



BROOKHAVEN NATIONAL LABORATORY

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401367

MEDICAL DEPARTMENT

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September 2, 1976

Dr. W. W. Burr, Jr.
Deputy Director
Division of Biomedical &
Environmental Research
U.S. Energy Research and
Development Administration
Washington, D.C. 20545

Dear Bill,

With regard to the plutonium problem on Bikini we would like to bring you up to date on (1) sample collections planned for Sept.-Oct. survey in the Marshalls; (2) samples still being analyzed from previous surveys, and (3) summary Tables of previous data comparing Rongelap and Utirik findings.

Samples for Sept.-Oct. 1976: Urines 1. Bikini: 5 gal. carboys on 5 individuals (carboys distributed last June); also 5 - 5 gal. pooled samples; 2. Rongelap: 5 - 5 gal pooled samples; 3. Utirik: 5 - 5 gal. pooled samples; 4. Wotje: 5 - 5 gal. pooled samples; 5. Ebeye: 5 - 5 gal. pooled samples; 6. Majuro: 5 - 5 gal. pooled samples and samples on 50 Bikini people planning to return in the near future. You will note we are collecting samples from a number of atolls not directly involved in the 1954 fallout.

Whole body gamma spectroscopy on Bikini people (for ¹³⁷Cs body burdens) originally planned for October are being delayed until April in hope that the advance group of Eniwetok people will have returned to their atoll and can also be counted during that operation.

N. Greenhouse, J. Naidu and V. Nelson plan on collecting soil and plant samples in Sept.-Oct. from Wotje, Ailuk, Utirik, Rongelap and Bikini.

Samples presently being analyzed are animal samples (pig, chickens, crabs from Rongelap and Bikini, water from Bikini cisterns, soil from Rongelap. Autoradiographs for alpha tracks of animal lung and liver tissues are being run.

The enclosed Tables have been compiled by N. Greenhouse, J. Naidu and me and include data from various sources. Many of the Tables are incomplete. We are attempting to pull together in one file all available data from personnel and environmental radiological surveys on Rongelap, Utirik and Bikini atolls. When this is accomplished we should be able to make more comprehensive comparative Tables on these atolls. We hope these data will be on hand for your planned meeting of the experts.

Sincerely,

Bob

Robert A. Conard, M.D.

RAC:gc

Enc.

CC: J. Deal
T. McCraw
R. Ray
N. Greenhouse
J. Naidu

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RADIOCHEMICAL ANALYSES OF URINE (DATA IN AVERAGE pCi/liter)^{*}

Year	No. in group	Av. vol. ml	⁹⁰ Sr	¹³⁷ Cs	²³⁹⁻²⁴⁰ Pu
<u>Rongelap</u>					
1970	20	895	3.5	2700	
1971	15	534	3.7	2400	
1972	18	460	2.4	2600	
1973	11	249	6.5	4600	
1974	14	557	2.8	4500	
1975 (Mar)	14	753	4.6	2100	
1976 (Mar)	17**	679	4.6	2100	0.009 ± .002
	1	1250			0.014 ± .007
<u>Utirik</u>					
1974	11	542	1.3	1300	
<u>Bikini</u>					
1970	Pooled		1.2	1150	
	Urine G	1100	2.2		
	Urine M	930	1.9		
	HASL control	3000	1.0	120	
	HASL control	1000	1.6		
1971	Pooled	2670	1.7	1830	
1972	Pooled	2700	4.2	0910	
1973	13	304	6.7	1300	
1974	8	165	2.3	1300	
	10	649			
1975 (Mar)	8	360	7.3	1800	
(Oct)	18	510	3.1	1300	
	Pooled	9319			0.01 ± .002
1976 (Mar)	24**	480	4.7 ± 4.6	1600 ± 800	0.009 ± .002
N.Y. City (1976)	Pooled	20,000			0.0009 ± .0004
	1	500	0.9	8.0	
	1	500	0.8	10.0	

*Analytical error terms associated with ⁹⁰Sr and ¹³⁷Cs analyses were usually less than 10 percent.

** Pooled for Pu analysis.

INDIVIDUAL RADIOTOLOGICAL MONITORING DATA - TENTANT

No.	Age	Sex	Urine Levels - aml/l;		137Cs Body Burden - 1974, nCi		1975 (Mar.)		1975 (Oct.)		1976 (Mar.)		1976 (Oct.)			
			90Sr pCi	137Cs nCi	Yrs. Bik.	90Sr pCi	137Cs nCi	Yrs. Bik.	90Sr pCi	137Cs nCi	Yrs. Bik.	90Sr pCi	137Cs nCi	Yrs. Bik.		
B1	46	F			<0.1	0.5	58	1.5								
B2	20	F			5.5	2.6	?		72		2.2	2.0	1			
B3																
B4	62	M	18.9	1.3					78	2	4.5	2.1	3	4.8	2.9	4
E																
B6			2.0	0.4												
B7	24	M					95	1								
B8	31	F					108	3								
B9	16	F														
B10	26	M							4.7	1.9	1.5					
B11	32	M			3.2	1.7	156	6			8.2	2.9	1			
B12	51	M					290	0.5	12.0	2.1	1.5	2.9	0.9	2		
B13	32	M	2.2	0.6	1			81	2			2.1	0.8	3.5		
B14	24	M			<0.2	1.5			2			5.7	2.1	3		
B15	57	M					51	2				2.3	0.3	4		
I	25	F														
B17	56	F							4.8	2.5	1					
B18	47	F					116	2								
B19		M														
B20	25	F			2.4	0.8	73	3								
B21			5.7	1.1			103	4								
B22	32	M														
B23	24	M														
B24	41	M	7.8	2.0	1				122	2	18.0	3.0	3			
B25	44	M									2.4	0.4	2.5	1.9	2.0	3
											6.8		4			

INDIVIDUAL, RADILOGICAL MONITORING DATA - BIKINI
(Urine Levels - amt/l; 137 Cs Body Burdens - 1974)

INDIVIDUAL RADIOLOGICAL MONITORING DATA - BIKINI

No.	Age	Sex	1973		1974		1975 (Mar.)		1975 (Oct.)		1976 (Mar.)		1976 (Oct.)		
			⁹⁰ Sr pCi	¹³⁷ Cs nCi	Yrs. Bik.										
B51	33	M			3.0	0.6	222	2			6.8	2.8	4		
B52	19	M					77	1							
B53	46	M			156	1	0.5	0.5	2		2.3	1.4	3		
B54	51	M					72	5							
B55	56	M									2.8	1.1	3		
B56	54	F									5.1	3.2	6		
B57	24	M									3.0	1.0	3		
B58	22	F									7.6	0.9	4		
B59	20	M									4.3	1.9	3		
B60	24	M									1.5	1.6	2		
B61	30	M									5.5	1.1	3		

*⁹⁰Sr Gamma Spectrographic analyses - body burdens.

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Mean Cesium-137 Levels Obtained by Whole Body Counting - 1974

	Male			Female		
	No.	nCi	nCi/kg body wt.*	No.	nCi	nCi/kg body wt.*
Bikini	8	128	1.84 (0.43-5.11)	13	73	1.15 (0.22-3.26)
Utirik	9	262	4.05 (2.64-6.84)	13	133	2.13 (0.96-3.85)
Rongelap	22	475	7.76 (4.37-16.3)	24	304	5.13 (2.71-13.46)
BNL med. team	4		2.93 0.0352(0.0134-.0791)			

* MPC 43 nCi/kg

Estimated Dose to Bone Marrow (mrem/yr)*

SOURCE	USA				
	BIKINI	ENUE	RONGELAP	UTIRIK	DENVER
Natural	80	80	80	80	325
Medical					
Dental	0	0	10	10	70
Contamination					
Gamma	165	7	20	7	
Internal	21	21	68	31	
TOTAL	266	108	178	128	395
					260

* Dose on Marshall Islands based on personnel and environmental data.

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ANIMAL DATA
COCONUT CRABS

Island	Year	Part			
			⁹⁰ Sr	¹³⁷ Cs	²³⁹⁻²⁴⁰ Pu
			nCi/kg	nCi/kg	pCi/kg
Rongelap	1964	edible	4.0 - 9.0		
"	1969	whole	53.0	8.5	
"		"	34.0	7.0	
"	1972	"	56.0	13.0	
		"	28.6	5.0	
		"	39.0	6.1	
		"	31.0	6.8	
		"	23.0	5.1	
	1974	"	18.0	5.0	
		"	40.0	8.2	
		"	18.0	4.8	
	1975	{ edible	0.4	2.7	1.9
" Arbur Is.		skeleton	26.4	1.4	8.3
" Kabelle		{ edible	2.4	21.3	8.2
Island		skeleton	0.1	8.8	14.8
"		{ edible	0.8	14.6	5.1
		skeleton	24.1	5.0	2.2
Bikini		whole	23.3	11.8	1.5
	1970	"	24.8	14.8	0.07
	1971	"	132.0	11.4	
		"	412.0	8.6	
	1973	"	45.7	9.3	
	1974	muscle	16.0	380.0	18.0
		hepatopancreas	36.0	93.0	25.0
		skeleton	160.0	70.0	21.0
Enue	"			0.3	

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ANIMAL DATA (1974)

OTHER THAN CRABS

Atoll	Sample	^{90}Sr pCi/kg*	^{137}Cs * nCi/kg*	$^{239-240}\text{Pu}$ pCi/kg*
Pig				
Rongelap (Kabelle)	meat	10	11.0	
	organs	5	3.4	2.2
	bones	11,000	6.0	7.0
" Rongelap Island	Pig			
	meat	1.5	2.0	
	bones	1,600	0.9	0.4
" " chicken	meat	4	0.7	
	bones	480	0.6	0.8
	" meat	36	1.1	
	bones	3,500	0.6	0.6
Bikini Island	chicken	8	0.7	
	{ meat			
	{ bones	750	0.8	0.9
Rongelap Island	Rat 1	350	3.6	
	" 2	280	4.2	
	" 3	540	4.3	
Bikini Is.	Rat 1	6,000	8.1	6.7
	Fish	60		4.0
	(dry wt.)	240		20.0
		180		45.0
	" surgeon muscle			<.001 dpm/g

* Wet weight except dry wt. for fish.

TABLE 4

 RADIOCHEMICAL ANALYSES OF WELL WATER (pCi/liter) AND SLUDGE FROM WATER
 CISTERNS (pCi/g. dried sludge) FROM BIKINI

Year	Sample	Vol.,ml	^{90}Sr *	^{137}Cs **	^3H	$^{239-240}\text{Pu}$ ***
1971	"good well"	1830	6.0 \pm 17%	600	\pm 1% 770 \pm 40%	0.04 \pm 25%
	"bad well"	1830	25 \pm 3%	850	\pm 1% 1040 \pm 30%	0.05 \pm 20%
	"good well" (closed)	1810	103 \pm 2%	1044	\pm 1%	0.058 \pm 15%
	"good well" (opened)	1980	125 \pm 3%	818	\pm 1%	5.76 \pm 6%
	drinking water (camp area)	3580	0.46 \pm 4%	1.53 \pm 8%		0.004 \pm 100%
1972	well water	1000	15.4 \pm 9%	800	\pm 1%	
	drinking water	1960	0.61 \pm 6%	1.8 \pm 8%		
1973	new well	60	52	600		0.38 \pm 40%
	B-1 well	225	11	724		0.08 \pm 50%
1975	Sludge from water cisterns (6 samples)					2.91-4.02 \bar{x} 3.06

* MPC 4×10^3 pCi/l** MPC 2×10^5 pCi/l*** MPC 3×10^5 pCi/l

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PLANTS

Year	Atoll/Island	Tissue	⁹⁰ Sr Range	137 Cs Avg.	137 Cs Range	239 Pu Avg.	239 Pu Range	241 Am Avg.	241 Am Range	Avg.
1. Bread Fruit (pCi/g dry)										
74										
75	Bikini	leaves	251 - 446	332	29 - 95	53	.043-.148	.10		
74	Rongelap	leaves	23		27					
75	Wotho	leaves	.21		.35					
		fruit	<.08		1.7					
75	Bigej			- no data -						
2. Pandanus (pCi/g dry)										
74										
75	Bikini	leaves	41 - 402	170	37 - 1035	508	.031-.20	.087		
		fruit	34 - 255	138	3524 - 3665	3591	.001-.01	.005		
74	Rongelap	leaves	11		13					
		fruit		- no data -						
75	Wotho	leaves		- no data -						
75	Bigej	leaves	<.10		.92					
		fruit	.15		.55 - 1		.78			
3. Coconut (pCi/g dry)										
74										
75	Bikini	leaves	5.2 - 35	15.7	58 - 649	154	.018-.96	.205		
74	Rongelap	leaves	2.1		4.2					
75	Bigej	meat	<.15		1.2-2.3		1.75			
75	Wotho	leaves	.10		.70					
4. Messerschmidia (pCi/g dry)										
74	Bikini	leaves	235		305					
75		leaves	15 - 384	102			.07 -.985	.478		
74	Rongelap	leaves		- no data -						
75	Bigej	leaves	.16		2.3					
75	Wotho	leaves		- no data -						

Year	Atoll/Island	Tissue	<u>PLANTS</u>						
			⁹⁰ Sr Range	¹³⁷ Cs Avg.	¹³⁷ Cs Range	Avg.	²³⁹ Pu Range	Avg.	²⁴¹ Am Range
5. Scaveola (pCi/g dry)									
74	Bikini	leaves	33		110				
75		leaves	31 - 169	92			.07-.931	.252	
74	Rongelap	leaves	3.0		27				
75	Bigej	leaves	<.17		.95				
75	Wotho	leaves		- no data -					
6. Papaya (pCi/g dry)									
74	Bikini	fruit	81		1050		<.002		
75		fruit	74 - 79	76			.001-.009	.005	
75	Wotho	fruit	<.15		0.32				
		rind	<.14		15				
		seeds	<.14		12				
7. Squash (pCi/g dry)									
74	Bikini/	fruit	10		794				
	Bikini	fruit	5				.003		
8. Banana (pCi/g dry)									
74	Bikini	fruit	7.9		16				
75		fruit	9.33				.002		
		skin	90				.18		
9. Arrowroot (pCi/g dry)									
75	Bikini	tubers					.239		

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SOIL, AIR AND HOUSE DUST

Atoll/Island	Year	<u>SOIL</u>							
		⁹⁰ Sr Range	pCi/g. dry Average	¹³⁷ Cs Range	pCi/g. dry Average	²³⁹ Pu Range	pCi/g. dry Average	²⁴¹ Am Range	pCi/g. dry Average
Bikini/Bikini	1970	-	-	27 - 955	199	7 - 140	43	5 - 45	17.5
	1972	-	-	-	-	2.5 - 132	21	.85 - 8.7	3.8
	1974	5.8 - 370	130.6	-	-	.44 - 9.3	3.	-	-
	1975	18 - 432	127	14.9 - 250	24.5	.55 - 73	23	.24 - 17	6.5
		14 - 578	202	-	-	-	-	-	-
Kwajalein/Bigej	1975	.4	-	-	-	-	-	-	-
Wotho/Wotho	1974	.3	-	-	-	-	-	-	-
	1975	-	-	1.1	-	-	-	.08	-

*MPC for Pu established by Eniwetok Task Group is 40 pCi/g.

AIR SAMPLES
(pCi/M³)

Bikini/Bikini	1972	0.06 x 10 ⁻⁴	0.12 x 10 ^{-4*}
		to 0.2 x 10 ⁻⁴	

*MPC is 6 x 10⁻³ pCi/M³ (ICRP, Pub. 2, 1959).

HOUSE DUST
(pCi/g)

Bikini/Bikini	1975	1.97 - 3.3	2.2
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BODY BURDENS - STRONTIUM-90
 (BASED ON RADIOCHEMICAL URINE ANALYSES)

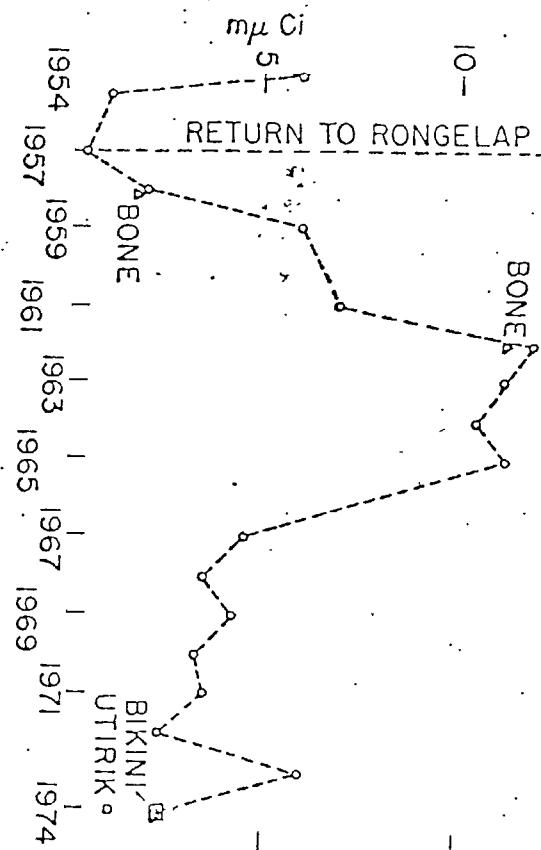


Fig. 1

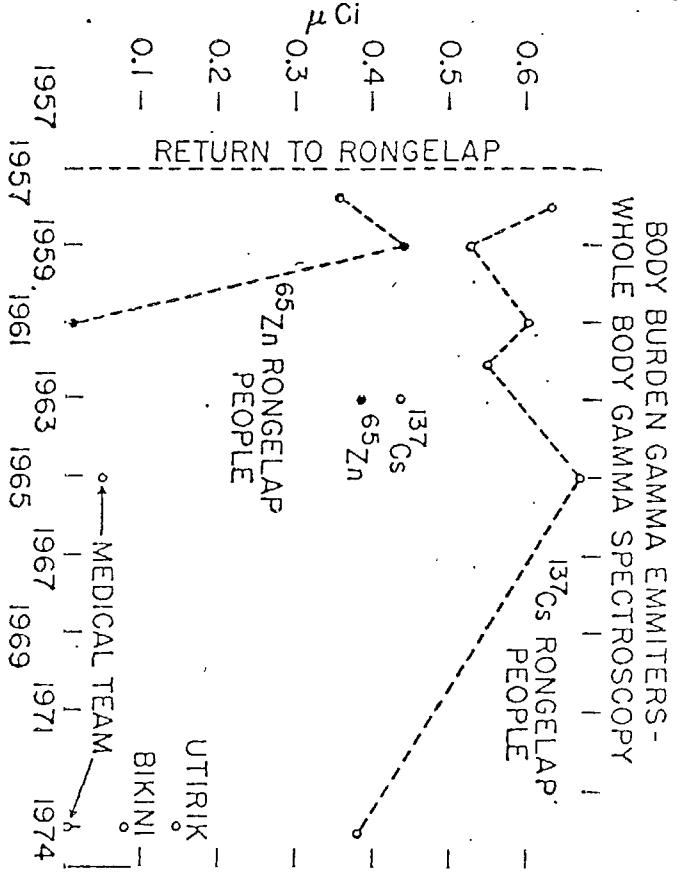


Fig. 2