400171

United States Government

Department of Energy

MEMORANDUM

H25

DATE: JUL 22 1985

REPLY TO ATTN OF: EH-132

SUBJECT: Department of Energy (DOE) Involvement in the Evacuation of Rongelap Atoll

TO: Edward J. Vallario, EH-132

The evacuation of Rongelap Atoll appears to be a totally senseless action unless the role of the Department of Energy in this decision is understood. DOE's involvement could subject this Agency to severe criticism both nationally and internationally.

On May 21, 1985, the first of about 300 people left Rongelap Atoll claiming their atoll was not a safe place to live. The population was transported to Kwajaleiu Atoll on the Greenpeace Ship Rainbow Warrior, the ship that was sunk in New Zealand about a week ago. The Rongelap people have been disillusioned by what they perceive as contradictory advice from DOE on radiation protection, by monitoring results from a DOE contractor indicating that whole body exposures have increased at Rongelap Atoll (in a related finding, exposures also increased at Enewetak Atoll), by a high exposure prediction in a Marshallese/English booklet provided by DOE, and by DOE's failure to provide answers to questions on their total radiation exposure experience. While there were undoubtedly other political and legal forces at work, the sum total of DOE's failures is a substantial indictment. The DOE unnecessarily gave the Rongelap people radiological justification to support their leaving Rongelap.

After almost 10 years of internal strife over who would manage the programs in the Marshalls, these responsibilities were reassigned from the Office of Environmental Protection, Safety, and Emergency Preparedness (EP) to the Assistant Secretary of Defense Programs (DP), and more specifically to the Deputy for Pacific Operations (DPO) of the Nevada Operations Office (NV) (see Attachments 1 and 2).

The complaints about contradictory advice appear to refer to advice presented by the DPO at a meeting at Majuro Atoll in December 1982. This advice was confusing and non-specific. The Rongelap people were told that they should make their own judgments on radiation protection. They were also told that

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EP files

[redacted]

they could eat food that had been restricted for many years (see Attachments 3 and 4). To support these judgments, information on radiation protection fundamentals was also provided in a Marshallese/English booklet with the intention that the people could make educated decisions (see Attachment 5). Risk estimates, rather than radiation standards that were important in the past, would be used for such judgments.

Whole body exposures on Rongelap Atoll measured by Brookhaven National Laboratory (BNL) increased significantly during 1982 and were still elevated in 1983. The relaxing of a restriction on use of certain food from more contaminated islands at Rongelap appears to be a contributing factor. In the past, this restriction was stated clearly as a prohibition (see Attachments 3 and 6).

The high exposure prediction for Rongelap Island residents of 400 mRem/yr in the Marshallese/English booklet (see page 39 of Attachment 5), appears to be an erroneous value not supported by whole-body monitoring. Such a high chronic exposure level would not be acceptable. The whole-body measurements support an exposure less than 100 mRem/yr, provided the food restriction remains effective. This latter exposure is within current standards. To my knowledge, this error has never been corrected. Attachment 7 contains acute and chronic exposure estimates and Attachment 8 contains relevant radiation standards.

Questions about past radiation exposures on Rongelap have remained unanswered for more than 2 years (see Attachment 3). Though not requested in writing, it is reasonable to assume the Rongelapese need a discussion of:

1. The possibility of additional delayed health effects for acute exposures received in 1954.

2. The additional chronic exposures received since 1957 for the highly exposed individuals.

3. The chronic exposures since 1957 for those not in the high exposure group.

4. A comparison of exposures, past and future, with radiation protection standards.

Medical followup and advice has been very good for the Rongelapese, but not providing them information on their total radiation exposure condition, information that is available, amounts to a coverup. The questions the Marshallese have raised

about radiological conditions in their atolls have not been answered satisfactorily by DOE's Marshallese/English booklet that evaluated radiological conditions in the Marshalls in terms of risk and cancer fatalities instead of using radiation standards. The Marshallese, to my knowledge, have never argued against use of standards or complained that they were not applicable. This booklet may be a factor of confusion rather than education for the Marshallese.

The full dimension of the technical aspects of this problem in the Marshalls and the reasons for DOE's loss of credibility with the Rongelapese, are not well known within DOE. Dissatisfaction with the advice they have received reached serious proportions in April 1983 when a party of DOE visitors were interrupted in a meeting with the people on Rongelap by an irate citizen and had to leave the island. The meeting on Rongelap was never resumed and the people's anger and mistrust (of DOE) has been allowed to fester.

Many of us who have worked in the Marshalls have been frustrated by the burdensome dietary restrictions, and we have seen the hardships caused by the loss of use of fallout contaminated islands. All of this is being imposed by application of radiation protection standards mandated by Washington bureaucrats. Right or wrong, I have argued that exposures not found acceptable for the U.S. population are also not acceptable in the Marshalls, and that radiological criteria should be the same from atoll to atoll. This, of course, is not compatible with the idea that the population of each atoll should make its own judgment. Short of acting against Federal policies, or having the Department of Interior (DOI) mount a successful effort to get an exemption from these policies, the DOE appears to have no valid alternative but to continue to apply current radiation standards in the Marshalls. Turning radiological judgments over to the people was a drastic unilateral action. This appears to have been a profoundly disturbing experience for some Marshallese and an action that undermined confidence in DOE and in the United States Government. The new advice that was obviously intended to give freedom of choice has backfired. The Rongelap people followed the advice they were given, made the judgment not to accept the risk, and left their atoll.

What has been written about the Majuro meeting (who said what and why) is not so important as what the Marshallese heard and comprehended. The transcript clearly indicates that the DOE spokesman's answers to questions were not compatible with past DOE advice and that the Marshallese recognized this and objected (see Pages 49 and 50, December 9, Attachment 3). I reported this problem to DOE staff and to management of Operational Safety--nothing happened, and the Rongelapese have underscored this with their rejection of DOE visitors and with their later evacuation. Still nothing was done to correct the errant advice and to respond to their questions. Now "U.S. government officials" are criticizing the evacuation and are quoted in the press as stating unequivocally that Rongelap is safe, a question the DPO was unwilling to agree to in Majuro (see Attachment 3, December 9, Page 28, and Attachment 9).

Even though DOE's credibility with the Rongelap people may be zero, and whether the compact is approved or not, I suggest DOE has an obligation to correct obvious numerical errors and to clarify its radiation protection policy in the Marshalls. In the past that policy was to evaluate radiological conditions against radiation protection standards, to recognize that the DOI is the agency responsible for health and safety in the Marshalls, and to look to DOI for any decisions related to health and safety in the Marshalls, and for communication of such decisions to the Marshallese. DOE looks to the Environmental Protection Agency (EPA) and to DOI, not to the Marshallese, for decisions on radiological issues (see Attachment 10).

I have identified the problems in the Marshalls but there are also contributing factors within DOE in the management of programs:

1. No approved program plan has ever been issued for DOE's radiological protection efforts in the Marshalls.

2. Coordination of radiological protection issues with Headquarters' safety staff is almost non-existent.

3. Less than adequate utilization of DOE technical resources.

4. No liaison with EPA since 1982.

5. No independent overview.

Attachment 1

.1. #7256

Office of the Assistant Secretary
for Defense Programs

3/24/83

To: Bob Davies - EP

Per our previous discussions.
This is on the way up
the system, but I wanted
to give you a heads up.

Troy

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Not to cite a lot of problems without any suggestions, I recommend that a white paper be developed that clarifies DOE's position on radiation protection policy as applied to the Marshalls along with answers to the questions on the total radiation exposure experience on Rongelap. A good source of radiological data and advice on these exposures and their implications is available at Brookhaven National Laboratory (see Attachment 11). Translation into Marshallese would be needed, the Environmental Protection Agency should be informed, and the paper provided to the Marshallese through DOI.

I further recommend that there is a valuable lesson in the creation of this situation that needs to be told. Regardless of interests that were served, and certainly not those of the Marshallese, from a health physics viewpoint, transfer of a unique radiological safety program to DP/NV, a program that required a high degree of coordination and cooperation between DOE, DOI, and EPA at the Washington level, was a mistake. DP's interest in the program appears to have been primarily the altruistic interests of one person who wanted to change radiological rules used in the Marshalls, rules that were causing hardships through loss of use of contaminated land. EP's ignoble interest in transferring the program to DP was apparently to get rid of a hot potato, and had nothing to do with Safeguard C. The result is a new low in the annals of radiation protection standards implemention that should serve as a warning to those who follow narrow self-serving interests.

Tommy F. McCraw

Tommy F. McCraw
Health Physics
Radiological Controls Division
Office of Nuclear Safety

Attachment

-2- 41256

U.S. DEPARTMENT OF ENERG

memorandum

DATE

REPLY TO ATTN OF DP-224.2

SUBJECT ACTION: Marshall Islands Programs

TO The Secretary
Deputy Secretary

Thru: Under Secretary

PROBLEM:

Whether the Secretary should transfer the Marshall Islands programs from the Office of Environmental Protection, Safety, and Emergency Preparedness (EP) to Defense Programs (DP).

URGENCY:

A prompt decision is recommended so that the programs will continue uninterrupted during status negotiations between the United States (U.S.) and the government of the Marshall Islands concerning the Compact of Free Association.

BACKGROUND:

The U.S. tested 66 nuclear weapons at the Pacific Proving Grounds of Bikini and Enewetak atolls in the Marshall Islands from 1946 to 1958. These islands sustained damage from the detonations as well as from radioactive contamination. The peoples of these two atolls were relocated by the U.S. Government to other areas in the Marshall Islands prior to the tests. The resulting social and technical problems in the Marshall Islands are the legacy of the atmospheric test program.

Starting in early 1972 with the gradual resettlement of Bikini, the involvement and responsibilities of the Department of Energy (DOE), then the Atomic Energy Commission, began to escalate. The DOE was tasked to conduct a radiological resurvey of Bikini (spring 1972) and to conduct a massive radiological cleanup survey of Enewetak. During this same time, Micronesian Legal Services Corporation (MLSC) challenged both the DOE and the Department of Defense in Federal court as the legal representative of the Enewetak people.

The master plan for Enewetak resettlement, a major radiological resurvey of Bikini, the Bikini lawsuit brought by MLSC, the acquisition of the DOE Marshall Islands Research Vessel, Liktanur, all occurred in 1974-1975. From 1975 to 1977, the Brookhaven National Laboratory (BNL) medical program, established in 1954 in response to the fallout victims of Rongelap and Utirik atolls, began to expand. An agricultural research program was established by Lawrence Livermore National Laboratory (LLNL) for the DOE at Enewetak. The Mid-Pacific Research Laboratory (established in 1947) was placed under Nevada Operations Office (NV) administration.

-3.#1256

From 1977 to 1980, the DOE Enewetak Radiological Support Project provided the technical expertise for the Defense Nuclear Agency's $100 million cleanup project. While this was in process, DOE/NV was tasked to organize and conduct a radiological survey covering 288 islands (over 250,000 square miles of the Northern Marshalls).

DISCUSSION:

When the DOE was created in 1977, responsibility for the Marshall Islands' programs was assigned to EP. With the exception of the professional medical capability, the technical resources that are in use in the Marshall Islands are largely weapons-program related, and most of the DOE's logistic and support base is common to the Safeguard "C" readiness program. Safeguard C is one of the four safeguards in the Nuclear Test Ban Treaty and requires the U.S. to maintain the capability to resume atmospheric testing. In fact, much of the field effort in the Marshall Islands is an exercise of the expeditionary capability which is an important aspect of Defense Programs' Safeguard "C."

DP should assume the policy direction and control of the DOE's Marshall Islands activities as a single coherent program. These activities include the management of the research vessel, the Mid-Pacific Research Laboratory, the medical support programs, the funding and guidance for LLNL to accomplish the terrestrial environmental studies and the marine program, and the funding and guidance for BNL's environmental studies and medical programs. These activities are funded at $4,151,000 for FY 1982.

RECOMMENDATION:

That the Secretary approve the immediate transfer of the Marshall Islands' programs to DP from EP with the FY 1982 program appropriation of $4,151,000.

NEXT STEPS:

1. Ensure FY 1983 monies, as appropriated by Congress, are transferred to DP.
2. Establish and fill a full-time equivalent position to provide program management for DP.

Originally Signed By
Herman E. Roser

Herman E. Roser
Assistant Secretary
for Defense Programs

APPROVED: _____

DISAPPROVED: _____

DATE: _____

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DP-224.2:KHarris/jce:252-5553:3/16/82

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Attachment 2

MAY 20 1982

NOTE TO: General Hoover (Signed) Thomas F. Cornwell for

FROM: John E. Rudolph

SUBJECT: Status of Marshall Islands Program Transfer

Mr. Roser, Assistant Secretary for Defense Programs (DP), Mr. Trivelpiece, Assistant Secretary for Energy Research (ER), and Mr. Vaughn, Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness (EP) met May 13, 1982, to discuss the transfer of the Marshall Islands programs from EP to DP.

- o The ER position is that they do not want to manage the programs but would be interested in contributing expertise and some funding.
- o Mr. Vaughn sees EP as an oversight office and did not have a prepared position with regard to the Marshall Islands.
- o DP considers the programs vital to the U.S. Government.

It is Mr. Roser's opinion that over the years the programs have been poorly managed by EP. If DP gets the programs, a Headquarters task force will be immediately established (with representatives from EP and ER) to determine future program policy and direction.

Mr. Vaughn will have further discussions with his staff this week in order to develop an EP position. The action memorandum is still in Vaughn's office and once he has staff discussions, he will either forward the memorandum to the Secretary or have further discussions with DP. We will keep you informed.

DP-224.2:KMorris/jcc:353-5553:5/19/82

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Attachment 3

TRANSCRIPTION OF MEETING BETWEEN DOE REPRESENTATIVE AND GOVERNMENT OFFICIALS OF THE REPUBLIC OF THE MARSHALL ISLANDS AT MAJURO

DECEMBER 8 AND 9, 1982

Note: The attached pages were selected from a 99 page transcripton of a tape recording prepared by Dr. William Bair, of the Battelle Pacific Northwest Laboratory.

Male Person: How much more have we got to cover?

Buck: We are ready to start Chapter 5 and Chapter 6 before the maps. We weren't going to go on to each individual map.

[Alice continued presentation in Marshallese.]

TAPE 3, SIDE 2

Marshallese: I am asking about cancer and birth defects, but primarily about cancer. How many cancers have appeared in the Rongelap population since the time of the testing of the bombs?

Bair: I don't know.

Marshallese: So, what is the meaning of 0.1?

Bair: That means that if people, that if people receiving radiation during the next 30 years, not in the past, but during the next 30 years, we would..., if they receive radiation on Rongelap for the next 30 years, we would not really expect any cancers to be caused by the radiation. But we are not saying there isn't a chance that there might be one. The risk is, I don't know how to...

Bair: One possible way; if there were 10 times as many people on Rongelap, if there were 2,000 people today and they lived and had children for the next 30 years, then there might be one person (receiving) having cancer caused by radiation. There might be.

Marshallese: If your figures here reflected the period from the time that the bombs were tested for a 30 year period, would you be able to make an estimate in figures that way?

Bair: If I knew the radiation doses, if I knew how much radiation people received, yes. But I don't know how much radiation people received.

Marshallese: Could you refer to the report of all the teams that have come and visited us and taken samples and examined us and gathered data? Could you not look at that? We have been visited.

Bair: It might be possible to estimate how many but it would be very difficult because you also have to know how much food people ate during that period of time. I have no way of knowing.

Cowan: You make assumptions based upon MLSC and the Battelle Northwest diet to make these projections. Couldn't you use the same diet as the basis to make projections based on data (unclear)?

Bair: It is not a Battelle diet it is Brookhaven diet.

Cowan: Okay, whatever diet, you had to use some basis of food intake to make these projections?

Bair: You could do that.

Marshallese from Rongelap: I think that we have had a lots of data gathered in our population at Rongelap and if you went to the labs in Seattle and looked into this, probably that could be determined.

Bair: I think Brookhaven is making a determination on the thyroid; the radiation, the amount of radiation the thyroid(s) of the people have received. I don't think their report is finished yet.

Marshallese: I'm just wondering. As we've already asked, seriously I wish that you could tell how many people might have died from cancer from the time of the testing until now rather than this figure which projects into the future.

Ray: I think the answer, an answer to that question is, yes, a study could be done. Our data and amount of information that we would have about those earlier days would not be nearly as complete as what we have now from the 1978 time. Nevertheless some estimate could be made. That estimate still would only be able to indicate the likelihood that, of those people who have died of radiation relateable diseases, some number might be attributable to the radiation.

Marshallese: I feel that this whole book is affecting or applicable to the coming generation, the young children, because in the next 30 years my age group and older will be gone. So this isn't really a report for us, it is maybe a report for them rather than us. And, also, that I detect that the results of the information in this book is reporting a time that has much less damaging effects, in fact, it almost looks rather clean in comparison to the number of years which are not included in this book. And, so from my point of view, I don't know that this is..., I would much prefer a book that gave the entire picture rather than half the picture and the better half at that. In fact I hesitate to go forward and say much about this book.

Ray: Well, I would just like to say again, the purpose of this book, that purpose was to provide a basis for informed decisions about future actions. That's the sole purpose of the survey, to determine whether there should be recommendations made for future actions that would protect people in the event that we found radiation levels that were of concern. That was the commitment that we made some time ago, for this particular purpose. This is not the whole story, you are absolutely right. (and) There are many reports published that deal with the past. Those are available and as I have said earlier, if there are specific questions I am sure that we would be willing to help with converting those, translating those, into your language so that they are understandable. That wasn't the purpose of this survey. It was to guide future actions.

Ray: He was asking about Jorkan. Do you have it?

Robison: We, no we don't have it. (background discussion) We didn't calculate the dose for that.

Buck: Jorkan is down from Melu, two islands.

Robison: Yeh, the only thing. Let me look. We didn't calculate a dose for that island because that was never given to us as one of the residence islands. So I am trying to find here...if we even have... I don't even have that name. (Background discussion: No, you didn't do that one. You did Melu.) We have no data on that one. Except we have the external gamma data, which I can easily tell, it's it's like Melu, but I would have to look at that data first.

Marshallese: The northern part of Rongelap is the place that they gather a lot of their protein sources, you know, meats from animals. (Alice: You say what?) Pigs, crabs, birds. Even though they don't live there they like to go and gather these kinds of things from there.

Buck: Okay, let's have the slides that show these comparisons. And maybe that's sort of a good summary. I'm not sure we were going to pass these papers out.

[Alice continued presentation in Marshallese.]

Marshallese: Do you have a safety standard then for these? Where does the standard come with reference to these figures?

Bair: One comparison is that people in the U.S. who just get radiation from background would get about 2500 in 30 years. Which is the number right there.

Buck: For any part of the body?

Marshallese: Now I would like to also, then, repeat the question that I asked yesterday. Does this indicate that these atolls are all within safe standards for people to live and eat the food that is grown on those atolls?

Ray: We do not normally try to characterize a location as safe or not. It is a matter of amount of risk and the amount of risk is set forth here.

Marshallese: It seemed like yesterday the statement was said that actually the amount of radiation in the Marshalls is similar to that of other places in the world. And so that would indicate that, well people live fairly freely in their places, other places in the world, and if we are like them, that it seems to me that we ought to have that same description of our conditions, that it is safe to be there. And yet, no, we hear that actually we shouldn't eat certain things. So you seem to be talking double talk. It seems like you say in one statement, we are like other places, and in another statement you are saying, no it is different.

Ray: What we are saying is that with the exception of Bikini Island, the, all of the locations we have studied, Bikini Island rather than atoll, all of the locations we have studied would meet the standards, stay within the standards living in those places. However, there are places where choices can be made to keep the radiation exposures of people lower, even, by, for example, restricting the intake of food from the northern islands of Rongelap. That seems a smart thing to do if there is an alternative and there is.

Senator John: Thank you for your reply and it seems like now that's a little different from what I understood you to say yesterday. It seems like yesterday you were saying everything was fine and dandy and now you at least say, separated Bikini island out. I would like to now ask about Enewetak. I would like to ask about that if you are going to talk about Enewetak. And then I would like to be heard again after he's finished.

Ray: All right, Senator.

Senator John: I was interested to hear you say that the island of Bikini is different from all of the other islands in these atolls. But now I want to ask pointedly, face to face, how about Runit and Enjebi?

Ray: You are correct, Senator, that I should have mentioned Runit because it is a special case. I was thinking of it as an island that is not now and has not been intended to be, for some years, a residence island. It certainly is an exception. It's not quite the same situation as Bikini but all of us agree that residence on Runit would not be advisable. As to Enjebi, Enjebi is, has been reported to the people of Enewetak, and the, and the dose expectations for living on Enjebi have been reported. It falls within this same range, the range of numbers that we're talking about here. Bill you can help me with what they are.

Robison: It is very near the guidelines. It is right around the guidelines for that island.

Ray: Enjebi is very close to the guideline, very close to the standards.

Buck: Close to the standard?

Ray: Close to the guidelines.

Senator John: Okay, well, I would really like a clarification on Enjebi then, since I have heard what you have just said. I understand, that, I know that there has been plenty of breadfruit planted for experimentation, for observation at Enjebi and we are in a situation now where we're hungry. We have, and there are plenty of ripe breadfruit at Enjebi. Would I have your recommendation, permission to notify my people that they can eat breadfruit from Enjebi, that breadfruit which is grown there and that was in a test situation but is ripe and ready to eat and we need it? We are out of food at other places, so can we go to Enjebi and harvest breadfruit there?

Ray: Well, I think the answer is clearly, yes you can. But if there are substitute locations, substitute sources which would have lower radiation levels we would recommend that those be used.

Senator John: Well, thanks, I'm, I'm glad to hear that, that we can use those breadfruit from Enjebi. But it seems funny that you add a "but" right away as soon as you say that, when in actuality we've had a storm hit us and we only have very young trees planted on other islands in the atoll and, even though they weren't full grown, they had produced some breadfruit, sort of out on their trunks almost, not even on the ends of the limbs where they usually appear. But they were there, but these have been blown away. We really can't harvest breadfruit from other islands, but they are at Enjebi. We got good breadfruit at Enjebi and, so, we don't have a choice. You say if we had that choice you would recommend using some other. Well, that choice isn't there, but we do have those breadfruit there, so, I'm glad to hear, then, that you say we can use those.

Ray: That's correct. I would like Bill Robison to comment on that.

Robison: Yes, Senator, we planted the breadfruit and pandanas and coconut trees on Enjebi, as you know, as part of our program in order to better evaluate Enjebi Island. As you know there were no foods available for us to directly measure and we had to predict what we thought the concentration would be in food products at Enjebi by knowing what was in the soil. So we planted the crops, so that we would have samples to directly measure and, therefore, we could make a much more precise estimate of the doses on Enjebi. And therefore, we need those for samples, and it takes quite a number of breadfruit and quite a number of pandanas fruit and a quite a number of coconut in order for us to be able to make the analysis we need. So we planted those for a purpose and we do need them for a purpose. We do not, we do not need them all but we do need...

Buck for the Marshallese: Oh, I was just going to say, the meaning of your reply, is leave them for us. Don't use them because we need them.

Ray: Well, I'm just saying that we do need a certain number of breadfruit and pandanas in order to, to make better evaluations of Enjebi Island and if they are all gone then we can't do that. So we need some of them.

Senator John: I would like there to be a supplement report or additional information given than what is in the book and on this, this matter. Where in each island or atoll is it best to harvest or have food grown and what are the amounts of certain foods that would be advisable for us to feel free in eating as opposed to other amounts. Are there some guidelines like that, because that information isn't given here and it seems very important for us to know?

Ray: And that is precisely, that is precisely one of the reasons that Bill Robison needs to continue the experimentation on Enjebi. That is not exclusively applicable to Enjebi. It's learning what occurs in an island for application to other locations, as well.

Senator John: Well, thank you for your reply. I just am still kind of marveling at the fact that you have quite extensive data in this report from atoll to atoll but I really don't see any concrete recommendations that you have made regarding people's diet. And it seems like that is very important for us to know. How much breadfruit, how much pandanas?

Robison: Well, I think again I can repeat what was said earlier with the exclusion of Bikini and the northern end of Rongelap there is no need to worry, I mean you can eat breadfruit and pandanas and coconut from any of the islands in any quantity from the other atolls. The doses we predict from that are very low and like we said are no different than, than exposures that other people get throughout the world.

Marshallese: Your number 4 on this map, ...it seems like yesterday you said everywhere is fine, permissible for people to live and take their food

from every place, any place on the map and of course now you are saying well the northern part of Rongelap would be treated differently and Bikini island itself. Well, we see other fours around and so I am confused by the information you are telling me right now. It seems like it has changed from what you said. Yesterday, it seems like it was fine anywhere, now you are saying, well, anywhere but those places and yet that doesn't correspond to what the map reflects. What does 4 here mean? Is four all right or not all right?

Robison: Well, we didn't say yesterday that it was okay to use foods from everywhere. That was not what was said. I am saying now that except for the northern part of Rongelap and Bikini, that the other atolls that were part of the survey, they're fine. I mean you can eat all the breadfruit and pandanas that you want from those places and the doses we estimate are very low. The "four" numbers you see, once again remember, Phil, that designates a range and it doesn't mean that an island that has a 4 is necessarily the exact same number. It just means that they are in a range somewhere and they can be different.

Senator John: I have further questions, later on, but I will defer now to others and I am just concerned though, too. I feel I am a bit confused and therefore I am fairly certain that people on the outer islands will be perhaps as confused as I am and, even more, with this kind of explanation that we are hearing.

Buck: There is a hand over there.

Ray: I wanted, if I may, to go back to Senator Ishmael John's, question about Enjebi and I want to leave that. Recognizing that you do have a problem because of the recent storm, and because things are not yet producing on the southern islands, we would not recommend against your supplementing the diet on the southern islands by some foods taken from Enjebi. On the basis of any radiation concern we would not recommend

against that, or any health concern. But we would plead with you, to not destroy the 8 years of work that has gone into trying to understand what's going on there by, by taking all of the crops off Enjebi.

Senator John: May I reply to that? Well, then, I just want to remind you that the first part of this year, I believe, DOE sent their ship up, and we had a body count of our population or, you know certain of our people. And some people who had not showed contamination before, or at least a certain amount, that had risen and so we were asked, those people were asked, "Well have you been drinking coconuts from Enjebi?" "Yah!" "Have you eaten some breadfruit from Enjebi?" "Well yes." "Well then that is why your body count has risen." And so look, we have already been told that and now you are saying that we can go do that. And yet that, it is obvious that we are gonna, our body counts are going to rise, because if we go and do that.

Ray: That is absolutely correct. It will rise, you would expect that, and that is one of the reasons we have the whole body counting program, in order that we can anticipate and see before that rise becomes a matter of concern. All of us have a fluctuation in our whole body count throughout our life. This is occurring all the time. I would compare it, Senator, with your doctor who may put you on the scale and weigh you periodically. If he has put you on a diet, I am not speaking of you of course, this would not apply to you, but if your doctor should think that someone was gaining too much weight, he might put him on a diet and make some recommendations to him and then he will periodically weigh him. And if he finds that he is getting too heavy, too fat, he will make some new recommendations. The whole body counting is very much like that. We use the whole body counting to monitor what's happening in the population and the fact that we come back and yes, your number has risen, does not necessarily, does not mean that there is any expectation of illness from this, but it may mean that we would suggest that you try to change your diet some and not let that continue, not let it rise continuously.

Ray: Is there another question over here? Yes, sir.

Ray: It's right here.

Robison: The small one down here.

Buck: E N E J A. And he says there is another one there which we haven't named. Two of them in that area.

Buck: Oh, just that one.

Robison: Okay thank you. I just wondered which one he was speaking of.

Ray: I'm sure we don't have any explanation for that.

(Bair: It's not radiation, Roger.)

Ray: We can say with considerable confidence that there doesn't seem to be any plausible radiation explanation for it.

Marshallese: I am asking regarding an island in the Rongelap atoll and I am to understand that you say that the northern part of Rongelap is hazardous?

Ray: What we have said is, that the foods that might be gathered from the northern islands of Rongelap have radiation levels considerably higher than the foods, similar foods from the southern islands. And that given a choice we would recommend against using the foods from the northern islands as an important part, as a large part of the diet.

Buck: Would you explain what kinds of foods is it that we should steer away from, that are raised in the northern part of the atoll?

(Robison to Ray: I don't think we steered away from any of them.)

Robison: I think we can talk about it just in general terms that if, if you consume breadfruit, pandanas fruit, coconut or coconut crab, or papaya or banana, whatever might be there, if you consume those products from the northern part of Rongelap they will have a higher amount of activity than those from the southern part of Rongelap. The doses we estimate even from those products are identified in the booklet and are below the standards, for example, but if you do consume the products from that end of the atoll, up in the north, you will have more activity in your body than you will if you consume those from the southern part. So we are just saying that you are better off using the ones from the southern half most of the time. That doesn't mean that there can't be occasional use of the northern products if it is absolutely necessary.

Marshallese: I feel that the explanation just given, can be confusing to our people. To say you may eat from those islands, but it would be wiser to have most of your diet come from the south. Because just saying this, that you may eat from those islands, we take to mean you may eat there. And so, people would tend to then go and just indiscriminately take a lot from that, that the word is out that it is all right. The added clause, "but take care," or "it's better to eat more from south," almost confuses the issue. It would better for you to say it is much better for you not to eat those things. Or even to say don't eat them. Because once you say you can but take care, that's where we got a mixed message, and I think that is confusing to have that kind of an explanation offered.

Ray: Well, Senator my doctor tells me that I need not stop eating eggs for breakfast. But he tells me that I would be wise to eat no more than perhaps 3 eggs a week and it is that sort of thing that we are trying to impress here. That, if you have a choice and have an ample diet, adequate food from the southern islands from Rongelap, then in the long run you are better off to not eat foods from the northern islands. At the same time if there is a shortage of food on the southern islands, we don't want to say, "don't eat it at all," because you don't have food on the southern islands. It is a matter of how much and how often and for how long. If there is a

better way to express that, we need help from the leaders of the community such as you, in expressing that in ways that will be understandable to the people.

Marshallese: Could we say that this would be accurate and permissible or recommended? That if you have no food if there is no possibility of having food from the southern islands, then it is all right to eat from the northern islands? Would that be, would that be good to say? That, and there ultimately is no harm in eating that food since you don't have any from the southern to use.

Ray: Well, I would surely say that is right. If you have no food on the southern islands presumably you will starve to death unless you eat something. And if there is food on the northern islands that prevents that, then certainly that would be a recommended temporary solution. All that we are suggesting is that to the extent that the circumstances permit, the bulk of the diet should come from the southern islands. But people need not be fearful if, for one circumstance or another, caught overnight in a storm in the northern islands, or a shortage of some particular food in the southern islands, that they consume some food from there. It's not an abrupt difference. It is a matter of degree.

Marshallese: I'd still like to just kind of think of examples of what might be the situation. I think I am correct in saying that the people feel that the northern islands tend to have more of abundance of let's say crabs and birds, things of this sort. So, if a people were to go and eat a chicken or a bird (I guess that would be a bird) or a crab a day up there, is that a problem then if they did that? (So I ask, "A day, one day out of a month?" And he says, "No, each day.")

Ray: Do you want to try that one, Bill?

(Robison to Ray: No, because we are in a continuous living pattern. I don't know what to say about that...)

(Buck: And that plane flight would be anywhere not just because it was flying in Marshallese air?)

(Ray: That's right. Any plane flight.)

Marshallese: Well, it is unfortunate that you had to receive greater radiation because of a trip here, to meet with us, on the other hand we know that you made the trip because of something that your government did in our islands and you came to make this explanation to us and meet with us and we are grateful for your concern and willingness to accept that increased radiation as a result of the trip. I see a difference in your example, though, because this is something that by choice you have done and in a sense we're not sure what our choice is because we would rather have not had our islands contaminated in this way. And yet they are by people other than ourselves, by a choice that was not ours, and so we are faced with this condition. And so I'm just concerned now about our people and this choice is forced upon us. You did it of your own free will. But with us it is a forced choice now that we have to make, or situation we have to deal with. And I think that is a bit different but we understand your explanation.

Ray: Well, we too feel that it is most unfortunate that Rongelap was contaminated. That was not by our own free will, it was as a result of an accident. What we are talking about here is I think the choices that now exist and the Senator was asking, "Is it appropriate to tell people they must not go to the northern islands or is it appropriate to say they may, freely?" Well it is somewhere in between and there are..., that's the value judgment that I wanted to address.

Robison: The practice throughout the world in radiation protection is that even though 500 mrem is an acceptable level that governments work with, if there is any practical way to stay below that level even though they say that's a level you can, you know, go up to and around, if there is any practical way to stay below that, they do it. And what we are saying here

Ray: There is, I think not, a yes or no answer to the question. And, the portion of the diet that comes from the northern islands, as that portion increases, the radiation dose to that person increases. If all of the diet comes from the northern islands, that still is not a great catastrophe. But things can be better if none of it comes from the northern islands. So it is a matter of degree. And there are choices to make if there are benefits such as a better diet or a more delicious diet from going to the northern islands than confining to the southern islands. There is a choice that the individual must make or the community must make. Perhaps you would translate that and then come back to me.

(Buck to Ray: I have a question.)

(Ray to Buck: Okay, I wanted to continue there.)

Ray: In coming here, Senator, to present this report all of us have as you know, have flown an airplane from the mainland. And because of that flight we have been exposed to radiation much higher than we would have been, appreciably higher than we would have been had we stayed home. By being up at high altitudes we get more radiation than had we been on the ground at home. The amount of radiation that all of us received just coming here for this visit is not very different from the increase in radiation that your Rongelap person would have by your daily increase in diet from the northern islands over six weeks. Our one trip here might equate to a month or six weeks of this increase diet from Rongelap. We derive some benefit from that. It is important to us to be here so we accept that additional radiation, knowing that it is an additional risk to us, because there is something that needs to be done here or that we want to do, that we like to do. Similarly, if it is important enough to go to the northern islands and expand the diet, there is some additional risk, we believe the risk is small and the risk is described in this booklet. Nevertheless, we cannot say that there is no increased risk from eating food from the northern islands.

Bair: It is the number shown on the chart for Rongelap.

Marshallese: Point 6 means not, it doesn't even mean one person. It is less than one person for a 30 year period!

Ray and Bair: Right.

Marshallese: What about fish, sea life? Either ocean or lagoon at Rongelap? What about them? Is there any problem with that?

Robison: We have measured the sea life, the radionuclide concentrations in the sea life at all the lagoons and in the ocean at all the Northern Marshalls and we have found no place that we would recommend that you are not able to fish. The marine products, be it the lagoon or the ocean, have low levels of radioactivity in them. In fact we find that the radionuclide concentrations in the fish at the atolls here in the Marshalls are really about the same or less than what we see in fish in the United States, in the United Kingdom, Britain and Japan.

Marshallese: Shellfish. Like clams and crabs. What about these in the Rongelap islands?

Robison: The concentration...

Buck: He says fish obviously swim around and move. What about these things that are not as mobile?

Robison: The same thing is basically true of the clams, the big clams and the smaller variety and the lobster. They're very low level and there is...you know...

Marshallese: I just think that it would please me if you as experts in the field and the scientists who have studied all of these and are familiar with the significance, the way these things affect us, you, it seems to me

to have the authority to really be specific and say either, "don't use these foods from the northern part," or "yes, it is all right for you to use these things." We don't have that capability, that understanding of the situation, so it is hard for us to be, consider ourselves the authority on this. But you are, and so, that word, it seems to me, needs to come from you.

Ray: Well, we certainly could make a very positive statement that if you wish to keep your radiation dose as low as possible then, do not eat any foods from the northern islands. In just the same way we could say to you, if you wish to keep your risk of lung cancer to an absolute minimum do not buy or smoke any more cigarettes. Or we could say if you do not, we could say if you do not wish to die in an airplane crash do not again ride in an airplane. It has been our choice, instead of that, to try in the best way we know how, to describe to you the amount of risk that you take in making your own choice about radiation in your environment. We recognize that this is very difficult, it is difficult for us to explain, it is difficult for you to comprehend. But, we do not want to be rule makers, we do not want to be saying you may not or cannot do these things. We hope to continue to describe to you and explain to you how these risks relate to other things that you are accustomed to, and hope then that you can make your own judgements.

Marshallese: Before your 1978 survey, we were given a statement and it was perfectly clear and that was, "you shouldn't eat crabs from the northern islands in Rongelap." Now that is a clear statement, we understand that. Now it seems like your saying, "well, sure you can, if you choose, eat one a day or something like that." Is that a, am I hearing you clearly that that has now changed? What you are saying today is different than what you told us before the '78 survey?

Ray: I think we are trying to say it in a way that provides greater understanding rather than rules. Senator Balos said earlier that it would be better and easier if we would simply say do, or do not. If it is at all

possible we would like not to be in the position of telling people what they must or should do but rather of informing them of the degree of risk and permitting them to accept risk if that is their choice and to control their own lives rather than asking us to control them. So, perhaps the way we are saying it is different. It is very easy to say that we can avoid excess radiation exposure at Rongelap by not eating coconut crabs, at all, because there aren't many on the southern islands and they are on the northern islands. We would choose not to do that but certainly if the council, the people at Rongelap, should want to make that decision it is much more, they have a much greater right to do that than we do.

deBrum (in English): I was taken by your explanation that ... I didn't pay any attention... Let me try it the best way I can. (Oscar translated the above into Marshallese)

Marshallese: I think I detect one of the reasons these kind of questions are coming up, is that the people have their own council and also some other sources of scientific data or doctors that come to check them and sometimes that they have asked well what were you told by the DOE people and then they say, well that's inaccurate or that's certainly not so, they are misleading you or deceiving you. And so, that is why we are really puzzled. This makes for a lot of misunderstanding, so it is difficult now for us to really know what to do when we get that kind of information from different sources, so, I think that is one of the reasons why we are having these questions.

Ray: Well, if that's the case it seems to me that this is a very wholesome exchange and that we should and do encourage a discussion with those advisors, those council members, those experts. And, we have freely made available to any legitimate representatives or advisors of the people, all of the information that we have. We welcome their advice and you know in the case of the Bikini people we cooperated extensively with the counselors and advisors that they retained. And we stand, certainly, willing and ready, and these documents are available, as I said earlier this morning,

Ray: Could we go on to another and come back to Dr. Bair?

Marshallese: What I want to bring up, now, is sort of different from what we have been discussing, because that we now understand that this book was prepared with detailed information regarding the conditions for the 30-year period following the 1978 survey. And I have a feeling that people who are involved and live in that period are to be considered fortunate to have this document, now, that explains so much of what will be effective then. My concern or my question now really revolves around those that have been affected prior to that year, just what can be done for them? Is there any, I suppose compensation, is there any help, is there anything to tell them? Any information for them about their condition, because this book you say definitely is not addressed to them?

Ray: That is correct. Well, there are other publications that have come out from time to time ever since 1954 on the condition of and the consequences to those people. There are numerous publications on those subjects and the matter of their future and compensation has been a part of the negotiations between our two governments over the past many months. We are not prepared to really discuss that subject here. There are other forums where that is being discussed and we have no real authority to come and talk about it here. This visit has a different purpose.

Marshallese: I want to ask about Kwajalein and Rongrik (did he say?) and Kwajalein and Rongrik; what about the radioactivity that may be involved or incurred by the missiles that are being tested? Is there an increase (or is this, increase or decrease) increase in the radioactivity in those two places, Rongrik and Kwajalein, from the missile testing?

Ray: We are not even indirectly responsible for the missile activities at Kwajalein. Those are Department of Defense, Department of Army activities. But I am not aware of any radiation consequence of those missile launches. There are to the best of my knowledge no significant amounts of radioactive materials that are involved in those, in those missile launches.

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(7-78)

U.S. DEPARTMENT OF ENERGY

memorandum

DATE December 16, 1982

REPLY TO ATTN OF EP-32

SUBJECT Meeting on DOE/EP Northern Marshalls Survey - Majuro Atoll, December 8-9, 1982

TO James De Francis, CP-2

Per your instructions, I attended the subject meeting. Ed Patterson had informed me that he had given Roger Ray the responsibility to act as the agency spokesman and to answer questions. I was to be an observer. A copy of annotated notes taken during the meeting and a list of attendees are attached. No representative from the Trust Territory attended the meeting.

The Marshallese/English book prepared for presentation of the survey and the DCRL technical report on the survey results were well received in Majuro. During the formal briefing on the book and in the question and answer sessions that followed, a number of requests were heard for additional information. Other than agreeing to provide available radiological data and to pass along those requests that should be directed to the Department of Defense and to the Government of the Marshall Islands, no new commitments for additional work by DOE were made. The earlier agreement to provide the Northern Marshalls survey results to the populations of the surveyed atolls and islands was reaffirmed. The responses to technical questions by Dr. Bair (health effects and risks), and by Dr. Robison (data collection, analysis, and dose assessment) were very precise and tailored to the audience. Roger Ray was very effective in responding to questions on the purpose and findings of the survey and in keeping the participants on the intended subject.

There was one aspect of the meeting in Majuro that I found very disturbing. This involves agency policy on radiation protection in the Marshalls. The past policy has been to view DOE's responsibilities in the Marshalls as limited in scope and directed primarily toward providing radiological advice and assistance to the Department of the Interior and to the High Commissioner of the Trust Territory of the Pacific Islands, advice that has been thoroughly coordinated within this agency. This advice has emphasized, as a U.S. Government position, application of Federal and International radiation protection standards in decisions on radiation exposure issues in the Marshalls for which the U.S. Government is responsible. This position has been reviewed and accepted in numerous congressional hearings in which DOE has assisted DOI and the Department of Defense in obtaining approval of their radiation protection plans and programs. The Environmental Protection Agency, EPA, has informed DOI that U.S. standards do apply to U.S. activities in the Marshalls. In his answers to questions regarding radiation safety and the restrictions that DOI has urged the Marshallese to follow on use of food from certain islands at Rongelap and Enewetak that have higher contamination levels, Roger Ray's statements were not compatible with past policy. Advice was given directly to the Marshallese representatives that changed and, in the perception of some, voided past restrictions. To my knowledge, these changes were not coordinated with anyone in EP, GC, CP, [illegible] of the Marshallese at the meeting appeared sur-

Island and from the northern islands at Rongelap could be eaten with certain qualifications, and that the people should make their own judgments based upon cancer risk estimates and upon the need for the food. The representatives at the meeting recognized that this advice was new and inconsistent with the unqualified restrictions they have been urged to follow for many years. It was stated that they preferred instead advice that was clear and free of qualifications that would require them to make a judgment on whether they should eat the food. Though the Marshallese were polite, and it is not their way to give offense, even so, some of their statements to Roger at this point were obviously sarcastic even when filtered through the interpreter. There was an embarrassing moment when Roger asked the Marshallese to help him explain the advice he had given to them.

Rather than relax current restrictions on use of coconut crabs from the northern Islands at Rongelap Atoll and on all food from Enjebi Island at Enewetak Atoll, the restrictions need to be strengthened. Body burden measurements by the Brookhaven National Laboratory, BNL, during the past year at both atolls have indicated increased levels of Cs-137 in some individuals who have been eating food from restricted locations. BNL's reports are attached. The restriction at Rongelap needs to be increased to include all foods from the northern islands. Body burdens for females less than eleven years of age at Rongelap had increased 82% at the time of the last measurement in July 1982. Adult male burdens were up 56%. Doses are expected to continue to increase to 250 mRem/yr. Relaxing restrictions will likely cause doses to go even higher. In the past in Operational Safety, we have considered it vital that DOE's health protection policy and the implementation of this policy in the Marshalls should provide a uniform degree of protection from atoll to atoll and should be consistent with protection provided in the U.S. Because of the uncertainties associated with dose predictions, DOE's criteria for cleanup of Enewetak that was approved by EPA and by Congress, specified 250 mRem/yr (not 500 mRem/yr), and 4,000 mRem/30 yr (not 5,000 mRem/30 yr). I urge that these lower criteria should apply anywhere in the Marshalls where decisions are to be made based on dose predictions. I would be happy to discuss this further if you wish.

On several occasions in after-hour discussions during the trip, Roger and I disagreed on how questions on radiological safety should be handled. This is only a continuation of a difference of opinion between DOE headquarters safety staff and NV staff (at the greatest intensity between Roger and myself) that began many years ago when NV became involved in Enewetak cleanup. This disagreement has intensified as DP and NV have taken steps to take over EP programs and responsibilities in the Marshalls. My view is that this new approach to radiation protection will be difficult for this agency to explain and defend in the future. It may seem curious to others why a shift in programmatic responsibilities within DOE causes a shift in radiation protection policy and practice in the Marshalls? I wonder about this myself. I expect that the Bikinians will quickly recognize the implications of this new DOE advice. A logical extension of Roger's advice is that the Bikinians should make their own decision on whether to return to Bikini Atoll. Doses for Bikini Island residents could be 10 times the U.S. standard. Such residents may not meet the standards for radiation workers, and this population includes pregnant women and infants.

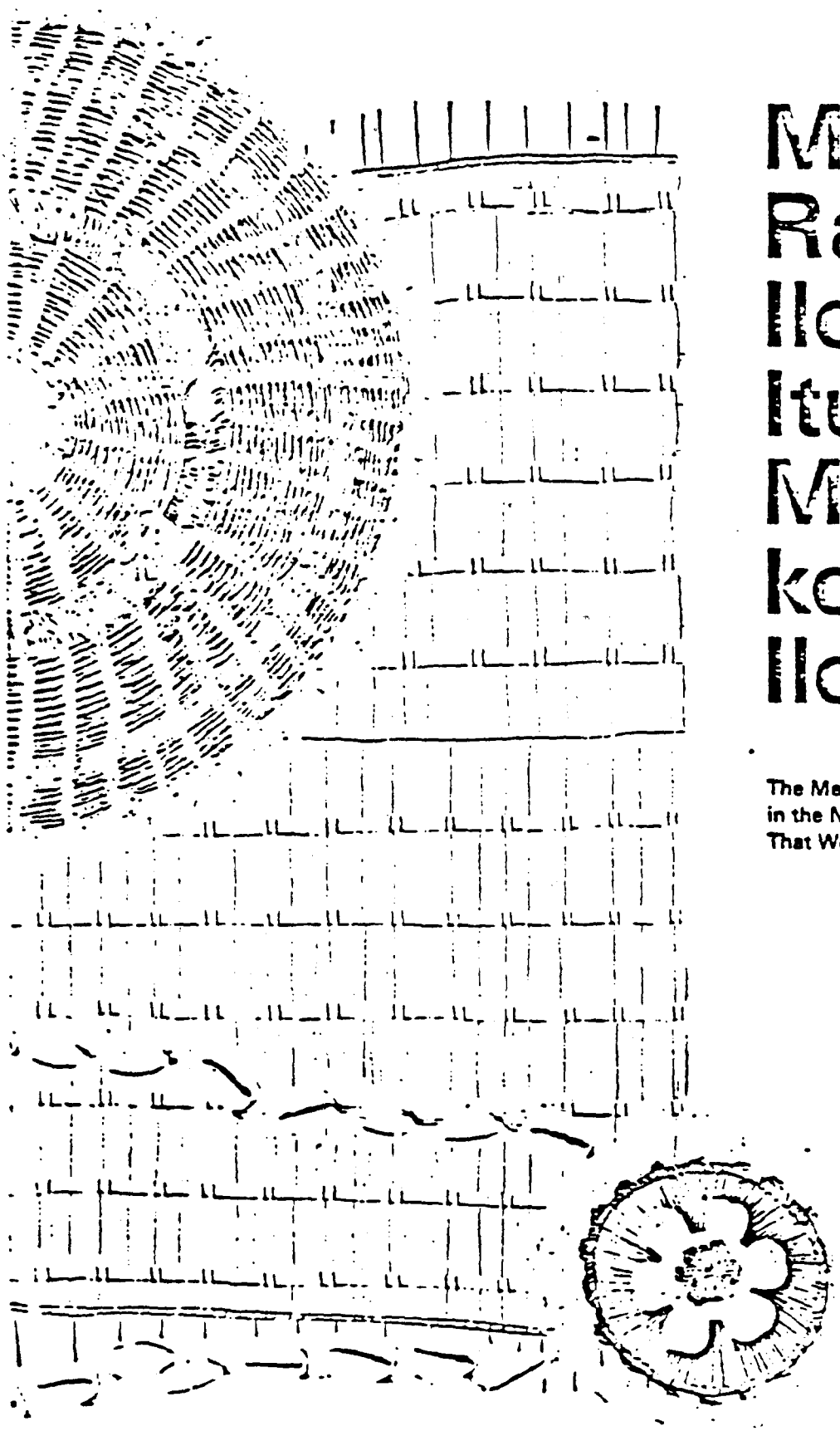
I anticipate that once Roger's advice is passed along to the Marshallese people and their leaders and legal counsel, there will be many additional questions on why DOE's recommendations have changed. At the next opportunity for Marshallese to appear before a Congressional hearing or a DOI budget review, they will likely raise this issue if not before that time. DOE will need to develp a coordinated position with DOI and EPA on this new advice.

Tommy F. McCraw

Tommy McCraw
Office of Operational Safety
Environmental Protection, Safety,
and Emergency Preparedness

3 Attachments

cc w/attachments:
D. E. Patterson, EP-32
B. Wachholz, EP-32
B. Siebert, DP-3.1
J. Thiessen, ER-71
A. Pingeret, GC-23
J. Rudolph, DP-224
M. Crosland, GC-34



Melelen Radiation llo Ailiñ ko Ituiōñ llo Majōl, ko Rar Etali llo 1978

The Meaning of Radiation for Those Atolls in the Northern Part of the Marshall Islands That Were Surveyed in 1978

Melele ko Retōbrak jen Joñok ko ilo 1978

Elañe 233 armij rej jokwe ionenen Rongelap im mōñā mōñā in ailiñ kein ko wōt jen ionene:

Scientist ro rej antone bwe joñan radiation eo elaptata im juōn armij emaroñ bwelen bōke iumin juōn yiō jen atom ko reradioactive im rar walok jen ien kōkōmmālmel eo an United States ej 400 millirem. Ak joñan radiation eo elaptata ekkā an juōn armij maroñ bwelen bōke enaj drik jen joñan in. Joñan radiation in ej driklok yiō otemjej, bōtab ekanuij in rumwij an driklok.

Joñan radiation eo iolap (average) eo elaptata im juōn armij emaroñ bwelen bōke ilo yiō kein 30 rej itok ej 2500 millirem ilo jabrewōt mōttan ko ilo enbwin, im 3300 millirem ilo wōt nonnonmej.

Ilo yiō kein 30 rej itok, scientist ro rej antone bwe emaroñ wor 10 armij remaroñ mij jen nañinmij in cancer ko rej walok jen un ko jet ijellokin radiation eo ej itok jen ien kōkōmmālmel kin atomic bomb ko. Innem emaroñ bar kobatok 0.1 ñōn 0.6 oran ro remaroñ mij ilo yiō kane rej itok, jen cancer ko rej walok jen radiation eo rej bōke ilo yiō kein 30 rej itok, jen ien kōkōmmālmel kin atomic bomb ko.

Ilo yiō kein 30 rej itok, scientist ro rej antone bwe emaroñ wor 60 ajiri rej lotaktok kin nañinmij ak utamwe walok jen un ko jet ijellokin radiation eo ej itok jen ien kōkōmmālmel kin atomic bomb ko. Innem emaroñ kobatok 0.007 ñōn 0.1 oran ajiri ro renaj bwelen lotaktok tokelik kin utamwe, walok jen radiation eo jineir ak jemeir rej bōke ilo yiō kein 30 rej itok, jen ien kōkōmmālmel kin atomic bomb ko.

Elañe armij renaj jokwe ion Eneaetok im jab ionenen Rongelap, im mōñā mōñā in ailiñ kein ko wōt jen Eneaetok, joñan radiation eo rej bōke enaj bwelen ja joñan eo wōt.

Elañe armij renaj etal ñōn Naen jen ionenen Rongelap, im mōñā mōñā ko jen Naen, emaroñ tarrin lalim alen an laplok joñan radiation eo remaroñ bwelen bōke ilo air bed ijo.

Elañe armij renaj etal ñōn Namen ak Melu jen ionenen Rongelap, im mōñā mōñā ko jen ene kein ruo, emaroñ tarrin ruo alen an laplok joñan radiation eo rej bōke ilo air bed ijo.

Information That Has Been Obtained from the Measurements Made in 1978

If 233 people live on Rongelap Island and eat local food only from Rongelap Island,

Scientists estimate that the largest amount of radiation a person might receive in one year from radioactive atoms that came from the U.S. bomb tests is 400 millirem. But usually the largest amount a person might receive would be less than this. This amount of radiation decreases every year, however, it decreases very slowly.

The highest average amount of radiation people might receive in the coming 30 years is 2500 millirem in any part of the body and 3300 millirem in just the bone marrow.

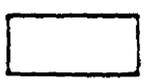
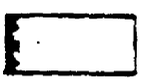
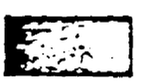
In the coming 30 years, scientists estimate that 10 people *may* die from cancers caused by things other than radiation from the atomic bomb tests. In addition to this, from 0.1 to 0.6 people may die in the future from cancers caused by radiation received in the coming 30 years from the atomic bomb tests.

In the coming 30 years, scientists estimate that 60 children could be born with health defects caused by things other than radiation from the atomic bomb tests. In addition to this, 0.007 to 0.1 children may eventually be born with health defects caused by radiation their parents receive in the coming 30 years from the atomic bomb tests.

If people live on Eneaetok and not on Rongelap Island, and eat local food only from Eneaetok, the amount of radiation they receive would be about the same.

If people go to Naen from Rongelap Island, and eat food from Naen, they might receive about five times more radiation while they are there.

If people go to Namen or Melu from Rongelap Island, and eat food from these two islands, they could receive about two times more radiation while they are there.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Attachment 6

BROOKHAVEN NATIONAL LABORATORY
ASSOCIATED UNIVERSITIES, INC.
Upton, Long Island, New York 11973
(516) 282-4250
FTS 666-4250

Safety & Environmental Protection Division

November 8, 1982

Mr. Roger Ray
Deputy for Pacific Operations
Department of Energy
Nevada Operations Office
P.O. Box 14100
Las Vegas, NV 89114

Dear Roger:

I am enclosing the July 1982 Field Trip Report and a computer printout of individual body-burden data. The report is a summary of our activities and a commentary on the grouped data resulting from the July bioassay mission.

The computer printout is a compilation of historical and up-to-date direct whole-body counting data on the Rongelap people. The individual data are arranged alphabetically and grouped according to sex and age. This report and printout document recent results of the Marshall Islands Radiological Safety Program.

If you have any questions, please do not hesitate to call.

Sincerely,

Edward T Lessard

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ETL/cc

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JULY 1982 FIELD TRIP REPORT

Brookhaven National Laboratory has continuously monitored the radiological status of persons inhabiting areas in the Marshall Islands which were contaminated by fallout from Pacific nuclear testing. As part of this monitoring a whole-body counting, urine, breast milk, and fecal sampling program was performed during July 1982. Bioassay data were obtained (see Table One) from the residents of Rongelap Atoll, the former residents of Bikini Atoll and from unaffected individuals at Majuro Atoll who volunteered to be part of a comparison population. Effective dose equivalent assessments for inhabitants of this region are to be made based on these data and prior measurements.

The attached computer printout forms contain the directly measured body-burden data for Cs-137, K 39-41, Co-60 and Bi-207 obtained in July 1982. Historic body burdens of gamma-emitting nuclides are also included. Participants in the whole-body counting program included persons above five years of age. Gamma emitters were detected by using a chair-geometry whole-body counter, a computer-based multichannel analyzer, and a Sodium Iodide detector. The spectra from the whole-body counting measurements were stored on magnetic disks and are retained at the Laboratory. A complete body-burden history was given to each person after verification of the current whole-body count. Whole-body counting results from this trip have been verified and were entered into the computerized body-burden data base. The tables showing individual body burdens were generated from this data base. Replicate counting, point-source counting, background measurements and other quality control measures were made to ensure proper calibration of the system, and to facilitate the interpretation of spectra.

The average adult male Rongelap body-burden for Cs-137 rose 56% from 6.7KBq (0.18 μCi) to 10KBq (0.28 μCi) during the interval July 1981 to June 1982. The mean adult female Cs-137 body burden increased 11% from 6.9KBq (0.19 μCi) to 7.1KBq (0.21 μCi); the male adolescent body burden remained at 6.3KBq (0.17 μCi); the female adolescent body burden decreased 15% from 9.3KBq (0.25 μCi) to 8.1KBq (0.22 μCi); for male children it increased 9% from 4.0KBq (0.11 μCi) to 4.4KBq (0.12 μCi) and for female childen it increased 82% from 3.5KBq (0.093 μCi) to 6.3KBq (0.17 μCi). Overall, the population exhibited a 1.8% per month rise in Cs-137 body burden during the July 1981 to June 1982 interval. This follows an apparently constant body burden (0.0% per month rise) of Cs-137 during the previous twenty four month interval, August 1979 to August 1981 and a constant declining body burden from the early 1960's until 1979 (see Graph One). This recent increase may have resulted from the relaxing of restrictions to the northern islands of Rongelap Atoll as a source of coconuts and coconut crabs. A summary of the Rongelap Atoll residents' June 1982 average Cs-137 body burden is given in Table Two.

The effective dose equivalent rate on July 10, 1982 from gamma emitters was estimated for various average body masses (see Table Three) for persons residing at Rongelap Atoll. These body masses represent the mean body mass of the adult, adolescent, and juvenile groups. The nuclide Cs-137 contributes the greatest portion of the total effective dose equivalent rate. The effective dose equivalent rate from Co-60 and Bi-207 was estimated to be less than 5×10^{-6} Sv a^{-1} (0.5 mrem per year) and was based on the minimum detection limit of the direct whole-body counting system. The net (natural background subtracted) external effective dose-equivalent rate is also reported in Table

Three. These data were collected during the August 1981 Field trip to Rongelap and have been modified to accurately reflect the typical living pattern of the population at Rongelap Atoll.

The effective dose-equivalent rate from internal Cs-137 increases as body mass decreases (see Table Three). This occurs because the increase in specific activity which results when body mass decreases more than offsets the decline in the amount of photon energy absorbed by the body. This effect, is most pronounced in the infant. Studying the diet of the infant and measuring Cs-137 activity in breast milk will provide information to determine the dose equivalent for persons too young to participate in the personnel monitoring program. Recent results for current and previously collected breast milk samples are summarized in Table Four. The consistent ratio between activity in breast milk and body burden will allow assessment of infant's Cs-137 dose equivalent based on historic body-burden data for the mother.

An assessment of the 1982 annual committed effective dose equivalent at Rongelap Atoll is given for the average adult in Table Five. The activity intake data for Sr-90, Fe-55, and Co-60 were based on extropolation of prior body-burden and urine anlayses data, and a mathematical model describing the declining continuous intake pattern which was exhibited in the Rongelap population prior to 1981. Bi-207 activity was below our minimum detection limits, thus, the impact on total committed effective dose equivalent is insignificant. The intake for Cs-137 was based on the 1981 and 1982 field measurements and a mathematical model for increasing continuous intake. The total effective dose equivalent of 6.1×10^{-4} Sv (61 mrem) for the calendar year 1982 is less than the 5×10^{-3} Sv (500 mrem) annual limit recommended by the International Commission on Radiological Protection (ICRP Publication 26)

for individual members of the general public. The highest individual adult committed effective dose equivalent (ID #1180) was estimated to be 1.4×10^{-3} Sv (140 mrem) during the calendar year 1982.

The validity of the Pu-239,240 data used to estimate the body burden at Rongelap Atoll in 1973 had been considered previously by an ad hoc committee of the Energy Research and Development Agency. The committee concluded that, because of the possibility of contamination of the urine and fecal samples, the data were uncertain. To determine the extent of sample contamination and to estimate a background level of Pu in these samples, urine and fecal samples were collected during the July 1982 field trip from two groups of persons not living on contaminated atolls. The former Bikinians provided samples for these studies as did some current residents of Majuro Atoll. Collections at Rongelap will provide an estimate of body burden during 1981 and 1982 and allow assessment of the effective dose equivalent since rehabitation of the atoll in 1957. The long mean residence time of Pu-239,240 in the body will allow for assessment of effective dose equivalent to the former Bikini residents while living at Bikini Atoll based on the analysis of recently collected samples.

The Cs-137 body burden of the former Bikini Atoll residents is now statistically indistinguishable from the comparison population values obtained at Majuro Atoll (see Table Two). The former Bikini residents have the lowest Cs-137 population body burden (see Graph Two) out of the four atoll populations currently under study. The increasing Cs-137 body burdens at Rongelap, Utirik and Enewetak imply that local phenomena influenced the elevation of Cs-137 in the diet. The observed decline in the former Bikinian body burdens was anticipated based on the value for the long-term biological turnover rate constant for Cs-137.

The elevation of Cs-137 in the Rongelap population indicates increased use of the northern islands and the potential body burden from this source may be anticipated to rise over the next several years. At Rongelap Atoll, the northern island Naen is some 20 to 30 times more contaminated with Cs-137 relative to the inhabited southern island, Rongelap. The mean exposure rate at Naen Island is currently similar to that observed at Rongelap Island shortly after rehabitation in 1957. Assuming the unlikely event of heavy dependence on the northern islands for food, one might anticipate the adult mean body burdens rising to about 18KBq (0.5 uCi) over the next year or so. A maximum of 53KBq (1.5 uCi) might be anticipated in any single individual. It is more probable that the eastern, southern and northeastern islands will continue to be used for food production and if the northern islands are included, the overall result may be an increase in the adult mean body burden to perhaps 11KBq (0.3 uCi). These estimates on the future adult body burdens of Cs-137 are based on extrapolation of direct body burden measurements. This method is not very accurate beyond about a year after the last measurement and is subject to variation which is directly related to the daily intake of radioactive material.

Tables Six and Seven contain quality control results related to the precision and accuracy of the whole-body counting system. The accuracy of the whole-body count for Cs-137 was estimated to be about plus or minus 10% based on point source counting. The precision was within plus or minus 10% based on replicate counts. Whole body counts for Cs-137 above the minimum detection limit and for K39-41 were used to estimate precision (see Table Seven). The comparison between results from system one or system two was also determined

to be within plus or minus 10%. Variation in accuracy was largely due to the variation in the positioning of the point source relative to the standard geometry used for the computer analysis. Variation in background also affected the measurements.

Table One

July 1982 Survey Summary

Description	Number of Samples	Analyses	Status
Whole Body Counts	329	Gamma scans for fission and activation products, and naturally occuring nuclides.	Results enclosed
Urine Samples	237	Gamma scans same as above, radiochemical analyses for Pu-239,240.	Results in approximately one year
Fecal Samples	14	Gamma scans and radiochemical analyses same as above.	Results in approximately one year
Milk Samples	3	Gamma scans, radiochemical and elemental analyses	Results enclosed

Table Two

July 1982 Field Trip Results - Average Cs-137 and E39-41 Whole-Body Counting Data

Population Grouping	Age Group	Sex	Number Group	Body Burden Mean ± 1 S.E. Cs-137 (Bq)	Cs-137 (uCi)	E39-41 (g)
Rongelap	≥ 16	M	29	$1.0\times10^{4}\pm1.0\times10^{3}$	$2.8\times10^{-1}\pm2.7\times10^{-2}$	$1.3\times10^{2}\pm9.4\times10^{0}$
Rongelap	≥ 16	F	18	$7.8\times10^{3}\pm9.3\times10^{2}$	$2.1\times10^{-1}\pm2.5\times10^{-2}$	$8.5\times10^{1}\pm6.6\times10^{0}$
Rongelap	11-15	M	12	$6.3\times10^{3}\pm9.6\times10^{2}$	$1.7\times10^{-1}\pm2.6\times10^{-2}$	$7.9\times10^{1}\pm9.5\times10^{0}$
Rongelap	11-15	F	7	$8.1\times10^{3}\pm1.7\times10^{3}$	$2.2\times10^{-1}\pm4.6\times10^{-2}$	$8.4\times10^{1}\pm7.2\times10^{0}$
Rongelap	<11	M	16	$4.4\times10^{3}\pm7.4\times10^{2}$	$1.2\times10^{-1}\pm2.0\times10^{-2}$	$5.1\times10^{1}\pm2.3\times10^{0}$
Rongelap	<11	F	9	$6.3\times10^{3}\pm1.1\times10^{3}$	$1.7\times10^{-1}\pm3.1\times10^{-2}$	$5.2\times10^{1}\pm4.2\times10^{0}$
Former Bikinian	≥ 16	M	77	$2.1\times10^{2}\pm1.3\times10^{1}$	$5.8\times10^{-3}\pm3.5\times10^{-4}$	$1.5\times10^{2}\pm3.0\times10^{0}$
Former Bikinian	≥ 16	F	42	$1.3\times10^{2}\pm1.9\times10^{1}$	$3.5\times10^{-3}\pm5.0\times10^{-4}$	$1.2\times10^{2}\pm3.6\times10^{0}$
Former Bikinian	11-15	M	9	$5.6\times10^{1}\pm6.7\times10^{0}$	$1.5\times10^{-3}\pm1.8\times10^{-4}$	$1.2\times10^{2}\pm9.0\times10^{0}$
Former Bikinian	11-15	F	8	$6.7\times10^{1}\pm9.6\times10^{0}$	$1.8\times10^{-3}\pm2.6\times10^{-4}$	$1.0\times10^{2}\pm1.4\times10^{1}$
Former Bikinian	<11	M	15	$4.1\times10^{1}\pm7.4\times10^{0}$	$1.1\times10^{-3}\pm2.0\times10^{-4}$	$6.2\times10^{1}\pm3.9\times10^{0}$
Former Bikinian	<11	F	17	$4.1\times10^{1}\pm6.3\times10^{0}$	$1.1\times10^{-3}\pm1.7\times10^{-4}$	$5.5\times10^{1}\pm4.1\times10^{0}$
Comparison Majuro	≥ 16	M	11	$1.6\times10^{2}\pm3.6\times10^{1}$	$4.2\times10^{-3}\pm9.6\times10^{-4}$	$1.4\times10^{2}\pm6.0\times10^{0}$
Comparison Majuro	≥ 16	F	6	$1.1\times10^{2}\pm1.6\times10^{1}$	$3.1\times10^{-3}\pm4.4\times10^{-4}$	$1.0\times10^{2}\pm3.5\times10^{0}$
Comparison Majuro	11-15	M	9	$5.9\times10^{1}\pm1.6\times10^{1}$	$1.6\times10^{-3}\pm4.3\times10^{-4}$	$7.0\times10^{1}\pm4.7\times10^{0}$
Comparison Majuro	11-15	F	11	$4.8\times10^{1}\pm9.3\times10^{0}$	$1.3\times10^{-3}\pm2.5\times10^{-4}$	$6.7\times10^{1}\pm6.8\times10^{0}$
Comparison Majuro	<11	M	13	$4.1\times10^{1}\pm7.4\times10^{0}$	$1.1\times10^{-3}\pm2.0\times10^{-4}$	$5.2\times10^{1}\pm4.1\times10^{0}$
Comparison Majuro	<11	F	8	$4.1\times10^{1}\pm7.4\times10^{0}$	$1.1\times10^{-3}\pm2.0\times10^{-4}$	$5.5\times10^{1}\pm5.7\times10^{0}$
Former Rongelap at Jabor	10-68	M&F	9	$5.4\times10^{1}\pm1.1\times10^{1}$	$1.5\times10^{-3}\pm3.0\times10^{-4}$	$9.4\times10^{1}\pm7.3\times10^{0}$
Former Rongelap at Majuro	39-68	M&F	3	$1.1\times10^{3}\pm7.0\times10^{2}$	$2.9\times10^{-2}\pm1.9\times10^{-2}$	$1.5\times10^{2}\pm3.1\times10^{1}$

Table Three

Estimate of Mean Effective Dose Equivalent Rate From Photon Emitters at Rongelap Atoll

Non-Node Source of Irradiation	Male Effective Dose-Equivalent Rate On July 10, 1982 - Sv y^{-1} (mrem y^{-1})			Female Effective Dose-Equivalent Rate On July 10, 1982 - Sv y^{-1} (mrem y^{-1})		
	87 Kg	71 Kg	77 Kg	59 Kg	70 Kg	77 Kg
Internal Cs-137	3.8×10^{-4} (38)	4.2×10^{-4} (42)	4.0×10^{-4} (40)	3.2×10^{-4} (32)	4.9×10^{-4} (49)	3.7×10^{-4} (37)
Internal Co-60	$<5\times10^{-6}$ (<0.5)	$<5\times10^{-6}$ (<0.5)	$<5\times10^{-6}$ (<0.5)	$<5\times10^{-6}$ (<0.5)	$<5\times10^{-6}$ (<0.5)	$<5\times10^{-6}$ (<0.5)
Internal Bi-207	$<5\times10^{-6}$ (<0.5)	$<5\times10^{-6}$ (<0.5)	$<5\times10^{-6}$ (<0.5)	$<5\times10^{-6}$ (<0.5)	$<5\times10^{-6}$ (<0.5)	$<5\times10^{-6}$ (<0.5)
Net External Exposure	1.5×10^{-4} (15)	1.5×10^{-4} (15)	1.5×10^{-4} (15)	1.5×10^{-4} (15)	1.5×10^{-4} (15)	1.5×10^{-4} (15)

Table Four

Breast Milk ^{137}Cs Results From 1981 & 1982 Field Trips

Sample ID	Volume ml	Collection Date	1st ^{137}Cs Result pCi/ml	2nd ^{137}Cs Result pCi/ml	Result pCi/ml	^{137}Cs Body Burden pCi	Ratio Breast Milk to Body Burden ml^{-1}
9044	10	7/81	6.9×10^{-7} ±13%	5.4×10^{-7} ±19%	6.2×10^{-7}	0.251	2.4×10^{-6}
911	10	7/81	4.4×10^{-7} ±19%	4.1×10^{-7} ±21%	4.3×10^{-7}	0.17	2.5×10^{-6}
91	10	7/81	1.2×10^{-6} ±10%	1.1×10^{-6} ±11%	1.2×10^{-6}	0.23	5.2×10^{-6}
9037	10	7/81	4.55×10^{-7} ±18%	4.6×10^{-7} ±22%	4.6×10^{-6}	0.13	3.5×10^{-6}
2316	10	7/81	3.1×10^{-7} ±36%	2.7×10^{-7} ±28%	2.9×10^{-7}	0.077	3.8×10^{-6}
9039	5	7/81	< MDL	4.6×10^{-7} ±13%	4.6×10^{-7}	0.092	5.0×10^{-6}
9023	10	7/81	2.9×10^{-7} ±25%	2.4×10^{-7} ±23%	2.7×10^{-7}	0.084	3.2×10^{-6}
1044	10	7/81	4.2×10^{-7} ±19%	3.3×10^{-7} ±23%	3.8×10^{-7}	0.094	4.0×10^{-6}
9037	10	7/81	< MDL	2.5×10^{-7} ±41%	2.5×10^{-7}	0.072	3.5×10^{-6}
3331	10	7/81	1.3×10^{-7} ±56%	< MDL	1.3×10^{-7}	0.075	1.7×10^{-6}
9034	5	7/81	< MDL	< MDL	< MDL	0.010	-
6068	15	7/81	< MDL	< MDL	< MDL	0.0042	-
6150	7	7/81	< MDL	< MDL	< MDL	0.0015	
None	9.5	7/81	< MDL	< MDL	< MDL	No data	-

MDL = 2.6×10^{-6} uCi
1 uCi = 3.7×10^{4}

Table Five

Estimate of Total Annual Committed Effective Dose Equivalent At Rongelap Atoll During 1982

Man-Made Source of Radiation	Adult Average Activity Intake During 1982 Bq (μCi)	Adult Average Committed Effective Dose Equivalent Sv (mrem)	Adult Average Body Burden Estimate January 1, 1982 Bq (μCi)	Adult Average Body Burden Estimate December 31, 1982 Bq (μCi)
Internal Cs-137	3.3×10^{4} (8.9×10^{-1})	4.5×10^{-4} (4.5×10^{1})	7.4×10^{3} (2.0×10^{-1})	1.1×10^{4} (3.0×10^{-1})
Internal Sr-90	1.6×10^{2} (4.2×10^{-3})	5.6×10^{-6} (5.6×10^{-3})	9.4×10^{1} (2.6×10^{-3})	8.9×10^{1} (2.4×10^{-3})
Internal Fe-55	1.4×10^{3} (3.8×10^{-2})	2.2×10^{-7} (2.2×10^{-2})	8.6×10^{2} (2.3×10^{-2})	6.7×10^{2} (1.8×10^{-2})
Internal Co-60	3.8×10^{-5} (1.0×10^{-9})	2.7×10^{-13} (2.7×10^{-8})	4.2×10^{-2} (1.1×10^{-6})	2.7×10^{-2} (7.3×10^{-7})
Internal Bi-207	ID	$<5.10^{-6}$ (<0.5)	$<7.4 \times 10^{1}$ ($<2.0 \times 10^{-3}$)	$<7.4 \times 10^{1}$ ($<2.0 \times 10^{-3}$)
Internal Pu 239,240	ID	ID	ID	ID
Net External Exposure	-	1.5×10^{-4} (15)	-	-
Total Man-Made	-	6.1×10^{-4} (61)	-	-

ID = Insufficient Data

Table Six

July 1982 Quality Control Point Source Counting

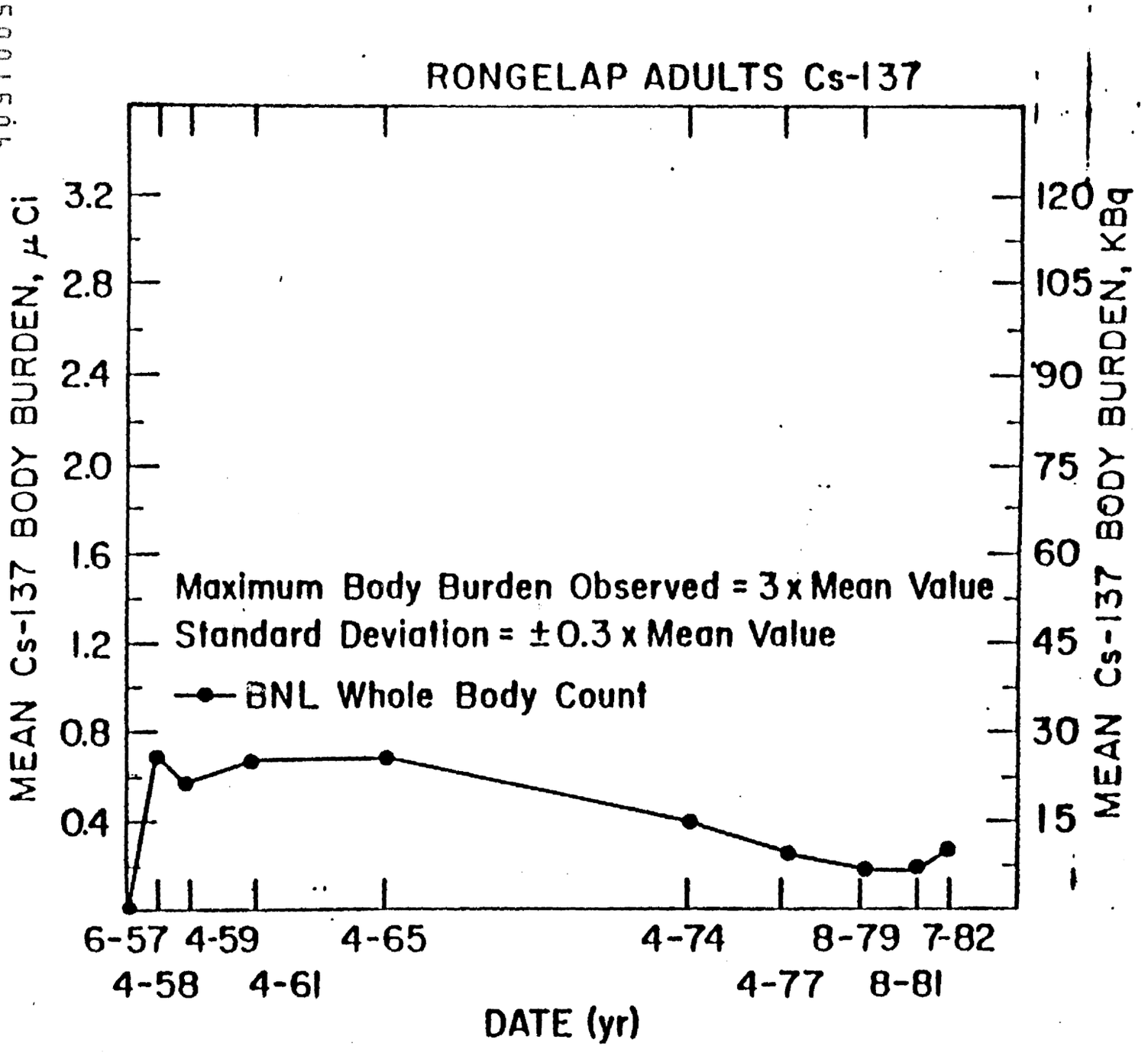
Date	Time	System No.	Activity μCi±1σ
7-04-82	1632	1	$9.9\pm1.7\times10^{-2}$
7-05-82	0838	1	$9.8\pm1.6\times10^{-2}$
7-07-82	1200	1	$10\pm1.6\times10^{-2}$
7-07-82	1715	1	$8.8\pm6.6\times10^{-3}$
7-08-82	0830	1	$9.5\pm1.6\times10^{-2}$
7-08-82	1302	1	$10\pm1.6\times10^{-2}$
7-11-82	0845	1	$9.1\pm1.5\times10^{-2}$
7-11-82	2030	1	$9.8\pm1.5\times10^{-2}$
7-12-82	2030	1	$9.7\pm1.5\times10^{-2}$
7-13-82	1104	1	$9.4\pm1.5\times10^{-2}$
7-14-82	0829	1	$8.7\pm1.5\times10^{-2}$
7-16-82	0810	1	$9.5\pm1.5\times10^{-2}$
7-04-82	1500	2	$10\pm6.3\times10^{-3}$
7-05-82	1000	2	$10\pm6.0\times10^{-3}$
7-07-82	0851	2	$8.2\pm1.4\times10^{-2}$
7-07-82	1725	2	$8.4\pm6.4\times10^{-3}$
7-08-82	0759	2	$9.3\pm1.5\times10^{-2}$
7-08-82	1020	2	$9.1\pm1.5\times10^{-2}$
7-08-82	1305	2	$9.1\pm1.5\times10^{-2}$
7-08-82	1440	2	$9.2\pm1.5\times10^{-2}$
7-11-82	0855	2	$9.1\pm1.5\times10^{-2}$
7-11-82	2000	2	$8.3\pm1.4\times10^{-2}$
7-12-82	2000	2	$8.6\pm1.5\times10^{-2}$
7-13-82	1010	2	$8.8\pm1.5\times10^{-2}$
7-14-82	0830	2	$8.8\pm2.1\times10^{-2}$
7-15-82	0845	2	$8.9\pm1.5\times10^{-2}$
7-16-82	0815	2	$8.7\pm1.5\times10^{-2}$
Mean ± Mean σ			$9.2\pm1.4\times10^{-2}$
Standard Error			11%

Table Seven

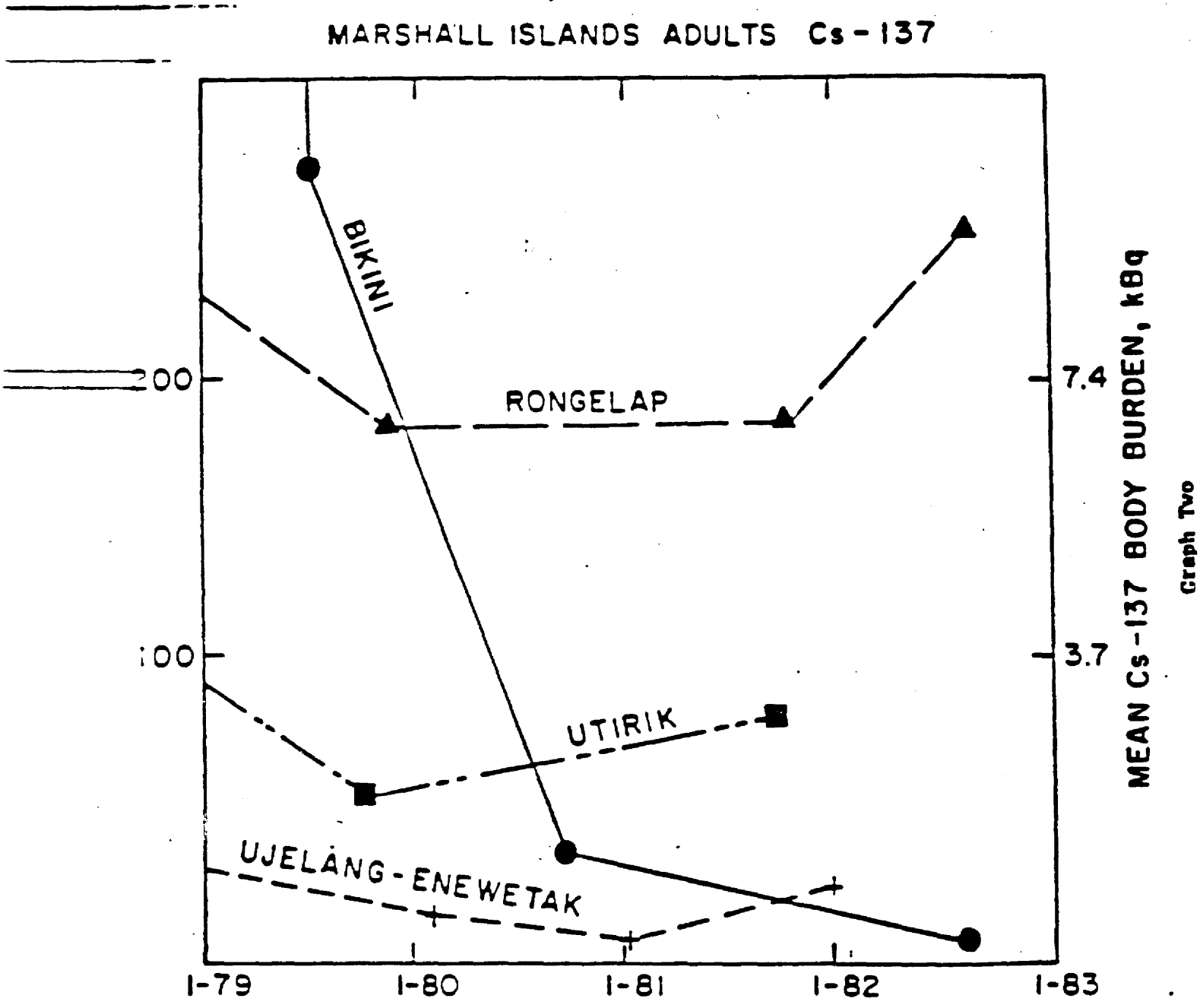
July 1982 Quality Control Replicate Counting

Name	Date	System No.	Ratio 1st ^{137}Cs /2nd ^{137}Cs	Ratio 1st K/2nd K
M.T. Ryan	7-5-82	1	MDL	1.1
M.T. Ryan	7-5-82	2	MDL	
S.V. Musolino	7-5-82	1	MDL	1.04
S.V. Musolino	7-5-82	1		
S.V. Musolino	7-5-82	1	MDL	1.01
S.V. Musolino	7-5-82	2		
E.T. Lessard	7-7-82	1	MDL	1.06
E.T. Lessard	7-15-82	2		
A. Leviticus	7-11-82	1	0.907	1.02
A. Leviticus	7-11-82	1		
J. Harper	7-12-82	1	MDL	0.99
J. Harper	7-13-82	1		
M.T. Ryan	7-5-82	1	MDL	1.03
M.T. Ryan	7-12-82	1		
E. Jibas	7-11-82	2	1.1	0.94
E. Jibas	7-11-82	2		
Winnie	7-7- 2	1	1.0	0.86
Winnie	7-7-82	2		
Randy	7-7-82	1	1.0	0.987
Randy	7-7-82	2		
Mean			1.0	1.0
Standard Deviation			7.9%	6.7%

MDL = Minimum Detection Limit



Graph One



Graph Two

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Exposures for Rongelap Population

Acute 1954	Average Chronic WB[1] 1957-1978[2]	Annual WB[1] 1978[2,5]	Annual WB[1] 1982[3,4]	Average Chronic WB[1] 1978-2008[2,5]
175-200 Rem WB[1] 700-1400 Rads thyroid, child	1.7 Rem/21yrs[3]	0.4 Rem/yr High Indiv. LLNL dose model	0.14 Rem/yr High Indiv. 0.046 Rem/yr average adult male (<0.1 Rem/yr High Individual with Restriction)	2.5 Rem/30 yrs (0.08 Rem/yr)

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[1] WB - Whole Body

[2] Exposures are referenced to the time of the DOE Northern Marshalls survey in 1978.

[3] Dose estimates derived from whole body counting (in-vivo) by Brookhaven National Laboratory (BNL). these estimates are much more reliable than estimates from dose models.

[4] The average adult dose in 1982 represents a 56 percent increase compared to 1981 due to relaxed restrictions. The high individual dose of 0.14 Rem/yr was expected to be reduced to less than 0.1 Rem/yr if restrictions had remained effective.

[5] Dose prediction developed by Lawrence Livermore National Laboratory using results from Northern Marshalls survey and dose models. This exposure estimate was given to the Rongelap people in 1982 in a Marshallese English booklet. This value is not supported by in-vivo monitoring data, and has never been corrected.

Current Radiation Protection Standards

Whole Body
Rem

	Annual Dose		30 Year Population
	High Individual	Average Population	
Periodic Exposure	Ø.5	Ø.17	5
Continuous Exposure	Ø.1	--	4 Enewetak*
Enewetak*	Ø.25	--	

*Planning guides developed for cleanup and resettlement of Enewetak Atoll in 1974, reviewed by Environmental Protection Agency and published in an Environmental Impact Statement in 1975.

Wash Post May '85

Residents Vacate Atomic-Test Atoll

Associated Press

HONOLULU, May 21—Chickens, pigs, canoes and dismantled houses were unloaded today at a central Pacific island that will be the new home for 327 people whose atoll was covered by nuclear fallout 31 years ago.

Seventy residents of Rongelap Atoll and their possessions arrived at Majetto Island aboard the Greenpeace ship Rainbow Warrior, according to Dick Dillman, a San Francisco-based spokesman for the environmental organization.

Once the unloading was completed, the 150-foot motor-sail ship was scheduled to make the 100-mile trip to pick up more residents, Dillman said. Greenpeace officials estimated that a complete evacuation would take four trips, he said.

Rongelap, in the Marshall Islands, was evacuated in 1954 after a U.S. nuclear test called Operation Bravo. The islanders were allowed to return in 1957.

However, fear that lingering contamination may pose a threat to children led atoll leaders to decide to leave the island again.

Roger Ray of the U.S. Department of Energy has said radiation levels on Rongelap pose no health threat and are, on average, lower than in some parts of the United States.

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Editorials

EVACUATE WASHINGTON

Perhaps the answer to the radiation problem on Rongelap Atoll has finally been found, albeit unintentionally, by the Department of Energy which discounts fears of lingering radiation hazards with the now well-worn analogy that Rongelap radiation levels are no higher than those in Washington, D.C. The DOE would do well to explain to Washington residents how their city resembles an atoll that was contaminated with fallout from at least four separate nuclear tests. If Washington is as "hot" as Rongelap, and Rongelap radiation is equal to or higher, in some cases, than islands in Bikini then the answer is obvious: evacuate Washington, D.C. without delay.

THE MARSHALL ISLANDS JOURNAL

40¢ on Majuro

Volume 16, Number 18
Friday, May 3, 1985

Rongelap Radiation Danger Exaggerated?

Majuro May 2 With the Rongelap Atoll evacuation now fast approaching, U.S. government officials have suddenly begun to poohpah the Islanders' fear of continued radiation exposure arguing that the atoll is safe for inhabitation.

"There are no radiological or medical reason to move," said Andy Wilson, a U.S. official who has been involved in the Enewetak replanting and recently announced that coconuts grown on Enewetak's northern islands are too radioactive to eat.

Interior and Energy Department officials began criticizing the resettlement plan as the Rongelap story

Tale Page 17 ilo Kajin Majol

began hitting the front pages of newspapers in the U.S., Europe and the Pacific. The stories followed the departure of the Greenpeace ship "Rainbow Warrior" from Honolulu for the Marshall Islands where it will aid in the evacuation of Rongelap.

Onboard, in addition to a crew from 11 nations, are Kotak Loeak and Julian Riklon representing Rongelap.

In Washington, D.C. Interior official Larry Morgan asserted that radiation levels on Rongelap are no greater than in Washington,D.C.

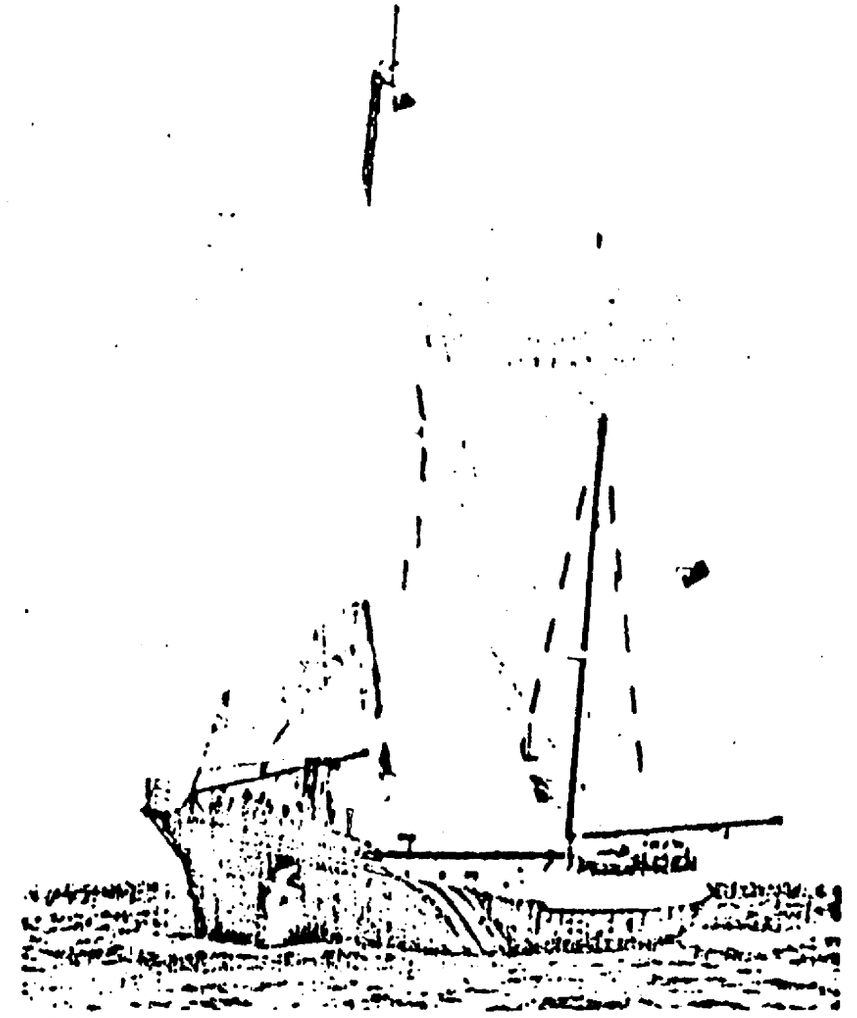
Continued page 4

KAC CONSIDERING BANKRUPTCY MOVE

Majuro May 2 Will the Kwajalein Atoll Corporation declare bankruptcy and remove jurisdiction over Kwajalein from Marshall Islands courts and remove control of U.S. compensation payments [illegible] to an independent Federal Bankruptcy laws to take jurisdiction of Kwajalein matters — including future use — out of the hands of Marshall Islands courts.

That concept, stated by KAC attorney George bankruptcy laws as a means of putting all jurisdiction in a bankruptcy trustee rather than in the numerous local courts.

This action would put the Kwajalein landowners in the position of dealing directly with a bankruptcy



THE "RAINBOW WARRIOR", a 150-foot ship owned by Greenpeace, will sail into Majuro's lagoon next Friday. At the request of the Rongelap community the ship will be traveling to the radiation-effected atoll to evacuate the people to Kwajalein Atoll.

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Note: DOE's NMI report ... Bill Robison's dose estimates considerably higher than have ever been measured by BNL. The

U.S. CRITICIZES RONGELAP MOVE TO KWAJ.

From page 1

Rongelap leaders say that typifies the attitude of the Energy and Interior Departments to radiation on Rongelap. Underscoring their contention that Rongelap is dangerously radioactive, they cite the 1978 DOE radiation survey of the northern Marshalls which shows radiation levels on islands in Rongelap to be higher than radiation rates on Bikini Atoll which, without a clean-up, must be kept off-limits for habitation for decades to come. In view of this information, they ask why the DOE continues to say that Rongelap is safe?

Rongelap representatives announced plans to evacuate their home islands for an island in northern Kwajalein in 1984, and received a unanimous vote of support from the Nitijela for the move.

Currently, Senator Jeton Anjain is in Washington, D.C. requesting aid for the emergency evacuation expected to begin in two weeks. Two months ago, Rep. John Seiberling promised funds for an independent radiation study of Rongelap.

But Johnsay Riklon, a Majuro attorney who represented Rongelap in Congressional testimony last month, said that while such a survey is sorely needed, the Rongelap people would not delay their move from islands which even the Department of Energy says are radioactive.

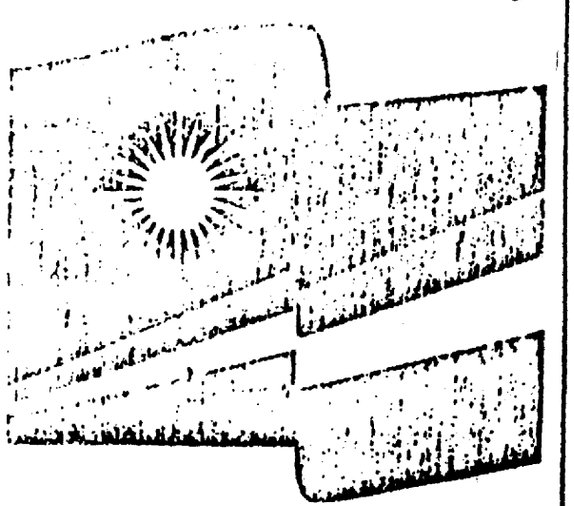
Rongelap leaders have cited thyroid tumor rates among the highest in the world, and other health disorders, including documented chromosome damage to a significant portion of the population.

DOE program manager for the Marshalls, Roger Ray, argues that much of the people's anxiety has been "stirred up" by attorneys who are looking to cash in the plight of nuclear victims.

"I know people are worried, and all I say to them is that our studies show that the general condition of the population of Rongelap is not noticeably different from that of the rest of the Marshall Islanders," said Ray in a San Francisco Examiner story of April 30.

The DOE claims it is safe for the people to reside on Rongelap as long as they do not eat food from or visit the northern islands in their atoll.

Thyroid tumors have been the most serious radiation-related health problem to affect the Rongelap people, and 31 years after their exposure to the Bravo hydrogen bomb test the tumor rate is showing no signs of a downturn.



RONGELAP ATOLL

Majuro May 9 Rongelap leaders in Majuro were not amused at U.S. government officials who said (Journal, May 3) the atoll was perfectly safe to live on, and they strongly criticized the implication that the fear of continuing radiation exposure was being stirred up by outsiders.

"What is really in the people of Rongelap's hearts is the love of their ancestral homeland, but they have chosen to make a sacrifice for an immediate evacuation as they love their children and grandchildren," said Jeban Riklon.

"Thank God, after years of being showered under the foggy umbrella of poisonous atmospheric mushroom clouds, the Greenpeace 'Rainbow Warrior' will assist with the relocation of the victims."

We have learned, he continued, "that a few U.S. government officials, who remain blindfolded or refuse to admit the truth, continue arguing that the atoll is safe for human habitation."

So many contradictory pronouncements have been issued by U.S. government scientists and the Rongelap people wonder if the officials have bothered to do their homework before claiming the atoll is safe.

The Rongelap people have good memories, Riklon said, and they remember the studies by the Department of Energy showing high radiation levels on Rongelap and the order from DOE scientists not to use the northern islands in Rongelap because of hazardous radiation.

An Interior official said last week that Rongelap radiation levels are no greater than in Washington, D.C. By easily knowing that 1978 DOE radiation survey shows radiation levels on the islands of Rongelap as equal or even higher than radiation contamination on Bikini which has been declared off-limits for habitation, I must caution Washington, D.C. for an immediate evacuation," said Riklon.

He said that these statements are "absolutely meaningless" and that Rongelap "will soon become another oklol which is classified off limits for 20 100 years."

Responding to the DOE he said that the "people of Rongelap are victims of your 'Energy'...Bombing of Hiroshima, Japan in August 6, 1945 was an act of war. Bombing of Bikini on March 1, 1954 was an act of peace."

The Rongelap people, who have many thyroid cancers, will continue voicing their concerns as they "seek green dollar for their resettlement and for the U.S. to clean up their atoll," he said.

The U.S. treats Rongelap as if it doesn't exist, ignoring or covering up the problem, he charged. The U.S. spent billions of dollars on its nuclear testing program which contaminated his islands, but won't help them now that the problem is getting worse.

"If I had a sailing canoe I would accompany the Greenpeace 'Rainbow Warrior' on its 1985 Pacific Peace Voyage," said Riklon.

Bikini Doctor to head 4-Atoll Program

Majuro May 9 Dr. Graham Conway, who has provided medical care to the Bikinians for the past two years, has been named medical director for the newly awarded Four Atoll Health Care program, the contractor announced this week.

In a press statement, John Short and Associates ed and that indeed the success of the program depends on the "amount of cooperation, participation and support that the contractor receives from the Marshallese people."

Summer Youth Employment Program

All interested employers, both public and private, are invited to apply for summer youth employment positions. All you have to do is fill out a simple application. Applications are available at the MCAA office. Applications must be returned before May 30. The Private Industry Council will make the final selections.

The program will last for 10 weeks, starting on June 17. The program is expected to be even bigger than last year so get your application in now. Both you and the youth will benefit from your participation this summer.

Stop by MCAA and pick up your application or call 3346 for more information.

Greenpeace called to task for "Traumatic Evacuation"

The following is the text a news release of the fice of Micronesian Sta- Negotiations):

Washington DC June 14 S. government officials y the evacuation of Ron- lap Atoll in the Marshall lands by Greenpeace last onty may not have been cessary.

The Greenpeace organiza- on, a conservation and ti-nuclear group, appar- ntly moved the entire opulation of Rongelap toll – about 300 peo- le – as well as their hous- g materials and livestock, Mejato, an island in wajalein atoll in the Mar- halls by boat during the st week of May. Green- eace claimed radioactivi- y renders Rongelap unfit or human habitation.

This, U.S. government of- icials asserted in recent in- erviews, is far from cer- ain. Levels of radioactivi- y on the main island of Rongelap, they said, are on the average comparable to levels of naturally-occuring radioactivity in most areas of the continental United States, or even below levels in some areas in the U.S.

Rongelap was dusted by fallout from U.S. open-air atom bomb testing in the 1950's, testing long since prohibited to signatories of the Limited Test Ban Treaty of 1963 including the United States. Since then, radioactive contamination has apparently sunk to safe levels in the main inhabited areas of the atoll, the officials said, with the current diet and lifestyle of the Rongelapese taken into account. Rongelapians returned in 1957 and have been living on the atoll since then.

In most areas of the Continental United States, the officials said, inhabitants are subject to naturally occuring background radiation of about 100 to 200 millirems per year. Recent tests on biological samples from Rongelap residents show that the average Rongelapian is being exposed to 100 millirems a year from all sources, officials said.

Radiation on most of Rongelap, one expert said, is "within the internationally accepted standard." There is no evidence of continuing ill-effects from residual radiation, he said.

"Every study, every report, every analyisl" done by the U.S. government to measure radioactivity on Rongelap has been published and made available to arrorneys for the Marshall Islands people and to the Marshall Islands government, the expert noted. In 1983, a U.S. team visited Rongelap, explained the results of the surveys, and left native-language brochures, he said.

Immediately following the "Bravo" nuclear test of 1954, some inhabitants of Rongelap inadvertently exposed to direct fallout contamination suffered radiation trauma to the thyroid, the U.S. expert said, and there was some evidence of increase in abnormal pregnancies in the early years after the test.

But by now, U.S. officials say, the effects of any continuing radiation on Rongelap are minor, if measurable at all.

Since the 1954 test there have been visits to Rongelap by a well-equipped U.S. medical ship every six months to treat the islanders and to follow up on old exposures, officials note. If necessary, Rong-

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AT FIRST GLANCE, this recent Journal photo of a land and lagoon scene at Laura is attractive enough, but on closer inspection we see the discarded cans of Budweiser, the carelessly strewn plastic cups, the myriad pieces of debris brought down to Laura and left there week after week by visiting "tourists" from Rita.

According to police chief Bob Canfield, the people

UNWANTED MEDDLING

UNITED NATIONS – Certain groups meddling in the affairs of Micronesians before the United Nations Trusteeship Council have been criticized by FSM Washington Representative Epel Ilon.

Ilon, calling the proponents "self-appointed" said he was appalled by many of the remarks made by the petitioners on behalf of Micronesians.

He said they have little real familiarity with the islands here.

IN THE HIGH COURT
REPUBLIC OF THE MARSHALL ISLANDS

IN RE THE WAR CLAIM OF MILI ATOLL BY ELSON DANIEL PETITIONER

CIVIL ACTION NO. 1984-95

NOTICE OF AND MOTION: TO AMEND ORDER; TO ALLOW INTRODUCTION OF DISTRIBUTION PLAN; TO SET DATE, PLACE, AND NOTICE REQUIREMENTS OF FINAL DISTRIBUTION HEARING; AND TO SET FINAL DATE FOR FILING OBJECTIONS TO DISTRIBUTION PLAN

TO: All persons who are or may be interested in the Title I

J.S. officials worry about 'Greenpeace Trauma"

rom page 6

lapese are evacuated to J.S. hospitals at U.S. government expense.

In interviews, U.S. officials expressed sympathy or the fears of the islanders, and support for their ight to move anywhere hey pleased. "We don't ave any vested interest in eeping the people on Rongelap," one U.S. government official said. "If we'd had reason to believe t was unsafe we'd say so."

The official noted that the U.S. moved people off Bikini atoll a second time in 1978 after having declared nine years earlier that Bikini, the site of atomic tests in the 1950's was safe to inhabit. The second move-off came because too much radioactivity had stayed in the Bikini food chain. The U.S. would have alerted the Rongelapese, the official said, had it seen convincing data that the inhabited area of Rongelap was still unsafe.

U.S. officials say that the fish in the Rongelap lagoon are safe to eat with the exception of the coconut crab, a local delicacy, which should not be consumed at the rate of more than one crab per day per person. Most Rongelapese supplement their diet with imported foods.

Some of the smaller islands on the northern rim of the atoll, U.S. officials say, should not be lived on nor should food be taken from them, but most Rongelapese live on the main island of Rongelap, in the southern part. Officials acknowledge that Rongelapese, especially those who had personal ownership of land in the northern part of the atoll, are unhappy about loosing access to their former islands.

U.S. officials expressed concern that the trauma of the move from Rongelap to Mejato could be worse than danger associated with radiation levels. They also expressed concern for the lack of educationsal and health facilities for Rongelapese on their new atoll.

Shortly after the move by Greenpeace, the Rongelapese said they had been deposited on their new atoll without the necessary supplies and were hungry. A Marshall Islands supply ship was diverted to provide food.

U.S. sources note that the government of the Marshall Islands had taken the position that there is no reason for the Rongelapese to move. The 300 Rongelapese plan to ask the U.S. Congress for 27 million dollars in resettlement money, according to the news reports.

Under the proposed Compact of Free Association between the Marshall Islands and the United States, currently being debated in the U.S. Congress, each inhabitant of Rongelap is due to receive about $8,000 per year for the next 15 years as part of an agreed-upon package of nuclear claims compensation. This constitutes a generous sum, U.S. sources say, given the Marshall Islands average annual income of about $500 to $700 per year, but slightly less than the compensation offered to the inhabitants of Bikini and Enewetak under the Compact. In addition, all atomic claimants will continue to receive U.S. government agricultural and health services.

Attachment 10

→ Tony

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

23 AUG 1979

Mrs. Ruth G. Van Cleve
Director, Office of Territorial Affairs
Department of the Interior
18th & C Streets, N.W.
Washington, D.C. 20240

Dear Mrs. Van Cleve:

The Environmental Protection Agency has examined the applicability of Federal Guides to radiation protection for those Marshall Islands people who want to return to Enewetak. Several issues are relevant to this possible Federal action, and the following are our views:

1. Do Federal Guides apply to this situation?

Yes. It is our view that any Federal action conducted by an agency of the U.S. Government is subject to the Federal Radiation Protection recommendations approved by the President. The responsibility to provide these recommendations was created by Executive Order 10831 and was later enacted by Congress. It is codified at 42 U.S.C. 2021(h) and was transferred to EPA by Reorganization Plan No. 3 of 1970. The appropriate language reads as follows:

> It is the statutory responsibility of the Council (Administrator) to "...advise the President with respect to radiation matters, directly or indirectly affecting health, including guidance for all Federal agencies in the formulation of radiation standards and in the establishment and execution of programs of cooperation with States...". (25 F.R. 4402)

2. What Federal Guides are to be used?

The appropriate Guides are those approved by President Eisenhower in 1960 (25 F.R. 4402) and by President Kennedy in 1961 (26 F.R. 9057). These guides are designated as Radiation Protection Guides (RPG's). The 1960 RPG for an individual in the population is 0.5 rem per year and applies when individual whole body doses are known. When the individual whole body doses are not known, as an operational technique to provide

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resonable assurance that the 0.5 rem per year is met, the protection guide for annual whole body dose is 0.17 rem per capita per year. Likewise, the annual individual whole body dose of 0.5 rem is likely to assure that the 1960 gonadal RPG of 5 rem in 30 years is not exceeded. The 1960 guides did not include internal emitters, but in 1961 additional guidance was provided to translate the 1960 RPG's into daily rates of intake of specific radionuclides, e.g., strontium-89 -90, based on equivalent organ doses or lower. These guides are basically identical to those promulgated by the International Commission on Radiological Protection.

Additional Federal guidance was provided as Protective Action Guides by President Johnson in 1964 (29 F.R. 12056) and in 1965 (30 F.R. 6953). This guidance is applicable to acute localized contaminating events. Only Category III for controlling the "...long-term transmission of strontium-90 through soil into plants in the years following..." applies to the Enewetak situation, since the other PAG's are limitations imposed in the first year following the event. The numerical dose limits for Category III are effectively identical to the RPG's quoted above after the first year.

In our view, the 1960 RPG's and the operational techniques for their attainment are applicable to the Federal programs concerned with Enewetak.

3. Can the 1960 Federal Guides be exceeded?

Yes. The guidance states the following:

> It is recommended that:
> 7. The Federal agencies apply these Radiation Protection Guides with judgment and discretion, to assure that reasonable probability is achieved in the attainment of the desired goal of protecting man from the undesirable effects of radiation. The Guides may be exceeded only after the Federal agency having jurisdiction over the matter has carefully considered the reason for doing so in light of the recommendations in this paper. (25 F.R. 4402)

Further in 1965, it was stated that:

> Although radiation doses numerically equal to the RPG's may impose a risk so small that they can be accepted each year for a lifetime if there is significant benefit from the programs causing the exposure, they do not and cannot establish a line that is safe on one side and unsafe on the other. Rather, some risk of injury may exist at any level of dose and the risk continuously increases with dose. Caution should be exercised in decisions to take protective actions in situations where projected doses are near the numerical values of the RPG's since the biological risks are so low that the actions could have a net adverse rather than beneficial effect on the public well-being. (30 F.R. 6953)

Thus, in carrying out its programs, the Department of Interior can, without violation of Federal Guides, allow the possibility of occasional individual doses in excess of 0.5 rem/yr, provided it has carefully considered the reason for doing so.

If further information is required, please contact Dr. William A. Mills of my staff for assistance.

Sincerely yours,

/S/

David M. Rosenbaum
Deputy Assistant Administrator
for Radiation Programs (ANR-458)

cc: Dr. Bruce Wachholz, DOE

Attachment 11

BROOKHAVEN NATIONAL LABORATORY
ASSOCIATED UNIVERSITIES, INC.
Upton, Long Island, New York 11973

Safety & Environmental Protection Division

(516) 282-4250
FTS 666-4250

July 8, 1985

Mr. Thomas McCraw
U.S. Department of Energy (PE-222)
Office of Operational Safety
EP-32
Washington, DC 20545

Dear Tommy:

I am enclosing a copy of my assessment of radiation risk at Rongelap. I have summarized the conclusions on the bottom of page eight and top of page nine of the report. The information was initially passed on to Roger Ray as part of our last mission report.

Best regards.

Sincerely,

Edward T Lessard

Edward T. Lessard

ETL/cjl

Enclosure

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BROOKHAVEN NATIONAL LABORATORY
ASSOCIATED UNIVERSITIES, INC.
Upton, Long Island, New York 11973

Safety & Environmental Protection Division

(516) 282-
FTS 666-4250

October 29, 1984

Mr. Roger Ray
Deputy for Pacific Operations
Department of Energy
Nevada Operations Office
P.O. Box 14100
Los Vegas, Nevada 89114

Dear Roger:

Thank you for your recent letter. I am enclosing a summary of the 1984 bioassay mission conducted at Rongelap, Utirik and Enewetak. In addition, I have included previous results at Rongelap and indicated our progress on the measurement of Pu. If you should require detailed individual results I will prepare them for you.

Best regards.

Sincerely,

Edward T Lessard

Edward T. Lessard
Program Manager
Marshall Islands Radiological
Safety Program

ETL/lg

Enclosure

cc: W. Adams
W. Bair
J. Baum
W. Robison

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1984 BIOASSAY SUMMARY

Whole-body counting was performed at Rongelap, Utirik and Enewetak Islands during June 1984. Urine samples were collected for Pu analysis which will be performed at Brookhaven National Laboratory at a later date. The field whole-body counting units were calibrated with phantoms which represented adults, teenagers and children. Quality control measurements were made before, during and after the mission.

Historic Results

The history of whole-body counting for ^{137}Cs at Rongelap is given as Figure 1. The plot is for adults. Besides ^{137}Cs, other radionuclides were present in persons who returned to Rongelap and these historic results are recorded in Table 1.

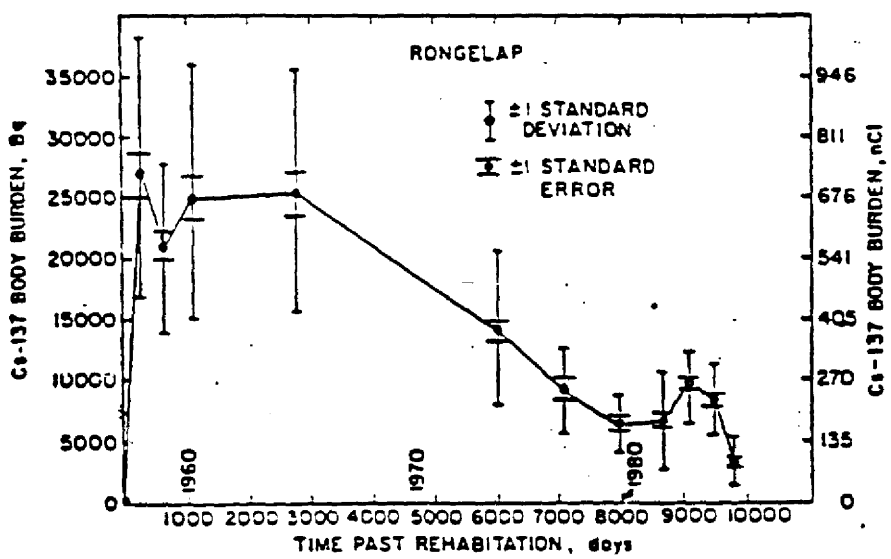

Figure 1. ^{137}Cs Body-Burden History for Adults

Table. 1. Average Radionuclide Burden and Time Since Rehabitation for Rongelap Adults

	Adult Males (>15a)		Adult Females (>15a)		Adults (>15a)			
	Body Burden Bq	Number of Individuals	Body Burden Bq	Number of Individuals	Body Burden Bq	Number of Individuals	Time Post Rehabitation Days	Year
^{60}Co	1.1×10^{0}	(A)	6.3×10^{-1}	(A)	9.3×10^{-1}	(A)	0	1957
	3.7×10^{2}	37	2.9×10^{2}	37	3.3×10^{2}	74	1370	1961
	9.3×10^{1}	45	7.4×10^{1}	45	8.1×10^{1}	90	2831	1965
^{65}Zn	1.9×10^{3}	4(B)	(C)	(C)	(C)	(C)	0	1957
	2.3×10^{4}	17	6.4×10^{3}	8	1.8×10^{4}	25	244	1958
	1.6×10^{4}	30	1.4×10^{4}	12	1.5×10^{4}	42	304	1958
	2.3×10^{4}	32	1.9×10^{4}	27	2.1×10^{4}	59	639	1959
	3.5×10^{3}	38	3.1×10^{3}	23	3.4×10^{3}	61	1370	1961
^{55}Fe	1.6×10^{4}	28	1.5×10^{4}	32	1.5×10^{4}	60	4626	1970
^{90}Sr	7.0×10^{0}	(A)	5.2×10^{0}	(A)	6.3×10^{0}	(A)	0	1957
	1.7×10^{1}	11	1.1×10^{1}	4	1.4×10^{1}	15	304	1958
	4.7×10^{1}	24	2.9×10^{1}	16	4.1×10^{1}	40	639	1959
	6.3×10^{1}	9	2.5×10^{1}	4	5.1×10^{1}	13	1370	1961
	3.0×10^{2}	13	1.8×10^{2}	15	2.4×10^{2}	28	1696	1962
	2.1×10^{2}	12	1.9×10^{2}	13	1.9×10^{2}	25	2100	1963
	2.1×10^{2}	11	2.0×10^{2}	7	2.1×10^{2}	18	2466	1964
	7.7×10^{1}	12	1.6×10^{2}	12	1.3×10^{2}	24	3561	1967
	1.5×10^{2}	11	1.2×10^{2}	11	1.3×10^{2}	22	3927	1968
	1.6×10^{2}	11	1.3×10^{2}	13	1.5×10^{2}	24	4293	1969
	8.5×10^{1}	9	1.5×10^{2}	11	1.1×10^{2}	20	4657	1970
	1.4×10^{2}	8	1.2×10^{2}	7	1.3×10^{2}	15	5022	1971
	9.6×10^{1}	5	8.7×10^{1}	7	9.6×10^{1}	12	5388	1972
	3.2×10^{2}	4	2.1×10^{2}	7	2.5×10^{2}	13	5753	1973
	1.7×10^{2}	10	8.5×10^{1}	4	1.5×10^{2}	14	6118	1974
	2.5×10^{2}	26	(C)	(C)	(C)	(C)	7579	1978
	3.7×10^{1}	25	2.8×10^{1}	19	3.3×10^{1}	44	8057	1979
^{137}Cs	5.2×10^{2}	(A)	3.1×10^{2}	(A)	4.1×10^{2}	(A)	0	1957
	2.9×10^{4}	38	1.9×10^{4}	13	2.7×10^{4}	51	304	1958
	2.9×10^{4}	47	1.5×10^{4}	49	2.1×10^{4}	96	639	1959
	3.5×10^{4}	37	1.7×10^{4}	37	2.5×10^{4}	74	1370	1961
	3.5×10^{4}	44	1.8×10^{4}	45	2.5×10^{4}	89	2831	1965
	1.8×10^{4}	22	1.1×10^{4}	24	1.4×10^{4}	46	6118	1974
	1.1×10^{4}	30	7.0×10^{3}	21	9.3×10^{3}	51	7213	1977
	6.7×10^{3}	19	5.6×10^{3}	18	6.3×10^{3}	37	8057	1979
	6.7×10^{3}	36	7.0×10^{3}	30	6.7×10^{3}	66	8813	1981
	1.0×10^{4}	29	7.8×10^{3}	18	9.4×10^{3}	47	9180	1982
	8.9×10^{3}	23	7.8×10^{3}	29	8.3×10^{3}	52	9540	1983
	3.9×10^{3}	43	3.4×10^{3}	35	3.7×10^{3}	78	9910	1984

= Number of individuals not recorded.
= Measured at Argonne National Laboratory.
= No females measured.

Both Figure 1 and Table 1 indicate to us that a steady decline in adult average body-burden is to be expected in future years. There are short-term increases which we cannot predict in advance and these cause the measured values to vary from the expected decline. However, over a long period of time increases will be balanced by decreases below the expected value.

Our estimates indicate to us that an individual's dose equivalent rate from all sources at Rongelap may vary by a factor of three above the average adult value and this would be due to living pattern variations. Again over a long period of time an individual's dose equivalent (the integrated dose equivalent rate) would be expected to be close to the average value. The average effective dose equivalent we estimate from 1957 to 2007 is 0.042 Sv (4.2 rem). In quantitative terms if the radiation exposure at Rongelap leads to a Gaussian error distribution of dose equivalent, then the probability of exceeding the 50-year integrated average-adult value, 0.042 Sv (4.2 rem), by more than a factor of five is 1 out of 100,000. This factor of five corresponds to a 50-year integrated effective dose equivalent in excess of 0.2 Sv (20rem). This in turn corresponds to an average dose equivalent rate greater than 0.004 Sv per year (400 mrem per year) for 50 years.

1984 Results

We have tabulated the average 1984 whole-body counting results in Table 2. The maximum burden did not vary from the average value by more than a factor of three for any age grouping at either of the three locations listed. We have summarized, in Figure 2, recent ^{137}Cs body-burden results for adults which we have obtained over the past few years. Body burdens are greatest at Rongelap and lowest at Enewetak.

TABLE 3. WHOLE-BODY COUNTING RESULTS, 1984

Groupings	Average Age ±1SD	Number in Group	F Group ±1SD	$^{137}Cs^{m}_{act}$ ±1SD	^{137}Cs Bq ±1SD	^{60}Co act ±1SD	^{60}Co Bq ±1SD
Bikini							
Adult Males	34 ± 17	78	134.6 ± 20.6	3.3E + 2 ± 1.7E + 2	12.2E + 2 ± 6.3E + 2	2.2E − 4 ± 2.3E − 4	8.1E00 ± 8.5E00
Adult Females	35 ± 16	83	104.5 ± 15.3	2.2E + 2 ± 0.88E + 2	8.1E + 2 ± 3.3E + 2	1.9E − 4 ± 2.1E − 4	7.0E00 ± 7.8E00
Teen Males	13 ± 1.3	33	103.3 ± 31.8	2.6E + 2 ± 1.1E + 2	8.9E + 2 ± 4.1E + 2	2.3E − 4 ± 2.6E − 4	7.8E00 ± 8.9E00
Teen Females	13 ± 1.3	36	93.1 ± 17.6	1.7E + 2 ± 0.79E + 2	6.3E + 2 ± 2.8E + 2	1.8E − 4 ± 2.0E − 4	6.7E00 ± 7.4E00
Child Males	7.4 ± 1.8	61	55.4 ± 12.6	1.1E + 2 ± 0.81E + 2	4.1E + 2 ± 3.0E + 2	1.2E − 4 ± 1.3E − 4	4.4E00 ± 5.0E00
Child Females	7.1 ± 1.2	29	51.6 ± 10.1	0.85E + 2 ± 0.64E + 2	3.0E + 2 ± 1.7E + 2	1.7E − 4 ± 1.7E − 4	6.3E00 ± 6.3E00
Rongelap							
Adult Males	33.3 ± 15.7	63	132.4 ± 25.6	18.6E + 2 ± 8.4E + 2	69.0E + 2 ± 31.1E + 2	1.9E − 4 ± 2.6E − 4	7.0E00 ± 9.6E00
Adult Females	37.8 ± 16.1	35	101.4 ± 17.0	9.1E + 2 ± 3.3E + 2	33.7E + 2 ± 12.4E + 2	0.65E − 4 ± 1.3E − 4	2.4E00 ± 4.8E00
Teen Males	13.8 ± 1.3	23	98.7 ± 23.1	7.3E + 2 ± 3.5E + 2	27.0E + 2 ± 13.0E + 2	1.9E − 4 ± 2.4E − 4	7.0E00 ± 8.9E00
Teen Females	12.8 ± 1.3	13	84.7 ± 18.9	9.1E + 2 ± 5.3E + 2	33.7E + 2 ± 20.4E + 2	1.3E − 4 ± 2.3E − 4	4.8E00 ± 8.5E00
Child Males	8.8 ± 1.9	28	63.1 ± 13.7	4.9E + 2 ± 3.8E + 2	18.1E + 2 ± 13.6E + 2	0.47E − 4 ± 1.2E − 4	1.7E00 ± 4.4E00
Child Females	6.9 ± 1.7	24	54.6 ± 16.3	4.7E + 2 ± 2.7E + 2	17.4E + 2 ± 10.0E + 2	1.1E − 4 ± 1.6E − 4	4.1E00 ± 5.9E00
Enewetak							
Adult Males	34.7 ± 13.9	104	153.5 ± 21.7	1.1E + 2 ± 0.99E + 2	4.1E + 2 ± 3.3E + 2	5.6E − 4 ± 2.6E − 4	2E.7E00 ± 9.8E00
Adult Females	35.1 ± 12.6	115	99.8 ± 14.6	0.60E + 2 ± 0.70E + 2	2.2E + 2 ± 2.6E + 2	4.1E − 4 ± 2.3E − 4	15.2E00 ± 8.5E00
Teen Males	13.1 ± 1.3	27	79.3 ± 16.5	0.26E + 2 ± 0.12E + 2	0.96E + 2 ± 0.43E + 2	2.8E − 4 ± 1.6E − 4	10.4E00 ± 5.9E00
Teen Females	12.6 ± 1.3	22	81.5 ± 20.2	0.21E + 2 ± 0.13E + 2	0.78E + 2 ± 0.48E + 2	3.6E − 4 ± 2.1E − 4	13.3E00 ± 7.8E00
Child Males	7.7 ± 1.7	66	52.3 ± 10.6	0.14E + 2 ± 0.10E + 2	0.52E + 2 ± 0.37E + 2	2.6E − 4 ± 1.7E − 4	9.6E00 ± 6.3E00
Child Females	8.3 ± 1.4	49	50.6 ± 9.2	0.11E + 2 ± 0.08E + 2	0.40E + 2 ± 0.29E + 2	2.4E − 4 ± 1.8E − 4	8.9E00 ± 6.7E00

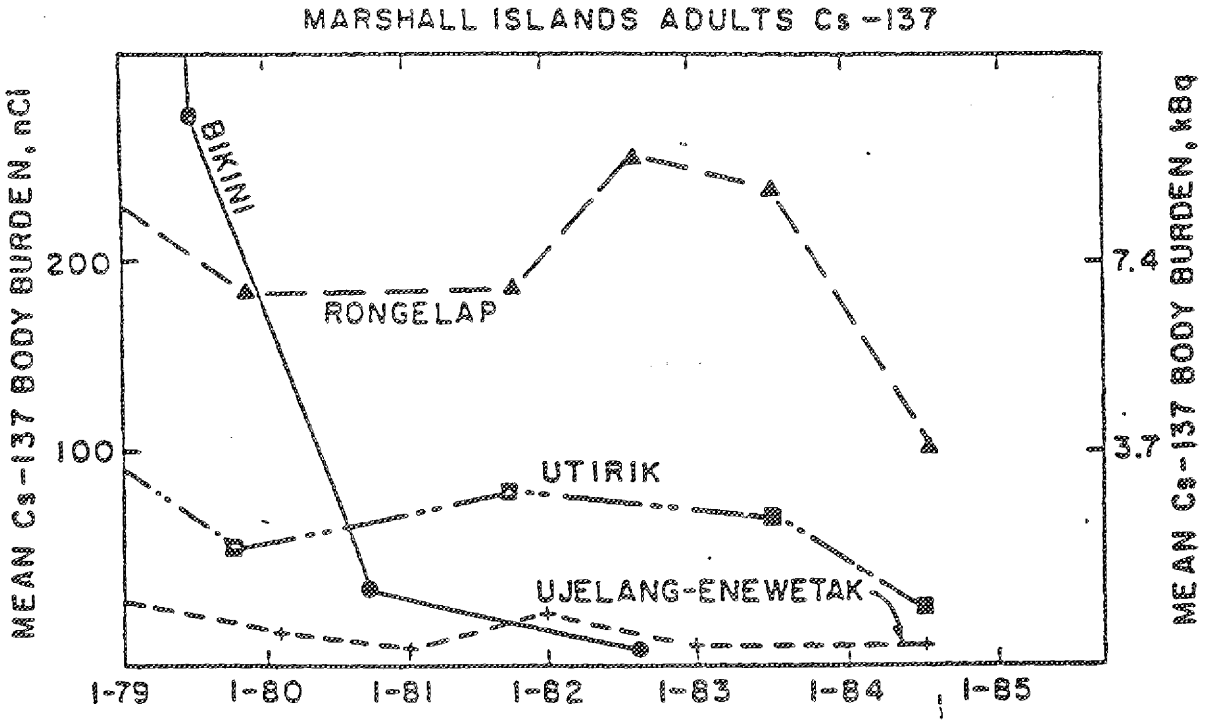

Figure 2. Recent ^{137}Cs Body Burdens

Annual Dose Equivalent Results

We have estimated the annual eommitted effective dose equivalent from five radionuclides present in Rongelap people since day of return in June 1957 up to June 2009. These are average results for adults which we based on numerous measurements made from 1957 to present. Evaluation of dose equivalent from transuranium elements is incomplete, however, we are expending great efforts to complete this phase of the study and expect results by the end of December.

The annual average external exposure at one meter above the ground at Rongelap Island is tabulated in Table 3 (background was subtracted). By multiplying these annual external exposure values by the factor 0.7, one may approximate the average annual effective dose equivalent from external whole-body irradiation. The sum of the committed effective dose equivalent from internal sources and effective dose equivalent from external sources is recommended by ICRP to be less than 1 mSv per year (100 mrem per year, see ICRP Publication 26) for the general population. On the average, the sum of the committed effective dose equivalent plus the effective dose equivalent from external whole-body irradiation is 0.85 mSv per year (85 mrem per year) at Rongelap. This was estimated based on time averaging the dose equivalent rate over 50 years. This period of time was chosen because the average adult was about 30 years old in 1957. Life expectancy at this age is about 50 years.

TABLE 3. Rongelap Adult Committed Effective Dose Equivalent,(1)
Average Value Committed Each Year

Test YO	Year	^{60}Co (mrem yr^{-1})	^{137}Cs (mrem yr^{-1})	^{65}Zn (mrem yr^{-1})	^{90}Sr (mrem yr^{-1})	^{55}Fe (mrem yr^{-1})	Average Annual External Exposure Rate (mR yr^{-1})
3	1957	19.8	199	151	4.32	10.9	290
4	1958	8.35	181	33.8	3.97	8.44	210
5	1959	3.53	164	7.36	3.64	6.51	170
6	1960	1.49	149	1.69	3.34	3.02	140
7	1961	0.63	136	0.38	3.06	3.88	120
8	1962	0.27	123	0.08	2.81	2.99	100
9	1963	0.11	112	0.02	2.58	2.31	90
10	1964	0.05	102		2.37	1.78	80
11	1965	0.02	92.4		2.17	1.38	73
12	1966		83.9		1.99	1.06	66
13	1967		76.2		1.83	0.82	61
14	1968		69.2		1.68	0.63	56
15	1969		62.9		1.54	0.49	52
16	1970		57.2		1.41	0.38	49
17	1971		51.9		1.29	0.29	46
18	1972		47.2		1.19	0.22	43
19	1973		42.9		1.09	0.17	41
20	1974		38.9		1.00	0.13	38
21	1975		35.4		0.92	0.10	36
22	1976		32.1		0.84	0.08	35
23	1977		29.2		0.77	0.06	33
24	1978		26.5		0.71	0.05	32
25	1979		24.1		0.65	0.04	30
	1980		21.9		0.60	0.03	29
27	1981		19.9		0.55	0.02	28
28	1982		19.1		0.50	0.02	27
29	1983		16.4		0.46	0 01	26
30	1984		14.9		0.42	0.01	25
31	1985		13.5		0.39	0.01	24
32	1986		12.3		0.36		23
33	1987		11.2		0.33		23
34	1988		10.2		0.30		22
35	1989		9.22		0.28		21
36	1990		8.38		0.25		21
37	1991		7.61		0.23		20
38	1992		6.92		0.21		19
39	1993		6.28		0.20		19
40	1994		5.71		0.18		18
41	1995		5.19		0.16		18
42	1996		4.71		0.15		17
43	1997		4.28		0.14		17
44	1998		3.89		0.13		16
45	1999		3.53		0.12		16
46	2000		3.21		0.11		15
47	2001		2.92		0.10		15
48	2002		2.65		0.09		15
49	2003		2.41		0.08		14
50	2004		2.19		0.08		14
51	2005		1.99		0.07		14
52	2006		1.80		0.06		14
53	2007		1.64		0.06		13
54	2008		1.49		0.05		13
55	2009		1.35		0.05		13

(1) Multiply by 10^{-5} to convert to Sv.

Risk from Radiation

At Rongelap there are two distinct populations at risk. One group (called the exposed group) was exposed acutely in 1954 and in addition was exposed to low levels of radiation in a protracted fashion from 1957 to present. Another group (called the unexposed group) was exposed only from 1957 to present. The cancer mortality risk from a single exposure to radiation is protracted in time (see Figure 3), thus, the exposed group is experiencing risk from the 1954 exposure in addition to experiencing risk from the protracted exposure. I have tabulated the retrospective and prospective annual risk for the Rongelap people in Table 4. I based the estimate on the rectangle approximation of annual risk given in Figure 3.

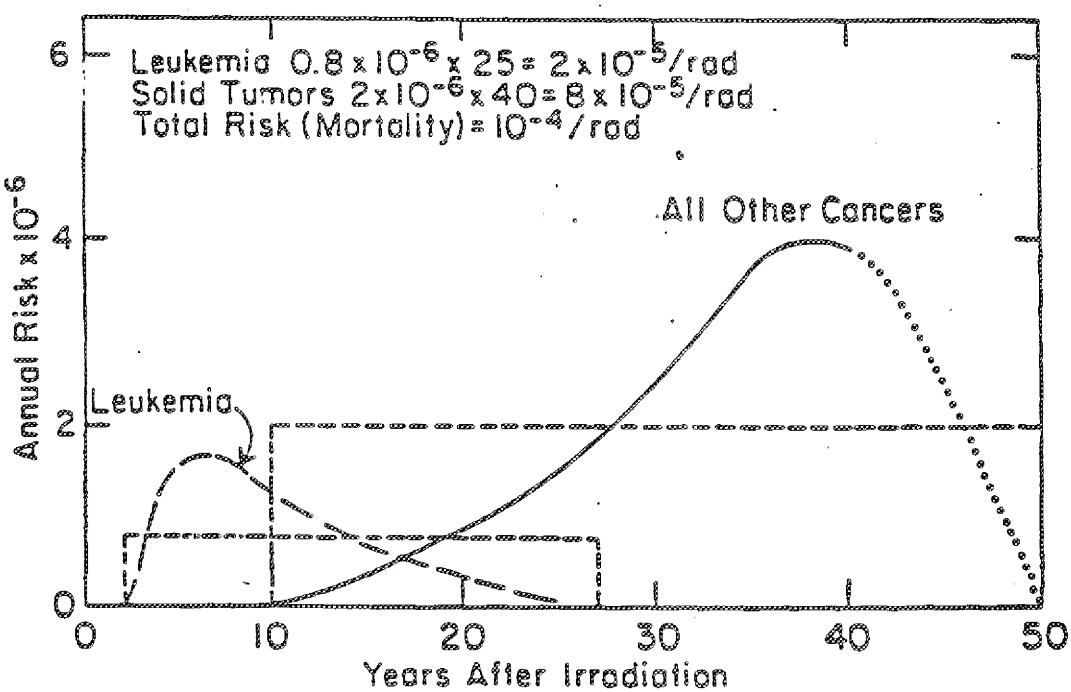

Figure 3. Protracted risk following a dose of one rad, adapted from Sinclair "Risk as a Basis for Radiation Protection", paper presented at 6th International Congress of the International Radiological Protection Association, in Berlin (West), May 7-12, 1984.

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extractive scintillator. We have instituted an additional chemical procedure, ion exchange, in order to perform the necessary Pu-Po separation. Four additional PERALS counters have been built and added to the four we now use.

In order to verify the Pu activity in urine, we have developed a procedure to quantitatively extract the Pu from the scintillation fluid which remains after counting with PERALS. This enables us to measure ^{239}Pu by fission track etch analysis. In addition, it is useful in cases where the sample activity is too low to be detected by PERALS. The fission track technique will allow us to detect ^{239}Pu at levels of less than 3.7 uBq (.1 fCi) per sample. This bioassay limit corresponds to detecting an annual committed effective dose equivalent of greater than 10 uSv per year (1 mrem per year) for Rongelap adults. We anticipate initial results from this technique by the end of December 1984.

The Rongelap unexposed group is expected to remain near the upper range of the prospective annual risk limit recommended by ICRP. Moving away from Rongelap at this time will not significantly alter future annual risk. In large part, the unexposed group's future risk will be from radiation exposure received during the last 27 years.

Recent Bioassay Results from Pu

The estimates of radiation dose and associated risks given previously do not include the contribution from transuranic nuclides. We anticipate this dose to be negligible based upon estimates by Bill Robison which apply to former Bikinians, however, this has not been verified through bioassay. We have analyzed about 500 test samples using alpha liquid scintillation (PERALS) procedures. Test samples were run at two outside laboratories in addition to our work at BNL. In July 1984 we identified 40 Marshall Islands urine samples which we suspected as either not containing Pu or as containing low levels of Pu. Briefly, we wet ashed these samples and solvent extracted to obtain pure Pu. We then introduced the Pu into an extractive scintillator so that the sample could be counted on PERALS. The minimum detection limit for this method is 190 uBq (5 fCi).

A number of these Marshall Islands urine samples showed alpha counts in the ^{239}Pu region, however, on further investigation we noted that some of this activity was due to the decay of naturally occurring ^{210}Po. Experiments done here and at one other laboratory indicated to us that the solvent extraction procedure unexpectedly allows significant amounts of ^{210}Po to pass into the

Table 4. Annual Average Excess Cancer Mortality Risk

Year	Rongelap Exposed[1]	Rongelap Unexposed[2]
1957	2×10^{-4} per year	0 per year
1961	2×10^{-4} per year	9×10^{-7} per year
1972	6×10^{-4} per year	6×10^{-6} per year
1984	4×10^{-4} per year	1×10^{-5} per year
1994	4×10^{-4} per year	1×10^{-5} per year
1997	4×10^{-4} per year	1×10^{-5} per year
2008	$<10^{-5}$ per year	$<10^{-5}$ per year

[1]Acutely exposed March 1, 1954 plus protracted exposure 1957 to 2008

[2]Protracted exposure 1957 to 2008

According to ICRP a risk of 10^{-6} to 10^{-5} per year is thought to be acceptable for a non-occupational group (see ICRP Publication 26 and see proposed revision to DOE Order 5480.1A). This ICRP recommendation is intended for prospective risks. Clearly the Rongelap exposed group will remain above the ICRP recommended value, however, if these people left Rongelap it would not alter this fact. The additional increment of risk from protracted exposure is small when compared to the risk still experienced from the acute exposure.