400188 File Rongelap

HSA:EPH

April 17, 1956

Dr. Willis R. Boss, Assistant Chief
Biology Branch
Division of Biology and Medicine
U. S. Atomic Energy Commission
1901 Constitution Avenue, N. W.
Washington 25, D. C.

Dear Dr. Boss:

We are sending for your information, a copy of our Laboratory Report 56-4 entitled "Rongelap Survey, October 1955 - Results of Analyses Performed at HASL". It is a summary of our analyses of samples received from the University of Washington, Applied Fisheries Laboratory.

Sincerely yours,

Edward P. Hardy, Jr., Chemist
Analytical Branch
Health and Safety Laboratory

CC: Dr. C. M. Dunning ✓
Dr. L. R. Donaldson

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During November 1955, HASL received 12 soil, 12 seawater, 8 vegetation, 1 plankton, 2 algae, 6 fish, and 15 coconut samples collected by A. Seymour of the Applied Fisheries Laboratory, University of Washington. This particular set of samples was collected during October 21-23, 1955 on Rongelap, Kabelle, and Labaredj Islands of Rongelap Atoll and Mogiri Island of Alinginae Atoll.

Each sample was analyzed at HASL for total activity and Sr-90. Selected samples were analyzed for normal calcium by the oxalate-permanganate titration method, for reporting values in Sunshine Units. Values are reported as of February 27, 1956 and are presented in three sections:

1. A summary of HASL results including a comparison with data obtained from University of Washington Report No. UWFL-43.

2. A complete tabulation of HASL data with pertinent information given for each sample.

3. Notes covering sources of information, analytical procedures, and standardization and counting techniques used at HASL in processing these samples.

1. SUMMARY OF HASL DATA AND COMPARISON WITH AFL

SOIL

Area Collected	Depth	Total Activity d/m/g - wet HASL	Total Activity d/m/g - wet AFL	Sr-90 d/m/g - wet HASL	Sr-90 d/m/g - wet AFL
Kabelle	0-3"	6600-15000	16000-23000	200-510	N. R.
	3-6"	300- 620	420- 760	5- 23	N. R.
Labaredj	0-3"	5500- 7500	9600-25000	190-260	N. R.
	3-6"	360- 620	230- 550	5- 7	N. R.
Rongelap	0-3"	3000- 5700	3700-45000	190-210	N. R.
	3-6"	410- 1000	800- 1500	12- 32	N. R.

Total Activity

top 0-3", 6-25 times higher that 3-6" layer (HASL)

Sr-90

top 0-3", 7-50 times higher than 3-6" layer (HASL)

Average % Sr-90 in top soil - 3.9 (HASL)

Average % Sr-90 in bottom soil - 2.3 (HASL)

% Total Activity in top 3"

	HASL	AFL
Kabelle	96	97
Labaredj	96	97
Rongelap	88	89

NOTE: Average Sr-90 found in continental United States soil top 0-2", 0.2 d/m/g (HASL)

SEAWATER

Area Collected	Total Activity d/m/liter HASL	Total Activity d/m/liter AFL	Sr-90 d/m/liter HASL	Sr-90 d/m/liter AFL
Kabelle	650	300-500	undet.	N. R.
Labaredj	300	300-500	undet.	N. R.
Rongelap	undet.	undet.	undet.	N. R.
Mogiri	undet.	undet.	undet.	N. R.

ALGAE

Rongelap Island

Location	Total Activity d/m/g - wet HASL	Total Activity d/m/g - wet AFL	Sr-90 d/m/g - wet HASL	Sr-90 d/m/g - wet AFL
Cistern	9410	8860-23600	undet.	N. R.
Well	680	570- 1880	~5	N. R.

PLANKTON

Kabelle-Rongelap

Total Activity d/m/g - wet HASL	Total Activity d/m/g - wet AFL	Sr-90 d/m/g - wet HASL	Sr-90 d/m/g - wet AFL
44	99-418	undet.	N. R.

VEGETATION

Rongelap

		Total Activity d/m/g - wet		Sr-90 d/m/g - wet	
		HASL	AFL	HASL	AFL
Papaya	pulp	58	17-137	0.4	N. R.
	pulp and skin	100		1.0	N. R.
	skin	>20		0.8	N. R.
	seeds	64	37-503	>0.3	N. R.
Morinda	entire	34	14- 73	1.0	N. R.
Arrowroot	corm	102	78-193	3.0	N. R.
Squash	flowers and leaves	25	20-120	5.0	N. R.
Pandanus	entire	84	76-189	2.0	N. R.
Coconut	outer husk	80	N. R.	1.0	N. R.
	inner shell	20	N. R.	0.2	N. R.
	meat	40	23- 83	0.2	N. R.
	milk		20-115		N. R.

% Sr-90

HASL ½ - 4% of total activity
AFL 2 - 5% of total activity
} except coconuts

COCONUTS - (HASL)

Island	Total Activity d/m/g - wet Outer husk	Inner shell	Meat and milk	Sr-90 d/m/g - wet Outer husk	Inner shell	Meat and milk
Kabelle	80	20	50	0.4	0.1	0.1
Rongelap	80	20	40	1.0	0.2	0.2
Labaredj	200	30	80	2.0	0.4	0.4

% Sr-90

Outer husk	~1%
Inner shell	~1%
Meat and milk	~0.1%

AFL - reports 0.1% in meat and milk

COMMERCIAL COCONUTS

Total Activity

Inner shell	2
Meat and milk	5

FISH

			Total Activity d/m/g - wet HASL	AFL	Sr-90 d/m/g - wet HASL	AFL
Kabelle	Tuna					
		bone	31	N. R.	~0.2	N. R.
		muscle	24	40	undet.	N. R.
		liver	186	1070	undet.	N. R.
Labaredj	Bonito					
		muscle	56	102	undet.	N. R.
		bone	227	N. R.	undet.	N. R.
Rongelap	Goatfish					
		muscle	21	18-37	undet.	N. R.

AFL - Sr-90 undetectable in marine organisms

2. COMPLETE HASL DATA

SOIL

HASL No.	Spec. No.	Collection Date	Area Collected	Description	Depth	Beckman MX-5 Reading Surface	3" below	6" below	Total Activity d/m/gram Wet	Dry	Sr-90 d/m/gram Wet	Dry	% Ca Based on Wet Weight	I. U.
3182	A 1	10-21-55	Kabelle Island	Open area - 200 yards from lagoon near mid - island	0 - 3"	3.5/12		0.2 /0.9	15000±225	16300±244	506 ±4.7	548 ±5.1	27	852 ±7.7
3183	A 2	10-21-55	Kabelle Island	Open area - 200 yards from lagoon near mid - island	3 - 6"	3.5/12		0.2 /0.9	617± 90	658± 96	22.7±2.6	24.2±2.8		
3184	A 3	10-21-55	Kabelle Island	Grass area - 20 feet from A 1 and A 2	0 - 3"	2/8		0.2 /0.5	6620±152	7950±182	200 ±3.3	240 ±4.0	29	314 ±5.0
3185	A 4	10-21-55	Kabelle Island	Grass area - 20 feet from A 1 and A 2	3 - 6"	2/8		0.2 /0.5	302±104	329±113	4.7±0.67	5.1±0.73		
3186	A 5	10-21-55	Labaredj Island	Open area - 100 yards from lagoon (high tide mark in SW part of island)	0 - 3"	2/8		0.08/0.5	5470±147	5990±161	188 ±3.4	206 ±3.7		
3187	A 6	10-21-55	Labaredj Island	Open area - 100 yards from lagoon (high tide mark in SW part of island)	3 - 6"	2/8		0.08/0.5	623± 88	678± 97	6.7±0.99	7.3±1.1	32	9.5±1.4
3188	A 7	10-21-55	Labaredj Island	Under a tree 15 feet from A 5 and A 6	0 - 3"	0.6/7.0	0.3/1.0	0.07/0.5	7480±129	9490±164	263 ±4.5	334 ±5.7	26	460 ±7.7
3189	A 8	10-21-55	Labaredj Island	Under a tree 15 feet from A 5 and A 6	3 - 6"	0.6/7.0	0.3/1.0	0.07/0.5	356± 70	395± 78	4.9±0.47	5.4±0.52		
3190	A 9	10-21-55	Rongelap Island	Grass near well (10 feet W of well)	0 - 3"	0.3/0.9	0.05/0.3	0.05/0.2	3000± 74	4230±104	187 ±2.6	264 ±3.7	30	233 ±3.9
3191	A 10	10-22-55	Rongelap Island	Grass near well (10 feet W of well)	3 - 6"	0.3/0.9	0.05/0.3	0.05/0.2	406± 54	543± 72	11.8±0.68	15.8±0.91	31	17.3±1.1
3192	A 11	10-22-55	Rongelap Island	Papaya cluster (near school house) rocky soil	0 - 3"	0.3/1.0	0.1/0.5	0.1 /0.4	5700± 69	12300±149	212 ±3.3	457 ±7.1	24	401 ±4.3
3193	A 12	10-22-55	Rongelap Island	Papaya cluster (near school house) rocky soil	3 - 6"	0.3/1.0	0.1/0.5	0.1 /0.4	1040± 75	1410±101	32.3±1.0	43.6±1.4	29	50.4±1.5

SEAWATER

HASL No.	Spec. No.	Area Collected	Collection date	Total Activity d/m/l	Sr-90 d/m/l
3194 A	A-1	Kabelle Is.	10-21-55	290 ± 65	(-0.75) ± 10.6
B	A-1	Kabelle Is.	10-21-55	750 ± 70	6.55 ± 12.2
C	A-1	Kabelle Is.	10-21-55	850 ± 72	14.6 ± 12.6
3195 A	A-2	Labaredj Is.	10-21-55	450 ± 66	(-3.98) ± 11.9
B	A-2	Labaredj Is.	10-21-55	300 ± 66	(-2.90) ± 10.7
C	A-2	Labaredj Is.	10-21-55	190 ± 65	(-1.45) ± 12.0
3196 A	A-3	Rongelap Is.	10-22-55	56 ± 61	(-1.25) ± 12.1
B	A-3	Rongelap Is.	10-22-55	36 ± 64	5.48 ± 9.58
C	A-3	Rongelap Is.	10-22-55	66 ± 64	(-2.25) ± 10.7
3197 A	A-4	Mogiri Is.	10-23-55	56 ± 65	(-0.20) ± 11.6
B	A-4	Mogiri Is.	10-23-55	(-25) ± 66	25.1 ± 12.4
C	A-4	Mogiri Is.	10-23-55	60 ± 66	12.7 ± 11.1

VEGETATION

HASL No.	Specimen No.	Organism	Tissue	Area Collected	Collection Date	Remarks	Total Activity d/m/gram Wet	Total Activity d/m/gram Dry	Sr-90 d/m/gram Wet	Sr-90 d/m/gram Dry	% Ca Based on Wet Weight	S. U.
3175	A 35-39	Papaya	pulp	Rongelap Island	10-22-55	5 fruits - village area, skin and seeds removed: dried at 95°C	58.2±0.6	415± 4.3	0.43±0.02	3.07±0.14	0.022	838 ± 41
3172	A 40-42	Papaya	pulp and seed	Rongelap Island	10-22-55	Halves from 3 fruits, village area: seeds removed: dried at 95°C	105 ±1.0	740± 7.0	1.23±0.06	8.64±0.39	0.037	1511 ± 74
3170	A 35-39	Papaya	skin	Rongelap Island	10-22-55	Peeled from 5 fruits, village area: dried at 95°C	21.0±0.5	146± 1.5	0.86±0.07	5.96±0.48	0.070	559 ± 45
3173	A 35-42	Papaya	seeds	Rongelap Island	10-22-55	8 fruits, village area: dried at 95°C	63.9±1.0	345± 5.4	0.32±0.04	1.75±0.25	0.169	85.9± 11
3177	A 62-64	Morinda	entire	Rongelap Island	10-22-55	3 fruits, village area: dried at 95°C	33.8±1.9	278± 7.5	1.12±0.08	9.22±0.67	0.065	783 ± 56
3171	A 67-71	Arrowroot	corm	Rongelap Island	10-22-55	Peeled tubers, skin removed, village area: ashed at 550°C	102 ±1.1		3.61±0.32		0.030	5469 ±485
3168	A 143	Squash	leaves and flowers	Rongelap Island	10-22-55	Village area, plant in blossom but no fruit: dried at 95°C	24 ±1.0	307±13	5.72±0.43	71.5 ±4.27		
3213 - 3217	A 45-49	Pandanus	entire	Rongelap Island	10-22-55	Part of 5 fruits from 5 trees, village area	84.4±0.6		2.57±0.07		0.136	859 ± 33

ALGAE

3164	A 109			Rongelap Island	10-22-55	From cistern in village, species undefined: dried at 95°C	9411±60	48440±425	9.73±9.35	70.0±67.3		
3166	A 110			Rongelap Island	10-22-55	From well in village (taken from sides below water level) species undefined: dried at 95°C	683±13	2140± 72	6.90±2.14	37.7±11.7		

COCONUTS

HASL No.	Specimen No.	Area Collected	Collection Date	Remarks	d/m/gram - wet Total Activity Outer Husk	Inner Shell	Meat and Milk	d/m/gram - wet Sr-90 Outer Husk	Inner Shell	Meat and Milk	% Ca Based on Wet Weight Outer Husk	Inner Shell	Meat and Milk
3198	A 30	Kabelle Is.	10-21-55	ONE COCONUT FROM EACH OF FIVE (5) TREES - - - - VARIOUS AREAS OF THE ISLAND	84.0± 3.3	15.8±0.7	54.5±2.3	1.2 ±0.34	0.60±0.19	0.06±0.33			
3199	A 31	Kabelle Is.	10-21-55		56.6± 2.7	39.5±1.6	60.3±2.6	0.11±0.31	0.07±0.04	(-0.24)±0.18			
3200	A 32	Kabelle Is.	10-21-55		66.3± 2.9	12.7±1.1	37.1±1.6	0.09±0.06	(-0.05)±0.08	0.03±0.14	0.038	0.058	0.013
3201	A 33	Kabelle Is.	10-21-55		69.6± 3.1	20.4± .95	45.5±1.9	0.12±0.05	0.03±0.06	(-0.07)±0.14			
3202	A 34	Kabelle Is.	10-21-55		127 ± 5.5	32.0±1.5	55.2±2.4	0.66±0.25	0.14±0.08	0.28±0.23			
3203	A 35	Labaredj Is.	10-21-55	NORTHERN END OF ISLAND	141 ± 6.0	20.9±0.9	59.2±2.5	1.3 ±0.14	0.28±0.11	(0.35)±0.32			
3204	A 36	Labaredj Is.	10-21-55		318 ±13	26.1±1.1	177 ±7.1	4.8 ±0.30	0.89±0.16	0.10±0.34			
3205	A 37	Labaredj Is.	10-21-55		182 ± 7.6	31.1±1.3	61.3±2.6	1.3 ±0.16	0.17±0.07	0.10±0.18	0.062	0.019	0.011
3206	A 38	Labaredj Is.	10-21-55		220 ± 9.2	41.2±1.7	63.1±2.7	1.0 ±0.29	0.19±0.12	0.56±0.22			
3207	A 39	Labaredj Is.	10-21-55		143 ± 6.2	23.4±1.1	54.0±2.3	1.5 ±0.14	0.33±0.11	0.32±0.30			
3208	A 40	Rongelap Is.	10-22-55	VILLAGE AREA	254 ±11	46.3±1.9	81.2±3.3	3.5 ±0.24	0.51±0.13	0.22±0.20			
3209	A 41	Rongelap Is.	10-22-55		49.4± 2.2	4.0±0.2	55.2±2.2	0.39±0.10	0.09±0.07	(0.07)±0.10			
3210	A 42	Rongelap Is.	10-22-55		87.4± 3.9	34.6±1.4	24.0±1.0	(0.19)±0.20	0.21±0.09	0.44±0.21	0.053	0.078	0.007
3211	A 43	Rongelap Is.	10-22-55		73.2± 3.3	9.5±0.5	33.3±1.5	0.70±0.21	0.31±0.13	0.57±0.42			
3212	A 44	Rongelap Is.	10-22-55		84.3± 3.5	5.3±0.3	20.3±1.0	0.75±0.17	0.07±0.10	0.09±0.23			

COMMERCIAL COCONUTS

3311		Puerto Rico	February 1956		1.2±0.2	5.1±1.0							
3312		Puerto Rico	February 1956		8.0±0.2	5.3±1.0							
3313		Puerto Rico	February 1956		1.9±0.2	5.8±1.0							

FISH

HASL No.	Specimen No.	Organism	Tissue	Area Collected	Collection Date	Remarks	d/m/gram Total Activity Wet	d/m/gram Total Activity Dry	d/m/gram Sr-90 Wet	d/m/gram Sr-90 Dry	% Ca Based On Wet Weight
3176	A 165	Dog-tooth Tuna	bone	Kabelle-Labaredj	10-21-55	Caught half-way between Kabelle and Labaredj Islands in Rongelap Lagoon. Total weight: 44 lbs. Bone includes some connective tissue. Not possible to remove all tissue.	31 ±35	86 ±95	0.17 ±0.07	0.48 ±0.20	11.3
3179	A 165	Dog-tooth Tuna	muscle	Kabelle-Labaredj	10-21-55	Dried at 95°C - shared with U of W: NYOO samples pladed into 5 bags.	24.4± 1.0	111 ± 4.5	(0.01)±0.04	(-0.05)±0.18	0.0017
3167	A 165	Dog-tooth Tuna	liver	Kabelle-Labaredj	10-21-55	Dried at 95°C - shared with U of W.	186 ± 2.5	1483 ±20	0.104±0.41	0.83 ±3.3	0.0048
3174	A 64	Bonito	muscle	Labaredj Island	10-21-55	1 fish dried at 95°C.	56.3± 1.0	269 ± 4.8	0.019±0.11	0.089±0.53	0.043
3165	A 64	Bonito	bone	Labaredj Island	10-21-55	Backbone boiled to remove meat. Wet weight given is that after boiling.	227 ±78	269 ±87	(0.28)±0.90	(0.33)±1.06	18.0
3169	A 112-116	Goatfish	muscle	Rongelap Island	10-22-55	Part sample of 5 fish: dried at 95°C.	21.1± 1.8	89.6± 7.7	0.082±0.12	0.35 ±0.51	

PLANKTON

3178	A 2 - 5			Kabelle-Rongelap	10-21,22-55	A 2-5 pooled after removing samples for U. of W. - AFL - Sample A 2 and A 3 off Kabelle Island, 10-21-55: and A 4 and A 5 off Rongelap Island, 10-24-55. ~ 20 gms wet weight in pooled sample, of which ~ 80% is from samples A 4 and A 5.	43.1± 1.0	663 ±17	0.19 ±0.89	2.97 ±13.7	

3. NOTES

SOIL

1. Spec. No., Collection date, Area collected, Description, Depth, Backman readings - information supplied by A. Seymour.

2. Beckman readings in mr/hr taken 1" above ground - shield closed/shield open. Background - 0.05 mr/hr.

3. "Wet" refers to weight of soil as received at HASL.

4. "Dry" refers to soil aliquot dried at 100°C for eight hours.

5. Procedure:

   a. Soil aliquot ashed at 550°C for 8 hours, then dissolved in HNO_3. Solution aliquot plated directly on glass planchet for beta counting. Standardized against 0.2 gram K_2CO_3, mounted in similar manner.

   b. Self-absorption correction applied in each case: based on self-absorption of activity in two top soils.

6. Sr-90 - suitable aliquot taken from solution of dissolved soil.

7. Error term associated with each result is one Poisson standard deviation.

SEAWATER

1. Spec. No., Area collected, Collection date - information supplied by A. Seymour.

2. All islands in Rongelap Atoll except Mogiri, which is part of Alinginae Atoll.

3. All water collections made in lagoons except Mogiri, where collection was made from anchorage.

4. The total activity result was obtained by precipitating carbonate from a 200 ml aliquot, mounting on 2" plastic disc and

beta counting under 2" tube.

a. Standardized with K-40 (3 gms K_2CO_3 mounted in similar manner) where 3 gms $K_2CO_3 \equiv 2955$ d/m.

b. A self-absorption factor of 2 was applied to each result (See fig. 6 - Troll Report).

c. Assumptions:

1. 18 month old pile produced f.p.'s simulate these conditions.

2. Ca content of these waters and those sampled on Troll - constant.

5. Sr-90 analyses performed on 400 ml aliquot.

6. Error term associated with each result - one Poisson standard deviation.

VEGETATION

1. Spec. No., Organism, Tissue, Area collected, Remarks, - information supplied by A. Seymour.

2. "Wet" refers to wet weight given by A. Seymour, except in case of Pandanus, which was received in wet state at HASL.

3. Samples dried at 95°C by A. Seymour wherever a result is given, except for Algae, which were dried at HASL.

4. In all cases except Arrowroot, sample wet ashed at HASL.

5. Total activity results: based on direct plating of aliquot in glass planchet and beta counting. Standardized against 0.2 g K_2CO_3, mounted in similar manner.

Self-absorption correction factor applied in each case: based on self-absorption of activity in Papaya pulp and Cistern algae.

6. Aliquot taken for Sr-90: represented 10-20 gms wet material.

7. Error term associated with each result is one Poisson standard deviation.

COCONUTS

1. Spec. No., Area collected, Tissue, Remarks, - information supplied by A. Seymour.

2. "Wet" refers to weight as received at HASL. Samples were not dried but ashed at 550°C for 8 hours.

3. For total activity measurement a 0.2 gm aliquot of ash was beta counted in a plastic planchet and standardized against 0.2 gms K_2CO_3, similarly prepared.

4. No self-absorption correction applied.

5. Aliquot of dissolved ash analyzed for Sr-90.

FISH

1. Spec. No., Organism, Tissue, Area collected, Collection date, Remarks - information supplied by A. Seymour.

2. "Wet" refers to wet weight given by A. Seymour.

3. Samples were dried at 95°C by A. Seymour except in case of Plankton, which was received in formalin.

4. In all cases except bone, sample was wet ashed at HASL. Bone was ashed at 550°C then dissolved.

5. For total activity - aliquot plated on glass planchet and beta counted. Standardized against 0.2 gms K_2CO_3 mounted in similar manner. Self-absorption correction factor applied in each case: based on self-absorption of activity in tuna muscle and bonito bone.

6. Aliquot taken for Sr-90: represented 10-20 gms wet material.

The special assistance received from J. Alercio, A. Rodriguez, E. French and I. Whitney was invaluable in the preparation and analysis of these samples.