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This memorandum concerns an evaluation of the scope and frequency of medical surveys of the Rongelapese that will be necessary in the future, particularly during the next five year period. The following facts related to the health status of these people are presented to show the basis for evaluation.

1. Early Effects of Their Radiation Exposure. As a result of the fallout accident on 1 March 1954, the people of Rongelap received a high sub-lethal exposure of gamma radiation and extensive beta burns of the skin. In addition radioisotopes were absorbed. The gamma radiation caused significant depression of their blood forming organs during the two months following exposure. There may have been an effect on general metabolism as evidenced by weight loss for several months in the majority of people and a slight retardation of growth and development of the children during the first two years after the accident. The people have largely recovered from these effects of their exposure with the exception of complete recovery of their blood platelets, whose mean level is still slightly below the level of the unexposed comparison population, but within the normal range.

2. Possible Late Effects of Exposure. Of greater concern now is the possible development of late effects of radiation based on knowledge gained from animal studies and from limited experience with human beings. Some of these effects which may possibly appear in the Marshallese are: shortening of life span, premature ageing, increase in degenerative diseases, increased incidence of malignancies, development of opacities of the lens of the eyes and genetic changes. Such effects have not yet been observed in the Marshallese but continued examination is considered necessary in order to detect and carry out treatment of any diseases that may develop as soon as they might appear. To this end a cancer detection program will be instituted in the surveys. This will include careful observation of the residual scars of beta burns for signs of malignant change. In the Japanese exposed to the atomic bombings an increased incidence of leukemia,

which reached a peak between 5 and 10 years after exposure, was noted. Therefore, the next five years is a critical period for the development of radiation induced leukemia in the Marshallese. Dr. E. B. Lewis (Science 125:965-72, 1957) has calculated that radiation may cause 2×10^{-6} cases of leukemia per roentgen per year. Thus if a normal incidence of 25 leukemia cases per million per year is taken, a single case of leukemia developing after 175 r would represent a probability of about 14 out of 15 that such a case was due to this exposure in individuals less than 40 years of age. The probability in older people would be slightly less. Therefore, the etiology of such a case would have to be regarded as most probably due to radiation exposure. Since the average time from diagnosis to death in some forms of leukemia is less than a year, annual surveys for leukemia are essential in order that a possible case is not missed.

3. Environmental Contamination. Another situation that needs continued checking in the next few years is the influence of low levels of residual radiation contamination of Rongelap Atoll and the body burden of radioisotopes that the people are accumulating internally. Before the people were returned to Rongelap Atoll, numerous surveys showed the island to be safe for habitation. As was to be expected, however, the return of the people has resulted in some increase in body levels of radioisotopes. These levels are presently considered acceptable since they are far below the permissible limits which have been set by the National Committee on Radiation Protection for Industrial Populations. Nevertheless little or nothing is known about such safety limits when internal exposure is considered in combination with whole body radiation such as the Marshallese sustained.

In view of the above stated facts, continued examination of the Rongelap people is considered necessary on a yearly basis until such time as it is the medical consensus that examinations be reduced in frequency. This matter has been discussed at some length with medical experts in this field, many of whom have participated in past surveys. There is unanimous agreement on this point.

As a result of recent conferences with Trust Territory officials, including Dr. M. H. Macdonald, Director of Public Health, the Trust Territory has agreed to take a more active part in the surveys. This is considered a very important step forward and has many favorable aspects including the following: (1) The presence of Trust Territory medical personnel will make the examinations seem more routine, reducing some degree of disturbing influence occasioned by the presence of a large outside group visiting the island; (2) Since the Trust Territory has the continued responsibility of the general health of the Marshallese people, participation in these surveys will give them greater insight into the problems associated with radiological exposure and greater continuity of observations may be expected during the interim between surveys; (3) If the Trust Territory will be willing to furnish one of their ships for taking the 2i ton steel room to Rongelap on some of the future surveys, this will avoid the disturbing

effect of using a Navy ship with the presence of its crew. This statement is not meant to reflect adversely on the ships that the Navy has so kindly loaned but merely results in an unnatural situation for these islanders. The presence of the Trust Territory ships with their small crew, on the other hand, is commonplace to the islanders.

Plans for the next five years include annual surveys which will generally be reduced in scope and number of participating personnel. This is possible for the following reasons: (1) Certain types of examinations may now be done less frequently than on a yearly basis; (2) More accurate and rapid methods of examination have been developed; (3) With recent improvement in instrumentation the number of specially trained technicians required is reduced. In addition, by alternating major programs, individual surveys may be reduced in scope. It is unlikely that teams as large as have been used in past surveys will be needed in the future. This reduction in size of individual surveys does not necessarily preclude considerable post-survey examinations of samples returned from the field which will occupy the time and effort of a number of scientists at various institutions. It should be pointed out that the number of personnel actually involved in the surveys at Rongelap has represented a small component of the number of scientists and technicians who have contributed to the surveys in the laboratories in the United States. By far the greatest part of the work connected with the survey comes in the post-survey period, such as compilation and statistical analysis of data, particularly of the growth and development measurements in children and gamma spectography data, both of which require the aid of statisticians and many hours of computer analysis; radiochemical analyses of urine samples; interpretation of x-rays, electrocardiograms and audiograms; developing and compilation of documentary photographs; the completion and duplication of all clinical records; etc. Certain studies that are carried out in the laboratories in the United States may not appear on first consideration to be directly related to radiation effect. For example, studies are carried out from small aliquots of blood for determination of blood groups and genetically inherited characteristics. Such studies are important in assessing the homogeneity of the population under study and in obtaining baseline genetic data, which information is of vital importance in interpreting other observations. The scientific value of these studies is secondary to their value in evaluating radiation effects in the exposed people. Therefore, any inference that the Marshallese people are being used as "guinea pigs" because of such studies is completely unjustified.

Details of the March 1960 survey have been worked out with Dr. Macdonald. The survey will involve only a brief examination of the exposed Rongelapese including one WBC and differential count. A limited number of urine samples will be collected for radiochemical analyses. It is anticipated that this survey will require only 4 to 5 days at Rongelap. The several exposed Rongelap people residing at Kbeye and Majuro will also be examined at their respective islands.

Definite plans have only been made through the 1961 survey. During that survey a more complete examination schedule is planned including growth and development studies of the children, leukemia and cancer survey, complete routine hematological survey, use of the steel room for carrying out gamma spectroscopy, and collection of urine samples for radiochemical analyses to be carried out at Brookhaven National Laboratory.

Though specific plans for the 1962, 1963 and 1964 surveys have not been made, it is likely that these surveys will not be of large scope in view of the alternating schedule referred to above. For instance such studies as gamma spectroscopy, growth and development studies and ophthalmological studies may be carried out at separate times. Certain examinations, however, will be necessary on an annual basis such as physical examinations, leukemia and cancer survey and hematological examinations.

Precise figures cannot be given at this time on the number of personnel participating from the United States. This will depend entirely on the number of personnel the Trust Territory can furnish. It seems likely that the number of personnel from the United States will not need to exceed about 8 to 10 in any future survey.

It should be possible to carry out all future surveys in a period of one week to ten days.

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