv) 1.5E+00/1.5E-02	Weighting Factors	Weighted Organ Dose Equivalent (rem/Sv) 3.8E-01/3.8E-03
Breast	5.0E-05/5.0E-07	1.5E-01	7.6E-06/7.6E-08
Red Marrow	8.2E+00/8.2E-02	1.2E-01	9.8E-01/9.8E-03
Lung	3.9E+01/3.9E-01	1.2E-01	4.7E+00/4.7E-02
Thyroid	4.7E-05/4.7E-07	3.0E-02	1.4E-06/1.4E-08
Bone Surface	1.1E+02/1.1E+00	3.0E-02	3.2E+00/3.2E-02
Liver	1.9E+01/1.9E-01	6.0E-02	1.1E+00/1.1E-02
Other	1.8E+00/1.8E-02	6.0E-02	1.1E-01/1.1E-03
Lower Large Intestine	3.9E-03/3.9E-05	6.0E-02	2.3E-04/2.3E-06
Upper Large Intestine	1.3E-03/1.3E-05	6.0E-02	7.8E-05/7.8E-07
Small Intestine	2.7E-04/2.7E-06	6.0E-02	1.6E-05/1.6E-07
Effective Dose Equivale		1.0E+01/1.0E-01	

(b) (6)

(b)(6)

Three urine samples were analyzed by alpha spectrometry. One of the three samples analyzed by alpha spectrometry were reported as NDA (no detectable activity) and two were reported with a positive result. The three values were fit using CINDY and the Jones excretion model to estimate an intake (34,000 pCi), organ doses, and a CEDE (10 rem/0.10 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 65,000 pCi and a CEDE (ICRP-60) of 4.5 rem (0.045 Sv).

Conclusion:

Prepared Ry:

Based on the results of intake estimates and dose calculations, this individual received an intake of 34,000 to 65,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 4.5 to 10 rem (0.045 to 0.10 Sv). That dose is about the cumulative dose (7 rem) from a lifetime (70 years) of exposure at the current level (0.100 rem) for members of the public. It is much less than the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). Serious consequences on health are not associated with this dose level.

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DEPARTMENT OF THE AIR FORCE 48TH TACTICAL HOSPITAL (USAFE) APO New York 09179





REPLY TO

ATTN OF:

SGAP

28 December 1966

SUBJECT :

Urinalysis

AFLC (SGHW) TO:

Wright-Patterson AFB, Ohio 45433

1. The following named individual reported to this hospital requesting a "radiation urinalysis" examination. He was reportedly advised to obtain this test every six months after an alleged exposure at Palomares, Spain. Pertinent data is as follows:

Name: Rank: A2c AFSN: (b) (6) SSN: Caucasian Age: Race: TDY Period: 20 Jan 66 to 11 Feb 66 Duty: Loadcrew removing aircraft parts and remains (no weapon items). Last Urinalysis: April 66 - reportedly high although not in excess of TLV. Present Assignment: 5th Aerial Port Squadron, APO NY 09127

2. If a specimen is desired, coordination can be effected through this office.

FOR THE COMMANDER

Captain, USAF, MC Chief, Military Public Health Service

Jin, USAF, Tic Health Ser Graph analyzed #670365

Softyler-Send Both-Send 7 Done Jan 67

DEPARTMENT OF THE AIR FORCE
USAF RADIOLOGICAL HEALTH LABORATORY (AFLC)
WRIGHT-PATTERSON AIR FORCE BASE OHIO 45433



TTN OF SGHW

7 Dec 1967

Long-Term Medical Follow-Up, Palomares Operation Urine Studies for 239 Pu.

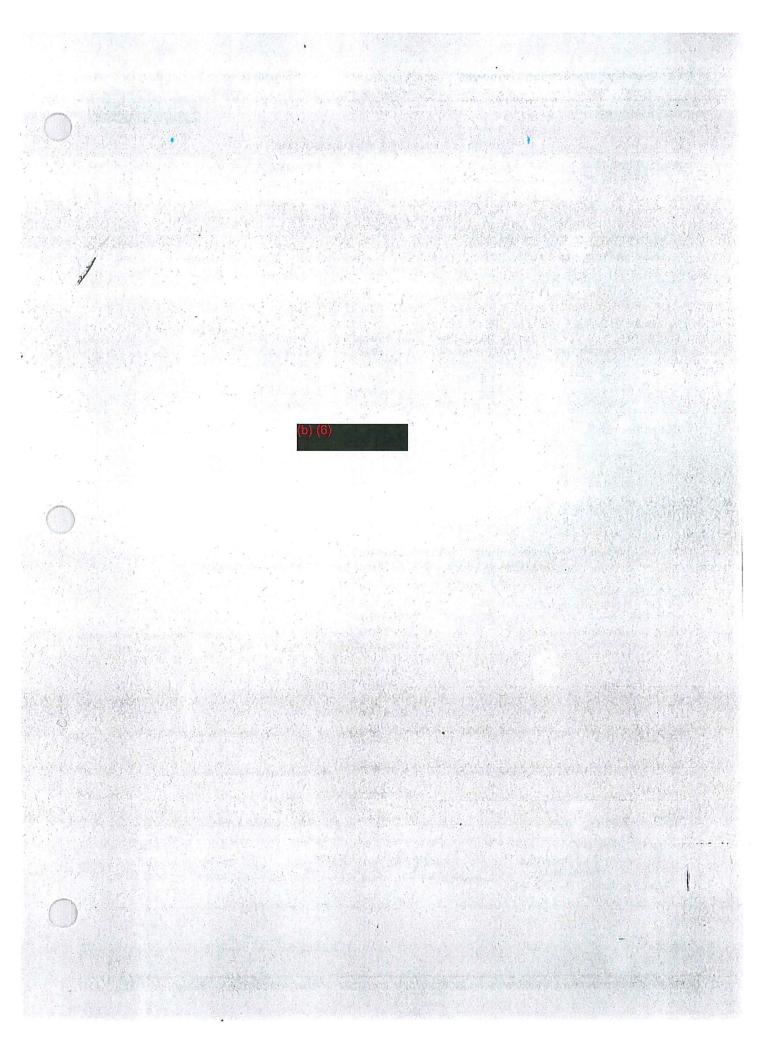
5th Aerial Port Sq APO New York 09127

- 1. As a result of your splendid cooperation in this program, it is possible to discontinue further sampling.
- 2. Our results show that your health is in no jeopardy from retention of radioactive materials as a result of participation in subject operation.
- 3. If you are still on active duty, please present this letter to the custodian of your medical records so that it may be made a part of your permanent file. If not on active duty, it is suggested you retain it in your permanent personal records.
- 4. Our files show that three sample bottles were sent to you, and that three samples were returned for analysis.

b) (6)

LtCol, USAF, MC

Chief





(b) (6)

(b) (6)

Internal Dosimetr	ry Evaluation Form
NAME:(b) (6)	SSN: (b) (6)
MODE OF INTAKE: Inhalation Injection Ingestion Absorption Unknown Not applicable SUMMARY OF EXPOSURE CONDITIONS:	INTAKE DATE OR PERIOD: 01/17/66 through 01/30/66 on-site 1/17/66 assumed start.
Radionuclides/Respiratory Class/Particle Size: ²³⁹ Pu/100% Date or Period of Evaluated Data: 5 urine samples from 03/3 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain	0/66 to 09/18/67
Nasal Smears Attached In Vivo Attached	In Process ☐ Unavailable ☐ In Process ☐ Unavailable ☐ Unavailable ☐ Unavailable ☐ Unavailable ☐ Unavailable ☐ Unavailable ☐ Unavailable ☐ Unavailable ☐ Unavailable ☐ Unavailable
Decorporation: ☐ Yes ☐	No Date:
EVALUATION METHODOLOGY: Assumptions: Acute inhalation intake of ²³⁹ Pu, 100% Class Code/Model used for: Intake Estimate: CINDY, Ver. 1 Dose Estimate: CINDY, Ver. 1	
Bone Surface 310 Lung 1 Liver 5 Red Marrow Other 5	YR CDE (rem/Sv) 0 to 1,100/3.1 to 11 10 to 400/1.1 to 4 66 to 200/0.56 to 2 24 to 84/0.24 to 0.84 6.3 to 18/0.53 to 0.018 6.5 to 16/0.045 to 0.16
DOSE ASSESSOR: DATE:	PEER REVIEWER: DATE:
Signature:	Signature:
Print Name:	Print Name:
SSN:	SSN:
RECOMMENDATIONS: Additional Bioassay Required Suggested Sampling Frequency: Work Restrictions: N/A	alysis





Preliminary Internal Dosimetry Case Narrative

Identification:

Name: SSN:



Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. One urine sample data card indicated an exposure period of 17-30 January 1966. Another card indicated exposure during January and February 1966. An exposure date of 17 January 1966 corresponding to the first day of his presence on site was chosen as most conservative.

Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

Dates	% Body Burden
3/30/66	-
10/10/66	67
1/27/67	3
5/09/67	0
9/18/67	0

Radionuclide(s): 239Pu.

Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1 μ m AMAD particle size on 1/17/66. The date is the first day of the period on station from 1/17/66 to 1/30/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.





Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

				Elapsed	Result	Error	
_	Sample	*Analysis	Date	Days	(pCi/day)	(pCi/day)	Included
	66-2875	G	03/30/66	72	1.76	0.34	
	66-2875	AS	03/30/66	72	0.29	0.006	✓
	66-4910B	AS	10/10/66	266	1.03	0.29	✓
	67-0398	AS	01/27/67	375	0.0441	0.0221	✓
	67-1616	AS	05/09/67	477	ND		✓
	67-5038	AS	09/18/67	609	ND		✓

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

Modeling:

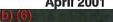
CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	100,000 to 350,000	31 to 110/0.31 to 1.1
LUDEP	1,100,000	79/0.79

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the results in the table below.

Five urine samples were collected. Four were analyzed by alpha spectrometry and one early sample by gross alpha counting. The gross alpha reported 1.76 +/- 0.34 pCi/day; however this sample was later reprocessed and analyzed by alpha spectrometry with a result of 0.29 +/- 0.006 pCi/day. The gross alpha result was not used in our analysis because the alpha spectrometry result was judged more reliable. Two of the five samples analyzed by alpha spectrometry were reported as NDA (no detectable activity) and three were reported with a positive result. The three values were fit using CINDY and the Jones excretion model to estimate an intake (100,000 to 350,000 pCi), organ doses, and a CEDE (31 to 110 rem/0.31 to 1.1 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 1,100,000 pCi and a CEDE (ICRP-60) of 79 rem (0.79 Sv).





				*	
				Weighted Organ	Weighted Organ
	Dose Equivalent	Dose Equivalent	Weighting	Dose Equivalent	Dose Equivalent
Organ	(rem/Sv) Low	(rem/Sv) High	Factors	(rem/Sv) Low	(rem/Sv) High
Testes	4.5E+00/4.5E-02	1.6E+01/1.6E-01	2.5E-01	1.1E+00/1.1E-02	3.9E+00/3.9E-02
Breast	1.5E-04/1.5E-06	5.2E-04/5.2E-06	1.5E-01	2.2E-05/2.2E-07	7.8E-05/7.8E-07
Red Marrow	2.4E+01/2.4E-01	8.4E+01/8.4E-01	1.2E-01	2.9E+00/2.9E-02	1.0E+01/1.0E-01
Lung	1.1E+02/1.1E+00	4.0E+02/4.0E+00	1.2E-01	1.4E+01/1.4E-01	4.8E+01/4.8E-01
Thyroid	1.4E-04/1.4E-06	4.9E-04/4.9E-06	3.0E-02	4.2E-06/4.2E-08	1.5E-05/1.5E-07
Bone Surface	3.1E+02/3.1E+00	1.1E+03/1.1E+01	3.0E-02	9.4E+00/9.4E-02	3.3E+01/3.3E-01
Liver	5.6E+01/5.6E-01	2.0E+02/2.0E+00	6.0E-02	3.3E+00/3.3E-02	1.2E+01/1.2E-01
Other	5.3E+00/5.3E-02	1.8E+01/1.8E-01	6.0E-02	3.2E-01/3.2E-03	1.1E+00/1.1E-02
Lower Large	1.1E-02/1.1E-04	4.0E-02/4.0E-04	6.0E-02	6.8E-04/6.8E-06	2.4E-03/2.4E-05
Intestine					
Upper Large	3.8E-03/3.8E-05	1.3E-02/1.3E-04	6.0E-02	2.3E-04/2.3E-06	8.0E-04/8.0E-06
Intestine					
Small Intestine	7.8E-04/7.8E-06	2.7E-03/2.7E-05	6.0E-02	4.7E-05/4.7E-07	1.6E-04/1.6E-06
Effective Dose E	quivalent		•	3.1E+01/3.1E-01	1.1E+02/1.1E+00

Conclusion:

The analysis produced an estimated intake of 100,000 to 1,100,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 31 to 110 rem (0.31 to 1.1 Sv). That dose range is high and apparently attributed to the result (1.03 +/- 0.29 pCi/day) of the 10 October 1966 sample. Such a result is not consistent with the result of (0.044 +/- 0.022) of 27 January 1967 nor the result (0.29 +/- 0.006 pCi/day) of 30 March 1966. Additional sampling and possible lung counting today should be considered to further assess this exposure.

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Signature:	Date:	
Peer Reviewed By:		
Name:		
Signature:	Date:	

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26 April 1966	<u></u>	1/5	0	1150) 		
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D(q) (63.68)						' '43 - 68)	

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Payne, G.N.

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April 28, 2000 ) (6)

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Letter sent 6 Dec 66

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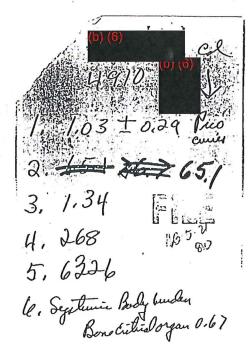
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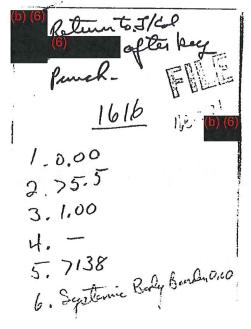
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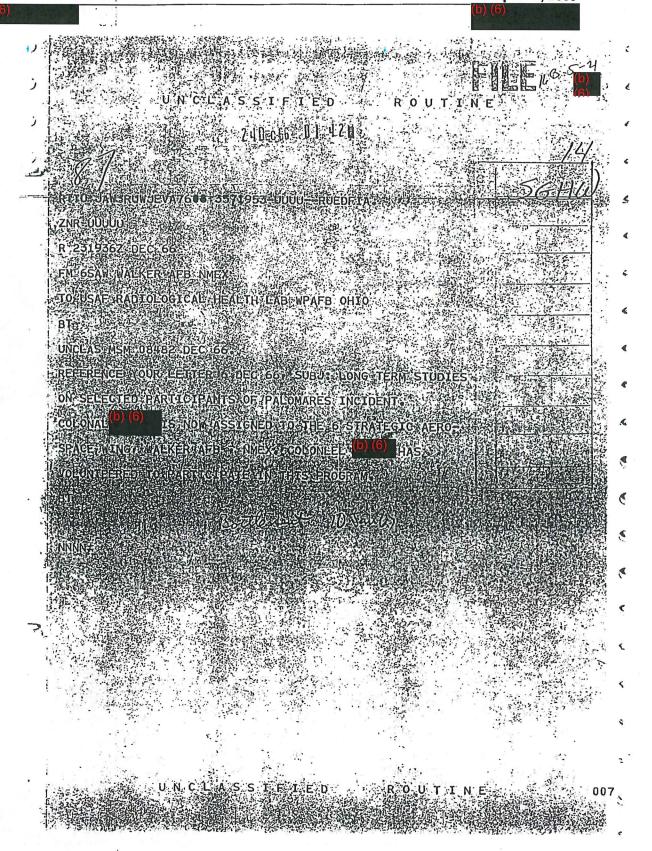
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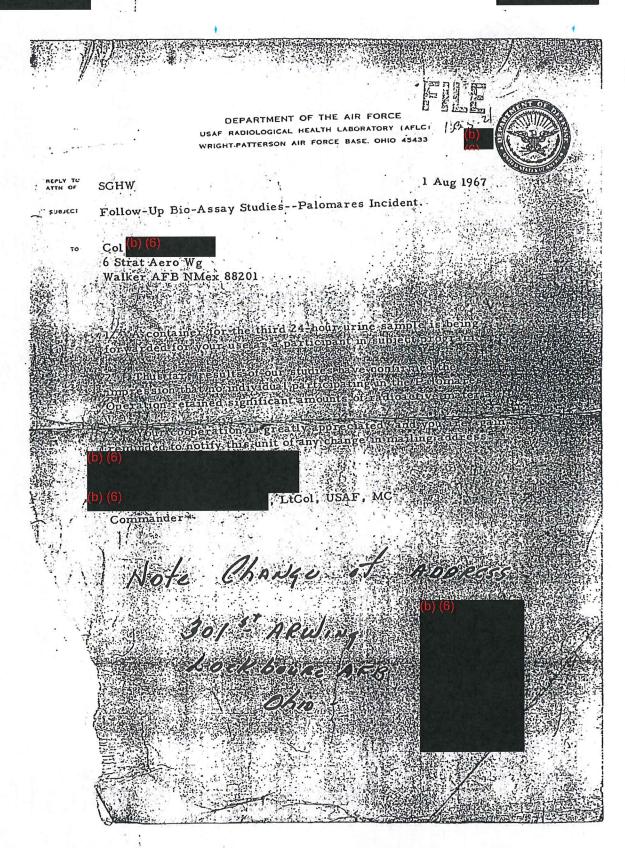
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DEPARTMENT OF THE AIR FORCE
USAF RADIOLOGICAL HEALTH LABORATORY (AFLC)
WRIGHT PATTERSON AIR FORCE BASE OHIO 45433



REPLY TO

SGHW

7 Dec 1967

Long-Term Medical Follow-Up, Palomares Operation Urine Studies for 239 Pu.

Col (b) (6) 301 AR Wg

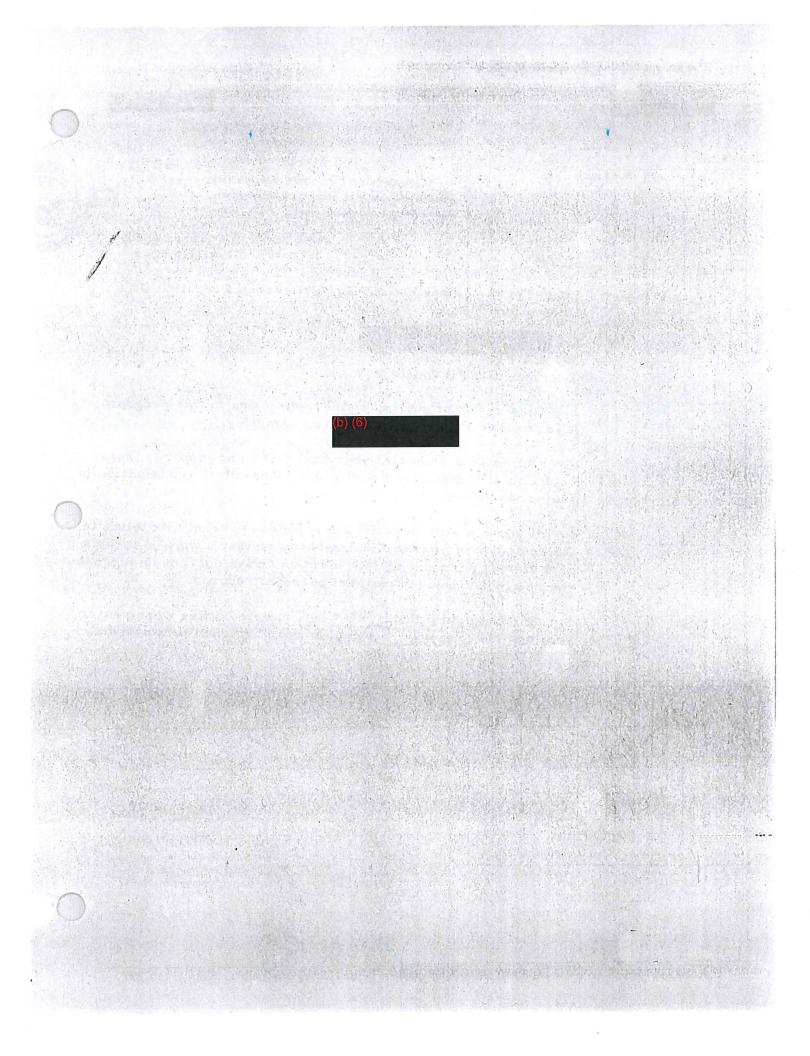
Lockbourne AFB Ohio 43217

- 1. As a result of your splendid cooperation in this program, it is possible to discontinue further sampling.
- 2. Our results show that your health is in no jeopardy from retention of radioactive materials as a result of participation in subject operation.
- 3. If you are still on active duty, please present this letter to the custodian of your medical records so that it may be made a part of your permanent file. If not on active duty, it is suggested you retain it in your permanent personal records.
- 4. Our files show that three sample bottles were sent to you, and that three samples were returned for analysis.

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LtCol, USAF, MC

Chief



Suggested Sampling Frequency:

Work Restrictions:

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**Internal Dosimetry Evaluation Form** NAME: (6) SSN: INTAKE DATE OR PERIOD: MODE OF INTAKE: ☑ Inhalation 01/22/66 through 02/09/66 on-site ☐ Injection Ingestion Absorption 1/22/66 assumed start. Unknown ☐Not applicable SUMMARY OF EXPOSURE CONDITIONS: Radionuclides/Respiratory Class/Particle Size: 239Pu/100% Class Y/1 µm AMAD Date or Period of Evaluated Data: 5 urine samples from 02/09/66 to 09/30/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain **EVALUATION DATA:** ☐ Attached ☐ In Process □ Unavailable Air Sampling Unavailable Attached In Process Health Physics Survey Data ☐ In Process Unavailable Bioassay - Urinalysis ☐ Attached ☐ In Process □ Unavailable Fecal ☐ Attached In Process Nasal Smears □ Unavailable In Process □ Unavailable In Vivo Attached Medical Treatment: Skin Decontamination: Yes ⊠ No Date: Agent: _____ Date: ___ Decorporation: ☐ Yes Date: __ ⊠ No Catharsis: Yes Yes Agent: ___ ☐ Yes ⊠ No Surgical excision: Date: **EVALUATION METHODOLOGY:** Assumptions: Acute inhalation intake of ²³⁹Pu, 100% Class Y, 1 µm AMAD particle size on 1/22/66 Intake Estimate: CINDY, Ver. 1.4/JONES Code/Model used for: Dose Estimate: CINDY, Ver. 1.4/ICRP 30, Part 4, General Systemic Model RESULTS SUMMARY Estimated Intake Activity (pCi): 71,000 50 YR CEDE (rem): 22 (0.22 Sv) 50 YR CDE (rem//Sv) **Organ Dose Equivalent Summary Bone Surface** 220/2.2 81/0.81 Lung Liver 40/0.40 Red Marrow 17/0.17 3.7/0.037 Other 3.2/0.032 Testes PEER REVIEWER: DATE: DOSE ASSESSOR: DATE: Signature: ___ Signature: __ Print Name: Print Name: _____ SSN: SSN: RECOMMENDATIONS: Additional Bioassay Required Urinalysis ☐ Fecal ☐ In Vivo

# **Preliminary Internal Dosimetry Case Narrative**

### **Identification:**

Name: SSN:

## **Incidents:**

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. One urine sample data card indicated that he arrived on 22 January 1966. Other cards indicated exposure during February 1966. An exposure date of 22 January 1966 corresponding to the first day of his presence on site was chosen as most conservative.

## **Previous Intake/Dose Assessments:**

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

## Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

Dates	% Body Burden
2/09/66	
6/08/66	7
1/19/67	3
4/17/67	=
9/30/67	0

Radionuclide(s): 239Pu.

## **Assumptions/Basis/Data Sources:**

Acute inhalation intake of Pu-239; 100% Class Y; 1  $\mu$ m AMAD particle size on 1/22/66. The date is the first day of the period on station from 1/22/66 to 2/9/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.

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Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

Campla	* 4 1	Data	Elapsed	Result	Error	Included
Sample	*Analysis	Date	Days	(pCi/day)	(pCi/day)	Iliciuded
66-758	G	02/09/66	18	1.96	1.15	
66-3971	AS	06/08/66	137	0.179	0.105	✓
67-0437	AS	01/19/67	362	0.0358	0.0212	✓
67-2152B	AS	04/17/67	450	0.01	0.01	✓
67-5646	AS	09/30/67	616	ND		✓

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

# Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	71,000	22/0.22
LUDEP	57,000	4.0/0.04

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

	Dose Equivalent	Weighting	Weighted Organ Dose Equivalent
Organ	(rem/Sv)	Factors	(rem/Sv)
Testes	3.2E+00/3.2E-02	2.5E-01	7.9E-01/7.9E-03
Breast	1.1E-04/1.1E-06	1.5E-01	1.6E-05/1.6E-07
Red Marrow	1.7E+01/1.7E-01	1.2E-01	2.1E+00/2.1E-02
Lung	8.1E+01/8.1E-01	1.2E-01	9.7E+00/9.7E-02
Thyroid	9.9E-05/9.9E-07	3.0E-02	3.0E-06/3.0E-08
Bone Surface	2.2E+02/2.2E+00	3.0E-02	6.6E+00/6.6E-02
Liver	4.0E+01/4.0E-01	6.0E-02	2.4E+00/2.4E-02
Other	3.7E+00/3.7E-02	6.0E-02	2.2E-01/2.2E-03
Lower Large Intestine	8.1E-03/8.1E-05	6.0E-02	4.8E-04/4.8E-06
Upper Large Intestine	2.7E-03/2.7E-05	6.0E-02	1.6E-04/1.6E-06
Small Intestine	5.5E-04/5.5E-06	6.0E-02	3.3E-05/3.3E-07
Effective Dose Equivale		2.2E+01/2.2E-01	

Revised Dose Evaluation Report April 2001

DRAFT

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Four urine samples were analyzed by alpha spectrometry and one early sample by gross alpha counting. The gross alpha reported 1.96 +/- 1.15 pCi/day; however this was not used in our analysis because of suspected contamination from on-site collection of the samples. One of the four samples analyzed by alpha spectrometry was reported as NDA (no detectable activity) and three were reported with a positive result. The four values were fit using CINDY and the Jones excretion model to estimate an intake (71,000 pCi), organ doses, and a CEDE (22 rem/0.22 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 57,000 pCi and a CEDE (ICRP-60) of 4 rem (0.04 Sv).

## **Conclusion:**

Prepared By:

Based on the results of intake estimates and dose calculations, this individual received an intake of 57,000 to 71,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 4 to 22 rem (0.04 to 0.22 Sv). That dose ranges from about one-half to about three times the cumulative dose (7 rem) from a lifetime (70 years) of exposure at the current level (0.100 rem) for members of the public. It is much less than the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). Serious health consequences are not associated with this dose level.

Name:		
Signature:	Date:	
Peer Reviewed By:		
Name:		
Signature:	Date:	

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-S10P				Millivolt - Stop			- Stop	
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**April 28, 2000** 

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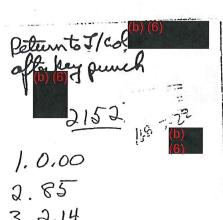
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401 resy Horp 11. (b) (6) APO MY 09283 Letter Sent - 6 Dec 66

Sequential folder containing fifteen 80-mcg. tablets of mestranol plus five tablets each combining 80 mcg. mestranol and 2 mg. chlormadinone acetate.

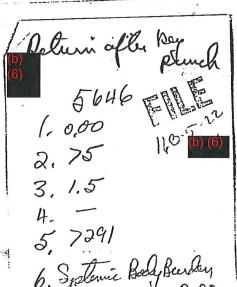
A More Physiological Approach to Oral Contraception

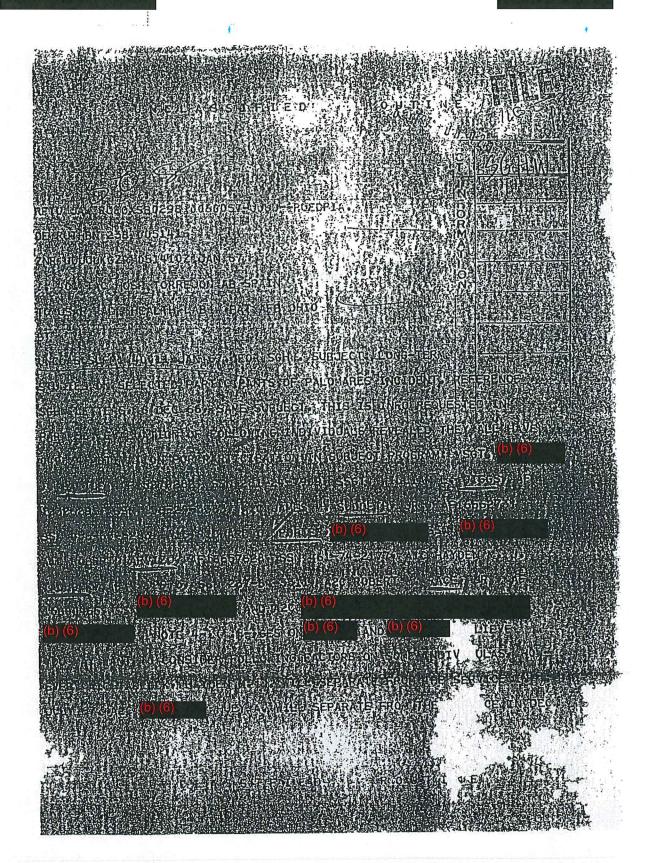
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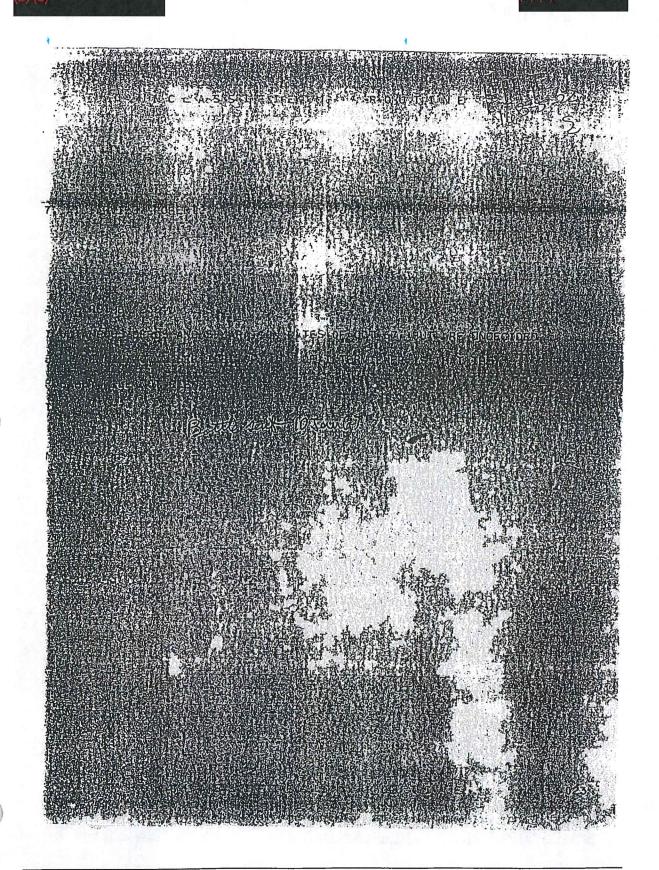


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DEPARTMENT OF THE AIR FORCE
USAF RADIOLOGICAL HEALTH LABORATORY (AFLC)
WRIGHT-PATTERSON AIR FORCE BASE OHIO 43433

REPLY TO

SGHW

7 Dec 1967

SUBJECT

Long-Term Medical Follow-Up, Palomares Operation Urine Studies for 200 Pu.

Sgt

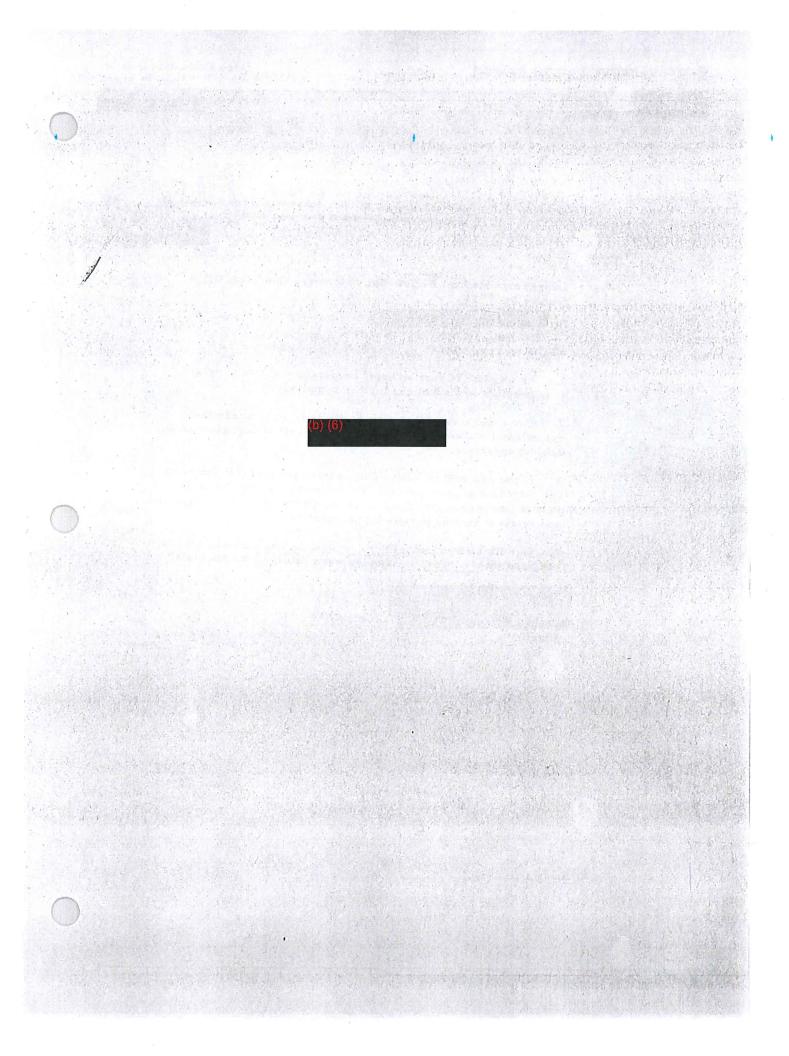
401 Tac Hosp (MSMH) APO New York 09283

- 1. As a result of your splendid cooperation in this program, it is possible to discontinue further sampling.
- 2. Our results show that your health is in no jeopardy from retention of radioactive materials as a result of participation in subject operation.
- 3. If you are still on active duty, please present this letter to the custodian of your medical records so that it may be made a part of your permanent file. If not on active duty, it is suggested you retain it in your permanent personal records.
- 4. Our files show that three sample bottles were sent to you, and that three samples were returned for analysis:

(b) (6)

LtCol, USAF, MC

Chief



Internal Dosimetry Evaluation Form					
NAME: (6) (6)	SSN: (b) (6)				
MODE OF INTAKE:    Inhalation	INTAKE DATE OR PERIOD: 01/18/66 through 02/19/66 on-site 1/18/66 assumed start.  Class Y/1 μm AMAD 19/66 to 09/15/67				
Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain	3				
EVALUATION DATA:  Air Sampling	In Process				
Surgical excision:	No Date:				
<b>EVALUATION METHODOLOGY:</b> Assumptions: Acute inhalation intake of ²³⁹ Pu, 100% Class	s Y, 1 μm AMAD particle size on 1/18/66				
Code/Model used for: Intake Estimate: CINDY, Ver. Dose Estimate: CINDY, Ver.	1.4/JONES 1.4/ICRP 30, Part 4, General Systemic Model				
Bone Surface Lung Liver Red Marrow Other Testes	9 YR CDE (rem/Sv) 140/1.4 50/0.50 25/0.25 11/0.11 2.3/0.023 2.0/0.020				
DOSE ASSESSOR: DATE: April 26. 2000	PEER REVIEWER: DATE:				
Signature:	Signature:				
Print Name:	Print Name:				
SSN:	SSN:				
RECOMMENDATIONS:  Additional Bioassay Required  Suggested Sampling Frequency:  Work Restrictions:  N/A					



# **Preliminary Internal Dosimetry Case Narrative**

### Identification:

Name: (b) (6) SSN:

## Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. One urine sample data card indicated an exposure of 18 January 1966. Other cards indicated exposure during January and February 1966. An exposure date of 18 January 1966 corresponding to the first day of his presence on site was chosen as most conservative. A sample date of 2/09/66 was assumed to be the day after the exposure ending date 2/08/66.

### Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

## Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated a retained systemic body burdens using the Langham 1956 equation as shown below.

Dates	% Body Burden
2/19/66	-
9/01/66	7
2/3/67	0
4/27/67	0
9/15/67	0

Radionuclide(s): ²³⁹Pu.

## Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1  $\mu$ m AMAD particle size on 1/18/66. The date is the first day of the period on station from 1/18/66 to 2/19/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.

Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

				Elapsed	Result	Error	
-	Sample	*Analysis	Date	Days	(pCi/day)	(pCi/day)	Included
	66-1215	G	02/19/66	32	1.88	0.52	
	66-4979	AS	09/01/66	226	0.125	0.066	✓
	67-0435	AS	02/03/67	381	0.00443	0.00991	✓
	67-2150B	AS	04/27/67	464	0.014	0.014	✓
	67-5650	AS	09/15/67	605	ND		✓

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

## Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	44,000	14/0.14
LUDEP	33,000	2.3/0.023

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the results in the table below.

	Dose Equivalent	Weighting	Weighted Organ Dose Equivalent
Organ	(rem/Sv)	Factors	(rem/Sv)
Testes	2.0E+00/2.0E-02	2.5E-01	4.9E-01/4.9E-03
Breast	6.5E-05/6.5E-07	1.5E-01	9.8E-06/9.8E-08
Red Marrow	1.1E+01/1.1E-01	1.2E-01	1.3E+00/1.3E-02
Lung	5.0E+01/5.0E-01	1.2E-01	6.0E+00/6.0E-02
Thyroid	6.1E-05/6.1E-07	3.0E-02	1.8E-06/1.8E-08
Bone Surface	1.4E+02/1.4E+00	3.0E-02	4.1E+00/4.1E-02
Liver	2.5E+01/2.5E-01	6.0E-02	1.5E+00/1.5E-02
Other	2.3E+00/2.3E-02	6.0E-02	1.4E-01/1.4E-03
Lower Large Intestine	5.0E-03/5.0E-05	6.0E-02	3.0E-04/3.0E-06
Upper Large Intestine	1.7E-03/1.7E-05	6.0E-02	1.0E-04/1.0E-06
Small Intestine	3.4E-04/3.4E-06	6.0E-02	2.1E-05/2.1E-07
Effective Dose Equivale	nt		1.4E+01/1.4E-01



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Four urine samples were analyzed by alpha spectrometry and one early sample by gross alpha counting. The gross alpha reported 1.88 +/- 0.52 pCi/day; however this was not used in our analysis because of suspected contamination from on-site collection of the samples. One of the four samples analyzed by alpha spectrometry was reported as NDA (no detectable activity) and three were reported with a positive result. The four values were fit using CINDY and the Jones excretion model to estimate an intake (44,000 pCi), organ doses, and a CEDE (14 rem/0.14 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 33,000 pCi and a CEDE (ICRP-60) of 2.3 rem (0.023 Sv).

### Conclusion:

Draward Dra

Based on the results of intake estimates and dose calculations, this individual received a relatively low intake of 33,000 to 44,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 2.3 to 14 rem (0.023 to 0.14 Sv). That dose ranges from less than one-half to two times the cumulative dose (7 rem) from a lifetime (70 years) of exposure at the current level (0.100 rem) for members of the public. It is well below the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). Serious health consequences are not associated with this dose level.

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Peer Reviewed By:		
Name:		
Signature:	Date:	

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AFJN: (b) (c	9)		INTERN	IAL DOSE DAT	A			
			C. NO. (21 - 29)	TYPE SAM	PLE (30)	TYPE ANAL. (31-32)		
(b) (d)	The second second second second	.2C	(0) (0	)	Urine			
	PLE NO. (33-36) SAMPLE DATE (39-44)			19 FEB 66			EXPOSURE	
66-1215 BASE (57-60)		OCCUPATIO		TO REQUESTED BY	DATE / SIAN C.C. TYPE			
		1	101-621	REQUESTED BY		•		
Torrejon DATE RECEIVED		57150	LUME	VOLUME ANALY	ED	DATE ANALYZ	ED	
3 March 1966	6	9	60 ml	960.				
TECHNICIAN (SIGN	ATURE AND DATE)	<del></del>		100,				
URINE	239	236		RADON		FECES/BLOOD		
Counter Number				Chamber Number		. Counter Number		
Counter Bkg. (cpm)				Cham. Bkg. (mv/sec)		Counter Bkg.		
Counter Eff. (%)				Counter Eff. (%)	- 10	Counter	Eff.	
Date/Time - Start	70 M1 R 66		1 1 1 1	Millivolt - Start		Date/Time - Start		
-Stop	095 -1470	119		Millivolt - Stop		All the second section	- Stop	
Total Counts	8	12		Total Millivots .		Total Co	unts .	
Counting Time	100	100		Total Drift Time		Counting	Time	
Gross cpm	10,08	0.12		Gross my/sec		Gross cpm		
Bkg. Cpm	0.0025	0.0075		Bkg. Mv/sec		Bkg. cpm		
Net cpm	0.0775	0.1125	0 1 14 0	Net my/sec	1	net cpm		
de of RECOVERY		5	- M	curies/my		dpm.		
dpm/24 hr. (69-74)				litter (69 - 74)		dps/cc		
K 40 Correction				11,14,14,14		Neutron I	Dose (rads) (63-68)	
REDBESO PC/NAPA		52	i .	D(q) (63-68)		uc/mg (	(69 - 74)	
D(q) (63-68)	D= 26	D .	D / CE	×10-3 MC		D(q) (63	- 68)	

AESN. (b)	(6)	INTER	NAL DOSE DATA	
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SAMPLE NO. 733-30	3)	SAMPLE DATE (39-44)		EXPOSURE
11/0-1280	16-1280 FROM		TO	DATE TYPE
TORRESTON DATE RECEIVED  S MARCH 1966		OCCUPATION (61 - 62)	REQUESTED BY	
		SAMPLE VOLUME	VOLUME ANALYZED	DATE ANALYZED
TECHNICIAN (SIGN	ATURE AND DATE)			
URINE	1		RADON	FECES/BLOOD
Counter Number	RICARD		Chamber Number	Counter Number
Counter Bkg. (cpm)			Cham. Bkg. (mv/sec)	Counter Bkg.
Counter Eff. (%)			Counter Eff. (%)	Counter Eff.
Date/Time - Start	VCM1866		Millivolt - Start	Date/Time - Start
-Stop_	1		Millivolt - Stop	- Stop
Total Counts	2782		Total Millivots	Total Counts
Counting Time	70		Total Drift Time	Counting Time
Gross cpm	139		Gross my/sec	Gross cpm
Bkg. Cpm	K4		Bkg. My/sec	Bkg. cpm
Net cpm	0		Net mv/sec	net cpm
dpm	O N	DA .	curies/mv	dpm
dpm/24 hr. (69-74)			litter (69 - 74)	dps/cc
K 40 Correction				Neutron Dose (rads) (63-68)
Net Beta			D(q) (63-68)	uc/mg (69-74)
D(q) (63-68)				D(q) (63-68)

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(b) (6)		ANALYSIS DESIRE		JESTED BY		FORCE BASE (68-71)
ype sample (23–32) Urine	(34-35)	Pu 2	39	SGEW DATE COLLE	CTED	PEXPOSURE DATE
ATE RECEIVED (37-42)	DATE ANALYZED	(81-88)	Nov66	1 Sent	66	Jon 66
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SUMMARY OF RESULTS: PCA	Ispl-0.1 t vol-8 1 anal-4	25±0.06 30	6	76 Rec	= 88.6 Burlen-	Action in the second

E OR REQUESTOR'S ID (1-2	(0)	GRADE	DIOLOGI	AFSN	77.9		DRITY HOMBI	ER RI	IL SAMPLE NUMBER	_(b) (
(b) (6) E SAMPLE (23-32) Cine -)	OCCUPATION	ANALYSIS I		-	REQUEST		-		CE BASE (68-71)	
ATE RECEIVED (37-42)	(34-35)	D (51-56)	DATE CO	Q CUTNU		DATE COL		E	POSURE DATE	
6 F b 67			177	et 6			3 Feb 6	7	Inn hen 66	
SAMPLE WEIGHT VOLUME	14	WEIGH	VOLUME AN	SMI		(1	0) (6)			
THER DATA + 100 ML				•	,					
NVIRONMENTAL SAMPLES										
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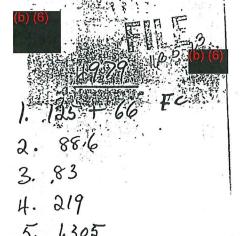
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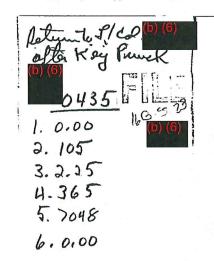


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## C-Quens®

Sequential folder containing fifteen 80-mcg. tablets of mestranol plus five tablets each combining 80 mcg. mestranol and 2 mg. chlormadinone acetate.

A More Physiological Approach to Oral Contraception



UNCLASSIFIED INE ZILORY -- RFTU JAW RUEOXSB0298 0060057-UUUU--RUEDFIA. JE RUTHBN 236 0051416 A ZNR UUUUUKGZR 051410Z JAN 67 1. 461 TAC HOSE TORREJON AB SPAIN 0 TO USAF RADL HEALTH LAB W PAT AFB OHIO JT UMCLAS SUFM1 40011 JAN 67. FOR SGHW. SUBJECT: LONG-TERM STUDIES ON SELECTED PARTICIPANTS OF PALOMARES INCIDENT. REFERENCE SGHA LETTERS, 6 DEC 66, SAME SUBJECT. THIS IS INFO REQUESTED IN PARA 5C. EVALUATION OF FOLLOWING INDIVIDUALS REVEALED THEY ALL HAVE 049034 MOTIVATION FOR PARTICIPATION IN SUBJECT PROGRAM: MSGT. SSN SSGT. AF SSN A1C SSN , A1C SSN AIC A1C SSN A2C AF , AND A2C . NOTE 4-1 ( :K-1GES ON (6) (6) AND BELIEVE YOU MAY WANT TO CONSIDER FOLLOWING FACTORS ON SOME INDIVIDULAS. HOW-EVER. A1C WILL SEPARATE FROM THE SERVICE IN JULY 67. AZC WILL SEPARATE FROM THE SERVICE IN DEC (b) (b)

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ROUTINE

67. A1C(b)(6)

AND ALC (b) (6)

BOTH HAVE

PAGE 2 RUTHEN 238 UNCLAS

SIMULTANEOUS DEROS AND SELARATION DATES OF OCT 67, BUT ARE UNDECIDED ABOUT REMAINING IN SERVICE. OPINION OF INTERVIEWER IS THAT THEY PROBABLY WILL NOT REENLIST.

BT

Bottle sont 10 Jan 67

NNNNX

o) (6)

DEPARTMENT OF THE AIR FORCE,
USAF RADIOLOGICAL HEALTH LABORATORY (AFLC)
WRIGHT PATTERSON AIR FORCE BASE, OHIO 45433



REPLY TO

SGHW

7 Dec 1967

TOBLECT

Long-Term Medical Follow-Up, Palomares Operation Urine Studies for 239 Pu.

A2C (b) (6)

401 Tac Hosp (MSMH) APO New York 09283

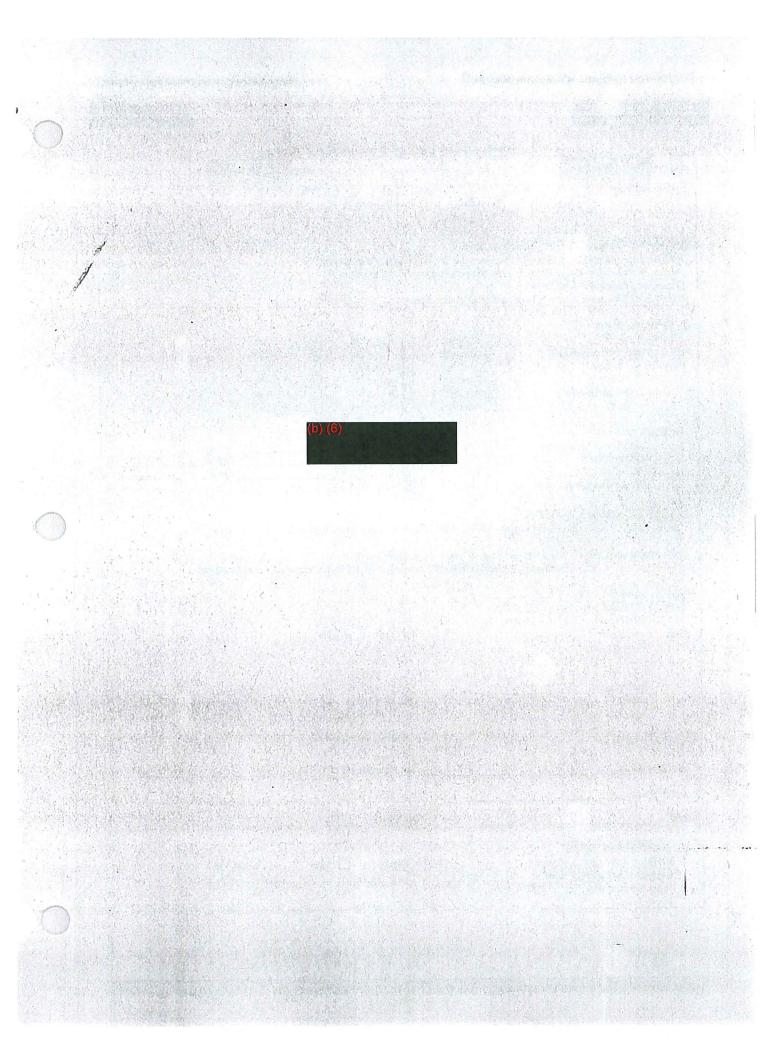
- 1. As a result of your splendid cooperation in this program, it is possible to discontinue further sampling.
- 2. Our results show that your health is in no jeopardy from retention of radioactive materials as a result of participation in subject operation.
- 3. If you are still on active duty, please present this letter to the custodian of your medical records so that it may be made a part of your permanent file. If not on active duty, it is suggested you retain it in your permanent personal records.
- 4. Our files show that three sample bottles were sent to you, and that three samples were returned for analysis.

(b) (6

(b) (6)

LtCol. USAF ... MC

Chief

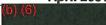




April 2001 (b) (6)

Internal Dosime	try Evaluation Form
NAME: (6) (6)	SSN: (b) (6)
MODE OF INTAKE:	INTAKE DATE OR PERIOD:
☑ Inhalation ☐ Injection	1/18/66 through 3/18/66 on-site
☐ Ingestion ☐ Absorption	1/18/66 assumed start.
☐ Unknown ☐ Not applicable	Control Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Section Sectio
SUMMARY OF EXPOSURE CONDITIONS:	
Radionuclides/Respiratory Class/Particle Size: 239Pu/100%	b Class Y/I μm AMAD
Date or Period of Evaluated Data: 6 urine samples from 01/	/21/66 to 08/15/67
Duration of Exposure: Unknown	
Location of Exposure: Camp Wilson, near Palomares, Spain	n
EVALUATION DATA:	
Air Sampling Attached	In Process Unavailable
Health Physics Survey Data	In Process Unavailable
	In Process Unavailable
	In Process Unavailable
	In Process Unavailable
In Vivo Attached	In Process Unavailable
Medical Treatment:	
Skin Decontamination: Yes	No Date:
Decorporation: Yes	No Agent: Date:
Catharsis:	No Agent: Date:
Surgical excision:	No Date:
Assumptions: Acute inhalation intake of ²³⁹ Pu, 100% Classification Code/Model used for:  Intake Estimate: CINDY, Ver. Dose Estimate: CINDY, Ver.	
RESULTS SUMMARY Estimated Intake Activity (pCi): 58,000 50 YR CEDE (rem): 18 (0.18 Sv)	
Organ Dose Equivalent Summary 50	0 YR CDE (rem/Sv)
Bone Surface	180/1.8
Lung Liver	66/0.66
Red Marrow	32/0.32
Other	14/0.14 3.1/0.031
Testes	2.6/0.026
<u> </u>	2.00.020
DOSE ASSESSOR: DATE:	PEER REVIEWER: DATE:
Signature:	Signature:
Print Name:	Print Name:
SSN:	SSN:
RECOMMENDATIONS:	
Additional Bioassay Required Urin	nalysis
Suggested Sampling Frequency: Work Restrictions: N/A	
Work Restrictions: N/A	





### **Preliminary Internal Dosimetry Case Narrative**

#### Identification:

Name: SSN:



#### **Incidents:**

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. One urine sample data card indicated an exposure of 19 January 1966. Other cards indicated exposure during January and February 1966. Personal conversations with Skaar indicated that he arrived on the day after the accident and remained until late March. An exposure date of 18 January 1966 corresponding to the first day of his presence on site was chosen as most conservative.

#### Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

#### Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated aretained systemic body burdens using the Langham 1956 equation as shown below.

Dates	% Body Burden
1/21/66	·-
3/18/66	=
10/26/66	11
1/19/67	1
5/5/67	0
8/15/67	0

Radionuclide(s): ²³⁹Pu.

#### Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1  $\mu$ m AMAD particle size on 1/18/66. The date is the first day of the period on station from 1/18/66 to 3/18/66.

b) (6)

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.

Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

			Elapsed	Result	Error	
Sample	*Analysis	Date	Days	(pCi/day)	(pCi/day)	Included
66-247	G	01/21/66	3	1.073	0.644	
66-2242	G	03/18/66	59	0.703	0.246	
66-5134	AS	10/26/66	281	0.17	0.09	1
67-0350	AS	01/19/67	366	0.0178	0.0126	✓
67-1536	AS	05/05/67	472	ND		✓
67-3985	AS	08/15/67	574	ND		✓

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

#### Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	58,000	18/0.18
LUDEP	75,000	5.2/0.052

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the results in the table below.

Four urine samples were analyzed by alpha spectrometry and two samples by gross alpha counting. The gross alpha samples reported 1.07 +/- 0.64 pCi/day; however this was not used in our analysis because of suspected contamination from on-site collection of the samples. Two of the four samples analyzed by alpha spectrometry were reported as NDA (no detectable activity) and two were reported with a positive result. The four values were fit using CINDY and the Jones excretion model to estimate an intake (58,000 pCi), organ doses, and a CEDE (18 rem/0.18 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 75,000 pCi and a CEDE (ICRP-60) of 5.2 rem (0.052 Sv).





	Dose Equivalent	Weighting	Weighted Organ Dose Equivalent	
Organ	(rem/Sv)	Factors	(rem/Sv)	
Testes	2.6E+00/2.6E-02	2.5E-01	6.5E-01/6.5E-03	
Breast	8.6E-05/8.6E-07	1.5E-01	1.3E-05/1.3E-07	
Red Marrow	1.4E+01/1.4E-01	1.2E-01	1.7E+00/1.7E-02	
Lung	6.6E+01/6.6E-01	1.2E-01	7.9E+00/7.9E-02	
Thyroid	8.1E-05/8.1E-07	3.0E-02	2.4E-06/2.4E-08	
Bone Surface	1.8E+02/1.8E+00	3.0E-02	5.4E+00/5.4E-02	
Liver	3.2E+01/3.2E-01	6.0E-02	1.9E+00/1.9E-02	
Other	3.1E+00/3.1E-02	6.0E-02	1.8E-01/1.8E-03	
Lower Large Intestine	6.6E-03/6.6E-05	6.0E-02	4.0E-04/4.0E-06	
Upper Large Intestine	2.2E-03/2.2E-05	6.0E-02	1.3E-04/1.3E-06	
Small Intestine	4.5E-04/4.5E-06	6.0E-02	2.7E-05/2.7E-07	
Effective Dose Equivale	nt		1.8E+01/1.8E-01	

#### **Conclusion:**

Based on the results of intake estimates and dose calculations, this individual received an intake of about 58,000 to 75,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 5.2 to 18 rem (0.052 to 0.18 Sv). That dose ranges from just below to about three times the cumulative dose (7 rem) from a lifetime (70 years) of exposure at the current level (0.100 rem) for members of the public. It is much less than one-half the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). Serious health consequences are not associated with this dose level.

Frepared By:	
Name:	_
Signature:	Date:
Peer Reviewed By:	
Name:	
Signature:	Date:

		7/8/	MIERI	NAL DOSE DAT	TYPE SAM	DI E (24)	TYPE ANAL. (31-32
(b) (6)	M.I.) (1 • 20)		Soc. Si	EC. NO. (21 - 29)	11PL SAM	1/5	GROSS ALPHA
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		FROM		то		DATE	TYPE
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TORRE	TON						
TORRES  DATE RECEIVED  JAN 25	1066	SAMPLE VOL		VOLUME ANALYZ		DATE ANALY	ZED
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TECHNICIAN (SIGN)	TURE AND DATE)			,			
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Counter Bkg. (cpm)				Cham. Bkg. (mv/se	c)	Counte	r Bkg.
Counter Eff. (%)	5/2/0			Counter Eff. (%)	7-1-7-	Counte	r Eff.
Date/Time - Start				Millivolt - Start		Date/T	Ime - Start
-Stop				Millivolt - Stop			- Stop
Total Counts	136			Total Millivots		Total C	Counts
Counting Time	55			Total Drift Time		Countin	ng Time
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dpm/24 hr. (69 - 74)				litter (69 - 74)		dps/co	
K 40 Correction							Dose (rads) (63-68)
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Palomares Nuclear Weapons Accident

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D(q) (63-68)			11 40 00	DB= 6,59.X	11.2	D(q) (63-68)	

(b) (6)

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VOUGIAT CORPORATION

multiple Launch Rocket system olvision Post Office Box 1015 Camden, Arkansas 71701 Telephone (501) 574-0200 Ext. 4259 an LTV company

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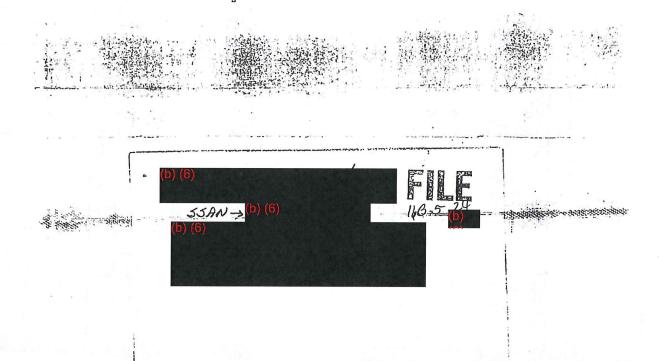
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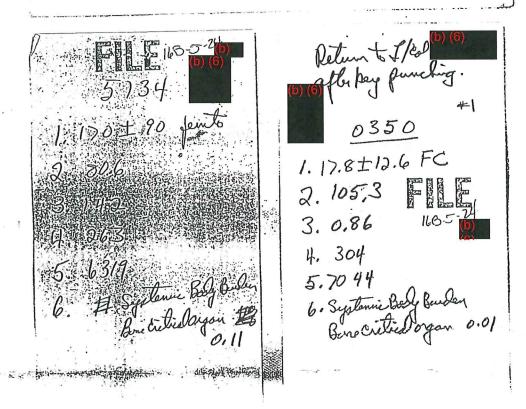
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(b)(6)







Return of leading 1,0,00 punch 3985 1,0,00 +3 2,84 5 3,2,3 4,-

Les & addres: -5 Dec 66

21 SAF Recruiting Service

Det 704

Room 104, les Fed Courthouse Body

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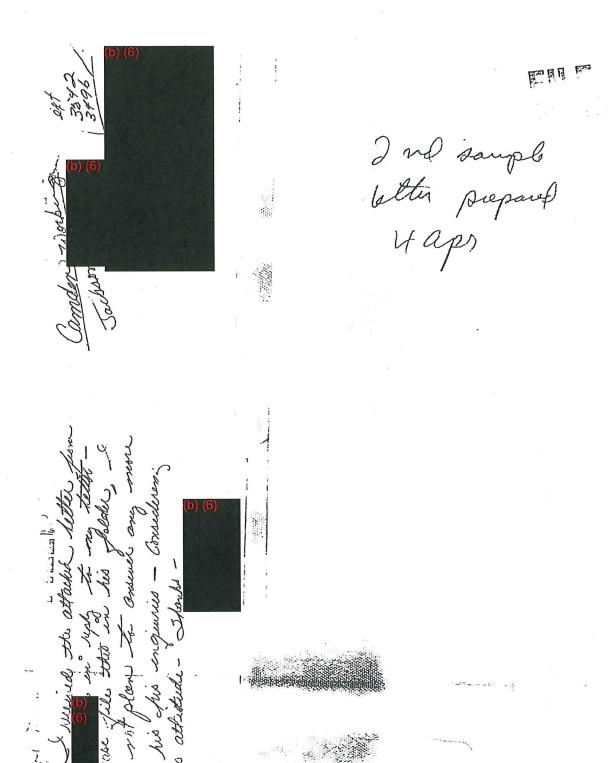
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April 28, 2000 (b) (6)



(D) (O)

CRE

JAN 11 1223

Colonel William E. Mabson, United States Air Force OEHL/CC Brooke Air Force Base, TX 78235

Dear Colonel Mabson:

Pursuant to a telephone conversation between you and Mr. (1)(6) of the Board of Veterans Appeals on December 21, this is to request information as to radiation exposure of (5)(6) on January 16 or 19, 1966, and thereafter. Mr. (5)(6) was reportedly involved in the recovery of nuclear weapons following the inflight accident of a B-52 bomber with a RC-135 refueling aircraft in Southern Spain.

Information is needed as to the details of (b) (6) exposure to radiation, including plutonium. His Social Security number is (b) (6)

Sincerely yours,

(D) (O) Chaesquar



o) (6)

-27 Jan 1982 3





My deepest apologies for not replying to your request in an expeditious manner. Your inquiry came at a most inopportune time. This long delay was primarily caused by massive data-base reprogramming and later by a shortage of Health Physicist personnel qualified to interpret radioanalytical analyses results.

It is terribly difficult to answer all your questions in lay language, however, I will try and provide you with an overall summation.

- a. You did submit four (4) urine samples, for your participation in the Palomares recovery operation. Records are onhand in this Laboratory.
- b. This Laboratory's sample #'s are: 1665134, 1670350, 1671536, and 1673985.
- c. Sample #1665134 was collected 26 Oct 66, #1670350 was collected 19 Jan 67, #1671536 was collected 5 May 67 and #1673985 was collected 15 Aug 67.
- d. Results of analyses were recalculated using state-of-the-art technique that incorporated the latest available exposure criteria. All samples were less than 0.20 pCi/sample. (one pCi =  $1 \times 10^{-12}$ Ci)
  - e. The above results show no measurable Pu239.
- f. Based on results of samples, no health effect should result from exposure to any radioactive nuclide that may have been present.

I hope this information will be sufficient to put to rest your concerns that the sample(s) analysis data were lost and that you had accrued sufficient exposure to be biologically harmful, neither of which is ostensibly true. As you have obviously noted, this is an informal answer. I preferred this method over generating a large pile of paper that would have meant absolutely nothing to you. Should you ever require that type of answer, however, please send a formalized request through an appropriate agency.

Wish you well in your new job. Let me hear from you, I would like to stay in touch.

Deepest Regards,

(b) (6)

SMSgt, USAF

Superintendent, Radiation Services Divisi

b) (6)



Dear (b) (6)

7 Mar 82

Thank you for your letter of 27 Jan82, which I received a couple of weeks ago via (b) (6) delivering it to my wife while she was working at the Baak on Base. He appologized for having opened it. No problem as far as I'm concered.

I do apprecaite your information, however at the expense of appearing ungrateful, it was of little help to me. The basic NNE critical question remains unanswered, "To what extent was I exposed while at the Broken-Arrow site of Palomares"? It is not a question of whether or not there was exposure, but rather a matter of EXTENT. Likewise, it is not a question of whether or not I am "bilogically harmful", but rather if medical science can guarentee that no ill-effects will result from the ultra-high levels of plutonium to which myself and others were exposed for those 45-60 days.

With that in mind as my goal, to have the Air Force; First, admit to the exposure as a matter of record — including the intensity —, and secondly having this information available to the VA, or to myself should the need arise. You cannot imagine how angry I was when the bureaucrats at the VA told me that they had received a copy of my exposure to radiation (DD form — whatever the number is, that we used to record the BS readings from the DT-60s and later generations of devices such as film badges! I informed them that was not applicable in my case and went on record to tell them where the exposure in question took place, how, when, etc., I was politely informed that they will again ask the Air Force to release whatever information is available. I told them where they might enquire. Now it is up to the officials involved to either admit or deny my exposure.

So as you can see, I am serious about this matter. Although I sincerely appreciate your letter, I'm afraid that you have missed my needs completely. If you can offer further advice/information fine, if not we can still stay in touch, I do, of course, appreciate your official position, all I ask is that you that are involved appreciate mine. I do not intend to allow this to die.

You asked about my job: Well I can best answer by saying, that I consider myself very fortunate to have a wonderful job in the wrong location at this point in our lives. (b) (6) and I would much rather be living in Colorado Springs than in E. Camden. But until such time as we can see our way to move we will continue here. It would be very nice to see you again (b) so please consider this an open invitation to visit. (b) (6) works at the base bank three days a week and is usually home in between. I am home on weekends, our son goes to sollege at UALR and works in evenings. I'menclosing my business card should you care to call, either professionally or friendly (or both). Thanks again.

Sincerely,





		***********
	**************************************	**************************************
23-JUN-92	·	AND ENVIRONMENTAL
	USAF	OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY(AFSC) BROOKS AFB, TEXAS 78235-5501
IDENTIFICATION	TYPE OF SAMPLE	DATE RECEIVED   OEHL NUMBER
(b) (6) SSAN:	URINE	24-JAN-67   16700350
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DEPARTMENT OF THE AIR FORCE ARMSTRONG LABORATORY (AFMC) BROOKS AFB, TEXAS 78235-5000

FROM: OEB

0 5 OCT 1992

SUBJ: Freedom of Information Act (FOIA) Request, HS-92M056 (Your Ltr, 29 Sep 92)

TO: ABG/IMDF AL/DOE IN TURN

- 1. The following information is supplied per the subject request:
- a. The names of the 26 participants who submitted bioassay samples subsequent to the cleanup at Palomares, Spain are as follows:

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                                       14)
                                            Maj
 2)
     A2C
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     MSgt
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12)
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                                            A20
13)
     LtCo.
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                                            A1C
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- b. We have no records on SMSgt (b) (6) in the Palomares file.
- c. We have no record of the initial urine samples which were hand-delivered to Wright-Patterson AFB. We also have no information concerning a laboratory evacuation because of leaking samples.
- d. We have no documentation as to how these specimens were prepared for analysis; therefore, any explanation of "laboratory errors in processing" would be speculation on our part.
- e. This laboratory only processed and analyzed the specimens which were submitted, we have no way of knowing the reasons certain individuals received higher exposures than others.
  - f. We have no records of Spanish nationals who were sampled.
  - g. Refer to answer e. above concerning subject #15's exposure.

o) (6)

) (6)

2. The information on the preceding page may be subject to AFR 12-35 (Privacy Act) in addition to AFR 4-33 (Freedom of Information Act). Please review before releasing this information.

(b) (6)

"Lt Col, USAF, BSC

Chief, Bloenvironmental Engineering Division

(10----

HQ AFMC/TMOD ATTN: (6) (6) Freedom Of Information Hanagement Wright-Patterson AFB, OH 45433

v . . . - -

20 Jul 92

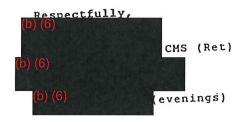
Dear Madam:

Thank you for the information and letter dtd 08 Jul 92. Of all the request which I have sent the only one which appears to draw attention is the "undated" one.

You have provided me with a vital element in my quest - the list of the "high 26" which have been referenced in other documents - the only thing missing now are the patients names. My comrade and friend, (b) (6) SMS USAF apparently is also one of the 26, and passed away - referred to as case #HPA 95-66 in report # 68W-02, your attachment 1.

Please provide these missing pieces: (1) Identify the names of patients one through twenty-six - I am one of them; (2) Confirm Please explain what that SMS Howe is case #HPA 95-66; (3) happened to the INITIAL urine specimens, collected, packaged, and delivered by me to an awaiting helicopter crewmember for the handto-hand courier trip to Wright-Pat., perhaps as early as 22 Jan 66. Feedback was that those samples had leaked and had caused the evacuation of the entire lab, plus that we had been exposed to "three times the lifetime acceptable dose"; (4) Please define those "**" entries which are footnoted, 'laboratory errors in those "**" processing'. What errors and why?; (5) Refer to patients numbered 16 and 21 - Why were they at the extreme high end of the range? When I see the names, I will be able to place them within the project and contamination plume; (6) Please provide the results of all Spanish nationals sampled; (7) Please explain how patient #15 (Army)'s initial analysis was 16 % approximately sixty days after site closure. I don't remember any Army present in the "hot" areas to the extent we USAF bioenvironmental health technicians were.

As you may note, I have an intimate association with this project and a driving desire to obtain answers. To that end I will be extremely grateful for your assistance.



of the Air Force of the Secretary ATTN: (b) (6)

TO: OPR

29 Sep 92

- 1. Please respond as best you can to all questions contained in paragraph 2 of FOIA request. These questions obviously arose from requester reading reports that were released to him (DNA surfaced these reports and sent them to AFMC/SGBO (Maj (D) (6) who determined that these 3 reports were fully releasable). Requester then submitted another request containing questions which AFMC could not answer and the request has been transferred to us for response.
- 2. The FOIA does state that we are not obligated to create a record in order to respond to a request, unless in doing so would result in a more useful response. In this case, I feel that the most useful response would be to try to answer the requester's questions. If any information is not available (we no longer have it or it is somewhere else) please state so in your response. If any information is to be denied, please cite the appropriate exemption from AFR 4-33 and provide your reasons why information should not be released.

you have any questions, please call me at 42168 or 42427.

FOIA Manager

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RECORD OF FREEDOM OF INFORMATION (FOI) PROCESSING COST Please read instructions on reverse before completing form. 3. DATE COMPLETED (YYMMDD) 2. TYPE OF REQUEST (X one) REQUEST NUMBER b. APPEAL 921005 a. INITIAL I-HS-92M056 HOURLY RATE COST TOTAL HOURS CLERICAL HOURS (E-9/GS-8 and below) a. SEARCH b. REVIEW/EXCISING \$ 12.00 X C. CORRESPONDENCE AND FORMS PREPARATION d. OTHER ACTIVITY HOURLY RATE TOTAL HOURS PROFESSIONAL HOURS (0-1 - 0-6/GS-9 - GS/GM-15) a. SEARCH 2 b. REVIEW/EXCISING \$ 25.00 c. COORDINATION/APPROVAL/DENIAL d. OTHER ACTIVITY HOURLY RATE COST TOTAL HOURS EXECUTIVE HOURS (0-7/GS/GM-16/ES 1 and above) a. SEARCH \$ 45.00 b. REVIEW / EXCISING C. COORDINATION / APPROVAL / DENIAL HOURLY RATE COMPUTER SEARCH a. MACHINE HOURS b. PROGRAMMER/OPERATOR TIME \$12.00 (1) Clerical \$25.00 (2) Professional COST NUMBER (2) OFFICE COPY REPRODUCTION .15 a. PAGES REPRODUCED RATE (3) MICROFICHE REPRODUCTION .25 a. MICROFICHE REPRODUCED RATE COST TOTAL PAGES O. PRINTED RECORDS a. FORMS .02 b. PUBLICATIONS c. REPORTS COST ACTUAL COST (2) 11. COMPUTER COPY a. TAPE X b. PRINTOUT COST ACTUAL COST NUMBER 12. AUDIOVISUAL MATERIALS a. MATERIALS REPRODUCED For FOI Office Use Only ١3. Comments to see the latest and the second 1. TOTAL COLLECTABLE COSTS a. SEARCH FEES PAID g. TOTAL PROCESSING COSTS b. REVIEW FEES PAID h. TOTAL CHARGED c. COPY FEES PAID No i. FEES WAIVED / REDUCED (X one) d. TOTAL PAID Chargeable to all requesters after application of all waiver e. DATE PAID (YYMMDO) criteria. .. Chargeable only to commercial requesters.

b) (6)

# PERSONAL RADIATION EXPOSURE HISTORY REQUEST

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 BIONSON 25 Jan 66 : 1.85 ± 1.11 PG/L (INHALATION)
        on 07/02/92 at 10:26:39
                                This report resides in File : lptl
Benerated on 07/02/92 at 10:26:39
                                Generated from REMedy File : Current.dat
********** Report ****************
     CASE: Acute INHALATION of PU-239Y on 16 JAN 1990
     BIOASSAY: 24hr Urine Analysis on 25 JAN 1990 - 1.85E-03 pCi/cc ID#
;
                              ID#
  Subject Name
  Analyst
                               ID#
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  AMAD (um)
                           9.0
  Days Post Exposure:
                        ICRP30
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                                                  : LungDat.lib
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  ALI (uCi)
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                               Screening Level(uCi): 8.11E-04
  TC Half-Time(Days):
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        BREAST
        R.MARROW
                                             2.59E+00
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        REMAINDER
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                                                      5.17E-01
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        EFFECTIVE
 *** WARNING *** Intake Requires investigation
 *** WARNING *** Calculated Intake Exceeds ALI
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                     EFFECTIVE
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COMMENTS:
SIGNATURE:
Authorized Licensee : AFOEHL/ADS CP2221
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b) (6)

27 Jan 1982





Dear (b)

My deepest apologies for not replying to your request in an expeditious manner. Your inquiry came at a most inopportune time. This long delay was primarily caused by massive data-base reprogramming and later by a shortage of Health Physicist personnel qualified to interpret radioanalytical analyses results.

It is terribly difficult to answer all your questions in lay language, however, I will try and provide you with an overall summation.

- Palomares recovery operation. Records are onhand in this Laboratory.
- b. This Laboratory's sample #'s are: 1665134, 1670350, 1671536, and 1673985.
- c. Sample #1665134 was collected 26 Oct 66, #1670350 was collected 19 Jan 67, #1671536 was collected 5 May 67 and #1673985 was collected 15 Aug 67.
- d. Results of analyses were recalculated using state-of-the-art technique that incorporated the latest available exposure criteria. All samples were less than 0.20 pCi/sample. (one pCi = 1  $\times$  10⁻¹²Ci)
  - e. The above results show no measurable Pu239
- f. Based on results of samples, no health effect should result from exposure to any radioactive nuclide that may have been present.

I hope this information will be sufficient to put to rest your concerns that the sample(s) analysis data were lost and that you had accrued sufficient exposure to be biologically harmful, neither of which is estensibly true. As you have obviously noted, this is an informal answer. I preferred this method over generating a large pile of paper that would have meant absolutely nothing to you. Should you ever require that type of answer, however, please send a formalized request through an appropriate agency.

Wish you well in your new job. Lat me hear from you, I would like to stay in touch.

Deepest Regards,

(b) (6) SMSgt, USAF Superintendent, Radiation Services Divisi

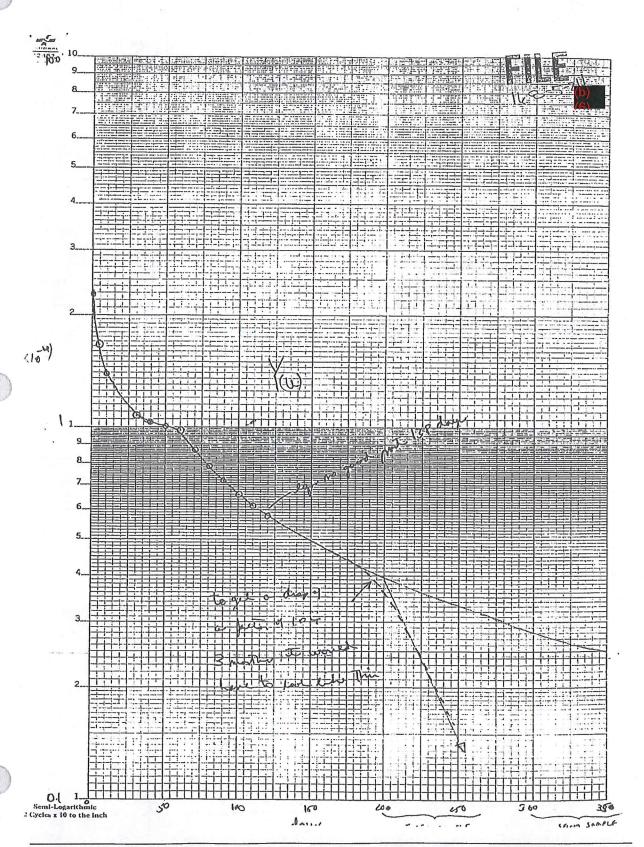
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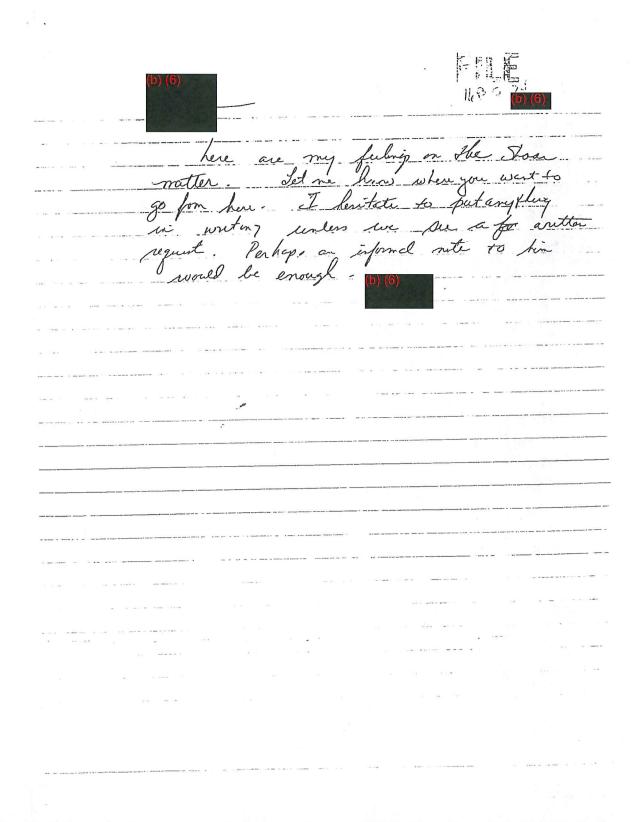
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促: (b) (6) SSAN (b) (6)
Participated in Palomous recovery operation during
Jan- Mar 1966. Search of records revioled the following atter results
on samples collected often nature to out someral from specation.
Samplett date Result % Recalculated Roselle (1981)  Collected pici/sshrsyl System Burker pli/opl
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has interidual was notified potat health was not in gio purdy.
from retention of radioactive materials from participation in operation. The same conclusion short would be reached
today.
Although as positive of Pu greater than were
reported at the time of analysis, slow represented amolt
reported at the time of analysis, How represented amell for there were small compared to the quidelines for permissible exposure. Several points on worth considering.
permissible exposure. Sexual points are worth considering.
a) The acceptable levels and melly quitethis
and five built in safety factors. They are
not a lard and fast limit above which harm
will definitely occur and below which one is totally sofe Rother, the Ruels are pe represent levels
sign that the same of represent the
which are not likely to result in any denacceptable

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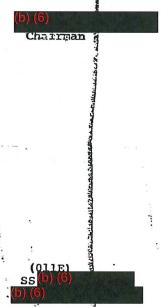
Colonel William E. Mabson, United States Air Force OEHL/CC Brooke Air Force Base, TX 78235

Dear Colonel Mabson:

Pursuant to a telephone conversation between you and Mr. (5) (6) of the Board of Veterans Appeals on December 21, this is to request information as to radiation exposure of (5) (6) on January 16 or 19, 1966, and thereafter Mr. (5) (6) was reportedly involved in the recovery of nuclear weapons following the inflight accident of a B-52 bomber with a KC-135 refueling aircraft in Southern Spain.

Information is needed as to the details of Mr. (b) (6) exposure to radiation, including plutonium. His Social Security number is (b) (6)

Sincerely yours,



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April 28, 2000
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EXPOSED: 16 JAN 66
BIOTOSTY! 25 Jan 66 (FN661 TON)
           1.85±1.11 PG/L
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This report resides in File : lptl
Printed on 07/02/92 at 11:25:39 Generated on 07/02/92 at 11:25:39
                                 Generated from REMedy File : Current.dat
************** SAIC REMedy Intake/Dose Evalutation Report ************
     CASE: Acute INGESTION of PU-239N on 16 JAN 1990
     BIOASSAY: 24hr Urine Analysis on 25 JAN 1990 - 1.83E-03 pCi/cc ID#
ID#
  Subject Name
                               ID#
  Analyst
  AMAD (um)
  Days Post Exposure:
                           9.0
                                                   : LungDat.lib
                                Lung Model ID
                        ICRP30
  Lung Model
                                 Screening Level(Bq) : 1.50E+05
                       3.00E+06
  ALI (Bq)
                                 Screening Level(uCi): 4.05E+00
  ALI (uCi)
                       8.11E+01
                                                    : 5.40E-01
  TC Half-Time(Days):
                       2.50E-01
                                 Fu
                                                    : 4.60E-01
                       1.00E-05
                                 Ff
******************** RESULTS USING ICRP-30 SYSTEMIC MODEL *********************
        Retention Fraction at Time Post-Exposure : 1.61E-10
         Intake (Bq) : 5.87E+08 % ALI
                                                : 19569.87
                                % Screening Level : 391397.32
        Intake (uCi): 1.59E+04
                                                First-Year Dose
                     50-Year Committed Dose
        ORGAN
                                               [Rem]
                                                       [Sv]
                               [Sv]
                      [Rem]
                      1.55E+02 1.55E+00
                                              3.17E+00
                                                       3.17E-02
        GONADS
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                      2.75E-03
                              2.75E-05
        BREAST
                                              2.22E+01
                                                       2.22E-01
                              9.69E+00
                      9.69E+02
        R.MARROW
                                                       4.44E-05
                      3.09E-04
                              3.09E-06
                                              4.44E-03
        LUNGS
                                              4.44E-03
                                                       4.44E-05
                      2.58E-05 2.58E-07
         THYROID
                                                       2.85E+00
                     1.21E+04
                                              2.85E+02
                              1.21E+02
        ENDOSTEAL
                                              4.46E+03
                                                       4.46E+01
                      1.40E+03
                              1.40E+01
        REMAINDER
                                                       2.85E+00
                      9.33E+02 9.33E+00
                                              2.85E+02
        EFFECTIVE
  *** WARNING *** Intake Requires investigation
  *** WARNING *** Calculated Intake Exceeds ALI
Dose Factor [ Sv/Bq ]
                      Organ
                      GONADS
                                 2.64E-09
                      BREAST
                                 4.68E-14
                                 1.65E-08
                      R.MARROW
                                 5.26E-15
                      LUNGS
                                 4.40E-16
                      THYROID
                      ENDOSTEAL
                                 2.06E-07
                      REMAINDER
                                 2.38E-08
                                 1.59E-08
                      EFFECTIVE
COMMENTS:
```

" THIENDS .

```
SIGNATURE:
Authorized Licensee : AFOEHL/ADS CP2221
      EXPED: 16 Jan 66
      BIOTOSTY: 18MON 66: .703 I. 246 PG/L (FNGWTION)
        on 07/02/92 at 11:27:26
                                This report resides in File : lptl
Printed
Generated on 07/02/92 at 11:27:26
                                Generated from REMedy File : Current.da:
*
     CASE: Acute INGESTION of PU-239N on 16 JAN 1990
     BIOASSAY: 24hr Urine Analysis on 18 MAR 1990 - 7.03E-04 pCi/cc ID#
Subject Name
                 :
                               ID#
  Analyst
                  :
                               ID#
  AMAD (um)
                          0.00
  Days Post Exposure:
                          61.3
  Lung Model
                         ICRP30
                                 Lung Model ID
                                                   : LungDat.lib
  ALI (Bq)
                       3.00E+06
                                 Screening Level(Bq) : 1.50E+05
  ALI (uCi)
                       8.11E+01
                                 Screening Level(uCi): 4.05E+00
  TC Half-Time(Days):
                       2.50E-01
                                                   : 5.40E-01
                                 Fu
  Fl
                       1.00E-05
                                                   : 4.60E-01
                                 Ff
************** RESULTS.USING ICRP-30 SYSTEMIC MODEL ******************
        Retention Fraction at Time Post-Exposure
                                               : 1.61E-10
        Intake (Bq) : 2.26E+08
                                % ALI
                                                : 7533.33
        Intake (uCi): 6.11E+03
                                % Screening Level: 150666.61
        ORGAN
                    50-Year Committed Dose
                                               First-Year Dose
                      [Rem]
                              [Sv]
                                               [Rem]
                                                       [Sv]
                     5.97E+01
        GONADS
                             5.97E-01
                                              1.22E+00
                                                      1.22E-02
        BREAST
                     1.06E-03
                              1.06E-05
                                              2.69E-03
                                                      2.69E-05
                     3.73E+02
                                                      8.54E-02
        R. MARROW
                             3.73E+00
                                              8.54E+00
                     1.19E-04
                              1.19E-06
        LUNGS
                                              1.71E-03
                                                      1.71E-05
                                              1.71E-03
        THYROID
                     9.94E-06
                             9.94E-08
                                                      1.71E-05
                     4.66E+03
        ENDOSTEAL
                              4.66E+01
                                              1.10E+02
                                                      1.10E+00
                     5.38E+02
                              5.38E+00
        REMAINDER
                                              1.72E+03
                                                      1.72E+01
        EFFECTIVE
                     3.59E+02 3.59E+00
                                              1.10E+02
                                                      1.10E+00
 *** WARNING *** Intake Requires investigation
 *** WARNING *** Calculated Intake Exceeds ALI
                                                        ...
***************** DOSE FACTORS USED IN CALCULATIONS *****************
                                Dose Factor [ Sv/Bq ]
                     Organ
                     GONADS
                                2.64E-09
                     BREAST
                                4.68E-14
                     R.MARROW
                                1.65E-08
                     LUNGS
                                5.26E-15
                     THYROID
                                4.40E-16
                     ENDOSTEAL
                                2.06E-07
                     REMAINDER
                                2.38E-08
                     EFFECTIVE
                                1.59E-08
```

```
Authorized Licensee : AFOEHL/ADS CP2221
       EXPOSED! 16, Ton 66
      BILASYY! 26 OCT 66: 017 ±0.09 PLY (FRGESTION)
          on 07/02/92 at 11:28:17
                                  This report resides in File : lptl
 Generated on 07/02/92 at 11:28:17
                                  Generated from REMedy File : Current.dat .
 CASE: Acute INGESTION of PU-239N on 16 JAN 1990
      BIOASSAY : 24hr Urine Analysis on 26 OCT 1990 - 1.70E-04 pCi/cc ID#
 Subject Name
                   :
                                ID#
   Analyst
                                ID#
   AMAD (um)
                           0.00
   Days Post Exposure:
                          283.2
   Lung Model
                          ICRP30
                                 Lung Model ID
                                                   : LungDat.lib
   ALI (Bq)
                        3.00E+06
                                 Screening Level(Bq) : 1.50E+05
   ALI (uCi)
                        8.11E+01
                                 Screening Level(uCi): 4.05E+00
   TC Half-Time(Days):
                        2.50E-01
                                 Fu
                                                   : 5.40E-01
                        1.00E-05
                                 Ff
                                                   : 4.60E-01
 ******************* RESULTS USING ICRP-30 SYSTEMIC MODEL **********************
         Retention Fraction at Time Post-Exposure
                                               : 1.60E-10
         Intake (Bq) : 5.51E+07
Intake (uCi) : 1.49E+03
                                % ALI
                                               : 1837.71
                                % Screening Level: 36754.30
         ORGAN
                     50-Year Committed Dose
                                               First-Year Dose
                      [Rem]
                               [Sv]
                                              [Rem]
                                                      [Sv]
         GONADS
                      1.46E+01
                              1.46E-01
                                             2.98E-01
                                                      2.98E-03
         BREAST
                      2.58E-04
                              2.58E-06
                                             6.56E-04
                                                      6.56E-06
         R.MARROW
                      9.10E+01
                              9.10E-01
                                             2.08E+00
                                                      2.08E-02
         LUNGS
                      2.90E-05
                              2.90E-07
                                             4.17E-04
                                                      4.17E-06
         THYROID
                      2.43E-06
                              2.43E-08
                                             4.17E-04
                                                      4.17E-06
         ENDOSTEAL
                      1.14E+03
                              1.14E+01
                                             2.68E+01
                                                      2.68E-01
         REMAINDER
                     1.31E+02
                              1.31E+00
                                             4.19E+02
                                                      4.19E+00
         EFFECTIVE
                     8.77E+01 8.77E-01
                                             2.68E+01
                                                      2.68E-C1
  *** WARNING *** Intake Requires investigation
  *** WARNING *** Calculated Intake Exceeds ALI
Organ
                                Dose Factor [ Sv/Bq ]
                     GONADS
                                2.64E-09
                     BREAST
                                4.68E-14
                     R. MARROW
                                1.65E-08
                     LUNGS
                                5.26E-15
                     THYROID
                                4.40E-16
                     ENDOSTEAL
                                2.06E-07
                     REMAINDER
                                2.38E-08
                     EFFECTIVE
                                1.59E-08
COMMENTS:
```

```
Authorized Licensee : AFOEHL/ADS CP2221
     DPWED: 16 Jan 66
    BIONSMY! 19 Jan 67: 0.017 ± 0.013 PC/L (FNGISTION
                                This report resides in File : lptl
        on 07/02/92 at 11:29:04
                                Generated from REMedy File : Current.dat
Frinted
Generated on 07/02/92 at 11:29:05
CASE: Acute INGESTION of PU-239N on 16 JAN 1990
     BIOASSAY : 24hr Urine Analysis on 19 JAN 1991 - 1.70E-05 pCi/cc ID#
*****************
:
                               ID#
   Subject Name
                               ID#
   Analyst
                          0.00
   AMAD (um)
                          368.2
   Days Post Exposure:
                                                  : LungDat.lib
                                Lung Model ID
                         ICRP30
   Lung Model
                                Screening Level(Bq) : 1.50E+05
Screening Level(uCi) : 4.05E+00
                       3.00E+06
   ALI (Bq)
                       8.11E+01
   ALI (uCi)
                                                   : 5.40E-01
                       2.50E-01
   TC Half-Time(Days):
                                                   : 4.60E-01
                       1.00E-05
                                Ff
   Fl
                         -
184.39
         Intake (Bq) : 5.53E+06
                                % ALI
                                % Screening Level: 3687.75
         Intake (uCi) : 1.50E+02
                                               First-Year Dose
                     50-Year Committed Dose
         ORGAN
                                                       [Sv]
                                              [Rem]
                      [Rem]
                               [Sv]
                                              2.99E-02
                                                      2.99E-04
                     1.46E+00
                              1.46E-02
         GONADS
                                              6.58E-05
                                                      6.58E-07
                      2.59E-05
                              2.59E-07
         BREAST
                                              2.09E-01
                                                      2.09E-03
                      9.13E+00
                              9.13E-02
         R.MARROW
                                                      4.18E-07
                                              4.18E-05
                              2.91E-08
                      2.91E-06
         LUNGS
                                                      4.18E-07
                                              4.18E-05
                              2.43E-09
                      2.43E-07
         THYROID
                                                      2.69E-02
                                              2.69E+00
                              1.14E+00
                      1.14E+02
         ENDOSTEAL
                                              4.20E+01
                                                      4.20E-01
                              1.32E-01
                      1.32E+01
         REMAINDER
                                                      2.69E-02
                                              2.69E+00
                              8.80E-02
                      8.80E+00
         EFFECTIVE
  *** WARNING *** Intake Requires investigation
  *** WARNING *** Calculated Intake Exceeds ALI
 ******************** DOSE FACTORS USED IN CALCULATIONS ******************
                                 Dose Factor [ Sv/Bq ]
                      Organ
                                 2.64E-09
                      GONADS
                                 4.68E-14
                      BREAST
                                 1.65E-08
                      R.MARROW
                                 5.26E-15
                      LUNGS
                                 4.40E-16
                      THYROID
                                 2.06E-07
```

2.38E-08 1.59E-08

ENDOSTEAL REMAINDER

EFFECTIVE

COMMENTS:_

```
EXPOSED 16 JAN 66
 BIONSY 18 MAR 66! , 703 ± , 246 PG/L (INHAUTION)
                                   This report resides in File : lpt1
         on 07/02/92 at 10:34:10
Printed
                                   Generated from REMedy File : Current.dat
Generated on 07/02/92 at 10:34:10
*************** SAIC REMedy Intake/Dose Evalutation Report *************
     CASE: Acute INHALATION of PU-239Y on 16 JAN 1990
     BIOASSAY: 24hr Urine Analysis on 18 MAR 1990 - 7.03E-04 pCi/cc ID#
***********************
:
                                  ID#
   Subject Name
                                  ID#
  Analyst
                             1.00
   AMAD (um)
                             61.3
   Days Post Exposure:
                                                       : LungDat.lib
                                    Lung Model ID
                    :
                           ICRP30
   Lung Model
                                    Screening Level(Bq) : 3.00E+01
                         6.00E+02
   ALI (Bq)
                                   Screening Level (uCi): 8.11E-04
                         1.62E-02
   ALI (uCi)
                                                        : 5.40E-01
                         2.50E-01
                                    Fu
   TC Half-Time(Days):
                                                        : 4.60E-01
                         1.00E-05
                                    Ff
************** RESULTS USING ICRP-30 SYSTEMIC MODEL *****************
                                                    : 1.04E-06
         Retention Fraction at Time Post-Exposure
         Intake (Bq) : 3.52E+04
Intake (uCi) : 9.51E-01
                                                    : 5863.72
                                   % ALI
                                   % Screening Level: 117274.49
                                                    First-Year Dose
                       50-Year Committed Dose
         ORGAN
                                                            [Sv]
                                                   [Rem]
                        [Rem]
                                 [Sv]
                                                            1.33E-03
                                                  1.33E-01
                        4.22E+01
                                 4.22E-01
         GONADS
                                                            3.23E-06
                                                  3.23E-04
                        9.82E-05
                                9.82E-07
         BREAST
                                                            9.50E-03
                                2.67E+00
                        2.67E+02
                                                  9.50E-01
         R.MARROW
                                                            2.37E+00
                                                  2.37E+02
                        1.14E+03
                                 1.14E+01
         LUNGS
                                                            2.75E-06
                                                  2.75E-04
                        8.23E-06
                                8.23E-08
          THYROID
                                                  1.23E+01
                                                            1.23E-01
                        3.34E+03
                                3.34E+01
         ENDOSTEAL
                                                            1.90E-01
                                                  1.90E+01
                        1.46E+02
                                 1.46E+00
          REMAINDER
                                                            2.85E-01
                                                  2.85E+01
                                3.23E+00
                        3.23E+02
          EFFECTIVE
  *** WARNING *** Intake Requires investigation
  *** WARNING *** Calculated Intake Exceeds ALI
******************* DOSE FACTORS USED IN CALCULATIONS ******************
                                   Dose Factor [ Sv/Bq ]
                        Organ
                                    1.20E-05
                        GONADS
                                    2.79E-11
                        BREAST
                                    7.60E-05
                        R.MARROW
                        LUNGS
                                    3.23E-04
                                    2.34E-12
                        THYROID
                        ENDOSTEAL
                                    9.50E-04
                                    4.16E-05
                        REMAINDER
                                    9.19E-05
                        EFFECTIVE
COMMENTS:
SIGNATURE:
Authorized Licensee : AFOEHL/ADS CP2221
```

SIGNATURE:

Authorized Licensee : AFOEHL/ADS CP2221

```
EXPOXED. 16 Jan 66
BIDGLY: 26 Oct 66: 0.17 ± 0.09 PG/L (FNHALATION)
                                  This report resides in File : lptl
       on 07/02/92 at 10:35:29
Printed
                                  Generated from REMedy File : Current.da
Penerated on 07/02/92 at 10:35:29
t**************** SAIC REMedy Intake/Dose Evalutation Report ************
     CASE: Acute INHALATION of PU-239Y on 16 JAN 1990
     BIOASSAY : 24hr Urine Analysis on 26 OCT 1990 - 1.70E-04 pCi/cc ID#
ID#
                  :
  Subject Name
                                ID#
  Analyst
                            1.00
  AMAD (um)
                           283.2
  Days Post Exposure:
                                                     : LungDat.lib
                                  Lung Model ID
                          ICRP30
                   :
   Lung Model
                                  Screening Level(Bq)
                                                    : 3.00E+01
                        6.00E+02
   ALI (Bq)
                                  Screening Level (uCi): 8.11E-04
                        1.62E-02
   ALI (uCi)
                                                     : 5.40E-01
                        2.50E-01
                                  Fu
   TC Half-Time(Days):
                                                      : 4.60E-01
                        1.00E-05
                                  Ff
****************** RESULTS USING ICRP-30 SYSTEMIC MODEL *****************
                                                 : 1.14E-06
         Retention Fraction at Time Post-Exposure
                                                  : 1285.86
         Intake (Bq) : 7.72E+03
                                  % ALI
                                  % Screening Level: 25717.18
         Intake (uCi): 2.09E-01
                                                  First-Year Dose
                      50-Year Committed Dose
         ORGAN
                                                 [Rem]
                                                          [Sv]
                                [Sv]
                       [Rem]
                                                2.92E-02
                                                        2.92E-04
                       9.26E+00
                                9.26E-02
         GONADS
                                                7.08E-05 7.08E-07
                                2.15E-07
                       2.15E-05
         BREAST
                                                         2.08E-03
                                                2.08E-01
                       5.86E+01
                                5.86E-01
         R.MARROW
                                                          5.21E-01
                                                5.21E+01
                                2.49E+00
                       2.49E+02
         LUNGS
                                                         6.04E-07
                                                6.04E-05
                       1.81E-06
                                1.81E-08
         THYROID
                                                         2.71E-02
                                                2.71E+00
                                7.33E+00
                       7.33E+02
         ENDOSTEAL
                                                4.17E+00
                                                         4.17E-02
                                3.21E-01
                       3.21E+01
         REMAINDER
                                                6.25E+00 6.25E-02
                       7.09E+01 7.09E-01
         EFFECTIVE
  *** WARNING *** Intake Requires investigation
  *** WARNING *** Calculated Intake Exceeds ALI
 **************** DOSE FACTORS USED IN CALCULATIONS ***************
                                   Dose Factor [ Sv/Bq ]
                       Organ
                                   1.20E-05
                       GONADS
                                   2.79E-11
                       BREAST
                                   7.60E-05
                       R. MARROW
                                   3.23E-04
                       LUNGS
                                   2.34E-12
                       THYROID
                                   9.50E-04
                       ENDOSTEAL
                                   4.16E-05
                       REMAINDER
                                   9.19E-05
                       EFFECTIVE
 COMMENTS:
```

```
EXPOSTD. 16 JAN 66
    BIOSISTY: 19 Jan 67: ,017±,013 PG/L (INTIMULATION)
          on 07/02/92 at 10:36:37
                                    This report resides in File : lpti
 Generated on 07/02/92 at 10:36:37
                                    Generated from REMedy File : Current.dat
 ********* SAIC REMedy Intake/Dose Evalutation Report ************
      CASE: Acute INHALATION of PU-239Y on 16 JAN 1990
      BIOASSAY : 24hr Urine Analysis on 19 JAN 1991 - 1.70E-05 pCi/cc ID#
 Subject Name
                                  TD#
   Analyst
                                  ID#
   AMAD (um)
                             1.00
   Days Post Exposure:
                            368.2
   Lung Model
                    ;
                           ICRP30
                                   Lung Model ID
                                                      : LungDat.lib
   ALI (Bq)
                         6.00E+02
                                   Screening Level (Bq)
                                                      : 3.00E+01
   ALI (uCi)
                         1.62E-02
                                   Screening Level(uCi): 8.11E-04
   TC Half-Time(Days):
                         2.50E-01
                                   Fu
                                                       : 5.40E-01
   Fl
                         1.00E-05
                                   Ff
                                                       : 4.60E-01
 *************** RESULTS USING ICRP-30 SYSTEMIC MODEL ****************
         Retention Fraction at Time Post-Exposure
                                                  : 1.17E-06
          Intake (Bq) : 7.55E+02
                                  % ALI
                                                     125.76
          Intake (uCi) : 2.04E-02
                                  % Screening Level: 2515.20
         ORGAN
                      50-Year Committed Dose
                                                  First-Year Dose
                        [Rem]
                                 [Sv]
                                                  [Rem]
                                                           [Sv]
                       9.05E-01
         GONADS
                                9.05E-03
                                                 2.85E-03
                                                          2.85E-05
         BREAST
                       2.11E-06
                                2.11E-08
                                                 6.93E-06
                                                          6.93E-08
         R.MARROW
                       5.73E+00
                                5.73E-02
                                                          2.04E-04
                                                 2.04E-02
         LUNGS
                       2.44E+01
                                2.44E-01
                                                 5.09E+00
                                                          5.09E-02
         THYROID
                       1.77E-07
                                1.77E-09
                                                 5.91E-06
                                                          5.91E-08
         ENDOSTEAL
                       7.17E+01
                                7.17E-01
                                                 2.65E-01
                                                          2.65E-03
         REMAINDER
                       3.14E+00
                                3.14E-02
                                                 4.07E-01
                                                          4.07E-03
         EFFECTIVE
                       6.93E+00
                                6.93E-02
                                                 6.11E-01
                                                          6.11E-03
  *** WARNING *** Intake Requires investigation
  *** WARNING *** Calculated Intake Exceeds ALI
-******************** DOSE FACTORS USED IN CALCULATIONS *****************
                       Organ
                                  Dose Factor [ Sv/Bq ]
                       GONADS
                                   1.20E-05
                       BREAST
                                   2.79E-11
                       R.MARROW
                                   7.60E-05
                       LUNGS
                                   3.23E-04
                       THYROID
                                   2.34E-12
                       ENDOSTEAL
                                   9.50E-04
                       REMAINDER
                                   4.16E-05
                       EFFECTIVE
                                   9.19E-05
OMMENTS:
SIGNATURE:
```

Authorized Licensee : AFOEHL/ADS CP2221

April 28, 2000

individual's file

28 JAN 1983

CC

Radiation Exposure Records



Board of Veterans Appeals Washington DC 20420

- In response to your request, dated 11 Jan 83, reference 011E, for details regarding any exposure to ionizing radiation, including plutonium, by SSAN we are providing the following information.
- 2. The named individual was involved during the initial response to the scene of the wreckage resulting from the collision of a B-52 and a KC-135 aircraft in January 1966 at Palomares, Spain. As is well known, this crash resulted in damage to muclear weapons and the release of some of the plutonium-239 containing components with subsequent contamination of lands, buildings, and equipment.
- 3. Our records indicate that Kr D submitted six urine samples to the USAF Radiological Health Laboratory for analysis. Urine was used to evaluate personnel exposure to plutonium at Palonares. Initial samples indicated some alpha particle activity. An additional sample collected upon Hr (5) (6) return to CONUS in Oct 66 had plutonium at a concentration representative of 11% of a systemic body burden. As a result, he was one of 26 individuals selected for long-term follow up to further assess any health effects. He did participate and submitted three additional samples which indicated a drop from 1 percent of a permissible systemic body burden for the first follow up sample to zero for subsequent samples. The data pertaining to these samples are listed in Atoh 1. Based on a review of these results, competent medical authority concluded that Hr (5) (6) health was in no jeopardy from retention of radioactive materials as a result of participation in the Palomeres Operation. As a result he was discontinued from further follow up as indicated in Atch 2. In summary, then, Mr (b) (6) was exposed to plutonium at Palomares, Spain and the material was found in his urine. Evaluation of the level of exposure by competent medical authority concluded that the exposure did not jeopardize his health.
- 4. The term permissible body burden has been used in evaluating Mr (5) (6) exposure to plutonium. By way of information, a permissible body burden is that quantity of a radionuclide which, when deposited in the total body, produces the maximum permissible dose equivalent rate to the body or to a critical internal organ. That is, it is a measure of radiation exposure which is deemed acceptable in light of anticipated effects.

o) (6)

) (6)

5. The attached urine results represent all information available to us regarding Mr (b) (6) exposure at Palomares. Should you have further questions regarding this information you may contact Lt Col(b) (6) at (b) (6)

SIGNED

WILLIAM E. MABSON, Col, USAF, BSC Commander

2 Atch

1. Data Samples

2. Urinalysis Results

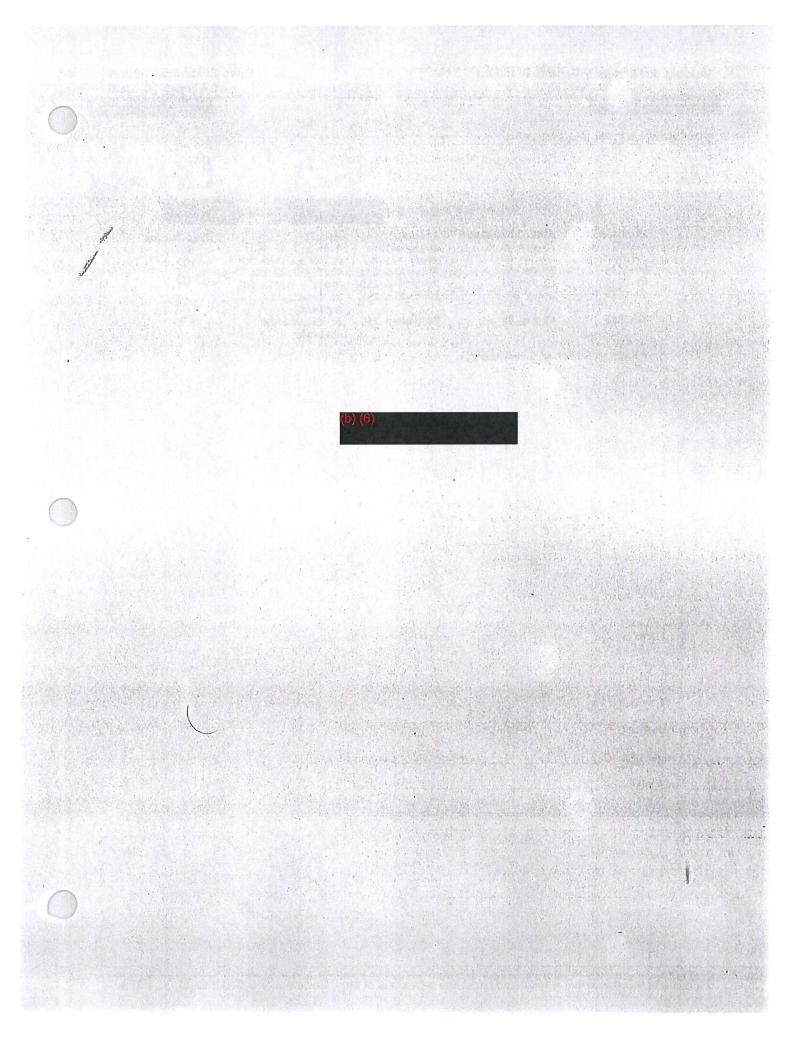
1 1 1 168-5-24

Urinalysis	Damel 6 m	
orinalysis	KOSUL CB	ror

00	A	11	

Sample No. 66-247 66-2242 66-5134 67-0350 67-1536	Date Collected 25 Jan 66 * 18 Mar 66 26 Oct 66 19 Jan 67 5 May 67	Analysis gross alpha gross alpha Plutonium 239 Plutonium 239 Plutonium 239	Result 1.85 ± 1.11 pC1/1 0.703 ± 0.246 pC1 0.17 ± 0.09 pC1 0.017 ± 0.013 pC1 No detectable	5 Body Eurden 10 15 11 1
				Ö
67-3985	15 Aug 67	Plutonium 239	No detectable Activity	0

^{*} Date received at Laboratory.



b) (6)

Internal Dosimetry Evaluation Form

Antel Mai Dosiniet	2
NAME: (6) (6)	SSN: (b) (6)
MODE OF INTAKE:	INTAKE DATE OR PERIOD:
☑ Inhalation ☐ Injection	01/18/66 through 02/06/66 on-site
☐ Ingestion ☐ Absorption	1/18/66 assumed start.
Unknown Not applicable	17 Toroto assumed start.
SUMMARY OF EXPOSURE CONDITIONS:	
Radionuclides/Respiratory Class/Particle Size: 239Pu/100%	Class V/I um AMAD
Date or Period of Evaluated Data: 5 urine samples from 02/	00/66 to 00/04/67
Dureties of European Helicana	08/00 to 09/04/67
Duration of Exposure: Unknown	
Location of Exposure: Camp Wilson, near Palomares, Spain	1
WIND A RIA GROOM TO A	
EVALUATION DATA:	
	In Process
Health Physics Survey Data	In Process Unavailable
Bioassay – Urinalysis 🛛 Attached	In Process Unavailable
Fecal Attached	In Process  Unavailable
Nasal Smears Attached	In Process Unavailable
In Vivo Attached	In Process Unavailable
Medical Treatment:	
	☑ No Date:
	No Agent: Date:
	No Agent: Date:
Surgical excision:	No Date:
umptions: Acute inhalation intake of ²³⁹ Pu, 100% Cla.  Code/Model used for: Intake Estimate: CINDY, Ver. Dose Estimate: CINDY, Ver.	•
	°
RESULTS SUMMARY	
Estimated Intake Activity (pCi): 64,000	
50 YR CEDE (rem): 20 (0.20 Sv)	
	0 YR CDE (rem/Sv)
Bone Surface	200/2.0
Lung	73/0.73
Liver	36/0.36
Red Marrow	15/0.15
Other	3.4/0.034
Testes	2.9/0.29
	- encounts
DOSE ASSESSOR: DATE:	PEER REVIEWER: DATE:
Signature:	Signature:
Print Name:	Print Name:
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RECOMMENDATIONS:	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	inalysis
Suggested Sampling Frequency:	
Work Restrictions: N/A	100

# **Preliminary Internal Dosimetry Case Narrative**

#### Identification:

Name: SSN:

### **Incidents:**

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. One urine sample data card indicated an exposure of 18 January 1966. Other cards indicated exposure during January 1966. An exposure date of 18 January 1966 corresponding to the first day of his presence on site was chosen as most conservative.

#### **Previous Intake/Dose Assessments:**

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

#### Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

Dates	% Body Burden
2/08/66	-
7/24/66	7
1/17/67	3
5/25/67	0
9/04/67	0

Radionuclide(s): 239Pu.

# Assumptions/Basis/Data Sources:

Acute inhalation intake of Pu-239; 100% Class Y; 1  $\mu$ m AMAD particle size on 1/18/66. The date is the first day of the period on station from 1/18/66 to 2/6/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.



Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

Sample	*Analysis	Date	Elapsed Days	Result (pCi/day)	Error (pCi/day)	Included
66-527	G	02/08/66	21	1.38	0.55	
66-4096	AS	07/24/66	187	0.163	0.118	✓
67-0432	AS	01/17/67	364	0.0415	0.0212	✓
67-2155	AS	05/25/67	492	ND		✓
67-5649	AS	09/04/67	594	ND		✓

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

## **Modeling:**

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)
CINDY	64,000	20/0.20
LUDEP	160,000	11/0.11

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

Organ	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent
			(rem/Sv)
Testes	2.9E+00/2.9E-02	2.5E-01	7.1E-01/7.1E-03
Breast	9.5E-05/9.5E-07	1.5E-01	1.4E-05/1.4E-07
Red Marrow	1.5E+01/1.5E-01	1.2E-01	1.8E+00/1.8E-02
Lung	7.3E+01/7.3E-01	1.2E-01	8.8E+00/8.8E-02
Thyroid	8.9E-05/8.9E-07	3.0E-02	2.7E-06/2.7E-08
Bone Surface	2.0E+02/2.0E+00	3.0E-02	6.0E+00/6.0E-02
Liver	3.6E+01/3.6E-01	6.0E-02	2.1E+00/2.1E-02
Other	3.4E+00/3.4E-02	6.0E-02	2.0E-01/2.0E-03
Lower Large Intestine	7.3E-03/7.3E-05	6.0E-02	4.4E-04/4.4E-06
Upper Large Intestine	2.4E-03/2.4E-05	6.0E-02	1.5E-04/1.5E-06
Small Intestine	5.0E-04/5.0E-06	6.0E-02	3.0E-05/3.0E-07
Effective Dose Equivale		2.0E+01/2.0E-01	

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b) (6)

Four urine samples were analyzed by alpha spectrometry and one early sample by gross alpha counting. The gross alpha reported 1.38 +/- 0.55 pCi/day; however this was not used in our analysis because of suspected contamination from on-site collection of the samples. Two of the four samples analyzed by alpha spectrometry were reported as NDA (no detectable activity) and two were reported with a positive result. The four values were fit using CINDY and the Jones excretion model to estimate an intake (64,000 pCi), organ doses, and a CEDE (20 rem/0.20 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 160,000 pCi and a CEDE (ICRP-60) of 11 rem (0.11 Sv).

#### Conclusion:

Prepared By:

Based on the results of intake estimates and dose calculations, this individual received an intake of about 64,000 to 160,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 11 to 20 rem (0.11 to 0.20 Sv). That dose is more than the cumulative dose (7 rem) from a lifetime (70 years) of exposure at the current level (0.100 rem) for members of the public. It is less than one-half the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). Serious health consequences are not associated with this dose level.

Name:		
Signature:	Date:	
Peer Reviewed By:		
Name:		
Signature:	Date:	: ^

FEB	10	1966
NTEP		

NAME (LAST, FIRST, M.		1.	(h) (G)	C. NO. (21 - 29)	URIL	JE (30)	GROSS ALPHA
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		460 ml.		200 ml.			
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URINE		SSGT		USATOON .		FECE	ES/BLOOD
Counter Number	B	- 33/2-		Chamber Number		. Counter N	Yumber
Counter Bkg. (cpm)	0,16			Chom. Bkg. (mv/sec)		Counter B	3kg.
Counter Eff. (%)	51			Counter Eff. (%)		Counter E	Eff.
Date/Time - Start 1	5 FEB 1966		~ ·	Millivolt - Start		Date/Tim	ne - Start
-Stop	F. B. 1550			Millivolt - Stop			- Stop
Total Counts	46			Total Millivots		Tatal Cou	unts
Counting Time	55	<b></b>		Total Drift Time		Counting	Time
Gross cpm	0.84			Gross my/sec	v	Gross cpr	m
Bkg. Cpm	0.16	<del>                                     </del>		Bkg. Mv/sec		Bkg. cpm	
Net cpm	0.69			Net my/sec	114	net cpm	
dpmPe3//	3.00±1.19	7.00		curies/mv		dpm	
dpm/24 hr. (69 - 74)	V-1111			litter (69 - 74)		dps/cc	
K 40 Correction		+	-	12.1.3/			Dose (rads) (63-68)
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D (q) (63-68)	11 20- 0104	4		+10-2c .2	L		

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Palomares Nuclear Weapons Accident

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Palomares Nuclear Weapons Accident

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Palomares Nuclear Weapons Accident

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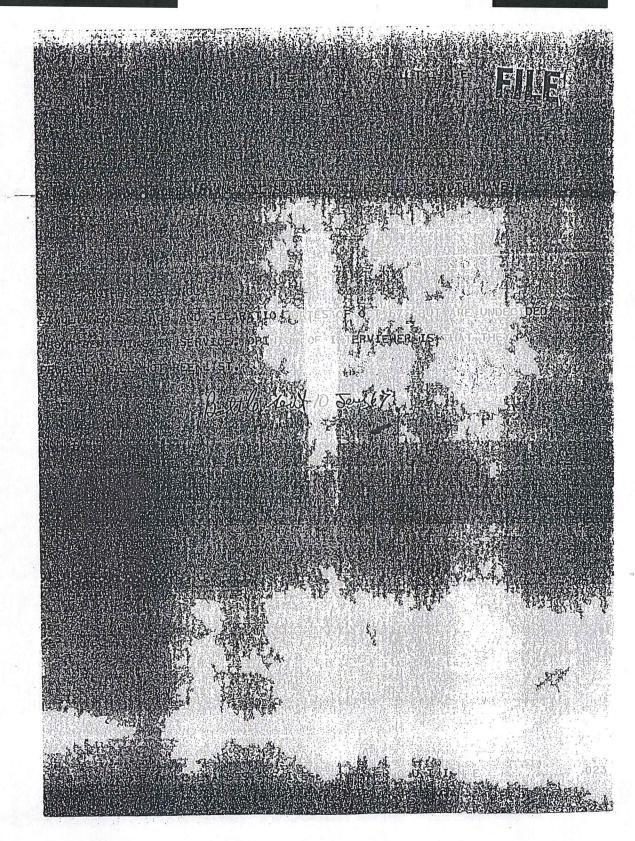
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April 28, 2000

DEPARTMENT OF THE AIR FORCE USAF RADIOLOGICAL HEALTH LABORATORY (AFLC) WRIGHT PATTERSON AIR FORCE BASE OHIO 45433

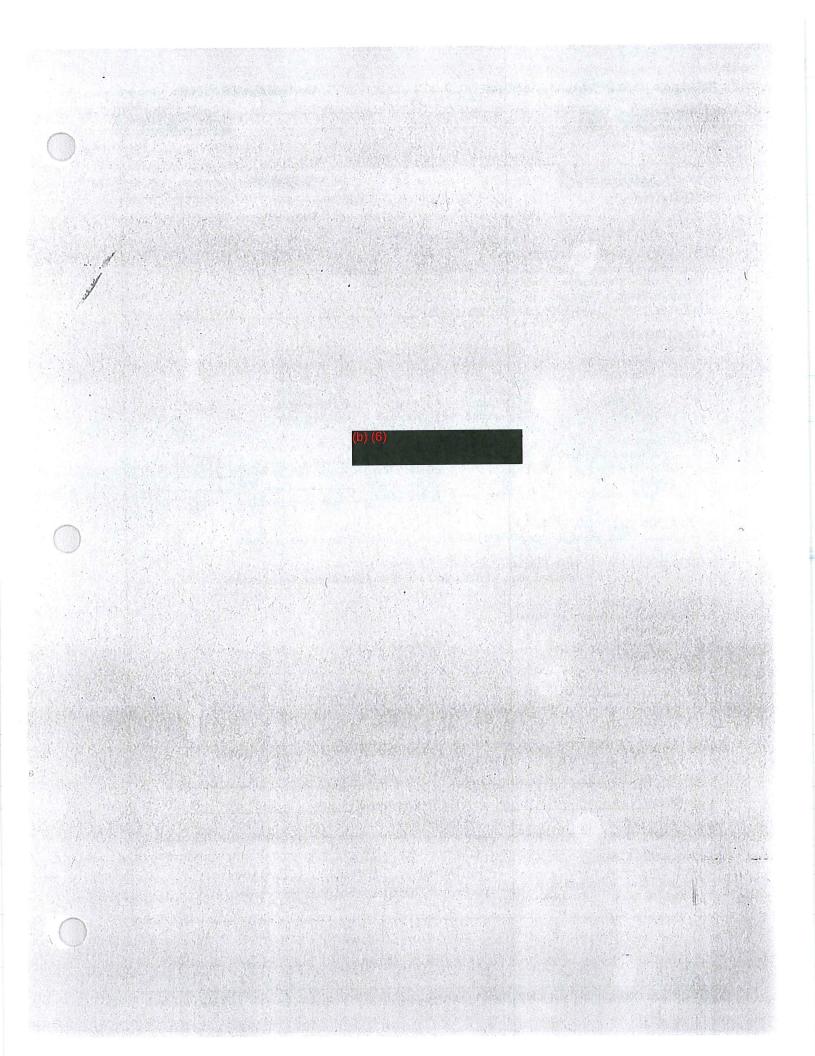


7 Dec 1967

Long-Term Medical Follow-Up, Palomares Operation Urine Studies for 239 Pu.

USAF Hosp Andrews Andrews AFB Wash DC 20331

- 1. As a result of your splendid cooperation in this program, it is possible to discontinue further sampling.
- Our results show that your health is in no jeopardy from retention of radioactive materials as a result of participation in subject operation.
- 3. If you are still on active duty, please present this letter to the custodian of your medical records so that it may be made a part of your permanent file. If not on active duty, it is suggested you retain it in your permanent personal records.
  - three sample bottles were sent to Our files show that you, and that three samples were returned for analysis.



(b) (6)

**Internal Dosimetry Evaluation Form** NAME: SSN: (b) (6) MODE OF INTAKE: INTAKE DATE OR PERIOD: **☒** Inhalation ☐ Injection 01/18/66 through 02/06/66 on-site ☐ Ingestion ☐ Absorption 1/18/66 assumed start. ☐ Unknown ☐Not applicable SUMMARY OF EXPOSURE CONDITIONS: Radionuclides/Respiratory Class/Particle Size: 239Pu/100% Class Y/1 µm AMAD Date or Period of Evaluated Data: 3 urine samples from 7/20/66 to 4/19/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain **EVALUATION DATA:** Air Sampling ☐ Attached ☐ In Process □ Unavailable Health Physics Survey Data Attached In Process **Unavailable** Bioassay - Urinalysis ☐ In Process ☐ Unavailable Fecal Attached ☐ In Process □ Unavailable **Nasal Smears** Attached In Process **◯** Unavailable In Vivo ☐ Attached ☐ In Process □ Unavailable Medical Treatment: Skin Decontamination: ☐ Yes ⊠ No Date: Decorporation: Yes Yes ⋈ No Agent: Date: Yes Catharsis: ☑ No Agent: Date: Surgical excision: ☐ Yes ⊠ No Date: **EVALUATION METHODOLOGY:** Assumptions: Acute inhalation intake of ²³⁹Pu, 100% Class Y, 1 µm AMAD particle size on 1/18/66 Code/Model used for: Intake Estimate: CINDY, Ver. 1.4/JONES Dose Estimate: CINDY, Ver. 1.4/ICRP 30, Part 4, General Systemic Model **RESULTS SUMMARY** Estimated Intake Activity (pCi): 99,000 50 YR CEDE (rem): 30 (0.30 Sv) **Organ Dose Equivalent Summary** 50 YR CDE (rem/Sv) Bone Surface 310/3.1 Lung 110/1.1 Liver 55/0.55 Red Marrow 24/0.24 Other 5.2/0.052 **Testes** 4.4/0.044 DOSE ASSESSOR: DATE: PEER REVIEWER: DATE: Signature: Signature: _ Print Name:__ **Print Name:** SSN: SSN: RECOMMENDATIONS: Additional Bioassay Required ☐ Urinalysis ☐ Fecal ☐ In Vivo Suggested Sampling Frequency: Work Restrictions: N/A





# **Preliminary Internal Dosimetry Case Narrative**

#### **Identification:**

Name: SSN:



#### Incidents:

Individual participated on site in response duties resulting from an accident involving three nuclear weapons at Palomares, Spain on January 17, 1966. Individual may have been exposed to weapons materials (primarily plutonium-239) by inhalation and ingestion from contaminated weapon and aircraft debris, lands, and vegetation. Primary activities included search, radiological monitoring, recovery of accident debris, and processing for disposal.

This individual arrived on site early in the response. Urine sample data cards indicated exposure in January 1966 and February – March 1966. An exposure date of 18 January 1966 corresponding to the first day of the response effort was chosen as most conservative.

#### Previous Intake/Dose Assessments:

This assessment applies to Palomares accident activities only. No previous intakes or doses were considered.

#### Other Information:

This individual was identified for follow-up sampling after the initial assessments in 1966. Follow-up sampling was generally under more controlled conditions and analysis performed using more sensitive and specific alpha spectrometry methods. Results of assessments at the time of the incident indicated retained systemic body burdens using the Langham 1956 equation as shown below.

Dates	% Body Burden
7/20/66	8
1/20/67	3
4/19/67	0

Radionuclide(s): ²³⁹Pu.

#### **Assumptions/Basis/Data Sources:**

Acute inhalation intake of Pu-239; 100% Class Y; 1  $\mu$ m AMAD particle size on 1/18/66. The date is the first day of the period on station from 1/18/66 to 2/06/66.

Inhalation was assumed as the major route of entry because the primary contaminant was created by explosion and fire and deposited in sandy soil and on buildings and plants. Conditions were generally windy and significant activity was underway.

Dose was determined entirely from modeling intake based on the following urinalysis results for this individual. The urine samples were collected over a period of time from the initial incident. Since this

(b) (6)



individual was identified for further follow-up sampling, several results are available. The results for samples collected on site were generally rejected because of sample contamination problems.

Sample	*Analysis	Date	Elapsed Days	Result (pCi/day)	Error (pCi/day)	Included
66-4084	AS	07/20/66	183	0.191	0.113	1
67-0433	AS	01/20/67	367	0.0411	0.0206	/
67-2151	AS	04/19/67	456	ND	0.0200	/

^{*} G means gross alpha counting; AS means alpha spectrometry.

Intakes and estimates of dose were prepared using CINDY Version 1.4 and LUDEP Version 2.05. Intake was estimated using the Jones excretion model in CINDY and LUDEP. Inhalation intake was estimated using the ICRP 66 respiratory tract model in LUDEP. CINDY estimated dose derived using the ICRP 30, Part 4, General Systemic Model and weighting factors; and LUDEP used the recommendations of ICRP 60.

## Modeling:

CINDY and LUDEP were used to estimate the intake and dose with the following results:

Model	Intake (pCi)	CEDE (rem/Sv)		
CINDY	99,000	30/0.30		
LUDEP	160,000	12/0.12		

Doses to individual organs and estimation of the effective dose equivalent using CINDY reported the following results:

Organ	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent (rem/Sv)
Testes	4.4E+00/4.4E-02	2.5E-01	1.1E+00/1.1E-02
Breast	1.5E-04/1.5E-06	1.5E-01	2.2E-05/2.2E-07
Red Marrow	2.4E+01/2.4E-01	1.2E-01	2.9E+00/2.9E-02
Lung	1.1E+02/1.1E+00	1.2E-01	1.4E+01/1.4E-01
Thyroid	1.4E-04/1.4E-06	3.0E-02	4.1E-06/4.1E-08
Bone Surface	3.1E+02/3.1E+00	3.0E-02	9.3E+00/9.3E-02
Liver	5.5E+01/5.5E-01	6.0E-02	3.3E+00/3.3E-02
Other	5.2E+00/5.2E-02	6.0E-02	3.1E-01/3.1E-03
Lower Large Intestine	1.1E-02/1.1E-04	6.0E-02	6.7E-04/6.7E-06
Upper Large Intestine	3.8E-03/3.8E-05	6.0E-02	2.3E-04/2.3E-06
Small Intestine	7.7E-04/7.7E-06	6.0E-02	4.6E-05/4.6E-07
Effective Dose Equivale	nt		3.0E+01/3.0E-01

Three urine samples were analyzed by alpha spectrometry. One of the three samples analyzed by alpha spectrometry were reported as NDA (no detectable activity) and two were reported with a positive result. The two values were fit using CINDY and the Jones excretion model to estimate an intake (99,000 pCi),



b) (6)

organ doses, and a CEDE (30 rem/0.30 Sv; ICRP-30) as shown above. LUDEP was also used to estimate an intake of 160,000 pCi and a CEDE (ICRP-60) of 12 rem (0.12 Sv).

### **Conclusion:**

Prepared By:

Based on the results of intake estimates and dose calculations, this individual received an intake of about 99,000 to 160,000 pCi of ²³⁹Pu resulting in a 50-year committed effective dose equivalent of 12 to 30 rem (0.12 to 0.30 Sv). That dose is more than the cumulative dose (7 rem) from a lifetime (70 years) of exposure at the current level (0.100 rem) for members of the public. It ranges slightly more than one-half the working lifetime limit of 50 rem recommended by the National Council on Radiation Protection and Measurements (NCRP). Serious health consequences are not associated with this dose level.

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Palomares Nuclear Weapons Accident

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E OR REQUESTOR'S ID (1=2		GRADE . Alc	(b) (6)		SOCIAL SECURITY NU	UMBER RHL SAMPLE NUMBER
TYPE SAMPLE (23-32)	OCCUPATION		IRED	REQUESTED		AIR FORCE BASE (68-71)
Urine DATE RECEIVED (37-42)	DATE ANALYZ	Pu 239		L SQ.		Torrejon AB
6 Feb 67	DATE ANALTZ	TED (51-56)	DATE SOUNTED	67	20 Jan 67	EXPOSURE DATE Feb Mar 66
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Palomares Nuclear Weapons Accident

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NAME OF BEOUESTOR'S ID (1-20)		GRADE	ıc	AFSH (b) (6)			RHL 664984
TYPE SAMPLE (23-32)	OCCUPATION (34-35)	ATION ANALYSIS DESIRED					Torre jon
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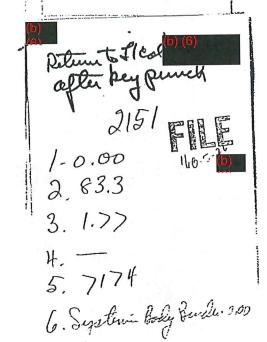
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2 ml Sample Letter prepared 4 apr

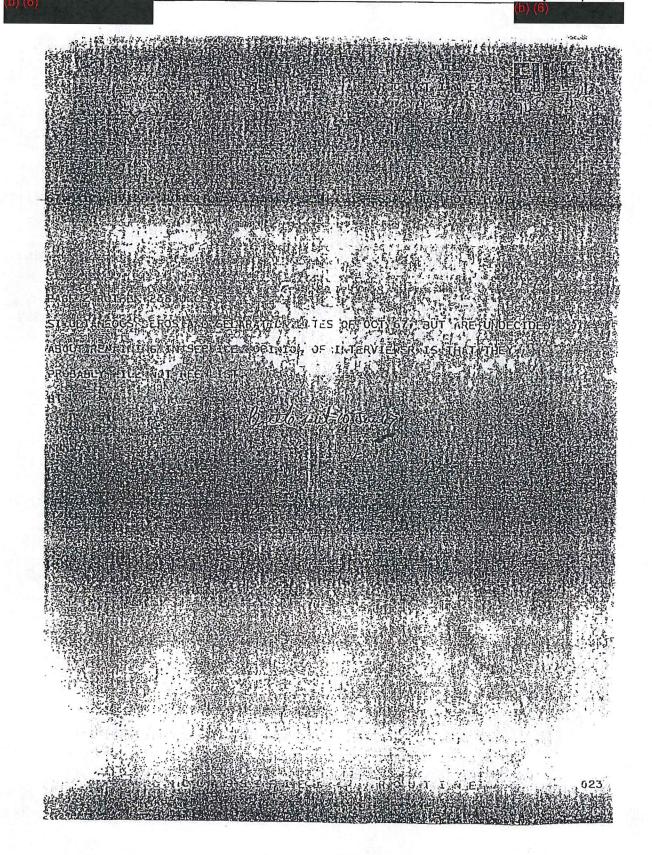
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SGHW

7 Dec 1967

SUBJECT

Long-Term Medical Follow-Up, Palomares Operation Urine Studies for 200 Pu.

Sgt (6) (6) 438 AB Gp

McGuire AFB NJ 08641

- 1. As a result of your splendid cooperation in this program, it is possible to discontinue further sampling.
- 2. Our results show that your health is in no jeopardy from retention of radioactive materials as a result of participation in subject operation.
- 3. If you are still on active duty, please present this letter to the custodian of your medical records so that it may be made a part of your permanent file. If not on active duty, it is suggested you retain it in your permanent personal records.
- 4. Our files show that three sample bottles were sent to you and that two samples were returned for analysis.

LtCol, USAF, MC

Chief