

PALOMARES NUCLEAR WEAPONS ACCIDENT



REVISED DOSE EVALUATION REPORT

Volume II

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

Date: April 2001

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

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.

APPENDIX C INDIVIDUAL DOSE ESTIMATES

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.

Name	Appendix	Name	Appendix
(b) (6)	C.4	(b) (6)	C.4
	C.4		C.4
	C.4		C.2
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.2
	C.4		C.3
	C.4		C.4
	C.2		C.3
	C.4		C.3
	C.2		C.3
	C.3		C.2
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.3
	C.3		C.4
	C.3		C.3
	C.4		C.3
	C.3		C.4
	C.2		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.3
	C.4		C.3
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.3
	C.3		C.3
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.3		C.4

Name

Appendix

Name _____

Appendix

- E -

(b) (6)

C.4
C.4
C.4
C.4
C.4
C.4
C.4
C.4
C.4
C.3
C.4
C.4
C.3
C.4
C.4
C.4
C.4
C.4
C.1
C.2
C.3
C.4
C.4

(b) (6)

C.4
C.1
C.4
C.3
C.4
C.3
C.4
C.4
C.4
C.4
C.4
C.3
C.4
C.3
C.2
C.3
C.4
C.4
C.3
C.3
C.4
C.3
C.4
C.4
C.3
C.4
C.4
C.4
C.3
C.3
C.4
C.4
C.4
C.4
C.4
C.4
C.4
C.4
C.4
C.4

-- F --

(b) (6)

C.4
C.3
C.4
C.4
C.1
C.3
C.4
C.4
C.4
C.4
C.1
C.4
C.4
C.4
C.3
C.4
C.2
C.3
C.3
C.4
C.2
C.4

- G -

(b) (6)

C.4
C.4
C.4
C.4
C.4
C.4
C.4
C.4
C.4

Name
(b) (6)

Appendix

C.4
C.4
C.4
C.4
C.4
C.4
C.4
C.3
C.4
C.4
C.3
C.4
C.3
C.4
C.3
C.4
C.4
C.4
C.4
C.3
C.3
C.4
C.4
C.2
C.4
C.4
C.4
C.4
C.3
C.4
C.4
C.4
C.3
C.4
C.4
C.3
C.4
C.4
C.3
C.4
C.3
C.4
C.3
C.4
C.3
C.3
C.3
C.4

Name
-- H --

(b) (6)

Appendix

C.4
C.3
C.4
C.4
C.4
C.3
C.4
C.4
C.4
C.3
C.4
C.4
C.4
C.4
C.4
C.2
C.4
C.4
C.3
C.4
C.2
C.4
C.2
C.4
C.4
C.4
C.4
C.4
C.4
C.3
C.4
C.4
C.4
C.4
C.4
C.4
C.4
C.4
C.3
C.3
C.4
C.4
C.4
C.4
C.3

Name	Appendix
(b) (6)	C.4
	C.3
	C.4
	C.1
	C.4
	C.3
	C.4
	C.3
	C.4
	C.4
	C.4
	C.4
	C.3
	C.3
	C.4
	C.4
	C.4
	C.4
	C.4
	C.4
	C.4
	C.4
	C.3
	C.4
	C.4
	C.4
	C.3
	C.3
	C.4
	C.4
	C.3
	C.3
	C.4
	C.3
	C.1
	C.4
	C.4
	C.4
	C.4
	C.4
	C.3
	C.4
	C.3
	C.3
	C.4
	C.4
	C.3
	C.3
	C.4

Name	Appendix
(b) (6)	C.4
	C.3
	C.4
	C.4
	C.4
	C.4
	C.3
	C.4
	C.4
	C.4
	C.4
	C.4
	C.3
	C.4
	C.4
	C.2
	C.3
	C.4
	C.4
	C.3
C.4	
C.3	
C.4	


- I -

(b) (6)

C.4
C.4
C.4
C.3

- J -

(b) (6)



C.4
C.4
C.4
C.3
C.4
C.4
C.4
C.3
C.3
C.4
C.1
C.3
C.4
C.4
C.3
C.4
C.4
C.4

Name	Appendix
(b) (6)	C.2
	C.4
	C.4
	C.4
	C.4
	C.4
	C.2
	C.3
	C.4
	C.4
	C.4
	C.4
	C.4
	C.4
	C.4
	C.4
	C.3
	C.3
	C.4
	C.4
	C.3
	C.4
	C.3
	C.4
	C.3
	C.4
	C.3
	C.4

-- K --

(b) (6)	C.3
	C.3
	C.3
	C.4
	C.4
	C.4
	C.4
	C.3
	C.4
	C.4
	C.4
	C.3
	C.4
	C.3
	C.4
	C.4
	C.3
	C.3
	C.4

Name	Appendix
(b) (6)	C.4
	C.3
	C.3
	C.3
	C.4
	C.4
	C.4
	C.3
	C.4
	C.2
	C.4
	C.3
	C.4
	C.3
	C.4
	C.4
	C.3
	C.4
	C.4
	C.4
	C.4
	C.2
	C.4
	C.4
	C.4
	C.4
	C.3
	C.4

-- L --

(b) (6)	C.3
	C.4
	C.2
	C.4
	C.4
	C.1
	C.3
	C.4
	C.4
	C.4
	C.4
	C.4
	C.4
	C.4
	C.4
	C.4
	C.4

Name	Appendix	Name	Appendix
(b) (6)	C.4	(b) (6)	C.4
	C.4		C.3
	C.4		C.4
	C.3		C.4
	C.4		C.3
	C.4		C.3
	C.4		C.3
	C.4		C.3
	C.4		C.4
	C.1		C.4
	C.4		C.3
	C.4		C.4
	C.3		C.4
	C.4		C.4
	C.3		C.3
	C.3		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.3
	C.3		C.4
	C.4		C.4
	C.4		
	C.3	-- N --	
	C.4		
	C.4	(b) (6)	C.4
	C.4		C.4
	C.4		C.4
	C.3		C.4
	C.4		C.3
	C.4		C.4
	C.3		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.3
	C.4		C.4
	C.3		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.3		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.3

Name	Appendix	Name	Appendix
(b) (6)	C.4	(b) (6)	C.4
	C.4		C.4
	C.3		C.4
			C.4
-- O --			C.3
			C.4
(b) (6)	C.4		C.4
	C.4		C.4
	C.3		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.1		C.4
	C.4		C.4
	C.2		C.4
	C.3		C.4
	C.3		C.3
	C.3		C.3
	C.4		C.4
	C.3		C.4
	C.4		C.4
	C.3		C.4
	C.4		C.4
	C.3		C.4
	C.4		C.2
	C.4		C.4
			C.4
-- P --			C.4
(b) (6)	C.4		C.3
	C.4		C.3
	C.3		C.3
	C.3		C.1
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.2		C.2
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.3		C.4
	C.4		C.4
	C.3		C.4
	C.4		C.3
	C.4		C.4
	C.4		C.4
	C.1		C.4

Name	Appendix	Name	Appendix
(b) (6)	C.4	(b) (6)	C.4
-- Q --			C.4
(b) (6)	C.4		C.3
	C.3		C.4
-- R --			C.4
(b) (6)	C.2		C.4
	C.1		C.4
	C.3		C.4
	C.4		C.4
	C.4		C.4
	C.3		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.3
	C.3		C.4
	C.3		C.4
	C.4		C.3
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.3		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.3		C.4
	C.3		C.3
	C.4		C.3
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.2		
	C.4	-- S --	
	C.4	(b) (6)	C.4
	C.4		C.3
	C.4		C.4
	C.4		C.3
	C.4		C.3
	C.3		C.4
	C.4		C.4
	C.4		C.4
	C.3		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4

Name	Appendix	Name	Appendix
(b) (6)	C.3	(b) (6)	C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.3
	C.4		C.4
	C.4		C.4
	C.4		C.3
	C.4		C.4
	C.4		C.4
	C.3		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.3
	C.4		C.4
	C.4		C.4
	C.4		C.3
	C.4		C.3
	C.4		C.4
	C.4		C.4
	C.4		C.3
	C.3		C.4
	C.3		C.4
	C.4		C.3
	C.3		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.3
	C.3		C.4
	C.4		C.3
	C.4		C.4
	C.4		C.2
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.2		C.3
	C.4		C.4
	C.4		C.3
	C.3		C.3
	C.4		C.4
	C.1		C.4

Name	Appendix	Name	Appendix
(b) (6)	C.4	(b) (6)	C.4
	C.4		C.4
	C.4		C.4
	C.4		C.3
	C.4		C.3
	C.4		C.4
	C.4		C.3
	C.4		C.3
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.3		C.3
	C.4		C.4
	C.1		C.3
	C.4		C.4
	C.3		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.3
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.3
-- T --			
(b) (6)	C.1	-- U --	
	C.4	(b) (6)	C.2
	C.4		C.3
	C.3		C.3
	C.4		C.4
	C.3		
	C.4	-- V --	
	C.4	(b) (6)	C.3
	C.3		C.4
	C.4		C.3
	C.4		C.4
	C.4		C.4
	C.3		C.4
	C.3		C.4
	C.3		C.4
	C.4		C.3
	C.3		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.2
	C.4		C.4
	C.4		C.4
	C.4		C.3
	C.3		C.4
	C.4		C.4

Name	Appendix	Name	Appendix
(b) (6)	C.4	(b) (6)	C.3
	C.4		C.4
	C.4		C.3
	C.4		C.4
			C.4
-- W --			C.4
(b) (6)	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.3
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.2		C.3
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.3		C.4
	C.2		C.3
	C.4		C.3
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.3
	C.4		C.4
	C.4		C.4
	C.2		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.4
	C.3		C.4
	C.3		C.4
	C.4		C.4
	C.4		C.4
	C.3		C.4
	C.4		C.3
	C.3		C.4
	C.2		C.4
	C.4		C.4
	C.4		C.4
	C.4		C.3

Name

Appendix

-- Y --

(b) (6)

C.4
C.4
C.3
C.4

-- Z --

(b) (6)

C.4
C.3
C.4
C.4
C.4

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)

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)																																									
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Ingestion <input type="checkbox"/> Unknown		<input type="checkbox"/> Injection <input type="checkbox"/> Absorption <input type="checkbox"/> Not applicable																																									
		INTAKE DATE OR PERIOD: 01/29/66 through 02/19/66 on site 1/29/66 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: 4 urine samples from 10/07/66 to 08/14/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain																																											
EVALUATION DATA: <table border="0"><tr><td>Air Sampling</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Health Physics Survey Data</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Bioassay – Urinalysis</td><td><input checked="" type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input type="checkbox"/> Unavailable</td></tr><tr><td>Fecal</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Nasal Smears</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>In Vivo</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr></table> Medical Treatment: <table border="0"><tr><td>Skin Decontamination:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Date: _____</td></tr><tr><td>Decorporation:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Agent: _____ Date: _____</td></tr><tr><td>Catharsis:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Agent: _____ Date: _____</td></tr><tr><td>Surgical excision:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Date: _____</td></tr></table>				Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable	Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____	Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable																																								
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____																																								
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																								
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																								
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____																																								
EVALUATION METHODOLOGY: Assumptions: Acute inhalation intake of ^{239}Pu , 100% Class Y, 1 μm AMAD particle size on 1/29/66 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): 68,000 50 YR CEDE (rem): 21 (0.21 Sv) <table border="0"><tr><td>Organ Dose Equivalent Summary</td><td>50 YR CDE (rem/Sv)</td></tr><tr><td>Bone Surface</td><td>210/2.1</td></tr><tr><td>Lung</td><td>78/0.78</td></tr><tr><td>Liver</td><td>38/0.38</td></tr><tr><td>Red Marrow</td><td>16/0.16</td></tr><tr><td>Other</td><td>3.6/0.036</td></tr><tr><td>Testes</td><td>3.0/0.030</td></tr></table>				Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)	Bone Surface	210/2.1	Lung	78/0.78	Liver	38/0.38	Red Marrow	16/0.16	Other	3.6/0.036	Testes	3.0/0.030																										
Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)																																										
Bone Surface	210/2.1																																										
Lung	78/0.78																																										
Liver	38/0.38																																										
Red Marrow	16/0.16																																										
Other	3.6/0.036																																										
Testes	3.0/0.030																																										
DOSE ASSESSOR:		PEER REVIEWER:																																									
DATE: _____		DATE: _____																																									
Signature: _____		Signature: _____																																									
Print Name: _____		Print Name: _____																																									
SSN: _____		SSN: _____																																									
RECOMMENDATIONS: Additional Bioassay Required <input type="checkbox"/> Urinalysis <input type="checkbox"/> Fecal <input type="checkbox"/> In Vivo Suggested Sampling Frequency: _____ Work Restrictions: N/A																																											

(b) (6)

(b) (6)

Preliminary Internal Dosimetry Case Narrative**Identification:**Name:
SSN:

(b) (6)

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): ^{239}Pu .**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		✓

* 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.

Organ	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent (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-03/2.6E-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 Equivalent			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

(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 ^{239}Pu 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: _____

(b) (6)

(b) (6)
April 28, 2000

INTERNAL DOSE DATA			
AFSN: (b) (6)		SOC. SEC. NO. (21-29) (b) (6)	
NAME (LAST, FIRST, M.I.) (1-20) (b) (6)		TYPE SAMPLE (30) Urine	
A2C		TYPE ANAL. (31-32) PU	
SAMPLE NO. (33-38) 66-1193	SAMPLE DATE (39-44) FROM 29 Jan 66 TO 19 Feb 66	EXPOSURE DATE 29 JAN 66 TYPE	
BASE (57-60) Torrejon	OCCUPATION (61-62) 761500	REQUESTED BY	
DATE RECEIVED 3 March 1966	SAMPLE VOLUME 1500 ml	VOLUME ANALYZED 1000 ml	DATE ANALYZED
TECHNICIAN (SIGNATURE AND DATE)			
URINE		RADON	
Counter Number		Chamber Number	
Counter Bkg. (cpm)		Cham. Bkg. (mv/sec)	
Counter Eff. (%)		Counter Eff. (%)	
Date/Time - Start		Millivolt - Start	
- Stop		Millivolt - Stop	
Total Counts		Total Millivots	
Counting Time		Total Drift Time	
Gross cpm		Gross mv/sec	
Bkg. Cpm		Bkg. Mv/sec	
Net cpm		Net mv/sec	
dpm		curies/mv	
dpm/24 hr. (69-74)		litter (69-74)	
K 40 Correction			
Net Beta		D(q) (63-68)	
D(q) (63-68)			
		FECES/BLOOD	
		Counter Number	
		Counter Bkg.	
		Counter Eff.	
		Date/Time - Start	
		- Stop	
		Total Counts	
		Counting Time	
		Gross cpm	
		Bkg. cpm	
		net cpm	
		dpm	
		dps/cc	
		Neutron Dose (rads) (63-68)	
		uc/mg (69-74)	
		D(q) (63-68)	

RADIOLOGICAL SAMPLE DATA					
NAME OF REQUESTOR'S ID (1-20)		GRADE	TECH	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
(b) (6)		AIC	(b) (6)	(b) (6)	9657
TYPE SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (88-71)	
URINE		JS 239	SCAW	MARCU AFB	
DATE RECEIVED (37-42)	DATE ANALYZED (31-36)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
14 OCT 66	26 OCT 66	26 OCT 66	17 OCT	JAN-MAR 66	
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED		TECHNICIAN	
1600 VOL + 80 ACID		800 ml		(b) (6)	
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
236					
239					
RADON					
236					
239					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
65.7 % Rec.					
SUMMARY OF RESULTS:					
<p> $PO_{250} - 0.212 \pm 0.110$ $\% \text{ Rec} = 71.3$ $\text{Tot Vol} - 1600$ $\text{Body Burden} - 0.16\%$ $\text{Ud anal} - 800$ </p>					

AFLC FORM 1165

PC 5400

AFLC-WPAFB-MAY 66 4500

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

AFLC-WPAFB-MAY 66 4500

(b)
(6)

Palomares Nuclear Weapons Accident

Dose Evaluation Report

April 28, 2000

(b) (6)

(b) (6)

(b) (6)		SUBMITTEE		SGHW		TYPE SPL		URINE		FILE NO.		P-653		673976		(b) (6)	
DATE COLLECTED		DATE RECD		EXPOSURE DATE(S)		TOTAL WT OR VOL		WT OR VOL ANALYZED									
14 AUG 67		17 AUG 67		FEB 66		10 fume		540 me									
ANALYSIS DESIRED		23910		TECHNICIAN		(b) (6)											
TYPE OF ANALYSIS		236		239													
COUNTER AND EFF		SPR #1 32															
TOTAL CTS AND TIME		280 = 224		0													
BK CTS AND TIME		800 - 4		1													
NET CTS PER MIN																	
I		20 22		±		33 35		43 1		20 22		±		33 35		43	
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																	
GR BETA SUS																	
DATE CTD																	
NET BETA PER 24 HR																	
SAMPLE WT DIS																	
SAMPLE WT SUS																	
SAMPLE VOL																	
RECOVERY		96 9		Percent													
ELAPSED TIME																	
SYSTEMIC BODY BURDEN																	
CRITICAL ORGAN BONE																	

AFLC FORM 1165 JUL 67

FC 3400

PREVIOUS EDITION WILL BE USED.

RADIOLOGICAL SAMPLE DATA AFLC-WPAFB-JUL 67 3M

(b) (6)

(b) (6)

Sample #2
Letter -
prepared
3 Apr 67

Last address - 5 Dec 66
15th AF Band
807 3rd Lt
March AFB, Calif.
92508
Letter Sent 6 Dec 66

(b) (6)

(b) (6)

Return after Key
Punch

3976

1. 0.00
2. 96.9 X
3. 1.08
4. —
5. 7243
6. Systemic Body Burden 0.00

4942

(b) (6)

1. 212 ± 110 feet
2. 71.3 X
3. 1.6
4. 209
5. 6299
6. Systemic Body Burden
Bone critical organ 0.16

Return Card to S/
after key-punching.

(b) (6)

Code 653

(b) (6)

0364 X

1. 0.00
2. 104.6
3. 0.86
4. 376
5. 7038
6. 0.00

Return to S/CO
after ~~key~~ key punch.

(b) (6)

Code-653 and krio-2

(b) (6)

1298

1. 0.00 X
2. 95.4
3. 0.80
4. 457
5. 7121
6. Systemic Body Burden 0.00

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

UNCLASSIFIED

ROUTINE

180016 23 590

FILE

1605 (b) (6)

12

14

RTTU JAW RUWBKNA2320 3502213-UUUU--RUEDFIA.

ZNR UUUUU

R 162000Z DEC 66

FM 22BW MARCH AFB CALIF

TO USAF RADL HEALTH LAB WPAFB OHIO

BT

UNCLAS MSME 05540 DEC 66

FOR SGHW. SUBJ: LONG-TERM STUDIES ON SELECTED PARTICIPANTS

OF PALOMARES INCIDENT. YOUR LETTER, 6 DEC 66. AIC (b) (6)

(b) (6)

SSN

(b) (6)

523RD AF BAND, THIS

STATION, HAS WILLINGLY CONSENTED TO PARTICIPATE IN YOUR STUDIES.

BT

Letter - container sent - 10 Jan 67 to 22 BW (Attn: MSME)

ACT INFORMATION	SGHW

NNNN

(b) (6)

(b) (6)

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

FILE



7 Dec 1967

REPLY TO
ATTN OF

SGHW

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

TO: Sgt (b) (6)
523 AF Band
March AFB CA 92508

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

(b) (6)

DRAFT

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME (b) (6)		SSN: (b) (6)	
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Ingestion <input type="checkbox"/> Unknown		<input type="checkbox"/> Injection <input type="checkbox"/> Absorption <input type="checkbox"/> Not applicable	
INTAKE DATE OR PERIOD: 01/18/66 through 02/04/66 on site 1/18/66 assumed start date.			
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 08/12/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain			
EVALUATION DATA:			
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Bioassay - Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable
Fecal	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Medical Treatment:			
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> 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): 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:		PEER REVIEWER:	
DATE: _____		DATE: _____	
Signature: _____		Signature: _____	
Print Name: _____		Print Name: _____	
SSN: _____		SSN: _____	
RECOMMENDATIONS:			
Additional Bioassay Required <input type="checkbox"/> Urinalysis <input type="checkbox"/> Fecal <input type="checkbox"/> In Vivo			
Suggested Sampling Frequency: _____			
Work Restrictions: N/A			

DRAFT

(b) (6)

(b) (6)

Preliminary Internal Dosimetry Case Narrative**Identification:**

Name:

SSN:

(b) (6)

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): ^{239}Pu .**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.

(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
66-367	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:

Organ	Dose Equivalent (rem)	Weighting Factors	Weighted Organ Dose Equivalent (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 Equivalent			2.6E+01/2.6E-01

(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:

Based on the results of intake estimates and dose calculations, this individual received an intake of 86,000 to 207,000 pCi of ^{239}Pu 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.

Prepared By:

Name: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: _____

FEB 7 1966

INTERNAL DOSE DATA					
NAME (LAST, FIRST, M.I.) (1-20)		SOC. SEC. NO. (21-30)		TYPE SAMPLE (30)	TYPE ANAL. (31-32)
(b) (6)		(b) (6)		Urine	Pu 279
SAMPLE NO. (33-38)	SAMPLE DATE (39-44)		EXPOSURE		
66-367	FROM 7 Feb 66 TO 7 Feb 66		DATE 18 Jan 66 TYPE Pu 279		
BASE (57-60)	OCCUPATION (61-62)	REQUESTED BY			
Tactical Adv. Sp.	3970544				
DATE RECEIVED	SAMPLE VOLUME	VOLUME ANALYZED	DATE ANALYZED		
	750	200 ml			
TECHNICIAN (SIGNATURE AND DATE)					
URINE GROSS ALPHA		RADON		FECES/BLOOD	
Counter Number	NMC-D	Chamber Number		Counter Number	
Counter Bkg. (cpm)	0.18	Cham. Bkg. (mv/sec)		Counter Bkg.	
Counter Eff. (%)	57	Counter Eff. (%)		Counter Eff.	
Date/Time - Start	10 FEB 1966	Millivolt - Start		Date/Time - Start	
- Stop		Millivolt - Stop		- Stop	
Total Counts	65	Total Millivots		Total Counts	
Counting Time	53	Total Drift Time		Counting Time	
Gross cpm	1.18	Gross mv/sec		Gross cpm	
Bkg. Cpm	0.18	Bkg. Mv/sec		Bkg. cpm	
Net cpm	1.00	Net mv/sec		net cpm	
dpm P01/L	4.4 ± 1.45	curies/mv		dpm	
dpm/24 hr. (69-74)		litter (69-74)		dps/cc	
K 40 Correction		D(q) (63-68)		Neutron Dose (rads) (63-68)	
Handwritten: 4.20 ± 1.38				uc/mg (69-74)	
D(q) (63-68) 12				D(q) (63-68)	

$$D_A = 2.10 \times 10^{-2} \mu\text{C}$$

13 Feb 66

RADIOLOGICAL SAMPLE DATA					
(b) (6)		GRADE <i>10/11</i>		RHL SAMPLE NUMBER <i>1653</i>	
TYPE SAMPLE (23-32)		OCCUPATION (34-35)		AIR FORCE BASE (88-71)	
<i>10/11</i>		<i>12/28/67</i>		<i>10/11</i>	
DATE RECEIVED (37-41)		DATE ANALYZED (51-56)		DATE COUNTED	
<i>5 June 67</i>		<i>24 Jan 68</i>		<i>24 Jan 68</i>	
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED		EXPOSURE DATE	
<i>2350 ml</i>		<i>117.5 ml</i>		<i>Jan 68</i>	
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
<i>NDA</i> <i>Total Vol = 2.35L.</i> <i>Vol anal = 1.18L.</i> <i>70 rec - 102</i> <i>Date Counted 23 Jan 67</i>					

AFLC FORM MAY 66 1165

FC 5400

AFLC-WPAFB-JAN 67 5M

1165-5 (b) (6) **FILE 3970** (b) (6) **ch53 R (H)**

RADIOLOGICAL SAMPLE DATA

NAME OR REQUESTOR'S ID (1-20) (b) (6)		GRADE A2C	ANALYSIS DESIRED Pu 239	REQUESTED BY USAF Rad Lab	RHL SECURITY NUMBER 683816
TYPE SAMPLE (23-32) urine	OCCUPATION (34-39)	AIR FORCE BASE (68-71) Torra ion, Spain		EXPOSURE DATE	
DATE RECEIVED (37-42)	DATE ANALYZED (43-48) 12 Sep 66	DATE COUNTED 8 SEP 1966	DATE COLLECTED 13-14 Jun 66	(b) (6)	
SAMPLE WEIGHT/VOLUME 570ml		WEIGHT/VOLUME ANALYZED 350ml			
OTHER DATA checked off master list					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
RADON					
Loss Recovery 88.1%					
SUMMARY OF RESULTS: $Pu^{239} - 0.231 \pm 0.078$ % Rec-99.6 Tt Vol-570ml Body Burden-0.095 Vol anal-350ml					

AFLC FORM 1165
MAY 66

FC 5400

AFLC-WPAFB-MAY 66 4500

AFLC FORM 1165
MAY 66

FC
5400

AFLC-WPAFB-JAN 67 SM

Palomares Nuclear Weapons Accident

Dose Evaluation Report

April 28, 2000

(b) (6)

(b) (6)

FILE 160-58) P653 R

IDENTIFICATION (b) (6)		TYPE SPL. <u>URINE</u>		RHL NO. <u>675648</u>	
SOC SEC. NO. (b) (6)		SUBMITTEE <u>SGH</u>		AFB <u>P. C. 53</u>	
COLLECTED <u>05 47</u>	DATE RECD <u>6 OCT 67</u>	EXPOSURE DATE(S)	TOTAL WT OR VOL <u>1100 ml</u>	WT OR VOL ANALYZED <u>550 ml</u>	
IS DESIRED <u>239Pu</u>		TECHNICIAN (b) (6)			
TYPE OF ANALYSIS	<u>Pu 239</u>	<u>236Pu</u>	<u>α - gross</u>	<u>β part</u>	
COUNTER AND EFF	<u>Spec #4. 23</u>		<u>α - gross</u>	<u>β - gross</u>	
TOTAL CTS AND TIME	<u>200 0</u>	<u>119</u>	<u>55- 81</u>	<u>55- 123</u>	
BK CTS AND TIME	<u>200 0</u>	<u>0</u>	<u>3780-192</u>	<u>900-40</u>	
NET CTS PER MIN		<u>51 %</u>	<u>55.190</u>		<u>AVG</u>
	<u>190d67</u>	<u>5.07</u>			
1	20 22	±	33 35	43 1	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					
GR BETA SUS					
DATE CTD					
NET BETA PER 24 HR					
SAMPLE WT DIS					
SAMPLE WT SUS					
SAMPLE VOL	<u>110</u>		<u>L</u>		
RECOVERY	<u>67</u>		<u>%</u>		
ELAPSED TIME					
SYSTEMIC BODY BURDEN					
CRITICAL ORGAN BONE					
			NUCLIDE	ACTIVITY	
			<u>Pu 239</u>	<u>NDA</u>	
				<u>14 NOV 1967</u>	

AFLC FORM 1165 JUL 67

FC 5400

PREVIOUS EDITION WILL BE USED.

RADIOLOGICAL SAMPLE DATA AFLC-WPAFB-JUL 67 3M

(b) (6)

(b) (6)

70
07

FILE

Last address - 5 Dec 66

Torrington AB

APO 09 ~~223~~
253

6251

3970 SW
Letter sent 6 Dec 66

tablets of mestranol
mestranol 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

(b) (6)

(b) (6)

Fl (b) (6)
punch
is (b) (6)
>

Return after key punch

(b) (6)

5648

1. 0.00

2. 67

3. 1.10

11. —

5. 7318

6. System Error 2.00

Refused 0.00

Sample
repared
2167

Return to JF (b) (6)
after Key Punch

(b) (6)

0436

1. ~~54~~. 44.3 ± 22.2

2. 84-8

3. 1.00

April 28, 2000

(b) (6)

(b) (6)

A sample
14 Nov-67
spec #3
239 236
200. 0 142
Bkg 0 0
% rec 67.1

B sample
14 Nov-67
spec #3
239 236
200 - 61 176
Bkg - 0 0
% rec - 80.5
first 4.97

239 -

3

Letter sent 10 Jan 67 to SDFM

(b) (6)

(b) (6)

FILE

16B-5

(b) (6)

... BOTH HAVE

... 210 ...

... DELAYED ... OCT 57 ... UNDECIDED
... SERVICE ... INTERVIEWER IS THAT THEY
... LIST.

Butch sent 10 Jan 67 - to SUFMI

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

UNCLASSIFIED

ROUTINE

FILE

(b) (6)

508

S G H W	1
	2
	3
	4
	5
	6
	7
	8
	9
	10

AFTU JAW RLEOAS20298 0060057-0000--P-001A.

E RUTHON 238 0051416

ENR 00000K6ZR 001410Z JAN 67

1. 401 TAC HOSP TORREJON AB SPAIN

IN USNF RADL HEALTH LAB W PAT AFB OHIO

UNCLAS SUFMI 40011 JAN 67. FOR SGHW. SUBJECT: LONG-TERM

STUDIES ON SELECTED PARTICIPANTS OF PALOMARES INCIDENT. REFERENCE

FOR LETTERS, 6 DEC 66, SAME SUBJECT. THIS IS INFO REQUESTED IN

PARA SC. EVALUATION OF FOLLOWING INDIVIDUALS REVEALED THEY ALL HAVE

49034 MOTIVATION FOR PARTICIPATION IN SUBJECT PROGRAM: MSGT. (b) (6)

(b) (6) (b) (6) SSN (b) (6) SSGT. (b) (6) AF

(b) (6) SSN (b) (6) A1C (b) (6)

SSN (b) (6) A1C (b) (6) (b) (6) SSN (b) (6)

A1C (b) (6) SSN (b) (6) A1C (b) (6)

(b) (6) SSN (b) (6) A2C (b) (6)

(b) (6) SSN (b) (6) AND A2C (b) (6)

(b) (6) NOTE 4-11 IN-REGS ON (b) (6) AND (b) (6) BELIEVE

YOU MAY WANT TO CONSIDER FOLLOWING FACTORS ON SOME INDIVIDUALS, HOW-

EVER. A1C (b) (6) WILL SEPARATE FROM THE SERVICE IN

JUL 67. (b) (6) WILL SEPARATE FROM THE SERVICE IN DEC

UNCLASSIFIED

ROUTINE

(b) (6)

(b) (6)

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

FILE

116B-5
(b) (6)



REPLY TO
ATTN OF

SGHW

7 Dec 1967

SUBJECT

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

TO

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)

Chief

LtCol, USAF, MC

(b) (6)

DRAFT

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME (b) (6)		SSN: (b) (6)	
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Injection <input type="checkbox"/> Ingestion <input type="checkbox"/> Absorption <input type="checkbox"/> Unknown <input type="checkbox"/> Not applicable		INTAKE DATE OR PERIOD: 01/18/66 through 03/20/66 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 03/20/66 to 04/30/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain			
EVALUATION DATA:			
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Bioassay - Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Medical Treatment:			
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> 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): 62,000			
50 YR CEDE (rem): 19 (0.19 Sv)			
Organ Dose Equivalent Summary		50 YR CDE (rem/Sv)	
Bone Surface		190/1.9	
Lung		71/0.71	
Liver		35/0.35	
Red Marrow		15/0.15	
Other		3.3/0.033	
Testes		2.8/0.028	
DOSE ASSESSOR:		PEER REVIEWER:	
DATE: _____		DATE: _____	
Signature: _____		Signature: _____	
Print Name: _____		Print Name: _____	
SSN: _____		SSN: _____	
RECOMMENDATIONS:			
Additional Bioassay Required <input type="checkbox"/> Urinalysis <input type="checkbox"/> Fecal <input type="checkbox"/> In Vivo			
Suggested Sampling Frequency: _____			
Work Restrictions: N/A			

DRAFT

(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
66-2302	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	✓
67-0649	AS	02/21/67	399	0.02	0.01	✓
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:

Organ	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent (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-03/2.4E-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 Equivalent			1.9E+01/1.9E-01

(b) (6)

(b) (6)

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 ($19 \text{ rem}/0.19 \text{ Sv}$; 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:

Based on the results of intake estimates and dose calculations, this individual received an intake of 27,000 to 62,000 pCi of ^{239}Pu 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.

Prepared By:

Name: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: _____

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

AFSN: (b) (6)		INTERNAL DOSE DATA			
NAME (LAST, FIRST, M.I.) (1-20)		AIC	SOC. SEC. NO. (21-29)	TYPE SAMPLE (30)	TYPE ANAL. (31-32)
66-3210		Urine		EXPOSURE 18 Jan 66 -	
BASE (57-60)		FROM 0600 TO 0600		DATE 18 Mar 66 TYPE	
Torrejon		OCCUPATION (61-62)		REQUESTED BY	
31 May 1966		SEARCHER			
DATE RECEIVED		SAMPLE VOLUME		VOLUME ANALYZED	
31 May 1966		590 ml		590 ml	
TECHNICIAN (SIGNATURE AND DATE)					
URINE		RADON		FECES/BLOOD	
Counter Number		Chamber Number		Counter Number	
Counter Bkg. (cpm)	43 (57)	Cham. Bkg. (mv/sec)		Counter Bkg.	
Counter Eff. (%)	51	Counter Eff. (%)		Counter Eff.	
Date/Time - Start		Millivolt - Start		Date/Time - Start	
- Stop		Millivolt - Stop		- Stop	
Total Counts	19	Total Millivots		Total Counts	
Counting Time	120	Total Drift Time		Counting Time	
Gross cpm	0.16	Gross mv/sec		Gross cpm	
Bkg. Cpm	0.05	Bkg. Mv/sec		Bkg. cpm	
Net cpm	0.11	Net mv/sec		net cpm	0.19 PC
dpm/24 hr. (69-74)	0.157 ± 0.023	curies/mv		dpm	NSBB
K 40 Correction		litter (69-74)		dps/cc	
Net Dose (63-68)	0.110 ± 0.072	D(q) (63-68)		Neutron Dose (rads) (63-68)	
				uc/mg (69-74)	
				D(q) (63-68)	

74

AFSN: (b) (6)		INTERNAL DOSE DATA			
NAME (LAST, FIRST, M.I.) (1-20)		AIC	SOC. SEC. NO. (21-29)	TYPE SAMPLE (30)	TYPE ANAL. (31-32)
66-2302		Urine		EXPOSURE	
BASE (57-60)		FROM 64750 TO		DATE 18 Jan 66 TYPE	
Torrejon		OCCUPATION (61-62)		REQUESTED BY	
1 April 1966		64750			
DATE RECEIVED		SAMPLE VOLUME		VOLUME ANALYZED	
1 April 1966		900 ml		900 ml	
TECHNICIAN (SIGNATURE AND DATE)					
SSgt (b) (6)		USAF			
URINE		RADON		FECES/BLOOD	
Counter Number	2	Chamber Number		Counter Number	
Counter Bkg. (cpm)	0.14 (515)	Cham. Bkg. (mv/sec)		Counter Bkg.	
Counter Eff. (%)	51	Counter Eff. (%)		Counter Eff.	
Date/Time - Start	14 Apr 66	Millivolt - Start		Date/Time - Start	
- Stop		Millivolt - Stop		- Stop	
Total Counts	36	Total Millivots		Total Counts	
Counting Time	55	Total Drift Time		Counting Time	
Gross cpm		Gross mv/sec		Gross cpm	
Bkg. Cpm		Bkg. Mv/sec		Bkg. cpm	0.41 PC
Net cpm		Net mv/sec		net cpm	NSBB
dpm/24 hr. (69-74)	0.457 ± 0.223	curies/mv		dpm	
K 40 Correction		litter (69-74)		dps/cc	
Net Dose (63-68)	0.411 ± 0.201	D(q) (63-68)		Neutron Dose (rads) (63-68)	
				uc/mg (69-74)	
				D(q) (63-68)	

$D_e = 3.85 \times 10^{-3}$

RADIOLOGICAL SAMPLE DATA					
NAME OF REQUESTOR (1-30)		GRADE		RHL SAMPLE NUMBER	
[REDACTED]		A1C		[REDACTED]	
TYPE SAMPLE (23-32)		OCCUPATION (34-35)		ANALYSIS DESIRED	
Urine		[REDACTED]		Pu 239	
DATE RECEIVED (37-42)		DATE ANALYZED (51-56)		DATE COLLECTED	
20 Oct 66		31 Oct 66		20 Sept 66	
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED		TECHNICIAN	
1058 + 100 ACID		1015 ml		checked off list	
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
$P_{eff} = 0.129 \pm 0.083$ $P_{eff} = 2030$ $P_{eff} = 1015$ $\% Rec = 80.6$ $Body Burden =$					

AFLC FORM 1165

FC 5400

AFLC-WPAFB-MAY 66 4500

Release of this document is restricted under the provisions of the Privacy Act, 5 U.S.C. 552(a). C-1-38

[illegible]

Palomares Nuclear Weapons Accident

Dose Evaluation Report

April 28, 2000

(b) (6)

(b) (6)

IDENTIFICATION (b) (6)		TYPE SPL URINE		FILE 16B-5 FILE NO. 671504		(b) (6)		(b) (6)	
SOC. SEC. NO.		SUBMITTEE SGHW		AFB 3901 Supply Gp. EGlin AFB - P. 658					
DATE COLLECTED 30 APR 67		DATE RECD 2 MAY 67		EXPOSURE DATE(S)		SPLINT OR VOL 2800 ml / 1400 ml			
ANALYSIS DESIRED		PS 239						(b) (6)	
TYPE OF ANALYSIS		236		239					
COUNTER AND EFF		Spec #4							
TOTAL CTS AND TIME		200 / 203		200 / 0					
BK CTS AND TIME		800 / 0		800 / 0					
NET CTS PER MIN				0					
1		20 22		2		33 35		43 1	
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									
GR BETA SUS									
DATE CTD									
NET BETA PER 24 HR						NUCLIDE Pu 239 PER 24 HR		ACTIVITY NDA	
SAMPLE WT DIS						DATE CTD		11 MAY 67	
SAMPLE WT SUS									
SAMPLE VOL		2.8		LITERS					
RECOVERY		76		PER CENT					
ELAPSED TIME		454		DAYS					
SYSTEMIC BODY BURDEN		0							
CRITICAL ORGAN BONE									

OT Form, Apr 67
MCGSCPF, hbf

SAMPLE DATA

AFLC-WPAFB-APR 67 300

(b) (6)

(b) (6)

Last address . 5 Dec 66

Torreyon AB

APD 09823 - N.Y.
283

Letter sent
6 Dec 66

FILE

165-5
(b) (6)

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

(b) (6)

(b) (6)

Return to S/col (b) (6) after
key punch.
0649

1. $0.02 \pm .01$ PC
2. 118
3. 1.4
4. 402
5. 7069
6. Systemic Body Burden
Bone Critical organ 0.03

2nd Sample
Letter
prepared
3 apr.

FILE

16B-5
(b) (6)

(b) (6)

- H 976
1. 12.9 ± 8.6 PC
 2. 80.6
 3. 2.03
 4. 237
 5. 6304
 6. Systemic Body Burden
Bone Critical organ Bone 0.07

(b) (6)

Return to S/col (b) (6)
after key punch
1504

1. 0.00
2. 76
3. 2.8
4. 454
5. 7131
6. Systemic Body Burden 0.00

(b) (6)

(b) (6)

11B-5 (b) (6)
FILE

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

7 Dec 1967

REPLY TO
ATTN OF
SGHW

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

To: 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.
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 two sample bottles were sent to you and that two samples were returned for analysis.

(b) (6)
Lt Col, USAF, MC
Chief

(b) (6)

(b) (6)

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

FILE

16-5
(b) (6)



REPLY TO

ATTN 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

(b) (6)

(b) (6)

Captain, USAF, MC
Flight Medical Officer

April 28, 2000

(b) (6)

(b) (6)

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

FILE



REPLY TO

ATTN OF:

PGDF

13 107

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

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

1. It has recently come to my attention that ALC (b) (6) (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.

(b) (6)

(b) (6)

Captain, USAF, MC, FMO

Chief, Aerospace Medicine Services

(b) (6)

DRAFT

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)																																									
MODE OF INTAKE: <div style="display: flex; justify-content: space-between;"><div><input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Ingestion <input type="checkbox"/> Unknown</div><div><input type="checkbox"/> Injection <input type="checkbox"/> Absorption <input type="checkbox"/> Not applicable</div></div>		INTAKE DATE OR PERIOD: 1/24/66 through 2/14/66 on-site 1/24/66 assumed start.																																									
SUMMARY OF EXPOSURE CONDITIONS: Radionuclides/Respiratory Class/Particle Size: ²³⁹ Pu/100% Class Y/I μm AMAD Date or Period of Evaluated Data: 7 urine samples from 04/04/66 to 10/10/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain																																											
EVALUATION DATA: <table border="0" style="width: 100%;"><tr><td style="width: 30%;">Air Sampling</td><td style="width: 15%;"><input type="checkbox"/> Attached</td><td style="width: 15%;"><input type="checkbox"/> In Process</td><td style="width: 40%;"><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Health Physics Survey Data</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Bioassay – Urinalysis</td><td><input checked="" type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input type="checkbox"/> Unavailable</td></tr><tr><td> Fecal</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td> Nasal Smears</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td> In Vivo</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr></table> Medical Treatment: <table border="0" style="width: 100%;"><tr><td style="width: 30%;">Skin Decontamination:</td><td style="width: 15%;"><input type="checkbox"/> Yes</td><td style="width: 15%;"><input checked="" type="checkbox"/> No</td><td style="width: 40%;">Date: _____</td></tr><tr><td>Decorporation:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Agent: _____ Date: _____</td></tr><tr><td>Catharsis:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Agent: _____ Date: _____</td></tr><tr><td>Surgical excision:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Date: _____</td></tr></table>				Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable	Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____	Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable																																								
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____																																								
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																								
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																								
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____																																								
EVALUATION METHODOLOGY: Assumptions: Acute inhalation intake of ²³⁹ Pu, 100% Class Y, 1 μm AMAD particle size on 1/24/66 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 <table border="0" style="width: 100%;"><tr><td style="width: 50%;">Estimated Intake Activity (pCi): 63,000</td><td></td></tr><tr><td>50 YR CEDE (rem) : 19 (0.19 Sv)</td><td></td></tr><tr><td>Organ Dose Equivalent Summary</td><td>50 YR CDE (rem/Sv)</td></tr><tr><td>Bone Surface</td><td>200/2.0</td></tr><tr><td>Lung</td><td>72/0.72</td></tr><tr><td>Liver</td><td>35/0.35</td></tr><tr><td>Red Marrow</td><td>15/0.15</td></tr><tr><td>Other</td><td>3.3/0.033</td></tr><tr><td>Testes</td><td>2.8/0.028</td></tr></table>				Estimated Intake Activity (pCi): 63,000		50 YR CEDE (rem) : 19 (0.19 Sv)		Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)	Bone Surface	200/2.0	Lung	72/0.72	Liver	35/0.35	Red Marrow	15/0.15	Other	3.3/0.033	Testes	2.8/0.028																						
Estimated Intake Activity (pCi): 63,000																																											
50 YR CEDE (rem) : 19 (0.19 Sv)																																											
Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)																																										
Bone Surface	200/2.0																																										
Lung	72/0.72																																										
Liver	35/0.35																																										
Red Marrow	15/0.15																																										
Other	3.3/0.033																																										
Testes	2.8/0.028																																										
DOSE ASSESSOR:		PEER REVIEWER:																																									
DATE:		DATE:																																									
Signature: _____		Signature: _____																																									
Print Name: _____		Print Name: _____																																									
SSN: _____		SSN: _____																																									
RECOMMENDATIONS: Additional Bioassay Required <input type="checkbox"/> Urinalysis <input type="checkbox"/> Fecal <input type="checkbox"/> In Vivo Suggested Sampling Frequency: _____ Work Restrictions: N/A																																											

DRAFT

(b) (6)

(b) (6)

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.

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): ^{239}Pu .**Assumptions/Basis/Data Sources:**

Acute inhalation intake of Pu-239; 100% Class Y; 1 μm 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.

(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
66-2868	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	✓
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 Equivalent			1.9E+01/1.9E-01

Palomares Nuclear Weapons Accident

Dose Evaluation Report

April 28, 2000

(b) (6)

(b) (6)

INTERNAL DOSE DATA			
AFSN: (b) (6)		SOC. SEC. NO. (21-23) (b) (6)	
NAME (LAST, FIRST, M.I.) (1-20) (b) (6)		TYPE SAMPLE (30) Urine	
MSGT		TYPE ANAL. (31-32)	
SAMPLE NO. (33-38) 66-2868	SAMPLE DATE (39-44) FROM 0800 3 Apr TO 0800 4 Apr 66	EXPOSURE 24 Jan - DATE 14 Feb 66 TYPE	
BASE (57-60) Torrejon	OCCUPATION (61-62) Command Post Tent	REQUESTED BY	
DATE RECEIVED 22 April 1966	SAMPLE VOLUME 1500	VOLUME ANALYZED 1500	DATE ANALYZED
TECHNICIAN (SIGNATURE AND DATE)			
URINE		RADON	
Counter Number 14	Chamber Number	FECES/BLOOD	
Counter Bkg. (cpm) 1.07 (9.5)	Cham. Bkg. (mv/sec)	Counter Number	Counter Bkg.
Counter Eff. (%) 51	Counter Eff. (%)	Counter Eff.	Counter Eff.
Date/Time - Start 131145h	Millivolt - Start	Date/Time - Start	Date/Time - Start
- Stop	Millivolt - Stop	- Stop	- Stop
Total Counts 202	Total Millivots	Total Counts	Total Counts
Counting Time 35	Total Drift Time	Counting Time	Counting Time
Gross cpm 3.67	Gross mv/sec	Gross cpm 1.55 PC	Gross cpm
Bkg. Cpm 1.03	Bkg. Mv/sec	Bkg. cpm 0.4188	Bkg. cpm
Net cpm 3.64	Net mv/sec	net cpm	net cpm
dpm 2.15 ± 0.30	curies/mv	dpm	dpm
dpm/24 hr. (69-74)	litter (69-74)	dps/cc	dps/cc
K 40 Correction	D(q) (63-68)	Neutron Dose (rads) (63-68)	Neutron Dose (rads) (63-68)
Net Beta 3.22 ± 0.46		uc/mg (69-74)	uc/mg (69-74)
D(q) (63-68)		D(q) (63-68)	D(q) (63-68)
SUMMARY OF RESULTS:			

AFLC FORM MAY 66 1165

FC 5400

AFLC-WPAFB-MAY 66 4500

INTERNAL DOSE DATA			
AFSN: (b) (6)		SOC. SEC. NO. (21-23) (b) (6)	
NAME (LAST, FIRST, M.I.) (1-20) (b) (6)		TYPE SAMPLE (30) Urine	
MSGT		TYPE ANAL. (31-32) PU	
SAMPLE NO. (33-38) 66-1153	SAMPLE DATE (39-44) FROM 24 Jan 66 TO 15 Feb 66	EXPOSURE DATE 24 Jan 66 TYPE	
BASE (57-60) Torrejon	OCCUPATION (61-62) 70970	REQUESTED BY	
DATE RECEIVED 1 March 1966	SAMPLE VOLUME 710	VOLUME ANALYZED 738	DATE ANALYZED
TECHNICIAN (SIGNATURE AND DATE)			
URINE		RADON	
Counter Number	Chamber Number	FECES/BLOOD	
Counter Bkg. (cpm)	Cham. Bkg. (mv/sec)	Counter Number	Counter Bkg.
Counter Eff. (%)	Counter Eff. (%)	Counter Eff.	Counter Eff.
Date/Time - Start	Millivolt - Start	Date/Time - Start	Date/Time - Start
- Stop	Millivolt - Stop	- Stop	- Stop
Total Counts	Total Millivots	Total Counts	Total Counts
Counting Time	Total Drift Time	Counting Time	Counting Time
Gross cpm	Gross mv/sec	Gross cpm	Gross cpm
Bkg. Cpm	Bkg. Mv/sec	Bkg. cpm	Bkg. cpm
Net cpm	Net mv/sec	net cpm	net cpm
dpm	curies/mv	dpm	dpm
dpm/24 hr. (69-74)	litter (69-74)	dps/cc	dps/cc
K 40 Correction	D(q) (63-68)	Neutron Dose (rads) (63-68)	Neutron Dose (rads) (63-68)
Net Beta		uc/mg (69-74)	uc/mg (69-74)
D(q) (63-68)		D(q) (63-68)	D(q) (63-68)

(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 ^{239}Pu 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.

Prepared By:

Name: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: _____

AFLC-WPAFB-MAY 66 4500

RADIOLOGICAL SAMPLE DATA					
NAME OR REQUESTOR'S ID (1-20)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
					11, B-5 (b) (6) 66-4092 B
TYPE SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED		REQUESTED BY	AIR FORCE BASE (68-71)
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
		7 OCT 66			
SAMPLE WEIGHT/VOLUME	WEIGHT/VOLUME ANALYZED		TECHNICIAN (b) (6)		
	600 mL				
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
Pu/SpL - NDA Tot Vol - 1750 Vol ANAL - 600 % Rec - 30.9 Body Burden -					

AFLC FORM 1165 MAY 66

FC 5400

AFLC-WPAFB-MAY 66 4500

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b)
(6)

(b)
(6)

RADIOLOGICAL SAMPLE DATA					
NAME OR REQUESTOR'S ID (1-20)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
TYPE SAMPLE (23-32)		OCCUPATION (34-35)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (68-71)
DATE RECEIVED (37-42)		DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED		TECHNICIAN	
OTHER DATA		370 ML.			
IRON EXTRACTION PROC. APPLIED					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
236					
239					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
0.204 ± 0.207					
SUMMARY OF RESULTS					
<p> <i>peilspl - 710H</i> <i>Tot Vol - 1750</i> <i>Vol ANAL - 370</i> </p> <p> <i>% Rec - 44.0</i> <i>Body Burden</i> </p>					

AFLC FORM 1165

FC 5400

AFLC-WPAFB-MAY 68 4500

RADIOLOGICAL SAMPLE DATA					
OR REQUESTOR'S ID (1-20)		GRADE	SECURITY NUMBER	RHL SAMPLE NUMBER	
(b) (6)		MSGL	(b) (6)	670434 (b) (6)	
SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (66-71)	
Urine		P 239	SGHW	Torrejon AB	
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
6 80 67	15 Feb 67	28 Jan 67	66	(b) (6)	
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED			
2000 ML		1000 ML			
OTHER DATA + 100 ML Acid					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
276 239					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
276 239					
RADON					
SUMMARY OF RESULTS:					
Fui/Spl - NDA					
Tot Vol - 2.0					
Vol Anal - 1.0					
% Rec - 103.3					
Body Burden -					
15 Feb 67					

AFLC FORM 1165
MAY 68

FC 5400

AFLC-WPAFB-JAN 67 5M

RADIOLOGICAL SAMPLE DATA					
NAME OF DEPARTMENT (b) (6)		GRADE (b) (6)	AFSN (b) (6)	SOCIAL SECURITY NUMBER (b) (6)	RHL SAMPLE NUMBER (b) (6)
TYPE SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED (36-37)	REQUESTED BY (38-39)	AIR FORCE BASE (68-71)	
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED			
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
<p>Total Vol 2.46L Val anal. 1.23L</p> <p>NOA</p> <p>41 rec 87.0</p> <p>Date counted: 22 Jan 67</p>					

AFLC FORM 1165
MAY 66

FC 5400

AFLC-WPAFB-JAN 67 5M

Palomares Nuclear Weapons Accident

Dose Evaluation Report

April 28, 2000

(b) (6)

(b) (6)

(b) (6)		(b) (6)		TYPE SPL URINE		FILE NO. 675818		(b) (6)	
SUBMITTEE SG4W		AFB P-653		DATE RECD 12 OCT 67		EXPOSURE DATE(S)		TOTAL WT OR VOL 1590 ml	
WT OR VOL ANALYZED 795 ml.		ANALYSIS DESIRED 239 Pu		TECHNICIAN (b) (6)					
TYPE OF ANALYSIS ground.		239		236					
COUNTER AND EFF B-51		spec #3 25 - 25							
TOTAL CTS AND TIME 55-155		200 - 0		213					
BK CTS AND TIME 900 - 101		200 - 0		0					
NET CTS PER MIN									
		spike 4.97							
1	20	22	±	33	35	43	1	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									
GR BETA SUS									
DATE CTD									
NET BETA PER 24 HR									
SAMPLE WT DIS									
SAMPLE WT SUS									
SAMPLE VOL		1	59		L				
RECOVERY		86			%				
ELAPSED TIME									
SYSTEMIC BODY BURDEN									
CRITICAL ORGAN BONE									
						NUCLIDE Pu ²³⁹		ACTIVITY NDA	
								16 NOV 1967	

AFLC FORM 1165

FC 5400

PREVIOUS EDITION WILL BE USED.

RADIOLOGICAL SAMPLE DATA AFLC-WPAFB-JUL 67 3M

(b) (6)

(b) (6)

2 no sample letter
3 April
prepared

Plutonium to T/Cd
after key punch
2156

1. 0.00
2. 87.0
3. 2.46
4. —
5. 71.63
6. Systemic Body Burden 0.00

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

For address - 5 Dec 66
Lorajin AB
APO 09005, N.Y.
283
Letter sent 6 Dec 66

11.5.5

(b) (6)

(b) (6)

Return to FICO (b) (6)
after key punch
(b) (6)
670434

1. 0.00
2. 103.3
3. 2.0
4. 378
5. 7046
6. 0.00

Return after key punch
(b) (6)
5818

1. 0.00
2. 86
3. 1.59
4. —
5. 7320
6. Systemic Code Reader
0.00

(b) (6)
4097

1. 0.00
2. 30.9
3. 1.75
4. 156
5. Discard 6280
6. 0.00

Discard previous
results.

- (b) (6)
4097
20 ± .21 PCI
1. ~~204 ± .21~~ PCI
 2. 44.0
 3. 1.75
 4. 146
 5. 6290
 6. 0.08

April 28, 2000

(b) (6)

(b) (6)

FILE 16-5-3

(b)

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



REPLY TO
ATTN OF

SGHW

7 Dec 1967

SUBJECT

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

TO

MSgt (b) (6)
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.

(b) (6)

(b) (6)

LtCol, USAF, MC

Chief

April 28, 2000

(b) (6)

(b) (6)

28 Jul 67

FILE (b) (6) 22 Copy

PERMANENT CHANGE OF STATION ORDER — MILITARY			
(Items preceded by an asterisk for overseas only.) (If more space is required, continue on reverse.)			
2. GRADE, LAST NAME, FIRST, MIDDLE INITIAL, AFSC MSGT (b) (6)		3. SHIPPING AFSC (Officer) 70590	4. CAFSC (Airmen) 70590
4. UNIT, MAJOR AIR COMMAND AND ADDRESS OF UNIT FROM WHICH BELIEVED 401 Tac Ftr Wg (USAFE) APO New York 09283		7. UNIT MAJOR AIR COMMAND AND ADDRESS OF UNIT TO WHICH ASSIGNED AND DUTY STATION IF APPROPRIATE Keesler Tech Tng Center (ATC) Keesler AFB, Miss 39534	
9. REPORT 1. C. MOR. NEW ASSIGNMENT NLT		10. (Reassignment from overseas unit to CONUS unit only.) REPORT AT NEW ASSIGNMENT NLT 34 DAYS AFTER DEPARTURE FROM CONUS PORT OF ENTRY UNIT	11. DALYF YES
12. TDY EN ROUTE (Indicate Location or unit and address.)		13. PURPOSE OF TDY	14. SECURITY CLEARANCE FOR PERIOD OF TDY OR COURSE OF INSTRUCTION
15. LEAVE ADDRESS c/o Mrs (b) (6) Main St Flanders, NJ		16. TDY REPORTING DATE	17. APPROXIMATE NO. OF DAYS
18. NEW MAILING ADDRESS (Use upon completion of TDY, if appropriate.)		19. DURATION OF COURSE (If reassignment is to attend course of instruction.)	
20. CONCURRENT TRAVEL OF DEPENDENTS IS NOT AUTHORIZED		21. TRAVEL OF DEPENDENTS TO A DESIGNATED POINT IS NOT AUTHORIZED	
22. CONCURRENT TRAVEL OF DEPENDENTS IS NOT AUTHORIZED		23. AUTHORITY FOR CONCURRENT TRAVEL AFM 75-4	
24. TRAVEL TIME WILL BE COMPUTED PER CHAPTER 1, PARAGRAPH 1022, AFM 39-11 TPA WITH 4 DAYS TRAVEL TIME		25. POUNDS BAGGAGE, INCLUDING EXCESS IS AUTHORIZED	
26. MODES OF TRANSPORTATION AUTHORIZED FOR OVERSEAS TRAVEL A. <input checked="" type="checkbox"/> MILITARY AIRCRAFT B. <input type="checkbox"/> COMMERCIAL AIRCRAFT (Category Z) C. <input type="checkbox"/> MILITARY AND COMMERCIAL VESSEL D. <input type="checkbox"/> COMMERCIAL AIRCRAFT OR VESSEL (Also foreign registry if US registry is not available) RAIL OR BUS WITHIN OVERSEAS AREAS		27. REPORT AT HATS PASSENGER SERVICE COUNTER TORRE JON AB, SPAIN <input type="checkbox"/> McGUIRE AFB <input type="checkbox"/> TRAVIS AFB <input type="checkbox"/> McCHORD AFB <input type="checkbox"/> CHARLESTON AFB	
28. PRIOR TO TRAVEL COMPLY WITH AFM 75-4.		29. WHILE ON LEAVE OVERSEAS COMPLY WITH AFM 35-22, AND CHAPTER 1, AFM 35-10.	
30. PCS ACCOMPANIED—contact your last commander immediately for instructions before reporting to port. In the event of general war or if the CONUS is attacked report to the nearest active Air Force Installation as soon as possible.			
31. REMARKS PCS Code J. Orders will be indorsed to include port call data.			
32. AUTHORITY, AFM 39-11 & Line Nr: G27681		33. DATE 31 May 1967	34. SPECIAL ORDER NO. AA-600
35. DESIGNATION AND LOCATION OF HEADQUARTERS DEPARTMENT OF THE AIR FORCE HQ 401st TACTICAL FIGHTER WING (USAFE) APO NEW YORK 09283		36. PCS EXPENSE CHARGEABLE TO 5773500 327 P577.92 1200 2100 2200 S503725 5783500 328 P577.02 1200 2100 2200 S503725 (b) (6) 4 5 748 5776 503725 44. TDY EXPENSE CHARGEABLE TO 4 5 848 5776 503725	
37. DISTRIBUTION "A"		38. SIGNATURE FOR THE COMMANDER (b) (6) Capt, USAF Asst Chief of Admin Services	

AF FORM 899

* U. S. GOVERNMENT PRINTING OFFICE: 1964-550-889

(b) (6)

(b) (6)

FILE

67. (b) (6) AND (b) (6) BOTH HAVE

PAGE FOUR 1238 UNCLAS

SIMULTANEOUS DEPOS AND SEPARATION DATES OF OCT 67, BUT ARE UNDECIDED

ABOUT REMAINING IN SERVICE. OPINION OF INTERVIEWER IS THAT THEY

PROBABLY WILL NOT REENLIST.

BT

67-1238-62650

ROUTINE 923

(b) (6)

C I N F O R M A T I O N	1977	SCAM
	REFERENCE	
	LECTED IN	

DECLASSIFIED ROUTINE

(b) (6)

(b) (6)

(b) (6)

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 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 µm 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

(b) (6)

(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
66-1394	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 Intestine	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
Upper Large Intestine	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
Small Intestine	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
Effective Dose 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

(b) (6)

(b) (6)

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 to 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:

The results of intake estimates and dose calculations indicate an intake of about 560,000 to 2,600,000 pCi of ^{239}Pu 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.

Prepared By:

Name: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: _____

MAR 9 1966

INTERNAL DOSE DATA			
AFSN: (b) (6)		SOC. SEC. NO. (21-29)	TYPE ANAL. (31-32)
(b) (6)		(b) (6)	GROSS ALPHA
SAMPLE NO. (33-38)		TYPE SAMPLE (30)	EXPOSURE
46-1394		URINE	
DATE RECEIVED	FROM 28 FEB 66 TO (144)	DATE 6 Feb 66	TYPE
BASE (57-60)	OCCUPATION (61-62)	REQUESTED BY	
MORIN	64550		
DATE RECEIVED	SAMPLE VOLUME	VOLUME ANALYZED	DATE ANALYZED
9 MAR 66	880	9/6	
TECHNICIAN (SIGNATURE AND DATE)			
URINE		RADON	
Counter Number	A	Chamber Number	FECEs/BLOOD
Counter Bkg. (cpm)	0.13	Cham. Bkg. (mv/sec)	Counter Number
Counter Eff. (%)	51	Counter Eff. (%)	Counter Bkg.
Date/Time - Start	6 APR 1966	Millivolt - Start	Counter Eff.
- Stop		Millivolt - Stop	Date/Time - Start
Total Counts	185	Total Millivots	- Stop
Counting Time	100	Total Drift Time	Total Counts
Gross cpm	1.85	Gross mv/sec	Counting Time
Bkg. Cpm	0.13	Bkg. Mv/sec	Gross cpm
Net cpm	1.72	Net mv/sec	Bkg. cpm
dpm	3.37	curies/mv	net cpm
dpm/24 hr (63-74)	1.17	litter (69-74)	dpm
K 40 Correction	1.03	D(q) (63-68)	dps/cc
Net Beta-p/ Sample			Neutron Dose (rads) (63-68)
D(q) (63-68)			uc/mg (69-74)
			D(q) (63-68)

corrected for spike
DR = .004 micro curies

RADIOLOGICAL SAMPLE DATA					
NAME OR REQUESTOR'S ID (1-20) (b) (6)		GRADE A1C	LEG (b) (6)	SOCIAL SECURITY NUMBER (b) (6)	RHL # 063917
TYPE SAMPLE (23-32) Urine	OCCUPATION (34-38) Py 239	ANALYSIS DESIRED	REQUESTED BY SCHW	AIR FORCE BASE (60-71) Moron AB Spain	
DATE RECEIVED (37-42) 26 Sept 66	DATE ANALYZED (51-56) 26 Sept 66	DATE COUNTED 26 Sept 66	DATE COLLECTED 22 Jun 66	EXPOSURE DATE	
SAMPLE WEIGHT/VOLUME 1000 mL	WEIGHT/VOLUME ANALYZED 500 mL				
OTHER DATA checked off master list					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
RADON					
SUMMARY OF RESULTS: $pc/sr = 0.393 \pm 0.187$ $\% R.F. = 36.1$ 68.4% Rec					
DET. VPL = 1000 ML					
VOL. ANAL. = 500 ML					
AFLC FORM 1165 MAY 66 FC 5400					
AFLC-WPAFB-MAY 66 4500					

AFLC FORM 1165
MAY 66

FC
5400

AFLC-WPAFB-MAY 66 4500

(b) (6)

(b) (6)

¹⁴⁶⁵⁻⁵
FILE
Last address - 5 Dec 66
~~Last add~~
Moins AB
APONY 09872
09252
3973 Supply
Letter sent 6 Dec 66

¹⁴⁶⁵⁻⁵ (b) (6)
FILE (b) (6)
3917
1. 3917 ± 18 Pico
2. 68.4
3. 28 1.00
4. 148
5. 6264
6. Systemic Body Burden
Critical Organ Bone 0.16

¹⁴⁶⁵⁻⁶ (b) (6)
FILE
2nd Sample
Letter
prepared
3 Apr 67

(b) (6)

(b) (6)

FILE

166-5-6

(b)

(6)

Follow-up TWX
sent on 7 Mar 67
as sample was not received

April 28, 2000

(b) (6)

(b) (6)

UNCLASSIFIED

ROUTINE

25 MAR 67 20H

1000
RFTU JAW 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.

BT

UNCLAS SUA1 01995 DEC 66

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

1. A2C (b) (6) SSN (b) (6) : DISCHARGED
FROM THE SERVICE; HOME ADDRESS IS RACCOON, KENTUCKY.
2. A2C (b) (6) SSN (b) (6) : HAS DEPARTED
PCS TO 810TH STRAT AEROSPACE DIV, MINOT AFB, N. DAK.
3. A1C (b) (6) SSN (b) (6) 7473 MATRON,
APO NEW YORK 09282: STATIONED AT THIS BASE AND HAS CONSENTED TO
SUBMIT REQUIRED SPECIMENS UNTIL PROJECTED DOS: 1 JUN 67.

BT

Both sent 10 Jun 67 - to SUA1

NNNN#

UNCLASSIFIED

ROUTINE

01:

(b) (6)

DRAFT

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)	
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Injection <input type="checkbox"/> Ingestion <input type="checkbox"/> Absorption <input type="checkbox"/> Unknown <input type="checkbox"/> Not applicable		INTAKE DATE OR PERIOD: 01/29/66 through 02/19/66 on-site 1/29/66 assumed start.	
SUMMARY OF EXPOSURE CONDITIONS: Radionuclides/Respiratory Class/Particle Size: $^{239}\text{Pu}/100\%$ 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:			
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Bioassay - Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Medical Treatment:			
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
EVALUATION METHODOLOGY:			
Assumptions: Acute inhalation intake of ^{239}Pu , 100% Class Y, 1 μm AMAD particle size on 1/29/66			
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): 65,000			
50 YR CEDE (rem): 20 (0.20 Sv)			
Organ Dose Equivalent Summary		50 YR CDE (rem/Sv)	
Bone Surface		200/2.0	
Lung		74/0.74	
Liver		36/0.36	
Red Marrow		16/0.16	
Other		3.4/0.034	
Testes		2.9/0.029	
DOSE ASSESSOR:		PEER REVIEWER:	
DATE: _____		DATE: _____	
Signature: _____		Signature: _____	
Print Name: _____		Print Name: _____	
SSN: _____		SSN: _____	
RECOMMENDATIONS:			
Additional Bioassay Required <input type="checkbox"/> Urinalysis <input type="checkbox"/> Fecal <input type="checkbox"/> In Vivo			
Suggested Sampling Frequency: _____			
Work Restrictions: N/A			

DRAFT

(b) (6)

(b) (6)

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 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.

(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
66-3129	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		✓
67-3682	AS	08/06/67	554	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	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 Equivalent			2.0E+01/2.0E-01

(b) (6)

(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:

Based on the results of intake estimates and dose calculations, this individual received an intake of 65,000 to 790,000 pCi of ^{239}Pu 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.

Prepared By:

Name: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: _____

(b) (6)

(b) (6)

AFSN: (b) (6)		INTERNAL DOSE DATA	
NAME (LAST, FIRST, M.I.) (1-20)		SOC. SEC. NO. (21-29)	TYPE SAMPLE (30)
(b) (6) A2C		(b) (6)	Urine
SAMPLE NO. (33-38)		SAMPLE DATE (39-44)	EXPOSURE DATE
66-1194		FROM 29 Jan 66 TO 19 Feb 66	29 Jan 66
BASE (57-60)		OCCUPATION (61-62)	REQUESTED BY
San Pablo		30450	
DATE RECEIVED		SAMPLE VOLUME	VOLUME ANALYZED
3 March 1966		710 ml	738 ml
TECHNICIAN (SIGNATURE AND DATE)			
URINE		RADON	
Counter Number		Chamber Number	
Counter Bkg. (cpm)		Cham. Bkg. (mv/sec)	
Counter Eff. (%)		Counter Eff. (%)	
Date/Time - Start		Millivolt - Start	
- Stop		Millivolt - Stop	
Total Counts		Total Millivots	
Counting Time		Total Drift Time	
Gross cpm		Gross mv/sec	
Bkg. Cpm		Bkg. Mv/sec	
Net cpm		Net mv/sec	
dpm		curies/mv	
dpm/24 hr. (69-74)		litter (69-74)	
K 40 Correction		D(q) (63-68)	
Net Beta			
D(q) (63-68)			

AFSN: (b) (6)		INTERNAL DOSE DATA	
NAME (LAST, FIRST, M.I.) (1-20)		SOC. SEC. NO. (21-29)	TYPE SAMPLE (30)
(b) (6) A2C		(b) (6)	Urine
SAMPLE NO. (33-38)		SAMPLE DATE (39-44)	EXPOSURE DATE
66-9129		FROM Not Submitted TO	29 Jan 66 - 19 Feb 66
BASE (57-60)		OCCUPATION (61-62)	REQUESTED BY
San Pablo		30450	9
DATE RECEIVED		SAMPLE VOLUME	VOLUME ANALYZED
17 May 1966		990 ml	990 ml
TECHNICIAN (SIGNATURE AND DATE)			
SSgt W G Edwards		USAF	2 JUN 1966
URINE		RADON	
Counter Number	D	Chamber Number	
Counter Bkg. (cpm)	21 (894)	Cham. Bkg. (mv/sec)	
Counter Eff. (%)	51	Counter Eff. (%)	
Date/Time - Start	2 Jan 66	Millivolt - Start	
- Stop		Millivolt - Stop	
Total Counts	66	Total Millivots	
Counting Time	120	Total Drift Time	
Gross cpm		Gross mv/sec	
Bkg. Cpm		Bkg. Mv/sec	
Net cpm		Net mv/sec	
dpm		curies/mv	
dpm/24 hr. (69-74)		litter (69-74)	
K 40 Correction		D(q) (63-68)	
Net Beta			
D(q) (63-68)			

RADIOLOGICAL SAMPLE DATA							
NAME OR REQUESTOR'S ID (1-20)		GRADE		SCALY READOUT NUMBER		RHL	
(b) (6)		A2C		(b) (6)		663826	
TYPE SAMPLE (23-32)		OCCUPATION (34-35)		ANALYSIS DESIRED		REQUESTED BY	
Urine		Pu 239		SGHW		AIR FORCE BASE (66-7)	
DATE RECEIVED (37-42)		DATE ANALYZED (51-56)		DATE COUNTED		DATE COLLECTED	
14 Sep 66		13 SEP 1966		13 SEP 1966		EXPOSURE DATE	
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED		(b) (6)			
2000ml		1150ml					
OTHER DATA							
checked off master list							
ENVIRONMENTAL SAMPLES							
COUNTER & EFFICIENCY							
TOTAL COUNTS & MINUTES							
GROSS CPM							
BKG CPM & MINUTES							
NET CPM							
YIELD							
BIOLOGICAL SAMPLES							
COUNTER & EFFICIENCY							
TOTAL COUNTS & MINUTES							
GROSS CPM							
BKG CPM & MINUTES							
NET CPM							
YIELD							
RADON							
51							
55							
5806							
225							
%Rec = 90.4							
SUMMARY OF RESULTS:							
$P_{1/2} = 0.209 \pm 0.097$ Tot Vol - 2000 Vol Anal - 1150 %Rec = 59.2 Body Burden = 0.080							

AFLC FORM MAY 66 1165

FC 5400

AFLC-WPAFB-MAY 66 4500

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

AFLC-WPAFB-MAY 66 4500

RADIOLOGICAL SAMPLE DATA					
NAME (b) (6)		GRADE 42C	ANALYSIS DESIRED (b) (6)		REQUESTED BY (b) (6)
TYPE SAMPLE (23-32) URINE		OCCUPATION (34-35) PU 297	AIR FORCE BASE (88-71)		EXPOSURE DATE
DATE RECEIVED (37-42) 12 DEC 67	DATE ANALYZED (51-56)	DATE COUNTED 25 APR 67	DATE COLLECTED 10-11 APR 67	TECHNICIAN (b) (6)	
SAMPLE WEIGHT/VOLUME 2460 ml	WEIGHT/VOLUME ANALYZED 1230 ml				
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY Spec #4					
TOTAL COUNTS & MINUTES 400					
GROSS CPM					
BKG CPM & MINUTES 800					
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
Activity Per 24 hr sp		NDA		To rec = 85.7	
Total Vol = 2.48 L				Body Burden =	
Vol Anal = 1.23 L				Date Counted = 25 APR 67	

AFLC FORM MAY 66 1165

FC 5400

AFLC-WPAFB-MAY 66 4500

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

Palomares Nuclear Weapons Accident

Dose Evaluation Report

April 28, 2000

(b) (6)

(b) (6)

(b) (6)

IDENTIFICATION		SUBMITTEE		TYPE SPL		AFB	
(b) (6)		SGHW		URINE		SAN PABLO SPAIN	
DATE COLLECTED	DATE RECD	EXPOSURE DATE(S)		TOTAL WT OR VOL		WT OR VOL ANALYZED	
16 AUG 67	9 AUG 67			2820 ml		1410 ml	
ANALYSIS DESIRED		239Pu (b) (6)					
TYPE OF ANALYSIS	IS	239	236				
COUNTER AND EFF	#4-24						
TOTAL CTS AND TIME	200- 1	167					
BK CTS AND TIME	800- 0	0					
NET CTS PER MIN							
spike value		5.25 dpm					
I	20	22	±	33	35	43	1
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							
GR BETA SUS							
DATE CTD							
NET BETA PER 24 HR							
SAMPLE WT DIS							
SAMPLE WT SUS							
SAMPLE VOL							
RECOVERY	66			%			
ELAPSED TIME							
SYSTEMIC BODY BURDEN							
CRITICAL ORGAN BONE							

AFLC FORM 1165 JUL 67

FC 5400

PREVIOUS EDITION WILL BE USED.

RADIOLOGICAL SAMPLE DATA AFLC-WPAFB-JUL 67 3M

(b) (6)

(b) (6)

FILE 116-54
(b) (6)
Last address 5 Dec 66
San Pablo, AB Spain
870 Med Hqs
APO NY 09284
Letter sent 6 Dec 66
Letter sent to
1522 N-67th East Ave
Tulsa, Okla - on 3 Jan 67

(b) (6)

$\frac{3826}{209 \pm 97.4}$
1. $0.209 \pm .097$
2. 59.2
3. 2.0 **FILE**
4. 132 116-54
(b) (6)
5. 6256
6. 0.08

April 28, 2000

(b) (6)

(b) (6)

Return to SIC
after key punch

(b) (6)

(b) (6)

0317

FILE

1. 0.00
2. 104
3. 1.66
4. 365
5. 7044
6. 0.00

FILE

Return after
key punch
3682

1. 0.00
2. 66
3. 2.82
4. —
5. 7241
6. Systemic Body Burden 0.00

2nd sample
water prepared

3aps

FILE

11.2.5

(b) (6)

Return to SIC all and
when key punched

Urine - 2

1266 Col 653

FILE

11.2.5

(b) (6)

1. 0.00
2. 85.7
3. 2.46
4. —
5. 7115
6. Systemic Body Burden 0.00

(b) (6)

(b) (6)

UNCLASSIFIED

ROUTINE

FILE 16-51

(b) (6)

10

1000
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

BT

UNCLAS SUA1 01995 DEC 66

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

1. A2C (b) (6) SSN (b) (6) DISCHARGED

FROM THE SERVICE; HOME ADDRESS IS RACCOON, KENTUCKY.

2. A2C (b) (6) SSN (b) (6) HAS DEPARTED

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

3. A1C (b) (6) SSN (b) (6) 7473 MATRON,

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

BT

NNNN#

UNCLASSIFIED

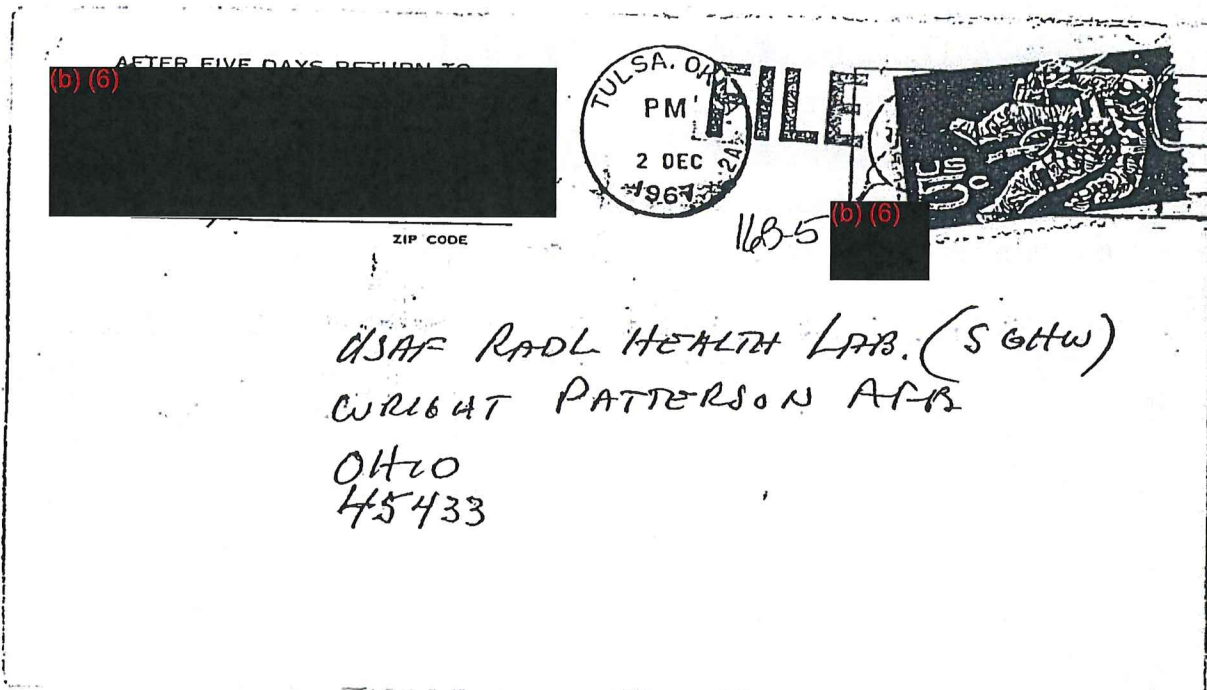
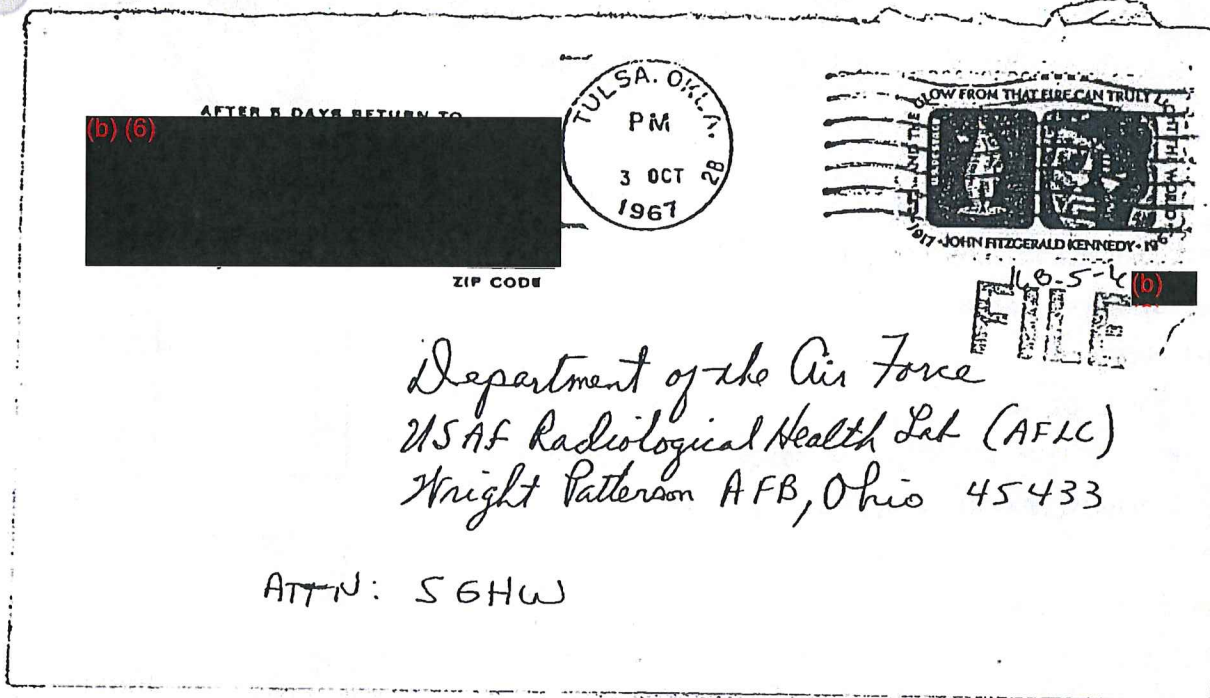
ROUTINE

012

April 28, 2000

(b) (6)

(b) (6)



(b) (6)

(b) (6)

2 DEC 1967
TULSA, OKLA.

USAF RADL HEALTH LAB. (SGHW)
WRIGHT PATTERSON AFB, OHIO 45433

FILE

163.5 (b) (6)

DEAR SIR:

THIS IS TO INFORM YOU OF MY NEW
MAILING ADDRESS, IN RELATION TO THE
PALOMARES PROGRAM.

I AM NOW RESIDING AT

(b) (6)

yours truly

(b) (6)

April 28, 2000

(b) (6)

(b) (6)

(b) (6)

Dept. of the Air Force
USAF Radl. Health Lab (AFLC)
Wright Patterson AFB, Ohio 45433

Attn: SGHW

148-5 (b) (6)
FILE

Dear Sir:

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

at (b) (6)
(b) (6)

Very Truly yours,

(b) (6)

(b) (6)

(b) (6)

FILE 168-5-1 (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.

Signed:-

(b) (6)

(b) (6)

Present Address:

(b) (6)

Booth sent 12 Feb 67

April 28, 2000

(b) (6)

(b) (6)

FILE

160-5-1

(b) (6)

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



7 Dec. 1967

REPLY TO
ATTN OF

SGHW

SUBJECT

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

TO

Mr. (b) (6)

(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 you, and that three samples were returned for analysis.

(b) (6)

(b) (6)

LtCol, USAF, MC

Chief

(b) (6)

DRAFT

April 2001

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)																									
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Ingestion <input type="checkbox"/> Unknown <input type="checkbox"/> Injection <input type="checkbox"/> Absorption <input type="checkbox"/> Not applicable		INTAKE DATE OR PERIOD: 01/18/66 through 02/06/66 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: 3 urine samples from 02/06/66 to 02/28/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain																											
EVALUATION DATA: <table border="0"><tr><td>Air Sampling</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Health Physics Survey Data</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Bioassay - Urinalysis</td><td><input checked="" type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input type="checkbox"/> Unavailable</td></tr><tr><td>Fecal</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Nasal Smears</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>In Vivo</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr></table> Medical Treatment: Skin Decontamination: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Date: _____ Decorporation: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Agent: _____ Date: _____ Catharsis: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Agent: _____ Date: _____ Surgical excision: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Date: _____				Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Bioassay - Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable	Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																								
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																								
Bioassay - Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable																								
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																								
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																								
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																								
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): 160,000 50 YR CEDE (rem): 49 (0.49 Sv) <table border="0"><tr><td>Organ Dose Equivalent Summary</td><td>50 YR CDE (rem/Sv)</td></tr><tr><td>Bone Surface</td><td>500/5</td></tr><tr><td>Lung</td><td>180/1.8</td></tr><tr><td>Liver</td><td>89/0.89</td></tr><tr><td>Red Marrow</td><td>39/0.39</td></tr><tr><td>Other</td><td>8.5/0.085</td></tr><tr><td>Testes</td><td>7.1/0.071</td></tr></table>				Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)	Bone Surface	500/5	Lung	180/1.8	Liver	89/0.89	Red Marrow	39/0.39	Other	8.5/0.085	Testes	7.1/0.071										
Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)																										
Bone Surface	500/5																										
Lung	180/1.8																										
Liver	89/0.89																										
Red Marrow	39/0.39																										
Other	8.5/0.085																										
Testes	7.1/0.071																										
DOSE ASSESSOR:		PEER REVIEWER:																									
DATE: _____		DATE: _____																									
Signature: _____		Signature: _____																									
Print Name: _____		Print Name: _____																									
SSN: _____		SSN: _____																									

RECOMMENDATIONS:

Additional Bioassay Required

☐ Urinalysis☐ Fecal☐ In Vivo

Suggested Sampling Frequency: _____

Work Restrictions: N/A

DRAFT

(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
66-521	G	02/06/66	19	2.59	0.81	
66-4909B	AS	09/28/66	253	0.225	0.125	✓
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)
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
Lung	1.8E+02/1.8E+00	1.2E-01	2.2E+01/2.2E-01
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 Equivalent			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 of 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 ^{239}Pu 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 10 1966

INTERNAL DOSE DATA					
NAME (LAST, FIRST, M.I.) (1-20) (b) (6)		SOC. SEC. NO. (21-29) (b) (6)		TYPE SAMPLE (30) URINE	
SAMPLE NO. (33-38) 66-521		SAMPLE DATE (39-44) FROM: 8 FEB 1966 TO: 8 JAN 1966		EXPOSURE DATE 8 JAN 1966 TYPE	
BASE (57-60) MORON AB, SPAIN		OCCUPATION (61-62) REQUESTED BY			
DATE RECEIVED FEB 10 1966		SAMPLE VOLUME 625 ml		VOLUME ANALYZED 200 ml	
TECHNICIAN (SIGNATURE AND DATE) (b) (6)		15 FEB 1966			
URINE		SSGT.		FECES/BLOOD	
Counter Number	C	Chamber Number		Counter Number	
Counter Bkg. (cpm)	0.13	Cham. Bkg. (mv/sec)		Counter Bkg.	
Counter Eff. (%)	51	Counter Eff. (%)		Counter Eff.	
Date/Time - Start	15 FEB 1966	Millivolt - Start		Date/Time - Start	
- Stop		Millivolt - Stop		- Stop	
Total Counts	59	Total Millivots		Total Counts	
Counting Time	55	Total Drift Time		Counting Time	
Gross cpm	1.07	Gross mv/sec		Gross cpm	
Bkg. Cpm	0.13	Bkg. Mv/sec		Bkg. cpm	
Net cpm	0.94	Net mv/sec		net cpm	
dpm/cc	4.15 ± 1.30	curies/mv		dpm	
dpm/24 hr. (69-74)		litter (69-74)		dps/cc	
K 40 Correction		D(q) (63-68)		Neutron Dose (rads) (63-68)	
Net Beta	2.59 ± 0.81	uc/mg (69-74)		uc/mg (69-74)	
D(q) (63-68)		D(q) (63-68)		D(q) (63-68)	

$D_R = 1.52 \times 10^{-4} \text{ sec}$ 34

17 Feb 66

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

RADIOLOGICAL SAMPLE DATA																	
NAME OR REQUESTOR'S ID (1-20) <i>P</i>		GRADE <i>A2C</i>	AFSN <i>(b)(6)</i>	SOCIAL SECURITY NUMBER <i>(b)(6)</i>	RHL SAMPLE NUMBER <i>56-909</i>												
TYPE SAMPLE (23-32) <i>Urine</i>	OCCUPATION (34-35) <i>P 239</i>	ANALYSIS DESIRED <i>P 239</i>	REQUESTED BY <i>SGHW</i>	AIR FORCE BASE (68-71) <i>MAFB MINOT AFS</i>													
DATE RECEIVED (37-42) <i>12 Sept 66</i>	DATE ANALYZED (51-56)	DATE COUNTED <i>21 Oct 66</i>	DATE COLLECTED <i>28 Sept 66</i>	EXPOSURE DATE <i>Feb Apr 66 Spain</i>													
SAMPLE WEIGHT/VOLUME <i>1300 ml</i>	WEIGHT/VOLUME ANALYZED <i>650 ml</i>		TECHNICIAN														
OTHER DATA																	
ENVIRONMENTAL SAMPLES																	
COUNTER & EFFICIENCY																	
TOTAL COUNTS & MINUTES																	
GROSS CPM																	
BKG CPM & MINUTES																	
NET CPM																	
YIELD																	
BIOLOGICAL SAMPLES																	
COUNTER & EFFICIENCY																	
TOTAL COUNTS & MINUTES																	
GROSS CPM																	
BKG CPM & MINUTES																	
NET CPM																	
YIELD																	
RADON																	
<table border="1"> <tr> <td><i>236</i></td> <td><i>238</i></td> <td><i>239</i></td> </tr> <tr> <td><i>500</i></td> <td><i>23.8</i></td> <td><i>12</i></td> </tr> <tr> <td><i>100 - 55</i></td> <td></td> <td><i>3.41</i></td> </tr> <tr> <td><i>800</i></td> <td><i>0</i></td> <td><i>0</i></td> </tr> </table>						<i>236</i>	<i>238</i>	<i>239</i>	<i>500</i>	<i>23.8</i>	<i>12</i>	<i>100 - 55</i>		<i>3.41</i>	<i>800</i>	<i>0</i>	<i>0</i>
<i>236</i>	<i>238</i>	<i>239</i>															
<i>500</i>	<i>23.8</i>	<i>12</i>															
<i>100 - 55</i>		<i>3.41</i>															
<i>800</i>	<i>0</i>	<i>0</i>															
SUMMARY OF RESULTS: <i>recount</i>																	

AFLC FORM MAY 66 1165

FC 5400

AFLC-WPAFB-MAY 66 4500

RADIOLOGICAL SAMPLE DATA					
NAME OR REQUESTOR'S ID (1-20)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
					664909-B
TYPE SAMPLE (23-32)	OCCUPATION (34-38)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (88-71)	
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
12 Sept 66	29 Nov 66	30 Oct 66			
SAMPLE WEIGHT/VOLUME	WEIGHT/VOLUME ANALYZED		TECHNICIAN		
1300 ml	650 ml		(b) (6)		
OTHER DATA					
Checked off Locount 23 Nov 66					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY			236	239	
TOTAL COUNTS & MINUTES			24.3	4	
GROSS CPM			200-48		
BKG CPM & MINUTES			800-2	2	
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY			236	239	
TOTAL COUNTS & MINUTES			24.3	4	
GROSS CPM			200-48		
BKG CPM & MINUTES			800-2	2	
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
<p>Pci/spl = 0.225 ± 0.125</p> <p>Tot Vol = 1.30 L</p> <p>Vol anal = .65 L</p> <p>%Pc = 61.8</p> <p>Body Burden = 0.09</p> <p>Date Counted = 23 Nov 66</p>					

AFLC FORM MAY 66 1165

FC 5400

AFLC-WPAFB-MAY 66 4500

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

April 28, 2000

RADIOLOGICAL SAMPLE DATA					
OR REQUESTOR'S ID (1-20)		GRADE	AESH	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
(b) (6)		A1C	(b) (6)	(b) (6)	(b) (6)
TYPE SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (68-71)	
8 Mar 67		Pu 239	SGHW	Minot AFB, ND	
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
8 Mar 67		16 Mar 67	20 Feb 67		
SAMPLE WEIGHT/VOLUME	WEIGHT/VOLUME ANALYZED		TECHNICIAN		
870 ml	4.35 ml		(b) (6)		
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
activity Pu-239 sp/ 0.03 ± 0.02 pc					
Total Vol = 0.87 L.					
Vol anal = 0.44					
To rec = 109					
Body Burden:					
Date Counted = 16 Mar 67					

AFLC FORM 1165

FC 5400

AFLC-WPAFB-JAN 67 5M

(b) (6)

(b) (6)

2nd Sample
letter
prepared
3 Apr 67

Code as 653

4909

1. 225 ± 125 fpm

2. 61.8

3. 1.3

4. 150

5. 6327

6. Systemic Body Burden
Bar critical organ 0.09

FILE

110-5-7 (b) (6)

FILE

Letter address - 5 Dec 66

Minot AFB, N. Dak

Letter sent 6 Dec 66

Letter sent to Minot

on 5 Jan 67

Second letter to Minot

on 19 Jan 67

Return to F/Col
After Key Punch
0699

1. 0.03 ± 0.02 PC

2. 108

3. 0.87

4. 409

5. 7075

6. Systemic Body Burden
Bar critical organ 0.02

FILE

110-5-7 (b) (6)

(b)
(6)

(b)
(6)

USAF RADIOLOGICAL HEALTH LAB (SGHW)
WRIGHT-PATTERSON AFB OHIO 45433

UNITED STATES AIR FORCE
OFFICIAL BUSINESS

FILE 118-3
AIR MAIL

*Unknown
No Such # 20011*

Sgt (b) (6)
810 Strat Aerospace Division
Minot AFB NDak 58701
(b) (6)

Received Unsealed at 23226

POSTAGE AND FEES PAID
DEPARTMENT OF THE AIR FORCE

REASON FOR NOT DELIVERED
☒ Not claimed
☒ Unknown
☐ Insufficient address
☐ Moved, left no address
☐ No such street number
☐ Unreadable
☐ Refused
☐ Other

UNDELIVERED NO. 6

(b) (6)

(b) (6)

UNCLASSIFIED

ROUTINE

FILE

(b) (6)

116-5
SGHW

11-13-66 20 26

1000
RFTU JAW 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.

BT

UNCLAS SUA1 01995 DEC 66

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

1. A2C (b) (6) SSN (b) (6) DISCHARGED

FROM THE SERVICE; HOME ADDRESS IS (b) (6)

2. A2C (b) (6) SSN (b) (6) HAS DEPARTED

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

3. A1C (b) (6) SSN (b) (6) 7473 MATRON,

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

BT

NNNN#

UNCLASSIFIED

ROUTINE

01

(b) (6)

(b) (6)

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

FILE 1165-7



REPLY TO
ATTN OF

SGHW

7 Dec 1967

SUBJECT:

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

TO:

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

(b) (6)

(b) (6)

LtCol USAF MC

Chief

(b) (6)

April 2001

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)															
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Ingestion <input type="checkbox"/> Unknown		<input type="checkbox"/> Injection <input type="checkbox"/> Absorption <input type="checkbox"/> Not applicable															
		INTAKE DATE OR PERIOD: 1/18/66 through 4/01/66 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: 7 urine samples from 04/02/66 to 09/14/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain																	
EVALUATION DATA: Air Sampling Health Physics Survey Data Bioassay - Urinalysis Fecal Nasal Smears In Vivo																	
<input type="checkbox"/> Attached <input type="checkbox"/> Attached <input checked="" type="checkbox"/> Attached <input type="checkbox"/> Attached <input type="checkbox"/> Attached <input type="checkbox"/> Attached		<input type="checkbox"/> In Process <input type="checkbox"/> In Process <input type="checkbox"/> In Process <input type="checkbox"/> In Process <input type="checkbox"/> In Process <input type="checkbox"/> In Process															
<input checked="" type="checkbox"/> Unavailable <input checked="" type="checkbox"/> Unavailable <input type="checkbox"/> Unavailable <input checked="" type="checkbox"/> Unavailable <input checked="" type="checkbox"/> Unavailable <input checked="" type="checkbox"/> Unavailable																	
Medical Treatment: Skin Decontamination: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Date: _____ Decorporation: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Agent: _____ Date: _____ Catharsis: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Agent: _____ Date: _____ Surgical excision: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> 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): 110,000 50 YR CEDE (rem): 34 (0.34 Sv) <table><thead><tr><th>Organ Dose Equivalent Summary</th><th>50 YR CDE (rem/Sv)</th></tr></thead><tbody><tr><td>Bone Surface</td><td>340/3.4</td></tr><tr><td>Lung</td><td>130/1.3</td></tr><tr><td>Liver</td><td>61/0.61</td></tr><tr><td>Red Marrow</td><td>26/0.26</td></tr><tr><td>Other</td><td>5.8/0.058</td></tr><tr><td>Testes</td><td>4.9/0.049</td></tr></tbody></table>				Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)	Bone Surface	340/3.4	Lung	130/1.3	Liver	61/0.61	Red Marrow	26/0.26	Other	5.8/0.058	Testes	4.9/0.049
Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)																
Bone Surface	340/3.4																
Lung	130/1.3																
Liver	61/0.61																
Red Marrow	26/0.26																
Other	5.8/0.058																
Testes	4.9/0.049																
DOSE ASSESSOR:		PEER REVIEWER:															
DATE: _____		DATE: _____															
Signature: _____		Signature: _____															
Print Name: _____		Print Name: _____															
SSN: _____		SSN: _____															
RECOMMENDATIONS: Additional Bioassay Required <input type="checkbox"/> Urinalysis <input type="checkbox"/> Fecal <input type="checkbox"/> In Vivo Suggested Sampling Frequency: _____ Work Restrictions: N/A																	

(b) (6)

(b) (6)

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. 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 Burden
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 µm 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.

(b) (6)

(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.

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	✓
66-4982B	AS	09/26/66	251	0.356	0.201	✓
67-0438	AS	01/19/67	366	0.0371	0.0186	✓
67-2153	AS	04/17/67	454	ND		✓
67-2153B	AS	04/17/67	454	0.014	0.014	✓
67-5651	AS	09/14/67	604	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	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).

(b) (6)

(b) (6)

Organ	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent (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 Equivalent			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 ^{239}Pu 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: _____

(b) (6)

April 28, 2000

(b) (6)

AFSN: (b) (6)		INTERNAL DOSE DATA	
NAME (LAST, FIRST, M.I.) (1-20)		SOC. SEC. NO. (21-23)	TYPE SAMPLE (30)
(b) (6)		(b) (6)	Urine
SSgt	66-2882	SAMPLE DATE (39-44)	TYPE ANAL. (31-32)
FROM 0700 1 Apr	TO 0700 2 Apr 66	EXPOSURE DATE	TYPE
OCCUPATION (61-62)	REQUESTED BY		
DATE RECEIVED	SAMPLE VOLUME	VOLUME ANALYZED	DATE ANALYZED
26 April 1966	1625	1625	
TECHNICIAN (SIGNATURE AND DATE)			
URINE		RADON	
Counter Number	D	Chamber Number	FECES/BLOOD
Counter Bkg. (cpm)	0.03 (900)	Cham. Bkg. (mv/sec)	Counter Number
Counter Eff. (%)	51	Counter Eff. (%)	Counter Bkg.
Date/Time - Start	13 May 66	Millivolt - Start	Counter Eff.
- Stop		Millivolt - Stop	Date/Time - Start
Total Counts	111	Total Millivots	- Stop
Counting Time	55	Total Drift Time	Total Counts
Gross cpm	2.02	Gross mv/sec	Counting Time
Bkg. Cpm	0.03	Bkg. Mv/sec	Gross cpm
Net cpm	1.99	Net mv/sec	Bkg. cpm
dpm per l	1.08 ± 0.21	curies/mv	net cpm
dpm/24 hr. (69-74)		litter (69-74)	dpm
K 40 Correction		D(q) (63-68)	dps/cc
Net Beta per l	1.76 ± 0.34		Neutron Dose (rads) (63-68)
D(q) (63-68)			uc/mg (69-74)
			D(q) (63-68)

AFLC-WPAFB-MAY 66 450

RADIOLOGICAL SAMPLE DATA					
NAME OF REQUESTOR'S ID (1-20) (b) (6)		GRADE SSGT	AFSN (b) (6)	SOCIAL SECURITY NUMBER (b) (6)	RHL SAMPLE NUMBER 664982
TYPE SAMPLE (23-32) Urine	OCCUPATION (34-38)	ANALYSIS DESIRED Pu 239	REQUESTOR SCW	AIR FORCE BASE (60-71) Torrion, Spain	
DATE RECEIVED (37-42) 20 Sept 66	DATE ANALYZED (81-86)	DATE COUNTED 27 Oct 66	DATE COLLECTED 26 Sept 66	EXPOSURE DATE Jan 66	
SAMPLE WEIGHT/VOLUME 900 + 45 ACID		WEIGHT/VOLUME ANALYZED 450 ml			
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS					
<p> <i>Calcd - 0.113 ± 0.069</i> <i>Detected 2 Nov 66</i> <i>% Rec = 72.0</i> <i>Tot Vol - 900</i> <i>Vol anal - 450</i> <i>Body Burden - 0.07</i> </p>					

AFLC FORM 1165
MAY 66

FC
5400

AFLC-WPAFB-MAY 66 4500

RADIOLOGICAL SAMPLE DATA					
NAME OF REQUESTER (1-10)		GRADE	AFSN	SOCIAL SECURITY NUMBER	128-5 (b) (6)
TYPE SAMPLE (23-32)	OCCUPATION (34-38)	ANALYSIS DESIRED	REQUESTED BY	SPL SAMPLE NUMBER 66-4982-B	
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	AIR FORCE BASE (66-71)	
SAMPLE WEIGHT/VOLUME 900 ML		WEIGHT/VOLUME ANALYZED 450 ML		TECHNICIAN (b) (6)	
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY	RADON				
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
$P_{eff}/S_{eff} = 0.356 \pm 0.201$ $Tot Vol = .09 L$ $Vol anal = .45 L$ $1/2 dec = 39.1$ $Body Burden =$ $Specs Counted - 29 Nov 66$					

AFLC FORM MAY 66 1165

FC 5400

AFLC-WPAFB-MAY 66 4500

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)		RADIOLOGICAL SAMPLE DATA		670438 (b) (6)	
OR REQUESTOR'S ID (1-30)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
(b) (6)		SSGT	(b) (6)	(b) (6)	(b) (6)
SAMPLE (33-32)	OCCUPATION (34-38)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (80-71)	
Urine		Pu 239	SCHW	Torrejon AB	
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DAYS COUNTED	DATE COLLECTED	EXPOSURE DATE	
6 Feb 67		16 Feb 67	18 Feb 67	66	
SAMPLE WEIGHT/VOLUME	WEIGHT/VOLUME ANALYZED		(b) (6)		
1360 ML	680 ML				
OTHER DATA + 100 ML Acid					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY	Spec 1		RADON		
TOTAL COUNTS & MINUTES	24				
GROSS CPM	552				
BKG CPM & MINUTES	500				
NET CPM	0				
YIELD					
SUMMARY OF RESULTS: $FCI / sat - 37.1 \pm 18.6$ % Rec = 101.6					
Total - 1.36 Body Burden -					
Vol Anal - 0.68 16 Feb 67					

AFLC FORM MAY 66 1165

FC 9400

AFLC-WPAFB-JAN 67 5M

Release of this document is restricted under the provisions of the Privacy Act, 5 U.S.C. 552(a). C.1-110

RADIOLOGICAL SAMPLE DATA									
REQUESTOR'S ID (1-20)		GRADE		AFSN		SOCIAL SECURITY NUMBER		RHL SAMPLE NUMBER	
SAMPLE (23-32)		OCCUPATION (34-35)		ANALYSIS DESIRED		REQUESTED BY		AIR FORCE BASE (66-71)	
RECEIVED (37-42)		DATE ANALYZED (51-56)		DATE COUNTED		DATE COLLECTED		EXPOSURE DATE	
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED		TE					
1600 me		foame		(b) (6)					
OTHER DATA									
ENVIRONMENTAL SAMPLES									
COUNTER & EFFICIENCY									
TOTAL COUNTS & MINUTES									
GROSS CPM									
BKG CPM & MINUTES									
NET CPM									
YIELD									
BIOLOGICAL SAMPLES									
COUNTER & EFFICIENCY									
TOTAL COUNTS & MINUTES									
GROSS CPM									
BKG CPM & MINUTES									
NET CPM									
YIELD									
SUMMARY OF RESULTS:									
<p> P4289 PER 34 NA - NOT TOT. VOL. - 1.6 L. VOL. ANAL. - 0.8 L. DATE CID - 30 JUN 67 % REC = 79% B.B. = 0 EXAMPTO TIME = 744 0175 </p>									

AFLC FORM 1165
MAY 66

FC
8400

AFLC-WPAFB-JAN 67 5M

Palomares Nuclear Weapons Accident

Dose Evaluation Report

April 28, 2000

(b) (6)

(b) (6)

(b) (6)

IDENTIFICATION (b) (6)		TYPE SPL URINE		FILE NO. 116054 P453 R	
SUBMITTEE SGHW		AFB P-653		675651 (b) (6)	
DATE COLLECTED 14 SEP 67	DATE RECD 6 OCT 67	EXPOSURE DATE(S)	TOTAL WT OR VOL 900 ml	WT OR VOL ANALYZED 950 ml	
ANALYSIS DESIRED 235 PU		TECHNICIAN (b) (6)			
TYPE OF ANALYSIS	PL 239	PL 236	Dr α		
COUNTER AND EFF	SPC 4 25	SPC 236	F-		
TOTAL CTS AND TIME	200	163	55-105		
BK CTS AND TIME	200-0	0	910-56		
NET CTS PER MIN			71.7 %mc		
25 OCT 1967					
1	20 22	±	33 35	43 1	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					
GR BETA SUS					
DATE CTD					
NET BETA PER 24 HR					
SAMPLE WT DIS					
SAMPLE WT SUS					
SAMPLE VOL	0 9		Liters		
RECOVERY	70 0		Per Cent		
ELAPSED TIME					
SYSTEMIC BODY BURDEN					
CRITICAL ORGAN BONE					

AFLC FORM 1165 JUL 67

FC 5400

PREVIOUS EDITION WILL BE USED.

RADIOLOGICAL SAMPLE DATA AFLC-WPAFB-JUL 67 3M

(b) (6)

(b) (6)

Return to I/col
after key punch
FILE
2153

1. 0.00
2. 79
3. 1.6
4. 441
5. 7181
6. Systemic Body Burden 0.00

FILE

4982

1. 113 ± 69 FC per S
2. 72.0
3. .9
4. 243
5. 6306
6. Systemic Body Burden
Bone Critical Organ 0.07

Return to I/col
after Key Punch

(b) (6)

FILE

0438

18-5

1. 37.1 ± 18.6 FC
2. 101.6
3. 1.36
4. 369
5. 7047
6. Systemic Body Burden
Bone Critical Organ 0.03

April 28, 2000

(b) (6)

(b) (6)

FILE

16-5-7 (b) (6)

Last address - 5 Dec 66
3970 Ses Sq. APO NY 09283
Torrejon, Spain

Letter Sent 6 Dec 66

2nd Sample
letter
prepared
2 apr 67

FILE

16-5-7 (b) (6)

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

Return after Bay Pouch

(b) (6)

5651

FILE

16-5-7 (b) (6)

1. 0.00 139 PU ALPHA SPEC
2. 70.0 236 PU SPIKE REC
3. 0.9 SAMPLE VOL.
4. —
5. 7296 DATE COUNTED
6. Systemic Body Burden 0.00

April 28, 2000

(b) (6)

(b) (6)

50

FILE

INFORMATION

NAME

DATE

TIME

LOCATION

STATUS

REMARKS

1. (b) (6) (b) (6) (b) (6) (b) (6)

2. (b) (6) (b) (6) (b) (6) (b) (6)

3. (b) (6) (b) (6) (b) (6) (b) (6)

4. (b) (6) (b) (6) (b) (6) (b) (6)

5. (b) (6) (b) (6) (b) (6) (b) (6)

6. (b) (6) (b) (6) (b) (6) (b) (6)

7. (b) (6) (b) (6) (b) (6) (b) (6)

8. (b) (6) (b) (6) (b) (6) (b) (6)

9. (b) (6) (b) (6) (b) (6) (b) (6)

10. (b) (6) (b) (6) (b) (6) (b) (6)

11. (b) (6) (b) (6) (b) (6) (b) (6)

12. (b) (6) (b) (6) (b) (6) (b) (6)

13. (b) (6) (b) (6) (b) (6) (b) (6)

14. (b) (6) (b) (6) (b) (6) (b) (6)

15. (b) (6) (b) (6) (b) (6) (b) (6)

16. (b) (6) (b) (6) (b) (6) (b) (6)

17. (b) (6) (b) (6) (b) (6) (b) (6)

18. (b) (6) (b) (6) (b) (6) (b) (6)

19. (b) (6) (b) (6) (b) (6) (b) (6)

20. (b) (6) (b) (6) (b) (6) (b) (6)

21. (b) (6) (b) (6) (b) (6) (b) (6)

22. (b) (6) (b) (6) (b) (6) (b) (6)

23. (b) (6) (b) (6) (b) (6) (b) (6)

24. (b) (6) (b) (6) (b) (6) (b) (6)

25. (b) (6) (b) (6) (b) (6) (b) (6)

26. (b) (6) (b) (6) (b) (6) (b) (6)

27. (b) (6) (b) (6) (b) (6) (b) (6)

28. (b) (6) (b) (6) (b) (6) (b) (6)

29. (b) (6) (b) (6) (b) (6) (b) (6)

30. (b) (6) (b) (6) (b) (6) (b) (6)

31. (b) (6) (b) (6) (b) (6) (b) (6)

32. (b) (6) (b) (6) (b) (6) (b) (6)

33. (b) (6) (b) (6) (b) (6) (b) (6)

34. (b) (6) (b) (6) (b) (6) (b) (6)

35. (b) (6) (b) (6) (b) (6) (b) (6)

36. (b) (6) (b) (6) (b) (6) (b) (6)

37. (b) (6) (b) (6) (b) (6) (b) (6)

38. (b) (6) (b) (6) (b) (6) (b) (6)

39. (b) (6) (b) (6) (b) (6) (b) (6)

40. (b) (6) (b) (6) (b) (6) (b) (6)

41. (b) (6) (b) (6) (b) (6) (b) (6)

42. (b) (6) (b) (6) (b) (6) (b) (6)

43. (b) (6) (b) (6) (b) (6) (b) (6)

44. (b) (6) (b) (6) (b) (6) (b) (6)

45. (b) (6) (b) (6) (b) (6) (b) (6)

46. (b) (6) (b) (6) (b) (6) (b) (6)

47. (b) (6) (b) (6) (b) (6) (b) (6)

48. (b) (6) (b) (6) (b) (6) (b) (6)

49. (b) (6) (b) (6) (b) (6) (b) (6)

50. (b) (6) (b) (6) (b) (6) (b) (6)

51. (b) (6) (b) (6) (b) (6) (b) (6)

52. (b) (6) (b) (6) (b) (6) (b) (6)

53. (b) (6) (b) (6) (b) (6) (b) (6)

54. (b) (6) (b) (6) (b) (6) (b) (6)

55. (b) (6) (b) (6) (b) (6) (b) (6)

56. (b) (6) (b) (6) (b) (6) (b) (6)

57. (b) (6) (b) (6) (b) (6) (b) (6)

58. (b) (6) (b) (6) (b) (6) (b) (6)

59. (b) (6) (b) (6) (b) (6) (b) (6)

60. (b) (6) (b) (6) (b) (6) (b) (6)

61. (b) (6) (b) (6) (b) (6) (b) (6)

62. (b) (6) (b) (6) (b) (6) (b) (6)

63. (b) (6) (b) (6) (b) (6) (b) (6)

64. (b) (6) (b) (6) (b) (6) (b) (6)

65. (b) (6) (b) (6) (b) (6) (b) (6)

66. (b) (6) (b) (6) (b) (6) (b) (6)

67. (b) (6) (b) (6) (b) (6) (b) (6)

68. (b) (6) (b) (6) (b) (6) (b) (6)

69. (b) (6) (b) (6) (b) (6) (b) (6)

70. (b) (6) (b) (6) (b) (6) (b) (6)

71. (b) (6) (b) (6) (b) (6) (b) (6)

72. (b) (6) (b) (6) (b) (6) (b) (6)

73. (b) (6) (b) (6) (b) (6) (b) (6)

74. (b) (6) (b) (6) (b) (6) (b) (6)

75. (b) (6) (b) (6) (b) (6) (b) (6)

76. (b) (6) (b) (6) (b) (6) (b) (6)

77. (b) (6) (b) (6) (b) (6) (b) (6)

78. (b) (6) (b) (6) (b) (6) (b) (6)

79. (b) (6) (b) (6) (b) (6) (b) (6)

80. (b) (6) (b) (6) (b) (6) (b) (6)

81. (b) (6) (b) (6) (b) (6) (b) (6)

82. (b) (6) (b) (6) (b) (6) (b) (6)

83. (b) (6) (b) (6) (b) (6) (b) (6)

84. (b) (6) (b) (6) (b) (6) (b) (6)

85. (b) (6) (b) (6) (b) (6) (b) (6)

86. (b) (6) (b) (6) (b) (6) (b) (6)

87. (b) (6) (b) (6) (b) (6) (b) (6)

88. (b) (6) (b) (6) (b) (6) (b) (6)

89. (b) (6) (b) (6) (b) (6) (b) (6)

90. (b) (6) (b) (6) (b) (6) (b) (6)

91. (b) (6) (b) (6) (b) (6) (b) (6)

92. (b) (6) (b) (6) (b) (6) (b) (6)

93. (b) (6) (b) (6) (b) (6) (b) (6)

94. (b) (6) (b) (6) (b) (6) (b) (6)

95. (b) (6) (b) (6) (b) (6) (b) (6)

96. (b) (6) (b) (6) (b) (6) (b) (6)

97. (b) (6) (b) (6) (b) (6) (b) (6)

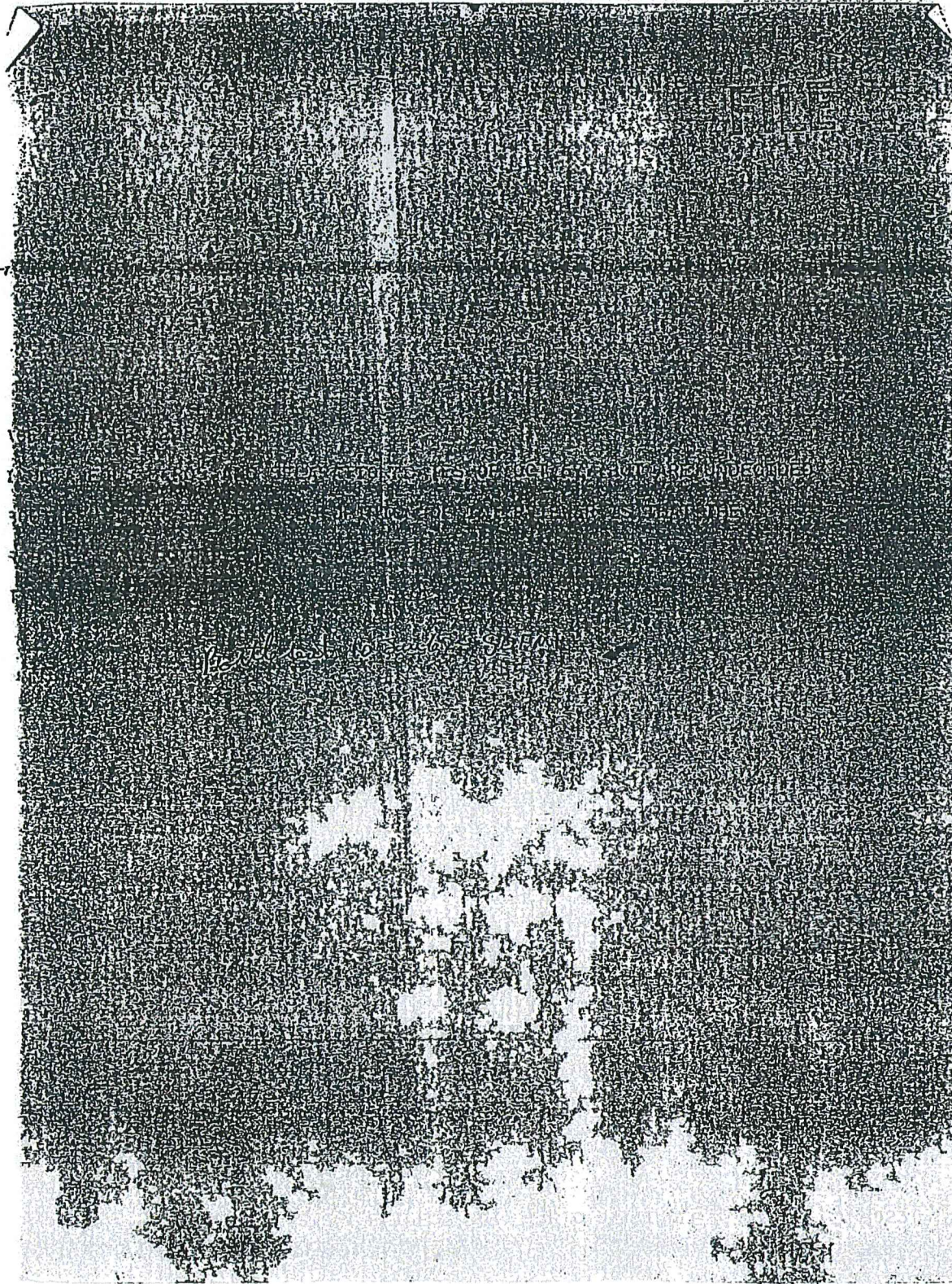
98. (b) (6) (b) (6) (b) (6) (b) (6)

99. (b) (6) (b) (6) (b) (6) (b) (6)

100. (b) (6) (b) (6) (b) (6) (b) (6)

(b) (6)

(b) (6)



(b) (6)

(b) (6)

PERMANENT CHANGE OF STATION ORDER — MILITARY FILE				110855-8 (b) (6)	
2. GRADE, LAST NAME, FIRST, MIDDLE INITIAL, AFSN TSgt (b) (6)		3. SHIPPING AFSC (Officer)	4. CAFSC (Airmen) 62270	1. INDIVIDUAL WP ON PCS AS SHOWN BELOW	
6. UNIT, MAJOR AIR COMMAND AND ADDRESS OF UNIT FROM WHICH RELIEVED 401 Cmbt Spt Sq, (USAFE) APO New York 09283		7. UNIT MAJOR AIR COMMAND AND ADDRESS OF UNIT TO WHICH ASSIGNED AND DUTY STATION IF APPROPRIATE 63 Svc Sq, (MAC) Morton AFB, Calif 92409		5. <input type="checkbox"/> OVER 4 YEARS SERVICE (AIC Only)	
9. REPORT TO COMDR, NEW ASSIGNMENT NLT		10. (Reassignment from overseas unit to CONUS unit only.) REPORT AT NEW ASSIGNMENT NLT 40 DAYS AFTER DEPARTURE FROM CONUS PORT OF ENTRY UNIT		11. DALVP YES	12. EDCSA 20 Nov 67
13. TDY EN ROUTE (Indicate Location or unit and address.)		14. PURPOSE OF TDY		15. SECURITY CLEARANCE FOR PERIOD OF TDY OR COURSE OF INSTRUCTION	
18. LEAVE ADDRESS (b) (6)		16. TDY REPORTING DATE		17. APPROXIMATE NO. OF DAYS	
19. NEW MAILING ADDRESS (Use upon completion of TDY, if appropriate.) GRADE, NAME, AFSN		20. DURATION OF COURSE (If reassignment is to attend course of instruction.) WEEKS		21. <input type="checkbox"/> CONCURRENT TRAVEL OF DEPENDENTS IS NOT AUTHORIZED	
22. <input type="checkbox"/> TRAVEL OF DEPENDENTS IS PROHIBITED		23. TRAVEL OF DEPENDENTS TO A DESIGNATED POINT <input type="checkbox"/> IS NOT AUTHORIZED		24. <input type="checkbox"/> TRANSPORTATION OF DEPENDENTS AND SHIPMENT OF HHG TO TDY STATION IS NOT AUTHORIZED	
25. CONCURRENT TRAVEL OF DEPENDENTS IS AUTHORIZED (List names of dependents and DOB of children.)		26. AUTHORITY FOR CONCURRENT TRAVEL		27. TRAVEL TIME WILL BE COMPUTED PER CH 39-11, AFM 39-11, 1022, AFM 39-11, TPA WITH 10 DAYS TRAVEL TIME	
28. POUNDS BAGGAGE, INCLUDING EXCESS IS AUTHORIZED		29. DISLOCATION ALLOWANCE CATEGORY		30. MODES OF TRANSPORTATION AUTHORIZED FOR OVERSEAS TRAVEL A. <input type="checkbox"/> MILITARY AIRCRAFT B. <input type="checkbox"/> COMMERCIAL AIRCRAFT (Category Z) C. <input type="checkbox"/> MILITARY AND COMMERCIAL VESSEL D. <input type="checkbox"/> COMMERCIAL AIRCRAFT OR VESSEL (Also foreign registry if US registry is not available) RAIL OR BUS WITHIN OVERSEAS AREAS	
31. REPORT AT MATS PASSENGER SERVICE COUNTER TORREJON AB SPAIN <input type="checkbox"/> McGUIRE AFB <input type="checkbox"/> TRAVIS AFB <input type="checkbox"/> McCHORD AFB <input type="checkbox"/> CHARLESTON AFB		32. FLIGHT NO. OR NAME OF VESSEL		33. PIER NO. AND ADDRESS	
34. REPORTING TIME AND DATE FOR SCHEDULED DEPARTURE NET NLT		35. *A. PRIOR TO TRAVEL COMPLY WITH AFM 75-4. *B. WHILE ON LEAVE OVERSEAS COMPLY WITH AFM 35-22, AND CHAPTER 1, AFM 35-10. C. In the event of limited war or mobilization and individual is traveling: PCS UNACCOMPANIED-proceed as scheduled. PCS ACCOMPANIED-contact your last commander immediately for instructions before reporting to port. In the event of general war or if the CONUS is attacked report to the nearest active Air Force Installation as soon as possible.		36. REMARKS Orders will be amended to include port call data.	
37. AUTHORITY, AFM 39-11, PCS Code J Line No KZL594		38. DATE 1 Sep 1967		39. SPECIAL ORDER NO. AA-1186	
40. DESIGNATION AND LOCATION OF HEADQUARTERS DEPARTMENT OF THE AIR FORCE HQ 401st TAC FTR WG (USAFE) APO NEW YORK 09283		41. PCS EXPENSE CHARGEABLE TO 5783500 328 P577.02 410 440 S503725 31AUG67		42. DISTRIBUTION	
43. CUSTOMER IDENTIFICATION CODE 4 5 848 5776 503725		44. TDY EXPENSE CHARGEABLE TO		45. TDN FOR THE COMMANDER	
46. SIGNATURE ELEMENT OF ORDERS AUTHENTICATING OFFICIAL (b) (6) Capt, USAF Asst Chief of Admin Services ATTH-3					

(b) (6)

(b) (6)

FILE 1635-8



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

7 Dec 1967

REPLY TO
ATTN OF

SGHW

SUBJECT

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

TO

TSgt (b) (6)
63 Svc Sq
Norton AFB Calif 92409

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)

1st Lt USAF MG

Chief

(b) (6)

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)	
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Injection <input type="checkbox"/> Ingestion <input type="checkbox"/> Absorption <input type="checkbox"/> Unknown <input type="checkbox"/> Not applicable		INTAKE DATE OR PERIOD: 01/18/66 through 02/05/66 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: 6 urine samples from 02/05/66 to 09/07/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain			
EVALUATION DATA:			
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Bioassay - Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Medical Treatment:			
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> 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): 42,000			
50 YR CEDE (rem): 13 (0.13 Sv)			
Organ Dose Equivalent Summary		50 YR CDE (rem/Sv)	
Bone Surface		130/1.3	
Lung		48/0.48	
Liver		23/0.23	
Red Marrow		10/0.10	
Other		2.2/0.022	
Testes		1.9/0.019	
DOSE ASSESSOR:		PEER REVIEWER:	
DATE: _____		DATE: _____	
Signature: _____		Signature: _____	
Print Name: _____		Print Name: _____	
SSN: _____		SSN: _____	
RECOMMENDATIONS:			
Additional Bioassay Required <input type="checkbox"/> Urinalysis <input type="checkbox"/> Fecal <input type="checkbox"/> In Vivo			
Suggested Sampling Frequency: _____			
Work Restrictions: N/A			

(b) (6)

(b) (6)

Preliminary Internal Dosimetry Case Narrative**Identification:**

Name: (b) (6)
SSN: (b) (6)

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): ^{239}Pu .

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.

(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
66-921	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:

Organ	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent (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 Equivalent			1.3E+01/1.3E-01

(b) (6)

(b) (6)

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 ^{239}Pu 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.

Prepared By:

Name: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: _____

(b) (6)

(b) (6)

FILE (b) (6) FEB 21 1966

INTERNAL DOSE DATA			
NAME (LAST, FIRST, M.I.) (31-32)		SOC. SEC. NO. (31-32)	
(b) (6)		(b) (6)	
SAMPLE NO. (33-36)		TYPE SAMPLE (30)	TYPE ANAL. (31-32)
66-921		URINE	GROSS ALPHA
BASE (57-60)	SAMPLE DATE (37-40)	EXPOSURE	
66-921	FROM 5-28-66 TO	DATE 10 JAN 67	
TORESON J.	OCCUPATION (61-62)	REQUESTED BY	
DATE RECEIVED	26250		
	SAMPLE VOLUME	VOLUME ANALYZED	DATE ANALYZED
	835	200	
TECHNICIAN (SIGNATURE AND DATE)			
[Signature] 8 MAR 1966			
URINE		RADON	
GROSS ALPHA			
Counter Number	B	Chamber Number	
Counter Bkg. (cpm)	20	Cham. Bkg. (mv/sec)	
Counter Eff. (%)	57	Counter Eff. (%)	
Date/Time - Start	8 MAR 1966	Millivolt - Start	
- Stop		Millivolt - Stop	
Total Counts	40	Total Millivots	
Counting Time	55 min	Total Drift Time	
Gross cpm	73	Gross mv/sec	
Bkg. Cpm	20	Bkg. Mv/sec	
Net cpm	53	Net mv/sec	
dpm/24 hr. (69-74)	2.14 ± 1.01	curies/mv	
K 40 Correction		litter (69-74)	
Net dpm/24 hr. (69-74)	1.95 ± 0.84	D(q) (63-68)	19
D(q) (63-68)	2.14 D		
		D _h = 2.05 x 10 ⁻⁴ rad	
FECES/BLOOD			
Counter Number		Counter Number	
Counter Bkg.		Counter Bkg.	
Counter Eff.		Counter Eff.	
Date/Time - Start		Date/Time - Start	
- Stop		- Stop	
Total Counts		Total Counts	
Counting Time		Counting Time	
Gross cpm		Gross cpm	
Bkg. cpm		Bkg. cpm	
net cpm		net cpm	
dpm		dpm	
dps/cc		dps/cc	
Neutron Dose (rads) (63-68)		Neutron Dose (rads) (63-68)	
uc/mg (69-74)		uc/mg (69-74)	
D(q) (63-68)		D(q) (63-68)	

1635 (b)(6) 869 Med Rep 12 (b)(6)

RADIOLOGICAL SAMPLE DATA

6643C

NAME OR REQUESTOR'S ID (1-20) (b)(6)		GRADE A1C	SOCIAL SECURITY NUMBER (b)(6)		RHL SAMPLE NUMBER
TYPE SAMPLE (23-27) Urine	OCCUPATION (34-35)	ANALYSIS DESIRED P. 239	REQUESTED BY SCHW	AIR FORCE BASE (48-71) Torrejon	
DATE RECEIVED (37-42) 22 Aug 66	DATE ANALYZED (51-55) 28 SEP 1966	DATE COUNTED 28 SEP 1966	DATE COLLECTED 28 July 66	EXPOSURE DATE	
SAMPLE WEIGHT/VOLUME 1215 ml	WEIGHT/VOLUME ANALYZED 615 ml		TECHN (b)(6)		
OTHER DATA <i>checked off by the List</i>					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
<p>SUMMARY OF RESULTS: <i>Per/spl - 0.1401 ± 0.0718</i> <i>% Rec - 80.0</i></p> <p><i>Total - 1215</i> <i>Body Burden -</i></p> <p><i>Urinal - 615</i></p>					

Radon
2-51
51-95
120-31
% Rec = 91.6

AFLC FORM MAY 66 1165 FC 5400 AFLC-WPAFB-MAY 66 4500

RADIOLOGICAL SAMPLE DATA					
NAME OR REQUESTOR'S ID (1-20)		GRADE	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER	
(b) (6)		SSGT	(b) (6)	670656	
TYPE SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (88-71)	
Urine		Pu 239	SGHW	WILLOW AFB, MISSOURI	
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
1 Mar 67	15 Mar 67	15 Mar 67	22 Feb 67	17 Jan 66	
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED		(b) (6)	
2860 mL		1000 mL			
OTHER DATA					
SPIKED 21 ML 5.8 DPM/ML Pu 236 AIC					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
266					
239					
RADON					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
Activity per 24 hr sp/ 0.03 ± 0.02 PC					
Total Vol/c 9.86 L					
Vol anal = 1.00 L					
70 recs 113					
Body Burden x					
Rate Counter = 15 Mar 67					

AFLC FORM MAY 66 1165

FC 5400

AFLC-WPAFB-JAN 67 5M

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

[illegible]

OT Form, Apr 67
!KCSCPF, hbf

SAMPLE DATA

AFLC-WPAFB-APR 67 300

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

IDENTIFICATION (b) (6)		TYPE SPL URINE		FILE NO. 674859-B	
SOC. SEC. NO.		SUBMITTEE		AFB	
DATE COLLECTED		DATE REC'D 15 Sept		EXPOSURE DATE(S)	
ANALYSIS DESIRED P239		TOTAL WT OR VOL 1620 ml		WT OR VOL ANALYZED 910 ml	
TECHNICIAN (b) (6)					
TYPE OF ANALYSIS		COUNTER AND EFF			
236		#4 - 23		B-51	
TOTAL CTS AND TIME		BK CTS AND TIME			
200 - 1		200 - 0		104	
NET CTS PER MIN				55 - 65	
				900 - 122	
				44% rec 40.3% rec	
I		20 22		33 35	
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		GR BETA SUS		NUCLIDE	
DATE CTD		140.64		P239	
NET BETA PER 24 HR		SAMPLE WT DIS		ACTIVITY	
SAMPLE WT SUS		SAMPLE VOL		97 D A	
RECOVERY		44 0			
ELAPSED TIME		liters			
SYSTEMIC BODY BURDEN		Percent			
CRITICAL ORGAN BONE					

AFLC FORM 1165 JUL 67

FC 5400

PREVIOUS EDITION WILL BE USED.

RADIOLOGICAL SAMPLE DATA AFLC-WPAFB-JUL 67 3M

Palomares Nuclear Weapons Accident

Dose Evaluation Report

April 28, 2000

(b) (6)

(b) (6)

(b) (6)

(b) (6)

IDENTIFICATION		(b) (6)		TYPE SPL		URINE		FILE NO. 674859		(b) (6)			
SOC. SEC. NO.		SUBMITTEE		AFB		SGHW		P-653					
DATE COLLECTED		DATE RECD		EXPOSURE DATE(S)		TOTAL WT OR VOL		WT OR VOL ANALYZED					
		15 SEPT 67				1220 ml		910 ml					
ANALYSIS DESIRED		PU 239		(b) (6)									
TYPE OF ANALYSIS		239		238		gross &							
COUNTER AND EFF		Spec 1				F-51							
TOTAL CTS AND TIME		100 0		104		55-63							
BK CTS AND TIME		400 0		5		900-41							
NET CTS PER MIN													
				35.0 % rec		recount		45.8 %					
1	20	22	±	33	35	43	1	20	22	±	33	35	43
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													
GR BETA SUS													
NUCLIDE													
ACTIVITY													
DATE CTD													
NET BETA PER 24 HR													
SAMPLE WT DIS													
SAMPLE WT SUS													
SAMPLE VOL													
RECOVERY													
ELAPSED TIME													
SYSTEMIC BODY BURDEN													
CRITICAL ORGAN BONE													

AFLC FORM 1165 JUL 67

FC 5400

PREVIOUS EDITION WILL BE USED.

RADIOLOGICAL SAMPLE DATA

AFLC-WPAFB-JUL 67 3M

(b) (6)

(b) (6)

Last address - 5 Dec 66

ALO 09283

Torrijon, Spain

869 - Med Tip

Letter sent
6 Dec 66
Second letter
sent 19 Jan 67
to Whiteman AFB

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

(b) (6)

(b)
(6)

Return to S/col (b) (6)
after bag punch.

1638

1-0.00

2, 64.6

3. 1.33

• 4. —

5. 7146

b. Systemic Body Burden 0.00

5 Jan 67

351st ~~Dist~~ ^{Missile} Bn
W. H. Jones AF B, Mo.

(b)
(6)

Return after
Key Punch

4859

1,000

2. 44

3. 1.82

4. —

5,7290

6. Systemic Body Burden 0,00

(b) (6)

(b) (6)

Returns to G/Cal
after Ray punch

(b) (6)

(b) (6)

FILE

0652

1. 0.03 ± 0.02 PC
2. 113
3. 2.86
4. 403
5. 7074
6. Systemic Body Burden
Biochemical organ 0.02

Sample containers
for

(b) (6)

AIC

(b) (6)

(Resample
Program)

sent 13 Feb 67

(b) (6)

FILE

2nd Sample
letter
prepared
3 apr

(b) (6)

(b) (6)

FILE

4.302 11.05.9

~~4.302~~

140 \pm 72 fCI

1. 0.140 ± 0.072
2. 80.0
3. 1.2X
4. 184
5. 6271
6. 0.07

Palomares Nuclear Weapons Accident

Dose Evaluation Report

April 28, 2000

(b) (6)

(b) (6)

FILE

ACT	SGLH
IN	
FOR	
MA	
TI	
ON	

UNCLASSIFIED

ROUTINE

1137 01430

RTTU JAW RUWTEWAG044 0302031-UUUU--RUEDFIA.

ZNR UUUUU

R 302011Z

FM 351STRATMSLWG WHITEMAN AFB MO

TO USAF RADIOLOGICAL HEALTH LABORATORY AFLC WPAFB OHIO

BT

UNCLAS MS 00202 JAN 67. REF LTR 19 JAN 67. LONG-TIME STUDIES
ON SELECTED PARTICIPANTS OF PALOMARES INCIDENT. PARA 5A SSGT

(b) (6) ASSIGNED 805TH MED GP THIS STATION. PARA 5C
INDIVIDUAL EVALUATED AND WILL COOPERATE WITH DIRECTED SCHEDULE.

BT

NNNN#

X-Ray

UNCLASSIFIED

ROUTINE

006

(b) (6)

(b) (6)

FILE 105-2

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



REPLY TO
ATTN OF

SGHW

7 Dec 1967

SUBJECT

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

TO

Sgt (b) (6)
351 Strat Msl Wg
Whiteman AFB MO 65301

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

(b) (6)

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)																																									
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Injection <input type="checkbox"/> Ingestion <input type="checkbox"/> Absorption <input type="checkbox"/> Unknown <input type="checkbox"/> Not applicable		INTAKE DATE OR PERIOD: 1/18/66 through 2/19/66, assumed 1/18/66 assumed start.																																									
SUMMARY OF EXPOSURE CONDITIONS: Radionuclides/Respiratory Class/Particle Size: $^{239}\text{Pu}/100\%$ 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: <table border="0"><tr><td>Air Sampling</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Health Physics Survey Data</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Bioassay – Urinalysis</td><td><input checked="" type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input type="checkbox"/> Unavailable</td></tr><tr><td>Fecal</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Nasal Smears</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>In Vivo</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr></table> Medical Treatment: <table border="0"><tr><td>Skin Decontamination:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Date: _____</td></tr><tr><td>Decorporation:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Agent: _____ Date: _____</td></tr><tr><td>Catharsis:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Agent: _____ Date: _____</td></tr><tr><td>Surgical excision:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Date: _____</td></tr></table>				Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable	Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____	Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable																																								
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____																																								
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																								
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																								
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> 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): 64,000 50 YR CEDE (rem) : 20 (0.20 Sv) <table border="0"><tr><td>Organ Dose Equivalent Summary</td><td>50 YR CDE (rem/Sv)</td></tr><tr><td>Bone Surface</td><td>200/2.0</td></tr><tr><td>Lung</td><td>73/0.73</td></tr><tr><td>Liver</td><td>36/0.36</td></tr><tr><td>Red Marrow</td><td>15/0.15</td></tr><tr><td>Other</td><td>3.4/0.034</td></tr><tr><td>Testes</td><td>2.9/0.029</td></tr></table>				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																										
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:		PEER REVIEWER:																																									
DATE: _____		DATE: _____																																									
Signature: _____		Signature: _____																																									
Print Name: _____		Print Name: _____																																									
SSN: _____		SSN: _____																																									
RECOMMENDATIONS: Additional Bioassay Required <input type="checkbox"/> Urinalysis <input type="checkbox"/> Fecal <input type="checkbox"/> In Vivo Suggested Sampling Frequency: _____ Work Restrictions: N/A																																											

(b) (6)

(b) (6)

Preliminary Internal Dosimetry Case Narrative**Identification:**

Name:

SSN:

(b) (6)

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:

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
2/20/66	-
6/9/66	7
1/21/67	2
4/25/67	0
8/25/67	0

Radionuclide(s): ^{239}Pu .**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 2/19/66.

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
66-1037	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:

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 Equivalent			2.0E+00/2.0E-02

(b) (6)

(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:

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.

Prepared By:

Name: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: _____

FEB 25 1966

FR 15337		INTERNAL DOSE DATA	
NAME (LAST, FIRST, M.I.) (1-20) (b) (6)		SOC. SEC. NO. (21-25) (b) (6)	
SAMPLE NO. (33-35) 66-1037		TYPE SAMPLE (30) Urine	
Lt. Col. SAMPLE DATE (35-44) 66-1037		TYPE ANAL. (31-32) GROSS ALPHA	
BASE (57-60) Tenafin		EXPOSURE DATE 20 Feb 66 TYPE	
OCCUPATION (61-62) Tenafin		REQUESTED BY	
DATE RECEIVED FEB 25 1966		VOLUME ANALYZED 200 ml.	
TECHNICIAN (SIGNATURE AND DATE) (b) (6)		DATE ANALYZED	

URINE		GROSS ALPHA		RADON		FECES/BLOOD	
Counter Number	A			Counter Number			
Counter Bkg. (cpm)	36			Counter Bkg.			
Counter Eff. (%)	57			Counter Eff. (%)			
Date/Time - Start	8 MAR 1966			Millivolt - Start			
- Stop				Millivolt - Stop			
Total Counts	43			Total Millivots			
Counting Time	55			Total Drift Time			
Gross cpm	0.78			Gross mv/sec			
Bkg. Cpm	36			Bkg. Mv/sec			
Net cpm	0.42			Net mv/sec			
dpm	2.16			curies/mv			
dpm/24 hr. (69-74)	1.85 ± 1.27			litter (69-74)			
K 40 Correction				D(q) (63-68)			
Net Beta	2.37 ± 1.64			Neutron Dose (rads) (63-68)			
D(q) (63-68)	2.37 D			uc/mg (69-74)			
				D(q) (63-68)			

9 MAR 1966
2.37
2.37 ± 1.64

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

RESAMPLE JUL 14 1966

FILE

AFSN: (b) (6)

INTERNAL DOSE DATA

NAME (LAST, FIRST, M.I.) (1-20) (b) (6)		SOC. SEC. NO. (21-29) (b) (6)	TYPE SAMPLE (30) Urine	TYPE ANAL. (31-32)
SAMPLE NO. (33-36) 66-3405	SAMPLE DATE (39-44) FROM 8 June 66 TO 9 June 66	EXPOSURE DATE Jan 66 TYPE		
BASE (57-60) Hq 8 AF Westover AFB, Mass	OCCUPATION (61-62)	REQUESTED BY		
DATE RECEIVED 14 June 1966	SAMPLE VOLUME 1920 ml	VOLUME ANALYZED 1070 ml	DATE ANALYZED	
TECHNICIAN (SIGNATURE AND DATE)				

URINE		RADON		FECES/BLOOD	
Counter Number		Chamber Number		Counter 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 mv/sec		Gross cpm	
Bkg. Cpm		Bkg. Mv/sec		Bkg. cpm	
Net cpm		Net mv/sec		net cpm	
dpm		curies/mv		dpm	
dr. hr. (69-74)		litter (69-74)		dps/cc	
Correction				Neutron Dose (rads) (63-68)	
Beta		D(q) (63-68)		uc/mg (69-74)	
D(q) (63-68)				D(q) (63-68)	

Repeat Recovery Loss 60%

NAME: SOCIAL SECURITY NUMBER: SAMPLE NUMBER:

AIR FORCE BASE

RESULTS OF ANALYSIS

Run analysis on half of sample B AB. ACCIDENT - 2 SEPT "A" SAMPLE

- ☐ Repeat the sample for the following reason:
- () Significant activity in recently analyzed sample(s)
 - () Data required to establish dose
 - () Improper flask used
 - () Other _____
 - () Suggested sampling schedule _____

SIGNATURE:

DATE:

ONE TIME FORM. OBSOLETE AFTER 30 JUN 66. (MCGSCPF, RAG, 4 APR 66)

AFLC-WPAFB-APR 66 2500

(b) (6)
Palomares Nuclear Weapons Accident

(b) (6)
Dose Evaluation Report
April 28, 2000

RADIOLOGICAL SAMPLE DATA					
NAME OR REQUESTOR'S ID (1-20)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
					66-3405 B
TYPE SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED		REQUESTED BY	AIR FORCE BASE (68-71)
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
		5 OCT 66			
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED		(b) (6)	
		450 mL			
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
RADON					
H-51					
55-70					
935-34					
% Rec-73.1					
SUMMARY OF RESULTS:					
Pci/Spl-6.174 ± 0.125					
Tot Vol-1920					
VOL ANAL-150					
% Rec-69.6					
Body Burden					

AFLC FORM 1165
MAY 66

FC 5400

AFLC-WPAFB-MAY 66 4500

RADIOLOGICAL SAMPLE DATA				FILE 18-5-10 670349	
NAME OR REQUESTOR'S ID (1-20) (b) (6)		GRADE AR/Col	LEAD (b) (6)	RADIOL SECURITY NUMBER (b) (6)	
PL SAMPLE (23-34) Urine 110.1		OCCUPATION (34-35)	ANALYSIS DESIRED P 239	REQUESTED BY SGHW	AIR FORCE BASE (68-71) Plumb
DATE RECEIVED (37-42) 24 Jan 67	DATE ANALYZED (51-56)	DATE COUNTED 13 Feb 67	DATE COLLECTED Jan 67	EXPOSURE DATE	
SAMPLE WEIGHT/VOLUME 1970 ml		WEIGHT/VOLUME ANALYZED 985 ml			
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
RADON					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
<div style="display: flex; justify-content: space-between;"> <div> <p>Fei/spl - 21.8 ± 15.7</p> <p>Tct Vol - 1.97</p> <p>Vol ANAL - 0.99</p> </div> <div> <p>% Rac - 106.0</p> <p>Body Burden</p> <p>13 Feb 67</p> </div> </div>					

AFLC FORM MAY 66 1165

FC 5400

AFLC-WPAFB-MAY 66 4500

April 28, 2000

(b) (6)

(b) (6)

5649 B
 15 Nov 67
 239 236
 193
 200 -
 Bkg - 0
 spike 4.97
 0
 free - 78

(b) (6)

(b) (6)

UNCLASSIFIED

ROUTINE

FILE
1/25/02

67. A1C (b) (6) AND A1C (b) (6) BOTH HAVE

PAGE 2 RUTHBN 238 UNCLAS

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

BT

Batch sent 10 Feb 67

UNCLAS

UNCLASSIFIED

ROUTINE

02

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

UNCLASSIFIED

ROUTINE

FILE

160-5-12

SGHW

RF1U JAW RUEXSB0298 0060057-UUUU--RUEDFIA.

DE RUTHBN 238 0051416

ZNR UUUUUKGZR 051410Z JAN 67

1. 401 TAC HOSP TORREJON AB SPAIN

TO USAF RADL HEALTH LAB W PAT AFB OHIO

BT

UNCLAS SUFMI 40011 JAN 67. FOR SGHW. SUBJECT: LONG-TERM

STUDIES ON SELECTED PARTICIPANTS OF PALOMARES INCIDENT. REFERENCE

SGHW 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. (b) (6)

(b) (6) SSN (b) (6) SSGT. (b) (6)

(b) (6) SSN (b) (6) A1C (b) (6)

SSN (b) (6) A1C (b) (6) SSN (b) (6)

A1C (b) (6) SSN (b) (6) A1C (b) (6)

(b) (6) SSN (b) (6) A2C (b) (6)

(b) (6) SSN (b) (6) AND A2C (b) (6)

(b) (6). NOTE 4-1 (1) :H-1GES ON (b) (6) THE (b) (6) BELIEVE

YOU MAY WANT TO CONSIDER FOLLOWING FACTORS ON SOME INDIVIDUALS, HOW-

EVER. A1C (b) (6) WILL SEPARATE FROM THE SERVICE IN

JULY 67. A2C (b) (6) WILL SEPARATE FROM THE SERVICE IN DEC

UNCLASSIFIED

ROUTINE

(b) (6)

(b) (6)

UNCLASSIFIED

ROUTINE

FTU JAW RUEOXS0298 0060057-UUUU--RUEDFIA.

RUTHBN 238 0051416

RR UUUUUKGZR 051410Z JAN 67

401 TAC HOSP TORREJON AB SPAIN

USAF RADL HEALTH LAB W PAT AFB OHIO

508

FILE
60.5.12
1
SGHW

CLAS SUFMI 40011 JAN 67. FOR SGHW. SUBJECT: LONG-TERM
STUDIES ON SELECTED PARTICIPANTS OF PALOMARES INCIDENT. REFERENCE
NEW LETTERS, 6 DEC 66, SAME SUBJECT. THIS IS INFO REQUESTED IN
NA 5C. EVALUATION OF FOLLOWING INDIVIDUALS REVEALED THEY ALL HAVE
9034 MOTIVATION FOR PARTICIPATION IN SUBJECT PROGRAM: MSGT. (b) (6)

(b) (6) SSN (b) (6) SSGT. (b) (6)

(b) (6) SSN (b) (6) A1C (b) (6)

ON (b) (6) A1C (b) (6) SSN (b) (6)

IC (b) (6) SSN (b) (6) A1C (b) (6)

(b) (6) SSN (b) (6) A2C (b) (6)

(b) (6) SSN (b) (6) AND A2C (b) (6)

(b) (6) NOTE 4-1: RE-REGES ON (b) (6) AND (b) (6) BELIEVE

YOU MAY WANT TO CONSIDER FOLLOWING FACTORS ON SOME INDIVIDUALS, HOW-

VER. A1C (b) (6) WILL SEPARATE FROM THE SERVICE IN

JULY 67. A2C (b) (6) WILL SEPARATE FROM THE SERVICE IN DEC

UNCLASSIFIED

ROUTINE

(b) (6)

(b) (6)

FILE 168-5-12 (b) (6)

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



7 Dec 1967

REPLY TO
ATTN OF SGHW

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

TO: 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)

1st Col, USAF, MC

Chief

(b) (6)

DRAFT

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)																																									
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Injection <input type="checkbox"/> Ingestion <input type="checkbox"/> Absorption <input type="checkbox"/> Unknown <input type="checkbox"/> Not applicable		INTAKE DATE OR PERIOD: 01/18/66 through 02/13/66 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 01/21/66 to 08/10/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain																																											
EVALUATION DATA: <table border="0"><tr><td>Air Sampling</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Health Physics Survey Data</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Bioassay – Urinalysis</td><td><input checked="" type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input type="checkbox"/> Unavailable</td></tr><tr><td>Fecal</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Nasal Smears</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>In Vivo</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr></table> Medical Treatment: <table border="0"><tr><td>Skin Decontamination:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Date: _____</td></tr><tr><td>Decorporation:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Agent: _____ Date: _____</td></tr><tr><td>Catharsis:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Agent: _____ Date: _____</td></tr><tr><td>Surgical excision:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Date: _____</td></tr></table>				Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable	Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____	Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable																																								
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____																																								
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																								
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																								
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> 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): 76,000 50 YR CEDE (rem): 23 (0.23 Sv) <table border="0"><tr><td>Organ Dose Equivalent Summary</td><td>50 YR CDE (rem/Sv)</td></tr><tr><td>Bone Surface</td><td>240/2.4</td></tr><tr><td>Lung</td><td>87/0.87</td></tr><tr><td>Liver</td><td>42/0.42</td></tr><tr><td>Red Marrow</td><td>18/0.18</td></tr><tr><td>Other</td><td>4.0/0.040</td></tr><tr><td>Testes</td><td>3.4/0.034</td></tr></table>				Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)	Bone Surface	240/2.4	Lung	87/0.87	Liver	42/0.42	Red Marrow	18/0.18	Other	4.0/0.040	Testes	3.4/0.034																										
Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)																																										
Bone Surface	240/2.4																																										
Lung	87/0.87																																										
Liver	42/0.42																																										
Red Marrow	18/0.18																																										
Other	4.0/0.040																																										
Testes	3.4/0.034																																										
DOSE ASSESSOR:		PEER REVIEWER:																																									
DATE: _____		DATE: _____																																									
Signature: _____		Signature: _____																																									
Print Name: _____		Print Name: _____																																									
SSN: _____		SSN: _____																																									
RECOMMENDATIONS: Additional Bioassay Required: <input type="checkbox"/> Urinalysis <input type="checkbox"/> Fecal <input type="checkbox"/> In Vivo Suggested Sampling Frequency: _____ Work Restrictions: N/A																																											

DRAFT

(b) (6)

(b) (6)

Preliminary Internal Dosimetry Case Narrative**Identification:**

Name:

SSN:

(b) (6)

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): ^{239}Pu .**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 2/13/66.

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.

(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
66-244	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:

Organ	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent (rem/Sv)
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 Equivalent			2.3E+01/2.3E-01

(b) (6)

(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.

Prepared By:

Name: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: April 28 2000

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

RESAMPLE

JUN 6 1966

FILE 3263

FR 13338		INTERNAL DOSE DATA		168-5-13 (b) (6)	
NAME (LAST, FIRST, M.I.) (1-20) (b) (6) <i>H/2pl</i>		SOC. SEC. NO. (21-29) (b) (6)		TYPE SAMPLE (30) Urine	
SAMPLE NO. (33-38) 66-3263		SAMPLE DATE (39-44) FROM 26 May 1966 TO 27 May 1966		TYPE ANAL. (31-32) Spain <i>P653</i>	
BASE (57-60) B097 <i>Kirtland</i>		OCCUPATION (61-62)		EXPOSURE DATE TYPE	
DATE RECEIVED <i>10 JUNE 1966</i>		SAMPLE VOLUME <i>1960 ml</i>		VOLUME ANALYZED <i>1370 ml</i>	
TECHNICIAN (SIGNATURE AND DATE)		NMC checked off <i>H/2pl</i>			
URINE		RADON		FECEs/BLOOD	
Counter Number		Chamber Number		Counter Number	
Counter Bkg. (cpm) <i>3</i>		Chem. Bkg. (mv/sec) <i>908-32</i>		Counter Bkg.	
Counter Eff. (%) <i>31.8</i>		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 mv/sec		Gross cpm	
Bkg. Cpm		Bkg. mv/sec		Bkg. cpm	
Net cpm		Net mv/sec		net cpm	
dpm/24 hr. (69-74)		litter (69-74)		dpm	
K 40 Correction		D(q) (63-68)		dps/cc	
Net <i>PC/SPH</i> <i>0.206 ± 0.078</i>				Neutron Dose (rads) (63-68)	
D(q) (63-68)				uc/mg (69-74)	
				D(q) (63-68)	
NAME: (b) (6)		SOCIAL SECURITY NUMBER: (b) (6)		SAMPLE NUMBER:	
AIR FORCE BASE B097					
RESULTS OF ANALYSIS <i>Pu/Spl - 0.206 ± 0.078</i> <i>Total Vol - 1960</i> <i>Vol Anal - 1370</i>		<i>% Rec - 74.2</i> <i>Body Burden - 0.07</i>		Previous Results <i>1.68 pCi/L</i> <i>0.25 BB</i>	
<input type="checkbox"/> Repeat the sample for the following reason: () Significant activity in recently analyzed sample(s) () Data required to establish dose () Improper flask used () Other _____ () Suggested sampling schedule _____					
SIGNATURE:				DATE:	

HW FORM 8
MAY 62

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

AF-WP-O-MAY 62 5M

(b) (6)

(b) (6)

LT/OL INTERNAL DOSE DATA					
NAME (LAST, FIRST, M.I.) (1-20) (b) (6)		SOC. SEC. NO. (21-29) (b) (6)		TYPE SAMPLE (30) URINE	TYPE ANAL. (31-32) GROSS ALPHA
SAMPLE NO. (33-38) (66-244)		SAMPLE DATE (39-44) FROM TO		EXPOSURE DATE	TYPE
BASE (57-60) TORREJON		OCCUPATION (61-62)		REQUESTED BY	
DATE RECEIVED JAN 25 1966		SAMPLE VOLUME 730 ml		VOLUME ANALYZED 200 ml	DATE ANALYZED
TECHNICIAN (SIGNATURE AND DATE)					
URINE GROSS ALPHA		RADON		FECES/BLOOD	
Counter Number	8	Chamber Number		Counter Number	
Counter Bkg. (cpm)		Cham. Bkg. (mv/sec)		Counter Bkg.	
Counter Eff. (%)	51%	Counter Eff. (%)		Counter Eff.	
Date/Time - Start		Millivolt - Start		Date/Time - Start	
- Stop		Millivolt - Stop		- Stop	
Total Counts	32	Total Millivots		Total Counts	
Counting Time	55	Total Drift Time		Counting Time	
Gross cpm	0.582	Gross mv/sec		Gross cpm	
Bkg. Cpm	0.236	Bkg. Mv/sec		Bkg. cpm	
Net cpm	0.246	Net mv/sec		net cpm	
dpm		curies/mv		dpm	
dpm/24 hr. (69-74)		litter (69-74)	report 7	dps/sec	
K 40 Correction		D(q) (63-68)	2	Neutron Dose (rads) (63-68)	
Net Beta				uc/mg (69-74)	
D(q) (63-68)	1.09 ± 1.08 PC/L		(LESS THAN 1 PC/L)	D(q) (63-68)	27 Jan 66

RADIOLOGICAL SAMPLE DATA					
NAME OR REQUESTOR'S ID (1-20)		GRADE	SOCIAL SECURITY NUMBER		RHL SAMPLE NUMBER
(b) (6) (b) (6)		Lt Col	(b) (6)		(b) (6)
SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (66-71)	
Urine NO. 1	P 239	SGHW		Lindsey AS Germany	
DATE RECEIVED (37-42)	DATE ANALYZED (81-84)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
4 Jan 67		13 Feb 67	Jan 20 67		
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED		TECHNICIAN	
1675 ml		840 ml		(b) (6)	
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
RADON					
SUMMARY OF RESULTS:					
<p> <i>FU/spl - 34.8 ± 20.6</i> <i>Tot VOL - 1.68</i> <i>VOL ANAL - 0.84</i> </p> <p> <i>010 Rec - 93.2</i> <i>Body Burden -</i> <i>13 Feb 67</i> </p>					

AFLC FORM 1165 MAY 66

FC 5400

AFLC-WPAFB-MAY 66 4500

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

RADIOLOGICAL SAMPLE DATA					
REQUESTOR'S ID (1-10)		GRADE	ANALYSIS DESIRED	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
(b) (6)		2700L	(b) (6)	(b) (6)	671685
TYPE SAMPLE (23-32)	OCCUPATION (34-35)	DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED
URINE		16 MAR 67	PJ 239	PJ 239	APR 17 1967
SAMPLE WEIGHT/VOLUME	WEIGHT/VOLUME ANALYZED	TECHNICIAN		AIR FORCE BASE (68-71)	
600 ml	600 ml			JAN 66	
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY	256	239			
TOTAL COUNTS & MINUTES	5.10 #1	21			
GROSS CPM	260	150			
BKG CPM & MINUTES	800	5			
NET CPM		0			
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY			RADON		
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
Pu 239 per 24 hr spl = 970 dA			870 rec = 62.8		
Total vol = 1.20 L.			Date Counted 6 Jan 67		
Vol anal = 0.60 L.					
AFLC FORM 1165 MAY 66		FC 5400			
AFLC-W/AFB-MAY 66 4500					

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

112-517 (b) (6) FILE P653 (b) (6)

IDENTIFICATION (b) (6)		TYPE SPL URINE		RHL NO. 673859																																																																																																																																																																																																																																																																																																
SOC SEC NO. (b) (6)		SUBMITTEE SC4W		AFB																																																																																																																																																																																																																																																																																																
DATE COLLECTED 10 AUG 67	DATE RECD 14 AUG 67	EXPOSURE DATE(S) JAN 68	TOTAL WT OR VOL 2480 ml	WT OR VOL ANALYZED 1240 ml																																																																																																																																																																																																																																																																																																
ANALYSIS DESIRED P ₂₃₉		(b) (6)																																																																																																																																																																																																																																																																																																		
TYPE OF ANALYSIS	ASP 239 236																																																																																																																																																																																																																																																																																																			
COUNTER AND EFF	#1 - 21																																																																																																																																																																																																																																																																																																			
TOTAL CTS AND TIME	200 - 0 192																																																																																																																																																																																																																																																																																																			
BK CTS AND TIME	800 - 0 5																																																																																																																																																																																																																																																																																																			
NET CTS PER MIN																																																																																																																																																																																																																																																																																																				
<table border="1"> <tr> <td>I</td> <td>20</td> <td>22</td> <td>±</td> <td>33</td> <td>35</td> <td>43</td> <td>I</td> <td>20</td> <td>22</td> <td>±</td> <td>33</td> <td>35</td> <td>43</td> </tr> <tr><td>GR ALPHA DIS</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>GR ALPHA</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>GR ALPHA PER 24 HR</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>DATE CTD</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>GR BETA DIS</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>GR BETA</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>GR BETA PER 24 HR</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>DATE CTD</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>GR ALPHA SUS</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>DATE CTD</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td>GR BETA SUS</td> <td colspan="6"></td> <td>NUCLIDE</td> <td colspan="6">ACTIVITY</td> </tr> <tr> <td>DATE CTD</td> <td colspan="6"></td> <td>Pu²³⁹</td> <td colspan="6">NOA</td> </tr> <tr> <td>NET BETA PER 24 HR</td> <td colspan="6"></td> <td></td> <td colspan="6">29 AUG 1967</td> </tr> <tr><td>SAMPLE WT DIS</td><td colspan="6"></td><td colspan="6"></td></tr> <tr><td>SAMPLE WT SUS</td><td colspan="6"></td><td colspan="6"></td></tr> <tr><td>SAMPLE VOL</td><td colspan="6"></td><td colspan="6"></td></tr> <tr> <td>RECOVERY</td> <td colspan="2">86</td> <td colspan="2"></td> <td colspan="2">%</td> <td colspan="6"></td> </tr> <tr><td>ELAPSED TIME</td><td colspan="6"></td><td colspan="6"></td></tr> <tr><td>SYSTEMIC BODY BURDEN</td><td colspan="6"></td><td colspan="6"></td></tr> <tr><td>CRITICAL ORGAN BONE</td><td colspan="6"></td><td colspan="6"></td></tr> </table>						I	20	22	±	33	35	43	I	20	22	±	33	35	43	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														GR BETA SUS							NUCLIDE	ACTIVITY						DATE CTD							Pu ²³⁹	NOA						NET BETA PER 24 HR								29 AUG 1967						SAMPLE WT DIS													SAMPLE WT SUS													SAMPLE VOL													RECOVERY	86				%								ELAPSED TIME													SYSTEMIC BODY BURDEN													CRITICAL ORGAN BONE												
I	20	22	±	33	35	43	I	20	22	±	33	35	43																																																																																																																																																																																																																																																																																							
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																																																																																																																																																																																																																																																																																																				
GR BETA SUS							NUCLIDE	ACTIVITY																																																																																																																																																																																																																																																																																												
DATE CTD							Pu ²³⁹	NOA																																																																																																																																																																																																																																																																																												
NET BETA PER 24 HR								29 AUG 1967																																																																																																																																																																																																																																																																																												
SAMPLE WT DIS																																																																																																																																																																																																																																																																																																				
SAMPLE WT SUS																																																																																																																																																																																																																																																																																																				
SAMPLE VOL																																																																																																																																																																																																																																																																																																				
RECOVERY	86				%																																																																																																																																																																																																																																																																																															
ELAPSED TIME																																																																																																																																																																																																																																																																																																				
SYSTEMIC BODY BURDEN																																																																																																																																																																																																																																																																																																				
CRITICAL ORGAN BONE																																																																																																																																																																																																																																																																																																				

AFLC FORM 1165 JUL 67

FC 5400 PREVIOUS EDITION WILL BE USED.

RADIOLOGICAL SAMPLE DATA AFLC-WPAFB-JUL 67 3M

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

DEPARTMENT OF THE AIR FORCE
UNITED STATES AIR FORCE HOSPITAL WIESBADEN
APO NEW YORK 09220

9 JAN 1967



REPLY TO
ATTN OF: MSMH

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

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

Contact has been made with Lt Colonel (b) (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.

FOR THE COMMANDER

(b) (6)

(b) (6)

1st Lt, USAF, BSC
Bio-Environmental Engineer

*Boyle sent
12 Jan 67*

(b) (6)

(b) (6)

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

FILE



7 Dec 1964

REPLY TO
ATTN OF SGHW

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

TO: LtCol (b) (6)
USAF Hosp
APO New York 09220

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

April 28, 2000

(b) (6)

(b) (6)

Return after Key Punch
3859

1. 0.00
2. 86
3. 2.48
4. —
5. 7241
6. Systemic Body Burden 0.00

(b) (6)

- 3263
206 ± 80
1. 0.206 ± .08
 2. 74.2
 3. 1.96
 4. 123
 5. 6249
 6. 0.07

Return to Key Punch
after Key Punch

FILE

0351

1. 34.8 ± 20.6 FC
2. 93.2
3. 1.68
4. 370
5. 7044

6. Systemic Body Burden
Bone Critical 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

(b) (6)

(b) (6)

2 ind sample
letter
prepared
3 apr

Last address - 5 Dec 66
4900 Rayling
Kirtland AFB
New Mexico 87117

Letter sent 6 Dec 66

(b) (6)

Cordelline-2

C653

Return to J/col (b) (6) after

1665 Ray punch

1. 0.00

2. 62.8

3. 1.20

4. -

5. 7157

6. Systemic Body Burden 0.00

FILE

116-5-13

(b) (6)

(b)
(6)

(b)
(6)

USAF RADIOLOGICAL HEALTH LAB (SGHW)
WRIGHT-PATTERSON AFB OHIO 45433

UNITED STATES AIR FORCE
OFFICIAL BUSINESS

POSTAGE AND FEES PAID
DEPARTMENT OF THE AIR FORCE

FILE
168 5-23

AIR MAIL

REASON FOR RETURN
Unclaimed
Addressee unknown
Insufficient address
No such street
No such office in state
Do not return in this envelope

Lt Col (b) (6)
USAF Hosp
APO New York 09220

Ref: Palomares Follow-Up Studies

22

(b) (6)

(b) (6)

FILE

110-5-17 (b) (6)

387

23 DEC 66 13 36

ACT
INFORMATION

SG/HW

PFTU JAW RUEOESC0253 3571154-UUUU--RUEDFIA.

DE RUEPBW 13 3570936

ZNR UUUUU

P 230900Z DEC 66

FM USAT HOSPITAL LINDSEY AS GERMANY

TO USAT RADL HEALTH LAB WRIGHT PATTERSON AFB OHIO

BT

UNCLAS NSMR 12206 DEC 66 FOR SGHW

LT COLONEL (b) (6) SELECTED TO PARTICIPATE IN THE PROGRAM

DESIGNED TO VERIFY RESULTS OF PREVIOUS URINALYSIS AND LONG-TERM

EFFECTS OF 239-PLUTONIUM, IS ASSIGNED TO THIS BASE. THIS PERSON

IS ON TDY AND WILL RETURN ON 3 JAN 67.

LT COLONEL (b) (6) WILL BE CONTACTED AS SOON AS POSSIBLE TO SOLICIT

HIS COOPERATION IN THIS PROGRAM.

BT

(b) (6)

(b) (6)

UNCLASSIFIED

ROUTINE

SECS 22 250

1488

14

SGHW

RTTU JAW RUWJFNA0611 3432147-UUUU--RUEDFIA.

ZNR UUUUU

R 092025Z DEC 66

FM 4900USAFDISP KIRTLAND AFB NMEX

TO USAF RADL HEALTH LAB WPAFB OHIO

BT

UNCLAS SWD 35085 DEK 66

REFERENCE YOUR LTR, LONG-TEJM STUDIES ON SELECTED PARTICIPANTS OF
PALOMARES INCIDENT (LT COL (b) (6), 6 DEK 1966.

RECORDS INDICATE THAT COL (b) (6) WAS TRANSFERRED PCS ON 8 JULY
1966 TO APO 09633. YOUR LETTE BEING FORWARDED TO THAT ADDRESS.

BT

NNNN#

UNCLASSIFIED

ROUTINE

00

(b) (6)

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)																																									
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Ingestion <input type="checkbox"/> Unknown		INTAKE DATE OR PERIOD: 2/01/66 through 4/02/66 on-site 2/01/66 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: 4 urine samples from 08/30/66 to 08/23/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain																																											
EVALUATION DATA: <table border="0"><tr><td>Air Sampling</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Health Physics Survey Data</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Bioassay - Urinalysis</td><td><input checked="" type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input type="checkbox"/> Unavailable</td></tr><tr><td>Fecal</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Nasal Smears</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>In Vivo</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr></table> Medical Treatment: <table border="0"><tr><td>Skin Decontamination:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Date: _____</td></tr><tr><td>Decorporation:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Agent: _____ Date: _____</td></tr><tr><td>Catharsis:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Agent: _____ Date: _____</td></tr><tr><td>Surgical excision:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Date: _____</td></tr></table>				Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Bioassay - Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable	Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____	Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Bioassay - Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable																																								
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____																																								
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																								
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																								
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____																																								
EVALUATION METHODOLOGY: Assumptions: Acute inhalation intake of ^{239}Pu , 100% Class Y, 1 μm AMAD particle size on 2/01/66 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): 72,000 50 YR CEDE (rem): 22 (0.22 Sv) <table border="0"><tr><td>Organ Dose Equivalent Summary</td><td>50 YR CDE (rem/Sv)</td></tr><tr><td>Bone Surface</td><td>220/2.2</td></tr><tr><td>Lung</td><td>82/0.82</td></tr><tr><td>Liver</td><td>40/0.40</td></tr><tr><td>Red Marrow</td><td>17/0.17</td></tr><tr><td>Other</td><td>3.8/0.038</td></tr><tr><td>Testes</td><td>3.2/0.032</td></tr></table>				Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)	Bone Surface	220/2.2	Lung	82/0.82	Liver	40/0.40	Red Marrow	17/0.17	Other	3.8/0.038	Testes	3.2/0.032																										
Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)																																										
Bone Surface	220/2.2																																										
Lung	82/0.82																																										
Liver	40/0.40																																										
Red Marrow	17/0.17																																										
Other	3.8/0.038																																										
Testes	3.2/0.032																																										
DOSE ASSESSOR:		PEER REVIEWER:																																									
DATE: _____		DATE: _____																																									
Signature: _____		Signature: _____																																									
Print Name: _____		Print Name: _____																																									
SSN: _____		SSN: _____																																									

RECOMMENDATIONS:

Additional Bioassay Required

☐ Urinalysis☐ Fecal☐ In Vivo

Suggested Sampling Frequency: _____

Work Restrictions: N/A

(b) (6)

(b) (6)

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 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 Burden
8/30/66	7
1/13/67	4
5/14/67	0
8/23/67	0

Radionuclide(s): ^{239}Pu .**Assumptions/Basis/Data Sources:**

Acute inhalation intake of Pu-239; 100% Class Y; 1 μm 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.

(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
66-4565	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:

Organ	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent (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 Equivalent			2.2E+01/2.2E-01

(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 ^{239}Pu 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.

Prepared By:

Name: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: _____

AFLC-WPAFB-MAY 66 4500

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

(b) (6)		LOCATION (b) (6)		TYPE SPL	FILE NO. 674417	(b) (6)	
C. NO.		SUBMITTEE		AFB	P-653		
DATE COLLECTED	DATE RECD	EXPOSURE DATE(S)		TOTAL WT OR VOL	WT OR VOL ANALYZED		
	15 SEP 67			2850 ml	1425 ml		
ANALYSIS DESIRED				TECHNICIAN			
239Pu				(b) (6)			
TYPE OF ANALYSIS	239	236					
COUNTER AND EFF	Spec #1 - 22						
TOTAL CTS AND TIME	200 - 0	195					
BK CTS AND TIME	800 - 1	4					
NET CTS PER MIN							
	15 SEP 1967						5.19
1	20	22	±	33	35	43	1
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							
GR BETA SUS							
DATE CTD							
NET BETA PER 24 HR							15 SEP 1967
SAMPLE WT DIS							
SAMPLE WT SUS							
SAMPLE VOL							
RECOVERY	85		%				
ELAPSED TIME							
SYSTEMIC BODY BURDEN							
CRITICAL ORGAN BONE							

AFLC FORM 1165 JUL 67

FC 5400

PREVIOUS EDITION WILL BE USED.

RADIOLOGICAL SAMPLE DATA AFCLC-WPAFB-JUL 67 3M

RADIOLOGICAL SAMPLE DATA					
NAME OF REQUESTOR (1-10)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
(b) (6)		Maj	(b) (6)	(b) (6)	664565
TYPE SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED (36-38)	REQUESTED BY	AIR FORCE BASE (40-71)	
Urine		PU 239	SGHW	Wh. elus AB, Libya	
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
12 Sept 66		5 OCT 66	30 AUG 66	Feb 1966	
SAMPLE WEIGHT/VOLUME	WEIGHT/VOLUME ANALYZED		TECHNICIAN	(b) (6)	
1950 ml	700 ml				
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
$P_{\text{u}}/sp1 = 0.174 \pm 0.125$ $T_{\text{OT}} U_{\text{O}} = 1950$ $U_{\text{O}}L \text{ ANAL} = 700$			$\% \text{ Rec} = 61.3$ $\text{Body Burden} =$		

AFLC FORM MAY 66 1165

FC 5400

AFLC-WPAFB-MAY 66 4500

Salomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

AFLC FORM 1165
MAY 66

FC
5400

AFLC-WPAFB-JAN 67 5M

April 28, 2000

(b) (6)

(b) (6)

Return after Key Launch

(b) (6)

4417

FILE

1. 0.00

2. 85

3. 2.85

4. —

5. 7258

6. Systemic Body Burden 0.00

Return to Col
after Key Launch

(b) (6)

0375

FILE

1. 47.8 ± 21.8 FC

2. 106.6

3. 1.89

4. 370

5. 7039

6. Systemic Body Burden
Bone Critical Organ 0.04

Code 653

168-5-14 (b) (6)

MEMO ROUTING SLIP		Never Use for Approvals, Concurrences, or Disapproval		ACTION	
1	TO	DATE	COORDINATION	INITIALS	CIRCULATE
	SG H. W.				
2	WRIGHT-PAT AFB, OHIO				FILE
				X	INFORMATION
3					NOTE AND RETURN
					PER CON-VERSATION
4					SEE ME
					SIGNATURE
REMARKS					
May (b) (6)					
HAS RETIRED FROM ACTIVE SERVICE, HIS NEW ADDRESS					
15 (b) (6)					
FROM				DATE	PHONE
MSM				8 Aug 67	

DD FORM 1 OCT 60 95

Replaces DD Form 94, 1 Feb 60, and DD Form 95, 1 Feb 60, which will be used until exhausted.

413-16-7570-1 GPO

(b) (6)

(b) (6)

FILE
Use this unit

4565

1. $.17 \pm .13$ PC
2. 61.3
3. 1.95
4. 202
5. 6278
6. 0.07

Return to F146
for punch

1788

1. 0.00
2. 103.
3. 0.84
4. 468
5. 7180
6. Systolic Body Bunden 0.00

FILE
Last address - 5 Dec 66
Wheeler AB, Libya
7272 Hwy 16-50
APO NY 09231
Letter sent 6 Dec 66
Second letter sent 19 Jan 67

FILE
2nd sample
better prepared
3 Apr 67

(b) (6)

(b) (6)

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



7 Dec 1967

REPLY TO
ATTN OF

SGHW

SUBJECT

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

TO Maj (b) (6) USAF (Ret)
(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 you, and that three samples were returned for analysis.

(b) (6)

(b) (6)

LtCol, USAF, MC

Chief

(b) (6)

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)	
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Injection <input type="checkbox"/> Ingestion <input type="checkbox"/> Absorption <input type="checkbox"/> Unknown <input type="checkbox"/> Not applicable		INTAKE DATE OR PERIOD: 01/31/66 through 03/08/66 on-site 1/31/66 assumed start.	
SUMMARY OF EXPOSURE CONDITIONS: Radionuclides/Respiratory Class/Particle Size: ^{239}Pu /100% Class Y/I μm AMAD Date or Period of Evaluated Data: 3 urine samples from 03/08/66 to 01/26/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain			
EVALUATION DATA:			
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Bioassay - Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Medical Treatment:			
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
EVALUATION METHODOLOGY:			
Assumptions: Acute inhalation intake of ^{239}Pu , 100% Class Y, 1 μm AMAD particle size on 1/31/66			
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): 180,000			
50 YR CEDE (rem): 55 (0.55 Sv)			
Organ Dose Equivalent Summary		50 YR CDE (rem/Sv)	
Bone Surface		560/5.6	
Lung		210/2.1	
Liver		100/1.0	
Red Marrow		43/0.43	
Other		9.5/0.095	
Testes		8.0/0.080	
DOSE ASSESSOR:		PEER REVIEWER:	
DATE: _____		DATE: _____	
Signature: _____		Signature: _____	
Print Name: _____		Print Name: _____	
SSN: _____		SSN: _____	
RECOMMENDATIONS:			
Additional Bioassay Required <input type="checkbox"/> Urinalysis <input type="checkbox"/> Fecal <input type="checkbox"/> In Vivo			
Suggested Sampling Frequency: _____			
Work Restrictions: N/A			

(b) (6)

(b) (6)

Preliminary Internal Dosimetry Case Narrative**Identification:**Name: (b) (6)
SSN: (b) (6)**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): ^{239}Pu .**Assumptions/Basis/Data Sources:**

Acute inhalation intake of Pu-239; 100% Class Y; 1 μm 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

Palomares Nuclear Weapons Accident

Dose Evaluation Report

April 28, 2000

(b) (6)

(b) (6)

(b) (6) 2 May 67 (b) (6)		(b) (6) 168-511 R II (b) (6)	
(b) (6)		TYPE SPL URINE	
(b) (6)		FILE NO. 671495	
(b) (6)		SUBMITTEE SC44W	
(b) (6)		AFB 11634 TEMPTATION DR. SAN ANTONIO, TEXAS 78246	
DATE COLLECTED 25 APR 67	DATE RECD 27 APR 67	EXPOSURE DATE(S)	SPL WT OR VOL 1490 ml / 745 ml ANAL
ANALYSIS DESIRED P2 239			
TYPE OF ANALYSIS 236	239		
COUNTER AND EFF Spect 424			
TOTAL CTS AND TIME 200 - 178	1		
BK CTS AND TIME 800 - 0	0		
NET CTS PER MIN	$0.007212 \pm 0.007252 \text{ c/min}$ $\% \text{ rec} = 65.2$		
1	20 22	2	33 35
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			
GR BETA SUS			
DATE CTD			
NET BETA PER 24 HR			
SAMPLE WT DIS			
SAMPLE WT SUS			
SAMPLE VOL			
RECOVERY			
ELAPSED TIME			
SYSTEMIC BODY BURDEN			
CRITICAL ORGAN BONE			
OT Form, Apr 67 HCGSCPF, hbf		SAMPLE DATA	
		AFLC-WPAFB-APR 67 300	

Palomares Nuclear Weapons Accident

Dose Evaluation Report

April 28, 2000

(b) (6)

(b) (6)

IDENTIFICATION		EVANS, G.O.		TYPE SPL		URINE		FILE NO.		674316	
SUBMITTEE		SCHW		AFB		P-653					
DATE COLLECTED		25 AUG 67		DATE RECD		29 AUG 67		EXPOSURE DATE(S)			
TOTAL WT OR VOL		1640 ml		WT OR VOL ANALYZED		820 ml					
ANALYSIS DESIRED		239 PU		TECHNICIAN		(b) (6)					
TYPE OF ANALYSIS		139		236							
COUNTER AND EFF		Spec #4									
TOTAL CTS AND TIME		200-0		203							
BK CTS AND TIME		500-1		1							
NET CTS PER MIN		112467								5.20	
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											
GR BETA SUS											
DATE CTD											
NET BETA PER 24 HR											
SAMPLE WT DIS											
SAMPLE WT SUS											
SAMPLE VOL											
RECOVERY		89		%							
ELAPSED TIME											
SYSTEMIC BODY BURDEN											
CRITICAL ORGAN BONE											

AFLC FORM 1165 JUL 67

FC 5400

PREVIOUS EDITION WILL BE USED.

RADIOLOGICAL SAMPLE DATA AFLC-WPAFB-JUL 67 3M

(b) (6)

(b) (6)

FILE 118-5-10
2nd sample
letter prepared
3 apr 67

FILE 118-5-10
NEW ADDRESS -

(b) (6)

(b) (6)

FILE 118-5-10
Letter addressed to
Hq 8th AF
Westover AFB, Mass
Letter sent
6 Dec 66

(b) (6)

(b) (6)

(b) (6) Code - 655 - wine - 2
Return to I/C (b) (6)
after key punch.

621495 FILE 16-5-10

1. 0.00
2. 65.2
3. 1.49
4. —
5. 7121
6. Systemic Body Burden 0.00

Return after key punch (b) (6)

4316

1. 0.00
2. 89
3. 1.64
4. —
5. 7254
6. Systemic Body Burden 0.00

FILE 16-5-10 (b) (6)
use this unit
3405 ↓

1. 0.17 ± 0.13 PC
2. 69.6
3. 1.92
4. 135
5. 6278
6. 0.07

Return to I/C (b) (6)
after key punch
FILE 16-5-10 (b) (6)
0349

1. 21.8 ± 15.7 FC
2. 106
3. 1.97
4. 365
5. 7044
6. Systemic Body Burden
Bone critical organ 0.02

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

DEPARTMENT OF THE AIR FORCE
814TH MEDICAL GROUP (SAC)
WESTOVER AIR FORCE BASE, MASSACHUSETTS 01022



REPLY TO
ATTN OF: MS

20 December 1966

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

TO: USAF Radiological Health Laboratory (AFLC)
Lt Col (b) (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 (b) (6) SSN (b) (6) (b) (6) Hq 8AF, was retired from active service on 31 July 1966.

2. Address listed on retirement orders is (b) (6)

(b) (6)

(b) (6)

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

(b) (6)

phone (b) (6)

*Will cooperate -
Fono call - 27 Dec 66*

Letter sent 10 Jan 67

Peace . . . is our Profession

April 28, 2000

(b) (6)

(b) (6)

FILE
100-4-10
S

MS

20 December 1966

Long-Term Studies on Selected Participants of Palomares Incident

USAF Radiological Health Laboratory (AFLC)
Lt Col (b) (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 (b) (6) SSN (b) (6) (b) Hq 8AF, was retired from active service on 31 July 1966.

2. Address listed on retirement orders is (b) (6)
(b) (6)

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

(b) (6)

(b) (6)

FILE 118-5102

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



7 Dec 1967

REPLY TO
ATTN OF SGHW

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

TO: LtCol (b) (6) USAF (Ret)
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.

(b) (6)

(b) (6)

Chief

LtCol, USAF, MC

(b) (6)

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)																																								
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Injection <input type="checkbox"/> Ingestion <input type="checkbox"/> Absorption <input type="checkbox"/> Unknown <input type="checkbox"/> Not applicable		INTAKE DATE OR PERIOD: 02/06/66 through 02/28/66 on-site 2/6/66 assumed start.																																								
SUMMARY OF EXPOSURE CONDITIONS: Radionuclides/Respiratory Class/Particle Size: $^{239}\text{Pu}/100\%$ Class Y/I μm AMAD Date or Period of Evaluated Data: 5 urine samples from 02/28/66 to 08/04/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain																																										
EVALUATION DATA: <table style="width: 100%;"> <tr> <td>Air Sampling</td> <td><input type="checkbox"/> Attached</td> <td><input type="checkbox"/> In Process</td> <td><input checked="" type="checkbox"/> Unavailable</td> </tr> <tr> <td>Health Physics Survey Data</td> <td><input type="checkbox"/> Attached</td> <td><input type="checkbox"/> In Process</td> <td><input checked="" type="checkbox"/> Unavailable</td> </tr> <tr> <td>Bioassay – Urinalysis</td> <td><input checked="" type="checkbox"/> Attached</td> <td><input type="checkbox"/> In Process</td> <td><input type="checkbox"/> Unavailable</td> </tr> <tr> <td>Fecal</td> <td><input type="checkbox"/> Attached</td> <td><input type="checkbox"/> In Process</td> <td><input checked="" type="checkbox"/> Unavailable</td> </tr> <tr> <td>Nasal Smears</td> <td><input type="checkbox"/> Attached</td> <td><input type="checkbox"/> In Process</td> <td><input checked="" type="checkbox"/> Unavailable</td> </tr> <tr> <td>In Vivo</td> <td><input type="checkbox"/> Attached</td> <td><input type="checkbox"/> In Process</td> <td><input checked="" type="checkbox"/> Unavailable</td> </tr> </table> <p>Medical Treatment:</p> <table style="width: 100%;"> <tr> <td>Skin Decontamination:</td> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> <td>Date: _____</td> </tr> <tr> <td>Decorporation:</td> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> <td>Agent: _____ Date: _____</td> </tr> <tr> <td>Catharsis:</td> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> <td>Agent: _____ Date: _____</td> </tr> <tr> <td>Surgical excision:</td> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> <td>Date: _____</td> </tr> </table>			Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable	Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____	Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																							
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																							
Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable																																							
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																							
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																							
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																							
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____																																							
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																							
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																							
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____																																							
EVALUATION METHODOLOGY: Assumptions: Acute inhalation intake of ^{239}Pu , 100% Class Y, 1 μm AMAD particle size on 2/06/66 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): 55,000 50 YR CEDE (rem): 17 (0.17 Sv) <table style="width: 100%;"> <thead> <tr> <th style="text-align: left;">Organ Dose Equivalent Summary</th> <th style="text-align: right;">50 YR CDE (rem/Sv)</th> </tr> </thead> <tbody> <tr> <td>Bone Surface</td> <td style="text-align: right;">170/1.7</td> </tr> <tr> <td>Lung</td> <td style="text-align: right;">63/0.63</td> </tr> <tr> <td>Liver</td> <td style="text-align: right;">31/0.31</td> </tr> <tr> <td>Red Marrow</td> <td style="text-align: right;">13/0.13</td> </tr> <tr> <td>Other</td> <td style="text-align: right;">2.9/0.029</td> </tr> <tr> <td>Testes</td> <td style="text-align: right;">2.5/0.025</td> </tr> </tbody> </table>			Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)	Bone Surface	170/1.7	Lung	63/0.63	Liver	31/0.31	Red Marrow	13/0.13	Other	2.9/0.029	Testes	2.5/0.025																										
Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)																																									
Bone Surface	170/1.7																																									
Lung	63/0.63																																									
Liver	31/0.31																																									
Red Marrow	13/0.13																																									
Other	2.9/0.029																																									
Testes	2.5/0.025																																									
DOSE ASSESSOR: _____ Signature: _____ Print Name: _____ SSN: _____		PEER REVIEWER: _____ Signature: _____ Print Name: _____ SSN: _____																																								
RECOMMENDATIONS: Additional Bioassay Required <input type="checkbox"/> Urinalysis <input type="checkbox"/> Fecal <input type="checkbox"/> In Vivo Suggested Sampling Frequency: _____ Work Restrictions: N/A																																										

(b) (6)

(b) (6)

Preliminary Internal Dosimetry Case Narrative**Identification:**

Name:

SSN:

(b) (6)

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): ^{239}Pu .**Assumptions/Basis/Data Sources:**

Acute inhalation intake of Pu-239; 100% Class Y; 1 μm 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.

(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
66-1391	G	02/28/66	22	1.52	0.38	
66-4527	AS	09/04/66	210	0.130	0.0879	✓
67-0286	AS	01/13/67	341	0.0229	0.0166	✓
67-1263	AS	04/08/67	426	0.024	0.017	✓
67-3659	AS	08/04/67	544	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	55,000	17/0.17
LUDEP	91,000	6.4/0.064

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	2.5E+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 Equivalent			1.7E+01/1.7E-01

(b) (6)

(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: _____

MAR 9 1966

INTERNAL DOSE DATA			
NAME (LAST, FIRST, MIDDLE) (b) (6)		SOC. SEC. NO. (21-23) (b) (6)	TYPE SAMPLE (30) URINE
SAMPLE NO. (33-38) 44-1391		SAMPLE DATE (39-44) 28 FEB 66	EXPOSURE DATE 6 Feb 66 TYPE
BASE (57-60) TACRETAN		OCCUPATION (61-62) 43151E	REQUESTED BY
DATE RECEIVED 9 MAR 66		SAMPLE VOLUME 910	VOLUME ANALYZED 946
DATE ANALYZED			
TECHNICIAN (SIGNATURE AND DATE)			
URINE		RADON	
Counter Number	C	Chamber Number	
Counter Bkg. (cpm)	0.05 (96/min)	Cham. Bkg. (mv/sec)	
Counter Eff. (%)	57	Counter Eff. (%)	
Date/Time - Start	8 APR 1966	Millivolt - Start	
- Stop		Millivolt - Stop	
Total Counts	235	Total Millivots	
Counting Time	100	Total Drift Time	
Gross cpm	0.35	Gross mv/sec	
Bkg. Cpm	0.05	Bkg. Mv/sec	
Net cpm	2.30	Net mv/sec	
dpm	4.51	curies/mv	
dpm/24 hr (69-74)	1.07	litter (69-74)	
K 40 Correction		D(q) (63-68)	
Net Beta Pk Sample	1.52	uc/mg (69-74)	
D(q) (63-68)		D(q) (63-68)	

Converted for alpha
one 2.30 microcuries
Dp = 0.05 microcuries

Long-Term Follow Up
RADIOLOGICAL SAMPLE DATA

NAME OR REQUESTOR'S ID (1-30) (b) (6)		GRADE A1c	AFSN (b) (6)	SOCIAL SECURITY NUMBER (b) (6)	RHL SAMPLE NUMBER 11825
TYPE SAMPLE (23-32) Urine-1	OCCUPATION (34-38) P 239	ANALYSIS DESIRED SGHW	AIR FORCE BASE (66-71) Torrejon, Spain		
DATE RECEIVED (37-42) 17 Jan 67	DATE ANALYZED (51-56) 17 Feb 67	DATE COUNTED 13 Jan 67	EXPOSURE DATE		
SAMPLE WEIGHT/VOLUME 2600 + 130 ACID	WEIGHT/VOLUME ANALYZED 1000 ml		(b) (6)		
OTHER DATA 5.70					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY	RADON				
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS: Fei/Spl - 22.9 ± 16.6 Tot Vol - 2.0 liter Urinal - 1 liter 0% Rec = 101 Body Burden - 9 Feb 67					

AFLC FORM MAY 66 1165

FC 5400

AFLC-WPAFB-MAY 66 4500

RADIOLOGICAL SAMPLE DATA					
NAME OR REQUESTOR (1-10)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
(b) (6)		A1C	(b) (6)	(b) (6)	664527
TYPE SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (66-71)	
Urine		Pu 239	SGHW	Torrejon, Spain	
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
1 Sept 66		30 Sept 66	4 Sept 66	6/2/66	
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED		TEC (b) (6)	
600		300 ml			
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
$Pu/spl = 0.1298 \pm 0.0879$ % Rec = 76.7 Tot Vol = 600 Body Burden: Vol ANAL = 300					

AFLC FORM 1165 MAY 66

FC 5400

AFLC-WPAFB-MAY 66 4500

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

Palomares Nuclear Weapons Accident

Dose Evaluation Report

April 28, 2000

(b) (6)

(b) (6)

(b) (6)

P653

118-5-11

(b) (6)

(b) (6)

(b) (6)

IDENTIFICATION (b) (6)		TYPE SPL URINE 239Pu		RHL NO. 673659	
SOC. SEC. NO. 56440		SUBMITTEE AFB			
DATE COLLECTED 4 Aug 67	DATE RECD 8 Aug 67	EXPOSURE DATE(S)	TOTAL WT OR VOL 560 ml	WT OR VOL ANALYZED 280 ml	
ANALYSIS DESIRED 239Pu		TECHNICIAN (b) (6)			
TYPE OF ANALYSIS	AS 239	236			
COUNTER AND EFF	#1 - 21	#1 - 21			
TOTAL CTS AND TIME	200 - 1	191			
BK CTS AND TIME	800 - 0	5			
NET CTS PER MIN					
cpk value 5.25dpm.					
1	20	22	±	33	35
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					
GR BETA SUS					
DATE CTD					
NET BETA PER 24 HR					
SAMPLE WT DIS					
SAMPLE WT SUS					
SAMPLE VOL					
RECOVERY	86			%	
ELAPSED TIME					
SYSTEMIC BODY BURDEN					
CRITICAL ORGAN BONE					
		NUCLIDE		ACTIVITY	
		Pu 239		WDA	
				29 AUG 1967	

AFLC FORM 1165 JUL 67

FC 5400

PREVIOUS EDITION WILL BE USED.

RADIOLOGICAL SAMPLE DATA

AFLC-WPAFB-JUL 67 3M

April 28, 2000

(b) (6)

(b) (6)

(b) (6) Return card to card (b) (6)
after key punch. urine-2
1263 FILE
1. 24 ± 17 FC 1105-11
2. 90.6
3. 1.15
4. 448
5. 2114
6. Systemic Body Burden
Bone critical organ 0.02

Return after key
punch

3659

1105-11 (b) (6)

1. 0.00

2. 86

3. 56

4. —

5. 7241

6. Systemic Body Burden 0.00

FILE

(b) (6)

1105-11 (b) (6)

4527

138188 fci

1. 0.130 ± 0.088

2. 26.7

3. .6

4. 220

5.

6273

6. 0.07

(b) (6)

(b) (6)

FILE 11B-5 (b) (6)

Lost address - 50266

(b) (6)

Return card to cal
after pay punch.

(b) (6)

(b) (6)

0286

11B-5-11

(b) (6)

1. 22.9 ± 16.6 FC

2. 101

3. 2.0

4. 363

5. 7040

6. Systemic Body Burden
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

FILE 11B-5-11 (b) (6)

2nd sample
little prepared

3 apr 67

(b) (6)

(b) (6)

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

FILE

REPLY TO
ATTN OF

SGHW

7 Dec 1967

SUBJECT

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

TO

Mr. (b) (6)
(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 you, and that three samples were returned for analysis.

(b) (6)

(b) (6)

LtCol, USAF, MC

Chief

(b) (6)

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)																																									
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Ingestion <input type="checkbox"/> Unknown <input type="checkbox"/> Injection <input type="checkbox"/> Absorption <input type="checkbox"/> Not applicable		INTAKE DATE OR PERIOD: 01/18/66 through 02/11/66 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 02/11/66 to 08/16/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain																																											
EVALUATION DATA: <table border="0"><tr><td>Air Sampling</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Health Physics Survey Data</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Bioassay – Urinalysis</td><td><input checked="" type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input type="checkbox"/> Unavailable</td></tr><tr><td>Fecal</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Nasal Smears</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>In Vivo</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr></table> Medical Treatment: <table border="0"><tr><td>Skin Decontamination:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Date: _____</td></tr><tr><td>Decorporation:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Agent: _____ Date: _____</td></tr><tr><td>Catharsis:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Agent: _____ Date: _____</td></tr><tr><td>Surgical excision:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Date: _____</td></tr></table>				Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable	Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____	Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable																																								
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____																																								
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																								
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																								
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> 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): 44,000 50 YR CEDE (rem): 14 (0.14 Sv) <table border="0"><tr><td>Organ Dose Equivalent Summary</td><td>50 YR CDE (rem/Sv)</td></tr><tr><td>Bone Surface</td><td>140/1.4</td></tr><tr><td>Lung</td><td>50/0.50</td></tr><tr><td>Liver</td><td>25/0.25</td></tr><tr><td>Red Marrow</td><td>11/0.11</td></tr><tr><td>Other</td><td>2.3/0.023</td></tr><tr><td>Testes</td><td>2.0/0.020</td></tr></table>				Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)	Bone Surface	140/1.4	Lung	50/0.50	Liver	25/0.25	Red Marrow	11/0.11	Other	2.3/0.023	Testes	2.0/0.020																										
Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)																																										
Bone Surface	140/1.4																																										
Lung	50/0.50																																										
Liver	25/0.25																																										
Red Marrow	11/0.11																																										
Other	2.3/0.023																																										
Testes	2.0/0.020																																										
DOSE ASSESSOR:		PEER REVIEWER:																																									
DATE: _____		DATE: _____																																									
Signature: _____		Signature: _____																																									
Print Name: _____		Print Name: _____																																									
SSN: _____		SSN: _____																																									

RECOMMENDATIONS:

Additional Bioassay Required

☐ Urinalysis☐ Fecal☐ In Vivo

Suggested Sampling Frequency: _____

Work Restrictions: N/A

(b) (6)

(b) (6)

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 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): ^{239}Pu .**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 2/11/66.

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.

(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
66-762	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	✓
67-2154	AS	04/17/67	454	ND		✓
67-5647	AS	08/16/67	575	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	29,000	2.0/0.020

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	2.0E+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 Equivalent			1.4E+01/1.4E-01

(b) (6)

(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: _____

FEB 11 1966

INTERNAL DOSE DATA					
NAME (LAST, FIRST, M.I.) (1-20)		SOC SEC. NO. (21-29)		TYPE SAMPLE (30)	TYPE ANAL. (31-32)
(b) (6)		(b) (6)		URINE	GROSS ALPHA
SAMPLE NO. (33-38)	SAMPLE DATE (39-44)		EXPOSURE		
66-762	FROM 10 FEB 66 TO 11 FEB 66		DATE 18 JAN 66 TYPE		
BASE (57-60)	OCCUPATION (61-62)	REQUESTED BY			
MORON SPAIN	29350				
DATE RECEIVED	SAMPLE VOLUME	VOLUME ANALYZED	DATE ANALYZED		
	450 ml	200 ml			
TECHNICIAN (SIGNATURE AND DATE)					
(b) (6) 25 FEB 1966					
URINE		RADON		FECES/BLOOD	
Counter Number	GROSS ALPHA	Chamber Number		Counter Number	
Counter Bkg. (cpm)	1.11	Cham. Bkg. (mv/sec)		Counter Bkg.	
Counter Eff. (%)	0.51	Counter Eff. (%)		Counter Eff.	
Date/Time - Start	5 FEB 1966	Millivolt - Start		Date/Time - Start	
- Stop		Millivolt - Stop		- Stop	
Total Counts	61	Total Millivots		Total Counts	
Counting Time	55 min	Total Drift Time		Counting Time	
Gross cpm	1.11	Gross mv/sec		Gross cpm	
Bkg. Cpm	0.55	Bkg. Mv/sec		Bkg. cpm	
Net cpm	0.55	Net mv/sec		net cpm	
dpm/24 hr. (69-74)	2.43 ± 1.55	curies/mv		dpm	
K-40 Correction		litter (69-74)		dps/cc	
Net Beta	1.04 ± 0.69	D(q) (63-68)		Neutron Dose (rads) (63-68)	
D(q) (63-68)				uc/mg (69-74)	
				D(q) (63-68)	

$D_R = 1.10 \times 10^{-2} \text{ rad}$ 1.25

28 Feb 66

RADIOLOGICAL SAMPLE DATA					
NAME OF PERSONNEL (23-32)		GRADE	AFSC	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
(b) (6)		A/2c	(b) (6)	(b) (6)	1653
TYPE SAMPLER (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (68-71)	
100ml		239	FM 401 TAC Hosp Tarr-Java	sp.	
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
5 June 67			17 APR 67	JAN 66	
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED			
780 ml		390 ml			
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
RADON					
SUMMARY OF RESULTS:					
<p> $\text{Total Vol} = 0.786$ $\text{Vol anal} = 0.396$ $\text{Total Vol} = 86.7$ $\text{Date Counted 22 June 67}$ </p>					

AFLC FORM MAY 66 1165

FC 5400

AFLC-WPAFB-JAN 67 5M

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

FC
5400

AFLC-WPAFB-JAN 67 5M

AFLC FORM 1165
MAY 66

Palomares Nuclear Weapons Accident

Dose Evaluation Report

April 28, 2000

(b) (6)

(b) (6)

FILE 11653 R

IDENTIFICATION NO. (b) (6)		TYPE SPL		RHL NO.	
SOC. SEC. NO.		SUBMITTEE		AFB	
		SGHW		P-653	
COLLECTED	DATE RECD	EXPOSURE DATE(S)	TOTAL WT OR VOL	WT OR VOL ANALYZED	
(b) (6)	Aug 67	6 Oct 67	750 ml	375 ml	
SIS DESIRED		TECHNICIAN			
239 Pu		(b) (6)			

TYPE OF ANALYSIS	239 Pu	236 Pu	B Part gross ct.	B Part 239 Pu	236 Pu
COUNTER AND EFF	Spec #4 J3		E-58-		
TOTAL CTS AND TIME	700 140 0	140	55-88	0	111
BK CTS AND TIME	100 - 0	0	900-35	0	0
NET CTS PER MIN			60.7	2 Nov 67	48.1% net
			0.002		

1	20	22	±	33	35	43	1	20	22	±	33	35	43
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													
GR BETA SUS													
							NUCLIDE						
DATE CTD							239 Pu	91	D. A.				
NET BETA PER 24 HR							Date Counted						
SAMPLE WT DIS													
SAMPLE WT SUS													
SAMPLE VOL	0	15					liters						
RECOVERY	78	2					Per Cent						
ELAPSED TIME													
SYSTEMIC BODY BURDEN													
CRITICAL ORGAN BONE													

AFLC FORM 1165 JUL 67

FC 5400

PREVIOUS EDITION WILL BE USED.

RADIOLOGICAL SAMPLE DATA AFLC-WPAFB-JUL 67 3M

April 28, 2000

(b) (6)

(b) (6)

FILE
2nd sample
letter
prepared
3aps

FILE
Last address - 5 Dec 66
Moron AB
APO 09782
~~22222222~~
Same add as
Luzon
Letter Sent 6 Dec 66

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

(b) (6)

(b) (6)

Return to S/col

(b) (6)

(b) (6)

after key punch

2154

FILE

1657 (b) (6)

1. 0.00
2. 86.7
3. .78
4. —
5. 173
6. Systemic Body Burden 0.00

Return after key punch

(b) (6)

5647

1657 (b) (6)

1. 0.00
2. 78
3. .75
4. —
5. 7320
6. Systemic Body Burden 0.00

FILE

1657 (b) (6)

~~11685~~

4665

136. ± 7. for

1. ~~11685~~ 0.136 ± 0.07
2. 75.2
3. .9
4. 218
5. 6266
6. 0.08

Return to S/col
after key punch

(b) (6)

(b) (6)

0439

1657 (b) (6)

1. 0.00
2. 93.3
3. 1.26
4. 369
5. 704.7
6. 0.00

(b) (6)

(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
66-2504	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:

Organ	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent (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 Equivalent			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 ^{239}Pu 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: _____

Release of this document is restricted under the provisions of the Privacy Act, 5 U.S.C. 552(a). C-1-209

(b)
(6)

RESAMPLE						6 June 66 ARMY		108-5-15 (b) (6)		R	
RADIOLOGICAL SAMPLE DATA						FILE		V153			
NAME OF REQUESTOR'S ID (1-30)			GRADE		RFLY		SOCIAL SECURITY NUMBER		RHL SAMPLE NUMBER		
(b) (6)			E-4		(b) (6)		(b) (6)		16-3275		
TYPE SAMPLE (23-32)		OCCUPATION (34-35)		ANALYSIS DESIRED		REQUESTED BY		AIR FORCE BASE (68-71)			
URINE				Do not		SGH W		GIESSEN			
DATE RECEIVED (37-42)		DATE ANALYZED (51-54)		DATE COUNTED		DATE COLLECTED		EXPOSURE DATE			
6 June 66		10 Sept 66		9 Sept 66		1 June 66		Jan 66			
SAMPLE WEIGHT/VOLUME			WEIGHT/VOLUME ANALYZED			(b) (6)					
1290 ml			730 ml								
OTHER DATA											
Checked off master list											
ENVIRONMENTAL SAMPLES											
COUNTER & EFFICIENCY											
TOTAL COUNTS & MINUTES											
GROSS CPM											
BKG CPM & MINUTES											
NET CPM											
YIELD											
E-127											
BIOLOGICAL SAMPLES											
COUNTER & EFFICIENCY											
TOTAL COUNTS & MINUTES											
GROSS CPM											
BKG CPM & MINUTES											
NET CPM											
YIELD											
RADON											
C-5-5-1											
Rec 78%											
SUMMARY OF RESULTS:											
Pef/sal - 0.244 ± 0.094 To Rec - 79.6 Tot Val - 1290 Body Burden - 0.091 Vol anal - 730											

AFLC FORM MAY 66 1165

FC 5400

AFLC-WPAFB-MAY 66 4500

April 28, 2000

(b) (6)

(b) (6)

Return to P/Col

(b) (6)

(b) (6) after punching.

code 653

11-03-15

(b) (6)

Change name to ~~Hamp~~
Hample

0363

1. 18.2 ± 12.9 FC

2. 103.1

3. 1.89

4. 376

5. 7038

6. Systemic Body Burden

Critical Organ Bone 0.02

TW X to
NMROE
on 30p
asking for
home of record

(b) (6)

(b) (6)

FILE

Last address - 5 Dec 66

Giessen - Germ

308 SWS Bm

Letter sent 6 Dec 66

(b) (6)

3275

244 ± 90. fci

1. 0.244 ± .09

2. 79.6

3. 1.29

4. 127

5. 6251

6. 0.09

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

(b) (6)

(b) (6)

UNCLASSIFIED

E F T O

P R I O R I T Y

23 DEC 17 100

SGHW

537

PFTE JAW RUEOESD0872 3571658-EEEE--RUEDFIA.

DE RUFDKA 24 3571445

ZNY EEEEE

P 221030Z DEC 66

FM CO USA NMRDE LANDSTUHL GER

TO DEPARTMENT OF THE AIR FORCE USAF RADIOLOGICAL HEALTH LAB

AFLC WRIGHT PATTERSON AIR FORCE BASE OHIO

BT

UNCLAS E F T O NM-6356-1

SUBJECT: LONG-TERM STUDIES ON SELECTED PARTICIPANTS OF

PALOMARES INCIDENT (b) (6) SP4 (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 FEB 67 FOR SEPARATION FROM SERVICE UPON RETURN TO CONUS.

B. 5C-EM WELL MOTIVATED AND WILLING TO PARTICIPATE IN
THE PROGRAM.

2. REQUEST CONFIRMATION OF ACCEPTANCE OF INDIVIDUAL AS HE IS
WILLING TO CONTINUE IN PROGRAM AFTER SEPARATION FROM SERVICE

yes! Twx sent on 27 Dec 66

UNCLASSIFIED

E F T O

P R I O R I T Y

Boell sent 10 Jan 67

(b) (6)

(b) (6)

DRAFT

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)																																									
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Injection <input type="checkbox"/> Ingestion <input type="checkbox"/> Absorption <input type="checkbox"/> Unknown <input type="checkbox"/> Not applicable		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: $^{239}\text{Pu}/100\%$ 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																																											
EVALUATION DATA: <table style="width: 100%; margin-top: 10px;"> <tr> <td>Air Sampling</td> <td><input type="checkbox"/> Attached</td> <td><input type="checkbox"/> In Process</td> <td><input checked="" type="checkbox"/> Unavailable</td> </tr> <tr> <td>Health Physics Survey Data</td> <td><input type="checkbox"/> Attached</td> <td><input type="checkbox"/> In Process</td> <td><input checked="" type="checkbox"/> Unavailable</td> </tr> <tr> <td>Bioassay – Urinalysis</td> <td><input checked="" type="checkbox"/> Attached</td> <td><input type="checkbox"/> In Process</td> <td><input type="checkbox"/> Unavailable</td> </tr> <tr> <td>Fecal</td> <td><input type="checkbox"/> Attached</td> <td><input type="checkbox"/> In Process</td> <td><input checked="" type="checkbox"/> Unavailable</td> </tr> <tr> <td>Nasal Smears</td> <td><input type="checkbox"/> Attached</td> <td><input type="checkbox"/> In Process</td> <td><input checked="" type="checkbox"/> Unavailable</td> </tr> <tr> <td>In Vivo</td> <td><input type="checkbox"/> Attached</td> <td><input type="checkbox"/> In Process</td> <td><input checked="" type="checkbox"/> Unavailable</td> </tr> </table> Medical Treatment: <table style="width: 100%;"> <tr> <td>Skin Decontamination:</td> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> <td>Date: _____</td> </tr> <tr> <td>Decorporation:</td> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> <td>Agent: _____ Date: _____</td> </tr> <tr> <td>Catharsis:</td> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> <td>Agent: _____ Date: _____</td> </tr> <tr> <td>Surgical excision:</td> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> <td>Date: _____</td> </tr> </table>				Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable	Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____	Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable																																								
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____																																								
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																								
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																								
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> 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 <table style="width: 100%; margin-top: 10px;"> <tr> <td colspan="2">Estimated Intake Activity (pCi): 210,000</td> </tr> <tr> <td colspan="2">50 YR CEDE (rem): 65 (0.65 Sv)</td> </tr> <tr> <td style="width: 50%;">Organ Dose Equivalent Summary</td> <td style="width: 50%;">50 YR CDE (rem/Sv)</td> </tr> <tr> <td>Bone Surface</td> <td>650/6.5</td> </tr> <tr> <td>Lung</td> <td>240/2.4</td> </tr> <tr> <td>Liver</td> <td>120/1.2</td> </tr> <tr> <td>Red Marrow</td> <td>51/0.51</td> </tr> <tr> <td>Other</td> <td>11/0.11</td> </tr> <tr> <td>Testes</td> <td>9.4/0.094</td> </tr> </table>				Estimated Intake Activity (pCi): 210,000		50 YR CEDE (rem): 65 (0.65 Sv)		Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)	Bone Surface	650/6.5	Lung	240/2.4	Liver	120/1.2	Red Marrow	51/0.51	Other	11/0.11	Testes	9.4/0.094																						
Estimated Intake Activity (pCi): 210,000																																											
50 YR CEDE (rem): 65 (0.65 Sv)																																											
Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)																																										
Bone Surface	650/6.5																																										
Lung	240/2.4																																										
Liver	120/1.2																																										
Red Marrow	51/0.51																																										
Other	11/0.11																																										
Testes	9.4/0.094																																										
DOSE ASSESSOR: Signature: _____ Print Name: _____ SSN: _____		PEER REVIEWER: Signature: _____ Print Name: _____ SSN: _____																																									

RECOMMENDATIONS:
 Additional Bioassay Required ☐ Urinalysis ☐ Fecal ☐ In Vivo
 Suggested Sampling Frequency: _____
 Work Restrictions: N/A

DRAFT

(b) (6)

(b) (6)

Preliminary Internal Dosimetry Case Narrative**Identification:**Name:
SSN:

(b) (6)

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): ^{239}Pu .**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)

(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
66-343	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 Equivalent			6.5E+01/6.5E-01

(b) (6)

(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:

The analysis produced an estimated intake of 210,000 to 700,000 pCi of ^{239}Pu 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.

Prepared By:

Name: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: _____

RADIOLOGICAL SAMPLE DATA					
(b) (6)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
URINE		MSgt	(b) (6)	(b) (6)	(b) (6)
DATE RECEIVED (37-42)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (66-71)		
27 JUL 67	R 232	SCHLW	COLUMBIA MO P.653		
DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE		
12 JUL 67					
SAMPLE WEIGHT/VOLUME	WEIGHT/VOLUME ANALYZED	TECHNICIAN			
1170 ml	585 ml	(b) (6)			
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
RADON					
SUMMARY OF RESULTS:					
Total Vol - 1.17 L		95.7% rec		Per 232 PGM AK HA - NOA	
Vol. Analyzed - 0.59 L		13 JUL 1967			

AFLC FORM MAY 66 1165

FC 5400

AFLC-WPAFB-JAN 67 5M

RADIOLOGICAL SAMPLE DATA					
NAME OR REQUESTOR'S ID (1-20) (b) (6)		GRADE Lieut	AFSN (b) (6)	SOCIAL SECURITY NUMBER (b) (6)	RHL SAMPLE NUMBER 16B-514 (b) (6)
TYPE SAMPLE (23-32) rine	OCCUPATION (34-35) Pu 239	ANALYSIS DESIRED SGHW	REQUESTED BY SGHW	AIR FORCE BASE (88-71) Columbia 9633	
DATE RECEIVED (37-42) 20 Oct 66	DATE ANALYZED (51-56)	DATE COUNTED 31 Oct 66	DATE COLLECTED 16 Oct 66	EXPOSURE DATE Jan 66 Palomares Spain	
SAMPLE WEIGHT/VOLUME 1500 ml + 75 ACID	WEIGHT/VOLUME ANALYZED 750 ml		TECHNICIAN checked off list		
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
<p> <i>Pa/sr - 0.551 ± 0.140</i> <i>Tpt Vol - 1500</i> <i>Vol anal - 750</i> <i>% Rec = 75.5</i> <i>Body burden - 0.33 %</i> </p>					

AFLC FORM 1165
MAY 66

FC
5400

AFLC-WPAFB-MAY 66 4500

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

MAR 17 1966

INTERNAL DOSE DATA			
AFSN: (b) (6)		SOC. SEC. NO. (21-23) (b) (6)	
NAME (LAST, FIRST, MIDDLE) (b) (6)		TYPE SAMPLE (30)	TYPE ANAL. (31-32)
SAMPLE NO. (33-38)	SAMPLE DATE (39-44)	EXPOSURE (45-50)	DATE/TIME (51-56)
66-1644	FROM 0800 3 MAR TO 0800 4 MAR 66	1800	1000
BASE (57-60)	OCCUPATION (61-62)	REQUESTED BY	
TOCCEION	WORKED IN FIRST AID TENT		
DATE RECEIVED	SAMPLE VOLUME	VOLUME ANALYZED	DATE ANALYZED
17 MAR 66	1554	1000	
TECHNICIAN (SIGNATURE AND DATE)			
URINE		RADON	
Counter Number	9	Chamber Number	
Counter Bkg. (cpm)	0.06	Cham. Bkg. (mv/sec)	
Counter Eff. (%)	51	Counter Eff. (%)	
Date/Time - Start	8 APR 1966	Millivolt - Start	
- Stop		Millivolt - Stop	
Total Counts	167	Total Millivots	
Counting Time	100	Total Drift Time	
Gross cpm	1.67	Gross mv/sec	
Bkg. Cpm	0.06	Bkg. Mv/sec	
Net cpm	1.61	Net mv/sec	
dpm	5.16	curies/mv	
dpm/24 hr (69-74)	1.973	liter (69-74)	
K 40 Correction			
Net Beta PC Sample	1.51		
D (q) (63-68)			
		FECES/BLOOD	
		Counter Number	
		Counter Bkg.	
		Counter Eff.	
		Date/Time - Start	
		- Stop	
		Total Counts	
		Counting Time	
		Gross cpm	
		Bkg. cpm	
		net cpm	
		dpm	
		dps/cc	
		Neutron Dose (rads) (63-68)	
		uc/mg (69-74)	
		D (q) (63-68)	

PR = 0.11 micro curies

FEB 7 1966

INTERNAL DOSE DATA					
(b) (6)		SOC. SEC. NO. (21-29)		TYPE SAMPLE (30)	
(b) (6)		TYPE ANAL. (31-32)		urine	
SAMPLE NO. (33-38)		SAMPLE DATE (39-44)		EXPOSURE	
66-343		FROM 3 Feb. TO 4 Feb.		DATE 18 Jan (6) TYPE	
BASE (57-60)		OCCUPATION (61-62)		REQUESTED BY	
Tomason AFB Sp.		869 Paul S.			
DATE RECEIVED		SAMPLE VOLUME		VOLUME ANALYZED	
AFSC 90257		420		200 ml	
TECHNICIAN (SIGNATURE AND DATE)		WALTER G. EDWARDS		9 FEB 1966	
GROSS ALPHA		SSGT.		USAF	
URINE		RADON		FECES/BLOOD	
Counter Number	A	Chamber Number		Counter Number	
Counter Bkg. (cpm)	0.13	Cham. Bkg. (mv/sec)		Counter Bkg.	
Counter Eff. (%)	57	Counter Eff. (%)		Counter Eff.	
Date/Time - Start	9 FEB 1966	Millivolt - Start		Date/Time - Start	
- Stop		Millivolt - Stop		- Stop	
Total Counts	1048	Total Millivots		Total Counts	
Counting Time	55	Total Drift Time		Counting Time	
Gross cpm	19.06	Gross mv/sec		Gross cpm	
Bkg. Cpm	0.13	Bkg. Mv/sec		Bkg. cpm	
Net cpm	18.93	Net mv/sec		net cpm	
dpm/24 hr. (69-74)	83.6 ± 5.2	curies/mv		dpm	
K 40 Correction		litter (69-74)		dps/cc	
Net Beta (63-68)	35.1 ± 2.2	D(q) (63-68)		Neutron Dose (rads) (63-68)	
D(q) (63-68)	1.76 x 10 ⁻¹	uc/mg (69-74)		D(q) (63-68)	

13 Feb 66

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

April 28, 2000

(b) (6)

(b) (6)

FILE

116-5-14

(b) (6)

4975

Destroy Previous Result
Cards

1. 150 ± 20 fpm
2. 75.5
3. 1.5
4. 263
5. 6304
6. Systemic Body burden
Bone critical organ 0.10

FILE

116-5-14

(b) (6)

Has one container
will submit sample
in Jan 67

2nd sample

116-5-14

(b) (6)

better

prepared 3 Apr

(b) (6)

(b) (6)

return to [redacted]
after Ray punch

2639

1. 0.00
2. 95.7
3. 1.17
4. —
5. 7/94
6. Systemic Body Burden 0.00

FILE

Last address - 5 Dec 66

3507 USAF Rtg Group
Det 706, Columbia, Mo.

(b) (6)

(b) (6)

4975

↓ pnc

1. 357.140 PC
2. 75.5
3. 1.3
4. 263
5. 6304

1. Systemic Body Burden
Critical organ bone 0.23

(b) (6)

(b) (6)

Call M Sgt. (b) (6)
at Rect off.
Det 706, Columbus MO,

442-4482

Mailed a sample
the Monday after
New Year's Jan 67

USAF Rect off
10-50 7th St.
Columbus, MO
65201

(b) (6)

(b) (6)

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

FILE



7 Dec 1967

REPLY TO
ATTN OF

SGHW

SUBJECT

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

TO

MSgt

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.
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 one sample was returned for analysis.

(b) (6)

(b) (6)

LTJGOL, USAF, MC

Chief

(b) (6)

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)																									
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Ingestion <input type="checkbox"/> Unknown <input type="checkbox"/> Injection <input type="checkbox"/> Absorption <input type="checkbox"/> Not applicable		INTAKE DATE OR PERIOD: 01/18/66 through 02/03/66 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: 6 urine samples from 02/01/66 to 08/17/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain																											
EVALUATION DATA: <table border="0"><tr><td>Air Sampling</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Health Physics Survey Data</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Bioassay - Urinalysis</td><td><input checked="" type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input type="checkbox"/> Unavailable</td></tr><tr><td>Fecal</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Nasal Smears</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>In Vivo</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr></table> Medical Treatment: Skin Decontamination: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Date: _____ Decorporation: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Agent: _____ Date: _____ Catharsis: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Agent: _____ Date: _____ Surgical excision: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Date: _____				Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Bioassay - Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable	Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																								
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																								
Bioassay - Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable																								
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																								
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																								
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																								
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): 66,000 50 YR CEDE (rem) : 20 (0.20 Sv) <table border="0"><tr><td>Organ Dose Equivalent Summary</td><td>50 YR CDE (rem/Sv)</td></tr><tr><td>Bone Surface</td><td>210/2.1</td></tr><tr><td>Lung</td><td>75/0.75</td></tr><tr><td>Liver</td><td>37/0.37</td></tr><tr><td>Red Marrow</td><td>16/0.16</td></tr><tr><td>Other</td><td>3.5/0.035</td></tr><tr><td>Testes</td><td>2.9/0.029</td></tr></table>				Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)	Bone Surface	210/2.1	Lung	75/0.75	Liver	37/0.37	Red Marrow	16/0.16	Other	3.5/0.035	Testes	2.9/0.029										
Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)																										
Bone Surface	210/2.1																										
Lung	75/0.75																										
Liver	37/0.37																										
Red Marrow	16/0.16																										
Other	3.5/0.035																										
Testes	2.9/0.029																										
DOSE ASSESSOR:		PEER REVIEWER:																									
DATE: _____		DATE: _____																									
Signature: _____		Signature: _____																									
Print Name: _____		Print Name: _____																									
SSN: _____		SSN: _____																									

RECOMMENDATIONS:

Additional Bioassay Required

☐ Urinalysis☐ Fecal☐ In Vivo

Suggested Sampling Frequency: _____

Work Restrictions: N/A

(b) (6)

(b) (6)

Preliminary Internal Dosimetry Case Narrative

Identification:

Name: (b) (6)

SSN: (b) (6)

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.

(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
66-410	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:

Organ	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent (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 Equivalent			2.0E+01/2.0E-01

(b) (6)

(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:

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.

Prepared By:

Name: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: _____

INTERNAL DOSE DATA					
NAME (LAST, FIRST, M.I.) (1-20)		SOC. SEC. NO. (21-29)		TYPE SAMPLE (30)	
(b) (6)				URINE	
SAMPLE NO. (33-38)		SAMPLE DATE (39-44)		EXPOSURE	
(66-246)				DATE TYPE	
BASE (57-60)		OCCUPATION (61-62)		REQUESTED BY	
TORREJON					
DATE RECEIVED		SAMPLE VOLUME		VOLUME ANALYZED	
JAN 25 1966		950 ml		200 ml	
TECHNICIAN (SIGNATURE AND DATE)					
URINE GROSS ALPHA		RADON		FECES/BLOOD	
Counter Number		Chamber Number		Counter 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 mv/sec		Gross cpm	
Bkg. Cpm		Bkg. Mv/sec		Bkg. cpm	
Net cpm		Net mv/sec		net cpm	
dpm		curies/mv		dpm	
dpm/24 hr. (69-74)		litter (69-74)		dps/cc	
K 40 Correction		D(q) (63-68)		Neutron Dose (rads) (63-68)	
Net Beta				uc/mg (69-74)	
D(q) (63-68)		27 Jan 66		D(q) (63-68)	
215 ± 8 PC/L					

April 28, 2000

(b) (6)		T/SGT INTERNAL DOSE DATA		TYPE ANAL. (31-32)	
(b) (6)		SOC. SEC. NO. (21-29)		TYPE SAMPLE (30)	
SAMPLE NO. (33-38)		SAMPLE DATE (35-44)		EXPOSURE	
66-410		FROM 1900 31 Jan 66 TO 1900 1 Feb 66		DATE TYPE	
BASE (57-60)		OCCUPATION (61-62)		REQUESTED BY	
Lamar, J. L.					
DATE RECEIVED		SAMPLE VOLUME		VOLUME ANALYZED	
9 Feb 66		2,580		200	
TECHNICIAN (SIGNATURE AND DATE)		(b) (6)		11 FEB 1966	
URINE		GROSS ALPHA		SSGT.	
Counter Number		5		Chamber Number	
Counter Bkg. (cpm)		0.33		Cham. Bkg. (mv/sec)	
Counter Eff. (%)		51		Counter Eff. (%)	
Date/Time - Start		10 FEB 1966		Millivolt - Start	
- Stop				Millivolt - Stop	
Total Counts		22		Total Millivots	
Counting Time		55		Total Drift Time	
Gross cpm		0.40		Gross mv/sec	
Bkg. Cpm		0.33		Bkg. Mv/sec	
Net cpm		0.07		Net mv/sec	
dpm				curies/mv	
dpm/24 hr. (69-74)		No		litter (69-74)	
K 40 Correction		Detectable		D(q) (63-68)	
Net Beta		Activity		uc/mg (69-74)	
D(q) (63-68)				D(q) (63-68)	
				15 Feb 66	
				FECES/BLOOD	
				Counter Number	
				Counter Bkg.	
				Counter Eff.	
				Date/Time - Start	
				- Stop	
				Total Counts	
				Counting Time	
				Gross cpm	
				Bkg. cpm	
				net cpm	
				dpm	
				dps/cc	
				Neutron Dose (rads) (63-68)	
				uc/mg (69-74)	
				D(q) (63-68)	

FEB 11 1966

INTERNAL DOSE DATA					
NAME (LAST, FIRST, M.I.) (1-20)		SOC SEC NO. (21-23)		TYPE SAMPLE (30)	
(b) (6)		(b) (6)		Urine	
SAMPLE DATE (39)		EXPOSURE		TYPE ANAL. (31-32)	
66-560		FROM 27 Feb TO 3 Feb		GROSS ALPHA	
BASE (57-60)		OCCUPATION (61-62)		DATE 18-30 Jan 66	
Rem. Area Gunner		REQUESTED BY			
DATE RECEIVED		SAMPLE VOLUME		VOLUME ANALYZED	
FEB 11 1966		142 cml.		200 ml.	
TECHNICIAN (SIGNATURE AND DATE)					
WALTER G. EDWARDS 15 FEB 1966					
URINE		GROSS ALPHA		SSGT.	
Counter Number		NMR A		LISAPON	
Counter Bkg. (cpm)		0.18		Chamber Number	
Counter Eff. (%)		51		Cham. Bkg. (mv/sec)	
Date/Time - Start		15 FEB 1966		Counter Eff. (%)	
- Stop				Date/Time - Start	
Total Counts		38		- Stop	
Counting Time		5.5 min		Total Millivots	
Gross cpm		0.69		Total Drift Time	
Bkg. Cpm		0.19		Gross mv/sec	
Net cpm		0.51		Bkg. Mv/sec	
dpm/PC/L		2.25 ± 1.10		Net mv/sec	
dpm/24 hr. (69-74)				curies/mv	
K 40 Correction				litter (69-74)	
Net Beta		3.20 ± 1.56		D(q) (63-68)	
D(q) (63-68)				uc/mg (69-74)	
				D(q) (63-68)	

$$D_q = 9.39 \times 10^{-5} \text{ rad}$$

17 Feb 66

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

FEB 11 1966

INTERNAL DOSE DATA					
NAME (LAST, FIRST, M.I.) (1-20)		SOC. SEC. NO. (21-29)		TYPE SAMPLE (30)	
(b) (6)		(b) (6)		GROSS ALPHA	
SAMPLE NO. (33-36)		SAMPLE DATE (39-44)		EXPOSURE	
66-566		FROM 3 Feb 66 TO 4 Feb 66		DATE 18.31 Jan 66 TYPE	
BASE (57-60)		OCCUPATION (61-62)		REQUESTED BY	
Ran Stein					
DATE RECEIVED		SAMPLE VOLUME		VOLUME ANALYZED	
FEB 11 1966		1840 ml		200 ml	
TECHNICIAN (SIGNATURE AND DATE) WALTER G. EDWARDS 15 FEB 1966					
URINE		GROSS ALPHA		FECES/BLOOD	
Counter Number		Nmc. 8		Counter Number	
Counter Bkg. (cpm)		0.49		Counter Bkg.	
Counter Eff. (%)		.57		Counter Eff.	
Date/Time - Start		15 FEB 1966		Date/Time - Start	
- Stop -				- Stop -	
Total Counts		48		Total Counts	
Counting Time		55 min		Counting Time	
Gross cpm		0.87		Gross cpm	
Bkg. Cpm		0.49		Bkg. cpm	
Net cpm		0.38		net cpm	
dpm/24 Hr. (69-74)		1168 ± 139		dpm	
K 40 Correction				dps/cc	
D(q) (63-68)		3.09 ± 0.56		Neutron Dose (rads) (63-68)	
				uc/mg (69-74)	
				D(q) (63-68)	

$D = 7.74 \times 10^{-3} \text{ rad}$

17 FEB 66

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

RESAMPLE JUL 14 1966

3414 R

AFSN: (b) (6)		INTERNAL DOSE DATA		TYPE ANAL. (31-32)	
NAME (LAST, FIRST, M.I.) (1-20)		SOC. SEC. NO. (21-29)		TYPE SAMPLE (30)	
(b) (6) TSgt		(b) (6)		Urine	
SAMPLE NO. (33-38)		SAMPLE DATE (39-44)		EXPOSURE	
66-3414		FROM 0600 5 Jun TO 0559 6 Jun 66		DATE Jan 66 TYPE	
BASE (57-60)		OCCUPATION (61-62)		REQUESTED BY	
Ramstein					
DATE RECEIVED		SAMPLE VOLUME		VOLUME ANALYZED	
14 June 1966		870 ml		435 ml	
TECHNICIAN (SIGNATURE AND DATE)					
Spec 254- Chelated off metal.					
URINE		RADON		FECES/BLOOD	
Counter Number	236 239	Chamber Number	Amc D-51	Counter Number	
Counter Bkg. (cpm)	800-3	Cham. Bkg. (mv/sec)	908-22	Counter Bkg.	
Counter Eff. (%)	31.8	Counter Eff. (%)		Counter Eff.	
Date/Time - Start		Millivolt - Start	55-119	Date/Time - Start	
-Stop		Millivolt - Stop	2.15	-Stop	
Total Counts	97 6	Total Millivots	1.02	Total Counts	
Counting Time	100 100	Total Drift Time	2.13	Counting Time	
Gross cpm		Gross mv/sec	4.19 dpm	Gross cpm	
Bkg. Cpm		Bkg. mv/sec	226	Bkg. cpm	
Net cpm		Net mv/sec		net cpm	
dpm % Rec	90.7	curies/mv		dpm	
dpm/24 hr. (69-74)		litter (69-74)		dps/cc	
K 40 Correction		D(q) (63-68)	124.47 K	Neutron Dose (rads) (63-68)	
Net Beta Pci/Spt	0.184 ± 0.079			µc/mg (69-74)	
D(q) (63-68)				D(q) (63-68)	
NAME:		SOCIAL SECURITY NUMBER:		SAMPLE NUMBER:	
AIR FORCE BASE					
RESULTS OF ANALYSIS					
Pci/Spt - 0.184 ± 0.079		% Rec - 90.7		Previous Results	
Totnl Vol - 870 ml		Body Burden - 0.07		1.68 Pci/L 0.1788	
Vol Analyzed - 435 ml					
<input type="checkbox"/> Repeat the sample for the following reason: <input type="checkbox"/> Significant activity in recently analyzed sample(s) <input type="checkbox"/> Data required to establish dose <input type="checkbox"/> Improper flask used <input type="checkbox"/> Other _____ <input type="checkbox"/> Suggested sampling schedule _____					
SIGNATURE:				DATE:	

ONE TIME FORM. OBSOLETE AFTER 30 JUN 66. (MCGSCPF, RAG, 4 APR 66)

AFLC-WPAFB-APR 66 2500

RADIOLOGICAL SAMPLE DATA					
NAME OR REQUESTOR'S ID (1-20) (b) (6)		GRADE TSOT	AFSN (b) (6)	SOCIAL SECURITY NUMBER (b) (6)	RHL SAMPLE NUMBER 670366
TYPE SAMPLE (23-32) Urine	OCCUPATION (34-35) P 239	ANALYSIS DESIRED P 239	REQUESTED BY SCHW	AIR FORCE BASE (68-71) Ranstad AFB, Germany	
DATE RECEIVED (37-42) 20 Jan 67	DATE ANALYZED (51-56) 11 8 Feb 67	DATE COUNTED 8 Feb 67	DATE COLLECTED 23 Jan 67	EXPOSURE DATE Jan 66	
SAMPLE WEIGHT/VOLUME 1320 + 70 g.c.d		WEIGHT/VOLUME ANALYZED 660 ml		TECHNICIAN (b) (6)	
OTHER DATA 5.71					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS: <i>Fci/dpl - 27.9 ± 20.2</i>					
<i>Tot Vol - 1.32 liter</i>					
<i>Vol anal - 0.66 liter</i>					
<i>% Rec = 83.2</i>					
<i>Body Burden -</i>					
<i>8 Feb 67</i>					

AFLC FORM 1165
MAY 66

FC
3400

AFLC-WPAFB-MAY 66 4500

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

RADIOLOGICAL SAMPLE DATA				
NAME OF REQUESTOR'S ID (1-20)		GRADE	AFSN	SOCIAL SECURITY NUMBER
(b) (6)		750T	(b) (6)	(b) (6)
TYPE SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (88-71)
URINE	PJ 235		SCHEW	86 TAC HOSP APO NY 09012
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE
12 JUN 67			9 MAY 67	
SAMPLE WEIGHT/VOLUME	WEIGHT/VOLUME ANALYZED		TECHNICIAN	
2800 ml	1400 ml		(b) (6)	
OTHER DATA				
ENVIRONMENTAL SAMPLES				
COUNTER & EFFICIENCY				
TOTAL COUNTS & MINUTES				
GROSS CPM				
BKG CPM & MINUTES				
NET CPM				
YIELD				
BIOLOGICAL SAMPLES				
COUNTER & EFFICIENCY				
TOTAL COUNTS & MINUTES				
GROSS CPM				
BKG CPM & MINUTES				
NET CPM				
YIELD				
RADON				
SUMMARY OF RESULTS:				
<p>7077</p> <p>Total Vol = 2.80 L.</p> <p>Vol anal = 1.40 L.</p> <p>Procc = 43.8</p> <p>Date Counted 23 Jun 67</p>				

AFLC FORM 1165

FC 5400

AFLC-WPAFB-JAN 67 5M

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

(b) (6)

(b) (6)

(b) (6)

IDENTIFICATION		SUBMITTEE		TYPE SPL		SHL NO	
(b) (6)		SCHW		URINE		674068	
DATE COLLECTED		DATE RECD		EXPOSURE DATE(S)		TOTAL WT OR VOL	
17 AUG 67		22 AUG 67				2060 ml	
ANALYSIS DESIRED		PO 239		TECHNICIAN		WT OR VOL ANALYZED	
				(b) (6)		1030 ml	
TYPE OF ANALYSIS		239		226			
COUNTER AND EFF		Spec#1					
TOTAL CTS AND TIME		200-2		152			
BK CTS AND TIME		500-1		4			
NET CTS PER MIN							
		17 Sept 67				5.20	
1	20	22	±	33	35	43	1
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							
GR BETA SUS							
DATE CTD							
NET BETA PER 24 HR							
SAMPLE WT DIS							
SAMPLE WT SUS							
SAMPLE VOL							
RECOVERY	66			90			
ELAPSED TIME							
SYSTEMIC BODY BURDEN							
CRITICAL ORGAN BONE							
NUCLIDE		ACTIVITY					
Pu 239		WDA					
		11 SEP 1967					

AFLC FORM 1165 JUL 67

FC 5400

PREVIOUS EDITION WILL BE USED.

RADIOLOGICAL SAMPLE DATA AFLC-WPAFB-JUL 67 3M

(b) (6)

(b) (6)

86 TAC ASP.
APO NY 09012

9 FEB. 66

410 #5

(b) (6)

TSG.

DIET 0401 7401 EDD SQ,
SJN. (b) (6)

1900 31 JAN - 1900 1 FEB.

3 BOTTLES

- TOTAL SAMPLE VOL. 2,580 mL

AMT USED 200 mL
NITRIC ACID, 50 mL

(b) (6)

(b) (6)

(b) (6)

(b) (6)

(b) (6)

Return to L/col
after key-punch

2268

1. 0.00

2. 93.8

3. 2.8

4. —

5. >174

6. Septic Body Burden 0.00

1.

0.184 ± .08

2.

90.7

3.

.87

4.

132

5.

6245

6.

0.07

C-Quens®

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

Physiological Approach to Oral Contraception

(b) (6)

(b) (6)

116-5-1
FILE

last address - Dec 5-66
Ramstein AB, Germany

letter sent
6 Dec 66

116-5-1
FILE

2nd Sample
letter prepared

3 ages

Return to key
Punch

(b) (6)

FILE
116-5-1
(b) (6)

4068

1. 0.00

2. 66

3. 2.06

4. —

5. 7254

6. Systemic Body Burden
0.00

(b) (6)

Code 65 **FILE**
116-5-1
(b) (6)

1. 27.9 ± 20.2 Fc

2. 83.2

3. 1.32

4. 373

5. 7039

6. Systemic Body Burden
Bone Critical Organ 0.02

Return to I/Cal
after key punch

(b) (6)

(b) (6)

(b) (6)

FILE

UNCLASSIFIED

ROUTINE

SG HW

10 DEC 65 14 18

INFORMATION

RF10 JAW RUEOESF0545 3501410-UUUU--RUEDFIA

DE RUEPSD 81 3501055

ZNR UUUUU

R 161016Z DEC 66

FM 86TH TACHOSP RAMSTEIN AB GER

TO USAF RADIOLOGICAL HEALTH LABORATORY AFLC WRIGHT PATTERSON

CB OHIO

BT

UNCLAS SG 00175 DEC 66

REFERENCE YOUR LETTER, SUBJ: LONG-TERM STUDIES ON SELECTED PARTICIPANTS OF PALOMARES INCIDENT, DTD 6 DEC 66, REGARDING

THE SELECTION OF

(b) (6)

SSN

(b) (6)

TSG (b) (6)

ASSIGNED TO THIS STATION AND HIS DATE OF ROTATION IS JANUARY 1968. THIS INDIVIDUAL HAS BEEN EVALUATED AND REALIZES THE NECESSITY FOR MEDICAL STUDIES OF THIS NATURE.

BT

Boyle sent - 10 Jan 67

NNNN

(b) (6)

(b) (6)

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

FILE



(b) (6)

7 Dec 1967

REPLY TO:
ATTN OF

SGHW

SUBJECT

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

TO

TSgt (b) (6)
26 Tac Hosp
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 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

(b) (6)

DRAFT

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)																			
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Ingestion <input type="checkbox"/> Unknown <input type="checkbox"/> Injection <input type="checkbox"/> Absorption <input type="checkbox"/> Not applicable		INTAKE DATE OR PERIOD: 1/18/66 through 2/15/66 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 02/16/66 to 08/09/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain																					
EVALUATION DATA: Air Sampling Health Physics Survey Data Bioassay – Urinalysis Fecal Nasal Smears In Vivo <table border="0"><tr><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td><input checked="" type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input type="checkbox"/> Unavailable</td></tr><tr><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr></table> Medical Treatment: Skin Decontamination: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Date: _____ Decorporation: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Agent: _____ Date: _____ Catharsis: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Agent: _____ Date: _____ Surgical excision: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Date: _____				<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																			
<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																			
<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable																			
<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																			
<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																			
<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																			
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): 68,000 50 YR CEDE (rem): 21 (0.21 Sv) <table border="0"><tr><td>Organ Dose Equivalent Summary</td><td>50 YR CDE (rem/Sv)</td></tr><tr><td>Bone Surface</td><td>210/2.1</td></tr><tr><td>Lung</td><td>78/0.78</td></tr><tr><td>Liver</td><td>38/0.38</td></tr><tr><td>Red Marrow</td><td>16/0.16</td></tr><tr><td>Other</td><td>3.6/0.036</td></tr><tr><td>Testes</td><td>3.0/0.030</td></tr></table>				Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)	Bone Surface	210/2.1	Lung	78/0.78	Liver	38/0.38	Red Marrow	16/0.16	Other	3.6/0.036	Testes	3.0/0.030				
Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)																				
Bone Surface	210/2.1																				
Lung	78/0.78																				
Liver	38/0.38																				
Red Marrow	16/0.16																				
Other	3.6/0.036																				
Testes	3.0/0.030																				
DOSE ASSESSOR: Signature: _____ Print Name: _____ SSN: _____		PEER REVIEWER: Signature: _____ Print Name: _____ SSN: _____																			
RECOMMENDATIONS: Additional Bioassay Required <input type="checkbox"/> Urinalysis <input type="checkbox"/> Fecal <input type="checkbox"/> In Vivo Suggested Sampling Frequency: _____ Work Restrictions: N/A																					

DRAFT

(b) (6)

(b) (6)

Preliminary Internal Dosimetry Case Narrative**Identification:**

Name:

SSN:

(b) (6)

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 January–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 Burden
2/16/66	-
10/06/66	11
3/09/67	0
4/13/67	5
8/09/67	0

Radionuclide(s): ^{239}Pu .

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 2/16/66.

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.

(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
66-958	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:

Organ	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent (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 Equivalent			2.1E+01/2.1E-01

(b) (6)

(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:

Based on the results of intake estimates and dose calculations, this individual received an intake of about 20,000 to 68,000 pCi of ^{239}Pu 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.

Prepared By:

Name: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: _____

April 28, 2000

FEB 21 1966

INTERNAL DOSE DATA				
NAME (LAST, FIRST, M.I.) (1-20)		SOC. SEC. NO. (21-29)	TYPE SAMPLE (30)	TYPE ANAL. (31-32)
(b) (6)		A/C Not submitted	Urine	GROSS ALPHA
SAMPLE NO. (33-38)	SAMPLE DATE (39-44)		EXPOSURE	
66-958	FROM ~ 16 Feb '66 TO		DATE Not submitted	TYPE
BASE (57-60)	OCCUPATION (61-62)	REQUESTED BY		
Tolson				
DATE RECEIVED	SAMPLE VOLUME	VOLUME ANALYZED	DATE ANALYZED	
FEB 21 1966	1040 ml.	200 ml.		
TECHNICIAN (SIGNATURE AND DATE) (b) (6)				
1 MAR 1966				
URINE		RADON		FECES/BLOOD
GROSS ALPHA				
Counter Number	F	Chamber Number	Counter Number	
Counter Bkg. (cpm)	0.18	Cham. Bkg. (mv/sec)	Counter Bkg.	
Counter Eff. (%)	0.51	Counter Eff. (%)	Counter Eff.	
Date/Time - Start	1 MAR 1966	Millivolt - Start	Date/Time - Start	
- Stop		Millivolt - Stop	- Stop	
Total Counts	24	Total Millivots	Total Counts	
Counting Time	55 min	Total Drift Time	Counting Time	
Gross cpm	0.44	Gross mv/sec	Gross cpm	
Bkg. Cpm	0.18	Bkg. Mv/sec	Bkg. cpm	
Net cpm	0.26	Net mv/sec	net cpm	
dpm/24 hr. (69-74)	1.15 ± 0.43	curies/mv	dpm	
K 40 Correction		Filter (69-74)	dps/cc	
Net cpm	1.20 ± 0.97	D(q) (63-68)	Neutron Dose (rads) (63-68)	
D(q) (63-68)	$\bar{x} = 1.1 D$		uc/mg (69-74)	
			D(q) (63-68)	

$D_A = 6.52 \times 10^{-4}$ rad

Release of this document is restricted under the provisions of the Privacy Act, 5 U.S.C. 552(a). C.1-249

RADIOLOGICAL SAMPLE DATA						671295
(b) (6)		GRADE AIC	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER	
TYPE SAMPLE (23-32) URINE	OCCUPATION (34-35)	ANALYSIS DESIRED PO 235		REQUESTED BY SGHJ	AIR FORCE BASE (66-71) BLYTHEVILLE AFB	
DATE RECEIVED (37-42) 17 APR 67	DATE ANALYZED (51-56)	DATE COUNTED 26 APR 67	DATE COLLECTED 13 APR 67	EXPOSURE DATE		
SAMPLE WEIGHT/VOLUME 1580 ML	WEIGHT/VOLUME ANALYZED 790 ML		(b) (6)			
OTHER DATA 1 ML PL 236 5.92 DPM/ML ADDED						
ENVIRONMENTAL SAMPLES						
COUNTER & EFFICIENCY						
TOTAL COUNTS & MINUTES						
GROSS CPM						
BKG CPM & MINUTES						
NET CPM						
YIELD						
BIOLOGICAL SAMPLES						
COUNTER & EFFICIENCY SPEC#4						
TOTAL COUNTS & MINUTES 400						
GROSS CPM						
BKG CPM & MINUTES 800 0						
NET CPM						
YIELD						
SUMMARY OF RESULTS:						
Activity PL 24 hr SPI 47 ± 23 FC						
Total Vol = 1.58 L						
Vol anal = 0.79 L						
To rec = 81.6						
Body Burden =						
Inst. Counts = 26 APR 67						
AFLC FORM MAY 66 1165		FC 5400		AFLC-WPAFB-MAY 66 4500		

April 28, 2000

(b) (6)

(b) (6)

RADIOLOGICAL SAMPLE DATA					
(b) (6)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
A2C		(b) (6)			664943
TYPE SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (68-71)	
URINE		PV 239	SGHW	BRYTHEVILLE AF	
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
14 OCT 66		26 OCT 66	10 OCT	14 NOV 66	
SAMPLE WEIGHT/VOLUME	WEIGHT/VOLUME ANALYZED		TECHNICIAN		
100 + 55 ACID	525 ml		Chad / Master		
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
PART 8					
236		239	recount		
236		239	236		
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY	Spec #4				
TOTAL COUNTS & MINUTES	100 66				
GROSS CPM	4				
BKG CPM & MINUTES	800 0.7				
NET CPM	0				
YIELD	78.00%				
SUMMARY OF RESULTS: PC/SPH = 0.000-0.007 0.17±0.09% RfC = 2.5% 80.2					
Tot. Vol = 1.05 L.					
Vol. ANAL = 0.54 L					
BODY BURNED = 0.11%					
DO PART 8					
HEAVY ORANGE					
DEPOSIT - SMEAR					

AFLC FORM 1165

FC 5400

AFLC-WPAFB-MAY 66 4500

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

DOE (b) (6)		TYPE SPL URINE		FILE NO. 673977		AFB P. 653	
DOC REC NO (b) (6)		SUBMITTEE SCHW		AFB P. 653			
DATE COLLECTED 9 AUG 67		DATE REC 17 AUG 1967		EXPOSURE DATE(S)		TOTAL WT OR VOL 820 ML	
ANALYSIS DESIRED 239 Pu		TECHNICIAN (b) (6)		WT OR VOL ANALYZED 410 ML			
TYPE OF ANALYSIS	Pu 236	Pu 239					
COUNTER AND EFF	Spec 4 22						
TOTAL CTS AND TIME	200 208	0					
BK CTS AND TIME	800 4	1					
NET CTS PER MIN							
1	20	22	±	33	35	43	1
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							
GR BETA SUS							
DATE CTD							
NET BETA PER 24 HR							
SAMPLE WT DIS							
SAMPLE WT SUS							
SAMPLE VOL							
RECOVERY	90	0					
ELAPSED TIME							
SYSTEMIC BODY BURDEN							
CRITICAL ORGAN BONE							

AFLC FORM 1165

FC 5400

PREVIOUS EDITION WILL BE USED.

RADIOLOGICAL SAMPLE DATA AFRC-WPAFB-JUL 67 3M

(b) (6)

(b) (6)

FILE

12B-5-18
(b) (6)

Last address - 5 Oct 66

851 3rd St

Blytheville AFB, MO

Arb 72315

Letter sent 6 Dec 66

FILE

2nd sample

letter

prepared

3 Apr 67

(b) (6)

(b) (6)

Return to T/col (b) (6) after
key punch
1295 Code 653
Urine - 2

1. 47±23 FC 116-5-12
2. 81.6
3. 1.58
4. 453
5. 7116
6. Systemic Body Burden
Bone critical organ 0.05

Code 653 1495 (b) (6)
Return to T/col (b) (6)
when key punching complete

- 0748
1. 0.00
 2. 1188
 3. 1.51L
 4. —
 5. 7082
 6. Systemic Body Burden 0.00

116-5-12 (b) (6)
4943 (b) (6)
1. 420±90 (b) (6)
2. 80.2
3. 1.05
4. 253
5. 6319
6. Systemic Body Burden
Bone critical organ 0.11
Code 653

Return after Key Punch
3977 FILE
116-5-12 (b) (6)
1. 0.00
2. 90
3. 0.82
4. —
5. 7244
6. Systemic Body Burden
0.00

April 28, 2000

(b) (6)

(b) (6)

UNCLASSIFIED ROUTINE

RTTU DAY RUMTBPAT1949 3461630-0000--RUEDFA.

ZNR 00000

R 121300Z DEC 66

FM 97BOMBWG BLYTHEVILLE AFB ARK

TO USAF RADT HEALTH CAB WRIGHT PATTERSON AFB OHIO

BT

UNCLASMS 00081 DEC 66

FOR SGHW/SUBJ MEDICAL FOLLOW-UP AIC (b) (6)

(b) (6) YOUR LETTER DATED 6 DEC 66

AIRMAN STILL ASSIGNED THIS BASE, COUNSELLED AND DESIRES TO PARTICIPATE IN THIS PROGRAM.

BT

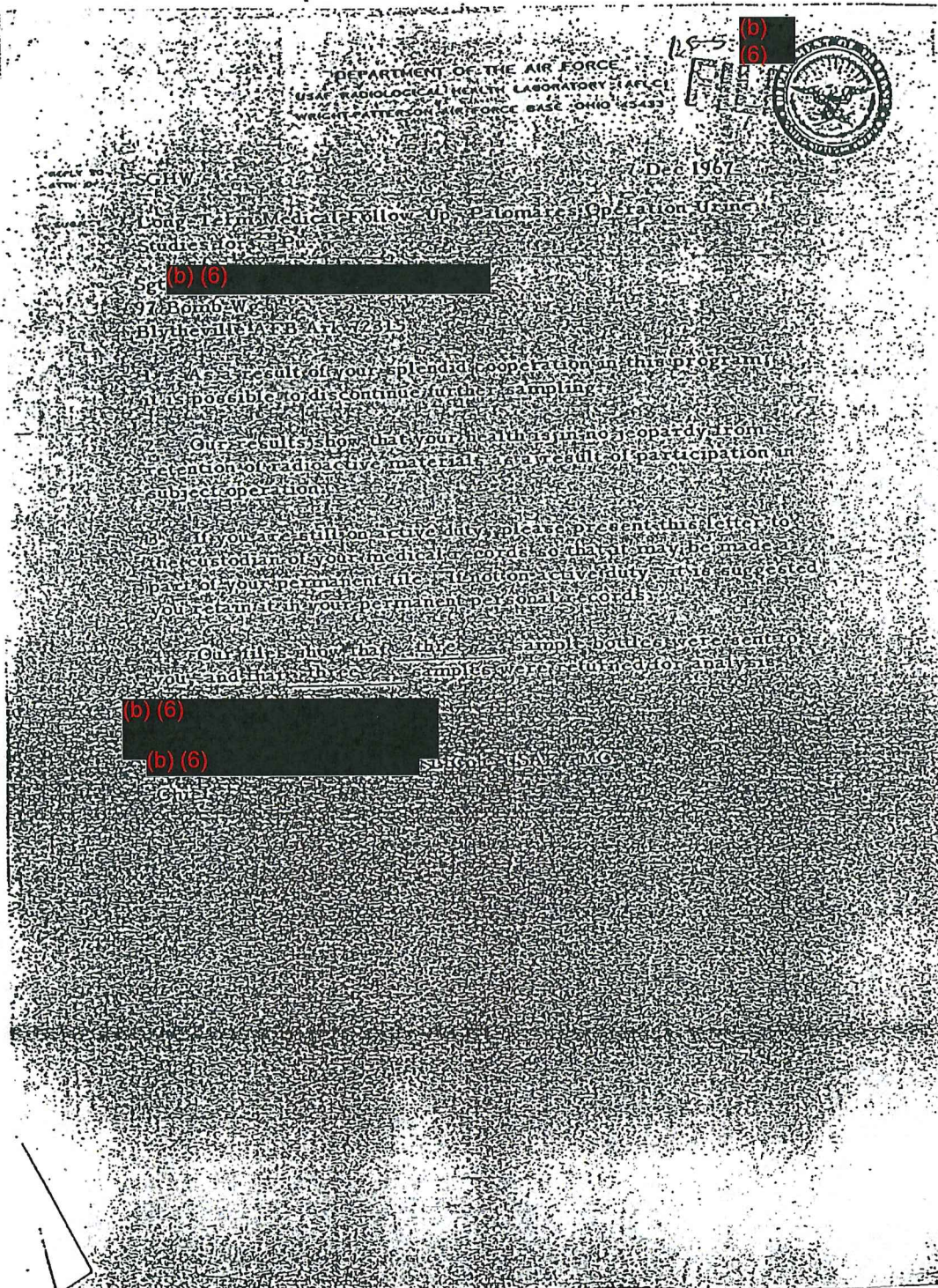
NNNN

UNCLASSIFIED ROUTINE

April 28, 2000

(b) (6)

(b) (6)



(b) (6)

April 2001

DRAFT

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)	
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Ingestion <input type="checkbox"/> Unknown		<input type="checkbox"/> Injection <input type="checkbox"/> Absorption <input type="checkbox"/> Not applicable	
INTAKE DATE OR PERIOD: 1/18/66 through 01/21/66 on-site 1/18/66 assumed start.			
SUMMARY OF EXPOSURE CONDITIONS: Radionuclides/Respiratory Class/Particle Size: $^{239}\text{Pu}/100\%$ Class Y/1 μm AMAD Date or Period of Evaluated Data: 5 urine samples from 01/21/66 to 08/13/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain			
EVALUATION DATA:			
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Bioassay - Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Medical Treatment:			
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> 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): 69,000			
50 YR CEDE (rem): 21 (0.21 Sv)			
Organ Dose Equivalent Summary		50 YR CDE (rem/Sv)	
Bone Surface		220/2.2	
Lung		79/0.79	
Liver		38/0.38	
Red Marrow		17/0.17	
Other		3.6/0.036	
Testes		3.1/0.031	
DOSE ASSESSOR:		PEER REVIEWER:	
DATE:		DATE:	
Signature: _____		Signature: _____	
Print Name: _____		Print Name: _____	
SSN: _____		SSN: _____	

RECOMMENDATIONS:

Additional Bioassay Required

☐ Urinalysis☐ Fecal☐ In Vivo

Suggested Sampling Frequency: _____

Work Restrictions: N/A

DRAFT

(b) (6)

(b) (6)

Preliminary Internal Dosimetry Case Narrative**Identification:**

Name:

SSN:

(b) (6)

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)

(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.

Sample	*Analysis	Date	Elapsed Days	Result (pCi/day)	Error (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)

(b) (6)

Organ	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent (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 Equivalent			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 ^{239}Pu 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: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: _____

INTERNAL DOSE DATA					
NAME (LAST, FIRST, M.I.) (b) (6)		SOC. SEC. NO. (21-29) (b) (6)		TYPE SAMPLE (30) URINE	TYPE ANAL. (31-32) GROSS ALPHA
SAMPLE NO. (33-38) (66-254)	SAMPLE DATE (39-44) FROM TO		EXPOSURE DATE TYPE		
BASE (57-60) TORREJON	OCCUPATION (61-62)	REQUESTED BY			
DATE RECEIVED JAN 25 1966	SAMPLE VOLUME 754 ml	VOLUME ANALYZED 200 ml	DATE ANALYZED		
TECHNICIAN (SIGNATURE AND DATE)					
URINE GROSS ALPHA		RADON		FECES/BLOOD	
Counter Number		Chamber Number		Counter Number	
Counter Bkg. (cpm)		Cham. Bkg. (mv/sec)		Counter Bkg.	
Counter Eff. (%) 51%		Counter Eff. (%)		Counter Eff.	
Date/Time - Start		Millivolt - Start		Date/Time - Start	
- Stop		Millivolt - Stop		- Stop	
Total Counts 76		Total Millivots		Total Counts	
Counting Time 55		Total Drift Time		Counting Time	
Gross cpm 0.659		Gross mv/sec		Gross cpm	
Bkg. Cpm 0.127		Bkg. Mv/sec		Bkg. cpm	
Net cpm 0.532		Net mv/sec		net cpm	
dpm		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) 2.35 ± 1.06 pc/L		27 Jan 1966		D(q) (63-68)	

(b) (6)

AFLC-WPAFB^U-MAY 66 4500

RADIOLOGICAL SAMPLE DATA					
TYPE SAMPLE (23-32)		GRADE	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER	
URINE		CADT	(b) (6)	1120	
DATE RECEIVED (37-42)	OCCUPATION (34-35)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (68-71)	
16 FEB 67		PS 239	SG HW	MAXWELL AFB, ALA	
DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE		
	27 FEB 67	12 FEB 67			
SAMPLE WEIGHT/VOLUME	WEIGHT/VOLUME ANALYZED		TECHNICIAN		
1770	885 ML		(b) (6)		
OTHER DATA					
1 ML Pu ²³⁹ 5.8 DPM/ml ADDED					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY	24.3	239	RADON		
TOTAL COUNTS & MINUTES	4.00	2			
GROSS CPM		0			
BKG CPM & MINUTES	800	0			
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
0% rec = 16.1					

AFLC FORM 1165
MAY 66

FC
5400

AFLC-WPAFB-JAN 67 5M

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

RADIOLOGICAL SAMPLE DATA					
NAME OR REQUESTOR'S ID (1-20) (b) (6)		GRADE CAPT	AFSN (b) (6)	SOCIAL SECURITY NUMBER (b) (6)	RHL SAMPLE NUMBER 671265
TYPE SAMPLE (23-32) URINE	OCCUPATION (34-35)	ANALYSIS DESIRED PS 239	REQUESTED BY SGT W	AIR FORCE BASE (68-71)	
DATE RECEIVED (37-42) 12 APR 67	DATE ANALYZED (51-56)	DATE COUNTED 25 APR 67	DATE COLLECTED 9 APR 67	EXPOSURE DATE	
SAMPLE WEIGHT/VOLUME 3390 ml	WEIGHT/VOLUME ANALYZED 1500 ml		TECHNICIAN		
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
RADON					
SUMMARY OF RESULTS:					
<p>Activity Pw 2444511 Total Val = 3.39 h. Vol anal = 1.50 h.</p> <p>710A</p> <p>70 rec = 73.8 Body Burden: Date Counted = 25 APR 67</p>					

AFLC FORM MAY 66 1165

FC 5400

AFLC-WPAFB-JAN 67 5M

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

IDENT (b) (6)		TYPE SPL URINE		MICRO. 673936		(b) (6)	
SUBMITTEE SGH		AFB		P-653			
DATE COLLECTED 13 AUG 67	DATE RECD 16 AUG 67	EXPOSURE DATE(S)		TOTAL WT OR VOL 2330 ml	WT OR VOL ANALYZED 1165 ml		
ANALYSIS DESIRED 237pJ		TECHNICIAN (b) (6)					
TYPE OF ANALYSIS	ASP 239	236					
COUNTER AND EFF	#1 - 21						
TOTAL CTS AND TIME	200 - 3	231					
BK CTS AND TIME	800 - 0	5					
NET CTS PER MIN							
1	20 22	±	33 35	43 1	20 22	±	33 35 43
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							
GR BETA SUS							
DATE CTD							
NET BETA PER 24 HR							
SAMPLE WT DIS							
SAMPLE WT SUS							
SAMPLE VOL							
RECOVERY	104			%			
ELAPSED TIME							
SYSTEMIC BODY BURDEN							
CRITICAL ORGAN BONE							

AFLC FORM 1165
JUL 67

FC
5400

PREVIOUS EDITION
WILL BE USED.

RADIOLOGICAL SAMPLE DATA AFLC-WPAFB-JUL 67 3M

(b) (6)

(b) (6)

Code 653
Return cap to S/col
after punching.

(b) (6)

(b) (6)

0526

110-5-19

(b) (6)

1. 0.02 ± 0.01 PC
2. 105
3. 1.77
4. 396
5. 7068
6. Systemic Body Burden
Bone Critical Organ 0.02

(b) (6)

(b) (6)

Return after Ray
Punch

3936

1. 0.00
2. 104
3. 2.33
4. —
5. 7242
6. Systemic Body Burden 0.00

~~Last address - 5 Dec 66~~

~~off of Surgeon~~

~~Hqs. SAC - off AFB~~

~~Last address~~

~~Staff and Civil School - 5 Dec 66~~

~~Maxwell AFB~~

~~Letter sent 6 Dec 66~~

Return to J/CS
after Ray punch.

Urine - 2 Code 653
671265

1. 0.00
2. 78.8
3. 3.39
4. —
5. 7115
6. Systemic Body Burden

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

April 28, 2000

(b) (6)

118-5-1 (b) (6)

(b) (6)

(b) (6)

2nd sample
prepared
3 Apr 67

1.

0.201 ± .08

2.

90.4

3.

1.99

4.

144

5.

6257

6.

0.08

FILE

31 Jul 67

Current address

DCS - Bioastronautics

Hqs. AFSC

Andrews AFB, Wash

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

[illegible]

Bottle sent 10 Jan 67

Palomares Nuclear Weapons Accident

Dose Evaluation Report

April 2, 2000

(b) (6)

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

317-66-2978

(b) (6)



7 Dec 1967

REPLY TO
ATTN OF

SGHW

SUBJECT

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

TO

Ma (b) (6)

DCS Bioastronautics
Hq AFSC, Andrews AFB, Wash DC 20331

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

(b) (6)

April 2001

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)																									
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Injection <input type="checkbox"/> Ingestion <input type="checkbox"/> Absorption <input type="checkbox"/> Unknown <input type="checkbox"/> Not applicable		INTAKE DATE OR PERIOD: 01/20/66 through 2/11/66 on-site 1/20/66 assumed start.																									
SUMMARY OF EXPOSURE CONDITIONS: Radionuclides/Respiratory Class/Particle Size: ²³⁹ Pu/100% Class Y/I 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																											
EVALUATION DATA: <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;">Air Sampling</td> <td style="width: 16.5%;"><input type="checkbox"/> Attached</td> <td style="width: 16.5%;"><input type="checkbox"/> In Process</td> <td style="width: 35%;"><input checked="" type="checkbox"/> Unavailable</td> </tr> <tr> <td>Health Physics Survey Data</td> <td><input type="checkbox"/> Attached</td> <td><input type="checkbox"/> In Process</td> <td><input checked="" type="checkbox"/> Unavailable</td> </tr> <tr> <td>Bioassay – Urinalysis</td> <td><input checked="" type="checkbox"/> Attached</td> <td><input type="checkbox"/> In Process</td> <td><input type="checkbox"/> Unavailable</td> </tr> <tr> <td> Fecal</td> <td><input type="checkbox"/> Attached</td> <td><input type="checkbox"/> In Process</td> <td><input checked="" type="checkbox"/> Unavailable</td> </tr> <tr> <td> Nasal Smears</td> <td><input type="checkbox"/> Attached</td> <td><input type="checkbox"/> In Process</td> <td><input checked="" type="checkbox"/> Unavailable</td> </tr> <tr> <td> In Vivo</td> <td><input type="checkbox"/> Attached</td> <td><input type="checkbox"/> In Process</td> <td><input checked="" type="checkbox"/> Unavailable</td> </tr> </table>				Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable	Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																								
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																								
Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable																								
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																								
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																								
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																								
Medical Treatment: <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;">Skin Decontamination:</td> <td style="width: 16.5%;"><input type="checkbox"/> Yes</td> <td style="width: 16.5%;"><input checked="" type="checkbox"/> No</td> <td style="width: 35%;">Date: _____</td> </tr> <tr> <td>Decorporation:</td> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> <td>Agent: _____ Date: _____</td> </tr> <tr> <td>Catharsis:</td> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> <td>Agent: _____ Date: _____</td> </tr> <tr> <td>Surgical excision:</td> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> <td>Date: _____</td> </tr> </table>				Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____	Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____								
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____																								
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																								
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																								
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____																								
EVALUATION METHODOLOGY: Assumptions: Acute inhalation intake of ²³⁹ Pu, 100% Class Y, 1 μm AMAD particle size on 1/20/66 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): 34,000 50 YR CEDE (rem) : 10 (0.10 Sv) <table style="width: 100%; border: none;"> <tr> <th style="text-align: left;">Organ Dose Equivalent Summary</th> <th style="text-align: left;">50 YR CDE (rem/Sv)</th> </tr> <tr> <td>Bone Surface</td> <td>110/1.1</td> </tr> <tr> <td>Lung</td> <td>39/0.39</td> </tr> <tr> <td>Liver</td> <td>19/0.19</td> </tr> <tr> <td>Red Marrow</td> <td>8.2/0.089</td> </tr> <tr> <td>Other</td> <td>1.8/0.018</td> </tr> <tr> <td>Testes</td> <td>1.5/0.015</td> </tr> </table>				Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)	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										
Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)																										
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: Signature: _____ Print Name: _____ SSN: _____		PEER REVIEWER: Signature: _____ Print Name: _____ SSN: _____																									

RECOMMENDATIONS:
 Additional Bioassay Required ☐ Urinalysis ☐ Fecal ☐ In Vivo
 Suggested Sampling Frequency: _____
 Work Restrictions: N/A

(b) (6)

(b) (6)

Preliminary Internal Dosimetry Case Narrative**Identification:**Name:
SSN:

(b) (6)

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 µm 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.

(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
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	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent (rem/Sv)
Testes	1.5E+00/1.5E-02	2.5E-01	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 Equivalent			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:

Based on the results of intake estimates and dose calculations, this individual received an intake of 34,000 to 65,000 pCi of ^{239}Pu 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.

Prepared By:

Name: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: _____

RADIOLOGICAL SAMPLE DATA					
NAME OF REQUESTOR'S ID (1-20)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
(b) (6)		A2C	(b) (6)	(b) (6)	(b) (6)
TYPE SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (68-71)	
Urine		Pu 239	SGHW	APO 09127	
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
30 Jan 67		8 Feb 67	24 Jan 67	Jan 67	
SAMPLE WEIGHT/VOLUME	WEIGHT/VOLUME ANALYZED		TECHNICIAN		
600 + 40 A.L.W.	400 ML		(b) (6)		
OTHER DATA					
Requested by Airman 5.71					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES	5.74				
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY	RADON				
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS: <i>Fu/Spl - 73.8 ± 26.3</i>					
<i>Tot Vol - 0.8 liter</i>					
<i>Vol Anat - 0.4 liter</i>					
<i>0% Rec = 102</i>					
<i>Body Burden -</i>					
<i>8 Feb 67</i>					

AFLC FORM MAY 66 1165

FC 5400

AFLC-WPAFB-MAY 66 4500

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

IDENTIFICATION (b) (6)		TYPE SPL URINE		FILE 671499																																																																																																																																																																																																							
SOC. SEC. NO. (b) (6)		SUBMITTEE SGHW		AFB																																																																																																																																																																																																							
DATE COLLECTED 26 APR 67	DATE RECD 1 MAY 67	EXPOSURE DATE(S)	SPL WT OR VOL 94.0ml / 470ml																																																																																																																																																																																																								
ANALYSIS DESIRED Pu 239		(b) (6)																																																																																																																																																																																																									
TYPE OF ANALYSIS	Pu 236	Pu 239																																																																																																																																																																																																									
COUNTER AND EFF	Spec #1 21																																																																																																																																																																																																										
TOTAL CTS AND TIME	700 - 210	1																																																																																																																																																																																																									
BK CTS AND TIME	800 - 5	0																																																																																																																																																																																																									
NET CTS PER MIN	0.01 ± 0.01 PC																																																																																																																																																																																																										
<table border="1"> <tr> <td>1</td> <td>20 22</td> <td>2</td> <td>33 35</td> <td>43 1</td> <td>20 22</td> <td>2</td> <td>33 35</td> <td>43</td> </tr> <tr><td>GR ALPHA DIS</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>GR ALPHA</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>GR ALPHA PER 24 HR</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>DATE CTD</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>GR BETA DIS</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>GR BETA</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>GR BETA PER 24 HR</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>DATE CTD</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>GR ALPHA SUS</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>DATE CTD</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>GR BETA SUS</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td>DATE CTD</td> <td></td> <td></td> <td></td> <td>NUCLIDE</td> <td colspan="4">ACTIVITY</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>Pu 239</td> <td>NDA</td> <td></td> <td></td> <td></td> </tr> <tr> <td>NET BETA PER 24 HR</td> <td></td> <td></td> <td></td> <td>Total Vol</td> <td></td> <td></td> <td></td> <td>0.94L</td> </tr> <tr> <td>SAMPLE WT DIS</td> <td></td> <td></td> <td></td> <td>Vol anal</td> <td></td> <td></td> <td></td> <td>0.47 L</td> </tr> <tr> <td>SAMPLE WT SUS</td> <td></td> <td></td> <td></td> <td>% rec</td> <td></td> <td></td> <td></td> <td>85.7</td> </tr> <tr> <td>SAMPLE VOL</td> <td></td> <td></td> <td></td> <td>Date Counted</td> <td></td> <td></td> <td></td> <td>11 May 67</td> </tr> <tr><td>RECOVERY</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>ELAPSED TIME</td><td>466</td><td></td><td></td><td>Days</td><td></td><td></td><td></td><td></td></tr> <tr><td>SYSTEMIC BODY BURDEN</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>CRITICAL ORGAN BONE</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>						1	20 22	2	33 35	43 1	20 22	2	33 35	43	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									GR BETA SUS									DATE CTD				NUCLIDE	ACTIVITY								Pu 239	NDA				NET BETA PER 24 HR				Total Vol				0.94L	SAMPLE WT DIS				Vol anal				0.47 L	SAMPLE WT SUS				% rec				85.7	SAMPLE VOL				Date Counted				11 May 67	RECOVERY									ELAPSED TIME	466			Days					SYSTEMIC BODY BURDEN									CRITICAL ORGAN BONE								
1	20 22	2	33 35	43 1	20 22	2	33 35	43																																																																																																																																																																																																			
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																																																																																																																																																																																																											
GR BETA SUS																																																																																																																																																																																																											
DATE CTD				NUCLIDE	ACTIVITY																																																																																																																																																																																																						
				Pu 239	NDA																																																																																																																																																																																																						
NET BETA PER 24 HR				Total Vol				0.94L																																																																																																																																																																																																			
SAMPLE WT DIS				Vol anal				0.47 L																																																																																																																																																																																																			
SAMPLE WT SUS				% rec				85.7																																																																																																																																																																																																			
SAMPLE VOL				Date Counted				11 May 67																																																																																																																																																																																																			
RECOVERY																																																																																																																																																																																																											
ELAPSED TIME	466			Days																																																																																																																																																																																																							
SYSTEMIC BODY BURDEN																																																																																																																																																																																																											
CRITICAL ORGAN BONE																																																																																																																																																																																																											

OT Form, Apr 67
MCGSCPF, hbf

SAMPLE DATA

AFLC-WPAFB-APR 67 300

April 28, 2000

(b) (6)

AFLC-WPAFB-JUL 67 3M

(b) (6)

(b) (6)

FILE
2nd Sample
Letter prepared
3 Apr 66

(b) (6)

Code 653
Return card to co (b) (6)
0365

1. 73.8 ± 26.3
2. 102
3. 0.8
4. 374
5. 7039
6. Systemic Body Burden
Bone critical organ 0.06

Return after key
Punch

FILE

3860

16-5-70

(b) (6)

1. 0.00
2. 91.7
3. 1.04
4. —
5. 7241
6. Systemic Body Burden
0.00

Return to S/CO (b) (6)
after key punch.

1499

FILE

16-5-70

(b) (6)

1. 0.01 ± 0.01 PC
2. 85.7
3. 0.94
4. 466
5. 7131
6. Systemic Body Burden
Bone critical organ 0.01

Palomares Nuclear Weapons Accident

Dose Evaluation Report

April 28, 2000

(b) (6)

(b) (6)

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



REPLY TO
ATTN OF: SGAP

28 December 1966

SUBJECT: Urinalysis

TO: AFLC (SGHW)
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: (b) (6) Rank: A2c AFSN: (b) (6)
SSN: (b) (6) Age: (b) (6) Race: Caucasian
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

(b) (6)

(b) (6)

Captain, USAF, MC
Chief, Military Public Health Service

*Sample analyzed # 670365
69 B.B.*

*Sgt Tyler -
Send Batch -
3 Jan 67
Done 6 Jan 67*

April 28, 2000

(b) (6)

(b) (6)

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

FILE
10-5-10
(b) (6)REPLY TO
ATTN OF

SGHW

7 Dec 1967

SUBJECT

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

TO

A2C

(b) (6)

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)

(b) (6)

LtCol, USAF, MC

Chief

(b) (6)

DRAFT

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)	
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Ingestion <input type="checkbox"/> Unknown		<input type="checkbox"/> Injection <input type="checkbox"/> Absorption <input type="checkbox"/> Not applicable	
		INTAKE DATE OR PERIOD: 01/17/66 through 01/30/66 on-site 1/17/66 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 03/30/66 to 09/18/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain			
EVALUATION DATA:			
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Bioassay - Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Medical Treatment:			
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
EVALUATION METHODOLOGY:			
Assumptions: Acute inhalation intake of ^{239}Pu , 100% Class Y, 1 μm AMAD particle size on 1/17/66			
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): 100,000			
50 YR CEDE (rem): 31 to 110 (0.31 to 1.1 Sv)			
Organ Dose Equivalent Summary		50 YR CDE (rem/Sv)	
Bone Surface		310 to 1,100	3.1 to 11
Lung		110 to 400	1.1 to 4
Liver		56 to 200	0.56 to 2
Red Marrow		24 to 84	0.24 to 0.84
Other		5.3 to 18	0.53 to 0.018
Testes		4.5 to 16	0.045 to 0.16
DOSE ASSESSOR:		PEER REVIEWER:	
DATE: _____		DATE: _____	
Signature: _____		Signature: _____	
Print Name: _____		Print Name: _____	
SSN: _____		SSN: _____	
RECOMMENDATIONS:			
Additional Bioassay Required <input type="checkbox"/> Urinalysis <input type="checkbox"/> Fecal <input type="checkbox"/> In Vivo			
Suggested Sampling Frequency: _____			
Work Restrictions: N/A			

DRAFT

(b) (6)

(b) (6)

Preliminary Internal Dosimetry Case Narrative**Identification:**Name:
SSN:

(b) (6)

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 µm 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.

(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
66-2875	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).

(b) (6)

(b) (6)

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	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 Intestine	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
Upper Large Intestine	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
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 Equivalent				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 ^{239}Pu 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.

Prepared By:

Name: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: _____

INTERNAL DOSE DATA					
AFSN: (b) (6)		SOC. SEC. NO. (21-29)		TYPE ANAL. (31-32)	
NAME (LAST, FIRST, M.I.) (1-20)		(b) (6)		TYPE SAMPLE (30)	
(b) (6) Col		Urine			
SAMPLE NO. (33-38)		SAMPLE DATE (39-44)		EXPOSURE DATE (45-50)	
66-2875		FROM 1200 29 Mar TO 1200 30 Mar 66		DATE 1700 TYPE	
BASE (57-60)		OCCUPATION (61-62)		REQUESTED BY	
Torrejon				30 Jan 66	
DATE RECEIVED		SAMPLE VOLUME		VOLUME ANALYZED	
26 April 1966		1150		1150	
TECHNICIAN (SIGNATURE AND DATE)					
URINE		RADON		FECES/BLOOD	
Counter Number	5	Chamber Number		Counter Number	
Counter Bkg. (cpm)	0.06 (90%)	Cham. Bkg. (mv/sec)		Counter Bkg.	
Counter Eff. (%)	51	Counter Eff. (%)	59	Counter Eff.	
Date/Time - Start	13 May 66	Millivolt - Start		Date/Time - Start	
- Stop		Millivolt - Stop		- Stop	
Total Counts	11.3	Total Millivots		Total Counts	✓
Counting Time	55	Total Drift Time		Counting Time	
Gross cpm	2.06	Gross mv/sec		Gross cpm	
Bkg. Cpm	0.06	Bkg. Mv/sec		Bkg. cpm	1.40 PC
Net cpm	2.00	Net mv/sec		net cpm	0.173 B
dpm per l	1.53 ± 0.30	curies/mv		dpm	
dpm/24 hr. (69-74)		litter (69-74)		dps/cc	
K 40 Correction		D(q) (63-68)		Neutron Dose (rads) (63-68)	
Net Dose per l	1.76 ± 0.34			uc/mg (69-74)	
D(q) (63-68)				(63-68)	

Continuation of Report

RADIOLOGICAL SAMPLE DATA

[illegible]

RADIOLOGICAL SAMPLE DATA					
NAME OR REQUESTOR'S ID (1-20) (b) (6)		GRADE 001	LESSN (b) (6)	SOCIAL SECURITY NUMBER (b) (6)	RHL SAMPLE NUMBER
TYPE SAMPLE (23-32) Urine	OCCUPATION (34-35)	ANALYSIS DESIRED Pu 239	REQUESTED BY SGHW	AIR FORCE BASE (68-71) Walker AFB, N.M.	
DATE RECEIVED (37-42) 12 Oct 66	DATE ANALYZED (51-55)	DATE COUNTED 21 Oct 66	DATE COLLECTED 10 Oct 66	EXPOSURE DATE Jan Feb 66 Spain	
SAMPLE WEIGHT/VOLUME 1340 ml		WEIGHT/VOLUME ANALYZED 670 ml		TECHNICIAN	
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
RADON					
236 238 239					
Spec #3 23.8					
100-63 4 59					
800-0 0 0					
8/Dec-81.7					
SUMMARY OF RESULTS:					
recount					

AFLC FORM 1165
MAY 66

FC
5400

AFLC-WPAFB-MAY 66 4500

(b)
(6)

Payne, G.N.

RADIOLOGICAL SAMPLE DATA					
NAME OR REQUESTOR'S ID (1-20)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
(b) (6)		Col	(b) (6)	(b) (6)	670338
TYPE SAMPLE (23-32)	OCCUPATION (34-39)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (88-91)	
Urine -1	Pu 239		SGTW	Walker AFB, TX	
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
9 Feb 67		17 Feb 67	26 Jan 67		
SAMPLE WEIGHT/VOLUME	WEIGHT/VOLUME ANALYZED		TECHNICIAN		
880 ml	440 ml		(b) (6)		
OTHER DATA					
+ 100 ml Ac10					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES	24.1	24.1			
GROSS CPM	400	463			
BKG CPM & MINUTES	800	0			
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
<p>Pu 239 Per 24 hr Spd Fci - 44.1 ± 22.1 o/o RUC = 85.4 Tot Val - 0.88 Body Burden - Val anal - 0.44 17 Feb 67</p>					

AFLC FORM MAY 66 1165

FC 5400

AFLC-WPAFB-JAN 67 5M

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

(b) (6)

P 11

IDENTIFICATION (b) (6)		TYPE, SPEC. <u>URINE</u>		RHL NO. <u>671616</u>	
SOC. SEC. NO.		SUBMITTEE <u>SC HW</u>		AFB <u>P. 653</u>	
DATE COLLECTED <u>9 MAY 67</u>	DATE RECD <u>12 MAY 67</u>	EXPOSURE DATE(S) <u>JAN 66</u>		SPL WT OR VOL <u>1000 ml / 500 ml</u>	
ANALYSIS DESIRED <u>Pu 239</u>		(b) (6)			

TYPE OF ANALYSIS					
COUNTER AND EFF	<u>SPC 41</u>				
TOTAL CTS AND TIME	<u>200 - 182</u>	<u>0</u>			
BK CTS AND TIME	<u>800 5</u>	<u>0</u>			
NET CTS PER MIN					

1	20 22	2	33 35	43 1	20 22	2	33 35	43
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								
GR BETA SUS					NUCLIDE	ACTIVITY		
DATE CTD					<u>187Mn/67 Pu 239 Pu 244</u>	<u>1 D A</u>		
NET BETA PER 24 HR								
SAMPLE WT DIS								
SAMPLE WT SUS								
SAMPLE VOL	<u>1 00</u>				<u>liter</u>			
RECOVERY	<u>75 5</u>				<u>Per Cent</u>			
ELAPSED TIME								
SYSTEMIC BODY BURDEN								
CRITICAL ORGAN BONE								

OT Form, Apr 67
MCGSCPF, hbf

SAMPLE DATA

AFLC-WPAFB-APR 67 300

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

IDENTIFICATION		(b) (6)		TYPE SPL		Urine		RHL NO.		675038 (b) (6)	
SOC. SEC. NO.				SUBMITTEE		SGHW 301 ARWING		AFB		Lockbourne AFB, OHIO	
DATE COLLECTED		17-18 SEP 67		DATE RECD		20 SEP 67		EXPOSURE DATE(S)		TOTAL WT OR VOL	
										760 ml	
ANALYSIS DESIRED		PJ 239		TECHNICIAN						WT OR VOL ANALYZED	
										380 ml	
TYPE OF ANALYSIS		239		236							
COUNTER AND EFF		SPEC#4 22									
TOTAL CTS AND TIME		200 0		195							
BK CTS AND TIME		900 0		0							
NET CTS PER MIN											
1		20 22		±		33 35		43		1	
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											
GR BETA SUS											
DATE CTD											
NET BETA PER 24 HR											
SAMPLE WT DIS											
SAMPLE WT SUS											
SAMPLE VOL		0.076				liters					
RECOVERY		89.3				per cent					
ELAPSED TIME											
SYSTEMIC BODY BURDEN											
CRITICAL ORGAN BONE											

AFLC FORM 1165 JUL 67

FC 5400

PREVIOUS EDITION WILL BE USED.

RADIOLOGICAL SAMPLE DATA

AFLC-WPAFB-JUL 67 3M

April 28, 2000

(b) (6)

(b) (6)

168-5-2 (b) (6)

ERR

Last address - 5 Dec 66

Walker AFB, N. Mex

812 7th St

Walker AFB N. Mex 88201

Letter sent 6 Dec 66

Return to L/col

(b) (6)

when key

Punched

(b) (6)

~~FILE~~ FILE

0398

168-5-2

(b) (6)

1. 44.1 ± 22.1 FC

2. 85.4

3. 0.88

4. 376

5. 7048

6. Systemic Body Burden

Benicritical organ 0.03

(b) (6)

(b) (6)

FILE

2nd Sample
letter
prepared
4 Apr 67

Return after key
punch

5038

1. 0.00

2. 87.3

3. 0.76

4. —

5. 7283

6. Systemic Body Burden 0.00

(b) (6)

(b) (6)

4910

cal

1. 1.03 ± 0.29 Pico
curies

2. ~~1.5~~ ~~2.5~~ 65.1

3. 1.34

4. 268

5. 6326

6. Systemic Body Burden
Bone Critical Organ 0.67

(b) (6)

Return to J/KL
after key
punch

1616

FILE

1. 0.00

2. 75.5

3. 1.00

4. —

5. 7138

6. Systemic Body Burden 0.00

(b) (6)

(b) (6)

UNCLASSIFIED ROUTINE

24 DEC 66 01 42H

FILE 16-5-24
(b) (6)

ZNR 00000

R 251936Z DEC 66

FM 65AF WALKER AFB NMEX

TO USAF RADIOLOGICAL HEALTH LAB WPAFB OHIO

BT

UNCLAS MSM 08482 DEC 66

REFERENCE YOUR LETTER 10 DEC 66 SUBJ: LONG TERM STUDIES
ON SELECTED PARTICIPANTS OF PALOMARES INCIDENT.

COLONEL (b) (6) IS NOW ASSIGNED TO THE 6 STRATEGIC AERO-
SPACE WING WALKER AFB NMEX. COLONEL (b) (6) HAS
VOLUNTEERED TO PARTICIPATE IN THIS PROGRAM.

BT

NNNN

UNCLASSIFIED ROUTINE

007

April 28, 2000

(b) (6)

(b) (6)

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

FILE



REPLY TO
ATTN OF

SGHW

1 Aug 1967

SUBJECT

Follow-Up Bio-Assay Studies--Palomares Incident.

TO

Col (b) (6)
6 Strat Aero Wg
Walker AFB NMex 88201

A container for the third 24-hour urine sample is being forwarded for your use as a participant in subject program.

Thus far, results of our studies have confirmed the impression that no individual participating in the Palomares Operation retained significant amounts of radioactive material.

Your cooperation is greatly appreciated, and you are again reminded to notify this unit of any change in mailing address.

(b) (6)

(b) (6)

LtCol, USAF, MC

Commander

Note Change of Address

*301st ARWing
Lockbourne AFB
Ohio*

(b) (6)

(b) (6)

(b) (6)

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

118-5

REPLY TO
ATTN OF

SGHW

7 Dec 1967

SUBJECT

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

TO

Col (b) (6) (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.

(b) (6)

(b) (6)

LtCol, USAF, MC

Chief

(b) (6)

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)																																									
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Ingestion <input type="checkbox"/> Unknown <input type="checkbox"/> Injection <input type="checkbox"/> Absorption <input type="checkbox"/> Not applicable		INTAKE DATE OR PERIOD: 01/22/66 through 02/09/66 on-site 1/22/66 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 02/09/66 to 09/30/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain																																											
EVALUATION DATA: <table border="0"><tr><td>Air Sampling</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Health Physics Survey Data</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Bioassay – Urinalysis</td><td><input checked="" type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input type="checkbox"/> Unavailable</td></tr><tr><td>Fecal</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Nasal Smears</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>In Vivo</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr></table> Medical Treatment: <table border="0"><tr><td>Skin Decontamination:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Date: _____</td></tr><tr><td>Decorporation:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Agent: _____ Date: _____</td></tr><tr><td>Catharsis:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Agent: _____ Date: _____</td></tr><tr><td>Surgical excision:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Date: _____</td></tr></table>				Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable	Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____	Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable																																								
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____																																								
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																								
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																								
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____																																								
EVALUATION METHODOLOGY: Assumptions: Acute inhalation intake of ^{239}Pu , 100% Class Y, 1 μm AMAD particle size on 1/22/66 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): 71,000 50 YR CEDE (rem): 22 (0.22 Sv) <table border="0"><tr><td>Organ Dose Equivalent Summary</td><td>50 YR CDE (rem/Sv)</td></tr><tr><td>Bone Surface</td><td>220/2.2</td></tr><tr><td>Lung</td><td>81/0.81</td></tr><tr><td>Liver</td><td>40/0.40</td></tr><tr><td>Red Marrow</td><td>17/0.17</td></tr><tr><td>Other</td><td>3.7/0.037</td></tr><tr><td>Testes</td><td>3.2/0.032</td></tr></table>				Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)	Bone Surface	220/2.2	Lung	81/0.81	Liver	40/0.40	Red Marrow	17/0.17	Other	3.7/0.037	Testes	3.2/0.032																										
Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)																																										
Bone Surface	220/2.2																																										
Lung	81/0.81																																										
Liver	40/0.40																																										
Red Marrow	17/0.17																																										
Other	3.7/0.037																																										
Testes	3.2/0.032																																										
DOSE ASSESSOR:		PEER REVIEWER:																																									
DATE: _____		DATE: _____																																									
Signature: _____		Signature: _____																																									
Print Name: _____		Print Name: _____																																									
SSN: _____		SSN: _____																																									

RECOMMENDATIONS:

Additional Bioassay Required

Suggested Sampling Frequency:

Work Restrictions: N/A

☐ Urinalysis☐ Fecal☐ In Vivo

(b) (6)

(b) (6)

Preliminary Internal Dosimetry Case Narrative**Identification:**

Name:

SSN:

(b) (6)

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 µm 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.

(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
66-758	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:

Organ	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent (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 Equivalent			2.2E+01/2.2E-01

(b) (6)

(b) (6)

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:

Based on the results of intake estimates and dose calculations, this individual received an intake of 57,000 to 71,000 pCi of ^{239}Pu 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.

Prepared By:

Name: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: _____

AF 17340819 INTERNAL DOSE DATA					
NAME (LAST, FIRST, M.I.) (1-20)		SOC. SEC. NO. (21-29)		TYPE SAMPLE (30)	
(b) (6)		(b) (6)		Urine	
SAMPLE NO. (33-38)		SAMPLE DATE (39-44)		EXPOSURE	
66-758		FROM 9 FEB 1966		DATE 22 Jan 66	
BASE (57-60)		OCCUPATION (61-62)		REQUESTED BY	
Foreign					
DATE RECEIVED		SAMPLE VOLUME		VOLUME ANALYZED	
13 Feb 66		840 ml.		200 ml.	
TECHNICIAN (51-56)					
(b) (6) 24 Feb 66					
URINE		RADON		FECES/BLOOD	
Counter Number	F	Chamber Number		Counter Number	
Counter Bkg. (cpm)	0.40	Cham. Bkg. (mv/sec)		Counter Bkg.	
Counter Eff. (%)	51	Counter Eff. (%)		Counter Eff.	
Date/Time - Start	24 Feb 66	Millivolt - Start		Date/Time - Start	
- Stop		Millivolt - Stop		- Stop	
Total Counts	51	Total Millivots		Total Counts	
Counting Time	55	Total Drift Time		Counting Time	
Gross cpm	0.93	Gross mv/sec		Gross cpm	
Bkg. Cpm	0.40	Bkg. Mv/sec		Bkg. cpm	
Net cpm	0.53	Net mv/sec		net cpm	
dpm/L	2.34 ± 1.37	curies/mv		dpm	
dpm/24 Hr. (69-74)		litter (69-74)		dps/cc	
K 40 Correction				Neutron Dose (rads) (63-68)	
1.96 ± 1.15		D(q) (63-68)	-	uc/mg (69-74)	
D(q) (63-68)				D(q) (63-68)	

$D = 1.01 \times 10^{-2} \text{ rad}$

1 Mar 66

RADIOLOGICAL SAMPLE DATA							
(b) (6)		OR REQUESTOR'S ID (1-20)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RNI SAMPLE NUMBER
SAMPLE (23-32)		OCCUPATION (34-35)		ANALYSIS DESIGNATION		REQUESTED BY	
RECEIVED (37-42)		DATE ANALYZED (51-56)		DATE COUNTED		DATE COLLECTED	
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED		EXPOSURE DATE			
URINE		2140 ml		1140 ml		(b) (6)	
OTHER DATA							
ENVIRONMENTAL SAMPLES							
COUNTER & EFFICIENCY							
TOTAL COUNTS & MINUTES							
GROSS CPM							
BKG CPM & MINUTES							
NET CPM							
YIELD							
BIOLOGICAL SAMPLES							
COUNTER & EFFICIENCY							
TOTAL COUNTS & MINUTES							
GROSS CPM							
BKG CPM & MINUTES							
NET CPM							
YIELD							
SUMMARY OF RESULTS:							
<p> Pu 239 PER 24 HA - 110A TOT. VOL = 2.14 L. VOL ANAL = 1.14 L. DATE CTR - 3 JULY 67 % REC = 85% B.G. = 0 ELAPSED TIME = 441 DAYS </p>							

AFLC FORM 1165
MAY 66

FC 5400

AFLC-WPAFB-JAN 67 5M

AFLC FORM 1165
MAY 88

(b) (6)		RADIOLOGICAL SAMPLE DATA		670437 (b) (6)	
REQUESTOR'S ID (1-20)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
(b) (6)		A1C	(b) (6)	(b) (6)	(b) (6)
TYPE SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED	REQUESTER	AIR FORCE BASE (68-71)	
Urine			SGHW	Torrejon AB	
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
6 Feb 67	15 Feb 67	15 Feb 67	19 Jan 67	66	
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED		(b) (6)	
2200 ML		1100 ML			
OTHER DATA + 100 ML ACID					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
<p> <i>Fci / ml - 35.8 ± 21.2</i> <i>Tot Vol - 2.20</i> <i>Vol Anal - 1.10</i> <i>3/dec - 90.5</i> <i>Body Burden -</i> <i>15 Feb 67</i> </p>					

AFLC FORM MAY 66 1165

FC 5400

AFLC-WPAFB-JAN 67 5M

RADIOLOGICAL SAMPLE DATA					
NAME OF REQUESTOR (1-30)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
(b) (6)		ALC	(b) (6)	(b) (6)	663971
TYPE SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (36-41)	
Urine		DU 220		Torrejon, Spain	
DATE RECEIVED (37-42)	DATE ANALYZED (51-55)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
		27 SEP 66	8 Jun 66		
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED		TECHNICIAN	
1925 ml		60 ml		checked off master list	
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
RADON					
5 - 51					
55 - 73					
2800 - 89					
% Rec = 76.1					
Body Burden					
SUMMARY OF RESULTS:					
$P_{ci}/sp = 0.179 \pm 0.105$ $Tot VOL = 1925$ $VOL ANAL = 600$					

AFLC FORM 1165
MAY 66

FC
5400

AFLC-WPAFB-MAY 66 4500

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

April 28, 2000

(b) (6)

(b) (6)

[illegible]

AFLC FORM 1165
JUL 67

FC
3400

PREVIOUS EDITION
WILL BE USED.

RADIOLOGICAL SAMPLE DATA AFLC-WPAFB-JUL 67 3M

(b) (6)

(b) (6)

into S/col
in Key Punch

0437

35.8 ± 21.2

90.5

2.20

369

7046

Systemic Body Burden
Bone critical organ 0.03

Last address - 5 Dec 66
Touyon, Spain,
APO 09283

401 Navy Hq
APO NY 09283
Letter Sent - 6 Dec 66

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

April 28, 2000

(b) (6)

(b) (6)

FILE 118-522
2nd sample
letter
prepared
4 apr

Return to J/col
after key punch

2152

1. 0.00
2. 85
3. 2.14
4. 441
5. 7184
6. Systemic Body Burden 0.00

see PC units

(b) (6)

3971

1. ¹⁸~~129~~ ± 1.11

2. 76.1

3. 1.92

4. 134

5. 6270

6. 0.07

FILE

Return after key punch

(b) (6)

5646

1. 0.00

2. 75

3. 1.5

4. —

5. 7291

6. Systemic Body Burden 0.00

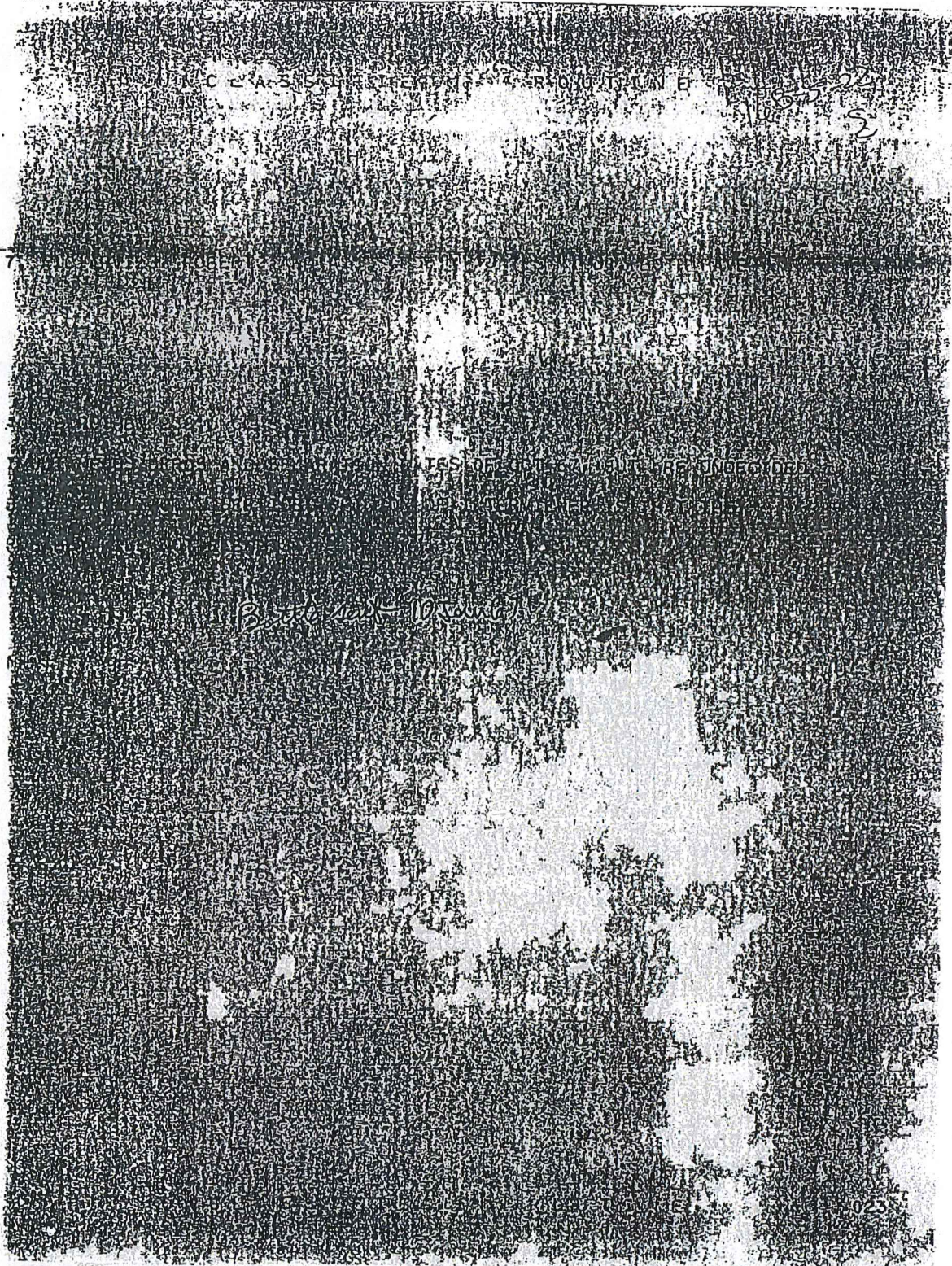
FILE

118-522
(b) (6)

(b) (6)

(b) (6)

(b) (6)



April 28, 2000

(b) (6)

(b) (6)

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

FILE



7 Dec 1967

REPLY TO
ATTN OF

SGHW

SUBJECT

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

TO

Sgt (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)

Chief

LtCol, USAF, MC

(b) (6)

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)																																									
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Ingestion <input type="checkbox"/> Unknown <input type="checkbox"/> Injection <input type="checkbox"/> Absorption <input type="checkbox"/> Not applicable		INTAKE DATE OR PERIOD: 01/18/66 through 02/19/66 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 02/19/66 to 09/15/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain																																											
EVALUATION DATA: <table border="0"><tr><td>Air Sampling</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Health Physics Survey Data</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td>Bioassay – Urinalysis</td><td><input checked="" type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input type="checkbox"/> Unavailable</td></tr><tr><td> Fecal</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td> Nasal Smears</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr><tr><td> In Vivo</td><td><input type="checkbox"/> Attached</td><td><input type="checkbox"/> In Process</td><td><input checked="" type="checkbox"/> Unavailable</td></tr></table> Medical Treatment: <table border="0"><tr><td>Skin Decontamination:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Date: _____</td></tr><tr><td>Decorporation:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Agent: _____ Date: _____</td></tr><tr><td>Catharsis:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Agent: _____ Date: _____</td></tr><tr><td>Surgical excision:</td><td><input type="checkbox"/> Yes</td><td><input checked="" type="checkbox"/> No</td><td>Date: _____</td></tr></table>				Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable	Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable	Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____	Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____	Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable																																								
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable																																								
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____																																								
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																								
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____																																								
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> 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): 44,000 50 YR CEDE (rem): 14 (0.14 Sv) <table border="0"><tr><td>Organ Dose Equivalent Summary</td><td>50 YR CDE (rem/Sv)</td></tr><tr><td>Bone Surface</td><td>140/1.4</td></tr><tr><td>Lung</td><td>50/0.50</td></tr><tr><td>Liver</td><td>25/0.25</td></tr><tr><td>Red Marrow</td><td>11/0.11</td></tr><tr><td>Other</td><td>2.3/0.023</td></tr><tr><td>Testes</td><td>2.0/0.020</td></tr></table>				Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)	Bone Surface	140/1.4	Lung	50/0.50	Liver	25/0.25	Red Marrow	11/0.11	Other	2.3/0.023	Testes	2.0/0.020																										
Organ Dose Equivalent Summary	50 YR CDE (rem/Sv)																																										
Bone Surface	140/1.4																																										
Lung	50/0.50																																										
Liver	25/0.25																																										
Red Marrow	11/0.11																																										
Other	2.3/0.023																																										
Testes	2.0/0.020																																										
DOSE ASSESSOR:		PEER REVIEWER:																																									
DATE: April 26, 2000		DATE:																																									
Signature: _____		Signature: _____																																									
Print Name: _____		Print Name: _____																																									
SSN: _____		SSN: _____																																									

RECOMMENDATIONS:			
Additional Bioassay Required	<input type="checkbox"/> Urinalysis	<input type="checkbox"/> Fecal	<input type="checkbox"/> In Vivo
Suggested Sampling Frequency:	_____		
Work Restrictions:	N/A		

(b) (6)

(b) (6)

Preliminary Internal Dosimetry Case Narrative**Identification:**Name:
SSN:

(b) (6)

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 μm AMAD particle size on 1/18/66. The date is the first day of the period on station from 1/18/66 to 2/19/66.

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
66-1215	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.

Organ	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent (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 Equivalent			1.4E+01/1.4E-01

(b) (6)

(b) (6)

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:

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 ^{239}Pu 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.

Prepared By:

Name: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: _____

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

NEW A2CIN

AFJN: (b) (6)		INTERNAL DOSE DATA			
NAME (LAST, FIRST, M.I.) (1-20) (b) (6)		SOC. SEC. NO. (21-29) (b) (6)	TYPE SAMPLE (30) Urine		TYPE ANAL. (31-32)
SAMPLE NO. (33-38) 66-1215	SAMPLE DATE (39-44) FROM 18 JAN 66 TO 19 FEB 66	EXPOSURE DATE 18 JAN 66 TYPE			
BASE (57-60) Torrejon	OCCUPATION (61-62) 57150	REQUESTED BY			
DATE RECEIVED 3 March 1966	SAMPLE VOLUME 960 ml	VOLUME ANALYZED 960 ml	DATE ANALYZED		
TECHNICIAN (SIGNATURE AND DATE)					
URINE		239	236	RADON	
Counter Number				Chamber Number	
Counter Bkg. (cpm)				Cham. Bkg. (mv/sec)	
Counter Eff. (%)				Counter Eff. (%)	
Date/Time -- Start	10 AM 18 66			Millivolt -- Start	
-- Stop	0910 - 1130			Millivolt -- Stop	
Total Counts	8	12		Total Millivolts	
Counting Time	100	100		Total Drift Time	
Gross cpm	0.08	0.12		Gross mv/sec	
Bkg. Cpm	0.0025	0.0075		Bkg. mv/sec	
Net cpm	0.0775	0.1125		Net mv/sec	
dpm	0.0775			curies/mv	
dpm/24 hr. (69-74)				litter (69-74)	
K 40 Correction					
Net Beta	1.03 ± 0.52			D(q) (63-68)	
D(q) (63-68)	26 D				
D _A = 6.88 x 10 ⁻³ mc					
FECES/BLOOD					
Counter Number		Counter Bkg.		Counter Eff.	
Date/Time -- Start		Date/Time -- Stop		Total Counts	
Counting Time		Gross cpm		Bkg. cpm	
Gross cpm		net cpm		dpm	
Bkg. cpm		dps/cc		Neutron Dose (rads) (63-68)	
Net cpm		uc/mg (69-74)		D(q) (63-68)	

AFJN: (b) (6)		INTERNAL DOSE DATA			
NAME (LAST, FIRST, M.I.) (1-20) (b) (6)		SOC. SEC. NO. (21-29) (b) (6)	TYPE SAMPLE (30) Nasal Sample		TYPE ANAL. (31-32)
SAMPLE NO. (33-38) 66-1280	SAMPLE DATE (39-44) FROM 10 MAR 66 TO 10 MAR 66	EXPOSURE DATE 10 MAR 66 TYPE			
BASE (57-60) Torrejon	OCCUPATION (61-62)	REQUESTED BY			
DATE RECEIVED 8 MARCH 1966	SAMPLE VOLUME	VOLUME ANALYZED	DATE ANALYZED		
TECHNICIAN (SIGNATURE AND DATE)					
URINE		RADON		FECES/BLOOD	
Counter Number	2382	Chamber Number		Counter Number	
Counter Bkg. (cpm)		Cham. Bkg. (mv/sec)		Counter Bkg.	
Counter Eff. (%)		Counter Eff. (%)		Counter Eff.	
Date/Time -- Start	10 MAR 66	Millivolt -- Start		Date/Time -- Start	
-- Stop		Millivolt -- Stop		-- Stop	
Total Counts	20	Total Millivolts		Total Counts	
Counting Time	139	Total Drift Time		Counting Time	
Gross cpm	144	Gross mv/sec		Gross cpm	
Bkg. Cpm	0	Bkg. mv/sec		Bkg. cpm	
Net cpm	0	Net mv/sec		net cpm	
dpm	0	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)	

RADIOLOGICAL SAMPLE DATA					
NAME OF REQUESTOR'S ID (1-20)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
(b) (6)		A20	(b) (6)	(b) (6)	664979
TYPE SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (68-71)	
Urine		Pu 239	SGHW	Torrejon, Sepin	
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
Urine		1 Nov 66	1 Sept 66	Jan 66	
SAMPLE WEIGHT/VOLUME	WEIGHT/VOLUME ANALYZED		TECHNICIAN		
830 ± 40 ACID	413 ml		checked off List		
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
Pci/Sml - 0.125 ± 0.066			% Rec = 88.6		
Tot Vol - 930			Body Burden -		
Vol Anal - 413					

AFLC FORM 1165 MAY 66 FC 5400

AFLC-WPAFB-MAY 66 4500

RADIOLOGICAL SAMPLE DATA					
(b) (6) OR REQUESTOR'S ID (1-20)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
(b) (6)					(b) (6)
SAMPLE (23-32)	OCCUPATION (34-39)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (68-71)	
Line -		Pu 239	SCWH	Torrejon AB	
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
6 Feb 67		17 Feb 67	2-3 Feb 67	Jan Feb 66	
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED		(b) (6)	
2250 ML		1125 ML			
OTHER DATA + 100 ML Acid					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
365					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
Rad 0.00443 ± 0.00491					
SUMMARY OF RESULTS: Pu 239 per 24 hr spl - NDA					
Total - 2.25					
Vol anal - 1.13					
% Rec = 105					
Body Burden -					
17 Feb 67					

AFLC FORM 1165

FC 5400

AFLC-WPAFB-JAN 67 5M

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

RADIOLOGICAL SAMPLE DATA					
NAME OR REQUESTER'S ID (1-20)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
TYPE SAMPLES (23-32) <i>URINE</i>		OCCUPATION (34-35)	ANALYSIS DESIRED <i>Pv-259</i>	REQUESTED BY	AIR FORCE BASE (66-71) <i>165-5-23 (b) (6)</i>
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
SAMPLE WEIGHT/VOLUME <i>2140 ml</i>		WEIGHT/VOLUME ANALYZED <i>1140 ml</i>		TECHNICIAN <i>(b) (6)</i>	
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY <i>Spec 1</i>					
TOTAL COUNTS & MINUTES <i>200</i>					
GROSS CPM					
BKG CPM & MINUTES <i>P05</i>					
NET CPM					
YIELD <i>0.014 ± 0.014</i>					
RADON					
SUMMARY OF RESULTS:					
<i>Pu 239 Pk 24 Hk - NDA</i>			<i>% REC - 76%</i>		
<i>TOT. VOL. = 2.14 L.</i>			<i>B.B. = 0</i>		
<i>VOL ANAL = 1.14 L.</i>			<i>EXPOSED TIME = 451 DAYS</i>		

AFLC FORM 1165
MAY 66

FC 5400
DATE CTA - 3 JUL 67

AFLC-WPAFB-JAN 67 5M

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

Q 20 # 20 NDA		RADIOLOGICAL SAMPLE DATA		1185 672150	
OR REQUESTOR'S ID (1-20) (b) (6)		GRADE A2C		SOCIAL SECURITY NUMBER (b) (6)	
SAMPLE (23-32) 2140		OCCUPATION (34-35) Pu339		RHL SAMPLE NUMBER P653	
RECEIVED (37-42) 5 June 67		ANALYSIS DESIRED Pu339		REQUESTED BY FM 401 Ac Hosp	
DATE ANALYZED (51-56) 21 June 67		DATE COUNTED 21 June 67		AIR FORCE BASE (68-71) Town Jan 57	
SAMPLE WEIGHT/VOLUME 2.140 ml		WEIGHT/VOLUME ANALYZED 1000 ml		EXPOSURE DATE 21 June 67	
OTHER DATA		TECHNICIAN J. J. 66			
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY I-51		TOTAL COUNTS & MINUTES 55-33			
GROSS CPM BKG CPM & MINUTES 945-79		NET CPM YIELD 18.4% rec			
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY 500#1		TOTAL COUNTS & MINUTES 21		RADON	
GROSS CPM BKG CPM & MINUTES 800		NET CPM YIELD			
SUMMARY OF RESULTS:					
Total Vol 2.14 l. Vol anal 1.00h					
700 rec = 14.2 Date Counted 21 June 67					

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

(b) (6)		ION		FACE R. M.		TYPE SPL		URINE		RHL NO.		675650		(b) (6)	
(b) (6)		SUBMITTEE		SCHW		AFB		P-653		(b) (6)		(b) (6)		(b) (6)	
DATE COLLECTED		DATE RECD		EXPOSURE DATE(S)		TOTAL WT OR VOL		WT OR VOL ANALYZED							
15 SEPT 67		6 OCT 67				2080 ml		1040 ml							
ANALYSIS DESIRED		239 PU		TECHNICIAN		(b) (6)		Resumant							
TYPE OF ANALYSIS		Pu 239		Pu 238		Hr d		239		238					
COUNTER AND EFF		Spec #4 25		E-		5000 #4									
TOTAL CTS AND TIME		200 - 0		150		35 - 115		200 - 0		0		039			
BK CTS AND TIME		200 - 0		0		900 - 36		200 - 0		0		0			
NET CTS PER MIN				64.4 % 0.001		79.6 % 0.001						59.7 % 0.001			
		(21007)				25 OCT 1967		26 Oct 67							
1	20	22	±	33	35	43	1	20	22	±	33	35	43		
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															
GR BETA SUS															
DATE CTD						NUCLIDE		Pu 239		ACTIVITY		n		d R	
NET BETA PER 24 HR												14 Nov 67			
SAMPLE WT DIS															
SAMPLE WT SUS															
SAMPLE VOL		1		04		liters									
RECOVERY		82				Per Cent									
ELAPSED TIME															
SYSTEMIC BODY BURDEN															
CRITICAL ORGAN BONE															

AFLC FORM 1165
JUL 67

FC 3400
PREVIOUS EDITION
WILL BE USED.

RADIOLOGICAL SAMPLE DATA AFLC-WPAFB-JUL 67 3M

(b) (6)

(b) (6)

5650 B
16 Nov 67

200	239	236	%E - 25
201 Bky	1	205	spike - 4.97
	0	0	%rec - 82

900 - 40
55 - 123
I - 51
B flat
ground

(b) (6)

(b) (6)

Return after key punch

(b) (6)

5650

1. 0.00

2. 82.0

3. 2.08

4. —

5. 7321

6. Systemic Body Burden 0.00

Return to S/Cd
after key punch

(b) (6)

(b) (6)

2150

1. 0.00

2. 76

3. 2.14

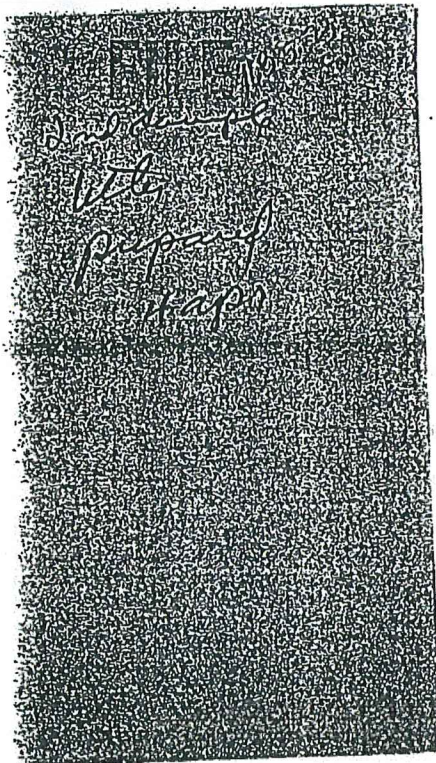
4. 451

5. 7184

6. Systemic Body Burden 0.00

(b) (6)

(b) (6)



Lost address - 5 Dec 66
401 CEG Sq. APO NY 09285
Torrejon, Spain

Letter Sent 6 Dec 66

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

(b) (6)

FILE

(b) (6)

1. 125 + 66 FC
2. 88.6
3. 83
4. 219
5. 6305
6. Systemic Body Burden
Bone critical organ 0.07

Return to S/col (b) (6)
after Key Punch
(b) (6)

0435

1. 0.00
2. 105
3. 2.25
4. 365
5. 7048
6. 0.00

(b) (6)

April 28, 2000

(b) (6)

(b) (6)

UNCLASSIFIED

ROUTINE

(b) (6)

508

RFTU JAW RUEXSB0298 0060057-UUUU--RUEDFIA.

DE RUTHBN 238 0051416

ZNR UUUUUKGZR 051410Z JAN 67

1. 401 TAC HOSP TORREJON AB SPAIN

TO USAF RADL HEALTH LAB W PAT AFB OHIO

BT

UNCLAS SUFM1 40011 JAN 67. FOR SGHW. SUBJECT: LONG-TERM STUDIES ON SELECTED PARTICIPANTS OF PALOMARES INCIDENT. REFERENCE SGHW 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. (b) (6)

1. (b) (6) SSN (b) (6) SSGT. (b) (6) AF

(b) (6) SSN (b) (6) A1C (b) (6)

SSN (b) (6) A1C (b) (6) SSN (b) (6)

A1C (b) (6) SSN (b) (6) A1C (b) (6)

(b) (6) SSN (b) (6) A2C (b) (6) AF

(b) (6) SSN (b) (6) AND A2C (b) (6)

(b) (6) NOTE 4-1 (b) (6) AND (b) (6) BELIEVE

YOU MAY WANT TO CONSIDER FOLLOWING FACTORS ON SOME INDIVIDUALS, HOW-

EVER. A1C (b) (6) WILL SEPARATE FROM THE SERVICE IN

JULY 67. A2C (b) (6) WILL SEPARATE FROM THE SERVICE IN DEC

(b) (6)

(b) (6)

UNCLASSIFIED

ROUTINE

160-5

67. A1C (b) (6)

AND A1C (b) (6)

BOTH HAVE

PAGE 2 RUTHBN 238 UNCLAS

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

BT

Bottle sent 10 Jan 67

NNNN#

April 28, 2000

(b) (6)

(b) (6)

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

FILE



7 Dec 1967

REPLY TO
ATTN OF

SGHW

SUBJECT

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

TO

AZC (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

(b) (6)

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)	
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Injection <input type="checkbox"/> Ingestion <input type="checkbox"/> Absorption <input type="checkbox"/> Unknown <input type="checkbox"/> Not applicable		INTAKE DATE OR PERIOD: 1/18/66 through 3/18/66 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: 6 urine samples from 01/21/66 to 08/15/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain			
EVALUATION DATA:			
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Bioassay - Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Medical Treatment:			
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> 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): 58,000			
50 YR CEDE (rem) : 18 (0.18 Sv)			
Organ Dose Equivalent Summary		50 YR CDE (rem/Sv)	
Bone Surface		180/1.8	
Lung		66/0.66	
Liver		32/0.32	
Red Marrow		14/0.14	
Other		3.1/0.031	
Testes		2.6/0.026	
DOSE ASSESSOR:		PEER REVIEWER:	
DATE: _____		DATE: _____	
Signature: _____		Signature: _____	
Print Name: _____		Print Name: _____	
SSN: _____		SSN: _____	

RECOMMENDATIONS:

Additional Bioassay Required

☐ Urinalysis☐ Fecal☐ In Vivo

Suggested Sampling Frequency: _____

Work Restrictions: N/A

(b) (6)

(b) (6)

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 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 retained 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): ^{239}Pu .**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 3/18/66.

(b) (6)

(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.

Sample	*Analysis	Date	Elapsed Days	Result (pCi/day)	Error (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	✓
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).

(b) (6)

(b) (6)

Organ	Dose Equivalent (rem/Sv)	Weighting Factors	Weighted Organ Dose Equivalent (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 Equivalent			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 ^{239}Pu 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.

Prepared By:

Name: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: _____

FILE 165-5-21 (b) (6)

INTERNAL DOSE DATA					
NAME (LAST, FIRST, M.I.) (1-20) (b) (6)		SOC. SEC. NO. (21-29)		TYPE SAMPLE (30) URINE	TYPE ANAL. (31-32) GROSS ALPHA
SAMPLE NO. (33-38) (66-247)	SAMPLE DATE (39-44) FROM TO		EXPOSURE DATE TYPE		
BASE (57-60) TORREJON	OCCUPATION (61-62)		REQUESTED BY		
DATE RECEIVED JAN 25 1966	SAMPLE VOLUME 580 ml	VOLUME ANALYZED 200 ml	DATE ANALYZED		
TECHNICIAN (SIGNATURE AND DATE)					
URINE GROSS ALPH.		RADON		FECES/BLOOD	
Counter Number	28	Chamber Number		Counter Number	
Counter Bkg. (cpm)		Cham. Bkg. (mv/sec)		Counter Bkg.	
Counter Eff. (%)	51%	Counter Eff. (%)		Counter Eff.	
Date/Time - Start		Millivolt - Start		Date/Time - Start	
- Stop		Millivolt - Stop		- Stop	
Total Counts	36	Total Millivots		Total Counts	
Counting Time	55	Total Drift Time		Counting Time	
Gross cpm	0.654	Gross mv/sec		Gross cpm	
Bkg. Cpm	0.236	Bkg. Mv/sec		Bkg. cpm	
Net cpm	0.418	Net mv/sec		net cpm	
dpm		curies/mv		dpm	
dpm/24 hr. (69-74)		litter (69-74)		dps/cc	
K 40 Correction		D(q) (63-68)		Neutron Dose (rads) (63-68)	
Net Beta				uc/mg (69-74)	
D(q) (63-68)	1.85 ± 1.11 pc/L		27 Jan 66	D(q) (63-68)	

9-7

FILE 168-5-74 (b)(6)

AFSN: (b)(6)		INTERNAL DOSE DATA	
NAME (LAST, FIRST, M.I.) (1-20)		SOC. SEC. NO. (21-29)	TYPE SAMPLE (30)
(b)(6)		(b)(6)	Urine
SAMPLE NO. (33-38)	TSgt	EXPOSURE	TYPE ANAL. (31-32)
66-2242		FROM 18 Mar 66 TO	DATE 19 Jan 66 TYPE
BASE (57-60)	OCCUPATION (61-62)	REQUESTED BY	
Moroh	90770		
DATE RECEIVED	SAMPLE VOLUME	VOLUME ANALYZED	DATE ANALYZED
5 April 1966	890 ml	890 ml	
TECHNICIAN (SIGNATURE AND DATE)			
URINE		RADON	
Counter Number	C	Chamber Number	
Counter Bkg. (cpm)	0.14 (712)	Cham. Bkg. (mv/sec)	
Counter Eff. (%)	51	Counter Eff. (%)	
Date/Time - Start		Millivolt - Start	
- Stop		Millivolt - Stop	
Total Counts	47	Total Millivots	
Counting Time	55	Total Drift Time	
Gross cpm		Gross mv/sec	
Bkg. Cpm		Bkg. Mv/sec	
Net cpm		Net mv/sec	
dpm Per M.I. = 0.790 ± 0.276		curles/mv	
dpm/24 hr. (69-74)		litter (69-74)	
K 40 Correction		D(q) (63-68)	
Net-Beto Per/gal = 0.743 ± 0.246		DA = 6.59 × 10 ⁻³ uc	
D(q) (63-68)			
FECES/BLOOD			
Counter Number		Counter Number	
Counter Bkg.		Counter Bkg.	
Counter Eff.		Counter Eff.	
Date/Time - Start		Date/Time - Start	✓
- Stop		- Stop	
Total Counts		Total Counts	
Counting Time		Counting Time	
Gross cpm		Gross cpm	0.79 PC
Bkg. cpm		Bkg. cpm	0.15 BB
net cpm		net cpm	
dpm		dpm	
dps/cc		dps/cc	
Neutron Dose (rads) (63-68)		Neutron Dose (rads) (63-68)	
uc/mg (69-74)		uc/mg (69-74)	
D(q) (63-68)		D(q) (63-68)	

Palomares Nuclear Weapons Accident

Dose Evaluation Report

April 28, 2000

RADIOLOGICAL SAMPLE DATA					
NAME OF REQUESTOR'S ID (1-20)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
(b) (6)		(b) (6)	(b) (6)	(b) (6)	(b) (6)
TYPE SAMPLE (23-32)	OCCUPATION (34-38)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (88-71)	
Urin No. 1		Pu 299	SGHW	AF Recruiting Services	
DATE RECEIVED (37-42)	DATE ANALYZED (81-88)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
24 Jan 67	13 Feb 67		19 Jan 67	Jan - Mar 66	
SAMPLE WEIGHT/VOLUME	WEIGHT/VOLUME ANALYZED		TECHNICIAN		
60 me	4/30 me		(b) (6)		
OTHER DATA					
Minneapolis, Minn.					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
236 235					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
<p> <i>Fu/Spl - 128 ± 12.6</i> <i>Tot Vol - 0.96</i> <i>Vol ANAL - 0.43</i> <i>o/g Rec - 105.3</i> <i>Body Burden - 139 ± 67</i> </p>					
AFLC FORM 1165 MAY 66		FC 549D		AFLC-WPAFB-MAY 66 4500	



VOUGHT CORPORATION
multiple launch rocket system division

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

Traffic Coordinator

April 28, 2000

(b) (6)

(b) (6)

IDENTIFICATION (b) (6)		TYPE SPL URINE		RHL NO. 671536	
SUBMITTEE SGT W		AFB AIR FORCE RECTRY GFC MINN 59401			
DATE COLLECTED 5 MAY 67		DATE RECD 8 MAY 67		EXPOSURE DATE(S) 1250ml / 625ml used	
ANALYSIS DESIRED P3 239				(b) (6)	
TYPE OF ANALYSIS 236		238			
COUNTER AND EFF SPES # 4					
TOTAL CTS AND TIME 200 / 293		200 / 0			
BK CTS AND TIME 800 / 0		800 / 0			
NET CTS PER MIN					
20 22		33 35		43 1	
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					
GR BETA SUS					
DATE CTD		NUCLIDE		ACTIVITY	
NET BETA PER 24 HR		DATE CTD		13 MAY 67	
SAMPLE WT DIS					
SAMPLE WT SUS					
SAMPLE VOL 1 / 25		LITERS			
RECOVERY 91		PER CENT			
ELAPSED TIME					
SYSTEMIC BODY BURDEN 0					
CRITICAL ORGAN BONE					

OT Form, Apr 67
MCGSCPF, hbf

SAMPLE DATA

AFLC-WPAFB-APR 67 300

April 28, 2000

(b) (6)

RADIOLOGICAL SAMPLE DATA

April 28, 2000

(b) (6)

(b) (6)

RU, URINE
URINE VERSION 10-OCT-79

*Recalculation of samples for
current procedures.*

FILE

1165-11 (b) (6)

ENTER SN#, SAMP CTS, SAMP TIME, BKG CTS, BKG TIME, %EFF, VOL ANAL, VOL TOT, %REC

1
5134, 4, 100, 2, 800, 24, 710, 1420, 80.6
SAMP# ACT ERROR MIN SENS CT TIME %VOL AN %EFF %REC
5134 .1746 .1870 .1986 100.0 50.0 24.0 80.6

2
350, 2, 400, 0, 800, 24, 0, 430, 860, 100.0
SAMP# ACT ERROR MIN SENS CT TIME %VOL AN %EFF %REC
350 .0188 .0265 .0375 400.0 50.0 24.0 100.0

3
1536, 0, 200, 0, 800, 24, 0, 625, 1250, 91.0
SAMP# ACT ERROR MIN SENS CT TIME %VOL AN %EFF %REC
1536 0.0000 0.0000 .0825 200.0 50.0 24.0 91.0

4
3985, 2, 200, 0, 800, 24, 0, 1150, 2300, 84.0
SAMP# ACT ERROR MIN SENS CT TIME %VOL AN %EFF %REC
3985 .0447 .0632 .0894 200.0 50.0 24.0 84.0

5
3999

(b) (6)

SSAN → (b) (6)

(b) (6)

FILE

1165-11 (b) (6)

(b) (6)

(b) (6)

(b) (6)



SMS (b) (6)
Super. Radiation Services Div.
USAF OEHL/RZ
Brooks AFB., TX 78235

FILE

5734

1. 17.0 ± 90 *per to*

2. 80.6

3. 14.2

4. 26.3

5. 63.7

6. #1 Systemic Body Burden
Bone Critical Organ 0.11

Return to I/col (b) (6)
after key punching.

(b) (6)

0350

1. 17.8 ± 12.6 FC

2. 105.3

3. 0.86

4. 304

5. 70.44

6. Systemic Body Burden
Bone Critical Organ 0.01

FILE

1685-21

(b) (6)

(b) (6)

Return after key punch
3985

1. 0.00 #3
2. 84 FILE
3. 2.3
4. —
5. 7242
6. Septin Body Burden 0.00

FILE 165
Last address: - 5 Dec 66

USAF Recruiting Service
Det 704
Room 104, US Fed Courthouse Bldg
Mpls, Minn 55401

Bottle sent 10 Jan 67

Code 653
Return to P/Cal
after key punch.
1536

1. 0.00 #2
2. 91 FILE
3. 1.25 165 (b) (6)
4. —
5. 7133
6. Septin Body Burden 0.00

(b) (6)

(b) (6)

apt
3842
3496

(b) (6)

(b) (6)

Camden - working
Sachin

2nd sample
better prepared
4 apr

I received the attached letter from
(b) (6) in 1988 to my letter -
Please file this in his folder, I
do not plan to answer any more
of his inquiries - Considering
his attitude - Thanks -

(b) (6)

(b) (6)

(b) (6)

EXP

JAN 11 1983

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. (b) (6) of the Board of Veterans Appeals on December 21, this is to request information as to radiation exposure of (b) (6) on January 16 or 19, 1966, and thereafter. Mr. (b) (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 (b) (6) exposure to radiation, including plutonium. His Social Security number is (b) (6)

Sincerely yours,

(b) (6)

Chairman

(011E)

/S (b) (6)

(b) (6)

(b) (6)

(b) (6)

27 Jan 1982

(b) (6)

Dear (b) (6)

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 = 1×10^{-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.

(b) 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)

SM Sgt, USAF
Superintendent, Radiation Services Division

(b) (6)

(b) (6)

FILE 168 74

Dear (b) (6)

7 Mar 82

Thank you for your letter of 27 Jan 82, which I received a couple of weeks ago via (b) (6) delivering it to my wife while she was working at the Bank on Base. He apologized for having opened it. No problem as far as I'm concerned.

I do appreciate your information, however at the expense of appearing ungrateful, it was of little help to me. The basic ~~xxx~~ 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 "biologically harmful", but rather if medical science can guarantee 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 (b) (6) 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) (6) 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 college at UALR and works in evenings. I'm enclosing my business card should you care to call, either professionally or friendly (or both). Thanks again.

Sincerely,

(b) (6)

(b) (6)

r/b

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

23-JUN-92	P653	SAMPLE ANALYSIS RESULTS	
		USAF OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY (AFSC) BROOKS AFB, TEXAS 78235-5501	
IDENTIFICATION	TYPE OF SAMPLE	DATE RECEIVED	OEHL NUMBER
(b) (6)	URINE	24-JAN-67	16700350
SSAN: - - -			1365

3095

April 28, 2000

(b) (6)

(b) (6)

DEPARTMENT OF THE AIR FORCE
ARMSTRONG LABORATORY (AFMC)
BROOKS AFB, TEXAS 78235-5000

FROM: OEB

05 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:

1) A1C (b) (6)	14) Maj (b) (6)
2) A2C (b) (6)	15) E4 (b) (6)
3) MSgt (b) (6)	16) MSgt (b) (6)
4) A1C (b) (6)	17) TSgt (b) (6)
5) A2C (b) (6)	18) A1C (b) (6)
6) A1C (b) (6)	19) Capt (b) (6)
7) A2C (b) (6)	20) A2C (b) (6)
8) SSgt (b) (6)	21) Col (b) (6)
9) A1C (b) (6)	22) A1C (b) (6)
10) LtCol (b) (6)	23) A2C (b) (6)
11) A1C (b) (6)	24) TSgt (b) (6)
12) A2C (b) (6)	25) A2C (b) (6)
13) LtCol (b) (6)	26) A1C (b) (6)

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.

(b) (6)

(b) (6)

2. The information on the preceeding 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)

(b) (6)

Lt Col, USAF, BSC
Chief, Bioenvironmental Engineering Division

(b) (6)

(b) (6)

HQ AFMC/TMOD

ATTN: (b) (6)
Freedom Of Information Management
Wright-Patterson AFB, OH 45433

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 that SMS Howe is case #HPA 95-66; (3) Please explain what happened to the INITIAL urine specimens, collected, packaged, and delivered by me to an awaiting helicopter crewmember for the hand-to-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 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.

Respectfully,

(b) (6)

CMS (Ret)

(b) (6)

cc: Dept. of the Air Force
Office of the Secretary
ATTN: (b) (6)

(b) (6)

(evenings)

Atak 1

(b) (6)

(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 (b) (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.

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

(b) (6)

FOIA Manager

(b) (6)

(b) (6)

RECORD OF FREEDOM OF INFORMATION (FOI) PROCESSING COST

Please read instructions on reverse before completing form.

REQUEST NUMBER	2. TYPE OF REQUEST (X one)		3. DATE COMPLETED (YYMMDD)	
I-HS-92M056	<input checked="" type="checkbox"/> a. INITIAL	<input type="checkbox"/> b. APPEAL	921005	
CLERICAL HOURS (E-9/GS-8 and below)		TOTAL HOURS (1)	HOURLY RATE (2)	COST (3)
a. SEARCH				
b. REVIEW / EXCISING			X \$ 12.00 =	
c. CORRESPONDENCE AND FORMS PREPARATION				
d. OTHER ACTIVITY				
PROFESSIONAL HOURS (0-1 - 0-6/GS-9 - GS/GM-15)		TOTAL HOURS (1)	HOURLY RATE (2)	COST (3)
a. SEARCH		2		
b. REVIEW / EXCISING		2	X \$ 25.00 =	
c. COORDINATION / APPROVAL / DENIAL				
d. OTHER ACTIVITY				
EXECUTIVE HOURS (0-7/GS/GM-16/ES 1 and above)		TOTAL HOURS (1)	HOURLY RATE (2)	COST (3)
a. SEARCH				
b. REVIEW / EXCISING			X \$ 45.00 =	
c. COORDINATION / APPROVAL / DENIAL				
COMPUTER SEARCH		TOTAL HOURS (1)	HOURLY RATE (2)	COST (3)
a. MACHINE HOURS				
b. PROGRAMMER / OPERATOR TIME			X	
(1) Clerical			\$12.00	
(2) Professional			\$25.00	
OFFICE COPY REPRODUCTION		NUMBER (1)	RATE (2)	COST (3)
a. PAGES REPRODUCED			X .15 =	
MICROFICHE REPRODUCTION		NUMBER (1)	RATE (2)	COST (3)
a. MICROFICHE REPRODUCED			X .25 =	
PRINTED RECORDS		TOTAL PAGES (1)	RATE (2)	COST (3)
a. FORMS				
b. PUBLICATIONS			X .02 =	
c. REPORTS				
COMPUTER COPY		NUMBER (1)	ACTUAL COST (2)	COST (3)
a. TAPE			X	
b. PRINTOUT				
AUDIOVISUAL MATERIALS		NUMBER (1)	ACTUAL COST (2)	COST (3)
a. MATERIALS REPRODUCED			X	
13. For FOI Office Use Only				
a. SEARCH FEES PAID		f. TOTAL COLLECTABLE COSTS		
b. REVIEW FEES PAID		g. TOTAL PROCESSING COSTS		
c. COPY FEES PAID		h. TOTAL CHARGED		
d. TOTAL PAID		i. FEES WAIVED / REDUCED (X one)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
e. DATE PAID (YYMMDD)		* Chargeable to all requesters after application of all waiver criteria.		
		** Chargeable only to commercial requesters.		

(b) (6)

(b) (6)

SEARCH FORM
PERSONAL RADIATION EXPOSURE HISTORY REQUEST

NAME: (b) (6) SUSPENSE DATE: (b) (6)
SSAN: (b) (6)
AFSN: EXPOSURE DATES: FROM: TO:
DATA SOURCES TO SEARCH

SOURCES	POSITIVE	NEGATIVE	INITIALS
1. TLD - CURRENT DATA BASE		✓	(b) (6)
2. MASTER RADIATION EXPOSURE REGISTRY			
A. CHECK FOR AL LISTING 1527		✓	(b) (6)
B. CHECK FOR ANY REECO CONFIRMATION		✓	
3. INTERNAL DOSIMETRY (RZA ARCHIVED FILES)		✓	
4. BIOASSAY (SQLPLUS)	✓		
5. SAM RESULTS DATABASE		✓	
6. REECO DATABASE (RZD DATABASE)		✓	
7. NUCLEAR TEST PERSONNEL REVIEW (NTPR)		✓	
8. MICROFICHE HISTORICAL DATA		✓	
9. TEST SHOT DATA (PACIFIC/NEVADA & ABC LOGS)		✓	
10. PALOMARES RECORDS	✓		(b) (6)

SEND HISTORY TO: _____

INFO COPY TO: _____

April 28, 2000

(b) (6)

(b) (6)

EXPOSED 16 Jan 66
BIOASSAY 25 Jan 66 : 1.85 ± 1.11 PC/L (INHALATION)

Printed on 07/02/92 at 10:26:39
Generated on 07/02/92 at 10:26:39

This report resides in File : lpt1
Generated from REMedy File : Current.dat

***** SAIC REMedy Intake/Dose Evaluation 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#
*

***** INPUT DATA *****

Subject Name : ID#
Analyst : ID#

AMAD (um) : 1.00
Days Post Exposure: 9.0

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 : 1.00E-06
Intake (Bq) : 9.58E+04 % ALI : 15970.28
Intake (uCi) : 2.59E+00 % Screening Level : 319405.53

ORGAN	50-Year Committed Dose		First-Year Dose	
	[Rem]	[Sv]	[Rem]	[Sv]
GONADS	1.15E+02	1.15E+00	3.62E-01	3.62E-03
BREAST	2.67E-04	2.67E-06	8.80E-04	8.80E-06
R.MARROW	7.28E+02	7.28E+00	2.59E+00	2.59E-02
LUNGS	3.10E+03	3.10E+01	6.47E+02	6.47E+00
THYROID	2.24E-05	2.24E-07	7.50E-04	7.50E-06
ENDOSTEAL	9.10E+03	9.10E+01	3.36E+01	3.36E-01
REMAINDER	3.99E+02	3.99E+00	5.17E+01	5.17E-01
EFFECTIVE	8.81E+02	8.81E+00	7.76E+01	7.76E-01

*** 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

COMMENTS:

SIGNATURE:

Authorized Licensee : AFOEHL/ADS CP2221

April 28, 2000

(b) (6)

(b) (6)

RUSH-FREEDOM OF INFORMATION

FREEDOM OF INFORMATION ACT REQUEST (Instructions on Reverse)		CASE NO. I-HS-92M056	SUSPENSE 7 Oct 92
I. DADF PROCESSING ACTIONS			
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> 1. REQUESTER INVOKED FOIA AND OWES NO OUTSTANDING FEES.			
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> 2. REQUEST IS REASONABLY DESCRIBED.			
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> 3. FEE ISSUE IS RESOLVED. <input type="checkbox"/> WAIVE FEES <input type="checkbox"/> REQUESTER WILL PAY UP TO \$ _____			
TO: AL/OEBS thru AL/DOE		FROM: HSC/IMDF XXXXXX	
<input checked="" type="checkbox"/> REQUEST IS FORWARDED FOR SEARCH ACTION.			
<input type="checkbox"/> ANOTHER AGENCY HAS SURFACED YOUR DOCUMENTS. PLEASE REVIEW FOR RELEASABILITY.			
<input checked="" type="checkbox"/> RECORD TIME EXPENDED ON DD FORM 2086.			
REMARKS SEE ATTACHED			
FOIA MANAGER'S NAME (b) (6)		PHONE (b) (6)	DATE 29 Sep 92
II. OPR/FOIA MONITOR PROCESSING ACTIONS			
<input type="checkbox"/> NO RECORDS COULD BE LOCATED.			
<input type="checkbox"/> RECORDS MAY BE AVAILABLE AT ANOTHER SOURCE. FORWARD REQUEST TO: _____			
<input type="checkbox"/> RECORDS ARE FULLY RELEASABLE.			
<input checked="" type="checkbox"/> REQUEST SHOULD BE <input type="checkbox"/> FULLY DENIED UNDER <input checked="" type="checkbox"/> PARTLY DENIED UNDER			
<input type="checkbox"/> b1 <input type="checkbox"/> b2 <input type="checkbox"/> b3 STAT _____ <input type="checkbox"/> b4 <input type="checkbox"/> b6 <input checked="" type="checkbox"/> b6 <input type="checkbox"/> b7 <input type="checkbox"/> b8 <input type="checkbox"/> b9			
REMARKS NAMES OF PARTICIPANTS MAY BE SUBJECT TO PRIVACY ACT (APR 12-35).			
(b) (6) Maj, USAF, BSC Chief, Radioanalytical Branch		SIGNATURE (b) (6)	PHONE (b) (6) DATE 5 Oct 92
III. LEGAL COORDINATION (Denials Only)			
<input type="checkbox"/> CONCUR WITH RECOMMENDED DENIAL <input type="checkbox"/> NONCONCUR. RATIONALE IN REMARKS			
REMARKS			
NAME, GRADE, TITLE	SIGNATURE	PHONE	DATE
IV. LOCAL COMMAND APPROVAL: (At HQ AFSG, DCS or SSO Approval)			
TO: /DADF.			
<input type="checkbox"/> CONCUR <input type="checkbox"/> NONCONCUR. RATIONALE IN REMARKS			
REMARKS			
NAME, GRADE, TITLE	SIGNATURE	PHONE	DATE

AFSC Form 648, JUN 87 PREVIOUS EDITION IS OBSOLETE

RUSH-FREEDOM OF INFORMATION

AFSC Form 648, JUN 87

Palomares Nuclear Weapons Accident

Dose Evaluation Report

April 28, 2000

(b) (6)

(b) (6)

(b) (6)

URINE #1 7024 7054
 39PU ALPHA SPECT D 17 8 12 6 FC PER S
 SYSTEMIC BODY BURDEN
 DATE COUNTED 7044 D
 LAPSED TIME D 304 DAYS
 SAMPLE VOLUME D 2 86 LITERS
 ONE CRITICAL ORGAN D 0 01
 36PU SPIKE RECOVERY D 5 3 PER CENT
 12 JSOIL 7089 7090
 CONTAINER EMPTY J RESAMPLE
 KARR VICTOR B URINE #2 7126 7144
 SYSTEMIC BODY BURDEN 0 00
 39PU ALPHA SPECT D 0 00
 36PU SPIKE RECOVERY D 91 PER CENT
 SAMPLE VOLUME D 1 25 LITERS
 DATE COUNTED 7133 D
 KARR VICTOR B URINE #3 7230 7250
 36PU SPIKE RECOVERY D 84 PER CENT
 39PU ALPHA SPECT D 0 00
 DATE COUNTED 7242 D
 SAMPLE VOLUME D 2 3 LITERS
 SYSTEMIC BODY BURDEN 0 00

FILE
 --R P653 16700350
 R P653-16700350
 R P653-16700350
 R P653-16700350
 R P653-16700350
 R P653-16700350
 R P653-16700350
 -- E185 16701116
 E185-16701116
 --R P653 16701536
 R P653-16701536
 R P653-16701536
 R P653-16701536
 R P653-16701536
 R P653-16701536
 --R P653 16703985
 R P653-16703985
 R P653-16703985
 R P653-16703985
 R P653-16703985

(b) (6)

(b) (6)

27 Jan 1982

FILE

(b) (6)

Dear (b) (6):

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 = 1×10^{-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.

(b) (6) 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)

(b) (6)

(b) (6)

FIVE

11/15/5

(b) (6)

the four urine samples analyzed for (b) (6) showed the following results:

<u>date</u>	<u>amount</u>	<u>body burden</u>
26 Oct 66	170 ± 90 fCi	0.11%
19 Jan 67	178 ± 12.6 fCi	0.01%
5 May 67	0	0
15 Aug 67	0	0

These results are consistent with all of the other folders we have for Palomares participants. They all have an initial result of about 200 fCi which decreases by about a factor of 10 after 4 months or so and finally to zero.

ICRP 10 indicates that a max permissible body burden for Pu^{239} is 40,000,000 fCi

\therefore 0.11% of BB would imply 44000 fCi
0.01% " " " 4000 fCi

ICRP 10 indicates that about 80% of inhaled Pu goes to CO

which implies about 20% excreted over a period of 50 yrs

I don't understand why the excretion rate drops off so fast
$$Y_{ur} = 0.0023 t^{-0.77}$$
 according to ICRP

April 28, 2000

(b) (6)

(b) (6)

FIVE

b. The results reported for the first two samples were liberal in interpretation. If the same samples were analyzed in our laboratory today, the values in column 5 would ~~have to~~ be reported. These results from a more conservative approach to defining specifying our analytical sensitivity; that is, the smallest amount of isotope that we can confidently measure. In light of these recalculations, our estimate of the situation is that all samples are identical and ~~show no~~ show no measurable Pu^{239} .

In summary, the USAF OEHL has on file records of samples submitted by (b) (6) as a result of his participation in the Palomares recovery operation. A reevaluation of the results leads to the same conclusion as was reached in 1967; that no health effect should be ~~affected~~ ^{result} ~~derived~~ from that participation.

April 28, 2000

(b) (6)

(b) (6)

FILE

Re:

(b) (6)

SSAN

(b) (6)

Participated in Palomares recovery operation during Jan-Mar 1966. Search of records revealed the following results on samples collected after return to and removal from operation.

Sample #	Date Collected	Result pCi/kilogram	% System Burden	Recalculated Results (1981) pCi/gpl
1665134	26 Oct 66	0.17 ± 0.09	0.11	< 0.20
1670350	19 Jan 67	0.0198 ± 0.0126	0.01	< 0.04
1671536	5 May 67	0	0	< 0.08
1673985	15 Aug 67	0	0	< 0.09

Individual was notified that health was not in jeopardy from retention of radioactive materials from participation in operation. The same conclusion should be reached today.

Although ^{concentrations} ~~or positive~~ of Pu ²³⁹ ~~greater than~~ were reported at the time of analysis, ~~they represented~~ small ~~for~~ there were small compared to the guidelines for permissible exposure. Several points are worth considering.

a) The acceptable levels are merely guidelines and have built in safety factors. They are not a hard and fast limit above which harm will definitely occur and below which one is totally safe. Rather, the ~~levels are~~ ^{guidelines} represent levels which are not likely to result in any unacceptable injury.

April 28, 2000

(b) (6)

(b) (6)

FILE
16-574
(b) (6)

$Y_a(x10^{-4})$	$t(\text{days})$
23	1
13	2
9.8	3
7.9	4
6.7	5
3.9	10
1.7	30
0.98	60
0.58	120

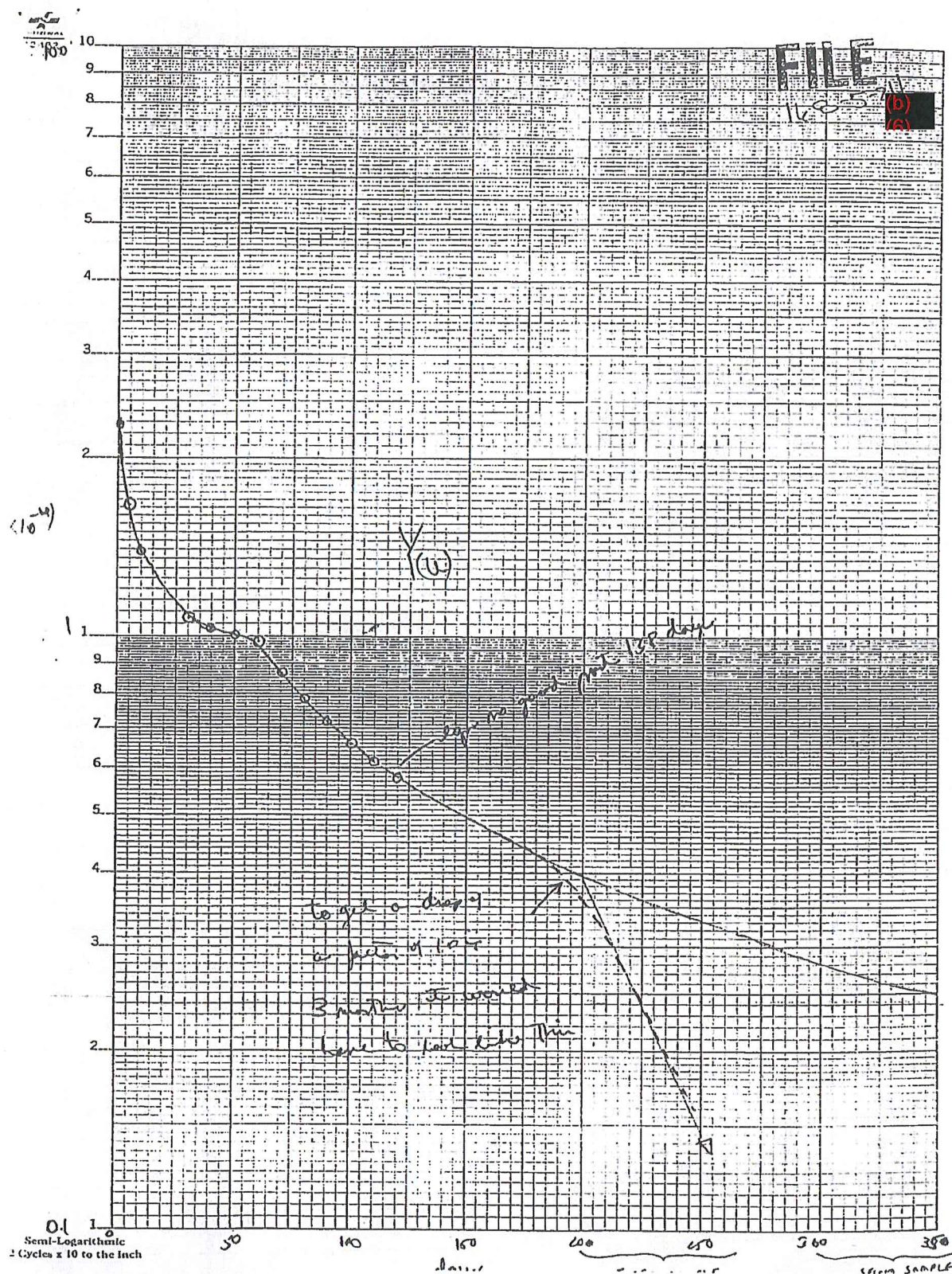
The sign is only good thru day 138 but it seems that the fractional exponent doesn't decrease that fast unless after 138 days it really drops fast. Why? I don't know (b) (6)

Sorry?

Since he was exposed between JAN + MAR 66 his first sample was 7-9 mo after exposure

(b) (6)

(b) (6)



April 28, 2000

(b) (6)

(b) (6)

(b) (6)

(b) (6)

here are my feelings on the Josa
matter. Let me know when you want to
go from here. I hesitate to put anything
in writing unless we see a for written
request. Perhaps an informal note to him
would be enough.

(b) (6)

April 28, 2000

(b) (6)

(b) (6)

FILE

Please Calculate these using URINE Program

Sample # 5134, Pu²³⁶ Rec = 80.6%, Pu²³⁹ ~~Rec = 23%~~Pu²³⁹ counts/time 4/100

BKG counts/time 2/800

Vol. Anal/Vol. Tot 710 ml/1420 ml

Eff = 0.24 (24%)

Recalc - < 0.2 pCi/
24 hours

Sample # 350

Pu²³⁶ Rec = 100%Pu²³⁹ counts/time 2/400

BKG " 0/800

Vol. Anal/Vol. Tot 430 ml/860 ml

Eff = 24% (0.24)

Recalculated -
< 0.04

Sample # 1536

Pu²³⁶ Rec = 91%Pu²³⁹ counts/time = 0/200

BKG counts/time = 0/800

Vol. Anal/Vol. TOTAL 625/1250

Eff = 24%

Recalc
< 0.08 pCi/24 hr

Sample # 3985

Pu²³⁶ Rec = 24%Pu²³⁹ counts/time 2/200

BKG counts/time 0/800

Vol. Anal/Vol. Total 1150/2300

Eff = 24%

Recalc - < 0.09

(b) (6)

April 28, 2000

(b) (6)

(b) (6)

JAN 11 1993

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. (b) (6) of the Board of Veterans Appeals on December 21, this is to request information as to radiation exposure of (b) (6) on January 16 or 19, 1966, and thereafter. Mr. (b) (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,

(b) (6)

Chairman

(011E)

SS (b) (6)

(b) (6)

April 28, 2000

(b) (6)

(b) (6)

EXPOSED: 16 Jan 66
BIOASSAY: 25 Jan 66 (FNB/THON)
1.85 ± 1.11 PC/L

Printed on 07/02/92 at 11:25:39
Generated on 07/02/92 at 11:25:39

This report resides in File : lpt1
Generated from REMedy File : Current.dat

***** SAIC REMedy Intake/Dose Evaluation 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#

***** INPUT DATA *****

Subject Name : ID#
Analyst : ID#
AMAD (um) : 0.00
Days Post Exposure: 9.0
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
Fl : 1.00E-05 Ff : 4.60E-01

***** RESULTS USING ICRP-30 SYSTEMIC MODEL *****

Retention Fraction at Time Post-Exposure : 1.61E-10
Intake (Bq) : 5.87E+08 % ALI : 19569.87
Intake (uCi) : 1.59E+04 % Screening Level : 391397.32

ORGAN	50-Year Committed Dose		First-Year Dose	
	[Rem]	[Sv]	[Rem]	[Sv]
GONADS	1.55E+02	1.55E+00	3.17E+00	3.17E-02
BREAST	2.75E-03	2.75E-05	6.99E-03	6.99E-05
R.MARROW	9.69E+02	9.69E+00	2.22E+01	2.22E-01
LUNGS	3.09E-04	3.09E-06	4.44E-03	4.44E-05
THYROID	2.58E-05	2.58E-07	4.44E-03	4.44E-05
ENDOSTEAL	1.21E+04	1.21E+02	2.85E+02	2.85E+00
REMAINDER	1.40E+03	1.40E+01	4.46E+03	4.46E+01
EFFECTIVE	9.33E+02	9.33E+00	2.85E+02	2.85E+00

*** WARNING *** Intake Requires investigation
*** WARNING *** Calculated Intake Exceeds ALI

***** DOSE FACTORS USED IN CALCULATIONS *****

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:

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

SIGNATURE: _____
Authorized Licensee : AFOEHL/ADS CP2221

EXPOSED: 16 Jan 66
BIOASSAY: 18 Mar 66: 7.03E-04 pCi/cc (INGESTION)

Printed on 07/02/92 at 11:27:26 This report resides in File : lpt1
Generated on 07/02/92 at 11:27:26 Generated from REMedy File : Current.dat

***** SAIC REMedy Intake/Dose Evaluation Report *****
*
* CASE : Acute INGESTION of PU-239N on 16 JAN 1990
* BIOASSAY : 24hr Urine Analysis on 18 MAR 1990 - 7.03E-04 pCi/cc ID#
*

***** INPUT DATA *****
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 Fu : 5.40E-01
Fl : 1.00E-05 Ff : 4.60E-01

***** RESULTS USING ICRP-30 SYSTEMIC MODEL *****
Retention Fraction at Time Post-Exposure : 1.61E-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]
GONADS 5.97E+01 5.97E-01 1.22E+00 1.22E-02
BREAST 1.06E-03 1.06E-05 2.69E-03 2.69E-05
R.MARROW 3.73E+02 3.73E+00 8.54E+00 8.54E-02
LUNGS 1.19E-04 1.19E-06 1.71E-03 1.71E-05
THYROID 9.94E-06 9.94E-08 1.71E-03 1.71E-05
ENDOSTEAL 4.66E+03 4.66E+01 1.10E+02 1.10E+00
REMAINDER 5.38E+02 5.38E+00 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 *****
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

April 28, 2000

(b) (6)

(b) (6)

Authorized Licensee : AFOEHL/ADS CP2221

EXPOSED: 16 Jan 66
BIOASSAY: 26 Oct 66: 0.17 ± 0.09 $\mu\text{Ci/l}$ (INGESTION)

Printed on 07/02/92 at 11:28:17
Generated on 07/02/92 at 11:28:17

This report resides in File : lpt1
Generated from REMedy File : Current.dat

***** SAIC REMedy Intake/Dose Evaluation Report *****

CASE : Acute INGESTION of PU-239N on 16 JAN 1990
BIOASSAY : 24hr Urine Analysis on 26 OCT 1990 - $1.70\text{E}-04$ pCi/cc ID#

***** INPUT DATA *****

Subject Name : ID#
Analyst : ID#
AMAD (um) : 0.00
Days Post Exposure: 283.2
Lung Model : ICRP30 Lung Model ID : LungDat.lib
ALI (Bq) : $3.00\text{E}+06$ Screening Level(Bq) : $1.50\text{E}+05$
ALI (uCi) : $8.11\text{E}+01$ Screening Level(uCi) : $4.05\text{E}+00$
TC Half-Time(Days): $2.50\text{E}-01$ Fu : $5.40\text{E}-01$
Fl : $1.00\text{E}-05$ Ff : $4.60\text{E}-01$

***** RESULTS USING ICRP-30 SYSTEMIC MODEL *****

Retention Fraction at Time Post-Exposure : $1.60\text{E}-10$
Intake (Bq) : $5.51\text{E}+07$ % ALI : 1837.71
Intake (uCi) : $1.49\text{E}+03$ % Screening Level : 36754.30

ORGAN	50-Year Committed Dose		First-Year Dose	
	[Rem]	[Sv]	[Rem]	[Sv]
GONADS	$1.46\text{E}+01$	$1.46\text{E}-01$	$2.98\text{E}-01$	$2.98\text{E}-03$
BREAST	$2.58\text{E}-04$	$2.58\text{E}-06$	$6.56\text{E}-04$	$6.56\text{E}-06$
R.MARROW	$9.10\text{E}+01$	$9.10\text{E}-01$	$2.08\text{E}+00$	$2.08\text{E}-02$
LUNGS	$2.90\text{E}-05$	$2.90\text{E}-07$	$4.17\text{E}-04$	$4.17\text{E}-06$
THYROID	$2.43\text{E}-06$	$2.43\text{E}-08$	$4.17\text{E}-04$	$4.17\text{E}-06$
ENDOSTEAL	$1.14\text{E}+03$	$1.14\text{E}+01$	$2.68\text{E}+01$	$2.68\text{E}-01$
REMAINDER	$1.31\text{E}+02$	$1.31\text{E}+00$	$4.19\text{E}+02$	$4.19\text{E}+00$
EFFECTIVE	<u>$8.77\text{E}+01$</u>	$8.77\text{E}-01$	<u>$2.68\text{E}+01$</u>	$2.68\text{E}-01$

*** WARNING *** Intake Requires investigation

*** WARNING *** Calculated Intake Exceeds ALI

***** DOSE FACTORS USED IN CALCULATIONS *****

Organ	Dose Factor [Sv/Bq]
GONADS	$2.64\text{E}-09$
BREAST	$4.68\text{E}-14$
R.MARROW	$1.65\text{E}-08$
LUNGS	$5.26\text{E}-15$
THYROID	$4.40\text{E}-16$
ENDOSTEAL	$2.06\text{E}-07$
REMAINDER	$2.38\text{E}-08$
EFFECTIVE	$1.59\text{E}-08$

COMMENTS:

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

Authorized Licensee : AFOEHL/ADS CP2221

EXPOSED: 16 Jan 66
BIOASSAY: 19 Jan 67: 0.017 ± 0.013 PC/L (INGESTION)

Printed on 07/02/92 at 11:29:04 This report resides in File : lpt1
Generated on 07/02/92 at 11:29:05 Generated from REMedy File : Current.dat

***** SAIC REMedy Intake/Dose Evaluation Report *****

CASE : Acute INGESTION of PU-239N on 16 JAN 1990
BIOASSAY : 24hr Urine Analysis on 19 JAN 1991 - $1.70E-05$ pCi/cc ID#

***** INPUT DATA *****

Subject Name : ID#
Analyst : ID#

AMAD (um) : 0.00
Days Post Exposure: 368.2

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 : $5.40E-01$
Fl : $1.00E-05$ Ff : $4.60E-01$

***** RESULTS USING ICRP-30 SYSTEMIC MODEL *****

Retention Fraction at Time Post-Exposure : $1.59E-10$
Intake (Bq) : $5.53E+06$ % ALI : 184.39
Intake (uCi) : $1.50E+02$ % Screening Level : 3687.75

ORGAN	50-Year Committed Dose		First-Year Dose	
	[Rem]	[Sv]	[Rem]	[Sv]
GONADS	$1.46E+00$	$1.46E-02$	$2.99E-02$	$2.99E-04$
BREAST	$2.59E-05$	$2.59E-07$	$6.58E-05$	$6.58E-07$
R.MARROW	$9.13E+00$	$9.13E-02$	$2.09E-01$	$2.09E-03$
LUNGS	$2.91E-06$	$2.91E-08$	$4.18E-05$	$4.18E-07$
THYROID	$2.43E-07$	$2.43E-09$	$4.18E-05$	$4.18E-07$
ENDOSTEAL	$1.14E+02$	$1.14E+00$	$2.69E+00$	$2.69E-02$
REMAINDER	$1.32E+01$	$1.32E-01$	$4.20E+01$	$4.20E-01$
EFFECTIVE	$8.80E+00$	$8.80E-02$	$2.69E+00$	$2.69E-02$

*** WARNING *** Intake Requires investigation
*** WARNING *** Calculated Intake Exceeds ALI

***** DOSE FACTORS USED IN CALCULATIONS *****

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:

April 28, 2000

(b) (6)

(b) (6)

EXPOSED 16 JAN 66
BIOASSAY 18 MAR 66: 703 ± 246 PC/L (INHALATION)

Printed on 07/02/92 at 10:34:10
Generated on 07/02/92 at 10:34:10

This report resides in File : lpt1
Generated from REMedy File : Current.dat

***** SAIC REMedy Intake/Dose Evaluation 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#
*

***** INPUT DATA *****

Subject Name : ID#
Analyst : ID#

AMAD (um) : 1.00
Days Post Exposure: 61.3

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 : 1.04E-06
Intake (Bq) : 3.52E+04 % ALI : 5863.72
Intake (uCi) : 9.51E-01 % Screening Level : 117274.49

ORGAN	50-Year Committed Dose		First-Year Dose	
	[Rem]	[Sv]	[Rem]	[Sv]
GONADS	4.22E+01	4.22E-01	1.33E-01	1.33E-03
BREAST	9.82E-05	9.82E-07	3.23E-04	3.23E-06
R.MARROW	2.67E+02	2.67E+00	9.50E-01	9.50E-03
LUNGS	1.14E+03	1.14E+01	2.37E+02	2.37E+00
THYROID	8.23E-06	8.23E-08	2.75E-04	2.75E-06
ENDOSTEAL	3.34E+03	3.34E+01	1.23E+01	1.23E-01
REMAINDER	1.46E+02	1.46E+00	1.90E+01	1.90E-01
EFFECTIVE	3.23E+02	3.23E+00	2.85E+01	2.85E-01

*** 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

COMMENTS:

SIGNATURE:

Authorized Licensee : AFOEHL/ADS CP2221

April 28, 2000

(b) (6)

(b) (6)

EXPOSED. 16 Jan 66
BIOASSAY: 26 Oct 66: 0.17 ± 0.09 pCi/L (INHALATION)

Printed on 07/02/92 at 10:35:29
Generated on 07/02/92 at 10:35:29

This report resides in File : lpt1
Generated from REMedy File : Current.da

***** SAIC REMedy Intake/Dose Evaluation Report *****

CASE : Acute INHALATION of PU-239Y on 16 JAN 1990
BIOASSAY : 24hr Urine Analysis on 26 OCT 1990 - $1.70\text{E-}04$ pCi/cc ID#

***** INPUT DATA *****

Subject Name : ID#
Analyst : ID#

AMAD (um) : 1.00
Days Post Exposure: 283.2

Lung Model : ICRP30 Lung Model ID : LungDat.lib

ALI (Bq) : $6.00\text{E+}02$ Screening Level(Bq) : $3.00\text{E+}01$
ALI (uCi) : $1.62\text{E-}02$ Screening Level(uCi) : $8.11\text{E-}04$

TC Half-Time(Days): $2.50\text{E-}01$ Fu : $5.40\text{E-}01$
Fl : $1.00\text{E-}05$ Ff : $4.60\text{E-}01$

***** RESULTS USING ICRP-30 SYSTEMIC MODEL *****

Retention Fraction at Time Post-Exposure : $1.14\text{E-}06$
Intake (Bq) : $7.72\text{E+}03$ % ALI : 1285.86
Intake (uCi) : $2.09\text{E-}01$ % Screening Level : 25717.18

ORGAN	50-Year Committed Dose		First-Year Dose	
	[Rem]	[Sv]	[Rem]	[Sv]
GONADS	$9.26\text{E+}00$	$9.26\text{E-}02$	$2.92\text{E-}02$	$2.92\text{E-}04$
BREAST	$2.15\text{E-}05$	$2.15\text{E-}07$	$7.08\text{E-}05$	$7.08\text{E-}07$
R.MARROW	$5.86\text{E+}01$	$5.86\text{E-}01$	$2.08\text{E-}01$	$2.08\text{E-}03$
LUNGS	$2.49\text{E+}02$	$2.49\text{E+}00$	$5.21\text{E+}01$	$5.21\text{E-}01$
THYROID	$1.81\text{E-}06$	$1.81\text{E-}08$	$6.04\text{E-}05$	$6.04\text{E-}07$
ENDOSTEAL	$7.33\text{E+}02$	$7.33\text{E+}00$	$2.71\text{E+}00$	$2.71\text{E-}02$
REMAINDER	$3.21\text{E+}01$	$3.21\text{E-}01$	$4.17\text{E+}00$	$4.17\text{E-}02$
EFFECTIVE	$7.09\text{E+}01$	$7.09\text{E-}01$	$6.25\text{E+}00$	$6.25\text{E-}02$

*** WARNING *** Intake Requires investigation
*** WARNING *** Calculated Intake Exceeds ALI

***** DOSE FACTORS USED IN CALCULATIONS *****

Organ	Dose Factor [Sv/Bq]
GONADS	$1.20\text{E-}05$
BREAST	$2.79\text{E-}11$
R.MARROW	$7.60\text{E-}05$
LUNGS	$3.23\text{E-}04$
THYROID	$2.34\text{E-}12$
ENDOSTEAL	$9.50\text{E-}04$
REMAINDER	$4.16\text{E-}05$
EFFECTIVE	$9.19\text{E-}05$

COMMENTS:

SIGNATURE:

Authorized Licensee : AFOEHL/ADS CP2221

April 28, 2000

(b) (6)

(b) (6)

EXPAST. 16 JAN 66

BIOASSAY: 19 Jan 67: .017±.013 pCi/L (INHALATION)

Printed on 07/02/92 at 10:36:37
Generated on 07/02/92 at 10:36:37This report resides in File : lpt1
Generated from REMedy File : Current.dat

***** SAIC REMedy Intake/Dose Evaluation 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#
*

***** INPUT DATA *****

Subject Name : ID#
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-04TC 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]
GONADS	9.05E-01	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-02	2.04E-04
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

COMMENTS:

SIGNATURE:

Authorized Licensee : AFOEHL/ADS CP2221

(b) (6)

(b) (6)

Capt

(b) (6)

individual's file

Cond Oklan 28 Jan 83

FILE

28 JAN 1983

CC

Radiation Exposure Records (b) (6)

SSAN (b) (6)

Board of Veterans Appeals
Washington DC 20420

1. In response to your request, dated 11 Jan 83, reference 011E, for details regarding any exposure to ionizing radiation, including plutonium, by (b) (6) (b) (6) SSAN (b) (6) 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 nuclear 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 Mr. (b) (6) submitted six urine samples to the USAF Radiological Health Laboratory for analysis. Urine was used to evaluate personnel exposure to plutonium at Palomares. Initial samples indicated some alpha particle activity. An additional sample collected upon Mr. (b) (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 Atch 1. Based on a review of these results, competent medical authority concluded that Mr. (b) (6) health was in no jeopardy from retention of radioactive materials as a result of participation in the Palomares 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. (b) (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.

April 28, 2000

(b) (6)

(b) (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).

FILE

SIGNED

WILLIAM E. MABSON, Col, USAF, BSC
Commander

- 2 Atch
1. Data Samples
2. Urinalysis Results

(b) (6)

(b) (6)

FILE 16B-5-24
(b) (6)

Urinalysis Results for (b) (6)

SSAN

(b) (6)

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

* Data received at Laboratory.

(b) (6)

DRAFT

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)	
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Injection <input type="checkbox"/> Ingestion <input type="checkbox"/> Absorption <input type="checkbox"/> Unknown <input type="checkbox"/> Not applicable		INTAKE DATE OR PERIOD: 01/18/66 through 02/06/66 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 02/08/66 to 09/04/67 Duration of Exposure: Unknown Location of Exposure: Camp Wilson, near Palomares, Spain			
EVALUATION DATA:			
Air Sampling	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Bioassay – Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Medical Treatment:			
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> 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): 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		2.9/0.29	
DOSE ASSESSOR:		PEER REVIEWER:	
DATE: _____		DATE: _____	
Signature: _____		Signature: _____	
Print Name: _____		Print Name: _____	
SSN: _____		SSN: _____	

RECOMMENDATIONS:

Additional Bioassay Required

☐ Urinalysis☐ Fecal☐ In Vivo

Suggested Sampling Frequency: _____

Work Restrictions: N/A

DRAFT

(b) (6)

(b) (6)

Preliminary Internal Dosimetry Case Narrative**Identification:**Name:
SSN:

(b) (6)

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): ^{239}Pu .**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 2/6/66.

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.

(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
66-527	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 Equivalent			2.0E+01/2.0E-01

(b) (6)

(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:

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.

Prepared By:

Name: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: _____

FEB 10 1966

INTERNAL DOSE DATA					
NAME (LAST, FIRST, M.I.) (1-20)		SOC. SEC. NO. (21-29)		TYPE SAMPLE (30)	
(b) (6)		(b) (6)		URINE	
SAMPLE NO. (33-38)		SAMPLE DATE (39-44)		EXPOSURE	
66-527		FROM 8 FEB 1966 TO		DATE 8 JAN 1966 TYPE	
BASE (57-60)		OCCUPATION (61-62)		REQUESTED BY	
TORREJON AB, SPAIN					
DATE RECEIVED		SAMPLE VOLUME		VOLUME ANALYZED	
		460 ml.		200 ml.	
TECHNICIAN (SIGNATURE AND DATE)					
WALTER G. EDWARDS : 5 FEB 1966					
URINE		SSGT		USAF/DON	
Counter Number		Chamber Number		FECES/BLOOD	
Counter Bkg. (cpm)		Cham. Bkg. (mv/sec)		Counter Number	
Counter Eff. (%)		Counter Eff. (%)		Counter Bkg.	
Date/Time - Start		Millivolt - Start		Counter Eff.	
- Stop		Millivolt - Stop		Date/Time - Start	
Total Counts		Total Millivots		- Stop	
Counting Time		Total Drift Time		Total Counts	
Gross cpm		Gross mv/sec		Counting Time	
Bkg. Cpm		Bkg. Mv/sec		Gross cpm	
Net cpm		Net mv/sec		Bkg. cpm	
dpm/100		curies/mv		net cpm	
dpm/24 hr. (69-74)		litter (69-74)		dpm	
K 40 Correction		D(q) (63-68)		dps/cc	
Net Beta/100		Neutron Dose (rads) (63-68)		uc/mg (69-74)	
D(q) (63-68)		D(q) (63-68)		D(q) (63-68)	

$D_m = 1.10 \times 10^{-2}$ 17 Feb 66

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

AFLC-WPAFB-JAN 67 5M

RADIOLOGICAL SAMPLE DATA					
MEMORANDUM ID (1-20)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
(b) (6)		A1C	(b) (6)	(b) (6)	670432
SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (68-71)	
Urine		Pu 239	SGHW	Torrejon AB	
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
6 Feb 67		14 Feb 67	17 Jan 67	Jan 66	
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED		(b) (6)	
2720 ML + 160 ML		1360 ML			
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
RADON					
SUMMARY OF RESULTS:					
<p> $Fe/5pk - 41.5 \pm 21.2$ $Tot Vol - 2.72$ $Vol ANAL - 1.36$ $\% Rec - 100.4$ $Body Burden$ $14 Feb 67$ </p>					

AFLC FORM MAY 66 1165 FC 5400

AFLC-WPAFB-JAN 67 5M

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

16.5 (b) (6) **FILE** K653 K

ON (b) (6) TYPE SPL URGENT HL NO. 675649 (b) (6)

SUBMITTEE S6H41 AFB P.653

DATE COLLECTED 4 SEP 67 DATE RECD OCT 67 EXPOSURE DATE(S) TOTAL WT OR VOL 2440 ml WT OR VOL ANALYZE 1220 ml

ANALYSIS DESIRED 239 Pu TECHNICIAN (b) (6)

TYPE OF ANALYSIS	239	236	gross d	B part present
COUNTER AND EFF	Apex #4	23	F-51	6-51
TOTAL CTS AND TIME	200 - 1	147	55-106	55-178
BK CTS AND TIME	200 - 0	0	3780-192	900-45
NET CTS PER MIN	200 d 67			over
	5.09 - 63%		72.7%	

1	20	22	±	33	35	43	1	20	22	±	33	35	43
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													
GR BETA SUS													
DATE CTD													
NET BETA PER 24 HR													
SAMPLE WT DIS													
SAMPLE WT SUS													
SAMPLE VOL													
RECOVERY													
ELAPSED TIME													
SYSTEMIC BODY BURDEN													
CRITICAL ORGAN BONE													

NUCLIDE Pu 239 ACTIVITY NDA

15 NOV 1967

SAMPLE VOL 244 L

RECOVERY 90 %

AFLC FORM 1165 JUL 67

FC 5400 PREVIOUS EDITION WILL BE USED.

RADIOLOGICAL SAMPLE DATA AFLC-WPAFB-JUL 67 3M

April 28, 2000

(b) (6)

(b) (6)

(b) (6)

11.6.5.27 (b)

FILE

Use PC unit

4096 ↓

1. 16.1 ± 1.2 PC

2. 71.3

3. 1.85

4. 150

5.

6271

6. 0.07

Return to S/col

(b) (6)

after Key Punch

(b) (6)

0432

FILE

11.6.5.27 (b)

1. 11.5 ± 21.2 FC

2. 100.4

3. 2.72

4. 7045

5. 367

6. Systemic Body Burden

Biocritical Organ 0.03

Last address - 5 Dec 66

FILE

(b)

APC N.Y. 09²⁸ 3

Torres, Spain

Letter sent 6 Dec 66

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

(b) (6)

(b) (6)

FILE
165-25
(b) (6)

2nd Sample
Letter prepared
April 67

Return to 2/Col (b) (6)
after key punch
(b) (6) 2155 FILE
165-25
(b) (6)

1. 0.00
2. 98.4
3. 2.32
4. —
5. 7163
6. Septatic Body Burden 0.00

Return after key punch
(b) (6) 5649 FILE
165-25
(b) (6)

1. 0.00
2. ~~2.4~~ 90
3. 2.44
4. —
5. 7319
6. Septatic Body Burden 0.00

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

spec #3	15 Nov
239	236
200 - 1	197
Bkg - 0	0

spike 4.97 dpm

%rec - 90.1

(b) (6)

(b) (6)

UNCLAS S S I F I E D R O U T I N E

FILE

50

DE RUT BEN 38 0031 116

ZNR 000006Z JAN 67

TO: 401 TAC HOSP TORREJON AB SPAIN

TO: USAF RADI HEALTH LAB W PAID AFB OHIO

BT

UNCLAS SUBM 140011 JAN 67. FOR 56HW. SUBJECT: LONG-TERM STUDIES ON SELECTED PARTICIPANTS OF PALOMARES INCIDENT. REFERENCE: 56HW LETTERS 6 DEC 66. SAME SUBJECT. THIS IS INFO REQUESTED IN PAR 56 EVALUATION OF FOLLOWING INDIVIDUALS REVEALED THEY ALL HAVE BEEN INDENTIFIED FOR PARTICIPATION IN SUBJECT PROGRAM: MSGT (b) (6)

(b) (6) (b) (6) SSN (b) (6) SSN (b) (6)

(b) (6) (b) (6) (b) (6) (b) (6)

SS (b) (6) (b) (6) SSN (b) (6)

(b) (6) (b) (6) SSN (b) (6) (b) (6)

(b) (6) (b) (6) SS (b) (6) A2C (b) (6)

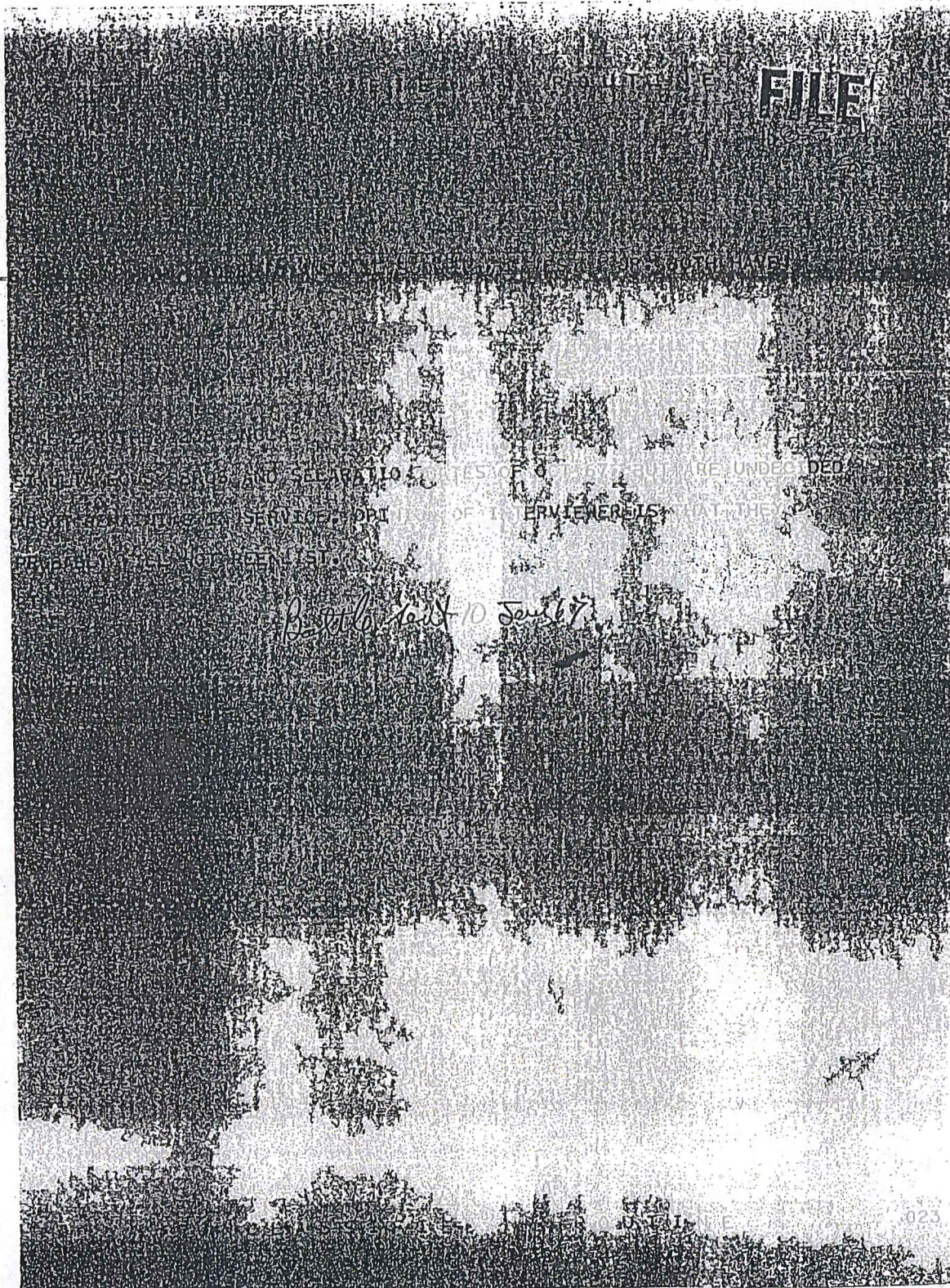
(b) (6) SS (b) (6) AND (b) (6)

(b) (6) NOTE: AIC RANGES ON (b) (6) AND (b) (6) BELIEVE YOU MAY WANT TO CONSIDER FOLLOWING FACTORS ON SOME INDIVIDUALS: HOWEVER, AIC (b) (6) WILL SEPARATE FROM THE SERVICE IN JULY 67. A2C (b) (6) WILL SEPARATE FROM THE SERVICE IN DEC

UNCLAS S S I F I E D R O U T I N E

(b) (6)

(b) (6)



(b) (6)

(b) (6)

FILE 11.85-25 (b) (6)

PERMANENT CHANGE OF STATION ORDER — MILITARY			
(Items preceded by an asterisk for overseas only.) (If more space is required, continue on reverse.)			
2. GRADE, LAST NAME, FIRST, MIDDLE INITIAL, AFSN A1C (b) (6)	3. SHIPPING AFSC (Officer) 90252	4. CAFSC (Airman) 90252	5. <input type="checkbox"/> OVER 4 YEARS SERVICE (AIC Only)
6. UNIT, MAJOR AIR COMMAND AND ADDRESS OF UNIT FROM WHICH RELIEVED 401 Tac Hosp. (USAF) APO New York 09283	7. UNIT MAJOR AIR COMMAND AND ADDRESS OF UNIT TO WHICH ASSIGNED AND DUTY STATION IF APPROPRIATE USAF Hospital (Hq Comd USAF) Andrews, AFB, Md 20331	8. PURPOSE OF REASSIGNMENT IF OTHER THAN DUTY	
9. REPORT TO COMDR., NEW ASSIGNMENT NLT	10. (Reassignment from overseas unit to CONUS unit only.) REPORT AT NEW ASSIGNMENT NLT 31 DAYS AFTER DEPARTURE FROM CONUS PORT OF ENTRY UNIT	11. DALVP yes	12. EDCSA 20 Oct 67
13. TDY EN ROUTE (Indicate Location or unit and address.)	14. PURPOSE OF TDY	15. SECURITY CLEARANCE FOR PERIOD OF TDY OR COURSE OF INSTRUCTION	
16. TDY REPORTING DATE	17. APPROXIMATE NO. OF DAYS		
18. LEAVE ADDRESS (b) (6)	19. NEW MAILING ADDRESS (Use upon completion of TDY, if appropriate.) GRADE, NAME, AFSN		
20. DURATION OF COURSE (If reassignment is to attend course of instruction.) WEEKS		21. <input type="checkbox"/> CONCURRENT TRAVEL OF DEPENDENTS IS NOT AUTHORIZED	
22. <input type="checkbox"/> TRAVEL OF DEPENDENTS IS PROHIBITED		23. TRAVEL OF DEPENDENTS TO A DESIGNATED POINT <input type="checkbox"/> IS <input type="checkbox"/> IS NOT AUTHORIZED	
24. <input type="checkbox"/> TRANSPORTATION OF DEPENDENTS AND SHIPMENT OF HHG TO TDY STATION IS NOT AUTHORIZED		25. AUTHORITY FOR CONCURRENT TRAVEL	
26. CONCURRENT TRAVEL OF DEPENDENTS IS AUTHORIZED (List names of dependents and DOB of children.)		27. DISLOCATION ALLOWANCE CATEGORY	
27. TRAVEL TIME WILL BE COMPUTED FOR TRAVEL TIME WITH <u>0022, AFM 39-11</u> DAYS TRAVEL TIME		28. <input type="checkbox"/> POUNDS BAGGAGE, INCLUDING EXCESS IS AUTHORIZED	
29. MODES OF TRANSPORTATION AUTHORIZED FOR OVERSEAS TRAVEL A. <input type="checkbox"/> MILITARY AIRCRAFT B. <input type="checkbox"/> COMMERCIAL AIRCRAFT (Category 2) C. <input type="checkbox"/> MILITARY AND COMMERCIAL VESSEL D. <input type="checkbox"/> COMMERCIAL AIRCRAFT OR VESSEL (Also foreign registry if US registry is not available) RAIL OR BUS WITHIN OVERSEAS AREAS		30. REPORTING TIME AND DATE FOR SCHEDULED DEPARTURE NET NLT	
31. REFERENCE COUNTER <input type="checkbox"/> McGuire AFB <input type="checkbox"/> Travis AFB <input type="checkbox"/> McChord AFB <input type="checkbox"/> Charleston AFB		32. FLIGHT NO. OR NAME OF VESSEL	
33. *A. PRIOR TO TRAVEL COMPLY WITH AFM 35-4. c. In the event of limited war or mobilization and individual is traveling: PCS UNACCOMPANIED-proceed as scheduled. PCS ACCOMPANIED-contact your last commander immediately for instructions before reporting to port. In the event of general war or if the CONUS is attacked report to the nearest active Air Force Installation as soon as possible.		34. WHILE ON LEAVE OVERSEAS COMPLY WITH AFM 35-22, AND CHAPTER 1, AFM 35-10.	
35. REMARKS Orders will be amended to include port Call data at a later date.			
36. AUTHORITY, AFM 39-11 AFM 39-11, PCS Code J Line Nr. J77632		37. DATE 7 Aug 1967	
38. DESIGNATION AND LOCATION OF HEADQUARTERS DEPARTMENT OF THE AIR FORCE HQ 401st TAC FTR WG (USAF) APO NEW YORK 09283		39. SPECIAL ORDER NO. AA-997	
40. DISTRIBUTION "A"		41. PCS EXPENSE CHARGEABLE TO 5783500 328 P577.02 410 440 S503725 (b) (6) 7AUG67	
		42. CUSTOMER IDENTIFICATION CODE 4 5 848 5776 503725	
		43. TDY EXPENSE CHARGEABLE TO	
44. TDM FOR THE COMMANDER (b) (6) (b) (6) Maj, USAF Chief of Admin Services		45. SIGNATURE ELEMENT OF ORDERS AUTHENTICATING OFFICIAL	

ATCH 4

★ U. S. GOVERNMENT PRINTING OFFICE — 1963-714-443

AF FORM
AUG. 63 899

(b) (6)

(b) (6)

148-5-25 (b) (6)

FILE



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

7 Dec 1967

REPLY TO
ATTN OF

SGHW

SUBJECT

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

TO

Sgt (b) (6)

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.
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

(b) (6)

(b) (6)

(b) (6)

Internal Dosimetry Evaluation Form

NAME: (b) (6)		SSN: (b) (6)	
MODE OF INTAKE: <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Injection <input type="checkbox"/> Ingestion <input type="checkbox"/> Absorption <input type="checkbox"/> Unknown <input type="checkbox"/> Not applicable		INTAKE DATE OR PERIOD: 01/18/66 through 02/06/66 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: 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	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Health Physics Survey Data	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Bioassay - Urinalysis	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input type="checkbox"/> Unavailable
Fecal	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Nasal Smears	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
In Vivo	<input type="checkbox"/> Attached	<input type="checkbox"/> In Process	<input checked="" type="checkbox"/> Unavailable
Medical Treatment:			
Skin Decontamination:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Date: _____
Decorporation:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Catharsis:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Agent: _____ Date: _____
Surgical excision:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> 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): 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:		PEER REVIEWER:	
DATE: _____		DATE: _____	
Signature: _____		Signature: _____	
Print Name: _____		Print Name: _____	
SSN: _____		SSN: _____	
RECOMMENDATIONS:			
Additional Bioassay Required <input type="checkbox"/> Urinalysis <input type="checkbox"/> Fecal <input type="checkbox"/> In Vivo			
Suggested Sampling Frequency: _____			
Work Restrictions: N/A			

(b) (6)

(b) (6)

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. 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 µm AMAD particle size on 1/18/66. The date is the first day of the period on station from 1/18/66 to 2/06/66.

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)

(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	✓
67-0433	AS	01/20/67	367	0.0411	0.0206	✓
67-2151	AS	04/19/67	456	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	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 Equivalent			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)

(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:

Based on the results of intake estimates and dose calculations, this individual received an intake of about 99,000 to 160,000 pCi of ^{239}Pu 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.

Prepared By:

Name: _____

Signature: _____

Date: _____

Peer Reviewed By:

Name: _____

Signature: _____

Date: _____

RADIOLOGICAL SAMPLE DATA					
E OR REQUESTOR'S ID (1-20)		GRADE	AFSN	SOCIAL SECURITY NUMBER	RHL SAMPLE NUMBER
(b) (6)		A1c	(b) (6)	(b) (6)	670433
TYPE SAMPLE (23-32)	OCCUPATION (34-35)	ANALYSIS DESIRED	REQUESTED BY	AIR FORCE BASE (68-71)	
Urine		Pu 239	STW	Torrejon AB	
DATE RECEIVED (37-42)	DATE ANALYZED (51-56)	DATE COUNTED	DATE COLLECTED	EXPOSURE DATE	
6 Feb 67		15 Feb 67	20 Jan 67	Feb Mar 66	
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED		(b) (6)	
1350 mL		690 mL			
OTHER DATA					
+ 100 mL ACID					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
236 239					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS:					
Fa/3pl - 41.1 ± 20.6					
Tet Vol - 1.38					
VOLANAL - 0.69					
%Rec = 91.3					
Body Burden -					
15 Feb 67					

AFLC FORM MAY 66 1165

FC 5400

AFLC-WPAFB-JAN 67 5M

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

RADIOLOGICAL SAMPLE DATA					
NAME (b) (6)		GRADE (b) (6)		RML SAMPLE NUMBER (b) (6)	
TYPE SAMPLE (23-32)		OCCUPATION (34-35)		AIR FORCE BASE (66-71)	
DATE RECEIVED (37-42)		DATE ANALYZED (51-56)		DATE COUNTED	
SAMPLE WEIGHT/VOLUME		WEIGHT/VOLUME ANALYZED		EXPOSURE DATE	
OTHER DATA					
ENVIRONMENTAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
BIOLOGICAL SAMPLES					
COUNTER & EFFICIENCY					
TOTAL COUNTS & MINUTES					
GROSS CPM					
BKG CPM & MINUTES					
NET CPM					
YIELD					
SUMMARY OF RESULTS: Pu 239 NDA 870 mc = 83,3					
Total vol = 1.77L.					
Vol anal = 0.88L.					
Date Counted 3 Jan 67					

AFLC FORM 1165

FC 5400

AFLC-WPAFB-JAN 67 5M

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

RADIOLOGICAL SAMPLE DATA							
NAME OR REQUESTOR'S ID (1-20) (b) (6)		GRADE A1C	AFSN (b) (6)	SOCIAL SECURITY NUMBER (b) (6)	RHL 684084	AIR FORCE BASE (88-7) Torrejon P 653	
TYPE SAMPLE (22-32) URINE	OCCUPATION (34-35)	ANALYSIS DESIRED Pu 239		REQUESTED BY SCHW	EXPOSURE DATE		
DATE RECEIVED (37-42)	DATE ANALYZED (51-55)	DATE COUNTED 20 JUL 66	DATE COLLECTED 20 Jul 66	TECHNICIAN (b) (6)			
SAMPLE WEIGHT/VOLUME 1800 mL		WEIGHT/VOLUME ANALYZED 600 mL					
OTHER DATA							
ENVIRONMENTAL SAMPLES							
COUNTER & EFFICIENCY							
TOTAL COUNTS & MINUTES							
GROSS CPM							
BKG CPM & MINUTES							
NET CPM							
YIELD							
BIOLOGICAL SAMPLES							
COUNTER & EFFICIENCY SPEC							
TOTAL COUNTS & MINUTES 100							
GROSS CPM							
BKG CPM & MINUTES 100							
NET CPM							
YIELD							
RADON							
C-51							
55-70							
680-25							
% Rec = 73A							
SUMMARY OF RESULTS: $PC/SPU: 0.19146 \pm 0.11289$ % REC = 66.6							
TOT. Vol. = 1800 ML							
Vol. ANAL. = 600 ML							
BODY BURDEN:							

AFLC FORM 1165

PC 5400

AFLC-WPAFB-MAY 66 4500

(b) (6)

(b) (6)

Return to T/CO
after Bay Lunch

(b) (6)

0433

1. 41.1 ± 20.6

2. 91.3

3. 1.38

4. 310

5. 2046

6. Systemic Body Burden
Bone critical organ 0.03

Palomares Nuclear Weapons Accident

Dose Evaluation Report
April 28, 2000

(b) (6)

(b) (6)

POSTAGE AND FEES PAID
DEPARTMENT OF THE AIR FORCE

DEC 11 1967
RECEIVED
NOV 10 1967

Sgt
438-ABCD
McGuire AFB NJ 08641



Last address 5 Dec 66
Torrey
N.Y. APO 09873
Letter sent 6 Dec 66

USAF RADIOLOGICAL HEALTH LAB (SGHW)
WRIGHT-PATTERSON AFB OHIO 45433

UNITED STATES AIR FORCE
OFFICIAL BUSINESS

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

(b) (6)

(b) (6)

FILE

146-5-24

(b) (6)

2nd Sample
better prepared
4 apr

(b) (6)

4084

191 ± 112

1. 0.191 ± .112

2. 66.6

FILE

3. 1.8

146-5-24

(b) (6)

4. 146

5. 6271

6. 0.08

(b) (6)

(b) (6)

Return to IIC
after key punch

2151

FILE

146-5-24

(b) (6)

1- 0.00

2. 83.3

3. 1.77

4. —

5. 7174

6. Septoria body 2000

April 28, 2000

(b) (6)

(b) (6)

10 Jun 67

FILE 116-576-211 Cpy

PERMANENT CHANGE OF STATION ORDER - MILITARY
(Items preceded by an asterisk for overseas only.) (If more space is required, continue on reverse.)

2. GRADE, LAST NAME, FIRST, MIDDLE INITIAL, AFSC A1C (b) (6)		3. SHIPPING AFSC (Officer)	4. CAISC (Airmen) 70250	5. OVER 4 YEARS SERVICE (A1C Only)
4. UNIT, MAJOR AIR COMMAND AND ADDRESS OF UNIT FROM WHICH RELIEVED 401 Cmbt Spt Gp (USAF) APO New York 09283		7. UNIT MAJOR AIR COMMAND AND ADDRESS OF UNIT TO WHICH ASSIGNED AND DUTY STATION IF APPROPRIATE 438 AB Gp (MAC) McGuire AFB N J 08641		6. PURPOSE OF REASSIGNMENT IF OTHER THAN DUTY SEPARATION
9. REPORT TO COMDR, NEW ASSIGNMENT UNIT	10. (Reassignment from overseas unit to CONUS unit only.) REPORT AT NEW ASSIGNMENT UNIT AFTER DEPARTURE FROM CONUS PORT OF ENTRY UNIT UPON ARRIVAL		11. DALVP NO	12. EDCLA
13. TDY IN ROUTE (Indicate Location or unit and address.)		14. PURPOSE OF TDY		15. SECURITY CLEARANCE FOR PERIOD OF TDY OR COURSE OF INSTRUCTION
16. LEAVE ADDRESS		19. NEW MAILING ADDRESS (Use upon completion of TDY, if appropriate.) GRADE, NAME, AFSC		20. DURATION OF COURSE (If reassignment is to attend course of instruction.) WEEKS
21. <input type="checkbox"/> CONCURRENT TRAVEL OF DEPENDENTS IS NOT AUTHORIZED		22. <input type="checkbox"/> TRAVEL OF DEPENDENTS IS PROHIBITED		23. TRAVEL OF DEPENDENTS TO A DESIGNATED POINT <input type="checkbox"/> IS NOT AUTHORIZED
25. CONCURRENT TRAVEL OF DEPENDENTS IS AUTHORIZED (List names of dependents and DOB of children.)		24. <input type="checkbox"/> TRANSPORTATION OF DEPENDENTS AND SHIPMENT OF HHG TO TDY STATION IS NOT AUTHORIZED		
27. TRAVEL TIME WILL BE COMPUTED PER CHAPTER 26, PART 1, AFM 33-11. TPA WITH _____ DAYS TRAVEL TIME		28. _____ POUNDS BAGGAGE, INCLUDING EXCESS IS AUTHORIZED		29. DISLOCATION ALLOWANCE CATEGORY
30. MODES OF TRANSPORTATION AUTHORIZED FOR OVERSEAS TRAVEL A. <input checked="" type="checkbox"/> MILITARY AIRCRAFT B. <input type="checkbox"/> COMMERCIAL AIRCRAFT (Category Z) C. <input type="checkbox"/> MILITARY AND COMMERCIAL VESSEL D. <input type="checkbox"/> COMMERCIAL AIRCRAFT OR VESSEL (Also foreign registry if US registry is not available) RAIL OR BUS WITHIN OVERSEAS AREAS				
31. REPORT AT MILITARY PASSENGER SERVICE COUNTER FOR REGION AB STALN <input type="checkbox"/> McGUIRE AFB <input type="checkbox"/> TRAVIS AFB <input type="checkbox"/> McCHORD AFB <input type="checkbox"/> CHARLESTON AFB		32. FLIGHT NO. OR NAME OF VESSEL		33. PIER NO. AND ADDRESS
34. A. PRIOR TO TRAVEL COMPLY WITH AFM 75-4. B. WHILE ON LEAVE OVERSEAS COMPLY WITH AFM 33-22, AND CHAPTER 1, AFM 33-10. C. In the event of limited war or mobilization and individual is traveling: PCS UNACCOMPANIED-proceed as scheduled. PCS ACCOMPANIED-contact your last commander immediately for instructions before reporting to port. In the event of general war or if the CONUS is attacked report to the nearest active Air Force installation as soon as possible.		34. REPORTING TIME AND DATE FOR SCHEDULED DEPARTURE NET MLT		
36. REMARKS PCS Code J. No change in organization of assignment. HOR & Future Mailing Address: (b) (6) Place of Enlistment: Charlotte N.C. Orders will be indorsed to include port call data.				
37. AUTHORITY, AFM 39-11 Line Nr GV9999		38. DATE 10 May 1967		39. SPECIAL ORDER NO. AA-466
40. DESIGNATION AND LOCATION OF HEADQUARTERS DEPARTMENT OF THE AIR FORCE HEADQUARTERS 401ST TACTICAL FIGHTER WING (USAF) APO NEW YORK 09283		41. PCS EXPENSE CHARGEABLE TO 2200 5503725 5773500 327 P577.02 2100 5503725 (b) (6) A1C, USAF		
42. DISTRIBUTION "A"		43. CUSTOMER IDENTIFICATION CODE 5 848 5782 503725		
		44. TDY EXPENSE CHARGEABLE TO		
45. TON FOR THE COMMANDER				
46. SIGNATURE ELEMENT OF ORDERS AUTHENTICATING OFFICIAL (b) (6) (b) (6) Capt, USAF Asst Chief of Admin Services				

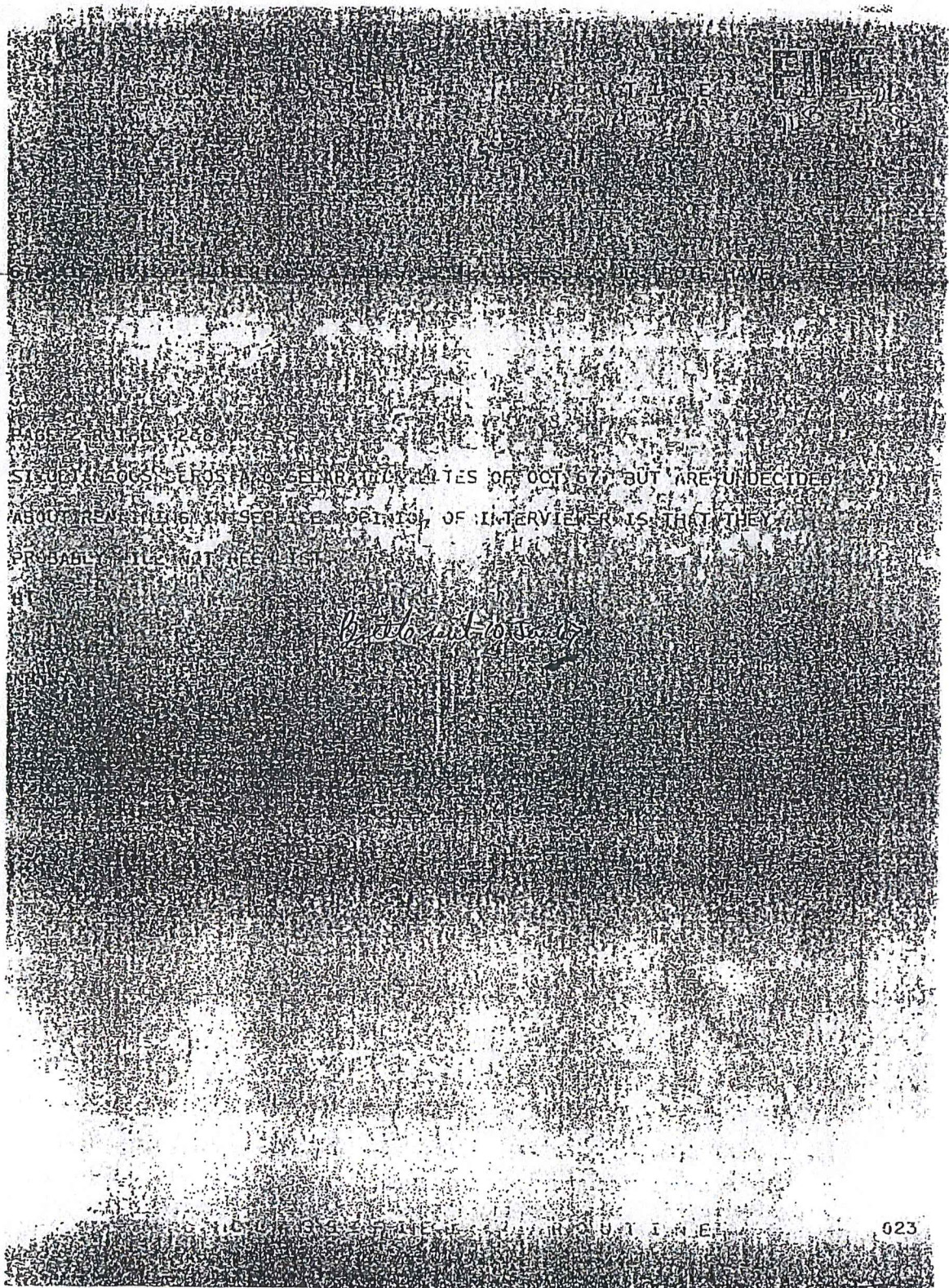
AF FORM 899

U. S. GOVERNMENT PRINTING OFFICE: 1958-000-209

Release of this document is restricted under the provisions of the Privacy Act, 5 U.S.C. 552(a). C.1-402

(b) (6)

(b) (6)



Palomares Nuclear Weapons Accident

Dose Evaluation Report

April 28, 2000

(b) (6)

(b) (6)

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



7 Dec 1967

REPLY TO
ATTN OF

SGHW

SUBJECT

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

TO

Sgt (b) (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.

(b) (6)

(b) (6)

LtCol, USAF, MC

Chief

