

The Medical Research Center
Brookhaven National Laboratory
Upton, L. I., New York

MEDICAL STATUS OF RONGELAP PEOPLE 5 YEARS AFTER EXPOSURE TO FALLOUT
RADIATION

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In March 1959 the regular annual medical survey was carried out on the Rongelap people who had received the heaviest exposure to radiocative fallout 5 years previously in the accident which occurred following the experimental detonation of a nuclear weapon.

The examinations were conducted on Rongelap Island to which the people had returned in July 1957. On their return, they were accompanied by an equally large group of unexposed relatives. This latter group has served as a comparison population for the medical studies. The Navy kindly furnished an LST for the survey.

These annual surveys are carried out under the direction of Brookhaven National Laboratory and sponsored by the Atomic Energy Commission with the support of the Trust Territory of the Pacific Islands, the Department of Defense, and other governmental agencies. A team of 20 physicians, scientists, and technicians, specialists in the field of radiation medicine, carried out the survey on Rongelap Island.

On arrival of the team at Rongelap there was some question in the minds of some of the people as to the necessity of having further examinations. Objections to the examinations were mainly directed toward their dislike of the blood sampling. It was also evident that the need for the examinations created some concern in the minds of the people about their health status. Some also were concerned about the radiological safety of their food and water for consumption. The people were reassured that their health was generally good and their food and water safe for consumption, and the importance of continued examinations and treatment in order to help insure their continued good health was stressed. These explanations appeared to alleviate their fears and the people cooperated extremely well with the medical team in carrying out the examinations.

The examinations included medical histories, complete physical examinations, and blood and other laboratory examinations. In addition spectrographs of gamma ray activity were obtained from individuals measured in a steel room and from radiochemical analysis of urine samples in order to determine their body burdens of radionuclides. Analyses of the data are not complete and those data referring to this recent survey must be considered as preliminary in nature. In conjunction with the examinations, considerable medical and dental treatment of the people was carried out to the extent possible under field conditions.

Following the accident, the Rongelapese had shown signs of significant exposure to radiation such as short-lived loss of appetite, nausea, vomiting, depression of their blood forming tissues, multiple burns of the skin from beta exposure and internal absorption of fission products.

Findings on the past survey revealed that the people have recovered from the acute effects of their radiation exposure. No diseases, illnesses, or deaths have occurred which could be directly related to their radiation exposure. The incidence of all diseases noted has been about the same in both the exposed and unexposed groups examined. The general physical condition of the exposed and unexposed people on the island appeared good and their nutritional status was satisfactory. During the past year one death occurred in a 35-year-old man, bringing the total deaths in the exposed group to 3 for the 5-year period. This represents a death rate about equal to that of the Marshall Islands as a whole (about 7 deaths per 1,000 population per year).

Findings, previously reported, which were interpreted as suggestive of a slight lag in growth and development of the children during the first few years after exposure are being reevaluated based on more exact age data obtained on the past survey. The results of this evaluation are not complete enough to make any statements at present.

One case of cancer (ovarian) developed in a 61-year-old female during the past year, the first case of cancer noted in either the exposed or unexposed populations. There is no reason to believe the cancer is related to radiation effect.

Fertility does not appear to have been affected since the birthrate has been higher in the exposed than in the unexposed Marshallese. A somewhat increased prevalence of miscarriages and stillbirths has been noted in the exposed group, but due to the paucity of vital statistics on the Marshallese and the small number of people involved, no statistical analysis is possible.

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Recovery of the blood-forming tissues is judged virtually complete based on studies of the peripheral blood counts. A possible exception is seen in the blood platelets which are slightly below the levels in the unexposed group but still within the normal range. There is no evidence of any untoward effect associated with this finding.

The beta burns of the skin healed rapidly during the first few months after exposure. In 12 cases there remain slight scarring of the skin and pigment changes at the former site of deeper burns. However, no evidence of any cancerous change in these scars is noted. In those that lost hair, regrowth of normal hair was complete by 6 months after exposure.

Very little is known about late effects of radiation in human beings. Increased incidence of leukemia in the exposed Japanese people has been noted and, in animal studies, the following late effects of radiation may result: Life shortening, premature aging, increase in degenerative diseases, increased incidence of malignancies, opacities of the lens of the eyes, and genetic changes. The Marshallese have been examined for evidence of such changes, but none have been seen. Radiation-induced leukemia is known to appear relatively soon after exposure and other types of malignancy at later times. Therefore, continued examination are essential in order to detect and, if possible, treat such effects should they develop.

The radioactive fission products that had been absorbed internally by the Rongelap people were never sufficient in amount to result in acute effects. These radioactive materials were excreted rapidly during the first 6 months after exposure. The island of Rongelap remains slightly radioactively contaminated, but careful surveys showed the island to be safe for habitation by the summer of 1957 when the people were returned to Rongelap. Studies of the body burdens of radioactive materials in these people is an important part of the medical surveys. A 21-ton steel room with very sensitive radiation-detecting equipment has been used in the past two annual surveys at Rongelap to determine the body burdens of radionuclides. In addition numerous urine samples have been analyzed for radioactivity. The results of these studies show that there has been an increase in body burdens, principally of cesium 137, zinc 65, and strontium 90 since their return to Rongelap. About the same levels of these isotopes have been noted in those exposed and unexposed.

During the first 8 months after their return to Rongelap their body burden of cesium 137 are estimated to have increased by factors up to 100 (resulting in a mean body burden of 0.68 μC); zinc 65 is estimated to have shown a concomitant increase (mean body burden of 0.86 μC); strontium 90 showed about a twentyfold increase rate of excretion in the urine. Only one sample of bone is available for estimating the body burden of strontium 90. This is from a Rongelap man who died in April 1958 (9 months after his return to Rongelap) which showed 3.6 $\mu\text{C}/\text{Sr}^{90}/\text{gm Ca}$ (strontium units). On the basis of North American data, it is expected that the values for children would be higher.

Based on preliminary analysis of data from the most recent survey (8 to 20 months after their return to Rongelap), it appears that the people have begun to attain equilibrium with their lightly contaminated environment. The cesium 137 levels appear to be slightly lower than the year before, while the zinc 65 has increased slightly. The strontium 90 analyses, unfortunately, are not available yet. The body burdens estimated above are far below the maximum permissible levels; cesium 137 is about 2 percent of the MPL, and zinc 65 is 1 percent of the MPL.

In summary, a medical survey of the Marshallese people in March 1959, 5 years after exposure to fallout radiation, showed that the people had recovered from the acute effects of their radiation exposure and appeared to be generally in good health. The following specific statements can be made in regard to their radiation health status:

1. No illnesses or diseases were found that could be directly associated with acute radiation effects.
2. One case of cancer and three deaths have occurred, but with no direct relation to radiation effects.
3. Fertility does not appear to have been affected. The incidence of miscarriages and stillbirths appears to be somewhat higher than in the unexposed Marshallese, but a deficiency of vital statistics precludes definite conclusions as to whether or not this is a radiation effect.
4. Suggestive evidence of slight lag in growth and development of exposed children noted previously is being reevaluated on the basis of better age data obtained during the past survey.

5. Blood platelet levels are within the normal range but somewhat below those of the control group.

6. Only 12 cases show residual changes in the skin from beta burns. None show any evidence of secondary change.

7. Possible late effects of radiation such as shortening of lifespan, premature aging, increased incidence of leukemia and malignancies, increased incidence of degenerative diseases, opacities of the lens, and genetic changes have not been observed.

8. The original body burdens of late absorbed fission products appears to be too low to have produced any acute or long-term effects.

9. The return of the people to the slightly contaminated island of Rongelap has caused some increase in body burdens of cesium 137, zinc 65, and strontium 90. However, the levels are far below the accepted maximum permissible dose and it is not believed any untoward effects will result.

In view of the limited knowledge of the late effects of radiation in human beings, it is considered essential that medical surveys of the Rongelap people continue to be carried out in order to detect and treat immediately any possible further effects of radiation that might develop. Though body burdens of radioactive isotopes are well below the accepted permissible dose levels and no further significant increase in these burdens is anticipated, a close check on these levels during future medical surveys is indicated.

(Whereupon, at 12:30 p.m., the committee recessed, to reconvene at 2 p.m., the same day.)

AFTERNOON SESSION

Representative HOLIFIELD. The committee will be in order.

Our first witness will be Dr. Gordon Dunning of the Division of Biology and Medicine of the AEC. Dr. Dunning will present a short summary of the effects of injection. We will accept his detailed statement for the record, and insert it at the end of his testimony.

Representative HOLIFIELD. Dr. Dunning, the Chair wishes to apologize for the necessity of asking you to summarize your testimony. As you can see, we are running late. We are going to have to carry over some of our witnesses until Friday morning. In the morning we plan to start on article X of the outline, which will have casualty estimates, human beings in the United States, and article XIII. We will try to cover that on Thursday. If we fail to get to some of the witnesses between now and then, we are going to have to carry over. We are running behind, and we have made commitments to members and others to have such data as is available on Thursday.

So at this time, Dr. Dunning, we will ask you to proceed.

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Addendum

A NOTE ON THE VEGETATION
OF THE NORTHERN ISLETS OF RONGELAP ATOLL, MARSHALL ISLANDS, MARCH 1959

B.S. BLUMBERG* AND R.A. CONARD

Fosberg^{1,2} reported changes in the vegetation of the northern islets of Rongelap Atoll (observed in 1956) which he inferred might have been associated with the radioactive fallout that occurred on this atoll in 1954. During the medical survey of the Rongelap people³ carried out in March 1959, an opportunity arose to visit some of these islets

and to re-examine the vegetation. A helicopter was available for transportation, which permitted general and detailed air examination as well as two short ground surveys. The northern islets were estimated to have received a radiation dose of ≈ 3000 r. The islets of Naen and Gegen were examined in greatest detail. The most striking feature observed from the air was the generally gray color of much of the vegetation, in contrast to its

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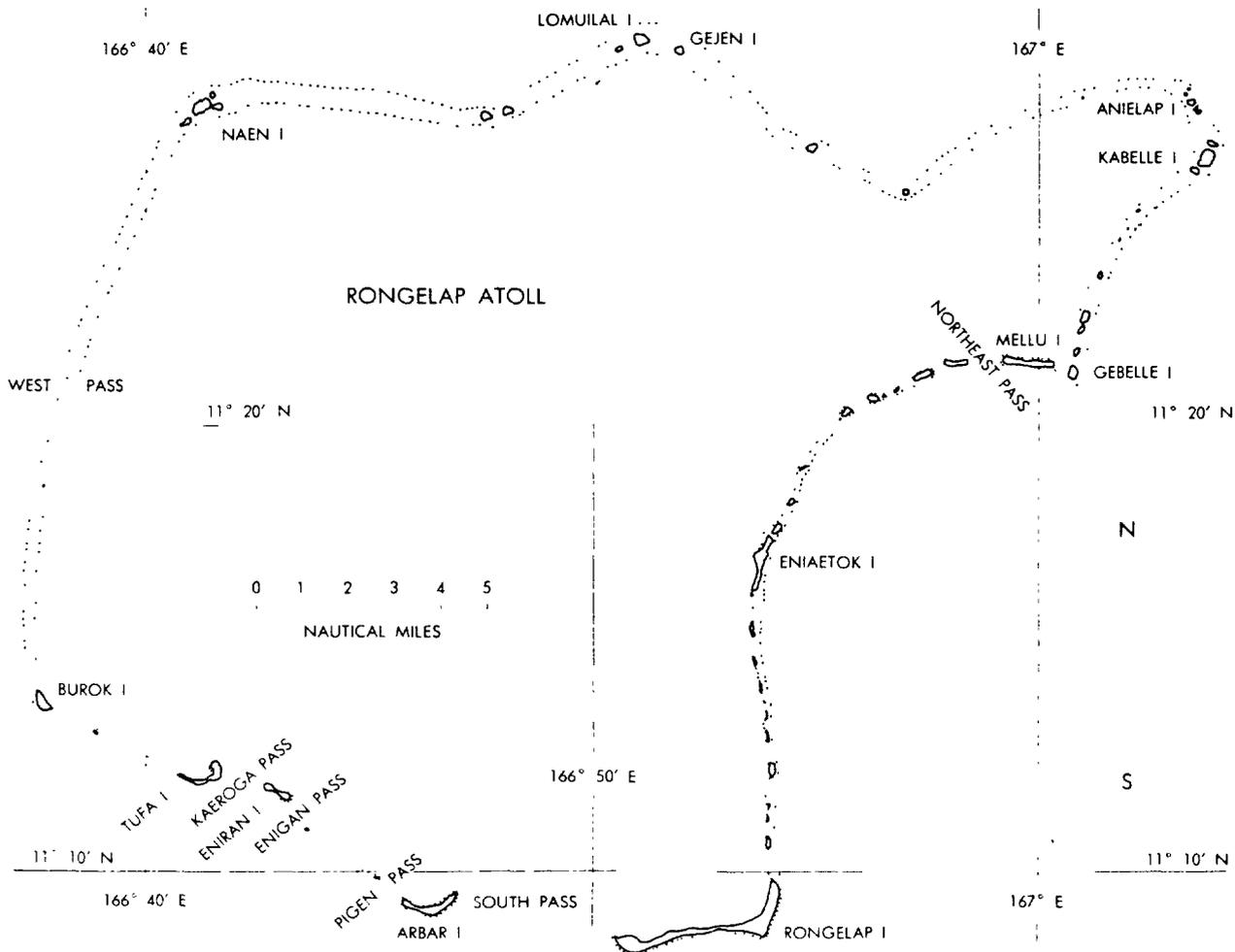


Figure A-1 Map of Rongelap Atoll showing position of major islets.

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Figure A-2. Affected *Guettarda speciosa* with normal appearing *Scaevola sericea*.

normal green color. Ground surveys revealed that *Scaevola sericea* was common and normal in appearance. Many of the *Guettarda speciosa* appeared to be in poor condition (Figure A-2). In some, all or nearly all the leaves were gone from the terminal 1 to 12 in. of the branches, and other leaves were yellowed and shriveled. In other *Guettarda*, nearly all the leaves were gone, and the bushes appeared completely dead. More than 50% of the *Guettarda* were affected in whole or part. In one area of Naen several hundred yards inland from the ocean beach, there was a field of ≈ 30 *Guettarda*, all of which were dead. Some young *Pisonia grandis* were seen which appeared to be in good condition. Mature *Pisonia* were seen which were partially defoliated, but these did not appear to be greatly different from those seen on Rongelap Islet on the southeast corner of Rongelap Atoll. None of the mistletoe-like clumps described by Fosberg were observed. Several *Ochrosia oppositifolia* were seen with nearly complete defoliation, which appeared dead. A small grove of coconut trees near the center of Naen Islet contained 4 to 5 dead trees within a radius of ≈ 300 yards, which were decapitated at heights 5 to 12 ft above the ground with no evidence of axe or machete marks. Two 2-headed coconut trees were seen, one with fronds that were mostly brown and appeared dead growing from the trunk ≈ 2 ft below the true crown of

the tree. Several trees had dry and shriveled fronds, and ≈ 6 had deformed bulges 4 to 8 ft below the crown with apparently normal growth above the bulges.

Photographs of the affected vegetation were examined by Dr. Fosberg, and he stated that the changes were similar to those he had previously reported.

It is not possible to evaluate the cause of the changes from the present observations. More extensive and detailed botanical and ecological surveys will be necessary, both on the islands that received radiation and on those that did not, to determine whether the changes seen bear any relation to fallout. In particular, it should be noted that these observations were made during the dry season.

We are indebted to Professor Frank Richardson of the University of Washington for identifying the plants, and to Commander W. Lyons, USN, for his assistance in taking the photographs.

REFERENCES

1. FOSBERG, F.R., *Nature* **183**, 1448 (1959).
2. FOSBERG, F.R., *Atoll Research Bulletin* **61**, 1-11 (1959).
3. CONARD, R.A. ET AL., *Medical Survey of Rongelap People, March 1958, Four Years After Exposure to Fallout*, BNL 534 (T-135).