

UNIVERSITY OF WASHINGTON  
SEATTLE, WASHINGTON 98195

*College of Fisheries  
Laboratory of Radiation Ecology*

July 3, 1974

Mr. Tommy McCraw  
Nuclear Explosives Environmental  
Safety Branch  
Division of Operational Safety  
U. S. Atomic Energy Commission  
Washington, D. C. 20545

Dear Tommy:

Gamma-spectrum analysis of the 38 samples collected in April, 1974, on Bikini Island and Rongelap Atoll, and later selected for analysis during FY 1974 as outlined in the Second Supplement to the Johnston Atoll Bioenvironmental Program, has been completed. After division of the fish and coconut crabs into tissue fractions, a total of 57 gamma-spectrum analyses were performed. The results of these analyses are given in Tables 1 through 5 which are attached.

The gamma-emitting radionuclide content of the single goatfish collected about two miles north of Bikini Island is less than the levels found in goatfish collected near Bikini Island in 1969 and near Nam Island in 1972. The mullet collected north of Bikini Island in 1974 had slightly higher levels of  $^{60}\text{Co}$  and  $^{137}\text{Cs}$  compared to mullet collected near Bikini Island in 1969, but had similar levels to concentrations found in mullet collected from Nam in 1972.

The single coconut crab collected on Bikini Island in 1974 had lower levels of  $^{60}\text{Co}$  and  $^{137}\text{Cs}$  than the levels found in six coconut crabs collected on Bikini Island in 1969 (i.e., a  $^{137}\text{Cs}$  level in the muscle of 380 pCi/g, dry, versus a range of 429 to 933 pCi/g, dry, in the six 1969 crabs).

The concentrations of  $^{60}\text{Co}$  and  $^{137}\text{Cs}$  in the coconut crabs from Rongelap Atoll are less, by factors of 4 to 10, than those found in the Bikini crab. Crabs from Kabelle Island, located at the northeast tip of Rongelap Atoll, had higher levels of  $^{60}\text{Co}$  and  $^{137}\text{Cs}$  compared to crabs from Busch and Arbar Islands in the southern part of the atoll. A single coconut crab collected on Rongelap Island in 1971 had muscle, hepatopancreas, and exoskeleton  $^{137}\text{Cs}$  concentrations of 32, 35, and 7.9 pCi/g, dry, respectively. These levels, except for the muscle concentration which is slightly lower, are similar to those found in the crabs collected on the other islands in 1974. We were unable to collect any crabs on Rongelap Island in 1974.

The results of the analyses of the soil profiles indicate that most of the gamma-emitting radionuclides are found in the surface 25 cm of soil. Cesium-137, however, is detectable even in the deepest samples from all three profiles and

especially in profile #1, which was a very disturbed site. Soil from profile #3 has radionuclide levels which are higher by about a factor of 10 than levels found in profiles 1 and 2. A map of the profile sites and a description of the soil characteristics is also attached (Page 5 of my trip report which I sent to you earlier).

The status of the other analyses to be performed on the samples discussed above is as follows: Pu - all the samples are extracted and plated and will be counted by 12 July,  $^{90}\text{Sr}$  - the samples are ready for  $^{90}\text{Y}$  extraction and will be counted by about the 23rd of July,  $^{55}\text{Fe}$  - two samples have been counted and three more will be counted by 12 July.

It has taken somewhat longer than we anticipated for the Pu and  $^{90}\text{Sr}$  analyses because we decided that the  $\gamma$ -spectrum, Pu and  $^{90}\text{Sr}$  analyses should be run on a single sample rather than taking separate aliquots for Pu and  $^{90}\text{Sr}$  analyses. Thus, the Pu analyses began after gamma-counting, and  $^{90}\text{Sr}$  analyses began after the Pu extraction. This type of procedure should give the best data for a comparison of the gamma-emitting radionuclides, Pu and  $^{90}\text{Sr}$ .

Sincerely yours,



Victor A. Nelson  
Fisheries Biologist

VAN:ah  
Enc.  
cc: Mr. John Stewart

Preliminary Data

Table 1. Gamma-emitting radionuclides in soil profile #1 collected in April 1974 on Bikini Island behind the first house south of the center baseline road.

Depth cm	pCi/g, dry			
	$^{60}\text{Co}$	$^{137}\text{Cs}$	$^{155}\text{Eu}$	$^{241}\text{Am}$
0-2.5	0.27 ± .05*	27.00 ± .4	0.32 ± .08	0.39 ± .23
2.5-5.0	0.35 ± .05	37.00 ± .5	0.42 ± .08	0.92 ± .23
5-10	0.37 ± .05	40.00 ± .5	0.48 ± .08	0.77 ± .23
10-15	0.30 ± .05	40.00 ± .5	0.46 ± .07	0.73 ± .14
15-25	0.45 ± .06	38.00 ± .4	0.64 ± .08	1.2 ± .23
25-50	0.26 ± .04	13.00 ± .3	0.32 ± .05	0.55 ± .11
50-75	0.04 ± .03	0.12 ± .04	NS	NS
75-100	0.10 ± .04	7.0 ± .2	0.23 ± .08	NS
100-115	0.13 ± .03	11.00 ± .3	0.16 ± .06	0.22 ± .09
115-130	0.09 ± .04	9.7 ± .2	0.16 ± .06	0.33 ± .16

\* The error terms are the two-sigma, propagated counting errors for single samples.

Preliminary Data

Table 2. Gamma-emitting radionuclides in soil profile #2 collected in April 1974 on Bikini Island at old coconut tree row #24 just south of the center baseline road.

Depth cm	pCi/g, dry			
	$^{60}\text{Co}$	$^{137}\text{Cs}$	$^{155}\text{Eu}$	$^{241}\text{Am}$
0-2.5	0.27 ± .05*	20.00 ± .4	0.45 ± .06	0.66 ± .12
2.5-5.0	0.38 ± .06	26.00 ± .4	0.51 ± .07	0.91 ± .14
5-10	0.34 ± .05	23.00 ± .4	0.41 ± .08	0.42 ± .22
10-15	0.27 ± .05	20.00 ± .3	0.42 ± .07	0.73 ± .22
15-25	0.15 ± .04	8.8 ± .22	0.25 ± .06	0.40 ± .16
25-50	0.15 ± .04	6.0 ± .20	0.28 ± .04	0.37 ± .09
50-75	0.17 ± .04	2.9 ± .14	0.19 ± .06	0.27 ± .16
75-100	NS	0.68 ± .07	NS	0.13 ± .08
100-125	0.04 ± .03	0.17 ± .05	NS	NS

\* The error terms are the two-sigma, propagated counting errors for single samples.

Preliminary Data

Table 3. Gamma-emitting radionuclides in soil profile #3 collected in April 1974 on Bikini Island at the old coconut tree row #24, just north of the 1st baseline south road.

Depth cm	pCi/g, dry			
	$^{60}\text{Co}$	$^{137}\text{Cs}$	$^{155}\text{Eu}$	$^{241}\text{Am}$
0-2.5	5.2 ± .22 *	380.00 ± 1.9	7.3 ± .25	15.0 ± 0.56
2.5-5.0	4.5 ± .41	320.00 ± 3.5	6.0 ± .48	13.0 ± 1.0
5-10	2.3 ± .13	150.00 ± 2.0	2.5 ± .34	5.8 ± 0.97
10-15	1.7 ± .13	97.00 ± 0.95	1.7 ± .14	3.8 ± 0.31
15-25	1.1 ± .069	81.00 ± 0.56	1.2 ± .08	2.8 ± 0.17
25-35	0.15 ± .067	7.7 ± 0.35	NS	NS
35-50	0.041 ± .031	4.2 ± 0.16	0.12 ± .09	NS
50-75	0.034 ± .032	2.4 ± 0.14	NS	NS
75-100	NS	0.43 ± 0.06	NS	NS

\* The error terms are the two-sigma, propagated counting errors for single samples.

Preliminary Data

Table 4. Radionuclides in individual coconut crabs collected in April 1974 on Bikini Island, Bikini Atoll, and on Arbar, Busch, and Kabelle Islands, Rongelap Atoll.

Sample No.	Island	Carapace Length (mm)	Tissue	pCi/g. dry				90 <sup>*</sup> Sr	239,240 Pu <sup>*</sup>
				40 K	60 Co	137 Cs	90 <sup>*</sup> Sr		
387	Bikini	135	Muscle	13 ±5.5**	2.2 ±.44	380 ±4.2			
389	"	"	Hepato-pancreas	2.0±1.3	2.0 ±.10	93 ±0.7			
391	"	"	Exo-skeleton	1.4±1.2	0.14±.04	70 ±0.6			
393	Kabelle	140	Muscle	6.6±1.0	0.43±.10	84 ±1.3			
394	"	"	Hepato.	5.3±2.2	1.9 ±.19	33 ±0.52			
395	"	"	Exoskel.	1.1±0.4	0.07±.02	9.8±0.06			
408	Kabelle	125	Muscle	9.7±1.9	0.56±.12	55 ±0.58			
409	"	"	Hepato.	2.8±1.2	1.7 ±.10	18 ±0.31			
410	"	"	Exoskel.	1.4±0.5	0.08±.03	9.5±0.08			
384	Kabelle	110	Muscle	9.5±2.2	0.37±.17	46 ±0.64			
385	"	"	Hepato.	3.5±1.2	1.3 ±.09	15 ±0.24			
386	"	"	Exoskel.	1.4±0.4	0.08±.02	7.7±0.06			
405	Busch	140	Muscle	9.5±1.9	0.30±.12	30 ±0.47			
406	"	"	Hepato.	3.0±0.9	0.51±.06	12 ±0.29			
407	"	"	Exoskel.	1.4±0.4	ns	4.4±0.05			
396	Busch	100	Muscle	9.0±2.2	0.20±.06	40 ±0.59			
397	"	"	Hepato.	3.1±1.2	0.82±.09	14 ±0.20			
398	"	"	Exoskel.	ns	ns	4.5±0.31			
399	Arbar	140	Muscle	7.7±1.8	0.28±.07	38 ±0.75			
400	"	"	Hepato.	3.5±1.0	0.34±.06	13 ±0.31			

Preliminary Data

Table 4 (cont)

Sample No.	Island	Carapace Length (mm)	Tissue	pCi/g, dry				
				<sup>40</sup> K	<sup>60</sup> Co	<sup>137</sup> Cs	<sup>90</sup> Sr**	<sup>239,240</sup> Pu*
401	Arbar	140	Exoskel.	1.8±0.4	0.04±0.02	7.0±0.05		
402	Arbar	135	Muscle	9.2±1.0	0.20±0.07	27 ±0.21		
403	"	"	Hepato.	3.1±1.2	0.20±0.04	12 ±1.2		
404	"	"	Exoskel.	1.4±0.8	0.02±0.01	4.9±0.19		

\* In process.

\*\* The error terms for <sup>40</sup>K, <sup>60</sup>Co, and <sup>137</sup>Cs are the two-sigma, propagated counting errors for single samples.

28 June 1974

## Preliminary Data

Table 5. Gamma-emitting radionuclides in fish collected on 12 April 1974 at Bikini Island, Bikini Atoll

Species	Tissue	No. of fish	Size, mm	pCi/g, dry						
				<sup>40</sup> K	<sup>60</sup> Co	<sup>137</sup> Cs	<sup>155</sup> Eu	<sup>207</sup> Bi	<sup>241</sup> Am	
Goatfish	Entire	1	175	11 +0.6*	0.14+.04	ns	ns	ns	ns	ns
Mullet	E. whole**	3	205-230	6 +0.9	3.5 +.08	0.12+.06	ns	ns	ns	ns
"	Viscera	3	"	4.2+1.6	16 +.76	0.73+.22	8.6+ .32	ns	ns	9.1+ 0.57
Mullet	E. whole	2	250,255	7.9+1.3	1.9 +.11	0.72+.08	ns	ns	ns	ns
"	Viscera	2	"	4.4+1.2	11 +.14	1.7 +.11	30 +24	0.22+.08	27	+12

\* Error terms are two-sigma, propagated counting errors for single samples.

\*\* Eviscerated whole samples include the entire fish, less the viscera.



PM - Nelson and Ash took surface soil samples, coconut fronds and  $\gamma$  readings along coconut rows 24 and 34 from the center base line to the 2nd base line south. Samples were taken at every 15th coconut tree, starting with the tree south of the center base line or 1st BLS. These samples were composited for four areas as follows:

- #1. Center base line to 1st BLS - Row 24.
- #2. 1st BLS to 2nd BLS - Row 24
- #3. Center BL to 1st BLS - Row 34
- #4. 1st BLS to 2nd BLS - Row 34

The row numbers are the numbers given to the original rows of coconut trees and are those used in reports of the 1969-70 and 1972 surveys. A row of coconut trees has since been planted between the original rows of trees.

Nelson and Ash began a gamma survey of the houses.

12 April (Friday) - Bikini Island

AM - Ash continued gamma survey of houses.

Nelson had a backhoe operator dig three soil pits in the following areas:

- #1. Ten yards south of the center base line and 30 yards inland from the first house south of the center base line. This pit is about 8 feet from a Pandanus tree from which fruit and leaves were collected. This pit had a mixture of dark organic soil and coral gravel to a depth of about 100 cm, and coral sand below 100 cm.
- #2. Ten yards south of the center base line on Row 24. This pit had a mixture of black organic soil and coral gravel from 0-30 cm, black organic soil and coral sand from 30-75 cm, and coral sand below 75 cm.
- #3. Five yards north of 1st Base line south on Row 24. This pit had fine dark organic soil from 0-35 cm, light gray coral sand from 35-50 cm, lighter shade of coral sand from 50-75 cm and white coral sand below about 75 cm.

Soil samples were taken by side wall sampling from these three soil pits at the following intervals, in cm, 0-2.5, 2.5-5, 5-10, 10-15, 15-25, 25-35, 35-50, 50-75, 75-100, 100+. These intervals varied in some cases, due to differences in soil horizons between the pits.

□ Bunker

