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Comments on the Statements by Bernd Franke

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A most important point is that the estimated ingestion dose due to ^{137}Cs at Rongelap Island based on the LLNL diet model and radionuclide concentration data in local food crops is in agreement with Brookhaven National Laboratory (BNL) whole body counting data. The results, shown in Table 3, indicate that the agreement is very good between LLNL predictions for the body burden of ^{137}Cs (i.e., dose) for Rongelap and Utirik and BNL's whole body measurements.

Similarly, the results of the estimates of the radiological dose due to Pu from both the LLNL environmental pathway analysis and the BNL urine analysis methods are very similar and indicate that the dose from Pu is very small indeed (see Attachment A, "The Radiological Dose from Pu at Rongelap Island").

Another important point is that the LLNL Environmental Program has been reviewed by five independent scientific committees, three of which have been hired by Marshallese communities or their government. The committees and their members are listed in Table 4; the scientists are all top people in their fields and are members of national and international commissions and many scientific committees and societies. In two of these cases independent scientists have gone on LLNL field trips and have split common samples for separate analysis. The most recent (1988) independent scientist to go in the field, review the LLNL sample collection methods and split samples for analysis was Dr. Herwig Paretzke of the Federal Republic of Germany at the GSF Institut f. Strahlenschutz laboratory and a member of the ICRP. The results of the measurement of ^{137}Cs, ^{90}Sr, Pu and Am from these independent scientists were in excellent agreement with LLNL results (8,9).

All of the independent scientific groups have visited the LLNL to observe the sample processing and analytical procedures. All groups have unanimously agreed that the LLNL sample collection and processing procedures are done with great care and precision, that the analytical work and quality assurance program are of the highest quality and <u>that the LLNL results are correct</u>.

Table 2. The 30- and 50-y integral dose equivalents in rem beginning in 1990 for Rongelap Island for whole body (WB), bone marrow (BM), and bone surface (BS) assuming imported foods are available.[a]

Pathway and radionuclide	30-y, rem[b]			50-y, rem[b]		
	WB	BM	BS	WB	BM	BS
External gamma	0.28	0.28	0.28	0.37	0.37	0.37
Ingestion						
^{137}Cs	0.48	0.48	0.48	0.66	0.66	0.66
^{90}Sr	-	0.067	0.15	-	0.094	0.21
$^{239+240}Pu$	-	0.0034	0.044	-	0.0086	0.11
^{241}Am	-	0.0017	0.022	-	0.0044	0.057
Inhalation						
$^{239+240}Pu$	-	0.014	0.19	-	0.036	0.48
^{241}Am	-	0.0087	0.11	-	0.022	0.29
Total	0.76	0.85	1.3	1.0	1.2	2.2

[a] The results in this table are based upon data from the 1978 Northern Marshall Islands Radiological Survey and new data from samples collected at Rongelap Island in 1985 and 1986. The new data quadrupled the amount of data available in 1978.

[b] The effective integral dose equivalents for 30 and 50 y are 0.79 rem and 1.1 rem, respectively.

Table 4. Committees that have reviewed the LLNL environmental program.

Enewetak Review Committee, 1979

Dr. William Ogle (deceased)
Dr. Michael Bender—National Cytogenetics, Inc.
Dr. A. Bertrand Brill—National Cytogenetics, Inc.

Bikini Review Committee, 1981—1982

Dr. Henry Kohn—Retired, Harvard University
Dr. John Harley—Retired, Environmental Measurements Laboratory
Dr. Nancy Dreyer—Epidemiology Resources, Inc.

Bair Committee, 1978—1983

Dr. William Bair—PNL Chairman
Dr. Roy Thompson—PNL
Dr. Richard Gilbert—PNL
Dr. Chet Francis—ORNL
Dr. Chet Richmond—ORNL
Dr. John Auxier—ORNL
Dr. Jack Healy—LANL
Dr. Roger McClellan—Lovelace Foundation
Dr. Bruce Wachholz—DOE

National Academy of Sciences, 1980—1981

Dr. Robert Morse—Woods Hole, Chairman
Dr. Colin Mawson—Canada
Dr. William Merritt—Chalk River, Canada
Dr. Frank Peterson—U. of Hawaii
Dr. Stephen Kim—RMC Technical Services
Dr. John Gnaedinger—Soil Testing Services, Inc.
Dr. John Wiggins—J.H. Wiggins Co.
Dr. Alfred Yee—Alfred A. Yee & Associates

BARC Committee, 1983—1989

Dr. Henry Kohn—Chairman
Dr. Earl Stone—U. of Florida
Dr. Frank Peterson—U. of Hawaii
Dr. Arthur Kubo—BDM Corp.

Rongelap Reassessment Project Report, 1988

Dr. Herwig Paretzke—GSF Institut f. Strahlenschutz
Dr. Ute Boikat-Kollert, Donderer & Boikat
Dr. Henry Kohn—Referee, Rongelap Reassessment Project

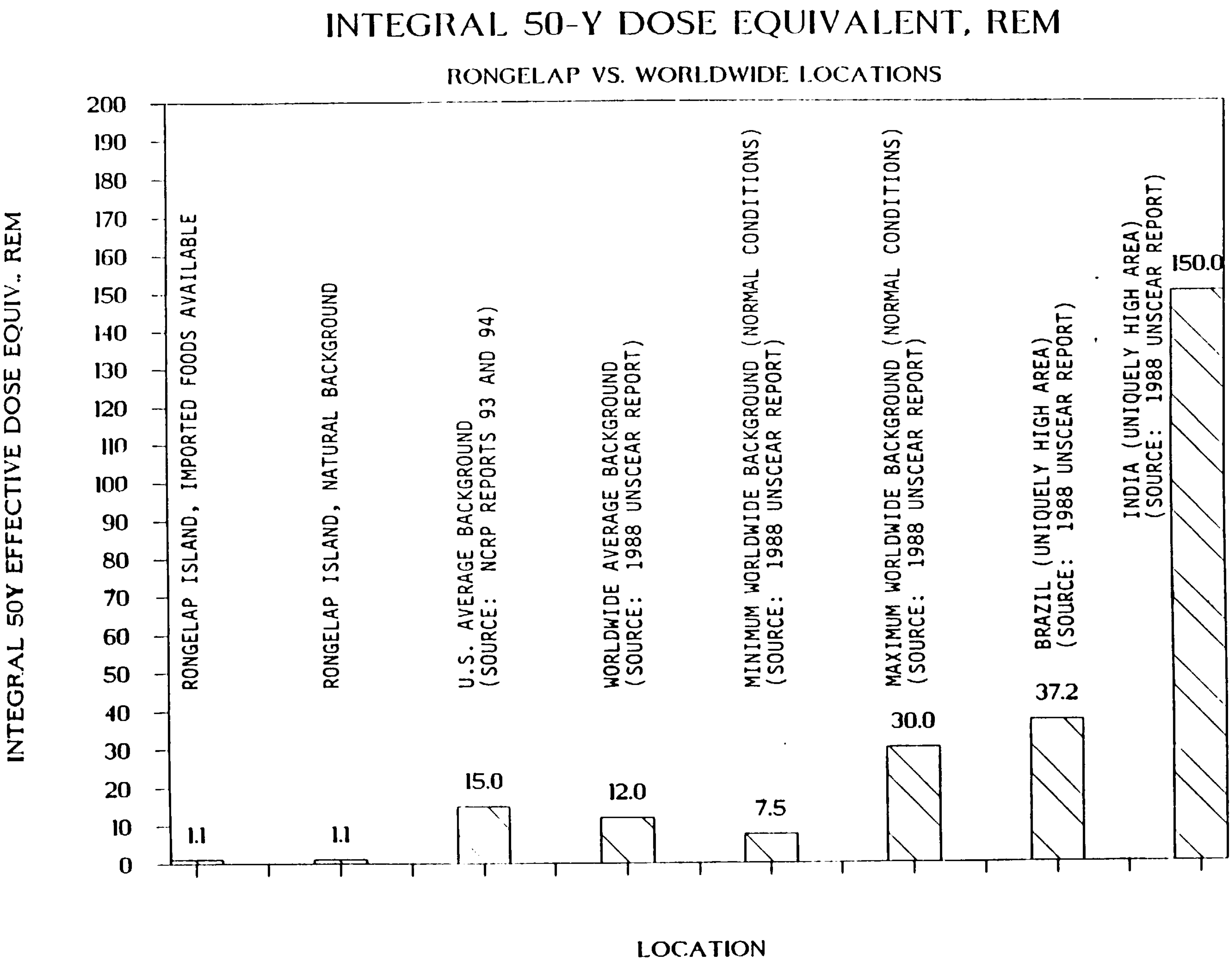

Figure 2. The integral 50-y dose equivalent at Rongelap Island and other locations.

6 pCi/g, well below the 17 pCi/g derived from the proposed EPA guidance. In fact, the maximum Pu plus Am concentration measured in surface soil at Rongelap Island is less than 20 pCi/g.

Mr. Franke, however, fails to mention the guidance for transuranic radionuclides in air which is preferable to the soil criterion. The EPA screening level for the transuranic nuclide concentration in air is 1000 aCi/m^3. Our resuspension studies at Bikini Island at Bikini Atoll and Enjebi Island at Enewetak Atoll (7), and measurements of Pu in the air at Bikini Island by other groups (13,14), indicate that under normal conditions the concentration of Pu in air ranges from 30 to 60 aCi/m^3; adding in Am would bring the air concentration to about 50 to 100 aCi/m^3. This is 5% to 10% of the EPA screening level. The air concentration of Pu and Am at Rongelap could be expected to be lower than at Bikini and Enewetak because the Pu concentration in surface soil at Rongelap Island is 1/3 to 1/5 that at Bikini Island and Enjebi Island.

When the soil concentration, and more importantly the air concentration, are below the EPA screening level it, according to EPA, "...generally would be considered in compliance with the recommendations."

Even if the transuranic radionuclide concentration in air or soil exceeds the screening levels, the EPA recognizes that it may not be of concern and state "...those that exceed it (the screening level)* would require more intensive evaluation to determine the actual dose rates to exposed persons."

Once again, even though both the Pu and Am concentration in soil and air meet the EPA proposed screening levels, the key issue is the potential dose to residents from transuranic radionuclides and not screening levels devised for a multitude of purposes. That is why we have always calculated the dose from the transuranic radionuclides even though the soil and air concentrations of the Pu and Am meet the proposed screening criteria.

A comparison of the dose from Pu at Rongelap Island, estimated by both measurements of Pu in the environment and in urine, are compared with U.S. background doses for perspective in the Attachment A report entitled, "The Radiological Dose from Pu at Rongelap Island." Also see Table 2 in the Introduction of this report.

*Our addition

Remark:

2. Transuranics in Soil of Rongelap Island Unevenly Distributed.

Response:

Mr. Franke states that "...the maximum level of transuranics (plutonium plus Americium) is 230 times higher than the minimum level measured."

Mr. Franke has made a major calculational error to generate this factor of 230. The maximum difference between the high and low concentration of Pu plus Am in surface soil that Mr. Franke reviewed is 17, not 230; in other words, Mr. Franke is in error by nearly a factor of 15. He generated his high number not by comparing the high and low value when both Pu and Am data were available, but by using one value where the Pu concentration was unavailable and only Am was available and happened to be a very low value. This is not correct and is not what he said he did.

The most important point is that the whole concept of the range between the high and low measured values is unimportant. If one sample were taken very near the beach and another in the interior of the island, one would expect a definite difference in the concentration of Pu. The potential dose is what is important and all the data were used in our calculations.

plutonium can be assumed for chronic uptake cases. Therefore, an excretion constant of 1×10^{-5} is used as a fraction of total uptake excreted in urine per day. Taking a 120 mrem/Bq dose conversion factor, a committed effective dose equivalent of 44 mrem is calculated for each of 100 aCi plutonium activity in urine. Therefore, over a 30 year period an approximate dose of 30 mrem is a reasonable expectation.

In comparing plutonium urine excretion functions beyond postuptake, the fraction excretion per day from one model to another may differ by several factors. This is due to a fast release of plutonium from the body via short term compartments. The deposition functions for long term bone compartment's are basically equivalent for all models.. Hence, the total transformation of plutonium atoms in bone is expected to be similar for all published models. In fact, the nonstochastic annual limit on intake (ALI) for plutonium-239 is based on the allowable bone dose which is independent the excretion model applied.

Therefore, according to our September 1988 urine results for the people of Rongelap, a 170 aCi/d plutonium corresponds to a total of 50 mrem over a 50 year interval. To confirm our existing results, new urine samples from the people of Rongelap in July will be collected. When the new data are available they will be made available to the people of the Marshall Islands as quickly as possible.

There is some variation in the aerial distribution of ^{137}Cs, ^{90}Sr, $^{239+240}Pu$ and ^{241}Am. This results from slight differences in deposition during cloud passage and subsequent mechanical disturbance of the surface soil over the years. The results are shown in Figures 5 and 6. The average Pu concentration in 18 samples is about 3 pCi/g; the maximum is about 10 pCi/g. The mean concentration of ^{241}Am in 17 samples is about 1.0 pCi/g; the maximum value is about 2.9 pCi/g. In Mr. Franke's calculation he assumes that 50% of the maximum observed total Pu + Am activity in 1000 g of soil is really in only 5 g. He then says this specific soil sample is what a child consumes. This is totally unsupported by any data from Rongelap, Bikini or Enewetak and is an untenable premise. His calculation leads to a Pu plus Am concentration in soil of 900 pCi/g—nearly 60 times any observed measurement and 150 times the average Pu and Am concentration; all of this based on absolute speculation and totally refuted by all available data.

Combining Mr. Franke's error in the gut transfer which is 10 to 100 times too high and his calculation of the Pu plus Am concentration in soil which is about 100 times too high makes his total calculation off by a factor of 1000 to 10,000.

In summary, Mr. Franke's assumptions are without scientific merit.

It should also be pointed out that based on Mr. Franke's scenario and using ICRP 30 dose conversion factors, the calculated committed effective dose from the one time ingestion of 5 g of soil containing 4500 pCi with 12.5% of the Pu reaching the blood is 2.0 rem, not 5 rem.

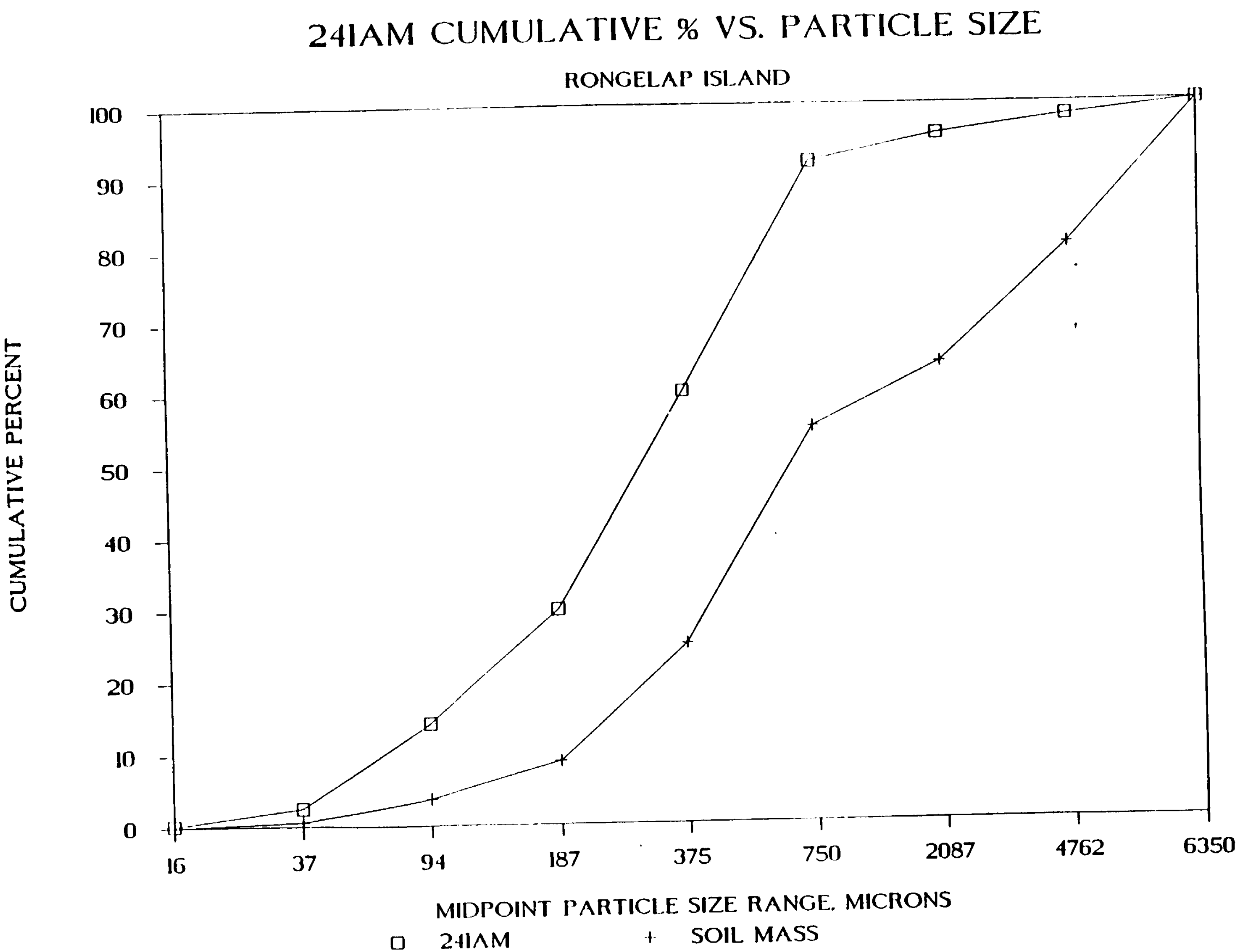

Figure 4. The cumulative percent Am as a function of particle size in the surface soil at Rongelap Island.

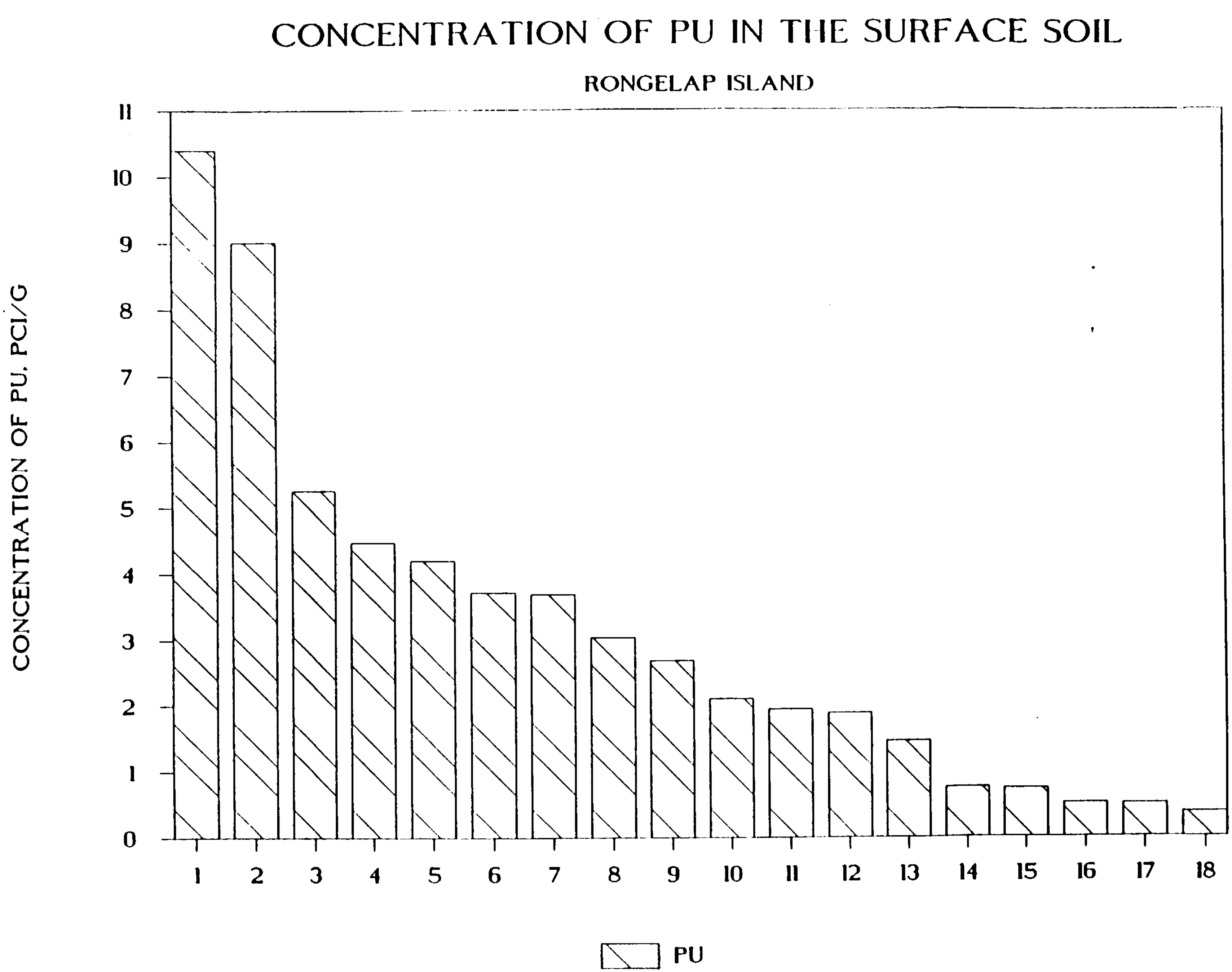

Figure 5. The concentration of Pu in 18 individual surface soil (0-5 cm) samples from Rongelap Island.

Remark:

5. Explanations for the High Levels of Pu in Urine.

Response:

The reason for the few high levels of Pu in urine was explained to the Rongelap people and Mr. Franke at Livermore before the revised version of his paper "Is Rongelap Safe?" It was explained in detail that the high levels were undoubtedly due to contamination of the urine sample and the reasons for this assessment were discussed with them.

Since that time the "contamination theory" has been further substantiated with the samples collected in September of 1988 and discussed in this paper.

Remark:

7. Total Doses for Mixed Food Diet.

Total Doses for "Local Food Only" Diet.

Response:

The use of a."local foods only" diet (Naidu A diet) is not supported by any knowledgeable observer of current dietary practices in the Marshall Islands. Neither is it supported by available data. For example, the diet model used by LLNL (which consists of about 65% imported food and 35% local food) predicts the actual body burdens (i.e., dose) measured by BNL at both Rongelap and Utirik as shown in Table 6. The "Naidu A" diet overestimates the observed body burdens by nearly a factor of 10.

The "Naidu A" diet assumes consumption for a lifetime of only local foods. This has not been the practice for a couple of decades, nor is it likely ever again to be the case, in the Marshall Islands. In addition, the authors of the report in which the "Naidu A" diet is presented state that the data are based on food prepared and not consumed and that the diet significantly overestimates actual consumption. The authors also stated in a private communication to one of the authors (W.L.R.) that the "A" diet would not apply to Rongelap.

According to Dr. Laurence Carucci, an anthropologist at Montana State University who has lived in the Marshall Islands at various times during the past 15 years, the "A" diet is not applicable to most atolls in the Marshall Islands (private communication to W.L.R. 1979 and 1989). He states that continued existence on "local food only" is totally unrealistic and that any short-term famine conditions requiring consumption of only local foods is a "political famine" in the sense that the governments (RMI and U.S.) have adequate means to alleviate even short-term shortages of food. Our observation is that in today's world, a diet consisting of only local foods is quite unrealistic. The demand for imported foods is present and they are considered staples, not luxuries, suppliers and commercial transport are available, and the people have cash in hand. Even though resupply schedules may be somewhat erratic, inventories of imported foods are expected to be such that the total absence of imported foods from the diet is most unlikely.

Table 6. Comparison of the predicted and measured body burdens of ^{137}Cs for three atolls in the Marshall Islands.

Atoll	Predicted adult body burdens using dose models and various diet options (μCi)				Measured average body burden in 1978 by BNL (μCi)[a]	
	LLNL diet model		BNL diet			
	Imports available	Imports unavailable	Community B	Community A	Average	Maximum
Bikini	5.5	11	20	45	2.4 (M)[b] 1.7 (F)[c]	5.7 (M) 2.7 (F)
Rongelap	0.16	0.42	0.46	1.3	0.17 (A)[d]	
Utirik	0.043	0.098	0.18	0.35	0.053 (A)	

[a] BNL data; references 10-12.
[b] Male.
[c] Female.
[d] Adult.

for 14 breadfruit, 3 pCi/g; for 96 drinking coconut meat, 1.9 pCi/g; and for 86 drinking coconut fluid, about 1 pCi/g. All are below, and most significantly below, the 10 pCi/g screening level.

2. Current recommendations by the Food and Agricultural Organization (FAO), the World Health Organization (WHO) and the International Atomic Energy Agency (IAEA) to the Codex Alimentarius Commission for radionuclide concentrations in food products for governing the international flow of food products is 27 pCi/g for ^{137}Cs (not 10 pCi/g) in all foods (17,18).

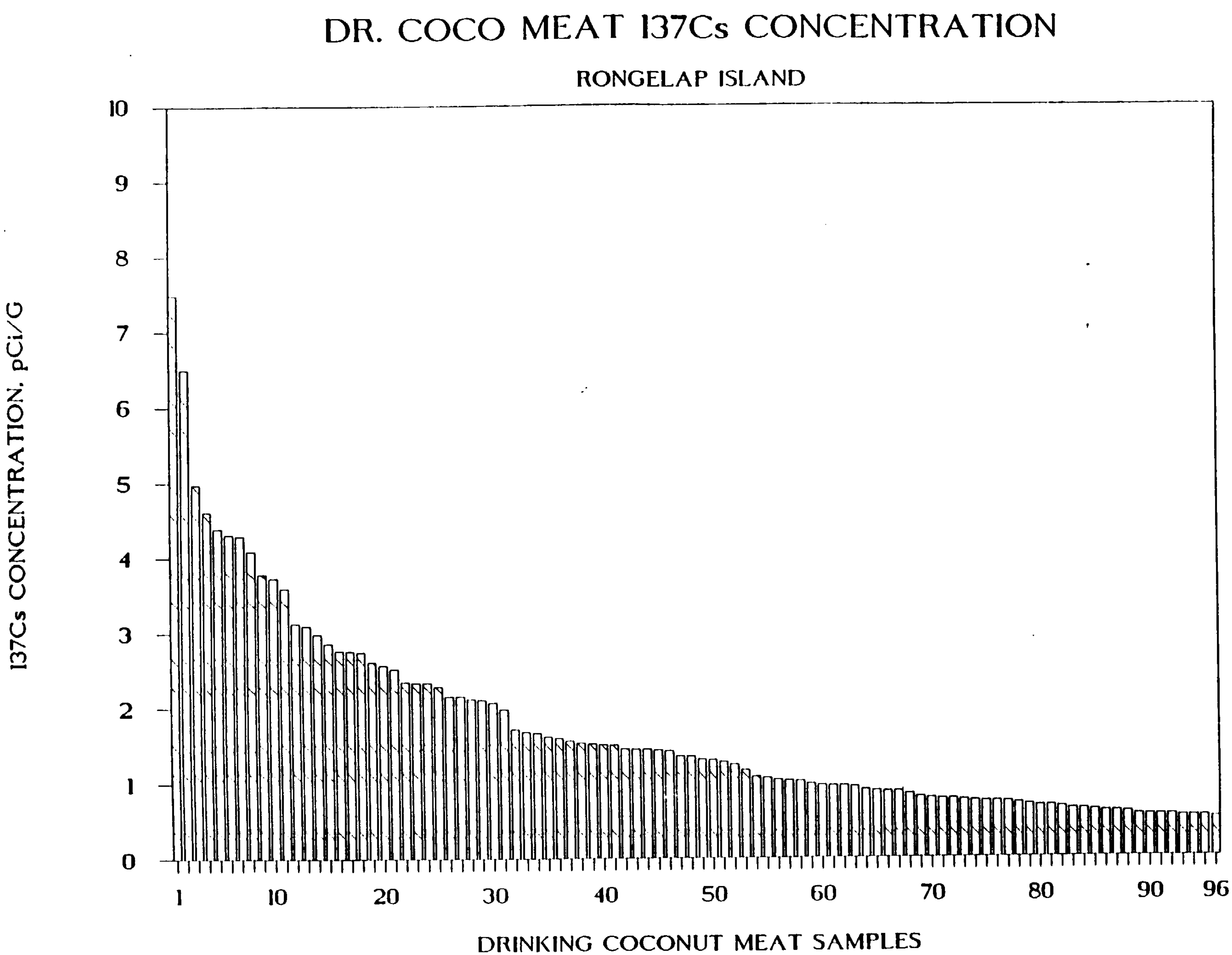

Figure 8. The concentration of ^{137}Cs in 96 individual samples of drinking coconut meat at Rongelap Island.

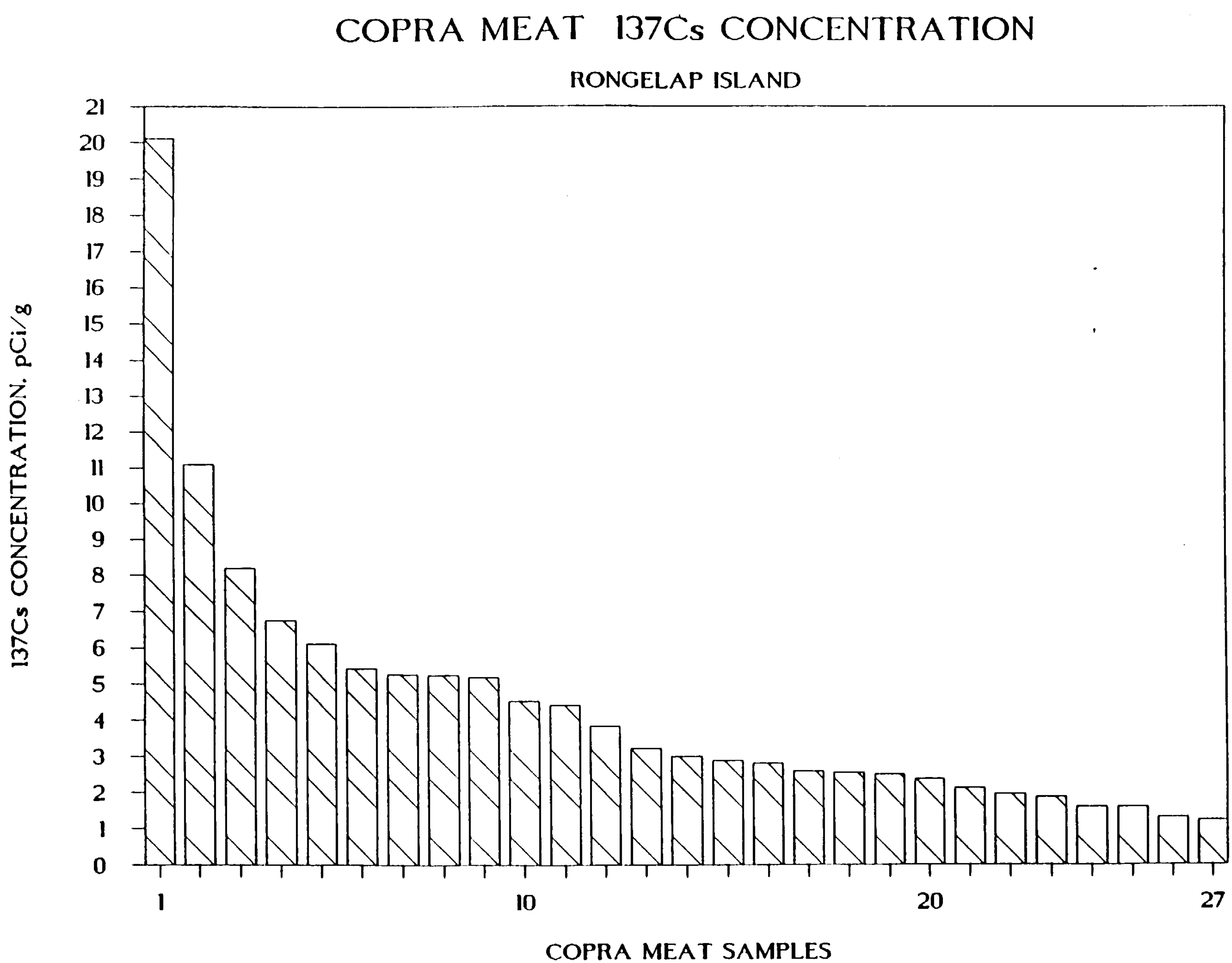

Figure 10. The concentration of ^{137}Cs in 27 individual copra meat samples at Rongelap Island.

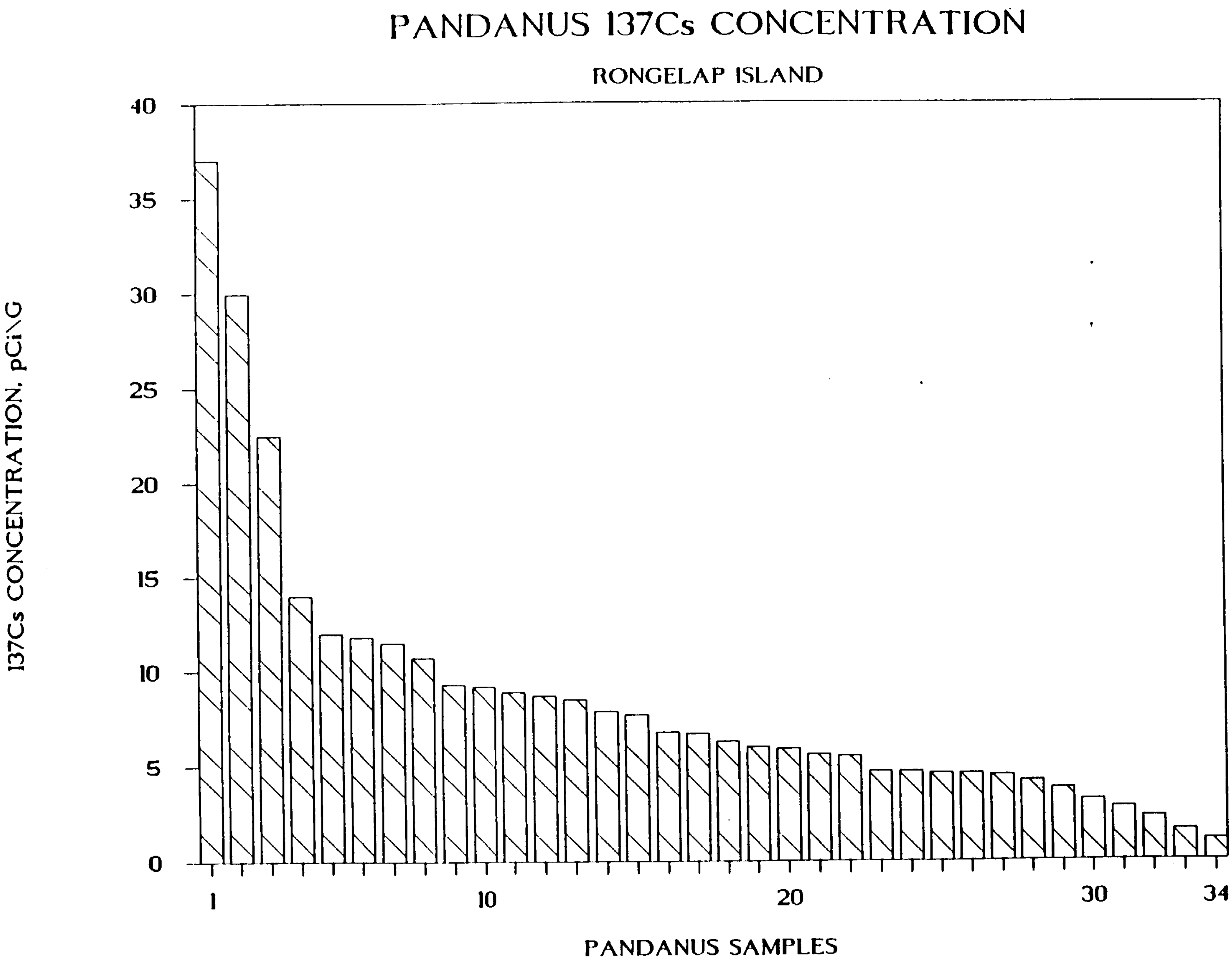

Figure 12. The concentration of ^{137}Cs in 34 individual *Pandanus* samples at Rongelap Island.

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The Radiological Dose from Pu at Rongelap Island

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C. Sun
C.B. Meinhold

A. Introduction

B. Dose Estimates
   1. Environmental Method (LLNL)
   2. Urine Analysis Method (BNL)
   3. Summary—Comparison Environmental and Urine Analysis

subsequent inhalation of Pu contaminated dust particles in the respirable size-range, is the major potential route of exposure to people in the Marshall Islands as it is in almost any environment.

The resuspension of surface soil varies greatly, however, from one environment to another; resuspension may be very high in one environment and essentially negligible and of no consequence in another. Thus, it is much preferred that data for the concentration of Pu in air be available so that models can be developed relating Pu air concentration to Pu surface soil concentration, thereby eliminating much of the uncertainty in predicting resuspension mechanisms for a specific environment. We also have extensive data on the Pu and Am concentrations in surface soil and air from which we can estimate the amount of Pu and Am which might be inhaled or ingested during residence on Rongelap Island.

The 50-y integral effective dose equivalents for both the ingestion and inhalation pathways are based on the following:

Ingestion

1. The average concentration of Pu and Am measured in food products from Rongelap Island.

2. The ingestion of local foods based on the diet listed in Table A-1 of the attached Appendix A.

3. An assumption that 10 mg per day soil is ingested for every day of a person's life. We think this is conservative in that it overestimates the actual soil consumption of adults over their lifetime.

Inhalation

1. The average Pu concentration in air based on the LLNL resuspension model for Rongelap Island is conservatively estimated to be 190 aCi/m^3. This concentration is assumed to be present every day of a person's residence on Rongelap Island and when combined with the average breathing rate of 22 m^3/d gives the daily Pu inhalation rate

Table 1. The effective committed dose equivalent from Pu for 50 y of residence on Rongelap Island.[a]

	mrem		
	Inhalation	Ingestion	Total
Pu	34 (28)	12 (6.3)	46 (35)
Am	23 (18)	6.0 (3.4)	29 (21)
Total	57 (46)	18 (9.7)	75 (56)

[a] The 50-y integral dose equivalent is given in parentheses.

Table 2. The effective committed dose equivalent from Pu and Am at Rongelap Island and the effective committed background dose equivalent in the United States.[a]

		Effective committed dose equivalent, mrem[a]
Pu + Am dose at Rongelap		75 (56)
^{137}Cs + ^{90}Sr dose at Rongelap		1,025
Natural background at Rongelap		1,100
	Total	2,200
U.S. background (all radionuclides)		15,000

[a] The 50-y integral dose equivalent is given in parentheses.

factor of 50 less than that for workers (5000 mrem divided by 50 equals 100 mrem). The results are shown in Table 3 and are converted from annual to daily intakes. The intakes at Rongelap for inhalation and ingestion are about 65 to 240 times less than one derives from the ICRP recommendations.

Urine Analysis Method (Brookhaven National Laboratory

In this method the Pu concentration in urine is determined by state-of-art fission track analytical (FTA) procedures. The measured Pu concentration

The polonium problem was resolved by the adaption of our FTA method. Regarding soil contamination of the urine sample, the analyses of the September 1988 samples provided the following information:

1. From the samples taken in Majatto, all of the plutonium results are below 170 aCi (a committed effective dose equivalent 85 mrem, i.e., the total dose to be received over the next 50 years). The median of the distribution is at the background level.

2. An interesting observation is that the plutonium concentrations in the Rongelap people's urine samples is similar to that of our BNL individual who was used as our laboratory control up to December 31, 1988.

3. The mean Pu concentration in urine is below the FTA detection limit of 80 aCi; the 50-year effective committed dose equivalent based on the detection limit is about 40 mrem. The actual 50-year effective committed dose equivalent is something less than 40 mrem but how much less is unknown because of the detection limit.

SUMMARY

The radiological dose due to Pu in the environment at Rongelap is estimated by two very different methods (Environmental and Urine Analysis) and compared in Table 4.

The estimated effective committed dose equivalent (or the 50-y integral dose equivalent) due to Pu at Rongelap Island are very similar for the two quite independent methods. It is apparent that there is complete agreement between BNL and LLNL on the magnitude of the dose from Pu at Rongelap Island. Consequently, the 40 to 46 mrem effective committed dose equivalent (35 mrem 50-y integral dose equivalent) from Pu is a very small fraction of the total estimated dose at Rongelap Island which in turn is less than 15% of the effective committed background dose of 15,000 mrem or more in the U.S. and other worldwide locations.

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Table A2. Model Diet: Rongelap Island. Local and Imported Food Available for Adult > 18 yrs.

Specific Activity in 1990, in pCi/g wet wt.: pCi/day

Local Food	Grams/d	Kcal/g	Kcal/d	137Cs	90Sr	239+240Pu	241Am	137Cs	90Sr	239+240Pu	241Am
Reef fish	24.2	1.40	33.9	1.9E-02	6.5E-04	2.4E-04	4.2E-05	4.7E-01	1.6E-02	5.8E-03	1.0E-03
Tuna	13.9	1.40	19.4	1.9E-02	6.5E-04	2.4E-04	4.2E-05	2.7E-01	9.0E-03	3.3E-03	5.8E-04
Mahi Mahi	3.56	1.10	3.92	1.9E-02	6.5E-04	2.4E-04	4.2E-05	6.8E-02	2.3E-03	8.5E-04	1.5E-04
Marine Crabs	1.68	0.90	1.51	5.8E-04	1.6E-03	1.1E-03	1.9E-04	9.7E-04	2.7E-03	1.8E-03	3.2E-04
Lobster	3.88	0.90	3.49	5.8E-04	1.6E-03	1.1E-03	1.9E-04	2.2E-03	6.3E-03	4.2E-03	7.4E-04
Clams	4.56	0.80	3.65	1.2E-03	4.0E-03	1.0E-02	3.1E-03	5.6E-03	1.8E-02	4.6E-02	1.4E-02
Trochus	0.10	0.80	0.08	1.2E-03	4.0E-03	1.0E-02	3.1E-03	1.2E-04	4.0E-04	1.0E-03	3.1E-04
Tridacna Muscle	1.67	1.28	2.14	1.2E-03	4.0E-03	1.0E-02	3.1E-03	2.1E-03	6.8E-03	1.7E-02	5.2E-03
Jedrul	3.08	0.80	2.46	1.2E-03	4.0E-03	1.0E-02	3.1E-03	3.8E-03	1.2E-02	3.1E-02	9.7E-03
Coconut Crabs	3.13	0.70	2.19	2.7E+00	1.2E+00	1.9E-03	6.2E-04	8.5E+00	3.7E+00	6.1E-03	2.0E-03
Land Crabs	0.00	0.70	0.00	2.7E+00	1.2E+00	1.9E-03	6.2E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Octopus	4.51	1.00	4.51	1.1E-02	1.6E-03	2.6E-04	4.6E-05	4.8E-02	7.3E-03	1.2E-03	2.1E-04
Turtle	4.34	0.89	3.86	3.1E-03	2.5E-04	8.2E-05	1.4E-05	1.3E-02	1.1E-03	3.5E-04	6.2E-05
Chicken Muscle	8.36	1.70	14.2	3.9E+00	4.1E-03	6.8E-05	9.0E-04	3.3E+01	3.4E-02	5.7E-04	7.5E-03
Chicken Liver	4.50	1.64	7.38	2.7E+00	8.7E-03	3.4E-04	8.4E-04	1.2E+01	3.9E-02	1.5E-03	3.8E-03
Chicken Gizzard	1.66	1.48	2.46	1.6E+00	9.7E-03	1.6E-04	2.7E-04	2.7E+00	1.6E-02	2.7E-04	4.5E-04
Pork Muscle	5.67	4.50	25.5	1.0E+01	2.7E-03	3.6E-05	2.5E-05	5.8E+01	1.6E-02	2.0E-04	1.4E-04
Pork Kidney	NR	1.40	0.00	1.3E+01	4.5E-03	3.4E-04	6.4E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pork Liver	2.60	2.41	6.27	5.7E+00	4.5E-03	9.1E-04	3.4E-04	1.5E+01	1.2E-02	2.4E-03	8.9E-04
Pork Heart	10.6	1.95	20.6	1.0E+01	2.7E-03	3.6E-05	2.5E-05	1.1E+02	2.9E-02	3.8E-04	2.6E-04
Bird Muscle	2.71	1.70	4.61	1.9E-02	6.5E-04	2.4E-04	4.2E-05	5.2E-02	1.8E-03	6.5E-04	1.1E-04
Bird Eggs	1.54	1.50	2.31	1.2E-02	2.9E-04	2.4E-04	4.2E-05	1.8E-02	4.5E-04	3.7E-04	6.5E-05
Chicken Eggs	7.25	1.63	11.8	3.9E+00	4.1E-03	6.8E-05	9.0E-04	2.9E+01	2.9E-02	4.9E-04	6.5E-03
Turtle Eggs	9.36	1.50	14.0	3.1E-03	2.5E-04	8.2E-05	1.4E-05	2.9E-02	2.3E-03	7.6E-04	1.3E-04
Pandanus Fruit	8.66	0.60	5.20	9.0E+00	4.4E-01	4.4E-05	2.2E-05	7.8E+01	3.8E+00	3.8E-04	1.9E-04
Pandanus Nuts	0.50	2.66	1.33	9.0E+00	4.4E-01	4.4E-05	2.2E-05	4.5E+00	2.2E-01	2.2E-05	1.1E-05
Breadfruit	27.2	1.30	35.3	2.8E+00	6.1E-02	1.6E-05	2.0E-05	7.6E+01	1.7E+00	4.4E-04	5.4E-04
Coconut Juice	99.1	0.11	10.9	8.5E-01	1.1E-03	2.7E-05	2.5E-05	8.5E+01	1.1E-01	2.6E-03	2.5E-03
Coconut Milk	51.9	3.46	179	4.4E+00	1.6E-02	4.5E-05	5.5E-05	2.3E+02	8.2E-01	2.3E-03	2.9E-03
Juba/Jekero	0.00	0.50	0.00	4.4E+00	1.6E-02	4.5E-05	5.5E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Drinking Coco Meat	31.7	1.02	32.3	1.7E+00	1.0E-02	3.3E-05	3.8E-05	5.5E+01	3.2E-01	1.1E-03	1.2E-03
Copra Meat	12.2	4.14	50.3	4.4E+00	1.6E-02	4.5E-05	5.5E-05	5.4E+01	1.9E-01	5.5E-04	6.7E-04
Sprout. Coco	7.79	0.80	6.23	4.4E+00	1.6E-02	4.5E-05	5.5E-05	3.5E+01	1.2E-01	3.5E-04	4.3E-04
Marsh. Cake	11.7	3.36	39.2	4.4E+00	1.6E-02	4.5E-05	5.5E-05	5.2E+01	1.8E-01	5.2E-04	6.5E-04
Papaya	6.59	0.39	2.57	9.8E+00	1.4E-01	1.3E-04	6.2E-05	6.4E+01	9.2E-01	8.6E-04	4.1E-04
Squash	NR	0.47	0.00	6.3E+00	8.6E-02	1.7E-05	8.3E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pumpkin	1.24	0.30	0.37	6.3E+00	8.6E-02	1.7E-05	8.3E-06	7.8E+00	1.1E-01	2.1E-05	1.0E-05
Banana	0.02	0.88	0.02	1.1E+00	2.6E-02	1.3E-04	6.2E-05	2.2E-02	5.3E-04	2.6E-06	1.2E-06
Arrowroot	3.93	3.46	13.6	6.5E+00	7.8E-02	6.9E-04	3.6E-04	2.5E+01	3.0E-01	2.7E-03	1.4E-03
Citrus	0.10	0.49	0.05	1.8E+00	0.0E+00	0.0E+00	0.0E+00	1.8E-01	0.0E+00	0.0E+00	0.0E+00
Rainwater	313	0.00	0.00	5.2E-04	1.9E-04	2.4E-06	3.9E-07	1.6E-01	6.0E-02	7.5E-04	1.2E-04
Wellwater	207	0.00	0.00	8.0E-04	1.8E-03	1.3E-05	7.5E-06	1.7E-01	3.8E-01	2.7E-03	1.6E-03
Malolo	199	0.00	0.00	5.2E-04	1.9E-04	2.4E-06	3.9E-07	1.0E-01	3.8E-02	4.8E-04	7.8E-05
Coffee/Tea	228	0.00	0.00	5.2E-04	1.9E-04	2.4E-06	3.9E-07	1.2E-01	4.4E-02	5.5E-04	9.0E-05
Soil	0.01	0.00	0.00	1.6E+01	5.2E+00	4.0E+00	2.4E+00	1.6E-01	5.2E-02	4.0E-02	2.4E-02
Total Local	1332		567					1034	13	0.18	0.071
Fluids	1046		11								
Solids	286		556								

Attachment A

Defense Nuclear Agency
Washington, D.C. 20305-1000

18 April 1989

Rong file

Brigadier General Paul F. Kavanaugh, USA
Deputy Assistant Secretary for
Military Applications
Defense Programs
Department of Energy
Washington, D.C. 20545

Dear General Kavanaugh:

This is in response to your recent inquiry.

The so called cleanup guide for Johnston Atoll cited in Health Physics, Vol. 55, No. 2 (August), pp. 451-453, 1988, "Plutonium Mining for Cleanup," by E. T. Bramlitt, was in fact nothing more than a test objective for a limited experiment, evaluating a novel cleanup technique. It in no way was derived from any health and safety evaluation pertaining to residence on Johnston Atoll; nor does it suggest that this experimental goal has been or should be applied in considering this or other areas for rehabilitation or for remedial measures.

Sincerely,

J. T. PARKER
Vice Admiral, USN
Director

Attachment B