

## AND REQUIRED REVISIONS IN LIGHT OF ACTUAL AND PROJECTED EXPANSION

## TRADITIONAL CHARACTERISTICS

## EXPANDED CHARACTERISTICS

1. Directed toward early detection treatment, and prevention of radiation induced disease.

2. Islands involved have included Rongelap, Alingnae, Rongerik and Utirik.

3. Populations under study have included:

- a. 64 Rongelap - 175 R  
4 in utero
- b. 18 Alingnae - 69 R
- c. 158 Utirik - 14 R

4. Rongelap received 175 R of gamma radiation; Alingnae received an unknown amount (approx. 69 R). Twenty-eight servicemen received an unknown amount on Rongerik; 158 people on Utirik received 14 R. In addition, all of these islands received an unknown amount of short-lived radio-nuclides - predominantly iodine.

5. The exposed populations were evacuated a period of 48-72 hours, to Kwajalein, where they were cared for by a team of radiation specialists from the AEC and other nuclear labs. Following an extensive medical and radiologic evaluation of the exposed population, an age-sex matched cohort was established for the people of Rongelap. No cohort was established for Utirik. The people of Utirik were returned to their island 3 months post-exposure; the people of Rongelap, 3 years post-exposure. Follow up

1. Same

2. Recent developments in 1978 and 1979 have opened the possibility that islands other than those designated in the traditional study may have received variable amounts of radiation, producing a wide spectrum of long term low level radiation of variable intensity. Recently obtained information from the papers of the USS Renshaw seem to indicate that on March 5-6, 1954 that there was a significant increase in background radiation at least on the island of Likiep (? 300mr/hr measured from the water of the cistern of the Catholic school.

3. The Secretary of State of the newly formed Marshall Island government, Mr. Anton deBrum states that as a child on Likiep at the time of the Bravo test on 3/1/54, he noted a particulate type of fallout. He remembers the visit of the Renshaw and states that a number of the people of the island underwent personal dosimetry at the time of the visit. He states he can remember the Geiger Muller counter clicking rapidly during the counting of the feet of many of the inhabitants being surveyed. During the ensuing 25 years, Mr. deBrum states he has noted a "very high" incidence of thyroid and congenital abnormalities in the people of Likiep.

4. In 1970, Dr. R. A. Conard (then director of the BNL Marshall Island Study) visited Likiep and attempted to perform a complete survey of the island aimed at detecting the presence of thyroid nodules by palpation of all available inhabitants. During this survey 135 people were examined and 5 nodules were detected. Of the three major populated islands in the atoll, one was surveyed.

In 1977, a similar survey was carried out on Wotje. Two of the four inhabited islands in the atoll were visited. The visits to Likiep and Wotje were designed to determine the presence of palpable thyroid nodules in an "unexposed" population. Current data indicate that this population might in fact have had a higher than ambient radiation exposure.

5. The inhabitants of all islands other than Rongelap, Utirik, Alingnae and Rongerik have been reassured repeatedly that they have not been exposed to "significant" radiation. Recently, Mr. deBrum designed and circulated a medical questionnaire to determine from a number of the people of Likiep and some surrounding atolls the prevalence of "thyroid" and "congenital" abnormalities since 1954. We have no solid information on the size of the population sampled. However, the survey has revealed an unusually high prevalence of "positive" results. The questionnaires have been completed by individuals and in many cases, by health care personnel. Interpretation of these questionnaires in their present format is impossible from an epidemiologic standpoint, however the questionnaires do raise the possibility of an unexpected incidence of the aforementioned diseases in Likiep. This information has been presented to US - Department of Interior and US - Department of Energy and assurances have been made to the Marshall Islands gov't. that a careful and scientifically valid

studies were performed at 6 months, 1 year and annually for Rongelap. Initially, the Utirik people were seen every 3 years. The surveys have included careful monitoring of the hematopoietic system as well as the thyroid. The only death in the irradiated group due to radiation occurred in a Rongelap child exposed at 1 year who died of acute myelogenous leukemia; there have been about 50 deaths due to natural attrition. In those children exposed at less than age 1 (and the 4 in utero at Rongelap), over 90% have developed evidence of thyroid abnormalities, adenoma, carcinoma or biologic hypothyroidism.

6. New characteristics - in 1957, a "New control" (comparison) population was established due to the mobility of the cohort.

is comparison population was closely related to the people of Rongelap and an attempt was made to match for age-sex. As the program has evolved there have been significant changes in the comparison population and as of this date, there is a relatively poor fit between the experimental and comparison populations.

The population of Utirik has developed an unexpectedly high increase of cancer of the thyroid which is unexplained on the basis of their acute initial exposure to radiation. The question has been raised concerning the possibility of the long term effects of low levels of radiation present on both Rongelap and Utirik following the return of the inhabitants.

epidemiologic survey will be performed as soon as possible by an impartial group. If that survey reveals the possibility of an unusual prevalence of possibly radiation induced diseases, a full medical survey, based on the traditional medical surveys will be performed for the islands of Likiep and possibly for Wotje, Mejit and Ailuk as well.

Due to the absence of adequate vital statistics, particularly prior to 1954, but continuing to the present, meaningful analysis of observed/predicted cases of possibly radiation related pathology is almost impossible to obtain. Existing health statistics when reviewed by epidemiologists familiar with the biologic and pathologic patterns prevalent in the South Pacific detect unexpected discrepancies in the Marshallese population. A more direct indication of these differences has been presented by automated biochemical analysis performed on the traditional study population. Analysis of these profiles reveals that from 95-97% of the study group (exposed and comparison) have at least one and on most occasions, multiple biochemical levels that fall outside two standard deviations for comparable US values at certified research laboratories.

To the best of our knowledge, no sufficient data exists to establish adequate, age-sex, specific normative curves for each of these biochemical parameters.

6. Several unique sub-populations have emerged over the last several years. These populations were the original inhabitants of the islands selected as the test site for a long series of nuclear and thermonuclear devices; specifically the atolls of Bikini and Enewetak. In 1977, following extensive restoration and decontamination procedures, the island of Bikini was declared safe for re-inhabitation. However, the returning population was cautioned about consuming certain borderline indigenous foods and in visiting other islands with higher background radiation levels. WBC was performed sequentially and in April, 1978 it was determined that the increment of elevation would place many of the individuals above the maximum permissible dose (determined by Cs<sup>137</sup> measured within the next year). It was therefore recommended that the population that had returned to Bikini Island (134 of approximately 600 Bikinians with land rights) would need to be repatriated to the island of Kili. The fact that this population had absorbed an unexpected amount of radiation, albeit well within the maximum permissible levels has evoked a demand by this population for continued close radiologic and medical monitoring for an indeterminate period of time. We understand that on at least two occasions, statements before US Congressional committees have assured the people of Bikini of these services.

A comparable but somewhat different situation now exists for the people of Enewetak. A multi-million dollar decontamination and rehabilitation program has been undertaken by the U.S. Government over the last several years with the intent of rendering a significant portion of Enewetak Atoll habitable. The people of Enewetak were originally evacuated to Ujelang Atoll. Over the past several years, small groups of people from Enewetak have been returned to the atoll to assist in the rehabilitation. I understand these groups have been rotated periodically (about every 6 months). However, the majority of the work force on Enewetak has been US contract personnel. Careful radiologic monitoring of these workers has indicated no significant radiation risk. Next month (9/79), a major meeting will be held on Enewetak to present to the reps of the Enewetak people, the current radiation situation for those islands of the atoll certified safe for habitation. In addition, they will be provided with other significant radiologic data concerning a number of islands in the atoll that are still considered unsafe for habitation or food gathering. It is the recommendation of their legal counsel that the people of Enewetak on the basis of all on this information make the decision of returning to their home atoll on the basis of "informed consent".

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Since the condition for return to Enewetak involve the voluntary restrictions of movement by the people among the islands of their atoll and prohibition of consuming specific foods from those areas the possibility of a situation developing analogous to that of Bikini exists. Because of this possibility the US - Department of Energy feels that it is mandatory that careful base line body burdens be obtained on all people returned to Enewetak and that this be done in conjunction with a careful medical examination. Subsequent WBC and medical examination will be necessary to detect any significant accumulation of radioactivity.

7. The study population now consists of the 244 originally exposed (minus the individuals lost to the study by death or dislocation) plus a group of 209 individuals in the comparison group.

Over the last 10 years, there has been an ever-expanding concern with primary care problems that have been detected in this population who have not been taken care of even after referral to the TT health care delivery system. The program has therefore

come more and more enmeshed in primary care, diagnosis and treatment of conditions not thought to be related to radiation, i.e., diabetes and high blood pressure and severe dental disease. Both the field and the departmental directors of the program have realized that adequate screening for radiation related disease will detect this other group of health problems and pathologic conditions and that we are compelled by the lack of TT services to provide primary care. Consequently, with essentially level funding there has been a dilution of the research dollar.

8. Staffing - for the last 24 years the full-time staff for this program has consisted of 1 full-time MD/director and 1-2 full time technicians. Over the last 6 years there have been intermittent resident physicians based in the Marshall Islands, however those physicians, with one notable exception, have frequently provided more problems that help to the PI.

7. In addition to the group outlined in the traditional program, the expansion of the program to include the following islands would increase the study population as follows:

1. Likiep	400 +
2. Wotje	400 +
3. Metjit	300 +
4. Bikini	6-800
5. Enewetak	4-500
TOTAL	2100 +

This population has received a variable amount of background radiation ranging from ambient to indeterminate low. If this population is included in the study group, a careful epidemiologic protocol will need to be provided to characterize the populations, identify the dependent and independent variables and consider the need for/or availability of a comparison population.

8. Staffing - over the last year there have been major changes in the scope and responsibility of the Brookhaven National Laboratory medical program. For the last 2 years there has been an increasing perception of the critical role that communication (health and radiation education) plays in the delicate interface between the Marshallese and the US representatives. Within the last six months, concurrent with the establishment of a new Marshall Islands government there has been a concerted effort by all parties concerned to develop a highly integrated and cooperative effort to serve the medical needs of the Marshallese people. In line with this effort, and considering the projected increase in the study population, a position paper was developed by Brookhaven National Laboratory for US - Department of Energy in December 1978. Since that time, recent developments have necessitated a re-evaluation of personnel needs. The program has been without a resident physician in the island for six months and it is anticipated that a functional replacement will not be available for another six months. The annual surveys have been re-designed

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Recently, a full-time Marshallese nurse-practitioner has been added to the staff in the Marshalls and a technician previously based at Brookhaven National Laboratory has been transferred to the Marshall Islands. The remainder of the staff over this 25-year period have been volunteers recruited from leading medical centers and research centers throughout the U.S. They have most frequently been unpaid, highly qualified sub-specialists with a primary interest in the area of thyroid pathology.

Academic liason - the pattern of professional liason established over the preceding 25 years has been primarily on a 1:1 basis - using many of the country's outstanding researchers.

to balance the field survey staff so that the basic adult screening protocol can be obtained in a five week survey, beginning in mid-January, including a staff of 14 professionals (4 MD's and 2 RN's).

Two and a half months later, a five week survey begins in mid-May, directed primarily toward pediatric care but designed also to follow-up on abnormal thyroid findings and to examine patients missed on the January survey. The staff is essentially the same with the substitution of a pediatrician for a thyroid specialist.

The third survey occurs two and one half months later in mid-September and concentrates primarily on delivering dental care and performing ancillary studies..., i.e., diabetes, etc. The staff is as before with the substitution of a dentist for the pediatrician.

The rapidly expanding character of this program has made it necessary to add the following positions:

1. Research Coordinator - since the principal investigator has been traveling 60% of the time since assuming direction of the program, and there has been a marked increase in the complexity of the program involving multiple governmental agencies and academic institutions, it is mandatory that some individual familiar with the intricacies of the program be available and resident at Brookhaven National Laboratory during the absence of the principal investigator. This individual should be supported by:

2. Secretary - since the vast majority of the staff will continue to be voluntary and in many cases, in a compensatory pay status, rapid hard copy communication and coordination is essential to the program.

In addition, the need for a full-time, highly qualified, innovative health educator has been identified. This request has come not only from all segments of the Marshallese people and government but also from the affiliated academic institutions and consultants. Since one of the primary criticisms repeatedly brought against the US Department of Energy program has been the lack of communication the present principal investigator feels that initially top priority should be given to developing a health education program designed:

- 1) to explain the role of each medical/radiation programs
- 2) discuss openly and freely radiation risks and to put them in an understandable cultural context and in turn to put those risks in relationship with the indigenous primary health risks.
- 3) such a program will necessitate the close integration and cross-cultural ties necessary to provide effective communication. The plan will be to develop a core of innovative health educators to train Marshallese from the affected atolls. These Marshallese will in turn, train a cadre of Marshallese. The goal of this program is to establish a fully competent and independent Marshallese training group using a Brookhaven National Laboratory health educator as a resource person.
- 4) with the incremental increase in the population under study (from 400 to 2000) and characteristics of the current logistic support system, i.e., at present the medical team is limited to 16 shipboard personnel who are able to examine approximately 500 people in a 5 week period, it becomes obvious that multiple field teams must be developed and logistic support must be refined. The new liasons will therefore involve cooperative efforts with large academic and contractual centers who are able to mount and maintain major field surveys. It is the opinion of a number of experts in this field that the medical programs for the low level radiation groups be university based with a non-nuclear identity. Therefore we have contacted the dean of the medical school at the University of Southern

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California and the director of the division of community medicine who is a recognized expert in the epidemiology of cancer in the South Pacific. They have expressed an interest in further details of the short and long term goals of the program. In addition, we have discussed the possibility of academic affiliations for training in tropical medicine, family practice, field medicine, preventive medicine and for training of paramedical personnel, i.e., Medex, nurse-practitioners. In addition, since the new Marshall Islands Government is in the process of contracting with a Seventh Day Adventist Health Maintenance Organization, we visited Loma Linda University, the academic base for this group. In discussions with the dean of the medical school and the dean of the school of health, we emphasized our desire to establish a close cooperative effort in delivering primary care for the Marshallese. We inquired if Loma Linda University would be interested in an academic collaboration using faculty and staff on the field trips. They indicated interest in this suggestion and will present the concept to University administration. In addition, we had a preliminary meeting with Dr. Don Parlia (Professor of Pathology at UCLA) who is one of the senior consultants in the Marshall Islands Study and was actually present in the USN evacuation task force in 1954. He has remained in close association with the program throughout its 25 years and indicated he would be willing to discuss and additional cooperative effort between the Department of Energy, Brookhaven National Laboratory and UCLA.

With the potential expansion of the program and the concomitant identification of a significant number of potential thyroid surgical cases, it was felt advisable to begin a preliminary search for West Coast (So. CA) surgical units. Our present arrangements use the services of Brookhaven National Laboratory for medical work ups and evaluation and Case Western Reserve (Cleveland) for surgery. Because of severe climatic conditions this seriously limits the number of months during the year during which we are able to treat the Marshallese. A warm west coast facility would give us a great deal more flexibility.

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