



United States Department of the Interior

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McCraw R

October 14, 1975

Memorandum

To: Director of Territorial Affairs

From: Senior Staff Assistant for Pacific Affairs *sig*

Subject: Interagency Meeting on Bikini, Department of the Interior, September 19, 1975

ATTENDEES:

1. Fred M. Zeder, Director of Territorial Affairs - Chairman
2. John E. deYoung, Senior Staff Assistant, OTA
3. Roger Ray, USERDA, Nevada
4. Dr. Martin Diles, ERDA-OS
5. Stephen Greenleigh, Assistant General Counsel, ERDA
6. N. F. Barr, DBER-ERDA
7. Earl P. Gilmore, Holmes & Narver, Anaheim, California
8. Oscar DeBrum, DISTAD, Marshall Islands
9. Tommy F. McCraw, ERDA-OS
10. L. Joe Deal, ERDA-OS
11. N. A. Greenhouse, Brookhaven National Laboratory
12. Peter T. Coleman, Deputy High Commissioner, TTPI
13. Earl L. Eagles, OLAG, DNA
14. LTC R. L. Crump, OMSN (Observer)
15. Capt. J. M. Elster, OSD/ISA/TTPI
16. Dr. Robert A. Conard, Brookhaven National Laboratory
17. Maj. General W. E. Shedd, DDOA, DNA
18. H. L. Gurnee, GC, DNA
19. George M. Allen, MLSC, P.O. BOX 376, Majuro, Marshall Islands 96960
20. Emmett M. Rice, Deputy Director, OTA
21. Charles Schmitz, OMSN
22. Charlotte Mauldin, OTA
23. Congresswoman Carmen Bigler (Congress of Micronesia)

AGENDA:

- A. Introduction: The group was welcomed by Mr. Zeder who briefly outlined reasons for calling the meeting, i.e.:



1. to recap the ERDA June Radiological Survey results and recommendations;
2. to discuss reactions of the people of Bikini; and
3. to discuss future actions with respect to the Bikini Resettlement Program.

B. Recap of ERDA June Radiological Survey Conclusions and Recommendations

1. Tommy McCraw, ERDA, presented a recap of ERDA's conclusions and recommendations based on the June Radiological Survey.

Summary of the Survey, Conclusions and Recommendations attached as Appendix "A."

2. Environmental Surveillance

Dr. Robert A. Conard presented a review of personnel monitoring done on Bikini Island to date. Full text of his remarks attached as Appendix "B."

Mr. George M. Allen, Micronesian Legal Services Corporation, representing the people of Bikini, raised a number of questions.

- (a) Inquiry on how many times the gamma spectographic analysis utilizing the lead counter had been done.

Reply: Dr. Conard indicated this analysis had been carried out once to date on the small group of people living on Bikini Island, in April 1974.

- (b) Inquiry as to whether radiation levels of people were expected to go up after return to Bikini as had been the case for the Rongelapese after their return to Rongelap.

Reply: Dr. Conard indicated that although there may be a slight increase in body burdens after return to Bikini Island this would not be comparable to case of the Rongelapese. The Rongelapese had intake of locally grown foods at once after return whereas the residents of Bikini Island would not be eating local foods since they would not be available.

- (c) ERDA's preliminary report had a table indicating that men and women would be spending 20 to 15% of time, respectively, in the interior of the island. Question was raised whether this time frame had been predicated on current period or situation when the coconut groves would be in full production.

Reply: Nat Greenhouse of Brookhaven National Laboratory stated that these time estimates were based on projections of when coconut trees would be fully bearing.

- (d) Mr. Allen inquired as to relationship between thyroid abnormalities in Rongelapese individuals and possible beta-gamma residual radiation on Rongelap Island.

Reply: Dr. Conard stated that it was believed that all thyroid cases were result of fallout experienced by the individual. The Rongelapese exposed to fallout received an internal dose to the thyroid gland from radioactive isotopes of iodine.

- (e) Mr. Allen indicated that there were indications of poison fish in the Bikini Lagoon although this was not necessarily related to the atomic testing program. He wondered though, what affect any restriction on local fish might have on the diet component of the people of Bikini on their return.

Reply: Mr. Roger Ray noted that the University of Hawaii was conducting research on the general problem of fish poisoning. Presently, short of testing each fish with a "mongoose" tester, scientists have not come up with adequate answers.

Distad DeBrum pointed out that it is usually the Red Snapper which falls into the dangerous category. Pattern is found throughout the Marshalls. Problem though is that there is no consistent pattern, i.e., at one time of year, Red Snapper may be poisonous, not another time, etc.

3. Prospective Aerial Survey

Mr. Joe Deal, ERDA, presented a brief synopsis of legacies of nuclear testing in the Pacific. The problems from Pacific weapons testing, the fallout and fallout pattern, and the need for an aerial radiological survey were described. Summary in chart form is appended as Appendix "C."

Mr. George Allen, MLSC, raised a number of questions.

- (a) Funding required; time frame required; time of start of survey if funds were available.

Reply: Mr. Deal, ERDA, indicated that an overall survey, that is of all the testing areas, presumably, exclusive of Enewetak Atoll which has been aerially surveyed, would involve:

cost: \$2-1/2 to \$3 million (ERDA can fund approximately one-half.)

timeframe: 60 days in Pacific -- 4-8 months for analysis.

starting time: ERDA ready to start at once but requires necessary logistic support.

Capt. J. M. Elster, OSD/ISA/TTPI pointed out that DOD does not have any funds programmed for logistic support. In reply to a question from Mr. Allen, he stated that DOD has yet to make a decision on whether it would seek funds for such a project.

He pointed out that DOD was not asked about logistic support until last spring. DOD is prepared to provide support at this time on a reimbursable basis.

- (b) Mr. Allen, MLSC, then asked if DOD was saying that it did not wish to accept responsibility for support. If so, who is going to take responsibility to get money for the support phase of the proposed survey?

Reply: Capt. Elster referred to the original Executive arrangement on Bikini, i.e.,

Radiological Survey - AEC

Cleanup - DOD

Rehabilitation and Resettlement - DOI

DOD had accomplished its part of the cleanup. The question of which agency should support the logistic requirements might have to be made by OMB.

Mr. Deal noted that ERDA has discussed the matter with OMB.

Mr. Allen commented that he had read the latest "round robin" of letters between Department of the Interior and Department of Defense on the matter, but no resolution appeared from this correspondence.

Capt. Elster pointed out that DOD would approach the matter on a humanitarian basis if it could be shown that there was radiation danger on Bikini Island. On such a basis, DOD could act at once but ERDA conclusions are that this danger does not exist.

DOTA Zeder commented on the long-range strategic interests for the knowledge which would come from such an aerial survey, as well as immediate need for Bikini Atoll. He stated that DOI gives the matter high priority.

C. Report by Distad DeBrum on Meeting with People on Kili Island

Distad DeBrum requested Mr. Earl Gilmore, Holmes and Narver, who serves as consultant to the Distad for Bikini program, to report on the Bikini Master Plan. Mr. Gilmore explained why the "Master Plan" for Bikini did not come into being until close to 4 years after start of construction. The Master Plan utilized both Bikini Island and Eneu Island, although 63 of the original complement of 78 houses were planned for Bikini Island. He noted that Eneu Island could take care of all the population (some 700) at the present time, but long-range needs would require use of other islands.

Only 78 houses are funded in the present proposal although the Master Plan notes that, if the desire of the people of Bikini would be met some 150 houses were projected. This would provide for future population requirements.

Distad DeBrum then briefly described the visit to Kili the first week of September. He explained to the people that the new survey had recommended use of houses on Bikini Island under specific restrictions, i.e., no consumption of locally grown food from the Island, also no more houses to be built on Bikini Island.

In his estimation, the people of Kili now are split into two groups. A group made up of individuals who were born on Bikini (perhaps 150-200) want to go back before December. A younger group have expressed a desire to stay on Kili in view of the new circumstances. This raises the question of whether the new houses for this group could be built on Kili Island.

The older group, who wish to return, ask that the Government assure them that radiation factors on Bikini Island will not cause ill health. If it is held that Bikini Island is not habitable, then this older group wishes to resettle on Eneu Island. Distad DeBrum pointed out that there was mixed feelings because of the restrictions which had been recommended.

Mr. George Allen said that he had talked to the Magistrate at Kili via shortwave radio on Monday, September 15, and received the impression that only two of the elders on the Council now are insistent about going back within the next several months. He did not know, however, how many family members would be involved with these two leaders. He thought that there might be a somewhat less pressing problem about early return than had been indicated at the Kili meeting. He noted, though, that the shortwave radio contact was, at best, tentative and felt that the only way to get a reliable reading is to go back to Kili Island for additional meetings.

It was his belief that regardless of the current restrictions and future patterns of life in Bikini, some 150 younger people might wish to remain on Kili Island and perhaps another group might wish to live on Jaluit Island.

OTHER POINTS RAISED

Ex Gratia Payment

Mr. Allen commented on matters with respect to the Bikini Ex Gratia payment. He thinks it essential that the rightful claimants be identified. A formula for distribution should be determined now and this should come from the Bikini Council. He commented that numbers may be inflated by the desire to participate in Ex Gratia payment and stated that he was planning to attempt to identify "rightful families" by district-wide census.

Mr. Gilmore (Holmes and Narver), referred to the census done in 1974 for the Master Plan which identified 426 people on Kili and Bikini Islands, with another 362 individuals who claimed Bikini affiliation scattered elsewhere in the Marshalls. This gives a planning figure of 784.

Unawareness of People of Bikini of Earlier AEC Reports

Mr. Allen stated that MLSC (Marshalls) is translating the 1967 AEC report on Bikini Atoll as well as a summary on Rongelap in order that the people of Bikini can have access to first-hand information. He felt that more original information should be translated.

Mr. Zeder closed the meeting by assuring the principal participants that DOI would do everything it could to cooperate with other agencies involved and would try to resolve pressing matters that now face the Bikini program.

" APPENDIX A "

ERDA RADIOLOGICAL SURVEY OF BIKINI AND ENEU ISLANDS

JUNE 1975

PURPOSE	-	TO EVALUATE THE POTENTIAL EXTERNAL GAMMA DOSES ASSOCIATED WITH PROPOSED HOUSING LOCATIONS ON BIKINI AND ENEU ISLANDS AND THE POTENTIAL DOSES RECEIVED THROUGH THE MAJOR TERRESTRIAL FOOD CROPS ON THE ATOLL.
DATE	-	JUNE 16 - JUNE 26
TEAM MEMBERSHIP	-	20
AGENCIES	-	ERDA, EPA, LLL, BNL, UNIV. OF WASH., AND TT.

ERDA RADIOLOGICAL SURVEY OF BIKINI AND ENEU ISLANDS

JUNE 1975

EXTERNAL GAMMA MEASUREMENTS

2500 LOCATIONS - BIKINI ISLAND

200 LOCATIONS - ENEU ISLAND

SAMPLES COLLECTED

SOILS - 814

PLANTS - ~ 100
AND FRUITS

WELL WATER - 12

PIGS AND - 1 EACH
CHICKENS

AVAILABILITY OF SURVEY RESULTS

1. EXTERNAL RADIATION MEASUREMENTS

THESE RESULTS WERE AVAILABLE IMMEDIATELY AFTER THE SURVEY IN JUNE 1975. FURTHER REFINEMENTS MAY BE MADE WITH THE AVAILABILITY OF THERMOLUMINESCENT DOSIMETER (TLD) RESULTS IN OCTOBER 1975, AND AN AERIAL SURVEY OF BIKINI AND OTHER ATOLLS IN 1976; BUT NO SUBSTANTIAL CHANGES IN THE JUNE RESULTS ARE EXPECTED.

2. GROUND WATER MEASUREMENTS

RESULTS AVAILABLE IN OCTOBER 1975.

3. FOOD CHAIN MEASUREMENTS

RESULTS AVAILABLE ABOUT JANUARY 1976.

4. OTHER ISLANDS IN BIKINI ATOLL

DETAILED SURVEYS TO BE MADE IN 1976.

TABLE I
ESTIMATED MAXIMUM ANNUAL DOSES
(Rem/yr)

	<u>Whole-Body</u>		<u>Bone Marrow</u>	
	<u>40 Houses</u>	<u>Interior</u>	<u>40 Houses</u>	<u>Interior</u>
Option 1: <u>Live on Bikini Island</u>				
Grow all food on Bikini Island.	0.616	0.696	0.797	0.877
Import* pandanus and breadfruit.	0.328	0.408	0.373	0.453
Import* pandanus, breadfruit, and domestic meat.	0.238	0.318	0.263	0.343
Import* all food.	0.173	0.253	0.173	0.253
Option 2: <u>Live on Eneu Island</u>	<u>Anywhere on Eneu</u>		<u>Anywhere on Eneu</u>	
Grow all food on Eneu Island.	0.093		0.093	

Note: Radiation standards for annual whole-body and for bone marrow doses are the same - 0.500 Rem/yr.

*Food can be imported from outside the Atoll or grown on Eneu Island.

TABLE II
ESTIMATED 30-YEAR WHOLE-BODY DOSES
 (Rem/30yr)

<u>Option 1: Live on Bikini Island</u>	<u>40 Houses</u>	<u>Interior</u>
Grow all food on Bikini Island.	10.56	11.99
Import* pandanus and breadfruit.	5.92	7.35
Import* pandanus, breadfruit, and domestic meat.	4.08	5.51
Import* all food.	3.36	4.79
 <u>Option 2: Live on Eneu Island</u>	 <u>Anywhere on Eneu</u>	
Grow all food on Eneu Island.	2.04	

Note: Radiation standard for whole-body for 30 years - 5.0 Rem/30 Yr.

*Food can be imported from outside the Atoll or grown on Eneu Island.

CONCLUSIONS

1. PEOPLE LIVING ON BIKINI ISLAND MAY RECEIVE A RANGE OF EXPOSURE ABOVE AND BELOW THE STANDARDS DEPENDING WHERE THEY LIVE AND THE SOURCE OF CERTAIN FOODS THEY EAT.
2. EXPOSURE ESTIMATES FOR PEOPLE LIVING IN THE INTERIOR OF BIKINI ISLAND ARE HIGHER THAN FOR LIVING IN THE PRESENT 40 HOUSES.
3. GROWING ALL FOODS ON BIKINI ISLAND GIVES DOSE ESTIMATES ABOVE THE ANNUAL STANDARDS FOR BOTH WHOLE-BODY AND BONE MARROW AND WELL ABOVE THE 30-YEAR STANDARD FOR WHOLE-BODY.
4. IMPORTING A NUMBER OF FOODS THAT ARE A NORMAL PART OF THE DIET OR GROWING THESE FOODS ON ENEU ISLAND IS REQUIRED TO REDUCE DOSE ESTIMATES FOR THE 40 HOUSES TO LEVELS BELOW THE STANDARDS.
5. IMPORTING ALL FOOD IS REQUIRED TO BRING DOSES WITHIN THE STANDARDS FOR HOUSES IN THE INTERIOR OF BIKINI ISLAND.
6. LIVING ON ENEU ISLAND AND GROWING ALL FOODS THERE GIVES DOSE ESTIMATES WELL BELOW THE RADIATION STANDARDS FOR BOTH ANNUAL AND 30-YEAR DOSES. NO RESTRICTIONS ON USE OF LAND OR ON FOOD GROWN ON THE ISLAND ARE NEEDED FOR ENEU.

RECOMMENDATIONS

1. NO ADDITIONAL HOUSES SHOULD BE CONSTRUCTED IN THE INTERIOR OF BIKINI ISLAND OR ALONG THE LAGOON ROAD. THE EXISTING HOUSES ALONG THE LAGOON ROAD MAY BE OCCUPIED IF CERTAIN RESTRICTIONS ARE FOLLOWED.
2. THE ADDITIONAL HOUSES AT BIKINI ATOLL SHOULD BE CONSTRUCTED ON ENEU ISLAND. ENEU ISLAND SHOULD BE THE POPULATION CENTER OF THE ATOLL FOR THE INDEFINITE FUTURE.
3. COMMUNITY FACILITIES PLANNED FOR THE VILLAGE AREA AT BIKINI ISLAND MAY BE CONSTRUCTED TO SERVE THE NEEDS OF THE PEOPLE WHO WILL OCCUPY THE EXISTING HOUSING THERE. HOWEVER, ADDITIONAL FACILITIES SHOULD BE CONSTRUCTED ON ENEU ISLAND, INCLUDING ANY WHICH ARE DESIGNED TO SERVE THE ENTIRE BIKINI-ENEU POPULATION.
4. RESTRICTIONS SHOULD BE PLACED ON USE OF CERTAIN LOCAL FOODS FROM BIKINI ISLAND. THESE RESTRICTIONS ARE AS FOLLOWS:
 - A. FISH, BIRDS, BIRD EGGS -- NO RESTRICTIONS.
 - B. COCONUT -- NO RESTRICTIONS.
 - C. PANDANUS GROWN ON BIKINI ISLAND SHOULD NOT BE USED.
 - D. BREADFRUIT GROWN ON BIKINI ISLAND SHOULD NOT BE USED.
 - E. PIGS AND CHICKENS -- NO RESTRICTIONS PENDING ANALYSIS OF SAMPLES.

- F. COCONUT CRABS MAY BE EATEN ONLY FROM ENEU, AERKIJ, AERKIJLAL, AND BIGIREN ISLANDS.
- G. OTHER FOODS SUCH AS BANANA AND PAPAYA GROWN ON BIKINI ISLAND SHOULD NOT BE USED UNTIL THEY HAVE BEEN ANALYZED AND DECLARED ACCEPTABLE.
- 5. NO RESTRICTIONS ARE NEEDED ON ANY FOOD ITEMS GROWN ON ENEU ISLAND.
- 6. CRUSHED CORAL GRAVEL AROUND THE HOUSES RESULTS IN A REDUCTION OF EXTERNAL EXPOSURE RATES. THIS PRACTICE SHOULD BE MAINTAINED AT ALL HOUSES AND COMMUNITY FACILITY LOCATIONS ON BIKINI ISLAND.
- 7. LENS WATER ON BIKINI AND ENEU ISLANDS SHOULD BE USED FOR AGRICULTURE ONLY. ALTHOUGH IT IS NOT EXPECTED THAT ANY PERMANENT RESTRICTION WILL BE NEEDED ON USE OF ENEU WATER FOR COOKING AND DRINKING, A FINAL STATEMENT TO THIS EFFECT MUST AWAIT LABORATORY ANALYTICAL RESULTS EXPECTED IN OCTOBER 1975.

A REVIEW OF PERSONNEL MONITORING AT BIKINI

As a result of the recent meeting at Kili by Trust Territory, ERDA and Micronesian Legal Service officials concerning restrictions on rehabilitation of Bikini it is apparent that there are several points of misunderstanding in the minds of the Bikini people concerning statements I have made regarding the radiological safety of Bikini. Before reviewing the radiological monitoring obtained on the people living at Bikini I would like to clarify some of the confusion. First, at the time of the Ad Hoc Committee meeting, the visit of the Trust Territory and AEC officials to Kili in 1968 and my visit to the island in 1969, the statements made about the radiological safety of Bikini were justified based on the survey data compiled at that time. Subsequent analyses of personnel monitoring data on the people living at Bikini showed low levels of radioactivity in the people confirming the original conclusions. In all sincerity, I disclosed this as additional assurance to the people living there. Based on these findings I would not hesitate to live in one of the houses on Bikini. I am sad about the statements a few people made about me at the Kili meeting. I have great friendship and respect for the people of Bikini and in no way and at any time have I tried to mislead them. From the beginning there were certain restrictions concerning rehabilitation of Bikini. It is only very recently that radiological survey data has made it necessary to impose further restrictions.

I would like to clear up another point of confusion regarding "medical" examinations. We have never done medical examinations on the Bikini people for possible radiation effects. The reason is that the radiation levels are so low that such examinations are not necessary. For this reason it is wrong for anyone to accuse us of using the people living at Bikini to study radiation

effects. Radiation there is too slight for medical studies to be of interest since no radiation effects would likely be detectable. The urine collection and measurements of the body for radioactivity are not medical procedures and are done by technicians. These measurements are important since they form the basis for reassurance of the people living on Bikini regarding their radiological safety. Though we are not doing medical examinations if our doctors are at Bikini, as in the past, we will always be glad to see, treat and prescribe for any people that are sick - but only at the request of the individual or the health aide. Unless requested by the people, it is not even necessary for our doctors to go to Bikini.

In 1969, personnel monitoring procedures were begun on a group of 30 workmen at a work camp on Eneu Island. By 1972 about 3 Bikini families had moved back (about 50) and also about 25-30 workers and agriculturists. Radiological monitoring at Bikini has been carried out annually since 1969. The size of the population has not changed much since 1973.

In order to assess the radiological hazard the following personnel monitoring procedures have been carried out:

1. Radiochemical analyses on urine samples: (individual 24 hour and pooled samples). These analyses require complicated chemical procedures and are done for us by the ERDA Health and Safety Laboratory in New York City. Such radiochemical analyses have also been carried out on water and local food products.

2. Direct measurement of radiation in the people by gamma spectrographic analysis: To do this tons of radiation-free lead bricks were shipped to the Marshalls and a shielded counting facility set up in one of our air-conditioned trailers and transported to Bikini on our vessel (LCU-Liktanur).

The measurement of body radiation by such analysis is very sensitive and requires complex electronic equipment and personnel highly trained in electronics from Brookhaven National Laboratory.

3. Personnel exposure to gamma radiation: Gamma levels on the island were derived from data furnished by other radiological survey groups.

MONITORING DATA

The results of the personnel monitoring data on people living at Bikini since 1969 are presented in the accompanying tables. The data on urine analyses are presented on Table I. Note that average pCi/liter for Bikini urine compared with Rongelap was for ^{90}Sr 2.5/3.8 and for ^{137}Cs 638/3360. Based on standard guide lines (International Congress of Radiation Protection - ICRP) these isotopes have been well below maximum permissible levels. Reassuring also is the virtual absence of plutonium in the samples. Levels for internally absorbed ^{137}Cs as measured by spectrographic analyses are presented in Table 2. Note the average values for males and females on Bikini compared with those on Rongelap (in nCi/pg body weight) was 1.4/6.4, again well below the maximum permissible levels. The graphs in figures 1 and 2 show that body burden (extrapolated) for ^{90}Sr and ^{137}Cs in the Bikini people are well below the peak values noted in the Rongelap people. The Rongelap people reached a peak of 6-11% of the maximum ^{90}Sr permissible level (for general populations) and of about 22% for ^{137}Cs . These low values for internally absorbed radionuclides is in accord with the fact that the people on Bikini have been subsisting mainly on imported foods. The contribution of gamma radiation to the people on Bikini is somewhat greater than on Rongelap.

Table 3 compares the total bone marrow dose (the critical organ for somatic radiation effects) for people living at Bikini, Rongelap, Utirik, Long Island, New York and Denver, Colorado. Since the people living at Denver have a considerably higher natural radiation and medical, dental contribution, the exposure to the people living there is probably higher than people living on Bikini. The estimated dose to people on Long Island is somewhat less than Bikini doses, also it might be noted that many thousands of people living in areas of South America and India are exposed to higher levels than indicated for Bikini due to high thorium content of the soil. There have been no reports of increased cancer or other illness in Denver or these other high level populations that might be related to their increased radiation exposure.*

More recent data from radiological surveys last June at Bikini showing higher than expected radiation levels in the interior of Bikini and higher levels in pandanus and breadfruit have resulted in some further restrictions on the future living patterns of the Bikini people. At the time of the Ad Hoc Committee meeting it was not known about plans for building houses in the interior of Bikini Island. Recommendations to put the first village and food crops on Eneu were not followed, nor were the recommendations to remove topsoil from planting sites of pandanus and breadfruit on Bikini followed. The recommendation for the addition of powdered milk to the diet of the people is being implemented. The restriction regarding consumption of pandanus and breadfruit may eventually be removed following investigation on growth of these plants at Eniwetak. Table 4 shows results of analyses of water samples from Bikini. Based on these findings the well water is in the permissible range. Catchment (rain) water is very low in activity. With the

* There have even been reports that the cancer incidence is lower in the Denver people.

construction of new cisterns and mending of leaking ones there should be ample catchment water for drinking and cooking. Consumption of marine life offers no radiation problem. Coconut crabs (see Table 5) appears to be high enough in activity to be avoided. They are quite scarce in any event. Further analyses of local products (pigs, chickens, vegetables, etc.) have not been completed. However, it is reassuring that the present consumption of available local foods and ground water based on these findings, have not raised body burdens of radionuclides above the low levels reported.

The direct measurement of radiation levels in the people living on Bikini is the critical test of radiological safety. The exposure of the people there, based on the present living pattern, are in the permissible range and as pointed out lower than some other communities in the world. As was pointed out radiation exposure is so low on Bikini that medical effects would not be discernable in this population (see ERDA letter of June 27, 1974 from Mr. J. Liverman to Mr. Chips Barry for estimated effects). We believe that continuation of personnel monitoring is important, however, to maintain a close check on the radiological status of the people. Also negative findings are important reassurance for the people living there.


Robert A. Conard, M.D.

Sept. 19, 1975

RAC:im

TABLE 1.

Radiochemical Analyses of Coconut Crabs From Bikini (Data in pCi wet weight)

Year	Wet wt., g	% Ash	g Ca per kg wet wt.	⁹⁰ Sr	¹³⁷ Cs	²³⁹ Pu	²⁴⁰ Pu
1970	1161	23.3	81	23,000	11,800	0.06 ± 50%	1.5 ± 10%
	1930	18.5	61	24,800	14,800	0.001 ± 100%	0.07 ± 37%
1971	1812	17.8	60	132,000	11,400		
	1827	21.5	72	412,000	8,600		
1973	1190		63.5	45,700	9,200		
				X(23,360)	11,176		

TABLE 2.

Radiochemical Analyses of Well Water From Bikini (Data in pCi/liter)

Year	Sample	Vol., ml	⁹⁰ Sr *	¹³⁷ Cs **	³ H	²³⁹ Pu
1971	"good well"	1830	6.0 ± 17%	600 ± 1%	770 ± 40%	0.04 ± 2%
	"bad well"	1830	25 ± 3%	850 ± 1%	1040 ± 30%	0.05 ± 2%
	*good well (closed)	1810	103 ± 2%	1044 ± 1%		0.058 ± 1%
	"good well" (opened)	1980	125 ± 3%	818 ± 1%		5.76 ± 5%
	drinking water (camp area)	3580	0.46 ± 4%	1.53 ± 8%		0.004 ± 16%
1972	well water	1000	15.4 ± 9%	800 ± 1%		
	drinking water	1960	0.61 ± 6%	1.8 ± 8%		
1973	new well	60	52	600		0.38 ± 40%
	B-1 well	225	11	724		0.08 ± 50%

* MPC 4×10^{-6} μ Ci/ml

** MPC 2×10^{-4} "

TABLE III

Estimated Dose to Bone Marrow (mrem/yr)*

USA

SOURCE	BIKINI	ENEU	RONGELAP	UTIRIK	USA	
					DENVER**	LONG ISLAND
Natural	80	80	80	80	325**	190
Medical - Dental	0	0	10	10	70	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 collected to date

** As high as 480.

TABLE 4
Radiochemical Analyses of Urine (Data in Average pCi/liter)

Year	No. in group	Av. vol., ml	Av. Ca, mg/liter	⁹⁰ Sr	¹³⁷ Cs	²³⁸ Pu	²³⁹ Pu	^{240,241} Pu
Rongelap								
1970	20	895.5	152.4	3.5	2700.			
1971	15	534.5	336.1	3.7	2400.			
1972	18	460.8	120.3	2.4	2600.			
1973	11	249.6	247.2	6.5	4600.			0.21
1974	14	557.9	706.8	2.8	4500.			
				\bar{X} 3.6	3360			
Utirik								
1974	11	542.5	734.9	1.3	1300.			
Bikini								
1970	<i>Pooled</i>							
		Urine G	1100.0	120.0	1.2	0115.	0.003	0.003
		Urine M	930.0		2.2		0.013	0.020
		HASL* control	3000.0	160.0	1.9		0.015	0.024
		HASL control	1000.0		1.0	0012.	0.003	0.003
					1.6		0.014	0.022
1971	Pooled		2670.0	84.5	1.7	0183.		0.004
1972	Pooled		2700.0	204.0	4.2	0910.		
1973	14		293.9	173.5	6.7	1500.		
1974	11		141.4	310.0	2.0	1100.		0.02
(Spring)					2.5	638		

*US AEC Health and Safety Laboratory, New York, N.Y.

TABLE 5
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	4.1 (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)
8 NL med. team	4	2.93	0.0352 (0.0134-0.0791)			

* MPC 43 mCi/kg.

BODY BURDENS - STRONTIUM-90
(BASED ON RADIOCHEMICAL URINE ANALYSES)

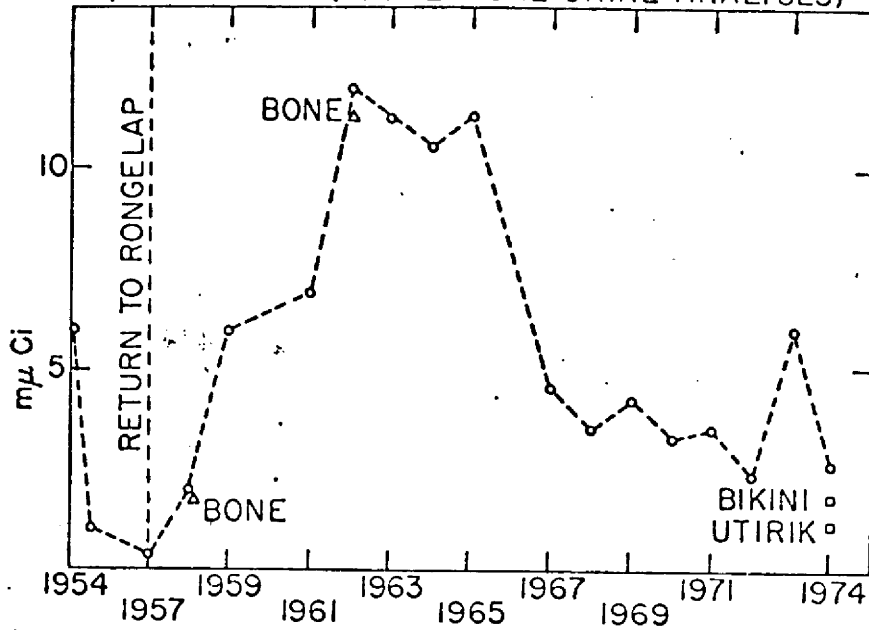


Fig. 1

BODY BURDEN GAMMA EMMITERS-
WHOLE BODY GAMMA SPECTROSCOPY

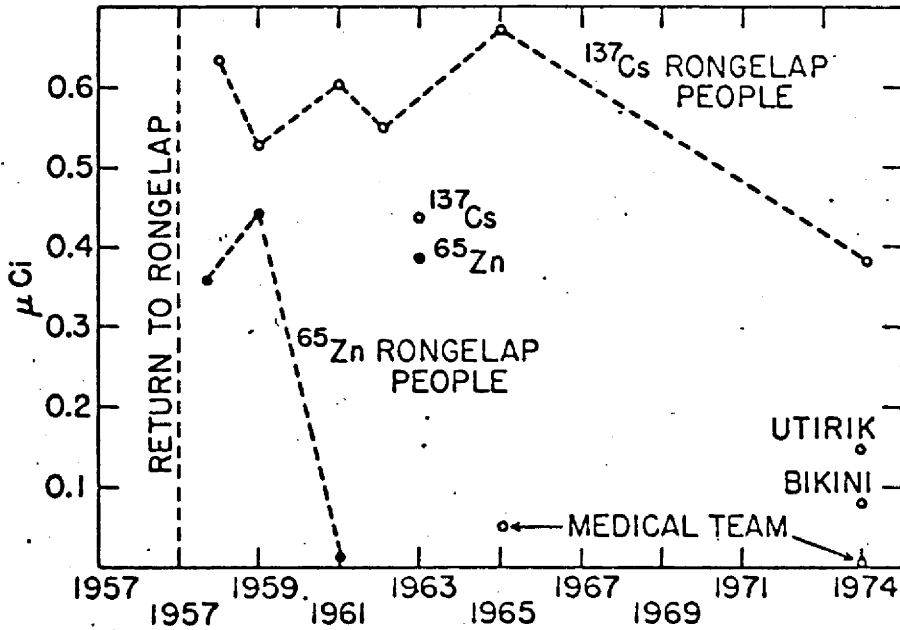


Fig. 2

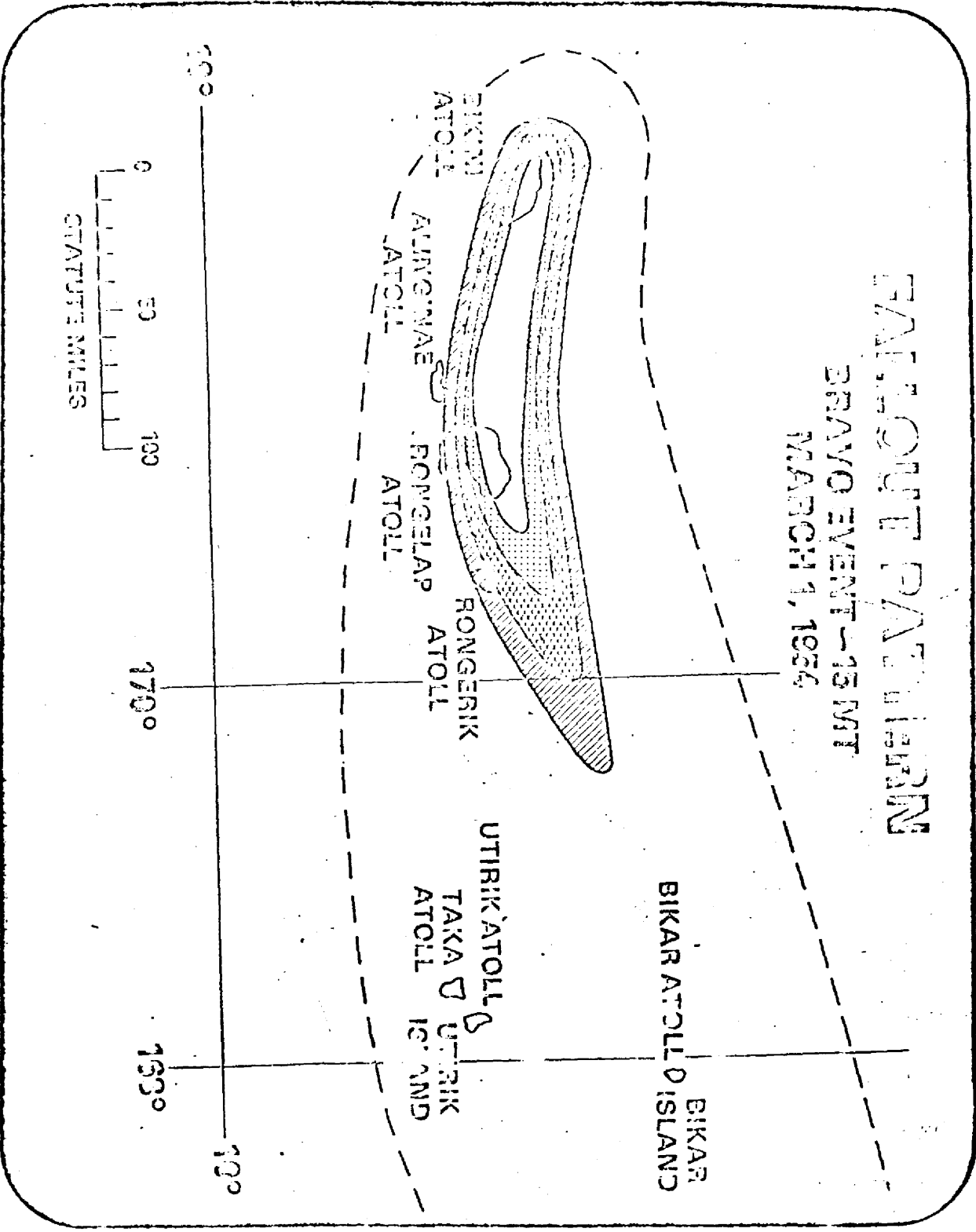
APPENDIX C

PROBLEMS FROM PACIFIC WEAPONS TESTING

1. RADIOACTIVE FALLOUT THROUGHOUT PACIFIC ISLANDS.
2. RADIATION INJURY TO RONGELAP PEOPLE.
3. MAINTAINING RADIATION DOSE OF BIKINI AND ENIEWATAK PEOPLE WITHIN STANDARDS.
4. GEL AND EXPLOSIVES - SINK IN LAGOON BOTTOM (U SHIPS).
5. CONSEQUENCE OF RADIOACTIVE DEBRIS ON ENIEWATAK CREATORS.
6. RADIOACTIVITY IN COPRA AND COPRA PRODUCTS.

EMERGENCY ROUTE MAP

BRAYO EVENT - 15 MT
MARCH 1, 1954



FALLOUT FROM PACIFIC TESTS

EVENT	LOCATION	DATE	ISLANDS AND ATOLLS IN FALLOUT AREA
SANDSTONE - ZEBRA	ENIWETOK	5/48	AILINGINAE, RONGELAP, RONGERIK
IVY - KING	ENIWETOK	11/52	UJELANG
CASTLE - BRAVO	BIKINI	2/54	AILINGINAE, RONGELAP, RONGERIK, TAKA, LIKIEP, UTIRIK, BIKAR, WOTHO, JEMO, AILUK
CASTLE - UNION	BIKINI	4/54	AILINGINAE, RONGELAP, RONGERIK
CASTLE - YANKEE	BIKINI	5/54	AILINGINAE, RONGELAP, RONGERIK, BIKAR
HARDTACK - MAGNOLIA	ENIWETOK	5/58	UJELANG
HARDTACK - MAPLE	BIKINI	6/58	AILINGINAE, WOTHO

NEED FOR DETAILED SURVEYS

- BIKINI SURVEYS USE 1960 TECHNOLOGY
- MODERN TECHNOLOGY IDENTIFIES SPECIFIC HISTORIES
- KNOWLEDGE FROM KENEWEAK SURVEY
- LOCATION OF HOUSES AND CROPS
- PRESSURE TO MATCH KENEWEAK SURVEY
- REQUEST FOR STATUS OF BRAVO FALLOUT ISLANDS
- LIKELY TERMINATION OF TRUST AGREEMENT
- U.S. OBLIGATION TO DOCUMENT CONDITIONS

AERIAL RADIOLOGICAL SURVEY

- FASTER
- CHEAPER
- BETTER DEFINITION OF CONTAMINATION ZONES
- SOFT COPY DEFINITION
- COMPLETE COVERAGE OF ISLANDS AND REEFS
- UNIFORM AUTOMATIC DATA HANDLING

