PROTOCOL FOR THE 1974 MEDICAL SURVEY IN THE MARSHALL ISLANDS

The 1974 Medical Survey will begin about the middle of March and will include examinations at Rongelap, Utirik, Bikini, Ebeye and Majuro. The Rongelap people, exposed and unexposed, are examined completely annually, Utirik people every 3-4 years. In addition, following the death of a 19-year-old exposed Rongelap boy last year with acute leukemia, hematological examination in the exposed Rongelap people now takes place twice a year. On the forthcoming survey the exposed and unexposed Rongelap people will be examined completely (except for some of the unexposed examined recently by Dr. Knudsen, our resident physician in the islands). The Rongelap and Utirik populations under study are scattered largely between their home islands, Ebeye and Majuro, the district center. Visits to all these islands will therefore be necessary. Utirik will be visited for purposes of general health care, radiological monitoring of personnel and environment, and for a diabetic survey. Bikini will be visited at the end of the survey for radiological monitoring of personnel and environment. Some 50 workmen are there and it is possible that by the time of our survey some of the Bikini people will have returned.

It is hoped that an LCU will be assigned to the AEC by the Army for our use for medical visits and radiological surveys in the Marshalls. If this materializes we plan on having on the LCU a trailer set up for whole body counting (lead shadow shielded gamma spectrographic instrument). Another trailer would have a complete "physicians office" arrangement including x ray. This vessel, though slow, could be beached conveniently near the villages. Except at Rongelap and Ebeye, we would live aboard the LCU. A "bunker" trailer would be brought on the vessel for sleeping purposes and an eating facility would be established. If the LCU is not furnished we will have to charter a "Trust Territory" cargo vessel. Though faster, such a vessel leaves much to be desired. (I'm sure that those who have been on previous surveys will say that this is putting it mildly.)

In addition to the routine history, physical examination and laboratory work, this survey will be highlighted by several other special examinations including a study of thyroid reserve in the exposed people who have not had surgery, a diabetic survey, a genetic study of children of exposed and unexposed parents, and radiological monitoring of personnel and environment at Utirik, Rongelap and Bikini. The procedures for these examinations and the reasons for doing them will be described below.

We are extremely fortunate in having Dr. James Field to head up the diabetic survey and Drs. Reed Larsen and Yon Wolff, the thyroid examinations. We are also most fortunate in having the cooperation and support from the Trust Territory, particularly Drs. Kumangai, Iaman and Riklon.

In this brief communication time does not permit a discussion of background information concerning political trials and tribulations which our team has had to face during the past several years. Suffice it to say that we are pleased that certain misunderstandings have been cleared up and I think we can count on full cooperation from the Micronesian Congress and local politicians. Senator O. Borja, who heads up the investigational committee for the Congress, has been of great help in accomplishing the improvement in the situation and he may be accompanying us on the survey. Mr. Bryan Farley, an advisor, may also be along. Mr. William Streenan of

the AEC Honolulu Office, has agreed to accompany us on the survey in order to help answer any AEC-directed questions from the Marshallese. Mr. Streenan has always been extremely helpful in logistic support of our surveys. In addition to the above personnel, Mr. Carl Thien, a BNL public relations man and Mr. Douglas Humphrey, photographer, may be accompanying the team to document various aspects of the survey.

The following is a tentative roster of personnel participating in the survey with possible assignments:

Administration: Dr. Robert A. Conard

Administration Assistant, Routeing of people: Mr. Bill Scott (BNL)

Medical Histories: To be designated (T.T.)*

Physical Exams: Dr. Yon Wolff (NIH)
Dr. Reed Larsen (Univ. Pittsburgh)
Dr. Knud Knudsen (BNL and Marshall Islands)
Dr. Ezra Riklon (T.T.)*

Diabetic Survey: Dr. James Field (U. Pittsburgh)
Dr. Isaao Kisino (T.T.)*
Mr. Nelson Zetkeia (T.T.)*

Genetic Survey: Dr. Robert Conard
Mr. Nelson Zetkeia (T.T.)*

Hematological Exams: Mr. Sebeo Shoniber (T.T.)*
Mr. Peter Heotis (BNL)
Mr. Robert Brown (BNL) indefinite as yet.

Urine Analyses: Mr. Bill Scott

X Rays and Photography: Mr. Ernest Libby (T.T.)*; Electronics - Mr. Douglas Clareus (BNL)

Radiological Surveys: Personnel Monitoring: Dr. Stanton Cohn (BNL)
Mr. John Rothmann (BNL)

Environmental Surveys: To be designated (BNL)
To be designated (Univ. Washington

AEC Representative: Mr. William Streenan (AEC, Honolulu)

Public Relations: Mr. Carl Thien (BNL)
Mr. Douglas Humphrey (BNL)

Possible guests from Micronesian Congress: Senator Olympio Borja
Mr. Bryan Farley

Total: 23

*To be approved by Trust Territory

Examinations

The people to be examined will usually be brought into the examination area by automobile. Various Marshallese personnel will assist with interpretation and routing for the examinations. Bill Scott will handle the administration and routeing of the people for the various examinations. Each person will be given a routeing sheet which will designate the various types of examinations to be done.

Routine Exams: Copies of the previous examinations and/or a summary of each case will be available. The history and physical exam forms have been revised and copies of the revised forms are attached. The history will be taken by a member of the Trust Territory Medical Personnel yet to be designated. The examining physicians should refer to the history and enlarge upon it through the interpreter as indicated. The physicians carrying out the exams other than the diabetic and genetic surveys are: Drs. Wolff, Larsen, Knudsen and Riklon. Dr. Riklon will interpret as necessary. A complete physical exam will be carried out including EKG and oscillometric examinations on certain cases. Routine laboratory work will include: complete blood study (WBC, differential slides, RBC, platelets, hemoglobin, hematocrit, plasma collection for blood chemistry), urinalyses and microscopic as indicated, chest x rays and other x rays as indicated.

Cancer: Careful examination for possible malignancy will include pelvic exam with Pap smears, rectal exams in all people over 40 years of age, skin exams, particularly of residual beta burn scars with color photography as indicated, sputum exams if indicated, x rays as indicated.

Leukemia: The hemogram will be carefully evaluated and differential smears scrutinized. Bone marrow exam will be carried out if indicated. Blood smears for alkaline phosphatase will be returned for analysis by Dr. Moloney of Boston.

Thyroid: Previous drawings of thyroids with questionable or positive findings will be available. From the history careful assessment of thyroid medication adherence should be evaluated. This is of paramount importance in the operated cases who are nearly all hypothyroid without Synthroid treatment. For the thyroid reserve study (see below) all of the exposed people in that group should be checked to be sure that they have been off Synthroid treatment for the previous 2 months. Thyroid exam should include a sketch of the gland on the neck drawing on the back of the physical exam form in those cases where there are positive or questionable findings. Plasma samples will be obtained routinely for T-4, T-3 and TSH on all exposed and possibly some control people.

Thyroid Reserve Study: There are 41 Rongelap people now living who have not developed any significant thyroid abnormalities. It would be of advantage to know what the thyroid reserve status is in this group since it is difficult to maintain a strict treatment regimen and this information

may be important in cases that might develop cardiac problems. Therefore this group will be taken off thyroxine prophylactic treatment beginning January 15, 2 months before the survey. (The 23 people who have had thyroidectomys including the 2 boys with thyroid atrophy, will not be included in this study since it is already known that their thyroid function is abnormal and continued thyroid treatment is of great importance in this group.) In order to test thyroid function in this study it is planned to measure thyroxine (T-4 and T-3) and TSH levels on an initial blood sample followed by administration of 10 units of TSH and another blood sample drawn 24 hrs later for measurement of thyroxine levels and clinical exam of the thyroid. About 10 unexposed Rongelap people will be similarly tested.

Dietary Iodine and Iodine Excretion Levels: Iodine in the diet may be evaluated by testing the level of this element in representative meals which will include local fruits and marine life. It has always been thought that the iodine level in their diet should be high and this will test this assumption. Urinary excretion of iodine, tested some years ago, was in the low-normal range and this test will be repeated on aliquots of 24-hr urine samples being collected for radiochemical analyses. These studies may also be done in some of the Utirik population since their diet is presumably less "westernized".

There are two other thyroid studies which may require some supplementary information: (1) excretion rate of iodine in children using ^{129}I is in progress. Activation analysis for measurement of urinary iodine on urines from 2 children given this isotope is being measured up to 16 days. This study is designed to help evaluate the thyroid dose received by children which has been based on an excretion rate of 0.1% of thyroid burden being excreted in the urine at 15 days after exposure (the time of the first urine collections). The other study (2) is an evaluation of iodoprotein levels which are unusually high in the Marshallese people. Jack Robbins, Ed Rall and I are particularly interested in investigating the environmental and genetic aspects of this finding. Other ethnic groups are under study. One study in progress concerns the use of orally administered ^{129}I with plasma collection before and at 2 and 4 days to determine possible incorporation of orally ingested iodine in the various serum iodine fractions. This study is of a preliminary nature and depending on the outcome, further sampling of the population may be indicated.

Diabetic Study: Diabetes in the Marshall Islands, along with cataracts, is considered to be of unusually high incidence. The Trust Territory Medical Personnel at the district centers have been quite concerned about the problem and have requested our help in any way possible. In response to this request, although we have not seen any connection between diabetes and radiation exposure in the Rongelap people, we are anxious to help if possible. We are therefore fortunate in having Dr. James Field, an expert in this field, participate in the survey and perhaps suggest further procedures for evaluation and therapy of this disease in the Marshalls.

Since only a limited number of people can be examined during the March-April visit, it is deemed advisable to concentrate on the Marshall Island populations, principally the Rongelap people living at Rongelap Island, Ebeye and Majuro. Sampling of the Utirik population will be carried out to the extent possible. In order to evaluate the genetic component, sampling of other ethnic groups would be desirable but the logistics and time involved in a study at a distant island preclude feasibility at this time. Of course, other studies of diabetes in Micronesian and other Pacific Island groups will be used for comparison. Dr. Kasino, a Trust Territory practitioner, has a strong interest in diabetes in the Marshalls and may assist Dr. Field in this survey. A hematological technician (Nelson Zeditka) will also assist.

From discussions with Dr. Field the following procedures are being considered: Ideally a fasting blood sugar specimen would be drawn followed by a glucose meal and 2 hrs later another sample drawn for blood sugar. However, only a limited number of people can be tested in this fashion since such samples must be obtained reasonably early in the day. At later times the samples are subject to uncertainty regarding food consumption. Dr. Field believes that if sampling only after the glucose meal means substantially larger numbers of people sampled (which seems likely), then this procedure should be considered at Utirik and where extra numbers of people are wanted. He believes the results using the 1-stick method may tend to slightly underestimate the incidence of diabetes. It is hoped that urine samples for sugar test can be obtained before and after the glucose meal. Obesity and cataract formation as related to diabetes will be evaluated. Obesity may be further evaluated in a limited number of cases by whole-body counting of ^{40}K measurements to obtain lean-mass-fat ratios on those people with positive urine sugars. In the Rongelap series cholesterol and triglycerides will be run on plasma samples returned to BNL. Samples of diet being obtained for radiochemical analysis and iodine content may also be examined for carbohydrate, protein, fat content. Dr. Field is working on a questionnarie to be filled out by all subjects in this study concerning family history of diabetes, dietary habits, etc.

Genetic Effects of Radiation: The generally negative results of the ABCC genetic studies of first generation children Japanese exposed to the A-bombs quelled our interest in such studies on the small Rongelap population. However I recently wrote Dr. James Neel at the University of Michigan who had been in charge of the ABCC studies for his opinion. Though he agrees that it is quite unlikely that such studies in the Marshallese will be fruitful, since he is carrying out a battery of tests for metabolic defects in the red cells and serum of blood in the Japanese children, he is willing to carry out these same tests on the Marshallese children of exposed parents and the parents and also on an equal number of children of unexposed parents and their parents. In addition he recommends analysis for sex chromosome aberrations in buccal smears. We would obtain the smears and they would be analyzed by Dr. Arthur Bloom, also at the U. Michigan. Dr. Neel also recommends that at the time of the blood drawing a brief physical exam for gross abnormalities also be carried out on the children. I will attempt to conduct this study which

will be set up in conjunction with the diabetic study station using the same hematological technician. These studies will be done at Rongelap, Ebeye and Majuro. It is possible that over 200 children and parents will be available for this study.

Radiological Surveys

As a result of the nuclear bomb testing at Bikini, slight amounts of residual radiation exist in the environment of the atolls of Utirik, Rongelap and Bikini. The amounts are least on Utirik and most on Bikini. The people living at Rongelap and Utirik absorbed internally slight amounts of radionuclides, principally ^{137}Cs, ^{90}Sr (also some ^{65}Zn, ^{60}Co and ^{55}Fe). These levels have been far below the doses set as guidelines by the International Commission on Radiological Protection and otheragencies. There has been no indication of any ill effects from these exposures, nor are any expected. A peak dose of about 130 mr/year was estimated for the Rongelap people in 1958 with declining doses subsequently. Thus the accumulated bone marrow dose over the years has most probably not been more than a couple of rads from internally absorbed emitters.

The return of the Bikini people to their home atoll in the near future will no doubt attract considerable attention. The radiological safety of their habitation on Bikini has been verified by numerous radiological surveys of the atoll including plant and marine life and an ad hoc committee on which I served years ago reviewed the then available data and decided that the return of the people "did not offer a significant threat to their health and safety". Recommendations were made to further reduce radiation levels on the island.

At Rongelap annual assessment of the body burdens of radionuclides have been carried out largely but by whole-body counting for gamma emitters (^{137}Cs, ^{65}Zn and ^{60}Co) and radiochemical analyses of 24-hr urine samples (largely of ^{90}Sr, ^{137}Cs and *Pu). Numerous environmental radiation surveys have also been made including external radiation measurements, assays of Rongelap diets, edible plants, land crabs, soil, marine life, etc. The latter have provided valuable information concerning the transport of radionuclides from the environment to man. However, temporal correlation of these environmental data with body burdens of personnel has not been done satisfactorily. Therefore during the survey direct correlation of body burden data with environmental data will be attempted. In view of the imminent return of the Bikini people, a more up-to-date assessment of the radiation status of that island and the people living there is of importance and the forthcoming survey will afford an opportunity to accomplish this. Furthermore the input information on transfer of radionuclides from environment to man on Rongelap and Utirik will be of great value in the assessment of the Bikini situation and now also Eniwetok.

The following procedures are planned:

Personnel Monitoring: Whole-body counts: Dr. Stanton Cohn and Mr. John Rothmann will carry out whole-body gamma spectrographic analyses on personnel using a shadow shielded detector in an air-conditioned trailer aboard the LCU which will be beached. A shower facility will be available and the subjects to be counted will be clothed in paper pajamas. Measurements will be made on the following estimated numbers of people: at Utirik 30, Rongelap 80 and Bikini 40 workmen and a sample of Bikini people if they have returned. ^{40}K samples will be used to evaluate lean body mass for the diabetic survey.

Radiochemical Urinalyses: 24-hr urines for radiochemical analysis will be collected as follows: in Utirik 12, Rongelap 15, Bikini 20. Pooled samples may also be obtained. Aliquots of these samples may also be used for iodine excretion studies.

Diet: A number of typical Marshallese diets will be obtained at Rongelap and Utirik for radiochemical analyses. (It is not expected that the Bikini diet will contain any native foods.) Aliquots of these diets will also be tested for iodine and CHO etc. for the diabetic study. Cocoanut crabs will be collected from various parts of Rongelap, Utirik and Bikini atolls for analysis.

Drinking Water: Samples will be collected at Bikini for radiochemical analyses.

Fruits: Cocoanuts, pandanus, arrowroot and other plants will be collected for radiochemical analyses at Utirik, Rongelap and Bikini. (Bikini samples will also be tested for Pu and Am.)

Soil: Samples will be tested for radionuclides at all three atolls and at Bikini also for Pu and Am.

Gamma Radiation Levels: A survey of Bikini Island for radiation levels will be an important part of the survey there. Levels at Rongelap and Utirik will also be checked including some of the northern islands of Rongelap.

It is anticipated that a member of the Health Physics Department at BNL and someone from the University of Washington School of Fisheries will be designated to assist in the radiological surveys. Starting Fiscal 1975 it is expected the environmental radiation surveys will be directed by Mr. Charles Meinhold of the Health Physics Department at BNL. One objective is closer coordination with the medical surveys. It is hoped that the U. Washington personnel who have contributed so much in the past will continue to participate.

Your assistance in finding a replacement for Dr. Knudsen will be appreciated. Ideally such a replacement should participate in the survey but at least should be available the first part of the summer to overlap with Knudsen in the Marshalls before he leaves in September. Such a doctor must be motivated for the type of challenge he will face. He should have some background in either general practice, internal medicine, surgery or perhaps pediatrics. Time will likely be available to carry on epidemiological or medical research of his own choosing. Salary will be negotiable. He will be entitled to tax free income if he stay 18 or more months. Air conditioned quarters at Kwajalein will be furnished.

Should you feel that a meeting of the doctors participating in the survey would be advantageous please let me know. At any rate I will appreciate comments and suggestions as soon as possible. Time is growing short.

Robert A. Conard, M.D.

PEOPLE TO BE EXAMINED - 1974 SURVEY

Island	Routine Exams	Diabetic Survey	Genetic Studies	Thyroid Reserve	Whole Body Counts
Majuro	33	33	35	5	0
Ebeye	26	26	143	14	0
Rongelap	65	65	89	21	80
Utirik	0	30	0	0	30
Bikini	0	0	0	0	60

Tentative March 1974 Marshall Island Survey Schedule

	U.S. Time	T.T. Time	
March	Fri,Sat 15,16		Exam Rongelap students in Hawaii
	Mon 18		Advance Team Kwaj-Majuro
	Tue 19	Wed 20	Medical Team Hono-Majuro
		Thu 21	Exams Majuro
		Fri 22	Exams Majuro
		Sat 23	Exams Majuro
	Sat 23	Sun 24	Majuro-Kwaj (arr 1530 Kwaj)
	Sun 24		
	Mon 25		Setup on Ebeye - Exams in P.M.
	Tue 26		Exam Ebeye
	Wed 27		Exam Ebeye
	Thur		Exam Ebeye
	Fri 29		Exam Ebeye 1/2 day, pack - Lv Ebeye- Utirik ~ 1800
	Sat 30	Sun 31	Sail to Utirik
April		Mon 1	Arr Utirik in A.M. Exams
		Tue 2	Utirik Exams - feast
		Wed 3	Lv Utirik 1800
		Thur 4	Sail for Rongelap
		Fri 5	Arr Rongelap in A.M. - Setup
		Sat 6	Exams Rongelap
		Sun 7	Rongelap
		Mon 8	Exams Rongelap
		Tue 9	Exams Rongelap ~ feast
		Wed 10	Exams Rongelap

	U.S. Time	T.T. Time	Continued
April	-	Thur 11	Lv Rong 1100
		Fri 12	Arr Bikini ~ 1200
		Sat 13	Plane Bikini-Kwaj; Plane Kwaj-Hono- * Bikini Exams
		Sun 14	Bikini
		Mon 15	Exams Bikini
		Tue 16	Lv Bikini
	Tue 16		Arr Kwaj
	Wed 17		Kwaj-Hono

* Some doctors may return to the U.S. at this time.