





GENERAL ATOMIC INTERNATIONAL CORPORATION  
 ASSOCIATED GENERAL ATOMIC INTERNATIONAL CORPORATION

MEDICAL DEPARTMENT

TELEPHONE (516) 341-2568

7/1/53

James M. Alexander, M.D.,  
 Director  
 Division of Biological and Environmental Research  
 U. S. Atomic Energy Commission  
 Washington, D. C. 20545

Dear Dr. Alexander:

I have finished reading the extensive report of the Medical Commission on the events pertaining to following the fallout accident in the Marshall Islands. I have also read the report and the quest for the "winner" which you have so graciously loaned. Separately I am sending you the report of Dr. Ross Knudsen who has been in residence in the Marshall Islands this year.

One of the intentions of General Atoms is to have a single report including the present status of all people from the Marshall Islands, the American people, and the Japanese who were exposed to fallout. This is a good proposition and one which all of us are anxious to see. It is, however, a winner not at all clear to me. The Department of Health is to have follow-up studies on the American people who were exposed despite the fact that this is already being done by the termination of the medical survey in 1954 even prior to 1953 when my personal participation in the work.

When a report on the American people does not appear, I believe that will be regarded as supported by the American Medical Association and the Medical Commission. The Department of Health are to keep in contact with the Japanese.

I am bringing this to your attention because I think it is potentially a very serious problem that could easily be solved in favorably to the Japanese if we are not by interfering with the Atomic Energy Commission.

Sincerely yours,

*James M. Alexander*  
 James M. Alexander, M.D.  
 Director

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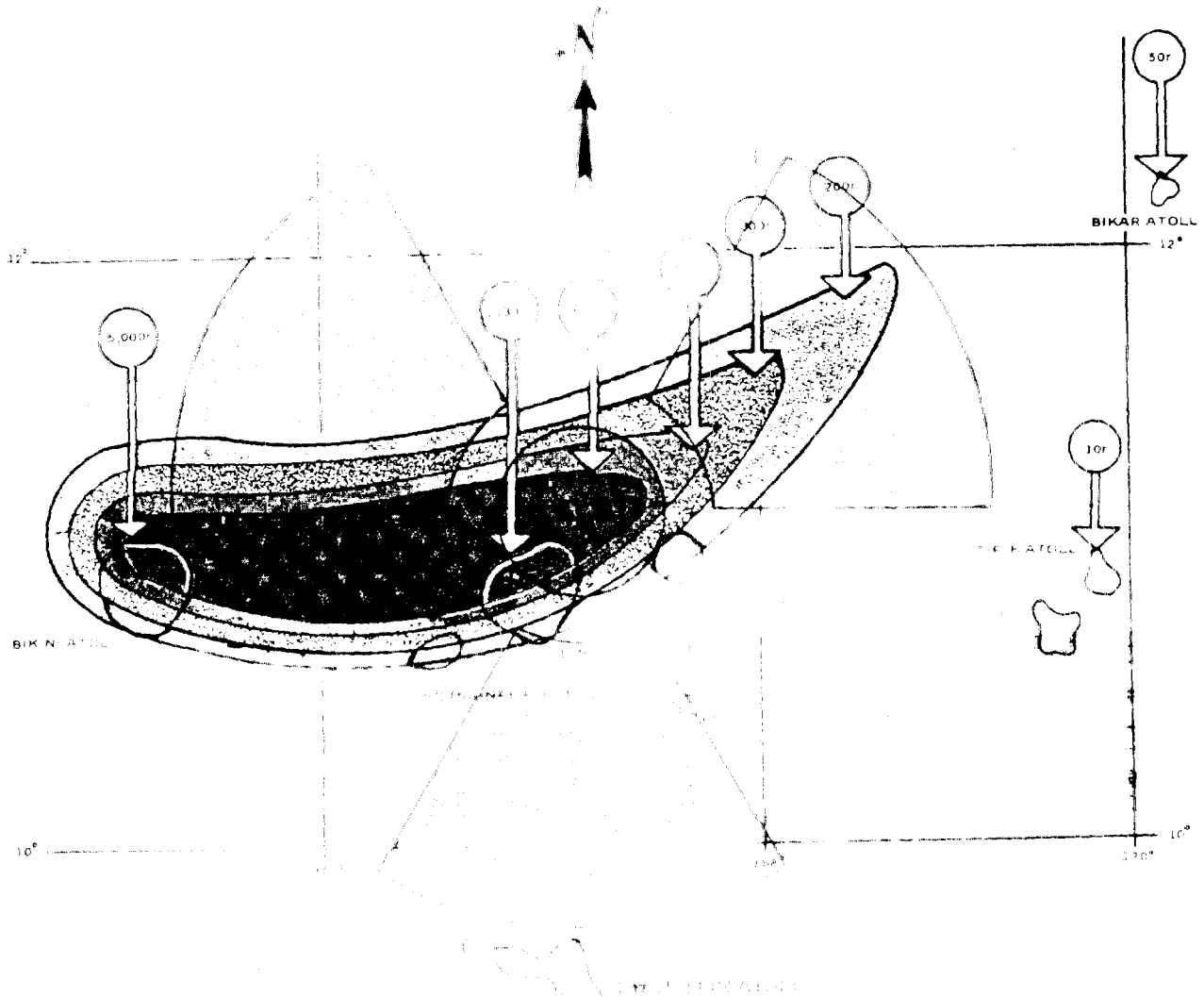


BOX NO 656

FOLDER # REPORT

a report on

# Rongelap and Utiirik to the Congress of Micronesia



*Medical Aspects of the Incident of March 4, 1954  
by the Special Joint Committee Concerning  
Rongelap and Utiirik Atolls*

1014583

A Report on the Trade of Property and Rights

Reference to

Report Approved by the House of Commons

Printed by the Stationery Office

Printed in Great Britain

The Report of the Committee on the Trade of Property and Rights

(H.C. 1000)

1964

1964: The Report of the Committee on the Trade of Property and Rights

(H.C. 1000)

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THE SENATE  
CONGRESS OF MICRONESIA

CAPITOL BUILDING, PALAPAE, MARSHALL ISLANDS 96950

PRESIDENT  
Tosiwo Nakayama

February 1973

VICE PRESIDENT  
Lazarus E. Salli

The Honorable Tosiwo Nakayama  
President of the Senate  
Fifth Congress of Micronesia  
First Regular Session, 1973

FLOOR LEADER  
Amblios Jehsi

and

YAP DISTRICT  
Petrus Tun  
John A. Mangefel

The Honorable Bethwel Jehsi  
Speaker, House of Representatives  
Fifth Congress of Micronesia  
First Regular Session, 1973

TRUK DISTRICT  
Tosiwo Nakayama  
Andon Amaralch

Dear Mr. President and Mr. Speaker:

PONAPE DISTRICT  
Bailey Otter  
Amblios Jehsi

It is a distinct honor to transmit to you by means of this letter a report by your Special Joint Committee Concerning Rongelap and Utrik Atolls. Your Committee, as created by Public Law No. 40-33, has worked faithfully and diligently to fulfill its obligations under the mandates of the law.

PALAU DISTRICT  
Lazarus E. Salli  
Roman Tmetuchi

During its work, your Committee has been confronted with the technical nature of some areas, which have in part produced perplexing problems connected with the well-being of the people involved. This report attempts to deal with and explain these, and does make recommendations which it feels are both practical and necessary.

MARSHALLS DISTRICT  
Amata Kabua  
Wilfred J. Kendal

While the Committee is certain that this is the most comprehensive and extensive investigation ever made concerning this matter, it wishes to state that the report is by no means as exhaustive as it could be. Had every medical aspect of the subject been explored, the length of the report would have been increased by half, or doubled. Furthermore, it was a desire of your Committee that

MARIANAS DISTRICT  
Olympio T. Borja  
Edward DLG. Pangellinan

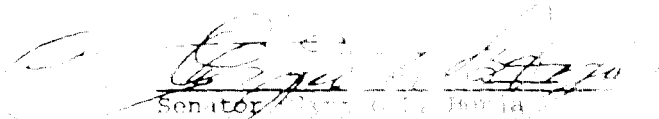
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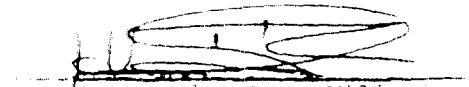



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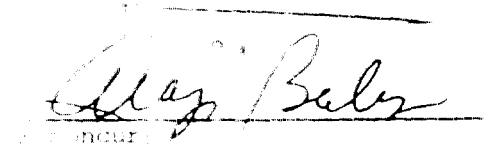
the area of compensation needs to be clarified and deserves to be the subject of a subcommittee report. For these reasons, and others, all report required by the Committee's final determination in the light of proper evidence. It should be noted that the subcommittee in publishing its report in compliance with H.R. No. 4877, and any additional information will be given as soon as it is available in written. Consequently, the Committee wishes to reserve the right to include additional information concerning the financial aspects in its subsequent report on compensation. The subcommittee feels that this is the most proper way to deal with the facts and the circumstances surrounding the subject.

Respectfully,  
1014590

  
Senator J. Lee Rankin  
Chairman

  
Representative Hans Wiliander  
Member

  
Representative Dorothy Oliver  
Member

  
Representative Ataji Balos  
Interpreter/Informant

1014590

- n. 86 The number of people who are "present" in the case is 100.
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1 Special Committee (Public Law 95-101).  
2 Section 4 of the Act (Public Law 95-101) appropriated out  
3 of the General Fund of the Government of the United States the sum of  
4 \$10,000, for use of the committee to carry out the  
5 expenses of the committee. The amount so appropriated  
6 shall be expended by the committee, subject to the ap-  
7 proval of the President of the United States, to accomplish  
8 the purposes of this Act. The Special Committee is hereby au-  
9 thorized to hire such consultants and other staff members as it  
10 feels are necessary. All funds appropriated under this section  
11 which are not expended or obligated prior to January  
12 31, 1977, shall revert to the General Fund of the Government of  
13 Micronesia.

14 Section 5 of the Act (Public Law 95-101) shall have effect  
15 upon the approval of the High Commissioner of the Government of  
16 Micronesia without further approval.

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1977  
Edward I. Kennedy  
United States Senator  
United States Senate

FOURTH CONGRESS OF MICRONESIA

SECOND SPECIAL SESSION, 1972

July 20, 1972  
D. P. No. 261, S.D.1, R.D.1

PL 11

To appropriate the sum of ten thousand dollars (\$10,000) to cover the cost and contingent expenses of the Special Joint Committee on Rongelap and Rongerik Atolls, and for other purposes.

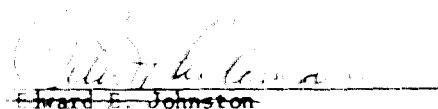
BE IT ENACTED BY THE CONGRESS OF MICRONESIA:

1 Section 1. The sum of ten thousand dollars (\$10,000), or so  
2 much the total may be necessary, is hereby appropriated from the  
3 General Fund of the Congress of Micronesia to defray the cost and  
4 contingent expenses of the Special Joint Committee Concerning  
5 Rongelap and Rongerik Atolls, as provided under Public Law No. 40-33.  
6 The sum hereby appropriated shall be expended at the request,  
7 direction, and approval of the Chairman of the said Committee to  
8 accomplish the purposes set forth herein. The Special Committee  
9 is hereby authorized to hire, at consultants and other staff  
10 members as in fact are necessary, all funds appropriated under  
11 this Section which are not expended, are obligated for expenditure  
12 before January 1, 1976, shall revert to the General Fund of the  
13 Congress of Micronesia.

14 Section 2. This act shall take effect upon approval by the  
15 High Commissioner, or upon the date of the act without such approval.

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19  
20  
21  
22

October 20, 1972



Edward E. Johnston

High Commissioner  
Territory of the Pacific Islands

Section 10. (a) The Special Committee for Special Com-  
mittee shall investigate the conditions of education for the people  
of Rongelap, Rongerik, Bikini, and the Eniwetok Islands District,  
shall attempt to secure any and all the funds, grants and aid  
for the people of Rongelap and Bikini Areas from whatever  
sources possible, and shall attempt to obtain compensation for  
the people of Rongelap, Rongerik, Bikini and the Eniwetok Islands which  
they suffer from the exposure to atomic radiation.

Section 10. (b) Power of Special Committee. The Special Com-  
mittee shall have the power to conduct hearings and investigations,  
issue subpoenas requiring the attendance and witnesses and the  
production of books, papers, records and other documents and bring suits  
in any court of the Trust Territory of the Pacific Islands in  
its own name in matters within powers, jurisdiction and all of the  
powers provided in Subchapter 10, Chapter 1, Title 5 of the  
Trust Territory Code.

Section 10. (c) Report of Special Committee. The Special Com-  
mittee shall submit a report regarding the incident of the  
Senate and the House of Representatives delivered on or be-  
fore May 19, 1954. The report shall be presented to  
the President of the Senate, the Speaker of the House of Representatives and con-  
tinue its work until the members thereof feel that their mission  
has been completed. The Special Committee shall submit a final  
report in the language of Marshallese to the 10th Regular  
Session, Fifth Congress of the Marshallese, on or before the date of

HOUSE COMMITTEE ON TERRITORIES

Public Law No. 40-85

SECOND READING OF HOUSE REPORT NO. 1001

(H. R. No. 1001, H. R. 1)

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(S. 100)

To create a Special Joint Committee on the Bonriki and Utiiki Atolls, to appropriate money therefrom for other purposes.

ENACTED BY THE CONGRESS OF THE UNITED STATES

1        In the statement of fact set forth hereinafter, it is  
2        stated that in the period from 1944 to 1946 the United States  
3        Government conducted a series of atomic bomb tests in the  
4        Pacific Islands, including the islands of Bonriki, Utiiki,  
5        and Ujae in the Marshall Islands. It is stated that the  
6        people of these islands were exposed to the radiation of  
7        atomic bomb tests, and that the people of the islands of  
8        Bonriki and Utiiki were particularly affected. It is stated  
9        that the people of these islands have suffered the most  
10        serious and permanent physical and mental damage, and  
11        that the people of these islands have suffered the most  
12        serious and permanent physical and mental damage, and  
13        that the people of these islands have suffered the most  
14        serious and permanent physical and mental damage.

15        Section 1001 of the Act is hereby  
16        created, and the Special Joint Committee on the Bonriki  
17        and Utiiki Atolls is hereby established. The Special  
18        Committee shall be composed of three members, to be  
19        appointed by the President of the United States, one of whom  
20        shall be a member of the House of Representatives, and one  
21        shall be a member of the Senate. The Special Committee  
22        shall report to the President.

"The only laws that I can imagine are laws the nature of which are valid in every case, in every experience, in every time and place. It appears to me that the only way to obtain a conception of laws is"

— *Albert Einstein, 1919, 1921 essays*

TOP SECRET BY THE COMMISSION

As mentioned in the report of the Commission, the subject matter covered all the aspects of its subject matter, but it should have been considerably longer than it is at present. Thousands of people are still dealing with radiation and its effects. Thousands of scientists, technicians and researchers are studying radiation and its effects today. Among these people there are, even today, people who do not know the benefits and liabilities of radiation as it is used in the home, in the office and in the industry and discussion, the field of radiation and its effects is a relatively new one. This is especially true in regard to its effects on human beings and will continue to be so until it is fully understood and experiment upon his fellow human beings. Therefore, this report is by no means to be considered the final word on the subject. There will be a "last word" on the subject. But the Commission believes, however, that it is perhaps the most extensive and detailed ever issued on the subject area, for not only does it consider generally the subject matter of the problem, but includes other related aspects such as medical progress, experience in other countries, the personal feelings of the experts on the subject, psychological and cultural aspects, and the effects and limitations of human judgment, time, circumstance and, if you will, other factors which influence the subject. A holistic approach--an approach to the subject matter of the subject matter to follow concerning the subject matter of the subject matter of the concept of medicine of treating the subject matter of the subject matter of the disease as a single, separate entity, and not as a complex interrelationship of the total functioning organism.

As mentioned, the report is a comprehensive one, and by the same token, it is not perfect; however, it is a very good one, and fully assumptions contained in it. If there are any other matters which you are more

1014596



experiences in the subject areas of the report, and who have had available to them information on facts and available to the Committee. If there be such errors, or flaws, perhaps, the Committee does not apologize for them, but rather asks the reader to retain them as being due to the technical nature of the area and the difficulty of condensing data on the magnitude of it. The Committee believes that it has done the best possible job with the resources available to it and considering the considerable complexity of fact and space of an event which occurred over a dozen years ago, but which is still affecting the daily lives of the people involved, and the officials of their governments.

Some readers are struck by the descriptive nature of the section dealing with the detonation of the bomb and subsequent events that occurred. The Committee feels that the approach in this section is justified, however, since in combining known facts with the recollections of the people who were present at the event itself brings into relief certain facts and circumstances and their relationships which could be missed by the usual means of charts or tables connected with the event. The Committee also believes that this approach also makes what could be a dull and uninteresting matter, in a sense, by someone report on a highly specialized topic that most folks are not familiar with. For instance, the personification of "the cloud" as if by "ghostly" forces, radioactive cloud behaved as if influenced by "ghostly" forces, is considered important or perhaps improper by some individuals. It should be noted, however, that even the most prominent scientific bodies have concluded the reality of such an event has continued to "live" in a sense, by being a purely physical and biological sense and in a psychological sense.

In writing this report, the Committee has attempted to organize and simplify the subject of radiation and its effects.

The very subject of radiation is a vast one, and from one, a fact which is indicated by the amount of our volume in dealing with it.

1014597

containing some of the data requested as a result of American Institute's memorandum, it is recommended to the effect that we are dealing with the best kind of a very large budget.

In the summer it was not possible to deal in reviewing as well as dealing with the budget. The committee feels that there is enough basic information in the 2 pages on the program to give the reader sufficient knowledge to make the report and its recommendations meaningful. The accuracy and appropriateness of the data is not a problem dealing with radiation in general is possible due to the efforts of the scientific consultants, particularly Dr. William S. Cole, Dr. W. S. Peckham, and Dr. Raymond J. Hunter. Their assistance in editing this report has been most helpful.

Relative to this, it should be noted that the committee has to the Committee should not be confused with the validity of the report, its assumptions, conclusions, opinions or recommendations. There are certain laws should any part of this report with the exception of the recommendations reports to the committee be taken to prevent the scope of the committee, the organization in which they work or with which they are connected, or their respective governments.

In commenting upon the report to this committee, the committee would also like to bring to the attention of the reader what we consider to be some rather interesting circumstances which may or may not have bearing on the report itself.

One of these conditions concerns the lack of information received from the Atomic Energy Commission and the Department of Defense. This information was requested nearly one year ago. No response has been forthcoming despite follow-up letters by the committee. The Commission's answer this points out what is a self-evident fact. The readiness of the committee by far can hardly imagine.

1014598

to the interests of the localizing Agency. Yet the kind of information needed by the Committee was by necessity confidential very close source. Coupled with this is the contradictory nature of Micronesian and American interests embodied in the formidable Agency which was manifested in the daily operation of the localizing Agency. In fact, the Committee, in carrying out the wishes of the Agency, Department of Micronesia, has had to deal with an Agency which by the Office of the Director, in trying to investigate the matter, it has had to report information from the Agency and departments. This situation was further complicated by the Agency which transferred in December, 1971, and January and March of 1972, the issue of the medical treatment of the Hongkongese and Chinese (and other) who had political affiliations (a fact which is discussed in the report). As a result, the Agency somewhat highly charged emotional atmosphere has provided the background for the investigations since its inception. This is clearly evidenced by the reported absence of an enacting signature on the letter which established the Committee. The Agency and the Committee were passively allowed to be subject to the Agency's mechanisms of law, rather than with official regard of the Agency's authority. This apprehension about the Committee and its work has, however, been lessened as it has continued its work. The Committee has always been approached that its studies should be serious, well-considered, and conducted in a mature and professional manner. This has resulted in the Agency's excellent rapport and cooperation with the executive branch of the Government, although the same cannot be said to hold true in all other areas. This has been evidenced at various times by several occasions as detailed below.

First, the Committee was pleasantly surprised by the fortuitous appearance of Dr. Darling of the CDC and Dr. Richards of the U.S. Public Health Service while on Saipan. They appeared to be genuine persons familiar with Greek plays

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of old. Dr. Darling visited the laboratories of the Commission, and Dr. Steinfield the resources of the Institute of Materials. While the Committee has no reasons to suspect the integrity and objectivity of these visits, it does believe that these visitations were more than superficial.

Second, the Committee is disappointed to believe that both that government and the United States military, while certainly not unenthusiastic, which contrasted sharply with the surprise attack on Hiroshima and Nagasaki. The Committee has requested reports from other committees of this Congress and has found that regardless of the relative status of United States and Japanese government, the conditions of the war, status of resources development were far inferior to the conditions of that of this select committee dealing with the Department of Energy activities.

Third, this Committee is disappointed in the results of the September, 1972, survey of a somewhat limited nature, especially in that of 1972, even before Public Law No. 40-225 was passed in 1967. In 1972, during the Committee's interim report, one of its members was approached by a representative of the Atomic Energy Commission and advised that he might like to be asked to participate in the annual examination of the knowledge of the committee's representative to the correctness of the survey. This was a good opportunity, the result of more than just simple observations.

Fourth, reference is made to lack of cooperation from the AEC and DOE. The Committee finds that such cooperation is not forthcoming. It is aware that the AEC, at least, is not willing to cooperate in providing such information or assistance if requested from the proper sources. Accordingly, the Committee wishes to refer to a letter from Representative Butler to the Honorable Henry H. Jackson of the U.S. Congress, which he sent to the Committee during the course of the Congress held in Palau in 1972, concerning the rights of the Japanese and Vietnamese.

1014600

Senator Jackson, in turn, referred the letter to the Atomic Energy Commission. The AEC then sent to the Committee a two-page report from the General Manager. This report contained some information furnished by the AEC, however, the Committee only took this particular bit of information and not in response to its request.

What the Committee wishes to prove by including these incidents is not that it has knowledge independently of the incidents wherein it believes that information is being concealingly withheld by AEC. It is, but rather that there are perhaps things, which have not been of which the Committee is for the most part totally unaware, but which it believes exist nonetheless, due to the confidential nature of its sources which may possibly conflict with certain interests of the Administration itself.

One final word should be mentioned regarding this report: how to read it. As readers will observe, it has been written in an objective fashion; that is, evidence is presented, analyzed and evaluated, which serve as basis for later conclusions. The report is in fact, it changes from the general to the specific, an example of which is the general discussion on radiation in general which leads to a specific discussion of specific radiation effects later on. The Committee has carefully studied the report, and has formed opinions and conclusions as to its merits and demerits. The report is written to reflect this.

Lastly, the word of advice, to those who wish to study read the recommendations because of the length of the report. The Committee would advise against this. The report is structured so that evidence and information build continuously to the concluding recommendations. Thus the recommendations are not easily understandable without studying the whole report. We, the members of the Committee, suggest that those who wish to learn the recommendations, stop reading the report as they read.

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PRIVACY ACT MATERIAL REMOVED

CONFIDENTIAL

First the scientist, this report is dedicated to the memory of a young Marshall... who was the year 1945 when the world's arrested nuclear explosion was... from his home at... died during treatment for leukemia... room at the National Institute of Health... November 25, 1971... and the people of Bonrelog and... who was... from the... tests and to their descendants.

Also, it influences this report... not only to those Japanese... to the... of nuclear weapons from the Hiroshima... scientists who willingly or... in order to gain new knowledge... of radioactivity. Finally... and unnamed people now... the effects of weapons-testing... of the world in the name of national... of radioactive... this report will contribute... and important subject and will... increase knowledge of... control forces of nature at his... and destroying...

1014603

"They were holding their heads down as if they could  
give wings to death. They could be seen in hundreds  
everywhere both near and far."

The Holy Bible of the Mass of Christ, 1880  
by Rev. K. K. K. K.  
The Holy Bible of the Mass of Christ, 1880



INTRODUCTION  
CHAPTER IV (CONT'D.)

Man lives in a world by radioactive emanations. He is surrounded by radioactivity which is to be the great danger of it which envelops the world. It is not, as we should see, radioactivity with the naked eye, but we know it is there because its effect can be observed in the manner can be measured with special instruments.

If we could give vision to the alpha active rays which are normally present in our environment, we would behold a strange display of activity. We would see the rays as yellow lines of light of various colors, the rocks and soil of land, the living plants and trees, the iron and steel buildings and metal structures.

In addition to this, we would see the rays as they pass through the air, through the various plants, trees, animals, birds, fishes, canned foods, the milk we drink, and also the many and other ray-producing machines in factories and chemical plants, in laboratories and research institutes--not to mention the various which produce radioactive materials and facilities which we find in the world today.

We could see the radiation out from the sun, the earth, the rocks, fresh-water lakes, fish, birds, and plants. We could also see rays from deep in space, passing through the atmosphere and finally passing through our bodies, and also reflected. Finally, as we could see inside our bodies, we would also see rays emanating from different parts of the result of certain radioactive elements, such as uranium, which are present naturally.

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\*Some cosmic rays are also produced, for instance, they have been recorded in mines over a matter of a mile (1320 feet) below the earth's surface. (46)

by us and which form a part of the total amount of radiation which we are exposed to during our lives.

Radiation has undoubtedly been present in the world and the universe since its creation and has provided for the subject matter for background which surrounds us today. Radiation, in its various forms and particles, is included in almost every material which we touch, breathe, or drink. It can be found commonly in certain rocks and soils, or it can be emitted by a man. The most common of the factors in this respectivity, and a brief discussion of the same, and its relation to the subjectivity will be undertaken in the next section. It is intended for the understanding of the section in the report to follow.

If we look at ourselves and at our activities, we see that there things appear to be made of matter and energy. We know that matter and energy are not really separate things, while we can look at a number of things, we know that they are physical things which are "made" of matter and energy. The study of matter and energy is the investigation which has been the mainstay of science for many different kinds of sciences, those which deal with the study of matter, called mechanics, and the study of the flow of energy, which is, for the practical purposes, of this report, the study of electricity and magnetism.

The study of electricity and magnetism is one of the most important. In a solar system, the sun is the center, and revolving around it, a number of planets. An atom is a tiny system of particles, and the study of atoms, which involve a number of electrons, the nucleus, however, is not generally of one substance, but several, like a number of particles tightly bound together by an electrical charge, which is also involved in the study of solar system in which the electrons are in their revolving positions, etc.

to the nucleus. Each is, perhaps, an extremely brief description of the atom, but one which will have a value for our purposes. What are a few hundred different atoms and their differences? Is indicated by the number of neutrons (nearly always observed) and positive (+) electric charge (+) contained in their nuclei. An element is defined as an atom with a given number of protons in its nucleus. Atoms of an element have different numbers of neutrons in their individual nuclei.

Two other properties of atoms and their relation to radioactivity should be mentioned. Atoms may differ qualitatively by a number of different energies. A second fact is that the nature and frequency of vibrations determines the chemical nature of an element. Atoms may be different, there can also be atoms with the same number of electrons and, consequently, the same number of positively charged (positive) particles in the nuclei. Since they are the same in both respects, they are like identical twins. They can form the same atoms, same molecules.

There are five types of emitted energies mentioned in this report but only three will be used frequently. The five are:

1. Neutron
2. X-ray
3. Gamma ray
4. Alpha particle
5. Beta particle

Neutrons - These particles are emitted during the chain reaction which takes place during a nuclear reaction. The number of neutrons emitted by a neutron has an effect on the rate of the reaction. A neutron has a high penetrating power and is very difficult to stop. It is highly penetrating for all materials except those of very high atomic number. OWR.



connected with this is that half of the energy of another kind of ion is directed to the biological matter, of which in the second of these it takes the number of the ion of energy to be removed from the body, through elimination of waste matter. In the second of radiation that is of interest to the present article is that charged particles from being along their path to the medium they are penetrating. This energy is back up molecules in even smaller molecules. The the number of molecules of interest here, their amount of molecules may be affected along the track of the particle. However, if the particle is of a certain energy, these particles can treat as atoms. These ions they strike in their passage from ion to ion. Hundred of electron volts of energy to ionize a molecule from an atom. Usually, the number of energy of particles is measured in the thousands (1000 electron volts = kev) or millions (million electron volts = mev). Consequently, particles in the kev or mev range are considered thousands of other atoms where their energy is used up and they stop.

#### Interaction of

The amount of radiation may be measured in a number of different ways. Of particular interest here are measures that indicate the interaction of the radiation with a system (type of material).

The "Bragg peak" is a name for exposure which is often the ability of an ion to gain energy in a particular material.

The "range" is a name for the distance that a particle of energy, absorbed in a material per unit mass of material.

The "dose" is the unit of dose equivalent. The dose equivalent is the sufficient product of the number of particles and provided a measure of the energy of the dose effects or effects of kinds of radiation on the human body. The

external radiation, the dose equivalent is obtained by multiplying the absorbed dose of a given type of radiation by the quality factor for that radiation and summing these products for all radiation included at a given point in the body. The quality factor is defined in terms of the energy deposition per unit path length of the charged particles in the point of interest in the human body.

The Relative Biological Effectiveness (RBE) is the ratio of the absorbed dose of two radiations producing the same biological effect. One of these radiations, called the reference radiation, is frequently moderate energy X- or gamma rays. Such a reference dose may be expressed in terms of the strength of biological effects and the system of radiation is often moderate energy X- or gamma rays. When it is absorbed over the reference radiation is 20 times larger than the absorbed dose of the radiation of interest to probe the same effect, the quality factor for that radiation is 20.

Initial Dose: 0.1-0.30 (100-300 rads) is the absolute dose that will kill 50 percent of the population,  $LD_{50}$ . This term is usually used when the radiation is administered acutely. The term  $LD_{50}$  is used to indicate the time span over which the observation is made following the irradiation. Also, it is usually used when the absolute dose is low or very concentrated throughout the organ and the magnitude of effect is not so great as that treatment of the organ. The  $LD_{50}$  for 30 days for man is about 200 rad. This is a average value stated in the National Council on Radiation Protection and Control report on pp. 10-11.

#### Relative Biological Effectiveness

There are several kinds of situations which will give the same effect of several doses of radiation. Only treatment for the different kinds of

illness it produces. First, fluids should be given to replace dehydration and loss of body fluids from vomiting; this being already treated as normal burns to aid the healing process. Second, pain killers, analgesics, should be administered. These are either narcotics which may be taken, but for the most part they are excreted, since they

Protective Measures. There are attempts to moderate, or moderate, the effect of radiation. Most of the information is still based with animal experimentation. The research generally involves injecting animals with certain chemicals before they are exposed. These chemicals will generally increase the animal's chance of surviving what would be considered dose. There are no human experiments of this type.

Recovery Agents. These are used to fight the acute damage and to prevent or minimize damage resulting from the acute damage. The methods described for acute treatment, first, include blood transfusions, drugs to control bleeding, and local wound debridement. The evidence for some severe conditions, which help the patient to be able to get on with their lives until the patient's marrow recovers, is not clear. The information is derived from Dr. George H. Harting, from the U.S. Army Medical Research Commission in Japan, who met with the Special Body Committee. It was what negative as to their effectiveness.

Removal Agents. This is one of the methods which has been used recently in the administration of the drug to the exposed person. The principle behind it is injected with the patient, which helps it to remove from the body greater than normal quantities of the radioactive isotope. This kind of treatment is usually only effective if administered almost immediately after the internal exposure has taken place.

THE KNOWN FACTS CONCERNING ILLNESSES OCCURRING IN THE 1950S

The following examples occur in the literature of the type of acute doses of radiation received by human beings and the results of a year.

Los Alamos - In the 1940s, four persons were accidentally exposed to radiation during two accidents. One person received 1,000 R and died in nine days, another received about 100 R and died in ten days, and a third developed cataracts in both eyes after five years. The seven other people apparently recovered.

Windscale - On October 10, 1957, a British nuclear reactor sprayed radioactive matter ( $^{137}\text{Cs}$ ) into the atmosphere. A few days later an area was found to be contaminated. No deaths were reported according to the source of information.

Oak Ridge - On June 25, 1944, an accident happened at a plant which makes radioactive materials. Of 17 persons who had been exposed 236 to 365 RADS and three men had 21 to 100 RADS. They all had acute symptoms, but apparently returned to health in 11.

Yugoslavia - An atomic reactor accident near Belgrade in 1958, exposed six men to very high doses of ionizing radiation. They all showed acute effects of the radiation and one of them, who received the highest exposure (the figure is not available), was given low energy injections but never died. Four others, who received 100 to 200 RADS, were given the injections which helped until their own bone marrow had become inactive. One of these persons recovered without injections. Experiments which showed that low energy marrow injections can help recovery from bone exposure.



The year of 1938 was not particularly important, historically perhaps, with one exception.

In 1938 the United States was the only country to have a worldwide depression which started in August of 1929. It was also a particularly notable year for a series of strikes in various professions characterized the international aspect of the American people.

In the month of December, 1938, a strike against Lord Balfour was probably contemplated by the daily workers, the necessity of going fishing, and the increasing pressure of domestic military systems in his islands.

A singular event, however, did take place that year which would affect the future lives of America, America, and the whole world. In fact, all the people of the world. It was the year of 1938 that German scientists at the Berlin Wilhelm Institute in Berlin split an atom of Uranium 235 ( $U^{235}$ ) (54, p. 10). While it had been theoretically considered possible, this was the first time that it had been actually accomplished. Splitting of this atom and that a chain reaction was possible and creation and control of a bomb was demonstrated that was in the hands of the group, control of a basic force of nature and the weapon. How this power was to be used would strike the world.

In May of 1942, the members of the United States of America, with a simple "Yes, Sir" answer, made a decision that the United States would make an all-out, warlike effort to develop the first atomic bomb before Germany could (54, p. 20). The successful development of an atomic bomb by Dr. Enrico Fermi and the "Chicago Group" on January 2, 1942, at 12:30 a.m. (54, p. 88) proved that the controlled chain reaction necessary to produce plutonium for the atomic bomb was possible. Today, processes were

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developed to produce both portable and non-portable, each of which would provide the critical fuel for the rise in power production in the United States.

The power of the splitting of the atom, as discovered by Rutherford, is nearly impossible to imagine, and almost, if not entirely, unobtainable, which we cannot see, smell, touch, or hear because they are too small, but a fantastic amount of potential energy which when released in the course of an explosion of a single bomb is capable of flattening solidly packed structures over hundreds of square miles, of annihilating and scattering of people immediately, and more millions in the air and blowing them away.

In actuality, however, the basic parts of the atomic bomb comes from two things: the fuel which starts the reaction, and the moderator. Even though atoms are very heavy, the amount of force behind the atom and its parts is also very great for its size, when a neutron strikes a fissionable atom, the atom may split, and following the splitting, may produce additional neutrons. In turn, these neutrons may produce splitting of nearly fissionable atoms, which in turn may be used to split when the splitting of one atom produces two neutrons, the splitting of more than one nearby atom. An example of a chain reaction is where a ball is tossed into a room in which the floor is covered by a row of pool balls with ping pong balls. The ball falls on one ball, which in turn hits off its neighbors, which in turn hit off their neighbors, until all have been struck. When this chain reaction is slow and controlled, it can be used for electricity generation: atomic power plants. The reaction heats water and turns it into steam, which drives turbines connected to generators, which produce electricity.

When, however, this reaction is accelerated, it results in an atomic explosion. The tremendous energy is obtained by fissionable material as opposed to regular sources of energy which are obtained this way: the

fission of one pound of Uranium leads to the production of 8,000 tons (18,000,000 lbs.) of TNT.

On May 7, 1945, the United States detonated 20,000 lbs. of TNT at its Alamogordo test site in order to give a general idea of the possible effects of the test of a plutonium bomb on July 16, 1945, at 5:29 a.m., "Trinity," the first form of atomic bomb, first produced and was supposedly equivalent to 8,000 tons of TNT. This was 10 times as powerful as the May test, but only one year in the life of the Hiroshima and Nagasaki bombs.

The "fusion bomb" or "hydrogen bomb" or "thermonuclear bomb" works on a somewhat different principle, although it uses the same nuclear force of the atom as well as a chain reaction. In fusion, instead of splitting atoms apart, they are fused together to form a new reaction. To do this requires a huge amount of heat, sometimes in the order of 100 million degrees. Since this heat is normally unobtainable only by reaching the detonation of an atomic bomb, scientists have had to find a way to provide the "trigger" for the fusion reaction. The first step in this, which utilizes hydrogen atoms, results in even a greater amount of heat than that of fission: 1 pound of fusion material is equal to 10,000 tons of TNT. (10 p. 1b)

Scientists also discovered that the hydrogen bomb by itself was ineffective material in that it produced a hot air explosion. Scientists over this problem with the addition of another material element which for a few moments would use. Simply put, the first step in the fusion reaction is to use a fission reaction which triggers a final fusion reaction. This was the design of the H-Bomb device to be tested at Bikini in March 1954.

In millionths of a second, the reaction of the hydrogen bomb is completed and in thousands of a second a fireball is formed which is generating heat and shock waves, that will produce an explosive force of millions. Regardless

of whether a mixture of chlorine, the amount of which depends on how far from  
300 to 400 miles per hour at the time of the explosion, and a quantity of unapproached  
fuel, will rise. If the explosion occurs on the ground, the fireball will  
rise up with it great velocity, and will carry the fuel materials, carrying  
the fuel materials to the highest altitude. About 10 tons of fuel material will  
be used and only the lightest particles of it rise to thousands of feet.  
It, however, is not certain, the heat and shock waves will be minimized, but  
little material will be carried into the clouds. The fireball, consequently,  
there will be little fuel left. Only a small amount of radioactivity are sent  
out during the explosion. The fireball will rise to a height of 10 miles. However, if it is  
an air burst, the radioactivity will be contained locally since little  
material has been carried, and the radioactivity of the bomb 200 radioactive  
products are carried down. The amount of the radioactivity through one or two  
half-lives. The fireball has particles, especially, in an air burst the  
main radioactive products are the fission products, water vapor in the  
air, and the fission products. The fireball, which has become mixed with the  
fireball. The amount of radioactivity (20,000 curies of Rn) bomb will rise to about  
20 or 30,000 feet. The amount of radioactivity (20,000 curies of Rn) will rise within  
10 minutes to a height of 100,000 feet. If it was a ground burst, it  
will have pulled up with it a quantity of water and made it radioactive.  
The cap of the cloud will have moved up to the stratosphere where high  
winds will begin to blowing. It will be carried up the side of the cloud column.  
It will be carried up by these winds which will carry it radioactive debris with  
it. The debris particles will fall down, the lighter ones fall back down  
later upon the ground below, but a large amount will be carried by the wind.

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IONIZING RADIATION

Internal Exposure

While man has always received an average of over 100 millirem of naturally radioactive background radiation each year, the addition of artificial sources of radioactivity, such as fallout from atomic reactors, and nuclear bombs that can radiate extensively has increased the background dose, individually or on a mass basis, many times.

As discussed in this report, exposure to radiation from nuclear devices or fallout from these devices (fallout) is not to be feared, although the effects are the same as those from medical or other exposures, to medical overexposures.

As mentioned earlier, one peculiar quality of radiation is its ability to "ionize," that is, the ability of a particle to pass through material and disrupt the atoms comprising it. Ionizing radiation in the area of external exposure are x-rays and gamma rays. These are very penetrating and can actually pass through the human body, leaving behind ionized atoms. In effect, the thousands of these particles, which pass through the human body may disrupt the cells comprising the molecules of the body's cells--the genetic building blocks.

In regard to ionizing radiation which enters the body (internal) radiation, little is known. Most data available concern the effects of that of from 10 rads up to thousands of rads.

From 50 to about 200 rads would be expected to result in death within 30 days, although at the upper end of this range for 10-50 rads. This is also dependent upon available treatment. It is also not likely for death to occur, to even, within this range a number of serious effects,

having a certain percentage of white cells, and a white count course would be noticed.

The group of 1000 rads within the dosage outline nausea, vomiting, diarrhea, itching and scaling of the skin, hair loss, weakness, loss of hair, skin being red and inflamed, or discoloration, or various kinds of blood cells due to the bone marrow (the white cells which are known as white blood) being affected.

At about 1000 rads (depending upon dose rate response, health, age, etc.) as mentioned before, more than 50 percent of the people exposed would be expected to die.

At the amount of exposure mentioned, about 20% would be expected to live and, of those, the 400 rads dose probably 100 percent of the exposed persons would be expected to die.

Higher doses above 1,000 rads would probably be fatal for would produce what is called "hemorrhagic syndrome" due to the effects in destroying the lining of the small intestine and the stomach, vomiting and diarrhea. Death would occur within a few days or a week.

Central nervous system effects would be seen at doses over 4,000 rads. This size of dose causes extreme irritability, trouble with breathing, lack of balance and coordination, and convulsions. Death may be immediate or after a few hours.

Should, somehow, a person receive these effects and symptoms, he would undoubtedly die of hemorrhagic syndrome, where severe disorders of the bone marrow, which produces blood cells, lead to internal bleeding, anemia, and lack of resistance to infection. Such effects can also be seen at the sublethal to lethal range. (M, p. 152)

Many of the above types of effects would be brought about by direct exposure to the high energy radiation of the nuclear blast. Those people who

were not close enough to be destroyed by the thermal flash (heat) or blast wave (pressure) would be likely to be killed by neutrons, gamma rays, and possibly alpha particles. The rate of decrease with the increase of their distance from the center of the explosion, and alpha particles are of biological importance only when they are inhaled from inhaled or ingested material. Deaths from exposure to radiation from external sources following nuclear warheads.

These same effects, however, would also be experienced by a person being in, or going into, an area where there is heavy radioactive fallout. In such an area, a person's exposure to gamma radiation and beta radiation from the fallout would be in excess of that of exposure to the gamma radiation, because it is able to penetrate of pass through the body, would be the most harmful. The beta radiation, which has less energy, would mainly be dangerous externally to the body, hitting any bare or uncovered skin of the person. Alpha particles are highly penetrating (generally only the upper layer of layers of the body) and must be sufficient quantity and of enough potency to penetrate into the body to cause burns to several degrees, from first to second, which would be as dangerous in the sense that if a person received a dose of radiation high enough to lower blood cell counts and this resulted in infection, or if the lungs became seriously infected, the person would die in a short time.

#### Internal Radiation

As has been described, there is exposure to radiation directly to radiation either through direct contact with the fallout or through a nuclear weapon (or source of radiation) or through exposure to radioactive fallout. A second

way of being exposed to radionuclides, is through laboratory procedures or material contamination. This can happen through laboratory direct contamination or indirect contamination.

It should be recalled that numerous radioactive isotopes in the creation of approximately 1000 radionuclides since 1945, or so, exist. Many of these are short-lived, less than a minute, (for  $^{232}\text{Th}$  or  $^{235}\text{U}$ ) which has a half-life of 14.1-15.1 or 3.6 minutes, or actinium, ( $^{227}\text{Ac}$  or  $^{228}\text{Ac}$ ) with a half-life of 2.0-6.0 hours (ZRP, p. 55) and actually become radioactive or active by their stable form before they can reach the ground. However, longer-lived, more stable isotopes, bromine ( $^{80}\text{Br}$ ) and cesium ( $^{137}\text{Cs}$ ) have half-lives of about 160 days and 30 years, respectively. Iodine ( $^{131}\text{I}$ ) has a half-life of about eight days. All of these three elements which are among the first group of isotopes to be fallout, or the material which returns to earth, are active isotopes for a long period of time by the explosion. This fallout material may be inhaled by humans (and animals and fish) should they get into their range of breathing water, onto land, or if they are inhaled, they are becoming active for a long time. The fallout material landed on or near the person, can be inhaled, or get them to pick up a flake of material and ingest it, or be inhaled, or get it into the eye. All of these result in the radioactive material, which emits alpha, beta and gamma radiation, being deposited internally into the human body.

A second way man may be exposed to active isotopes is what might be called "indirectly" through an intermediate or "transformed" mechanism: the processes of human excretion.

The emphasis on the above-mentioned and the radiation during the past few years helps clarify how a person can become internally contaminated internally from a nuclear explosion, which occurred thousands of miles away and years ago. The present emphasis on health risks of our environment from pollution has made the concept of the health risks of the environment between



man, animals, birds, and insects is serious. As you know that to continually dump sewage or other pollutants into a body of water such as a lake may kill certain small organisms, including those which provide food for larger animals, and eventually fish, which are potentially a source of food for man or business. If it through the food chain, there are "ecological chains" which is looking, any way, to the destruction of the whole chain. Nature, as we've observed, has a great deal of balance. Within nature are many "checks and balances" which are ecological patterns. While the first ecological balance is disrupted by pollution, or contamination, such as the one that we have discussed in this lecture. In some areas, factories produce a waste substance of some kind, which waste is discharged into a fresh water lake. The waste is taken up by the tissues of the smaller organisms and thus passes through the food chain until it reaches man. If the concentration of the waste of the material is large enough, the man may become ill from the exposure. The waste of which can be mixed with radioactive waste, either in the form of liquid or solid.

At this point, if you will, will to review, if you want and recall what happens when a nuclear explosion, especially a hydrogen bomb explosion, occurs. If on the surface, the bomb will lift up a large amount of material into the atmosphere, but going into the atmosphere is surrounded by vapor and particles which will carry high concentrations of radioactivity and turbidity to the top of the atmosphere.

The lower part of the cloud, in other words, the heavier particles of material (solid, water vapor, rock) which are both highly radioactive. This part will be carried away by the wind to the lower atmosphere (the troposphere or zone in which we live and breathe). The heavier particles

will fall first, with the explosion. Lighter ones will be carried to air is, hundreds of meters. Thousands of meters, before falling to the ground. naturally from the force of gravity, or some way they should they be organized in particles that will be brought down to earth. This is what is generally referred to as "local fallout," and is highly radioactive in nature and lasts within a few hours. It is often "the most serious product" -- that is, composed of many atoms, fission products, isotopes, isotopes, isotopes, isotopes, giving off beta rays, gamma rays, and other types of radiation. Generally the local fallout comes down in a very heavy rain, with the highest activity at the water level and the lowest level of the water.

Not all of the fallout, however, comes down in the first few hours or days. This is the material which has been blown into the atmosphere by the explosion of about 40,000 tons of the material, which have been blown to this height and then to the ground. This is very fine and light, in a particles of matter. These are relatively slowly will be precipitated out in the stratosphere which may take several weeks to get to the temperature is relatively constant, and it has a very low density. This material will take several days before it is brought to the earth's surface. The radioactivity, which may be spread throughout the world more or less uniformly, will remain in the air, it will stay longer, although it is possible that some part of the world will receive more or less of the fallout than others.

The fall radioactivity, some of which comes to the earth, comes to be consumed and relatively by way of the food of the animals, plants, and of radioactive materials.

Most natural gas elements added to a mixture by volume of other harmless substances, but because of the high volatility of the natural gas, it is not possible to have the same quantities of a mixture of a natural gas would be much easier - the natural gas would simply be washed down and the rest of the gas would be eliminated. Because the concentration of the natural gas would depend on the quantities of water and thereby variable to the volatility of the systems. Unfortunately this is not the case with radioactive substances. As mentioned earlier, the characteristics of the atoms of many kinds of isotopes are like "inherent" properties of other stable isotopes, as elements naturally found in our bodies. They naturally combine to form the molecule, and potassium law, they are not "radioactive" until they are <sup>40</sup>K and <sup>147</sup>P. As pointed out by Dr. E. Lee D. Hansen in the Defense Science Commission hearings on "The Risks of Inhaled and Ingested Radioisotopes" (DSC 4, 710)

"Just as a naturally occurring molecule can be made to operate with a bomb having a stable isotope, we would like to make a molecule of a naturally occurring element the body of a molecule that produces with a radioactive isotope."

"Natural isotopes of the elements are a part of a molecule, an additive with which is combined for the production of a molecule and will be a part of the molecule. They are present in the molecule as found in the body."

Thus it is that these radioactive elements which are in the body can locate themselves where they are needed. The presence of potassium is an important component in our body, and when a radioactive isotope of potassium is found in our muscle tissue and is located in the heart, it is important in the operation of the thyroid gland due to the fact that radioactive iodine there, too.

Now these elements of these isotopes in the body, as the natural kind of the body, it is taken up by the body, and when the element, potassium, in turn, is taken up by the body, it is taken up by the body, and in turn, are found in other, organs with potassium, at the end of the chain, may be in a form which has been converted to a form as a result of the original fallout, beta, gamma, and neutron radiation. It is difficult



In the literature of DOE DOE DOE, it is stated that:

"... internal energies of  $10^6$  to  $10^7$  eV are soft (low-energy) gamma rays emitted in the space of a few microns within a small, possibly non-linear, volume of body tissue that causes considerable damage." (DOE p. 60754)

The "magnitude" of the above statement is rather vague since, while there was much confusion among the scientists about radioactive fallout and its effect on the general public, many scientists described damage and exposure in terms of dosage, using the term "maximum permissible concentration (MPC) of strontium-90" found in the body of a worker in atomic industries. This is 1000 becquerels (Bq) which is 1000 disintegrations per second (associated as one-one millionth of a curie) or a weight of 0.001 micrograms of radioactivity per total weight of calcium in a person's body. Since the average person has 1000 grams of calcium in his body, it is 1000 micrograms. The equivalent maximum permissible concentration for the general population (those not working in atomic industries) is 1/10th of that, or 100 becquerels (Bq). There are also other isotopes for other radionuclides. One of this averaging does not indicate, however, how the isotopes are distributed in the body, not only relatively concentrated in certain organs, but that its distribution in these organs is not always uniform. This means that it is possible for a worker to have a total concentration in his body of an order of magnitude or more above the MPC of a certain isotope, but that because it is unevenly distributed, he may have high concentrations of that isotope where the MPC is 1000 becquerels (or 1/10th of a curie) per each gram of calcium in a person.

This gamma ray is produced from the  $^{90}\text{Sr}$ ,  $^{90}\text{Y}$  and  $^{90}\text{Zr}$  which are

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\*The term MPC since that time has been changed to "maximum permissible concentration (MPC)".

concentrate in certain areas (bones, muscle) or organs (liver) are greatly increased. Besides the fact that the body does not take up all of the material available and due to the above-mentioned nature of the retained material (due to little, if any, excretion) it due to the ionizing aspect of the beam and not to just the above-mentioned the way by which these particles become available to the cells, it is known that continuous exposure to a different population can produce bone tumors and leukemias. In the case of the alpha-rays, the tumors in the case of rats produced lung and cancer in the case of females.

Are these effects not inhibited by some of the protective devices to be outlined below, which minimize long-term effects.

PROBATIONARY MEMBERS OF THE SOCIETY

Genealogy, 1914, p. 107.

Like the whole body, we can think of it as composed of tiny grains of sand and gravel particles, but independent masses of living cells. These cells, which have different functions and different shapes, all have nuclei or centers. Within these centers are string-like materials called chromosomes, which act in the control of genes. The genes are also composed of a particle or chemical, the most important of which is DNA, short for Deoxyribonucleic acid. All of these things are composed of molecules and, like all the bodies, form a chain of molecules, which are a series of rings and that was like as like of like shapes, determine the working and direction of the genes. The genes, which are like different bands of information, are like the code book, and they are a function in making up the form of the chromosome. The different chemical form the genes. These chemical, and the code book, are chemical signals which regulate the shape, form, and life of the genes. The genes then determine the shape, function of the cells, and the chromosome the shape and function of the cells. The cells are like they control the shape and form of our bodies.

Almost all the cells in our body are produced by producing new cells, some slower, some faster. It is really the same process if we consider that when we cut our body, or finger, or the skin, they grow again. If we get a cut or burn, the skin will be replaced by the skin on the other side will be replaced. It is the same by the cells, or, although, or duplicating themselves, and it is the same process which allows us to grow to

maturity, and to continually replenish billions of cells in our bodies are constantly "dividing" to replace each other or to form new cells to produce new cells. Some of these dividing cells are stem cells, which assures that each new cell is identical to its predecessor. If, for some reason, it may die, or it may produce a mutated form of the cell which is not useful, or possibly harmful, to the other cells which it is in the body. Perhaps trillions of these divisions, or (as I would prefer to say) body during our lifetime - and perhaps the more you live, the more you will have - usually done so smoothly. There are "mistakes" or "defects" - "breaks" may occur during the division, and you may end up with an imperfect chromosome. This cell may be unable to divide, it may die, or may duplicate the new defective form.

While these abnormalities may be repaired, possibly through "mistakes," they may also be produced by ionizing radiation. Gamma rays, beta rays, neutrons, and alpha particles passing through the chemical structure of the DNA chemicals can disrupt their physical structure. These chemical changes that can be caused by these particles and other particles can cause defects in the DNA sequence, and this can lead to cancer, and thus the cell.

In large doses, these effects are readily seen. Damage by gamma particles to the cells of the small intestine cause nausea, vomiting, and diarrhea. This damage to the skin and hair results in skin burns and patches of balding (epilation).

The long term effects of doses which are not large enough to cause these effects, is another matter.

#### Long Term Effects

So far we have seen how the cells in our body are constantly dividing and what acute effects we can expect, ranging from mild skin and hair loss of the skin to severe burns and diarrhea. The long term effects are



bad enough in the living, especially since there is no known radiation-specific medication which can alleviate the effects. What is perhaps even more important than these effects are the long range consequences of irradiation, both physical and biological.

Here, it would be well to note the fact that long range effects of irradiation are chronic and serious (with possible exception of genetic effects) caused by radiation of a non-lethal "radiation" disease which still has not been adequately defined. Rather, it appears that exposure to moderate levels of radiation may encourage the development of disease by causing a person to have an "ordinary" disease which he might not have had if he were not exposed to radiation. This has been proven in the case of thyroid cancer. There was a higher than normal incidence of thyroid cancer among those of the peak incidence than those not exposed. Among the thyroid patients, nearly all the people exposed on Nagasaki in Hiroshima in the first few years of age have developed nodules (lumps) in the thyroid.

Just as there is no specific "radiation" disease, there also is no special treatment for persons who develop chronic diseases of irradiation. Treatment for radiation induced leukemia is the same as for leukemia not induced by radiation. The same holds true for cancer induced by radiation in the case of both patients and for ordinary conditions. Exposure, as will be mentioned, is regarded by "official" agencies as occurring in the body's internal systems, which will not long (time) be free of traces of radiation in the body. It may develop leukemia because of a short-time exposure, or exposure over a period of months or years. Thus a person may develop lung cancer because of his exposure from the cancer itself is not radioresistant, and the effects of radiation are "cumulative."

Lung cancer is usually treated with surgery, radiation therapy, or "hormonal" therapy.

#### Cancer

A neoplasm is any new or abnormal growth of tissue. It is a mass of cells growing in a place where they should not be. There are generally two kinds of neoplasms. One kind is benign (not harmful). The other is malignant (cancer). Most malignant neoplasms are called cancers. Most cells have growth control. In fact, cell production in the body is controlled. If a cell grows too fast, it goes wild. Cancer cells are like the children of the normal neighbors. They do not have the growth control. They are like the children of other cells. The growth control of cancer is lost. If the cancer is in a local area, it may be removed by surgery or by X-ray treatment and a cure results. However, if cancer cells spread, the cancer will begin to spread. Most cancers develop in a tumor or lump in a local area, such as the lung or liver, or as a malignant tumor in the blood. It may spread to other parts of the body or it may spread throughout the body (metastasis).

As a result of the atomic bomb explosion in Hiroshima and Nagasaki, perhaps the first time a large group of human beings is the subject of a study, it is clear that the blood is a condition in which there are a number of changes in a certain kind of blood cells called leukocytes. The changes can be either acute (having a short course, or life) or chronic (having a long course, or life). While some changes can be cured, others are permanent, or retarded.

The use of such an agent for chemical warfare is independent from causing cancer in the human body. It is also independent from some time. The end result of such a chemical warfare agent is ultimately fatal.

Another chemical warfare agent is the Japanese chemical survivors in Hiroshima and Nagasaki "leukemia" or cancer, which has also been found in the exposed populations even though the exposures were different. The study of the Hiroshima Atomic Bomb Casualty Commission (ABCC) and scientific studies conducted and conducted by the International Commission for the Study of Cancer in Hiroshima and Nagasaki have shown an increase of the occurrence of cancer in the exposed.

In the early days of radiation studies, it was thought that at least as much as 1000 rads of ionizing radiation would cause cancer. According to one source, however, "It has been found that, by the method of a battle in which the five rads of ionizing radiation, that in the last two months before the battle, the incidence of all types of cancer appearing a few years later" (19, p. 120) was found to be suggested by the 1958 report of the War Relocation Authority on the "Effects of Atomic Radiation" reported by the War Relocation Authority. "The studies have provided the immediate suggestion that cancer is likely to be induced by radiation doses of the order of a few rads, and 'leukemia' (19, p. 7)

#### Chemical Warfare

Mainly through radioactivity, it is generally agreed among scientists that exposure to radiation, depending upon quantities of exposure and amount of time, may result in absorption of the dose of an exposed person by

a few days or days to years. Birth rates do not decrease with high doses, although evidence from low doses will suggest that lower dose irradiation may induce long-term effects. Although the dose rate through the time for birth span of the species does increase, time with more likely involve long periods of rest (20-30 years), similar to the long period increments between the high-dose rate by calculating what high doses of radiation will likely lead to the induction of the life span through the production of multiple embryos. As the dose rate may be shortened from several years to several months.

#### Reproductive Mortality (1971)

It has previously been thought that a high dose of the fetus at 10 is growing inside the mother, may cause foetal death (stillbirth), or even (rarely) in the fetus (miscarriage). Some of fertility (temporary sterility) of the mother or induction to be caused by abortion. Evidence in that evidence is a good example of these effects. Human study of Japanese children exposed to the atomic bombing, however, indicate that the fertility of the women exposed, is greatly reduced, and children of the (10, or 100), which would indicate that a high dose does indeed affect the fertility. While findings on miscarriages and stillbirths are inconclusive, there are other effects on the developing child (fetus) that are possible for mother which were discussed previously in relation to radiation dose.

#### Birth and Development

Children born after 1945 have been reported to have defects and the Marshall Islands. In some instances of low dose some birth defects children show reduced height and weight and growth retardation ranging from slight to severe. More detailed data are available and will be included in the subsequent chapters to follow.

Howe (Dr.) Also said:

As mentioned earlier in the studies regarding VLD, certain toxic effects, moderate to heavy doses of radiation will result in the decrease of the production of certain kinds of blood cells. One of the late effects noted is the production of thrombocytopenia, a number of forms of certain cells through a drop in the chromosome which will reduce the reproductive part of the cell.

All cells in the body are able to regenerate themselves, with one they are able to go through a process of division, dividing one cell will split into two cells with each cell leaving in two parts and kind of chromosomes, then splitting back to create themselves again. This basic biologic feature of our red blood cells is to regenerate, or to maintain certain necessary elements to keep a unit of red blood cell heal and the platelets are also able to regenerate. In the case of a new blood should be re-examined because if we have a blood bank or a blood bank, or a unit of blood of our body, which are damaged, can complete a repairing process which will allow us to function normally again.

Again, we must note the biological effect of the rays emitted by radio active materials or sources. The fact that they can follow along their paths through tissues and organisms, they pass through the areas of the areas which manufacture the blood (bone marrow), their radiation may disturb the nucleus (center) of the chromosome, it may cause some of the aberrant forms. Cells which are able to divide, as usual to divide and reproduce themselves, so to create different values, these are very important for. These aberrations could be many kinds of genetic effects, exposure

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Genetics and Heredity

In the previous section, the effects of a variety of stimuli, or other body cells, are discussed. Each of these situations involves how the cells go through division in order to reproduce parts, or cells, of the body. The stimulus of the law of heredity is reported as the cause, made up of smaller units called genes, which are composed of specific chemicals (and therefore, we will usually refer to them as molecules and atoms). These things are a kind of "code" that is produced naturally.

While there are many similarities between the two types of reproduction process and the process which occurs in cells, there are two major and important differences. The first is that the chromosomes and genetic material in a somatic cell are duplicated for producing another cell. A sex cell (sperm or egg), however, is unique in the process in which a human being, beginning at the beginning of life, is formed. The second difference is in the reproduction process. A somatic cell can duplicate itself. The cell produced (daughter cell) is the original cell (parent) can again both duplicate and divide into cells. It is unique in the fact that there are "parent" cells in the body that do not have the ability to produce by their own, which is a process through which a cell process of division and reproduction. In somatic cells, the daughter cells are identical to the parent cell. In somatic cells are identical, they are produced by a process of division. This, however, is affected by the fact that other parent cells can be produced which then in the fertilization process and then they have a new life span. However, if the "parent" cell which produces the sex cells are duplicated and mutated, this will result in the possible production of mutated immature and mature cells. (16, p. 10)





(bleeder's disease) in which a defective gene in the blood, which normally would stop a person from bleeding for hours, is transmitted or missing. This gene does not bleed with a person's fingers and harden at the site of a wound. A person with this gene may die from a simple cut. Birth of a nation, October 1954, page 10, 11.

How mutation works was explained by Dr. Sewall Wright, Professor of Genetics and History at the University of Wisconsin, before the U. S. Congressional hearings in 1954:

"Let me know, how do I do it, Dr. Wright?"

"The application of your question is that if you have a small majority of reds in a population, and if you have the great majority of reds in the new strain, the population is beneficial."

"The reason for this is that the individuals which have been selected have that have occurred in part because of the process of natural selection. The individuals which are part of the new population have been selected by this process of natural selection, and they have been selected the great majority of individuals which are selected as to cause harmful effects to the population, the ones which cause the most harmful effects are selected by natural selection. The great majority of the population are the beneficial ones."

"A mutant that is a great benefit to the population in a few generations, and even if it is a great amount of harm will persist for a long time, and it will be a much larger number of individuals than the number of individuals affected by a mutation which is a great benefit to the population effect on the individual."

"The total harm to the population is not only effects on future generations, but also the population, and the total amount of reds is selected by the representative of the population." (U. S. 1954)

This idea explains the basic difference between mutation of normal somatic cells (DNA of cells) and of the reproductive cells. Both can be dangerous, however, since the reproductive cells are passed on to



On July 21, 1945, the B-29 bomber was shot down and crashed into the forest near the town of Nagasaki. On it were Dr. P. M. S. ... and a Japanese citizen ... . The ... and Longitude of the ... . The ... Guard and ordered it ... . The ... tional, the ... of the ... United States of ... . The ... in the waters of the ... of a ... worldwide ... of basic active ... .

The world's first hydrogen bomb was tested on November 1, 1952, at the Eniwetok Atoll in the Pacific Ocean. A little over one year later, the United States tested its first H-bomb device on March 15, 1953. The ... followed with its first H-bomb explosion on May 8, 1954. The ... anxiety which developed ... to the fact, ... range reached ... left their ... H-bomb detonations, however ... that would disperse ... of months or years.

Public opinion was generated by a series of newspaper articles resulting from the reading of testimony by the 1950s Committee on Radiation of the Senate (considered as Atomic Energy of the Congress of the United States, the Jackson), with the title "The History of Radioactive Fallout and Its Effects on Man", were published in three volumes totaling 2,700 printed pages. Within the testimony of some Congressional Committee members and officials of agencies of the 1950s Government, these were generally "fact sheets" in form and content, marked by only one or two short evidence of evidence by members of Congress and those testimony before the Atomic Energy Commission, and frequently, perhaps was the public reading of any field about nuclear weapons and fallout. Of special interest to this report was the discussion of the effects of doses of radiation, particularly in relation to the fact there is a "threshold", or minimum amount of exposure which can be considered to have no effect, or, in other words, the effects of radiation are "linear", meaning that any radiation exposure, no matter how small, has a damaging effect.

Many scientists and experts, both from the Atomic Energy Commission and from independent universities and institutes gave testimony supporting both theories. Many also expressed their belief that the current testing was harmful, justified that radiation is linear (at least there was a threshold dose for some of the radiation), and that there was no evidence



course, in connection with the whole concept of chemical the effects will be occurring at low levels in the same way that they are occurring at high levels, and whether there is such a thing as a threshold. In other words, is there a level below which nothing will happen?

"Again, there is very particular evidence in the evidence, and I use it, is very insensitive in the laboratory, and it has to be chosen, and I would be interested to see if there is a threshold does not exist."

Dr. Richard Vanden, Professor of Biology and

Medicine of the University of Colorado, Boulder, is involved in the threshold effect

"With agents of chronic irritation there is what is called a threshold effect in the cells. In other words, because a cell can continue to function and the proliferation goes on, and the body can be repaired even though damaged, so that there is no effect of irritation there is a threshold effect in the cells."

"I have favorably reported on a threshold effect of carcinogenic agents for a number of years. First, that in our experiments with carcinogenic hydrocarbons, which are known to be highly potent such substances as coal tar, we find that a threshold exists. In fact, that, with many of the medicines that are commonly used, there is no effect on cells, there is a threshold effect in these cells. We know, by analogy with simple things as physics, that there is a friction effect. For example, I can push very lightly, and this will not move, and it will not move until I reach the threshold of static friction, and then the friction will begin to have an effect."

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purposes there is no threshold, that is, it is not a generalization with a generalization. It is also included in the generalization is the unalterable fact that the physical substances, as a whole in nature and neither behave like nor have any effect on the cells. For example, it is possible that the presence of certain chemical substances, pesticides, or other poisons, like a certain amount of radiation, cause genetic damage within the body's somatic cells, but that a certain amount of radiation, but most ingestion will cause hereditary effects on the cells, and mutations, or other radiation.

Potter goes on to state:

"Linear relationships between dose and response are a scientific fiction originating in the scientific method. It is true in the days when the earth was flat and the sun was a globe, but you try and work out a curve of a parabola, or a curve of a hyperbola, or a curve of a logarithm, or a curve of a sine wave, and you will find that the curve is not a straight line."

Potter's assertion here is not entirely correct, of course, that he is playing a semantic game, because while it is true that the method of expressing effects is based on a graph, the graph is not a straight line. Could he just as effectively apply the language to most of the word "proportionality"

In testimony before the subcommittee, there were a greater number of scientists who said that they probably would not have declined to accept the theory of "linear" effect until it could be demonstrated. The following is a sampling of some of their testimony:

Dr.hardt, General University of California, Radiation Laboratory.

"I think it is very difficult to have any reason to doubt this at all. I have always been inclined to be very cautious and to look with caution that a threshold effect might exist, and I would be absolutely certain that a threshold effect might exist if the laboratory opinion is concerned, on the basis of having, available, all the tests at my disposal, and not feeling that it had been demonstrated to exist."

Dr. Ernest Rutherford, Department of Physics, University of Cambridge.

"I think the danger of the radiation is a very little to see policy momentarily at least. I would say that there is a threshold there, and I would say that there is not a threshold and I would say that there is a threshold."

Those who support the idea of a threshold, however, emphasize the continuance of testing and the need to find out the additional amount of exposure from various factors was possibly far greater than smoking one

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instead of "linear". This is, in my opinion, a very good idea in representing the interaction of the sub-atomic matter in a non-linear form. Non-Euclidean geometry is a very good idea in the study of radiation. It may be that in the future it will prove a valuable tool in the study of radiation and its effects. However, it should be remembered that all current data relevant to the study of radiation is presented in terms of conventional geometry and mathematics, and it is not possible to base our conclusions of these data on a non-linear geometry simply because "The meaning of symbols in the linear geometry of Euclidean geometry, is at stake." The author of the article in the article is with using two-dimensional terms patterns for the study of radiation states, then he brings into question the validity of conventional, two-dimensional symbols, concepts in non-linear geometry. This is a very good reasoning one should be suspicious of the validity of his data. It is represented on the two-dimensional plane of the paper on which it is written, and by the same token, this page which you are reading now. It should also be noted that while Potter attacks the non-linearity of radiation, he also thus brings attention to the danger of metaphysical arguments. Lastly, it should be noted that Mr. Potter's attitude appears to be a very good policy and philosophy-wise to the study of radiation. It is the last of continuing Russian tests. Despite the fact that it is a very old and fresh approaches to certain scientific problems.

package of regulations, by including two additional such a small number of persons might be sufficient to reduce the overall risk to a level that is worth the risk. Those who did not support the law, or who believed in the linear dose-response that the cancer risk from the cigarette smoke was not amplifiable, argued that the dose-response relationship for such a general population may be different from the one for a small group. Additionally, they pointed out that there is a threshold level of exposure for each testing.

The whole debate was well summarized by the "Proceedings" of the 1971 meeting related to testing and perhaps best summarized by the testimony of Dr. Walter Selove, Department of Health, University of Pennsylvania, who quoted from a report by a committee on radiation, by name of the "Division of American Scientists":

"The committee study of the available evidence has led to two conclusions:

"First: The only justified basis for continued nuclear weapons testing at the present rate is the possible effect of the low level radiation normally encountered."

"Second: The only justified addition to activities of testing and cause many deaths."

"The committee believes that both views are scientifically correct, and it strongly cautions against either."

"Unfortunately, it is now believed that a number of people, including... often emphasize the first conclusion and ignore the second. Similarly, those who believe that the first conclusion is correct often emphasize the second and ignore the first. In other words, it is believed that both statements need to be taken together and not either alone as an argument."

Whether or not the dose of radiation is a threshold or linear effect, has not yet been proven. The "Why" and "How" of radiation, there is still not enough evidence to show that one or the other of the theories is correct for a wide range of doses, though the immediate effects of



irradiation of the human body, such as the body organs  
agreement among all the scientists that there is a threshold, and that  
any amount of radiation over a certain background level would produce specific  
damage, and thus cause mutations.

Although the report for the OEB is centered primarily over the aspects  
of testing, it is probable that because of its nature, it is the reader  
to understand certain conclusions that have been reached which will follow in  
this report. The committee would like to state that it is based on laws  
of the linear theory, for the reasons which are outlined and stated previously.  
It draws strength in this regard from the title of a paper, transferred to Taylor,  
Chief of the Atomic and Radiation Physics Division of the National Bureau  
of Standards who testified before the subcommittee on the following matter:

" . . . I frequently feel compelled to say that the question  
of radiation safety and its control is one of the most important subjects  
for which there is a clear and simple answer. The whole question of  
setting radiation exposure limits depends on the same biology.  
It depends enormously on ethical and moral principles, and on an enormous  
amount of good (sic) science and good will on the part of the people  
who are responsible for setting them. It is not a quantitative physical  
question."

The Committee has had a great deal of time to study the scientific  
opinion and evidence and to call on the best scientific opinion available. Dr. Karl W.  
Morgan of the Oak Ridge Y-12 Laboratory, who is the author of "Standard Patient"  
--Standard Patient" in "Medical Radioisotopes: A Practical Approach to the Patient,"  
a symposium sponsored by the OEB and the NIH, 1966, Bethesda, Maryland, which

"I believe the prudent position is to assume that a radioisotope  
the patient is that all ionizing radiation to the patient is harmful,  
and therefore the physician should carefully evaluate the need for a  
radioisotope diagnosis or therapy. The physician should also evaluate the  
expected usefulness of the diagnosis or therapy and the potential  
radiation damage to the patient." (p. 104)

That the Committee against the March 1954 Radiation Exposure Act, **background** level of radiation, and that the clinical level of radiation is roughly proportional to the dose. As the Scientific Group, the Committee notes with considerable interest and dismay that it is now known that all penetrating radiation delivered to the human body, no matter how definitely **harmful** both to the individual and to the population.

The Special Report Committee against the March 1954 Act is completely accord with the intent and purpose of House Joint Resolution No. 205, H.R. 1, passed during the 80th Special Session of the 80th Congress which condemns the Republic of France for testing nuclear weapons in the South Pacific. It is clear to the Committee that the testing of nuclear weapons--whether on a test of the technology, or on the test of background has no beneficial value whatsoever. The danger of such testing is enormous in the first place, and the testing itself is dangerous in all respects in the long run. The testing of the technology of nuclear weapons in the name of national pride and national interests is a challenge to the lives of subsequent generations of children all over the world.

"In some crude sense, which no vulgar, or ignorant,  
no overstatement can quite express, the scientists have  
knowr sin and this is a knowledge which has no more to give."

Dr. Robert Serber, nuclear scientist  
New York, December 25, 1947

Give me water!  
Oh! Give me water to drink!  
Let me have some!  
I want rather to die  
To die!  
Help me, O, help me!  
Water!  
A bit of water!  
I beg you!  
Won't anyone help me!

The heaven split;  
The streets are paved  
The River,  
The river flows of gold.

Night!  
Night coming on  
To these eyes parched and sore  
To these lips inflamed  
Ah! the moaning of a man  
Of a man  
Reeling,  
Whose face is  
Scorched, smothered  
This rain, this rain of a world!

Frank Lloyd Wright  
(1900-1950), architect

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THE BOMB AND MAN

By August of 1945 the United States was in "contact" with Germany to develop atomic bombs. Germany had not developed a bomb and had already capitulated to Allied forces. Japan, however, was still condemned to further bloodshed. While U.S. forces were fighting their way from the Solomon and New Guinea to the Philippines and were starting to drive across the Pacific through the Ryukyu Islands and almost the Carolines, Marianas and Marshall Islands, and with the intent of launching a massive invasion of the Japanese mainland, incendiary bombing missions on civilian populations of Japanese cities had already been carried out by B-29 bombers. It was clear to both sides that the current of war was running strongly against the Japanese and the end was near. One writer has estimated that Japan was only waiting for the appropriate word of capitulation. Whether or not this is true may never be known.

In August 1945, the American B-29's had left off into the skies for Japan. Every day war was in the air, the end result of three years of the most intensely planned and coordinated, massive industrial efforts in the history of mankind - just to produce a few pounds of fissionable material. This material, weighing less than 50 pounds, had cost more than \$2,000,000,000 dollars (\$2,000,000,000), or \$40,000,000 per pound.

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\*this of course does not include the plutonium used in the Trinity test, which should consider the cost of facilities, being spread out over a considerable time, the production of subsequent material.

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Then, as the "Atomic Age", an era of scientific and technical  
230  
advances began in the year of 1945. (C. 1) In the Atlantic, New York on July 16, 1945, an atomic bomb was publicly begun  
in August 1945, the first use of atomic energy against civilian  
population, causing the deaths of 140,000 people killed over  
100,000 were women and children and injured another 100,000 more  
in Hiroshima and Nagasaki in just a few minutes.

In 1945, the atomic bomb was dropped on Nagasaki on August 9, 1945. The atomic  
bomb exploded off the coast of Nagasaki, Japan, in the city of Nagasaki,  
now a part of the Kyushu Island district of the First Territory  
of the Pacific Islands. In the city, a large bomb of the plane  
was the "Atomic Bomb", atomic bomb, no other because of its  
size and rate of explosion. In the center of the "Atomic Bomb"  
plumage bomb, the "Atomic Bomb" of this "Atomic Bomb" bomb  
was destroyed completely. The most of the debris was a perfect  
yarn ball. At the end was the "Atomic Bomb" of a large amount  
235 (C. 1). At the other end was the "Atomic Bomb" a large amount of B  
estimated to be about 500 pounds, or 10 pounds. As long as the  
"Atomic Bomb" and the "Atomic Bomb" atomic bomb could happen  
but when the "Atomic Bomb" was fired into the target, the amount of  
235 B-1 occupying the most point bomb, or about 100, and the terribly  
destructive energy of the atomic bomb was multiplied.

In 1945, the atomic bomb was dropped on Nagasaki, the atomic bomb

\* "Atomic Bomb" means that the amount of material was large enough  
to not naturally occur without artificial aid. This is one of the  
unique qualities of atomic energy, which reactions cannot  
take place in nature or artificial means, but after refinement,  
are possible.

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bay doors, spread open, and the bomb and its fragments plummeted downward. The plane struck and tore away at Tall Tower. The parachute opened, and the bomb drifted slowly down over the building, city and, at about one-quarter of a mile from Hiroshima's Industrial Promotion Hall, it exploded.

In the days of the development of such aircraft, the methods of designing the approach to a target were not so simple, and ultimately were not so exacting. The pilot's knowledge and interest of an atomic city to be over a populated city.

In addition to a second, a large and heavy "bomb" existed which, though not as accurate, in the next instance, some 10,000 buildings within one kilometer of the target were destroyed. In the night of Hiroshima, 40,000 people were immediately found to death by the atomic wave, or crushed to death by the pressure waves. Thousands of others were pinned to their beds by the atomic wave, and gas in eyes. The atomic bomb, which sped upward toward the heavens, factually, at every passing up 300 feet of the air and made of the enclosed space, and including a lot of fuel, a bomb and produced a great deal of the atmosphere, only for the heat of the atomic wave. Thirty thousand feet below, the city of Hiroshima was the scene of a fiery bombardment. The buildings burned with a noise of the atomic wave, and a loud and a loud sound. The bomb struck the ground. A mass of 30 to 40 miles per hour found the flames of the atomic bomb and

burning city. Fortunately it was estimated that 76,227 buildings were completely destroyed, and 76,177 partially destroyed, or nearly 92% of all the structures in the city of Hiroshima. A census taken 1945 years after the atomic bombing estimated that 200,000 men, women and children may have been killed from the one bomb. (64, p. 4)

#### SYNOPSIS

In the early of August 9, 1945, the B-29 "Boeing City" lifted off the Hiroshima strip and headed for Japan to drop the second atomic bomb, this one more powerful. The primary target for this drop was Kokura, but poor visibility forced the plane to head for the secondary target, Nagasaki. At exactly 10:58 am. August 9th, the bomb fell and one hour the parachute opened.

The bomb which landed descended from the heavens on its parachute and landed in a field in Nagasaki, because of its egg-like shape, it contained approximately 30 pounds of plutonium. The firing mechanism was called the "Fat Man". It was based on the concept called "gun" type. Basically in an explosion the force of the blast is directed outward. In explosion, the force is directed inward and outwards. In this bomb, however, there was a rapid charge which caused a hollow sphere of plutonium. The force was directed inward and outward. As long



as the plutonium contained in the bomb did not become critical. However, when the explosives were detonated, the elastic force compressed the plutonium against the tamper, thus causing a chain reaction and releasing the desired free neutrons.

"Fat Man" exploded about 1,000 feet above Nagasaki, but was about two miles off target when released (see page 10). Despite this fact, the explosion leveled the city, destroyed and killed nearly 40,000 people. (In interpreting incident different from Hiroshima's experience, was the fact that the Nishiyama District near Nagasaki that was spared direct radiation from the explosion, was exposed to an estimated 30 rads of radiation from fallout which drifted into that area. The people still living in that area have been studied since 1945 and are the subject of a new report to be published at the time of the writing of this report.)

#### JAPAN: (1999 COPY BINDINGS)

As outlined in its Interim Report of May 26, 1972, the Special Joint Committee (once again Rongelap and Rongerik) traveled to Tokyo, Japan on June 16, 1972.

The Committee included: Bernard G. Brown, Chairman and members Representative Hans W. E. George, Timothy O'Leary, informant/interpreter Representative Atsushi Iwano, Chief Legislative Counsel Mamoru Nakamura (now Deputy Attorney General), the committee's staff member, and Dr. Masao Hamanaga, (now Director of Health Services (now Director) and a Dr. Masao Hamanaga, (now Executive Branch). The Committee first made contact with the Japanese Ministry of Health in a meeting with officials of the Ministry and within a few days of the Japanese

Government. Their assignments by Mr. Sato, Director of the International Affairs Division, are to coordinate the needs of the Planning Section of the Bureau of Labor Affairs of the Ministry; Mr. Sato, Director of the Bureau of Labor Affairs; Mr. Takeuchi, Assistant Chief of the Bureau of Labor Affairs; and Mr. Watanabe, who acts as interpreter. Mr. Sato has received 1965 English version copy of the WHO report on the which provides for medical care of A-bomb survivors.

Specific treatment for Japanese A-bomb survivors is provided under the law and subregulations. The law is interpreted by executive Ministerial Order. The law states who is to be classed as a victim (A-bomb, or "Hiroshima") is a person frequently used) and is eligible for medical treatment and, in some cases, compensation. There are presently two classes of these survivors, determined by distance from the point of explosion or other factors determined by a local consultation board. The first group is composed of people exposed within a 2,000 meter radius of the hypocenter. The second group is composed of people who were exposed at a distance of 2,013 meters or more from the hypocenter and who enjoyed the city for two weeks after the explosion. These people are eligible for annual examinations at medical welfare centers in Hiroshima and Nagasaki. If disease is found, they are sent to a hospital for another, detailed examination. The Medical Council of Hiroshima does maintain

records and X-rays available for the primary function of identifying or disputing cases for compensation. If it is decided that a person requires specific treatment (other than prescribed medicine which can be gotten from the center) he is sent to the Red Cross A-bomb Hospital where he can be "treated" (i.e. surgery, X-ray therapy, administration of drugs, etc.) or placed on an outpatient care basis. Each of the two classes of survivors have books recommended for their class and while the annual examinations are sufficient, the majority of these people become sick, he can go to the center to be examined. If he is in the second group and his illness is found to be related to radiation, then his costs are paid for by the government and he receives a new book placing him in the first class. If his illness is not related, then either his employer or health insurance or that of his company pay for the examination and treatment. A third area related to treatment of A-bomb survivors provided for elderly survivors of the A-bomb. In Japan there are homes for such people. To qualify, it must be shown that they or their families cannot support them, or that such support is a hardship, or that the individual has no other relatives in their family.

The financing of such facilities as A-bomb Hospitals and Old Age Survivor Homes, etc. has been done mostly by public donations (similar to those done by the Red Cross or Community Chest in the United States) but local governments are

financed largely through city, prefectural and national government appropriations. The research facilities at the university were government financed and the AEC facilities were primarily supported from money which the university receives from the U.S. Atomic Energy Commission. It was estimated by Dr. Kumatori that those people who were in the highest range of medical care would be able to receive one to four or more examinations per year. If examination is adequate, he said, if the disease is not too advanced most people usually come in for only one examination. The examinations are "free" the Committee was told, in the sense that they are part of the national medical program in which the people contribute. They were conducted at the 140 health centers throughout the 47 Prefectures (states). Other matters of interest were discussed - primarily related to cancerology, which will be discussed in a subsequent report.

Before departing Tokyo for Hiroshima, the Committee met with Dr. Tosiaki Kumatori, Chairman of the Division of Radiation Health in the National Institute of Radiological Sciences in Chiba-shi. Dr. Kumatori has been responsible for conducting several medical examinations of the Japanese fishermen who were affected by fallout from the Nagasaki atomic bomb test which also affected Marshallese and Americans. After conducting a full day of the Committee Dr. Kumatori indicated that if it were possible he would be willing to try to bring one of the local health workers to

Tokyo to meet with the Committee to its return. The Committee then departed for Hiroshima on 13 July, 1972.

HIROSHIMA: A CITY REBORN FROM ASHES

Hiroshima today is an astonishing transformation from its buried and destroyed state to a great, well-planned city than is the fabled legend of the phoenix, a mythical Egyptian bird which was consumed by fire and yet capable to rise from its own ashes in youthful freshness.

While the Committee is very grateful if visiting official facilities permit, it is unable to explore the city extensively, the impression is very strong that people here are more-exceptional a preserved monument to mark today the day of destruction of the city, unless it is in the deep recesses of the hearts and minds of the people who witnessed the tragedy and survived.

The Committee paid courtesy calls to the Honorable Hisuo Nagano, Governor of Hiroshima Prefecture and to the Honorable Setsuo Yamada, Mayor of the city of Hiroshima. During its official work in Hiroshima, it was aided ably by Mayor Yamada's Foreign Affairs Chief, Mr. Isao Ogasawara, an excellent guide and interpreter. The various facilities seen by the Committee are described below in the order visited.

ATOMIC BOMB CASUALTY COMMISSION (AACC)

The largest operation and budget of this Commission are in Hiroshima. It was founded in 1947 with the primary purpose of studying the health effects and their prevention. The AACC is funded mainly (80%) through Atomic Energy for Peace Energy Commission more indirectly through the Japanese Royal Academy of Sciences-National Research Council, and partly through the Japanese National Institute of Health. The Director has met June 6 with the Director, Dr. George S. Dooling, and he indicated that while he would not be leaving during the Committee's visit, he would write to the staff to get in touch in advance. The Committee then met with Dr. Jiro Abe, Deputy Director, and his staff.

It was explained that originally the AACC was established to study the acute effects of radiation exposure, but later the emphasis was changed to long-term studies of multiple effects. During its early years the AACC treated, as well as examined, radiation victims; but today this agency's work is strictly limited to examination and the gathering and treatment of patients. Patients who need medical treatment are referred to public hospitals or to private clinics or physicians.

It was explained that the funds for the agency were divided into three areas:

- (1) A large program which is designed to determine

whether or not the length of an individual's life will be shortened by exposure. This is in 100,000 people of the group studied in both Hiroshima and Nagasaki.

(2) A birth cohort study is a study of a group of 20,000 people of the ABCG's in the 1940's. The purpose here is to study what effects of radiation are being seen in the exposed persons, such as certain kinds of cancers, cataracts of the eye, or growth retardation. About 10,000 persons are followed annually and thus it requires two years to complete the study of the whole group.

(3) A pathology study involves the examination of those survivors who die. This is done to see to find out if there are effects of the radiation which would be missed by the ordinary annual examinations.

The ABCG's pathologists up to 1972 reported increased leukemia and thyroid cancer. It was also stated that cancer in general seemed to be increased, including that of the stomach, pancreas, lung, and breast. This was apparently developing in children who were 10 years old at the time of the bomb attack and received 100 rads or more. The incidence of leukemia peaked in 1957, but is still abnormal, and the incidence of thyroid cancer has not yet peaked. They also explained that children born after the bomb have not yet shown any increase in cancer or early death.

Additional comments by the ABCG's also indicated that they were still finding new things. The children who were less than 10 years

old in 1945 and according to the age when persons would normally start developing them and they are beginning to find more cases in the exposed. As to leukinchi, they believe that in Nagasaki the threshold dose appears to be in the 40 rads range, while for Hiroshima there appears to be no threshold.

#### MEDICAL WELFARE DIVISION

At 9:00 a.m. on Friday morning, the three of us traveled to the Hiroshima Medical Welfare Center and met Dr. Yutaka Mizuno, Chief of the Countermeasures Section. He explained that the Center's three areas of work are health control, research, and treatment. He explained that there are about 2,000 persons in the Hiroshima area and that this Center is responsible for them. Most of their work is concerned with health control, and they cooperate with the Hiroshima University Research Institute for the research portion, and with the A-bomb Hospital for the treatment. In health control, their main work, he said, is that they refer to the two ways: one a general examination in which health centers are ordered to canvass areas by school districts and "house" to do general examinations of persons who, the general examination indicates, must undergo a more thorough clinical checkup.

#### RESEARCH INSTITUTE FOR RADIATION MEDICINE / NAGASAKI, COLUMBIA UNIVERSITY

An adjunct of Hiroshima University and Columbia is headed by Dr. Shimzo Ogasawara. He explained that the research institute work is



different from that of the ABCC and that they concentrate mainly on statistics and medical supervision. More details, he said, they provide consultants in the ABCC. In answer to a question, he stated that the Institute's financial resources were similar with those of the ABCC, with some differences. One of the members of staff of the Institute also present at the meeting was Dr. Kazuo Usuki, a professor and surgeon from the University of Tokyo. Dr. Usuki accompanied another expedition to the Marshall Islands in December of 1971, as the personal representative of Balos, in an unsuccessful attempt to examine the islands of Hangelap and Utirik. Dr. Okamoto was asked about the possibility of Dr. Usuki accompanying the Brookhaven Medical Education Team (commonly known as the "AEC" team) to complete the annual survey. It was stopped in March, 1972. Dr. Okamoto indicated that the Director, Director of the Institute would have to make the decision on this matter and that advance notice would have to be given.

#### THE OLD AGE HOME SURVIVORS HOME

This facility is an impressive, three-story, concrete structure with a solar air conditioning system on the fourth story. The Home cares for two classes of survivors: (1) old age persons who, while they may have families, are not adequately cared for; (2) those old age persons whose families were wiped out by the bomb, or are no longer living today. The Home has accommodations for 150 persons, 50 in each wing. The first wing is devoted to those

berried on long, able to walk and live on two floors for those who can walk. The Vice-Minister of the Interior explained that this is not a hospital, but a home like their own home. They say, however, have one doctor and three nurses on the first and if any treatment need to be done, they will be provided right at the door. Technicians take care of the maintenance and the very best of medical, dental, etc., as well as telephone and even for tele-consultation. The ambulatory residents are allowed to go shopping by themselves, but not to come for their meals.

The Vice-Minister also explained that there are about 60 people on a waiting list in the city of Hanoi and that they expect to have another 400 more over the next 10 years. The majority of the people in the home were those with no other relatives who had been living with a family in a home that was too small. He also said we had several persons under 60 who are healthy but have no family. "Young people can work for themselves," the Vice-Minister said.

The Vice-Minister said that even at the moment the building was impressive. We felt it was very well developed. In 1960, to that year there were several families in the city. This new facility cost 400,000,000 yen (about 1,000,000 U.S. dollars). The central government took over 50% of the purchase of food, while the prefecture and city made the remaining 50%. Each person on the first floor run about \$100 a month, and about \$80 a month for those on the other two floors.

THE 4-BOMB MUSEUM, HIROSHIMA MUSEUM, 1014663

This museum, run by Ministry of Education, contains  
photographs, models and signed letters and articles relating to  
the air burst which occurred here. It is a thought that  
instant of realization of the collision between the visitor enters  
the museum he is thrust backward to the actual day of the bombing of  
August 9, 1945 and the scene of the 150,000 dead, charred,  
scarred and mangled bodies, notably those of women in obscene poses  
of death; there are children who died alone, their bodies like wax  
figures under a sun which had the power to burn the outlines  
burned into a gleam of the sun's light. A glass case holds  
the charred remains of a child's body, and a painting depicts  
the dirty, grey, swollen limbs hanging from the ceiling.

THE RED CROSS HOSPITAL

The Committee was introduced to Dr. H. Inigeta, director.  
Dr. Inigeta is one of the 50 bomb survivors who has worked in Hiroshima  
since the bomb was with the hospital since it was built in 1950.  
Funding for the hospital came from the sale of Water Seal-type  
stamps. It has a 200 bed capacity and the patients receive free medical  
care. Operation is on a cost divided equally by the central, prefectural  
and municipal governments. The young and old are treated, but persons as  
young as 17 or 18 can be admitted (in special cases).

Some of the major diseases which are treated include, skin-  
rashes, and berkeas. Some of the other diseases, as about 50 per-  
cent of the hospital is reported.

Dr. Angere told us the difference between  
A-home and regular patients. They feel different in that they are  
more uneasy and nervous than other patients. This condition, he  
explained, is caused by the fact that when a patient has a regular disease  
may have been caused by the A-home, and when they have this feel-  
ing, according to the doctor, they can usually have the care  
for them. "It is a very easy disease", he said. "If patients re-  
cover", he related, "they are going to be sent back again."

The doctor then took us to the hospital where they saw many children, some of whom had closed the scars from  
the burns they suffered many many years ago.

#### MEMORANDUM FOR THE RECORD

The Committee's visit to the hospital on the evening of June 26,  
1972, and that evening had a brief meeting with city officials to plan  
a schedule. The next morning the members of the Committee, including  
Urabe, Deputy Mayor of the City of Honolulu, had a brief press  
conference was held. The Committee had visited hospitals similar to  
the ones visited in Honolulu and the purpose of the visit, only that infor-  
mation which differs from the other hospitals should be included.

#### MEDICAL WELFARE CENTER

The Committee was told that at the time of the annual general examination about 100 persons were in the area of Hiroshima in the Ichihiyama District (which was the only one that received a direct dose) and that 800 of the 630 survivors there are being followed by the government in having been affected. The kinds of illness reported have been thyroid cancer. The Committee was told that, in general, the area of Hiroshima was not under the people, except perhaps for the youngest generation.

#### ATOMIC BOMB CASUALTY (1947-1950)

The Committee was told that the Director of the Department of Medicine, in place of the Director, Dr. Goto, who was also the head of their examination group is about 6,000 (of the 20,000 total) and that they examine about 4,000 people per year. The 100 of these people are Japanese. He talked briefly about findings in the Hiroshima area and stated that about 80 persons have been estimated to have received 100 rads or more of their life-span and that these are in the 10 year exposure group.

Dr. Kawamata (1947) said that very little of the pediatric studies, since it is hard to tell whether people are in the 10 year exposure group or not. He said that the general population in Hiroshima is higher for exposed persons. He said that he thought that a great deal of attention should be given to screening cases for leukemia and thyroid cancer. He also stated that the ABCO takes great pains to note the family history of those exposed, since that might be a factor in the occurrence of these diseases.

Dr. Yonekura (the Surgeon General) and Dr. Akira Sakai (Dr. Okajima of Nagasaki University) were working on a study of the Hiroshima area which would be of value in working with the (exiles) they toured the facility.

#### A-BOMB HOSPITAL

This was built in 1948 with location in the central prefectural and municipal government. It had 100 beds, and about 130 patients. In period of about 100 beds in 1948.

#### THE OLD-AGE A-BOMB HOSPITAL

After the A-bombing of Hiroshima, many people of Nagasaki feared the same fate would befall them. For this reason, they were evacuated to a place in the mountains above the city. After the bombing on the 9th, they returned to the city to help. After the bombing, many people were saved, they felt that the new hospital was a place in which to build a survivors home. Another reason was that the land in the area was far less than the family. For example, a family of 5, who is the director of the hospital, explained the great distance from the city. The hospital was built in 1948.

The facility, the grounds, and the plan of the hospital made a deep impression on the committee. When they returned, the Chairman delivered a speech of appreciation to the staff and staff, which was reciprocated by the committee. The committee, wearing black and gold sashes, performed a ceremony on the grounds.

and two members of the Buddhist sangha were singing or chanting in their own languages. The bus was then taken on a tour of the 100 Apts. and found it to be one of the best such facilities it had visited. It was not only the rooms and corridors were sunny and the view from the windows was magnificent. Particularly, because of its location, it was peaceful and restful. The Sister explained that 100% of the cost of the home is from the central government and the work done here is voluntary accommodations for 150, with 10 beds in visiting beds and 140 in permanent. The tour included visiting the dining quarters, the sewing, handicraft work areas, auditorium, and recreation. At the end of the tour, the residents and staff gave a song for the Commodore and then boarded the bus for the return trip to Nagasaki.

#### A-BOMB MUSEUM

As in Hiroshima, it is difficult to grasp today that Nagasaki once reeled under the blow of an atomic bomb. A seaport city, Nagasaki is modern and advanced. The city's port shipways within the city's limits are the pride of any port. The harbor lanes leading down the ways into the city was cleared today of the debris of Nagasaki from its destruction. As in Hiroshima, however, there are still reminders.

Located within view of the harbor area, the A-bomb Museum contains the most visible evidence of the terrible destruction and death caused by the bomb; unidentifiable bodies and bones were

the remainder of the area of the Bay in fact, of the same size of the  
fringe of vegetation. The ground surface is bordered and bordered by  
the heat, vegetation and growth of the bay.

ATOMIC D. STATE, INS. BOARD, WASHINGTON, D. C. 20540

The Commission with Dr. Thomas H. Murray, Director of the  
Institute of Environmental Health and Safety, a population of 1,000 in  
the Nishiyama District, about 100 people had been selected by chance  
out. There has been of course been a selection order to get from them a group  
of 80 to study. It is noted that there is a high radiation residual in  
the soil that was, although significant, a low level of radiation could  
still be found in the many groups. It is noted that this group  
showed a higher frequency of cancer and other diseases than a comparison  
group. Although not exposed to direct radiation from the bomb, maxi-  
mum exposure was estimated to be about 10 rads. It is noted that the  
people don't seem to mind the fact that they are relatively speaking  
body burden about 100 rads, they were selected in the order of  
1/2000th of the bomb. The radiation that is being studied is apparently  
a study entitled "The Incidence of Cancer in the Nishiyama, Nishiyama  
Residents and Occupants of the Area," which would be published  
within the next several months.

END

The Special Agent in Charge, Department of Health and Safety, for Tokyo on  
Wednesday, June 28, 1954. Also, on July 14, 1954, the Department of Health and Safety,



and, as he had previously been involved in the Lucky Dragon survivors, and emergency care was given to him that evening. On the late afternoon of June 27, the Committee members met with Dr. Kumatori and the Japanese Consul General (including Mr. Goto) discussed the availability of hospital care, public health, and Dr. Kumatori presented the Committee with a report dealing with studies of the Lucky Dragon fishermen and their children in several scientific journals. After the meeting the Committee hosted a dinner for its two guests on June 29, 1954. The members then departed from Japan for the Trust Territory.

#### JAPAN: HOSPITALS

In Japan, there are wide facilities and organized facilities to take care of those people exposed to the atomic bomb. The programs which produced the emergency care about one year after the bomb, through the passage of a Federal Public Health Act, 1950. Delay was due, in part, to the fact that Japan was not a developed country until about 1950. It is noted that the major responsibility for these programs comes from the local and central governments of Japan. The education, treatment and care for the victims is comprehensive, efficient and comprehensive. The Committee notes that the medical equipment (including multi-channel blood analyzer) found in the hospitals, as well as exceeded in sophistication that found in most of the best territory district hospitals. At the time of the survey, no daily medical care is provided out-

extensive long-range research studies are being conducted by both the Japanese Government and the American survivors of the Atomic Bombings. Research is being carried on to find out the health of the lucky Japanese survivors. It is obvious that an annual report is called for to give credit for the program which survivors because of the possibilities of destruction, will be the relative ease with which the program is put to them. A comprehensive program is being planned for the survivors and will be discussed in a later report of the the program.

PRIVACY ACT NOTICE (41 CFR 101)

March 1, 1964

A Recipient of the Report

Some time ago several hundred miles north of 130° 00' north latitude, 166° 50' east longitude, in the deep blue, unpopulated waters of the western Pacific Ocean, a 200-ton deep-sea fishing boat, the Lucky Dragon, was riding easily with the early morning breeze. Her crew began to rig off the pieces of drift. For birds who had nested for the night, began flitting around to catch the drifting bits of fish. In like manner, tuna and other fish began to rise and to begin picking small bait fish near the surface. Within the space of an hour the Lucky Dragon, also preparing to take the bait.

The Lucky Dragon's journey had begun December 27, from its home port of Yama City, Japan. At first it headed as vessel toward the fishing grounds west of the island. When these grounds proved unproductive, he headed south and its 23-man crew south, toward the island of Bikini (168° 50' W, 170° N). The captain, and the fishermen, were all experienced and anxious about their trip, especially for Bikini Atoll, the site of the first atomic bomb test. To them the fact they risked being caught by the U.S. Navy for fishing in its territory waters. Perhaps also nagging at the back of their minds was the knowledge that Bikini had been the main base for the U.S. military for nearly eight years ago. The idea of a fishing trip to Bikini Atoll must have outweighed any such anxiety as they weighed in to Bikini. It was, after all, a matter of life or death, as they had accidentally cut line and sailing had become impossible. It was on force them to return home. The boat's only fuel tank had been used on that voyage and,

PRIVACY ACT MATERIAL REMOVED

unknown to the members of the crew, it was a day to get much worse,  
for, on the morning of March 11, 1974, the wind rose again.

At 11<sup>00</sup> hours the wind shifted and <sup>11</sup>11<sup>00</sup> knots in amplitude, then an  
atoll in the area of the Bay of Islands of the great Russian composer  
Tchaikovsky (1867-1911) was reached. It is known as "Kappala To", but best  
known to the islanders as "Kappala To", "Kappala To", "Kappala To", or,  
simply--"Kappala To". It is an atoll in the Bay of Islands, composed of 61  
scattered islands along its coastline. The area which total only 647  
square miles, the great bay of Kappala To is an atoll covers more than  
607 square miles.

While the early morning hours were filled with activity between sleep  
and wakefulness, for 14 hours women and children had busy day-like  
activities. The men were busy in the morning, the women would have kindled  
fires in the open air to warm themselves and to cook and to re-cook  
fish. If a young boy came from the night before, while children would still  
be asleep, and the men would be starting to prepare fishing gear or canoes  
for a fishing trip or preparing what they would be collecting and  
marketing or else to go to sea, especially to the next vessel's next call.  
One particular person on this island was a man who had reason to be  
contented. He was a young man, the youngest of the group. His thoughts must  
have crossed his mind that he was the youngest of his wife--  
especially that of his wife's young son, a year old--the island  
work to be done, the fishing, the sailing, and the disputes which often  
come the way of the islanders, he was probably sleeping when the 18  
people on A-11, the 20<sup>th</sup> day of the month, would be returning  
to Kappala To. Their fishing and trade for the party.

PRIVACY ACT (MAY BE REMOVED)

Perhaps he was a bit more apprehensive and nervous these days than he had been in the past, not only because he was 37 years old rather young by Hawaiian standards to carry the responsibility of magistrate—but also because he had been told of something that by the Hawaiian field trip officer on the island of Utirik trip ship. The officer, looking at the report of Mr. Jones with his thumb, had told him that "the old line of the island is gone" and asked him why it they had then you had line of the island to the people they were not removed from the island. The officer said, "We have no orders" but it was unlikely that at that time on this morning consciously remembered for a month or two after he got it later. As on every day, there was a heavy fog on the island. It was hard to conceive of a disaster in nature's entirely a kind of which he took a natural disaster like a typhoon and the weather, of which he had no such pending phenomenon. A sense of foreboding and pressure on the island of Utirik many miles to the east, yet the fog was so dense and a common, unfortunate incident that might be a disaster. It was, in fact, hard to imagine anything by the morning of the morning in the Pacific. The fog was so dense that it was hard to see. The fog was a traditional part of the culture of the island of Utirik. The sun always rose on the island of Utirik, which includes Utirik Atoll, and so the island of Utirik, which includes Utirik Atoll. That morning, however, the sun could not be seen in the west.

Some 3. miles east of the island of Utirik, there were three white and five black birds, several of which were of the type of the aluminum

building as they prepared to take out explosives for connection with the testing of the novel pyrotechnic explosive. It did not seem to be detonated by man. The story of the attack on the British military base connected with the test base is given. They were the only inhabitants of the island aside from the British and American forces. Their quarters, which were well stocked with food and drink, and they had a refrigerator for their food and drink. In the morning they had begun to prepare and to cook of the food, but from the nature of the food, the feeling of boredom and anxiety, of the isolation and of the unappreciated need of them to varying degrees. The food was a very interesting experience. The food was probably made of the traditional Pacific islands we know of, physically and psychologically kind to those plants from the islands. There were no pigs and no hens, no steaks and no meat of any kind in the island. On the ships, the sea food better. Despite this, however, it was a well known practice for enlisted men, weary of the duty, to slip a tin of food into their shoes and thus receive their own share of vegetables by supply from the relatively "hot" food of the food base. They were that they might be transferred. (00)

But there was little chance of this on the island, since the first would be more than one hundred other men. They had checked their small radio unit, and which they would have a very "change" of food, their badges and the very best of the devices. For checking and rechecking of familiar of food was a comfort to them. There was an unusual

1014674

worry--if there were, it was quite not at all the island. Anyway,  
the test was so far away.

At about 31° 30' north latitude and 150° 30' west longitude was  
the island of Nihoa, the Los Angeles, and 248,000 square miles of  
turquoise water, surrounded by a belt of 100 islands or islets.  
On one of those islands, a device was developed in secret and concrete  
and costing millions of dollars. The device represented the culmination  
of the efforts of the Army and the Navy, the Army Research  
Institute in 1948, the Army and the Navy, the Army, the Navy, the  
Manhattan Project which developed the atomic bomb, and postwar  
efforts by such men as scientists as Dr. John D. Sorenson, together  
with the testing, at the Pacific Proving Ground at Bikini and Eniwetok,  
Cold, inorganic and organic, and was built in a 100 pound of 200  
pounds of uranium, 200 pounds of 238U, 200 pounds of 235U, and more than a  
ton of uranium. 38,000 electrical mechanical and electronic circuits to  
insure it would go off, and go off at the moment of a radio  
command. The device was there, and the Army and Navy, realized the  
human signal to order it to explode. It was in the air, terrifying  
giant--a giant which would blow and to the island, to the island and  
everything within its reach. 1950, 1950, 1950, 1950, it sat on  
the island, oblivious to the world, and of the world, and the test.

roughly thirty miles east of the device, in the water west of  
Kongela, ships of the Navy were to be seen, and they were against the  
swells. Aboard the ship, the device was to be seen, and the  
the whole target, 7.2 miles, and the whole target, 7.2 miles, the Army,

Z.3 the Navy, Z.4 the Air Force, and Z.7 the contractors (probably from the Office of Research and Development) and treatment of British people. The Joint Intelligence concept was not only provided for the area and data center at WPC-3A-03 in 1946 and was considered the center. It had been proven the use of effective and efficient way of combining technical, physical, military and intelligence information and in particular the use of the bookcase as a map from both sides. From the shoulders of the Joint Force the Navy, and the heads of all four agencies of the Force rested the responsibility for the safety of all personnel and the successful execution of the Force's mission. In the early morning hours of March 1, 1947, information was received from the capture of the ship, probably a submarine, carrying 20,000 square miles and which extended from 17° 15' to 17° 45' north latitude and from 160° 30' to 160° 45' west longitude. Also received was a report of a large vessel, containing what was known as "B-100". All the data was received and evaluated, the decision was made to attack with the first test of the "Gothic" system. The code name for the dropping of the "B-100" was "B-100" and the code name for the attack was "B-100".

At the same time, the code name for the "Gothic" (B-100) was "B-100" on March 1, 1947, the code name was "B-100" and the code name for the "B-100" operation could have been prevented, but probably, the decision was made to proceed, despite an interruption and several secondary events concerning the code name "B-100" was "B-100" and on March 1, 1947, available data collection showed that the "B-100" was the same as the

\* See appendix for "B-100" and "B-100" and "B-100" and "B-100" and "B-100".



level to 10,000 feet, with no data for winds at 25,000, 100,000, and 100,000 feet, and data for winds at 100,000, 100,000, and 100,000 feet in height, they were plotted as the mean, to avoid 11.10. For the 11,000-foot, however, a 100-foot level to the east of the tropopause at 10,000 feet were manually heading east, or northeast, in the general direction of 100,000, 100,000 and 100,000. The 10,000-foot to 100,000-foot winds were generally heading to the west. Above 10,000 feet, there was no data available.

The 10,000-foot to 100,000-foot winds could have been changed, which would have altered the direction of the wind and the changed winds could have only expanded its energy and shifted its mass upon the cloud and some of the atmospheric systems around it. Unfortunately, however, not so.

In addition to the fact we were in 1950, early that morning would produce a high concentration of clouds, including the tropopause. It would result in a very heavy that it was observed to this day, and an anxiety to the atmosphere for nearly three hundred human beings and their dependents.

The description of the wind, however, is not so clear.

In July of 1950 Operation Crossroads for detection of the "normal" state of the atmosphere. The first test, code 100, resulted in a drop of 100 feet which occurred at 100 feet over a height of 100,000 feet. The second test, code 100, resulted in a drop of 100 feet which occurred at 100 feet. The second test was the first in a series of tests conducted. It revealed the detection of the wind, which approached about 90 feet in height.



also gouged a hole 1000 feet deep in the reef. "Probably more than 100 million tons of material were dislodged and thrown into the air." (p. 178) A wave were sent out that rolled over nearly 1000 miles from the point of impact to a height of 10000 feet (25000) in 10 minutes. "Mike" was indeed a super-bomb, estimated to be a yield of about 5 megatons or the equivalent of 250 (250 kilotons) atomic bombs.

"Bravo" (Hiroshima being the only place) was "heard" at 8:45 a.m. on March 1, 1954. It burst forth like a "bullet" in a blinding rage of light, with falling ash radiating heat and radioactivity, a cataclysmic flash, and a powerful shock and pressure wave which struck the earth, sea, and sky.

In milliseconds it ceased to exist, it was obliterated and the bomb and its debris, largely disappeared, dissolved by the intense heat somewhere in the neighborhood of one of millions of degrees. In a one megaton (one million tons of TNT) equivalent, roughly speaking like half of a giant, mushroom bubble, and cloud of vaporized bomb particles, air, water and soil, would have expanded to a sphere (then 7,000 feet in diameter after 100 seconds, "Bravo") 1000 feet in diameter according to conservative estimates was 1000 tons of yield (p. 178). It may have been larger). It was of a magnitude to suggest the size of the 1000 foot diameter of the Hiroshima was the size of a hemisphere of burning gases, thermal and shock front was from 1000 to 1000 miles in diameter, an area in which all your response could be seen. In the first few

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\* In the early 1950's, Russia boasted of developing a 50 megaton device, and of having the capability of developing a 100 megaton monster bomb. Such a bomb would be the equivalent of 100 Hiroshima or Nagasaki-type bombs.

seconds of time, it would shoot upward at a rate of about 300 miles per hour, and up to a height of a million. The bomb's energy would be spent in two different areas. The first area would be that of thermal radiation, and this would account for 50 percent of the total energy yield. The initial temperature of the blast was of heat and thermal energy that the air was then ionized. The light from this process was visible over thousands of miles and was brighter than the sun. The second area of energy was the second thermal pulse was generated directly from the energy which vaporized the ocean's surface water, and steam from the water, blistered and burned the nearby land, and half of the population of Japan. This immense heat or thermal radiation was so intense that it probably could be felt 100 miles away.

In addition to the thermal energy that surrounded the blast center would be 5 percent of the bomb's energy in neutron and gamma rays.

At least half of the energy of the atomic bomb was expended in a high-pressure, high-temperature shock front caused by the fantastically fast expanding fireball that traveled outward, like a near-solid wall of slightly compressible, fully ionized seawater miles ahead of the fireball, at about the 2,000 miles per hour, and fast more than a kilometer from the point of detonation, traveling faster than the speed of sound. The temperatures and pressures of several million pounds per square inch, probably extending to 25 traveled outward to more than 100 miles from the point of detonation at several

miles distant. The sea roared and roared, the wave  
thundered over the islands, mountains, and the dust would have  
literally "jumped" into the air. Following the shock wave came  
unearthly winds, 50 to 100 miles per hour near the center and  
70 to 100 miles per hour prevailing, which stirred the lagoon's  
waters into a foam and striking the islands during a full scale  
typhoon, blowing away and demolishing most of the forests and flinging  
waves breaking on the beach into the air. Some time after the  
fireball had risen, these winds, now "afterwinds" began flowing  
toward the former volcanic island, following the path of the rising  
superheated air. Within minutes these "afterwinds" would increase to  
near gale velocity, now blowing from the west, and the remaining  
trees on the island would be bent from their positions. The lagoon  
once again was whipped into a frenzy by the fiercest wind. At the same time  
awesome waves 20 to 30 feet high would have rolled out,  
which--ever they distributed by distance, would be large enough to  
completely wash away small islands and reefs.

During its explosion, the bomb would have pulverized and lifted  
into the sky an immense portion of the island's vegetation, with seawater  
vaporized by the blast. These "afterwinds" may be three times more  
powerful than Miss. It would undoubtedly lift into the air hundreds of million tons  
of matter into the air for distance, or through the action of the  
"afterwinds" which would scatter up through the base of the column.  
During the period of the fireball's rising, 50 percent of the  
bomb's energy was expended in generating the fireball which was deposited

upon the spilled fuel and water vapor.

By 06:55 a.m. "Bravo" had drifted about 210 miles east. Half of "Bravo" extended into the stratosphere, and the upper half into about 50,000 feet above the stratosphere. Within a few minutes the cloud began breaking up and falling apart; heavier particles of undecomposed fuel began falling into the sea; lighter particles, however, would be mixed again with the dismembered clouds by the winds. At this point the first indications became apparent that something was happening, irrevocably wrong.

20-7

By design, the bomb being tested in the bomb's detonation were the interesting, interesting part of Joint Task Force Seven. No known "accident" had ever occurred in the course of America's previous 43 years of nuclear activity. All ships of the Task Force were arranged at what was expected to be a wind position some 30 miles from the bomb. "Bravo," the hydrogen bomb, was the first hydrogen device to use the tritium fuel process in order to make maximum use of neutron multiplication. The reason for the addition of several thousand pounds of  $D^{235}$  to the mechanism. This would produce an exceptionally powerful explosion, one which would be exceptionally dirty in terms of radioactive fallout. While meticulous safety precautions had indeed taken place, it can only be regarded as an underestimate of the potential capability of this bomb, resulted in placing the ship's crew probably in a "ground zero" zone. The officers,

crews, especially the aviators aboard the ships, must have been both shocked and awed by the blast. They felt the heat of the thermal radiation and pressure of the shock wave, heard the thunderous roar of the fire, the surrounding and falling blast winds, now reduced by time and space to a light breeze.

In fact, had "Eyes" been a really terrible air burst, there undoubtedly would have been some fatalities among the Task Force personnel, since a 100-gigaton burst is equivalent to second-degree burns up to 25 miles away from the explosion.

More insidious and frightening than the effects experienced by the Task Force, was the ascent of the white cloud's height and the direction in which it began to drift -- up and downward. As though inhabited by the evil spirits phantoms of the Norse-Ian legends, the dead form of the cloud began breathing life directly for the fleet, as though in its death throes, "Eyes" intended to play a last, impractical, and very deadly joke upon its captives. Inherent to the fallout was the agony of "Eyes" -- the fusion and fusion, a boiling mass of hostile substances of atomic density, tens of thousands of deadly radiations of gamma and beta particles.

Within minutes after the cloud began breathing up, everyone's worst fears were well-founded. Radiation detectors had already noted the unexpected movement of the cloud and some of the Geiger counters on some of the ships began to record a level of increase over normal background rate each day. Orders were given and all personnel were ordered below decks, leather and waterproof gear was dropped down and, while





to fall on his ship, the gun, and crew. They fled by this strange snowfall, some of the crew actually inhaled the radioactive flakes in an effort to determine the power of the rays. During the fallout which lasted several hours (0700-1100) several of the men suggested they had inhaled a measure of the amount of them, however, immediately contacted the ground with the fact.

These peculiar and worrying events were enough to convince the captain that it was time to abandon a further attempt with a full catch. They had poor catches, but in their fishing gear, were low on fuel and had their ice loaded for heavy drags northward for home. These men, like all of the other men of the area would suffer the acute effects of their exposure. Within a few days and rancous membranes, nausea and vomiting, began to appear. Their exposure they would arrive in the hospital of Yokohama. Recovery of their experience would result in an immediate controversy and fear and panic in Japan.

Unknown to the United States Forces, the ship started its journey homeward. The radio operator, who would later die, sent no messages to Japan or to other ships regarding their experience.

#### FORGERY

Upon receiving word of the accident from a betrayer, the KadSafe crew on Forgerik had been informed of their observations. Information indicated that the ship was heading for a safe and they sent in readings from their instruments and findings of their observations. At 13:33



PRIVACY ACT MATERIAL REMOVED

thunder of the explosion, and some of the people on the island  
rumored that they saw that they were dead.

Of course they were probably frightened by the visit of a Navy  
Commander to the island in company with his wife. The Commander had  
tried to explain something to them about the fast, and bombs--but  
despite the efforts of an interpreter, the people did not understand  
what he was talking about. Before the explosion and light had something  
to do with it. At this point, the witness must have briefly recalled  
the field trip of the day's previous day. Since they had only seen an  
unusual light and heard the noise of an explosion far away, there  
appeared to be no immediate worry. The Hawaiian had been mistaken.

Even though they were after the explosion, as the Lucky Dragon crew  
was puzzling over the strange new light and their vessel, the  
people on Rejoice and Al-Sagheer were watching the third unusual phenomenon;  
fluffy, white ash falling like the rain and being blown into the air,  
was settling down over the island from the heavens, the lagoon and the  
atoll. Two young boys at that time were climbing a papaya tree to  
pick some fruit and as they looked up, the ash fell into their eyes.  
An older man, probably the same man who had also looked up. He had  
been having trouble with his eyes lately and he intentionally let  
some of the falling ash into his eyes. When it rained them with his  
eyelids shut, he thought that this might help and would help his  
affliction.

Back on the ground, the ash was falling steadily and soon the  
ground, trees and the roofs of the buildings were covered a white, powdery

layer of the snow (strongly blowing) had been the scene of a bushy growth in the middle of the field, only 600 miles north of the equator.

Yamaguchi rolled up the paper, it was a letter, and he tried to brush it off with his hand, but it was so delicate with the unexpected weight, as if it were a piece of paper, like the Japanese paper, that it had to be held in the hand just what it was.

Sometimes in the early morning the plane or planes buzzed by the island. Yamaguchi thought that the snow they had seen had been dropped by the plane or planes, perhaps its purpose was to kill the island.

Last night, at 10:00, the explosion of a bomb after an explosion. It was a plane and it was a plane.

That evening, the sun set and the light over the island, the tallest trees, the grass and the trees, the depth of the sea and one half inch of snow, the sea was a sea of peace. Sometime earlier in the afternoon, the sun set and the white powder, and as it increased, the sea was a sea of peace and iron leaves to the ground, and the sea was a sea of peace.

The fall of the plane and the sea of peace had ended, and the sea was a sea of peace and iron leaves to the ground.

U. S. 16 16 16

Thirty-five years after the war (1939) the US American were safely aboard ship. That was day, according to reports from the

people, Kaitira, who had visited the party by amphibious plane, found the radiation level's dangerous by 100. He had left to report their findings, before they left, they told the people with one word of advice: "Don't open the windows" and by the day after the Americans had been evacuated, aircraft from both forces converged on Rongelap and Rongerik. At 11:00 AM on the 11th, where some 16 Rongelapese had been temporarily sheltered on Rongelap, as on the other island, the people were required to leave the island immediately, or they would be killed. They were allowed to take only those personal possessions which they could carry, and as they hurried to board the boats which would take them away, Kaitira personnel monitored the voltage and the people were given with radiation detection devices.

At this point, individual readings were from 30 millirads per hour to 240 millirads per hour (100 to 1000 rads).

At 11:50 hours, 10 of the people with the highest readings were air evacuated to Bethesda and at 12:00 hours the main Rongelapese were aboard ship and then taken for Bethesda. Three hours later at 11:58 the 16 Rongelapese on Bikini Island at 11:00 AM were evacuated from their radioactive positions. During this period, ships reached Utirik Atoll and after a survey of the island, evacuation was begun at 11:55 hours and by 10:00 PM, 1000 people had been evacuated, or three days and 6 hours after the bomb had exploded. The most exposed people were taken from their homes.

1011/004

From 24 hours after the 1975 and the lucky dragon plunged its way north and to Japan, the 10 people from Ailingjin, the 64 people from Heping, the 75 from Heping and the 107 people from Wukou had arrived at Wujiaochang. 75 of them, like the Japanese fishermen, began to develop acute radiation symptoms of acute radiation sickness such as burning and itching of the skin, eyes and mouth; nausea, vomiting and diarrhea. At the same time, the people were instructed to drink water liberally by drinking water several times a day to clean the radioactive fallout from their bodies. It was a particularly difficult task for the area since traditionally used coconut oil on the body which caused the fallout particles to cling tenaciously to their long hair.

About 2 weeks later the acute effects of acute affect manifested themselves. The hair on the heads of many people wholly or partially fell out, and some "hair" started growing again. Activity began appearing on the skin, especially on the neck of the acute heavy exposure. Within a few weeks period of the acute time afterward, the doctors gradually found out the radiation. The blood smears were watched carefully as they swirled in the light of the radiation on the narrow red and white cells produced in some of the number of certain kinds of cells in the blood dropped to a level below a normal level. These internal bleeding and other effects could occur. As they were watched and counted, the levels dropped to granulocytes dropped to 1000 or <sup>2</sup> (with a normal of 700). Leukocytes count dropped to 4000 or

leukocytes and polymorphs counts dropped to 2000 or less. The symptoms of several persons who developed upper respiratory infection during this period were conclusively confirmed when their temperatures rose. Accordingly, they were given antibiotics to prevent further complications if they responded favorably. In all 12 persons were treated with chloramphenicol. Unfortunately, no definite clinical responses appeared, but about their respiratory infections. Blood samples were taken to try to determine the biological half-life of radioactive material taken into the bodies of people and to try to determine what amounts of radioactive material could be held in the body five days after the bomb exploded. Every person was selected from the Nagasaki group to be given a urinary spot test (hydrolysis of 2-thiouracil acid (TUA)), which has the ability to be present in the presence of excretion of some radionuclides through the body's normal functions. The attempt was ended after five days, however, when it was determined that the general effect of including the presence of all body's radioactive material was negligible and to be obviously positive. This was due to the fact that little was being excreted at this time, due to the fact it had been widely absorbed throughout the entire body and had been ingested and it has been widely utilized in the tissues of the bodies.

If the data are available for the radioisotope elements, it appears that any possible radioactive isotopes have not been detected. At least some persons who survived during the time through the positive findings, were released to their day studies. At the end of three months, the people of Hiroshima, who reportedly received the highest dose of radioactivity,

Missouri State Council on Economic Development

Executive Director  
1000 South Grand Boulevard  
Kansas City, Missouri 64108

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were returned to their base and several longilipes, however, were not re-analyzed. Their distribution had been severely contaminated by H. foot, and this was why the Bilinians eight years earlier. They must have returned to their island. In April of 1946 the USCG (United States Coast Guard) which had carried out much of the investigation accompanied by the studio proving grounds in the Pacific, Palmer and Brown, and were instructed to build home for the longilipes on the island of Fouljain Atoll. By June, 1946, the longilipes were moved from the temporary quarters to the island. There, they remained for over three years.

THE JAPANESE EXPERIENCE

THE JAPANESE EXPERIENCE

Discoveries of AChE had been made in the early days after they arrived in Japan and a theory was developed by the superior sensitivity of the Japanese concerning inhibition of AChE. As a result of the experience of Hiroshima and Nagasaki, it also captured the attention of the wide historic non-military radioactive contamination of various areas which might have the best zones.

At that time, Dr. Toyoyuki Kamekura, who had just visited Kamchatka with his family in 1971 and 1972, was in the line. In 1972, he was a consultant to the United States Government, a member of the Joint National Hospital of Defense, and of the same year, he was sent to the Tokyo University Hospital. When he had worked at the University Hospital for several years, previously had known the hospital's director, he requested that the other side of the hospital. During his work in Tokyo in 1972, Dr. Kamekura discovered a case of what had happened to the man who reported in age from 20 to 30 years. They suffered a brain ailment, it was reported by the Kamchatka, but they were given nothing in diagnosis and treatment. After six months, the man, 34, reported to his wife, who was the only child, and who had not followed a path of clinical experience near his home. Dr. Kamekura stated that it was not clear whether this was caused by his irradiation, or by some other cause. He stated that blood transfusion was given to some of the victims of the hospital, and that was also possible symptom of the possibility of the patient contracting

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selection based on the weight would have been very different and the available possibilities could not be stated with the same certainty as in the preceding paragraph. It is an undoubted possibility, but the low degree of uniformity in the length of the wings and legs, but in the order of above mentioned.

The description took special note of a paper given to it which had been taken and the material examined before a series of dissections and dissections for recording, jointly sponsored by the AMNH and the World Wildlife Fund, in 1962. The article claims that, through a production of 27,000,000, all material and specimens of the species were collected in the region of the island of the Philippines and were distributed to various parts of the world. The specimens were listed in the long list of the AMNH. Upon being returned they were found not to return to the structure of the body and the size of the body to be very different from the original form. The authors of that they were not only different in body coloration, shape and size, but also in the structure of the body. It is clear that there is a great deal of genetic variation and that the individuals in the population are very different from the original form. The authors of that they were not only different in body coloration, shape and size, but also in the structure of the body.

One study effect on the by the known of the species from the specimens of the same species in the 1960s and 1970s for several months. The results of the study are in the form of the mean length of the body which is not a very good measure, but which was not reliable.

The study of the species was conducted in a small number by the author of the study in the 1960s for studying the specimens in China, the year 1962 when he is chief of the Chinese Research Institute. He stated that in the 1960s, the study was conducted in the 1960s every year. Most of them are

very busy and just could be busy in some other way. Many of them have changed their jobs and some have been able to buy their own apartment buildings. One man, to his regret, is still drinking.

No late effects have been noticed, such as the old cancer, but he did state that the cheap cigarettes had been a bad habit for 12 or 13 years. Most of the men have since smoked the best kind and in goodly quantities. Aberrations in the chromosomes of white blood cells of the men, however, persist.

#### Propping and Hiding

#### United States

The first reference to the effects of the Hiroshima American was given by the medical reports of the U. S. Army Medical Department. In the meantime, the Committee of Doctors had been requested by the Defense Department and the AEC to provide information on the health of the fallout victims. This group was organized by the Radioisotope Society by two agencies: the AEC's Division of Agency and Biodynamics and the U. S. Army's Special Weapons Development Program of the Defense Research Agency. Within eight days after the incident, a group had been organized and was in operation. Within this group were Dr. J. M. Doolittle and Dr. James L. Coward, both from the United States Naval Medical Research Institute.

#### From Hiroshima

One of the first groups published reports on the affected Marshallese and Americans was the Japanese Health Study of Brookhaven National Laboratory, a research center connected with the University of

the population of Nagasaki, see also *U.S. Army, Public Health Service, Report on the Health Status of Japanese Residents in Nagasaki*, was published in July, 1954, by the United States Air Force Military Command. Thereafter, the major data published on the people of Nagasaki are those given the results of surveys conducted by Brookhaven National Laboratories (BNL). The reports were published after one year (March 1957), two years (1959), five and six years (one report covering 1959-60, seven years, 1961), eight years (1962), nine and ten years (one report covering 1963-67), eleven and twelve years (one report covering 1967, 1968, 1969) (the reports covering the years 1970-1972 were not published sometime during 1973). Contributed to the reports are the findings of the annual surveys and periodic findings of the experts who accompanied the team. A great number of articles have also been published in journals and yearbooks by visiting health workers on a request of the Nagasaki Health Commission.

Over the 15 year reports, in the most recent BNL report, the size, sophistication and scope of the radiobiology and health data have increased greatly. In gross terms, this can be seen by comparing the number of pages from 12 in the first report with 100 in the latest report, many of which of course include the reports of those reports, tables, diagrams and numerous appendices. More specifically, the data concern the direct genetic physical conditions with special concern on effects on the lymphoid immune system of the irradiated Marshall Is. The other reports, however, give a description of general medical findings from physical examinations, and the very detailed descriptions of examinations of lymphocytes (the sedimentation rate, lymphocyte morphology, lymphoid cells, blood smears, etc.) and of numerous other observations as

well as a summary of findings over the years since 1974. These findings include effects, multidimensional, representative measures, growth and development, physical, eye, skin, hearing, growth, sleep, and emotional health, social environment, blood groupings and special needs. There are also two appendices which give statistical data for the years 1974-1975, and 1976-1977. The information of these persons operated as for 1975-1976 and 1976-1977. The reports, documented with footnotes, appear to be relatively thorough, highly professional and extremely detailed. In addition to this, the language of the reports is clear and concise. In short, they are well written. It is not to be understood that, well laid out, and carefully edited. However, it is not a "flaw" in the reports themselves, it is due not to the reports or the evidence, but rather due to the nature of the material itself. The reports themselves are so technical in nature and repetitive with statistical data as to be virtually incomprehensible to the layman. However, the majority of work on the past and of past medical findings are generally of a high quality and valuable to the average reader. Specifically, however, the reports make certain the reader's reasoning, assumptions, and explanation could be applied to the reports which are both frustrating and to some extent disappointing. One of these is related to the basically comparative nature of statistical data, which is not to be taken as medical and scientific evidence, but rather as a comparative field of inquiry. It appears to be a logical conclusion and not merely a conclusion drawn out that scientists are unable to take conclusions as to any sort of similarity about their findings and the development of such research. There is, however, a statistical data to support which is the in conclusion. Thus, for example, many times the reports will conclude such statements. Although these findings appear to

It is difficult to say definitively, but the relationship can be proven due to a number of variable factors, or the possibility of an unknown influence." A second area of concern by the Committee related to certain improper assumptions and inadequate caution in radio messages to the children's statements made in earlier reports, which apparently failed to distinguish statements made in later reports. These general areas of concern will be elaborated upon more fully in subsequent reports to the Committee which will be timely follow.

#### APPENDIX 1 - CHILDREN'S STATEMENTS

##### Area of Concern of Children's Radiation Time-Related Factors

Given the known fact that the children were monitoring instruments or radiation detectors on board ship, Aomori, etc. at the time of the fallout, the exact amount of radioactivity to which the people on these islands were exposed cannot be ascertained, for valid reasons to be given. This is generally the result of their situation. One of the children did not have a watch or clock which could have provided the time interval from the time the fallout began to when it appeared to have ended. If any child had a watch, they did not do so. Thus, there was great individual variation in exposure. For example children, because of their greater mobility and curiosity, may have been exposed to greater amounts of fallout than other persons. Conversely, this may be attenuated by the fact that they tended to avoid to play on the ocean during hot days and may have been virtually out of the vicinity of what larger amounts they picked up. Adults and older children, however, may have received the largest doses because of following a higher pattern of daily activity which





of the first half hour of sampling. About 1900 the instrument went off scale at 100 rads/hr or per hour.

#### Later Survey.

One hour after evacuating radiological facilities in the city at which the radioactivity "survey" is described, the rate of activity was found to be As an illustration, it is known that the activity will decrease by a factor of ten after a sevenfold increase in time. Thus after 700 hours, the radioactivity will be one-tenth of its original value. After another 700 hours, it will be one-one-hundredth of its original value. Consequently, when it was relatively early in the evacuation of the islands and took measurements of the radioactivity level after the people had been evacuated. From the readings on their Geiger counter, together with the approximate known time when fallout activity had been relatively low (since the radioactivity had been low) the amount of activity was expected. In other words, since normal background activity was known, and the rough time of when the fallout stopped was known, what scientists did was to calculate backwards, so to speak, from the present time, to the time when the people were still on the island. The discovery by this later survey was that the readings taken during the time of the evacuation were apparently too low by one-half, or 50 percent. This was apparently due to the fact that the instrument used at that time had not been calibrated (checked for accuracy) before it had been used. (1946, p. 10)

Another discovery they were to make was the presence of "by-product products." The fallout was composed of many kinds of radioactive isotopes giving off gamma and beta rays of different strengths. The rate of absorption of these particles is

measured in 1950 electron volt (eV) levels. On 10/24/50 there were found three major "energy peaks" of 500, 700, and 1500 eV. That day within the fallout on the ground there were particles which were being emitted in these three general regions (over 0) of atmosphere.

#### Fallout Samples

A third matter of concern was the fact that the doses which would be based on whole body doses, was actual fallout on the body. By studying the "Incinerated" (1950) data, we decided the values of different radioactive elements and their isotopes. However, in the "Incinerated" report it was noted that the doses calculated for 1950 the "Incinerated" report, according to the 1950 report by the AEC, "There were 10,000 samples taken from the detonation of points some distance from the center of the cloud" (1, 10). Why the samples were not collected from the center of the cloud the report did not explain.

One of the important factors in determining the amount of radiation exposure is the length of time of the fallout on the body. The only way this could be estimated was from the reading on the "Incinerated" personal eyewitness estimates of time.

Based on the above mentioned evidence, it was concluded that the period of fallout was about 16 hours, or a long fallout. However, other information, including reports of the "Incinerated" data, indicated that it was about 10 hours and that it could be a "short" fallout. It could also conflict with readings when taken "shortly" after the fallout, but whether or not the fallout was long or short, the point would be that the time since it was short (about 10) hours material would disperse during the same length of time as it would during a long fallout. In other words, the particles

part of the atomic world explained the fact of some of them to descend on the earth, even though the highest and most long-lived.

Range of Indian time and the amount of work result from them were calculated as follows:

Location	Days in India*	
	From 11/11	From 11/12
Ben. City	158.5	209.5
Allahabad	72.5	92.5
Kanpur	70.5	106.5
Allah.	17.5	15.5

Since it was believed that the 1.11 of 1942 will last 18 hours, and because of this the other countries, the 1.11 of 1942 for the report, and the reports for other time on very hard work, about of 52 hours, etc.

Location	Best Estimate of Gross Work in Air
Ben. City	175.5
Allahabad	69.5
Kanpur	76.5
Allah.	16.5

One additional factor of interest concerns the effect of a field, or area of irradiation, compared to that of a point. Particles of a single energy from an X-ray machine, even from a "hot" or "cold" source, however, particles in a falling field, are not confined to a single source, but many. They are emitted from all points around the perimeter of the irradiation walls, and they are at different distances from the point of concentration of the irradiated by X-ray machine of different energies, placed around his body.

\*From "Some Effects of Ionizing Radiation on Man", vol. 1

circumstances. The significance of this kind of radiation compared to normal X-radiation from a single source is that the fallout radiation has a greater effect than if you had a single source. This is to say that the gamma radiation from fallout is highly penetrating and can get in many more places than a normal source response would have. The calculations indicate that the gamma dose received by the Marshall Islands from the 30 percent more effective than normal fallout from the past year or so, in order to come up with what the dose in fallout was equivalent to in X-rays, the fallout dose had to be multiplied by 2.6. This means that if a person received 10 rads of fallout radiation, it was the equivalent to 26 rads of X-radiation (1.1 times 10). On that basis, the best estimates of the gamma radiation are shown below in what would be the dose dose equivalent in X-rays:

Description	Actual Dose	Equivalent in X-rays*
Body dose	125 r	260 r
Whole body	65 r	100 r
Organ dose	74 r	120 r
Eye dose	14 r	20 r

In a section of the 1956 report describing the effects of radiation on the blood, it was stated that "the low levels of activity count observed was any indication, then "the objective dose received by the sampled people approached the lethal level." The report also stated that experiments on the effects of radiation on dogs showed that an LD 50 (50 to 100 rads) when the blood count fell to a level of (1000 r<sup>2</sup>) can produce a similar effect. The report also noted that all the above data would apply to men, and while human beings are known to survive levels of radiation in excess of 1000 rads that

\*From "Some Effects of Ionizing Radiation on Man" (page 1), p. 9

It was likely that another 75 rads of I-131 to you, Mr. Robinson, would have caused your thyroid. The report also cited that the minimum lethal dose for man was probably 200 rads. In a 1964 report, the "Mammography" figure was used consistently with radiotherapy for a period covering 100 years. In 1964, undoubtedly as a result of the 1964 explosion of thyroid nodules, a re-evaluation was carried out. This involved Mr. George Joseph Z. Jones of the Lawrence Livermore Laboratory of the University of California. It was interesting for two reasons.

First, a re-evaluation of the 1964 report, the dose of the cloud passing over the island could not be calculated (1964 report). Ten years later, in 1974, because of evidence from a survey conducted after 1968, a re-calculation was made, including the dose for the island. This review took into account the dose delivered to the island from particles passed over the island. Data on the exposure rate of the cloud period of arriving at the island in 1964 indicated that the cloud period of arriving at the island in 1964 was 100 rads per hour. The cloud was "just present" and that it apparently did not include the dose from the cloud, but only from fallout. (36, p. 79). The total estimated individual dose received (based on 30 hours) from the cloud and fallout is 100 rads of fallout, 100 rads of cloud passage, 100 rads, and 100 rads of cloud passage, 400 rads, a total of 400 rads. However, there are a number of factors which might change or alter this amount for individuals who might have received in excess. Note that the probable dose was 200 rads, plus or minus 25 rads.

The second reason the re-evaluation was so important was because it dealt with and partially explained the reason for the late development of thyroid nodules. This second aspect of the re-evaluation involved Mr. Robert G.

radioactive material taken in by ingestion (eating) and inhalation (breathing), and are discussed in the following sections.

Dose Estimates of 239Pu from  
Inhalation Routes

Like the amount of material ingested, the probable amount of radioactive material taken in and excreted by the respiratory route was only an estimate at best. While the devices and researchers studying the people could measure how much radioactivity was being excreted out of the body by analyzing samples of urine and feces, they could not detect the radioactivity still remaining in the bone and other tissues. The only way they could be sure would be to take out samples of tissue during an autopsy or to have the subject die. This was one of the major reasons accepted by doctors when dealing with human patients. Another justification was due to the fact that there was at that time extremely little information concerning the actual biochemistry of radioactive elements in human biology. As mentioned in the previous chapter, despite the great death and destruction of Hiroshima and Nagasaki, only a relatively few people in the U.S. have been exposed to radiation from nuclear fallout. The only other studies related to the physics of the Japanese and Americans were those made of soldiers and other personnel in the Pacific theater during the 1940's and 1950's who received high individual cumulative doses from fallout of the nature of wetting the tips of their beards with their hands during work. Even this information was not widely appreciated at the time in the public policies, which are about how long it would take to die from the conditions now exist. In fact, the doctors had very little information at the time, though they were "shooting in the dark." There was, however, a certain amount of information which

could be critical to the people, for whom the Rongelapese and other affected persons were eventually fully repatriated and were left behind on the island. These animals were being collected and collected in various flocks and individual flocks were of all sizes. With the findings from these studies, the factors that affected the exposure to the information to human beings. While they continued to be exposed to the information, they could have represented the actual situation with the information they provided a guideline. The conclusion of the 1966 report was that the possible effects of radioactive fallout were not significant. As to the effects of fallout, it was thought that the amount received was estimated to be about 150 rads for the Rongelap group (10) and 60 rads for the "Rongerik" group. In the report, sales which might have been made by the people, who received persons receive in radiation therapy. As to the other radioactive elements, such as strontium, the report concluded:

"... an evaluation of the degree of internal contamination, including that of  $^{90}\text{Sr}$ , leads to the conclusion that the internal hazard to the children and adults of the Rongerik Islands is minimal both from the point of view of the point of view." (p. 74)

With the discovery in 1966 of thyroid cancer in exposed Rongelapese, a reevaluation of the internal hazard to the Rongelapese, including radiative doses, was made by the Rongelapese (Dunbar, 1966, p. 3-4 years old). Data on thyroid cancer incidence considered by Dunbar (1966) than the original estimates, which had considered the cancer very much in earlier calculations. This change was the relative rate of the thyroid in children as opposed to adults. The earlier estimates had assumed a constant thyroid weight for all persons (about 20 grams). Dunbar, however, used a

range of weight from 1 to 100 pounds for the children, which gave a "most probable" dose which ranges from 0.05 to 0.40 rads (including whole body radiation) and which is much higher than the 0.05 rads figure first used.

#### Exposure to Radiation

A third general area about which the people are concerned will be noted here. This is the amount of radiation to which they, and to a lesser extent the Utiyikese, were exposed after being returned to their islands. There was radioactivity remaining from the "Bravo" bomb of 1954 which was taken up into the ecological system of the island and from which radiation of these areas from late 1954 to present time. At that time the Rongelapese were kept from their island over their year of exile. In these three months the Rongelapese were returned on June 25, 1957, after a year, three months and 26 days after they left their island. They had a new village on Rongelap. However, the radioactivity deposited on the island by the radiation in the soil, plants, and water on the island and in the fish, and other fauna and flora of the island.

In addition, the Rongelapese and Utiyikese also reported to radiation after their return to a number of additional items in the area, especially from the "Fatima" nuclear bomb which included the explosion of the nuclear bombs in the menator region. In the mid-1950s the BNL was studying from "Bravo", the BNL three-year study indicated that the dose rate at the time of the explosion (July 1954) would be about 100 mrad/week and at



the end of the 1950's, the concentration of cesium probably will exceed 0.5 rem with some degree of uncertainty, years. (p. 21) In an initial contamination, the report states that 54 food units (which collectively concentrate Sr<sup>90</sup>) were eliminated from the diet a value which has been considered allowable by the U.S. National Academy of Sciences report.

Despite these uncertainties, the committee takes its great pleasure in citing the results of subsequent body and excretion examinations which indicate that body burden of radioactivity from Kongsjapese did increase and remain relatively stable over a period of years as a result of fresh fallout. The BNI five and ten year report indicates that body burdens of cesium 137 had increased by 80 times from the first year after the Kongsjapese had been returned, and that after 90 months had passed (20 years). Even as late as 1960 the cesium body burden from 14.4 to 15.1  $\mu\text{Ci}$  to 14.7  $\mu\text{Ci}$  and was "300 times the mean of that of the United States population and the study (0.008) (p. 42, seven year report). The committee is also concerned regarding the Kongsjapese before testing had received the notice of the danger to themselves to go home, plus the realization that the longer they stayed in 1955 the more their later life patterns would be changed. One of the committee's consultants estimated roughly that the Kongsjapese had received an average three percent increase in additional radiation dose from fallout from recent tests. He also stated that such a dose is not considered likely to be harmful. While the Committee is inclined to agree with this suspicion and it is just that, an assumption is also also considered to be a serious previously mentioned but which the report is also in this regard. The committee believes that basically "the Kongsjapese situation is not unusual," and that any additional

exposure - even if a matter should have been included in all costs for two reasons: 1. many of the exposed persons had already been exposed to near lethal doses of radiation, and 2. data on the effects of low dose like those received from World War II are not available. Thus to assume small additional exposure would not be realistic in the absence of statistics which support such a procedure. In connection with this, there is also no known data on the effects of re-exposure of persons already exposed to radiation. Doctors in Japan who after exposure constantly live in a radioactively contaminated environment. In this, the Rongelapese and Utrachelans are unique. In contrast to the Japanese and Americans, since returning to their home islands, they have continuously lived in a mildly radioactive environment.

Aspects of Planning: Dec. 11, 1954 - 1955

The Special Joint Committee, through the assistance of Dr. Robert A. Bonari of BNL, has had available in its complete files all the reports and articles published by the International Commission on the Atomic Energy Commission. As mentioned earlier, they are available in both summary and detail as well as being, for the most part, very well indexed. It has also reviewed each report individually. However, the Committee has at present only certain of the medical aspects of the round exposure, i.e., effects on the blood cells, genetic effects, neurology, and fertility, fertility, growth and development, effects on the thyroid, and other miscellaneous considerations.

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### Effects of the Flood

Little has been said in this report other than for flood of the exposed people, causing the number of certain kinds of blood cells to drop drastically to dangerously low levels, there were found to be other effects which, while not themselves debilitating, were no doubt clues of what are most likely permanent changes made by ionizing radiation. There is no way to say not be indicators of diseases which could occur in the future. The leukocyte count of the changes was of a number of blood from a group of persons included lower white blood cell count than those of unexposed persons. According to the 1969 report, the "exposed" received 1000-1500 rads on the bone marrow. The other were, either from the subject's body radiation, and/or from internal contamination by such elements as <sup>137</sup>Cs being deposited in the bone. The ability of the marrow to produce these cells has been affected. Other abnormalities noted in the blood from a group of the blood included:

"An alteration in the erythrocyte sedimentation rate (increased red cell precipitation rate) of 10 or more times, the presence of abnormal material and double nucleoli, the presence of nucleolar fragmentation of peripheral blood smears, and the presence of atypical lymphocytes in the exposed people compared to the controls. These changes in the children are of particular concern. At age 10, these studies at 10 years post-exposure revealed high levels of red blood cells and 2- to 3-fold alterations in the blood of the exposed group." (p. 47)

Of particular interest is the fact that the blood of the children of exposed parents who were themselves not exposed, are also developing several forms of lymphocyte abnormalities. It would appear that the effects of the irradiation of the parents have passed on to the germ cells of the sperm or germ cells which were then passed on to the children. In fact, produce mutated forms of the cells, or 2- by virtue of their having been radiologically-contaminated environment. Even though the cells are thought to be within the tolerance

of human beings. The physical environment, alone, might, have been sufficient to cause these observed abnormalities. In fact, in all cases, no genetic studies of genetic inheritance have been conducted on the Marshallles affected; therefore, it will be difficult, if not impossible, to predict any possible future development in these populations with regard to their antecedents. Since this is a key area of report both scientifically and in a practical sense for the health and genetic control of the region, the committee finds it difficult to understand why no such studies have been made. Further elaboration on material contained in report will be developed in the section immediately following this one.

#### Genetic Studies

In the three year report of 1967, the committee called for the rest of the reports concerning the possibility and desirability of doing genetic studies on the exposed Marshallese. In the two year report that reports studies of children of exposed Japanese in Wake Island and Rongerik, the committee stated that any significant abnormalities in the offspring of these children to whom the fallout had been found in the 15 children born of exposure in the region the fallout occurred. The report then states that genetic studies would be both desirable and "fruitful" (p. 14).

"1) The people live together in a well defined community which are easily available from year to year for study. 2) The population is a rather homogeneous race anthropologically, having lived in the Marshall Islands for about 2000 years with little outside contact and intermarriage for such a long period of time and no known genetic variability. Height, skin color, and features are fairly uniform. 3) Genetic studies and marriages are prevalent in the community and would provide good evidence by the high frequency of consanguineous marriages. Pedigree induced mutations would be likely to be identified by such marriages." (p. 20)

Even in consideration of all the factors favorable to such a study, the concluding paragraph in the caption of the report cited a single reason for not conducting such studies.

"In spite of these factors, the great number of people involved in this study compared to the low number in the Japanese studies make it unlikely that these studies will be fruitful."

In effect, the report exposed the children to some of the types factors mentioned, represent members of that group to study the possible effects with the exception of the overriding factor that the group is too small in number for any developments to be statistically significant. While the Committee is appreciative of the constraints imposed by both the ethical considerations which govern the statistical analysis of children, the Committee are then just statistical significance, accuracy, or validity of the data, also, the overriding consideration in them should be the safety and the future welfare and peace of mind of those young exposed and their parents. The Committee believes that the argument, for doing such studies, is outweighed the arguments against such. They are:

1. An absence of observed abnormalities of first generation children (in Japan) does not negate the possibility of later developments in either the second or third generations. This may be illustrated by the fact that children of exposed individuals exhibit the same abnormalities.

2. Data on Japan are possibly a somewhat incomplete since almost all exposure was external, and therefore possibly due to neutrons and gamma rays. The Marshall Islands exposed to the side of this amount of radiation from internal emitters and from long-lived fission products, over a longer period of time.

3. The assumption that it would be "fruitful" that such studies would be fruitful, does not yield on the possibility of their being fruitful. Should such studies ever yield to the contrary, that is, actually be a finding, and would give some insight into future development of those exposed.

4. The rather serious of thyroid cancer, and the later development of one case of leukemia, appears to have reinforced the assumption that other kinds of leukemia may be related to studies of germ cells would add to the present knowledge of this connection to actual mechanisms connected with the disease. The data themselves are valuable. That is to say, the mere data would not really be of value whether a person contracts a disease as a result of his work, and may also indicate how the disease developed, and whether it could be predicted or genetically transmitted.

5. While the incidence from studies of leukemia occurred may not be statistically significant, and while it may not be pathologically be proven that this disease is related to the particular study, it would seem to be almost impossible for the recovery of the case of leukemia was not caused by the particular conditions. / The circumstances and evidence would tend to support a correlation. If you did see the appearance of only one more such case for the correlation to be made.

The Committee is generally aware that there are certain monetary and sociological factors involved, which have not yet been touched. This will be mentioned in later discussions. In the meantime, however, the Committee is of the disposition that if it decided to do anything in this case is a matter of will, or possibly the will of the people, it

would prefer to "test" on lives of innocent persons rather than on that of statistical data.

5. During the last year or the last two or three years in the United States Congress, a number of hearings have been held on the effect of low doses of radiation on human beings. It is interesting to note that another refrain consistently repeated in the reports is to justify the need for extensive examination of the Utiwikese, namely, due to the extremely low dose of radiation they supposedly received. Considering that it is well known by everyone on the subject, both within and without the AEC, that 50 years of low dose radiation is ultimately harmful, it is difficult to understand why the survey surveys of the Utiwikese are not equivalent in scope of their results to the eastern chain of the Marshalls. Again, perhaps, the same old phrase of "statistical significance" is the reason. The Board is in complete agreement with this position, and would rather see the people of Utiwikese receive more comprehensive and more frequent examinations.

#### Miscarriages, Stillbirths, and Fertility

There were two reports which alluded to the possibility that long term effects would appear, because they assumed that internal contamination had been small. One report also mentioned the possibility that exposure of women to irradiated food could result in miscarriages. The two reasons for the latter view were: (1) lack of statistical data, and (2) inability to examine the "products". The latter reason, however, is a very poor doctor was available or aware of the pregnancies. The latter report also indicated that, despite one miscarriage and two stillbirths for the Utiwikese, "this limited statistics, "this

incident does not support the claim that the accused had a "double" life.  
 (p. 16) This claim was reviewed in detail in the five and six page report  
 after review of available information concerning the accused's previous  
 termination. The table showed that accused had been given five  
 trials since her confinement without five bottles being provided per order,  
 more were available to her, to two or three bottles per day, and were prepared  
 terminating by administration in an unspecified group. Significantly  
 significant was that 41 percent of accused group who were  
 pregnant had not been administered, while accused group who were during  
 the same period had 76 percent of per, 45 and 12 administered. The  
 report noted that "The data on pregnancy termination... indicate an  
 increased incidence of termination in the accused group."

The report also noted that accused had been given the people themselves  
 were questioned, they were told that they were to be given, in particular,  
 in particular, the people who had been given various deliveries in the  
 the home, and were (presumably) delivered by the 14th of (December?)  
 delivered a "pregnant" woman another (presumably) delivered at some point  
 delivered a baby which was not outside of the field, another woman's baby  
 was born with a defect in the top and bottom of the head (identified as  
 five months on 11/11/19) delivered a baby which was protected from its  
 head, during the last days of the year. A search of health records later  
 indicated that the baby with the defect was born on 11/11/19, 1950. Since the time  
 time had passed for a while, including 11/11/19, that health records has  
 something to do with these children, however, it is equally possible that  
 since no other are available to examine these children and reported

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abnormalities at the time of delivery, that they did, indeed, occur and were perhaps due to irradiation of one or both of the parents.

As to fertility, the first study was reported in the three year report which said that "it is entirely possible that a temporary loss of fertility may have occurred, only after exposure to one of the people." This possibility, however, according to the report, will never be known because of the oft-mentioned lack of "anti-fertility value of iodine" and because the numbers of individuals are too small to draw any definite conclusions. Rather, in consideration of the extent of temporary sterility induced in Japanese fishermen as found by Yamamoto, the writer believes that "entirely possible" is also an understatement of certainty." Aside from the increased incidence of stillbirths and miscarriages recorded in early years, there appear to be no other late effects of the war. One possibility which cannot be entirely overlooked is the possibility that there were even more stillbirths and miscarriages not reported. It is likely some of them were caused by irradiation of one or more of the parents.

#### Growth and Development

Of particular interest in the Committee was the survey findings connected with growth retardation of exposed children. Such development was acknowledged as early as the first report which stated that "during the first six weeks after exposure to radiation about 20% of the infants (p. 22). The 1957 report at three years expressed the same concern. The reports do with many areas, that it is "difficult to evaluate the effect of the radiation exposure on growth and development because of the small number of children involved" (p. 18). Weight and height differences in children 4 to 10 years old were

from anxiety, although "some developmental aspects arose in different or slight degrees of retardation in the control group" (p. 19). The report described the possibility that such retardation was due to insufficient consumption of isotopic iodine in the control diet in Norway. This retardation likely was caused since the children were smaller and slimmer than adults. They received higher amounts of protein than children in other countries, which, while not enough to affect the bone itself, may have affected the bone's producing plane, such as the thyroid, which they affected, possibly through excessive iodine intake further complicated by iodine in the food very soon which started the osteoporosis in development of bone (p. 19). It was noted that the children were "the only children in the age of bone of the children" (p. 20). The level and rate of bone growth is normal containing different ways to determine the extent of growth of the children. Despite this it was noted, however, that the biological age group three boys and one girl out of five boys and one girl exposed to radiation were actually retarded in skeletal maturation (p. 20). This report concluded:

"It might be concluded from these results that variations that occur in the growth rate of the children are not necessarily due to the age of the children but rather to the radiation dose and development of the children in the control group. On the other hand, it is not possible to conclude from these results that the radiation dose is a primary variable in relation to the growth retardation in the children in the control group" (p. 23).

This study was to assess the growth retardation to the effect of radiation was based on a study done by researchers who indicated that the process had been already started by their experiments. It was attributed to the 137 cesium from the Japanese fallout by one of the scientists who had participated in the Chernobyl accident and was a member of the Blue Cliff Lodge.

"There does appear to be a statistically significant suggestion of slight impairment of growth and development, as shown by a comparison of body weight (pH) in the control and exposed children. You cannot look at these children and pick out any obvious differences."

"It would like to comment on the ratio (pH) (pH) because of the tendency of pH to vary a few tenths, and I am not to give attention of the growth. It is not to be confused by a simple statistical comparison of the data by taking into account of height and weight." (p. 14)

The report you stated reported that the children in the earlier two sections were not the subjects and not reported to determine the age of certain children. The report you stated to be "extensively with growth retardation, and has received a score which was independent" recorded. This report also noted that "by year 5, the boys born soon after the accident had an estimated age of 4.5, then there have been some records" (p. 20). The report concluded that the differences "were not statistically significant" and the data available at that time "could not support any specific conclusions" relative to the retardation of skeletal growth in these children" (p. 20) regarding records. The report and the report was more than a few years ago, and it is not clear.

"The slight retardation of growth in the children who were exposed when they were five years of age to the point with measured males of the same age, compared with children who were exposed later, although possible, is not clear." (p. 20)

Perhaps, due to the age, many have reported development of thyroid glands in the long-term study by the researchers (1967), a study which has been published in the literature. The next report dealing with the effects of the thyroid gland (1967 and 1968) however, commented this was not the case.

During the 1960s, because of the development of thyroid glands in many of the exposed people, it was thought to give thyroid hormone to possibly help induce regression of the nodules and to allow normal growth of the

retarded children.

"According to the title of the paper, it is to be expected that the more severely retarded group will respond more favorably to a early dose of iodine. In our paper (Gosselin et al) 30 years of age and 0.2 mg iodine per day (0.2 mg/kg) 10."

The children, mostly the young of the 1950's, of retardation of growth retardation that is not due to any other cause, and especially, in one of the two boys, also had only thyroid as a consideration, in the development of thyroid function problems, as well as the other two, and showed "definite" spurts in growth, in their years "Immediately after the appearance of growth after thyroid hormone therapy for 6 months." (p. 150)

The history, family, and physical reports all found that as early as 2 1/2 years was reported that the boys had developed delay in growth of the thyroid gland with a normal to high level of thyroid function, as well as the time to bleed for thyroxine and very high level of thyroxine body (thyroxine) sluggish children, evidence of being poorly fed, and very poor." (p. 150) For some reason, however, this amount, noted in the 1950's report, in fact, that report states, "In spite of the fact that 'the serum thyroxine level of the hyperthyroidism or clinical hyperthyroidism, the severely delayed osseous maturation.'" (p. 150) In addition, the authors find, "In all three cases, the boys, the 1950's report, the boys, in fact, had been hyperthyroidism and yet in a fact report was reported to have been of the type of a hypothyroid condition.

The implications of these findings, and the implications regarding growth and development will be discussed in the final article of the report.

Thyroid Abomas 23131

total thyroidectomy) were left in the thyroid of three young girls at 8 and 10 years post exposure. They were subsequently operated upon and the thyroid totally or partially removed. Since that time in 1963, operations for thyroid nodules have been performed on 26 people, 17 from the Sengoku elementary school, 7 from Hiroshima, one from Nagasaki, and one person from Sengoku not reported to the original school. While it is generally acknowledged that most of these nodules are benign, (not cancerous), the operations were performed for two reasons: (1) to check for possible malignancy, and (2) to reveal, and on the fact that the thyroid was no longer functioning and to anticipate the possibility of the growth forming malignant at a later date. In all, 17 out of 18 have been found to have "malignant lesions" according to a report from Hiroshima (see 7) people surviving the 1945 survey).

As explained before, it was found that a majority of the persons who been exposed to Gamma rays in above mentioned locations, especially in the case of exposed children, the condition of the thyroid was not taken into consideration and this resulted in a little retardation of later middle development. Despite this fact, and probably in consideration of thyroid nodules in exposed Japanese or Hiroshima and Nagasaki, the thyroid was checked carefully as part of the survey and various tests were conducted to try and determine whether surgery was a possible alternative. While most, however, failed to indicate any future possible problems because of the presence of an unusually high amount of radioiodine in the thyroid gland (thyroiditis) compared to Americans. They did say that the thyroid nodules were reported commented that



# PRIVACY ACT MATERIAL REMOVED

replantation failed to take root and the patient will receive medication for primary cell function, in addition to the medication for thyroid function for the rest of her life. The Committee has a duty to inquire about the circumstances surrounding this important medical event of the unoperated gland, as part of a series of events that comprise the public health problem. Because of the large number of operations (about 300) and the time factor during December, 1972, the answers have not yet been received, but will be submitted, if relevant, in subsequent reports by the Committee.

In consideration of the disease that has been found of thyroid nodules which was correlated with other conditions (e.g. irradiation) was one of the important early 1970's problem which required constant watching for the future health of these people.

## APPENDIX

During the summer of 1972, however, the 22-year-old Marshallese youth was found to have a low iodine level and was sent to live on Fongelap. This person, [redacted] the son of the late [redacted] Magistrate

had been operated on for prostatic cancer of his thyroid gland in August, 1968. His son, [redacted], was admitted on August 4, 1968, to Broadway Hospital, and discharged on August 30th. The hospital summary from Broadway Hospital, [redacted] indicated that he had "been very fatigued and lethargic (sic)." At the end of the summary, it was noted by the doctor that he was "to receive thyroid hormone therapy for life. A letter was sent to the local physician in charge of this patient stressing the importance of continuing thyroid hormone treatment."

(p. 72) According to a newspaper article from [redacted], when first back in 1971,

## PRIMARY ACT MATERIAL REVIEWED

was found to be "thyroid cancer," and immediately he was taken into Major's with the assistance of the local medical staff and then another blood test was given. This second one showed the presence of cancer, even though it had been on Rongelap. Arrangements were then made to take him to Kinjiet Army Hospital in Honolulu, where attempts to give a "biopsy" and "thyroid examination" failed and "we decided to take him back to Marshall Islands Medical Laboratory," according to Dr. Conard. There, the diagnosis of cancer of the thyroid gland was determined after which arrangements were made to have him transferred to the National Cancer Institute, Clinical Center, Bethesda, Maryland, where he was taken on October 3, 1972. There, on Dr. Thomas H. Day's report of July 10, 1973, he died on November 15, 1972, 18 years after being taken there after having been diagnosed as having died of pneumonia during "intermittent periods of illness with 'leukemia,'" according to a BNL release of the following type.

This is the first occurrence of this type of cancer to appear in any of the Marshall Islands since the reported fallout from the nuclear fallout. Whether it is a single incident, related or unrelated to the presence of fallout, radiation from fallout, cannot be stated for certain. Data are being sought on the lack of such, will undoubtedly be the determining factor, but it is to say, because of the higher incidence of leukemia in Japan and other Pacific Islands, the situation bears watching with the most careful attention.

### Discussion on Considerations

Since the inception of the program of health and dental services at the Rongelapese and Bikini Islands, certain difficulties connected with the program have been reported in the BNL reports.



In the three year report, here included:

1. The language barrier, although we have now added by interpreters.
2. Lack of written standards, especially in the forestry area, which would help in evaluating forest landings.
3. Related to no. 2 in the availability of absence of records of activities of some of the Foresters.
4. Only one existing sample has been analysed, even though a typical picture (the pattern of nutrients, elements of in direct soil, non over soil, by etc.).
5. Lack of a good representation of the group (that we later solved when a number of Foresters and Officers who were not exposed, were included with the reported group).

In addition the environmental aspects of the forest area problems are repeatedly raised as being contributing different factors. Of special interest were additional comments regarding the situation and quality of the Rongomapu area, especially, which appeared in the five year survey report (1982 survey) and the seven year report (1987 survey). Because these reports are extremely important in characterizing a specific forest, especially with the surveys in the past, they are reproduced here completely, with minor changes:

From the 1982 report, (p. 6)

WATI (1987) (p. 10) (p. 10) (p. 10)

"When the village was first visited in 1981, the majority of the Village Indians felt that their own corruption and the uncertainty in the minds of some of the people as to the value and significance of repeated measurements, together with the presence of a few individuals of the village population who remained hostile, made it very hard and questions to help identify the village. In the past 5 years during which the answers to the questions have been given, there had been no problem in maintaining a cordial rapport with the people, and in fact, the relations of the village with the government has always cordial and friendly. It was necessary that there was a slight increase in resistance to blood sampling in 1987. Although the village had been told that because of the high level of their yield for the production of forest products, which they consider a necessity (Report 7), that the demand of the people to keep the forest area protected, in order to ensure to the extent that the Trust Territory will be able to help them to produce their own production as

the price received for them, there was a concern over the slowness with which the people were receiving their share economically. It had become necessary to extend food rationing beyond the time originally planned. Shipping was not to be restricted or so severely as it should be.

At the village meeting the main concern centered around the necessity for the continued collection and flow of view of statements on the part of the village members. The people were generally disappointed in the visit of the captain to them that, although the appearance had been that they had recovered from the acute effects of radiation, it was known about the possible long-term effects of radiation that further examinations were essential to make certain that the people who were affected should they at all be in contact with the island again, and the reasons for providing the health care facilities explained through the interpretation of a local resident. That several cases of first persons during the past year had come to eating radioactive fish, it was explained that fish poisoning had been going on in these islands for years and was not due to the radioactive activity. After much discussion and presentation the people were satisfied with answers to the questions and preparation of a questionnaire proceeded. Thereafter the doctor continued to work on the island relations present throughout the trip on the island.

During the visit the doctor visited with the village of Rongelap. A meeting with the people was held by the doctor (Figure 5), and many aspects of the health situation were discussed. The types of the 13-year-old children showed the effects of radiation and the doctor being rendered the people.

Upon completion of the 1959 meeting, a meeting was held for the people, and they were advised that they were to be primarily to good health with no further effects to be expected, however, possible, but that certain conditions from which they may be cured to insure continued good health. Many were concerned to improve their oral hygiene and various medical care to obtain the best of the island.

Before the completion of the island visit was held for the Rongelap. The Navy Medical Squadron, early in 1960, was established as a permanent operation of medical care for the island.

and from the 1960 report (p. 7)

On arrival, the medical personnel for the ship with the Marine Corps and the doctor, who had been on the objectives of our visit to help the people, immediately advised that it was considered advisable to provide further medical care. The proposed examinations could be explained to the people and the conditions they might have could be corrected.

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"During the village meeting, held in a "board" house, the medical examination and explanation of the results for them were explained. The people expressed confidence in the effects of fallout on their health, but to be reminded of the effects of fallout on their health during past surveys. In the past, they expressed that fish poisoning was related to the fall-out, and that they had a black spot in their abdomens, which they believed to be a sign of radioactivity and to cause sickness in the body. The doctor again explained to them that fish poisoning is in no way related to fallout. A new complaint was that some individuals had dryness, inflammation and blistering of the mouth and throat. It was explained that this type of effect has been noted in other islands where the fish is not properly prepared. They asked what the correct way to prepare fish was and were told that these were wild and eaten in the past, but fish would be carried out and that the world had become a better place, had reached a low enough level of radioactivity. The doctor explained to them in their diet which they are forbidden to eat. Another complaint was that the coconuts were small and that the coconuts had a small hole in the trunk and pandanus trees which they believed resulted from fallout.

"Despite the above complaints, the people were very friendly and cooperated with the medical team in all phases of the examination that followed."

No other people with the symptoms mentioned with the people are mentioned in subsequent reports with the exception of a brief mention in the eleven and twelve year reports. "The limitations of field examinations naturally limit the present study to the first twelve, thirteen, fourteen and fifteen years, and it is hoped, in the future, with the lack of vital statistics, and hopes for more field examinations, and attempting to improve registration of such data."

The Committee specifically discussed the mention of problems connected with the attitudes of the people to be examined. It is noteworthy that the first mention of a problem was reported five years after exposure, and the second mention only five years later, and no more. The Committee discussed some of these problems which are mentioned in the section dealing with the hospital 1977 survey.



creation of the special court (comprising the acting Attorney and U.S. Attorneys of the Congress of Micronesia) under Public Law No. 40-30 have already been outlined in the last three chapters. Report of July 16, 1971. However, since only a limited number of copies (100) of the report were printed and since other developments have taken place since that time, the Committee feels a brief review for background purposes would be desirable here.

The United States followed the U.S. House of Representatives' advice to whose representative advised that the Japanese had sent a Japanese survey team headed by a Dr. Tsuda and a doctor to study the victims of the 1954 fallout. It had learned the team had been meeting the people of Rongelap and Hiriik had been completed that the Japanese had been treating them properly, as indicated in the preceding chapters. This was to invite the Japanese team to enter the provisions of the 1954 Treaty. In November, 1971. Representative of the attempt to enter the provisions for the entry of the Japanese from the island of Rongelap. By December no answer had been received, and the Japanese team had entered the Trust Territory with their families, heading to Rongelap and Hiriik after arrival. No small group of people had been seen there, the acting Attorney General ruled that they did not appear to be a bona fide medical survey team and thus could not enter the Trust Territory. Finally, the acting Attorney General gave his opinion that the group was indeed a research team, but because they had stayed longer than permitted could not change their status and would have to return to Japan. This they did, without completing any of their research.

On January 20, 1972, during the 10th session of the 10th Congress of Micronesia, in the House of Representatives, the Acting Attorney General delivered a speech on the

floor of the House of Representatives, in which he charged that the United States had intentionally exposed the people of Japan and Micronesia to radiation and that they were being used as "human guinea pigs" to determine the effects of the late of the Japanese program. He also requested that the World Health Organization to conduct a survey of the people. In 1971, he introduced a bill which later became Public Law 94-143. The bill caused considerable controversy which resulted in a rift between the legislative and executive branches, in Palau, where it was expected that their departments would be requested to accompany the regular employees survey team. Unfortunately, when the survey was attempted in March 1972, the Japanese doctor, Dr. Kiyakawa, was present. Dr. Toshiyuki Furutani had also been invited to conduct the survey. Dr. Hario Izaki who had been invited, was unable to attend. At that point, with only one Japanese doctor with the team and a doctor with little or no experience in the field of thyroid or radiation, Congressman Balos and Congressman O'Brien, who represented the people of Micronesia, asked the people not to consent to the radiation survey and the survey was cancelled.

On April 14, 1972, Public Law 94-143 automatically became law without the signature of the President. On April 17, 1972, the three members appointed by the Judiciary Committee of the Congress: Senator Olympic B. Borja, Jr. (representing the Philippines) and Senators Olerich, met on Saipan for an open public hearing. At that time the hearing was Representative Bingham presiding. The President's original and Representative Balos was appointed by the committee to serve as the interpreter/interpreter.

On April 19, 1972, through House Resolution 100-10, Mr. William Peck, the Committee was authorized to receive the cooperation of the United

States, Dr. Bruce D. Wolfe, who had been assigned to the Trust Territory to see what programs or activities of the United States and Welfare Department could be set up to help them. He was very impressed by his open and helpful attitude and was convinced by his offer to commit the resources of his department by the Trust Territory to carry out the following:

1. Assemble a team to carry out a survey of the resources of the United States Public Health Service which would be a survey independent of the BNL survey; and conduct consulting for local organizations on the future (if requested).

2. Provide a representative mission to be Special Joint Committee from NIH. This mission would be to carry out the Committee to Rongelap and Ujae and also to prepare the Report for the July and completed 1972 survey in September).

3. Provide a team to carry out a survey of radiation levels at Bikini and Rongelap before they are returned to them.

In carrying out the survey, the Government, through Dr. Peck, Dr. Knudsen, and Dr. Knudsen, had chosen to take the mission to the Trust Territory for one year on Kwajalein, Marsa, and Ujae, and then to carry out a follow-up examination of the people on Rongelap and Ujae and also to carry out vital statistics. Also, most of the survey would be carried out by the Trust Territory Public Health Service.

By May 16, 1972, the Committee had given its final Report as called for by the public law. Among the recommendations made in that report were:

1. The general health of the people of Rongerik and Bikini areas of utmost importance."

2. An agreement with the High Commission about a doctor from the U.S. Health Organization and the World Health Organization to be by the immediate team at "the earliest date possible," and to include the addition of an American doctor from the U.S. Public Health Service.

3. The doctor would work with the U.S. Navy from Rongerik and the U.S.

4. The doctor would have a long enough to study treatment of A-bomb survivors, and to be able to move to the island of Rongerik and Bikini in the Marshall Islands Territory.

By the end of July the Committee had completed its investigation and consultation with the High Commission. It was recommended the presence of the committee be delayed until the final agreement on behalf of the Committee is made as possible.

These recommendations were made to the High Commission by Dr. J. H. K. Wilbur, Director of the Department, who had been in the Committee in the Marshall Islands, and Dr. J. H. K. Wilbur, Director of the British Medical Research Council, Department of Clinical Research at the University College Hospital, London, England, who had been in the Committee and representing the World Health Organization. The High Commission had previously been recommended by the High Commission to be established with the Council of Research, who had reported under the name of the High Commission and the AEC of the Marshall Islands. The High Commission had proposed a starting date of September 27, 1978. The High Commission had reported on the part of the Committee that it would be able to handle the matter.





order to briefly describe the activities of the teams in contact with the people of Rugegezi.

After that very unproductive work was completed, meeting with the people of the district in 1970 was. At that meeting the purpose of the Committee's assignment of the study and the nature of the conclusions were explained. The Committee had in the graphs for the first 10000 and a half, to compare with the conclusions. The conclusions they introduced themselves. The state raised about the work they would be done and influenced the doctors on his team. He presented a questionnaire: (1) who would be at the hospital every morning (2) who would be at the hospital night and in the same time (3) how many would be about. He mentioned that due to radiological analysis, on each of the 10000 years. The people of Rugegezi would be able to eat the work they had done. After that time, the state of the work per person per day, then he opened the meeting to get finished.

The questioner stated that they were not able to find after that of the time and they hoped that full responsibility would be given to the state to do this. He should realize that he had done a lot of work on Rugegezi for 100 years. He would be happy that people would be at the hospital and that it was difficult to find doctors who had done a lot and the work would

Another questioner asked why if the state was really interested in the health, there is only one consultation a week. He should explain that "We are busy on land under the circumstances."

A last questioner asked why there was only one visit per person per day allowed. He should explain and answer that the state would not do that. "Yes, they were not going to do it, and that they would only come for the year for Eniactok to see if they could be stuck in a lot."

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On Thursday, September 17, it was decided that the team would not depart till Friday, but on Saturday a small group of friends invited by the BNI team set prices for the jam, preserves, curries, soups and biscuits for the Committee's representative to be sold by the for the people and passed out the food prepared by the team. It consisted of hot soups, soups, vegetable juice, and fish, dousing, and biscuits.

On Wednesday, September 20, the BNIs met and informally with the island's magistrates. During the administrative following points were brought out. While the people have learned to respect the terms of the constitution, the information that they are never used for preservation is not the term come on the island. Relative to this, the BNIs never seen with the magistrate and the curators, but rather with the curators. Hence, they are asked to provide their food, but were not asked for anything. Finally, they are usually told the curators. There will be used only for a feast; there will be covered. The BNIs are arranged to meet with the magistrates and curators for following reasons: (1) to meet with the BNIs for the BNIs and during the following year.

(2) The people would like the BNIs who are in the BNIs to be stationed on the island.

(3) The people want to visit the BNIs of the island and safe to visit since there is no other information. Many people still do not cut their hair today because they were apparently told not to do so upon their return to the island in 1957. They would like someone to come and play the radio, plastic, tapes, film, etc. to tell them if there is any information safe to cut.

PRIVACY ACT MATERIAL BANNED

... that people expressed their general feeling about the survey. They said that the survey related to the land is in the past. They (the survey) would come if they want. Our people said that they are afraid of the bomb. The person holding the land the area is in touch they can the island when they come for the survey.

At 14:20 with a person about the 1970s... long trip for 1970. Unknown to the Government, young... was on the island. Unknown to... on the ship in the lagoon... long trip... 1970... would be the last time to see... 1970...

The incident involved... 1970... on September 15, 1970, after... 1970... passage in the... 1970... people of... 1970... arranged and held... 1970...

A... 1970... by the... 1970... were... 1970... then... 1970... the... 1970... that there would... 1970... that there would... 1970... The... 1970... then asked if there... 1970...

One... 1970... of the... 1970... radioactivity... 1970... their... 1970... that... 1970... radioactivity... 1970... that... 1970... radioactivity... 1970... that... 1970... below... 1970... hazardous... 1970...

A... 1970... did the... 1970... with the... 1970... people... 1970... that... 1970... about

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difficult to control because of this. The doctor explained that it would be good to have Federal (1960) of the time for they applied on certain techniques of examination and had out on them to try to give the same kind of attention as Dr. Gordon. The doctor explained in the alternative.

Dr. Gordon then informed that the local people still had reservations about entering the program. He mentioned that the goals were based on the assumption that the people could have the equivalent of one person per person and that they had shown that it would be a good idea. He was further pointed that the people were still in the water. He expressed an interest over this and indicated that he had never heard that the had been on the recorded 1961.

It was noted that the people were not fully using the program and that the program had been very successful. They were a lot more of the program were not very confident.

On the question of why the few had entered the people of 1961, Dr. Gordon replied that it was for the purpose of providing baseline information about the thyroid in the community.

The doctor was then asked if he believed the people of 1961 and 1962 were normal today. He answered that there is a very little difference between the people of the two periods, they are not very different, and a slight increase in the thyroid. He said that the development of thyroid nodules, their frequency, and the fact that they are not very different. He said that the fact that they are not very different, and the fact that they are not very different.

Finally, he was asked if he would recommend any other information from the people during each survey. He noted that he did not think they had any other

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related to some very serious environmental problems, perhaps because of the  
campaigns he writes.

That evening a study was given, related to the same for King (p. 160). That  
evening about 100 people and the program was shown. It was  
produced at the expense of a large company which manufactures the kind of  
material used by the Movement.

The next day, the candidate met with the people and the members of  
the Board and discussed some of the information that had to do with the Board.

On 27-30, Sunday, August 29, the candidate departed for a trip to  
crossing the next day at 10:00 am.

While the candidates were going on to the Motion picture, the candidate  
met with the staff of the Office of the District Administrator. On Tuesday,  
Mr. Foster, and Mr. and Mrs. departed for Japan, with the wife and son. The  
candidate had been departed before for these hours.

On Monday, September 24, the candidate met with the people of Roy, Ia,  
and with the people of the district, which had the support of the people. It  
explains to the people. By September 27, 1972, the candidate of the  
candidate departed for the district and he was expected to return to the  
United States.

On March 1, 1954, an experimental thermonuclear device was exploded at the U.S. Atomic Energy Commission's Bikini Proving Ground in the Marshall Islands. Following the detonation, unexpected changes in the island structure deposited radioactive materials on the uninhabited atolls and on ships of the U.S. Navy, #7, #8.

Statement of Chester C. Lusk, P.M., Director,  
Division of Biology and Botany, AEC, 1956

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Introduction

were the knowledge and their weight in the various parts in laboratory experiments for the purpose of... intentionally cause 239 Marc... to be exposed to... fallout in order to study the effects... which occurred as a result of the... from the after-stated "unexpected...". The... believed that the answer... single statement. Although consideration of this subject... part of the Committee's mandate... that since the issue was raised... it is inextricably intertwined with the... to be broached and discussed... available to it a great quantity of information... to the question, and... the Committee wishes to... report.

Location

Bikini (and Eniwetok) was... for nuclear weapons. It suited all... 1,000 miles of an airfield which... heavy weather and no extreme... for test ships and support vessels... fishing zones, coastal waters and... were also not in choosing Bikini... evacuated without causing hardship... and perhaps most importantly it was... under the Navy.

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and later under a Strategic Arms Limitation Treaty.

(Originally 1957) was used in tests and effects of atomic weapons on naval vessels (see also above), and as a result the general public, as more information was available, tests were made in the Pacific and Pacific Proving Grounds, as well as in the Atlantic. An even more important role, that of testing and evaluating the effects of nuclear weapons, as noted by Dr. Gordon B. Dunning of the Navy on the subject of the AEC during Congressional hearings in 1957: "The tests that have been used to reduce the radioactive fallout of the testable devices, of course, only small nuclear devices are tested in the range of 100 to 10,000 tons. In the megaton range were ever tested in the range of 100 to 10,000 tons. All the nuclear weapons were either tested in the range of 100 to 10,000 tons in the Atlantic Ocean."

#### Public Relations and Information

Testing in the 1950s was accompanied by intensive public relations work by the AEC and the Department of Defense, including hearings in the U.S. Congress. Dr. Dunning testified at one of the public hearings and carried out:

"The off-site testing program, which started in March (Spring 1957) illustrates a cooperative system of information, to take numerous radiological measurements and also establish liaison with the citizens of the area. The AEC, the Atomic Energy Commission and the United States Public Health Service jointly organized a program wherein the areas around the test site were divided into 17 zones. A technically qualified man has been assigned to each zone. His duties consist not only of monitoring the radiation levels, prior to and during the test series, but also of informing the citizens of the zone, to know the people who are responsible for the radiation levels in the 17 zone commanders, as they are called, and also of providing teams on call to go to any locality to collect samples of radiation levels outside the 17 zones."

The public relations work in this area, which involved public discussions and showing of films, has been detailed in the report (see Appendix No. 6).

Information concerning the AEC in the 1950s is also given that "Practically every

person throughout the entire day, and the day followed by at least one discussion by radio. This was done through civic clubs, schools and PPT. (radio program). Arrived in the AM, one person in a town which had been bombed by 200 bombs. This is the only town attended by sixty persons, had several children born in the last night of the last night, since they were taking each person's own (and their own) "Air Cold" (sic).

Several times in the past of 1953-1954, the Pacific Proving Grounds (PPG), had deposited that was available to the Committee indicates that the same is available to the Marshallese. There was no other source in the vicinity, attending PPT meetings and church people, to show the use of this energy to the people. There were, however, a number of people who had returned in case of fallout contamination. It is reported that because of its relatively short length.

"RADIOACTIVE EMERGENCY PLAN FOR THE MARSHALL ISLANDS" (7)

"RADSAFE EMERGENCY PLAN FOR THE MARSHALL ISLANDS"

"1. The commander, PPG, is designated as the authority for each off-site location outside the PPG. For the purpose of this plan, the representative is responsible for the radiological safety of the local population and the members of the task force.

"2. The representative of the task force shall be provided guidance as follows:

(a) The Marshallese representative, the commander and the Marshallese health and medical officer for the island should be assured that every precaution has been taken to prevent exposure of the natives to radiation hazards resulting from fallout.

(i) The representative will instruct the local magistrate to insure that a method is provided whereby all boats or ferries may be summoned to a central point and evacuated by land or water transportation if a fallout emergency exists. The method will be determined by the commander, PPG. The representative will insure that a fallout emergency will be declared if the survey instruments, when held at a point, indicate a rate of 1 r./hr.

(ii) Such evacuation by air by persons and cargo will be limited to that which each aircraft can accommodate, i.e., 10 pounds, whether evacuation is achieved by air or land. The evacuation of a tabulation of items to be evacuated should be made as soon as possible to

insure the accuracy of claims against the Government.

(1) The local magistrate should be informed that in event of an unforeseen emergency, Islanders will be evacuated from the United States by special aircraft from the Island of Bikini, who will be evacuated to Kwajalein. At this time, it is recommended that the existence to permit the task for a change with any emergency.

(2) Islanders and Islanders who may be suspected by the presence of a saltlick, should be warned of the danger. Should such an event take place, it shall be confirmed by a local magistrate.

"3. The representative will arrange for the local magistrate and native health aid to inform the islanders of the danger and the measures that they may take to protect themselves from danger when it is suspected or confirmed. These measures are:

(a) Islanders should be warned to protect themselves from the falling of saltlick particles by staying in the shade.

(b) If possible, settle on the ground and shake off clothing.

(c) Wash and keep clean. Particular attention should be given to washing the face, arms, the groin, neck, and hair.

(d) Keep food covered to prevent contamination of fallout particles.

(e) Monitor the readings of fallout meters. It is recommended that the natives be advised to stand out in the water (ocean) and immerse themselves as often as practicable or keep their bodies under water. This recommendation is based on the fact that water is a good attenuating radiation."

Since these instructions are not definite, it is not possible to tell whether they existed prior to the evacuation of the islanders. If they do not know what to do; there were no monitors to affect the situation. They are not know what to do; if after, it is stated that there was a lack of a relations program nor a safety program for the Islanders.

#### DANGER ZONE

Another area of danger related to the size of the test zone and its relation to the ability of the people to evacuate. When Bikini was added to the test zone, the danger zone was enlarged to 50,000 square miles and ran from 165° 45' W. to 167° 45' W. and 166° 35' N. eastward to 166° 16' E. Roughly the danger zone extended from 165° 45' W. and 166° 35' N. to 166° 16' E. to 167° 45' W. and 166° 35' N. The danger zone extended to the westernmost limit extends to 167° 45' W. The danger zone is the northernmost boundary

extended above Rongelap Atoll by almost 80 miles (to 170), the easternmost boundary line stopped short of Ailinginae Atoll by 12' (about one mile) and of Rongelap Atoll by 21' (a little more than 20 miles). This was apparently done so that the people of the atolls would not have been included prior to the test, which would indicate an assumption that even if the cloud might go 80 miles north of Rongelap, it could not extend to Rongerik's longitudinal position. However, the Committee notes that if this were the assumption, then why was it that the Radsafe team was stationed at Rongerik, 80 miles further east of inhabited Rongelap.

Whatever the assumptions were at that time, it is interesting to note that the danger zone was enlarged eight times\* by the effect of the next shot on March 27, 1954, which was witnessed by the chairman of the Panel, Admiral Strauss.

#### Yield and Type of Burst

Other notable factors touched upon during the hearing deal with both the size and the location of the "Grave" shot. At that time, Grave's energy yield was estimated to be on the order of 100 kilotons, which would have made it 750 times more powerful than the A19 and Water Bombs. Dr. Robert Serber, in his book 'Proving Ground' noted that the "test was in fact of a greater yield than calculated." Other factors which would contribute to the danger from this detonation are outlined by Dr. Serber in the transcript of his additional hearings.

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\*Although the coordinates were not given in 'Proving Ground', a rough extrapolation based on the proportions of the latitude and longitude boundaries of the former zone would give a new danger zone which includes Rongerik, Ujelang, Utirik, and Likiep. Assuming this is true, and the zone remained the same size until the end of testing, it means that the returned Rongelapese and Bikese, as well as the people on the other inhabited islands were not included in the danger zone during subsequent tests.

Dr. Graves: "In the case of having a cloud, try to avoid a situation where the device would be held up in the air, because we don't want to have this very heavy cloud of dirt. We want to avoid this situation if we can. We try to get the device as high as we can, or we use air balloons in this case, or we use balloons for holding the device up. All of this is to avoid having this mixture of dirt into the cloud itself."

While Mr. Graves has probably talked about the Nevada site, the implications of his remarks are more generally clear in the following paragraph from "The Effects of Nuclear War":

"Although the cloud of the July, 1954 test did produce extensive local fallout yet remained at the altitude of the explosion, the phenomenon was not necessarily caused solely by (a) wind direction (b) thermobaric explosions. It is very probable that if the same explosion had been detonated at an appreciable distance from the ground, that the large fireball did not touch the ground, the cloud of fallout would have been of insignificant proportions." (p. 13, 14)

#### The Weather

Sayings about the weather are usually based on the inability of human beings to tell just what the weather is going to do. For the average person, what kind of weather is what depends on the weather's effect on his comfort or discomfort. For those people responsible for the Nevada test program, the whims of weather and wind conditions are of great importance. They would produce disease and death if they directed the fallout from atomic weapons test. For this reason, weather forecasting and tracking of wind directions and velocities was of prime importance. In fact, an hour of testimony from the Congressional hearings by Mr. Albert J. Carter, of the Weather Laboratory, who was test director for the Nevada Testing Grounds,

Dr. Graves: "Now we have finally arrived with a plan whereby the total amount of fallout is diminished, in order that we come to face with the problem of carrying out the test program. The fallout that does occur will not hurt anybody in order that we have assembled in Nevada as competent a meteorological group as can be found anywhere. This meteorological group tells us how the fallout will be like, such that we

can control where the fallout will occur.

"Consequently, it would like to give a very considerable hand to this group of meteorologists. Yet we have our fingers crossed, make us mad because they make us postpone, but they keep us from being mad. They tell us the weather with great accuracy and permit us to believe that the weather will not give us a fallacious picture that is wholly untrue."

Unfortunately for the people affected by the test, the meteorologists of the Pacific Proving Grounds did not do things so that they could "control where the fallout will occur." In fact, it is particularly ironic in the face of meteorological evidence from the Able and Brave shots, as previously mentioned. In the case of the shot, the direction above Enewetok was known, with gusts only at 50,000 feet and 100,000 to 105,000 feet. Included in the lower altitudes were the winds at 50,000 feet which almost totally were heading toward the west. Only at 100,000 feet and winds above 105,000 feet were heading east. For the Brave shot, however, the winds in the space above Bikini were blowing in a westerly or easterly direction. For 35 percent of the space above that, winds were blowing westward, away from Rongelap. The top 25 percent of the space above Bikini, up to 120,000 feet, the expected height limit of the fallout, there were winds blowing east. It may be granted that such weather reports are of necessity somewhat imprecise, it seems somehow incredible that the decision to have the device fired was made on the assumption that either the unknown winds were not blowing in a westerly direction (as they were at Enewetok) or that if they were blowing in a westerly direction, they would change by the time the device was exploded. What adds to the incredibility of this decision is that if the fallout had been fired from the east of Bikini, then firing of the device when the lower 50,000 feet of clouds were heading in that direction can only be judged as an act of foolishness and a serious error in judgment which only the faulty reliability prevented from becoming a disaster.

These events combined to produce a self-defense volume "The Effects of Nuclear Weapons," a Defense Department publication which stated that:

"11.149. Vaidia is (but not other) evidence of development and healing of beta burns has been obtained from the survivors of the Marshall Islanders who were exposed to fallout in Bikini. Although the fallout was observed as a fine powder, it consisted largely of particles of lime (calcium oxide) resulting from the decomposition of coral (calcium carbonate) by heat. The islanders could not have realized its significance. (emphasis added) (1964, p. 107)

#### Timing of the fallout

A further interesting factor is that according to reports the extent and duration of the fallout was severe known only the 28 Americans on Eniwetok who were present prior to the fallout. Two days after the explosion, the people of Eniwetok were evacuated. Later, after the detonation, the people of Bikini were ordered to evacuate. It is argued that attempting to pick up people from all these islands immediately after the detonation might have exposed them to some of the fallout. However, if radioactivity, it can also be argued that the amount of fallout was not known, and could have been avoided. Decontamination procedures could have been used to prevent serious exposure.

#### Timing of evacuation and evacuation procedures

Notwithstanding this, it is difficult to understand why it was that the people of Eniwetok and the Americans were evacuated at the same time, one day after, when the fallout had already begun to be especially valid question since the Americans would have been able to evacuate earlier because of certain factors. In the 1964 W. report it was stated that:

"Most of the Americans who were aware of the danger of the fallout, took shelter in buildings, under trees, and in dugouts, changed clothes and consequently avoided any serious damage to their health. (p. 15)

Dr. Dunning, before the NRC, described the evacuation procedures, described the situation for the Marshallese and Americans:

"The Marshallese were evacuated, but not the Americans, and most of them were out-of-door during the time of fallout. They bathed during the two-day



exposure period before evacuation, but it is believed, therefore, there were optimal conditions in general for preventing health damage."

#### 3.2.2. Radioactivity

These later developments (radioactivity) contrast to the press release issued by the Atomic Energy Commission 10 days after the event, and before the Lucky Dragon returned its home port. Before writer put it, apparently the Commission was trying to be optimistic.

"During the course of operations at Bikini, the Marshall Islands, 28 United States personnel and 28 residents were transported from neighboring atolls to Kwajalein Island according to plan as a precautionary measure. These individuals were subsequently exposed to some radioactivity. There were no burns. All were repaired well. After the completion of the atomic tests, the natives will be returned to their homes." (27, p. 160)

The Japanese, however, were not very optimistic. Discovering that the Lucky Dragon's crew had been exposed to several lethal doses of radioactivity. Especially disturbing was the possibility that vast areas of the Pacific had been contaminated by the atomic tests, and that possibility caused tremendous concern in the Japanese fishing and marine's fishing industry. Again, the Atomic Energy Commission is considered in a statement released on March 24, 1954, which is paraphrased:

". . . the warm currents which flow from the Marshall Islands area . . . move slowly (less than a mile an hour). Any radioactivity collected in test area would become harmless within 48 hours, and completely undetectable within 10 miles or less." (27, p. 161)

The Japanese, despite this statement, sent a scientific survey team which would cruise aboard the Japanese ship, *Shinkai Maru*, around the test zone. American scientists had been invited to participate in the survey, when they arrived in Tokyo, found that the ship had left for Tokyo 10 days earlier than scheduled, leaving them unable to participate. Japanese scientists differed somewhat from the least favorable statements made by Dr. Roger Revelle, Director

of the Scripps Institute of Oceanography (SIO) and the U.S. Committee

"This area of 100 miles around Bikini was recently investigated by Japanese oceanographers and biologists. Following the Castle test, they got figures for the radioactivity in the water: 18,000, 30,000, 70,000, 20,000 disintegrations per minute per liter of water. This is at a distance of about 300 miles. (Initial radioactivity in the water for seawater is 100 dpm.)

After the Marshallese Medical Reports

In discussing the medical reports of the Marshallese, the Committee would like to state its general impression concerning the content of the examinations and the reports of the medical profession. It is the impression of the Committee that the examinations, with their findings in terms of physical disabilities in terms of both general health and specific instances of radiation-induced disease, also provide a considerable body of information about the effects of a fallout field on human beings which has not previously been available for the persons affected. By saying "a considerable body of information" we do not exclude the known advantages of general medical care, the value of personal case histories for patients. What we are concerned with is that the reports, if they are written and presented are of primary value to the medical profession. Should such an event as happened in 1954 occur again in the future, the reports themselves are of value to the medical profession. They are of no value to the Marshallese.

Medical Reports to the U.S.

Like the reports of the Marshallese, the reports of the Marshallese and the radioactivity in the water, as reported by the Marshallese, the reports have tended to minimize effects, or other aspects of the radiation, etc., damages seem "too small" to have any effect, the size of the area is "too small" to

statistical significance, and the expected long "latency" over a long period of time, and exposures were found to be "marginally higher than near lethal." It is to the credit of the author that most of the data were disapproved most of these minimizing statements, even though the language tends to indicate a conservative, minimizing approach to findings. The author may see this as a mere game of semantics, but the first, but not only, purpose is to say that it is not particularly concerned with the words of words themselves and their connotations, but rather the psychological and psychological of mind which they imply. The Committee is of the opinion that there are also possible reasons for this tendency, which are discussed below.

#### The Marshall Islands Nuclear Catastrophe

As mentioned before, the tendency to minimize events or facts in order to be reassuring, and to minimize the responsibility of the news media seizing upon the sensationalism of an event, is a habit of the news media. Most "newsworthy" events are usually negative, and most people are not interested in what is going on, but what is going on. The Bravo event occurred at a time when the public's imagination was being excited by development of nuclear weapons and their psychological and political implications since World War II "cold war." The event at Bikini, 1946, and the atomic bombing of Japan most certainly had its repercussions in the public mind. Whether it is justified or not, it is easy to see why the Atomic Energy Commission "reassuring." It is also easy to see why it is expected that the people of the Marshall Islands also tended to "minimize" the effects of the event. The first major report dealing with the event was published by the World Energy Commission. This report set the tone for the public's opinion.



concept in elementary physics. When we are engaged in a particular situation and we simultaneously wish to know the objective of the situation, but at the same time we have strong impulses to enter the subject of the situation or avoid the situation. For a number of people, however, one of these impulses is stronger than the other, which results in one of the two courses of action. By means of this process, it appears that there are two motives, or influences apparently at work in the construction of the model. These influences might be characterized by saying that during the history of medicine, the doctors were interested in finding their patients as quickly as possible for any illness or dysfunction. At the same time, they were also interested in natural scientific curiosities to determine whether their patients had a susceptibility to such effects to document the effects of their treatment on the various processes--before administering treatment. Thus, the impulse of the doctor and scientific curiosity were perhaps both satisfied by the fact that the immediate treatment given concerning blood transfusion was the 20th century's equivalent, and also with regard to the growth and development of medicine over a period of several years.

Concerning the 1954-1955 study, the following report is given:

### "2.31 Clinical Observations and Laboratory Studies"

"Between the 3rd and 5th post-exposure days, 10 percent of the individuals in Group 1 (B-rodap) had a differential leukocyte level of 1000 per cubic millimeter or below. The lowest count observed during this period was 700 granulocytes/mm.<sup>3</sup> During this interval the advisability of giving prophylactic antibiotic therapy to the leukopenic individuals was carefully considered. However, prophylactic antibiotic therapy was not instituted for the following reasons:

(1) All individuals were under constant clinical observation, so that infection would be recognized in its earliest stages.

(2) Premature administration of antibiotic would have obscured indications for treatment and might also have led to the development of drug resistant strains of organisms which would be resistant to infection.

(3) There was no accurate knowledge of the number of granulocytes required by man to prevent infection with the type of leukocytopenia." (emphasis added)

The Committee has not discussed the possibility of a response to the passage, but at the time of the writing of this report a response had not been received.

It is hoped that a more complete report of the Committee.

To the layman, the above statement, at first appearing to be unnecessary and therefore somewhat irrelevant, appears to be somewhat contradictory. If there was no accurate knowledge of the number of bacteria required by man to prevent infection, how could it be known that antibiotic treatment would have led to recovery, despite the fact that the child was under continuous medical observation? The argument that administration of antibiotics might have resulted in the patient's development of resistance is a statement that can be made about any prophylactic antibiotic therapy, the phrase "obscured indications for treatment" is obscure, how is it known that particular effect or for other effects? Would treatment by the use of placebo treatment for that effect? It would seem that if the child had received treatment at that point might have prevented other effects, in other words, if an antibiotic were administered to help raise the cell count level at that point instead, that development might be prevented from occurring. This belief was apparently supported by the comforting fact that the people were well-treated by the medical profession. However, it would appear on the surface, that here the degree of antibiotic sensitivity was somewhat stronger than that of medical care response in the general case of the patient.

The Committee feels that the same degree of growth retardation, relatively early administration of Thyroxine, or a hormone therapy, which would have corrected the retardation of growth experienced by some of the Krongelap children, especially cases three and five. Early response to what appeared to be growth:

retardation, yet the fact remains that the children were never out of this retardation for more than a few years after the following: despite the fact that the reports consistently mention the fact of no response to the injections, these latter two cases were well developed. In these two cases also, when available birth dates, the reports by the physician in charge of the children, assuming that the administration of the vaccine would be credited to the children, even if it had no effect, it is difficult to understand why the doctors had to wait until the appearance of the first symptoms before to realize the value of administering the vaccine to the children. (p. 10)

Another matter of concern is the fact that the publication in the three-year report which states:

"Eight sera from the children who were used in a study of immunological response to tetanus toxoid as the primary stimulus of tetanus toxoid infection given 2 1/2 months previously. Sera were obtained just prior to the second injection of toxoid, and other six days later. Subsequently, tetanus toxin-antitoxin complexes of the sera were obtained for the two groups. Results by the method already described." (p. 6)

In other words, these children were injected with a supposedly safe amount of tetanus toxoid and then later on were taken just before a second injection. The question of the safety of the first and second injections was an indication of another fact, namely, the fact that the children were not protected against the possibility of the return to combat infections (such as tetanus) and those who were especially concerned about is whether the people understood about the danger and whether or not they did, if there was any other way of the danger. Assuming there was no further danger, the Government's position and the fact that this study was to the people involved. However, when a study is conducted for greater medical care of the people, and it is proved that the conditions were poor, which would leave them open to further infection, the danger would normally be a simple infection. However, since the number of children involved in this study is too small for statistical analysis, in view of other effects, it is curious

why the test either was not subjected to a rigorous statistical analysis (great statistical significance) or even subjected to a rigorous statistical analysis. To all intents and purposes, it is as if the test had not been described to be a highly sophisticated procedure for a laboratory study.

#### Thyroid Gland

Concerning the development of thyroid nodules in the people exposed (20 cases, four with malignancy), the test is not concerned with three particular areas of aspects:

One, it finds it difficult to believe that a glandular relationship involving this gland did not take into account the growth of the children. Many times, especially in cases where with the application of radioisotopes such as  $Sr^{90}$ , mention is made that the retention of the isotope is different from that estimated for adults because of the retention of the isotope. How was it that the many experts who worked in this field for many years never accounted for this factor until it was hastily incorporated in the development of nodules in 1963 and 1964. True, the committee is not a clinical chemist and scientist, despite the rigors of their high standards, but it is not just a matter of errors; however, the committee does not regret that a simple fact was overlooked for a long time only because the experts were faced with a development that was unexpected in the light of earlier assumptions.

By the same token, for the other field of the thyroid gland, that is, the inconsistent findings of nodules in the thyroid gland, it is difficult to believe that mention was made of the possibility of the nodules being malignant, or the findings were attributed to a nodular thyroiditis, or that from a hindsight point of view, it would be possible to consider the nodules as a form of iodine and considering the data on the thyroid gland, it is not clear how investigated with more detail the reasons for such nodules (through which) could have appeared to



be inconsistent with earlier data factors. It is also suggested that unusually high levels may have caused thyroid which would have indicated that thyroid function was not normal prior to the organophosphate (OP) study. Again, baseline information was lacking. However, considering the significance of the studies both to the scientific world and to the people that they appear to affect, a certain amount of research should be continuing to be done in the future, where prudent and carefully selected responses.

Finally, in the final part of the interview concerning the thyroid, the Committee is extremely interested to have to the point where the thyroid gland was accidentally seen in the medical records. In view of this fact. Secondly, the Committee is interested in whether the incident had any connections with future thyroid operations being performed in the United States as opposed to the Naval Hospital in Europe. Hopefully, the Committee's query will be answered by Dr. Conrad.

Very truly yours,  
[Signature]

The Committee notes that despite the importance of determining whether or not the incidence of miscarriages and of stillborn infants, there was no intensive effort to help the military researchers to determine whether these deliveries were possibly cases of fetal malformations. Again, the question of statistical significance and other factors. However, the Committee is of the opinion that despite the importance of this situation should have had closer attention. The Committee notes that there are certain kinds of effects of radiation which are observed in the course of research; examination of such may not have confirmed that it was due to radiation, but it would then have been a matter of some concern if it had been used to indicate that there possibly was an radiation effect.

As to fertility, it seems probable that the fact that a Japanese doctor working with a group of Marshallese children of statistical significance should come up with a more detailed analysis of spermatozoa production after irradiation of the testis (Kageura, 1950), while the AEC-Brookhaven teams apparently felt it unnecessary to do so (1950) with the irradiated Marshallese and Americans, adds the human dimension to the consideration of the private and personal nature of the fertility examinations connected with such studies, it is hard to find the subject as a matter even discussed except generally in terms of quality, and then only in terms of statistics.

#### Conclusions

The circumstances that led up to the detonation of "Bravo" on a clear March morning in 1954 are illustrative of how circumstance, time, error and human frailty can combine to produce an historical event: in this case a tragedy.

The location of the testing site, at a major factory, in that its placement provided the flexibility necessary for the detonation of large yield weapons, and the safety necessary should things go wrong. It was in a sense equivalent to the procedure, which provided the same flexibility and safety for smaller yield weapons. Unfortunately, in the Nevada, there was no Public Relations or information program, and no close working with the people. In Nevada, tests were conducted to level out the amount of local fallout. In the Marshalls, however, the visibility of a hydrogen bomb explosion, to that time, was determined by the ground, and if we boasted, they could practically control where the fallout would fall. Hence, someone made the decision to go with an impulsive picture of the wind, a wind shift was not "unexpected," since it had been known that the upper level of wind. Furthermore, the test danger zone for the Marshalls was defined at its eastern boundary to

save convenience to persons past and present. His exercise of judgment was also responsible for underestimating the amount of fallout received," and your judgment resulted in the Rongelap people being on full rations for two days, and the Utirikese for three days, after the explosion, rather than one day. Whether these actions and events were the result of carelessness, poor judgment, miscalculation, and faulty assumptions, or whether they were the result of negligence or worse, is a conscious and knowledgeable decision the committee will leave up to the reader of this report.

As to the medical aspects, the committee also finds that human error and faulty assumptions and their consequences have plagued the medical examinations and conservative and rigidly dogmatic assumptions have led to delays in both the seriousness of the original exposure and the significance of the findings which are related to irradiation. While the committee finds no evidence of a deliberate violation of the general principles of the Nuremberg Code, which are generally understood, supposed to serve as a guide for the physician, it does find the care of a physician, there have been a number of medical studies of people involved which did not necessarily prove of direct benefit to the people. This is made known in the three-year reports. (p. 20)

"The group of irradiated Rongelapese people is a most valuable source of data on human effects you have said. It covers all the possible modes of exposure. It is true though, that the radioactive contamination of Rongelap Island has not been perfectly uniform. Human habitation, the levels of activity are higher than those of any other inhabited locations in the world. The isolation of the group on the island will afford most valuable ecological and epidemiological data." (p. 21)

and in the four-year reports. (p. 32)

"The habitation of these people on Rongelap Island affords the opportunity for a most valuable ecological and epidemiological study of man being. Since only small amounts of radiation are necessary for such studies, the various radionuclides present on the island can be traced from the soil through the food and into the man's body, where the tissue and organ distributions, biological half-life, and excretion of the various radionuclides can be studied." (p. 33)

It is also the result of the remarkable similarity of the uniqueness of the experiences of the United States. It is not, however, a tendency, perhaps more unconscious than conscious, but a very real tendency to let scientific curiosity at times become a burden to the people. In 1953, the Committee would also like to say that such a tendency is not always included the Rongelapese. In the past, the Committee, the United States, and members of the teams themselves have had to include the people for comparison purposes. Even Dr. David Harold Jones was used as a "guinea pig" as disclosed by the group. In the 1953 annual twelve-year report (p. 159):

"Since facilities for a metabolism study were not available on Rongelap Island, one of us (H.W.J.) tried several native food items (pandanus fruit and coconut meat and bread) to Brookhaven and consumed them under controlled conditions. Urine and fecal specimens were collected and whole body counting measurements were made over a period of 180 days. The ratio of strontium-90 to cesium-137 in a seven-day period was twenty times higher than normal and in a 27-day period, sixty times higher than normal."

In conclusion, it is the Committee's view that by the very nature of their experience and conditions and by the unique nature of the unique set of circumstances surrounding the daily lives of the two groups, the people of Rongelap and Ujae are a unique group in the world. That no other group of people in the world have been exposed to the same amount of differing kinds of radioactivity, and no other group of people in the world have been exposed to the same amount of differing kinds of radioactivity, or no other group in the world has been so carefully studied for the results of such effects. Again, whether these people are being used as guinea pigs in an extended study of the effects of fallout products being tested, or whether they are a group of people who are being exposed in a study for the benefit of humanitarian aims is a decision the Committee will leave to the people. In closing, the

Committee wishes to say that opinions of the Japs and Itirikes are by their experience, and accordingly proposed and they deserve no less than extraordinary care, interest, and attention.

History and Present Status

Today, nearly 10 years after the events there are few outward signs of having happened. The people, especially those who were on Pendergrass Hill, have returned to their normal lives. The only notable exception is the fact that the only surviving child of the child who was examined by the CDC, was evidently not killed. This is in stark contrast to the acute and chronic conditions suffered by the people of Hiroshima and Nagasaki, the survivors of the atomic bombing, elderly patients with cancer, leukemia, and lymphoma (skin lesions, or gross changes in the shape of the nose, etc.), and the Marshall, if it is true that the effects of the radioactive fallout were not limited to those of the Hiroshima and Nagasaki operations which have been well documented, but also to those of those removed from the area. Such conditions as cancerous lesions and while these conditions may have been the result of other radionuclides or cancer, it still remains to be seen whether such developments may occur. As to the health of the people, it is reported that while late administration of the medicine has been given, it is wise to return to normal life as soon as possible, to the extent they can be helped, and to be aware of the fact that it is possible that radiation effects were also due to the other mentioned lack of adequate attention and the lack of adequate examination of the people. This is the fact that is expressed in consternation and a serious concern of the people of immediate

treatment and subsequent complications, if any, as evidenced by the reports of the attending physician. The examinations are thorough and conducted in a professional and humane manner.

Especially in view of the Committee's interest in the case of the Brookhaven worker, the appearance of a fatal case of acute myelogenous leukemia. The Committee hopes that the persons responsible for the investigation will give the same development the attention which it deserves for the benefit of the people involved. The Committee takes note of the New York Times, Tuesday, November 21, 1972, edition of the New York Times by the writer Walter Sullivan, which dealt with the death of the worker. The story said in part:

"To prepare the way for the Seattle visit two Japanese physicians and another from Britain were included in the party and they apparently missed the reception. Had the visit been made earlier, however, it is possible that the leukemia case might have been detected at a more advanced stage."

The phrase "missed the reception" is a fact that the annual survey had been held at the time the worker was reportedly notified. While it is possible that the visit might have been accomplished at the same time of the survey, in the understanding of the Committee that all forms of leukemia are ultimately fatal, and that acute leukemia, chronic leukemia and myeloid forms. In addition, the Committee would like to see in the record that if the period of surveillance is critical to the detection and remission of leukemia or other disease, the public consideration should be given to having the tests conducted on a one-time just a once-a-year basis.

One aspect of the booklet which is the subject of this report which has not been widely discussed to date is the public concern the psychological effects of exposure to atomic blast from nuclear weapons. Dr. William Dement, Director of the Department of Psychology, Stanford University Department of Psychology, is well known for his work in the area of human learning and conditioning. Although his original intention in preparing the psychological report was in connection with compensation, however, it also is an excellent and interesting study of human behavior. It is a well written and interesting study of human behavior. It is a well written and interesting study of human behavior. It is a well written and interesting study of human behavior.

In more recent years, particularly in the aftermath of the Japanese exposed to the atomic bomb in Nagasaki in 1945 and the atomic bomb in Hiroshima in 1945. In 1945, it is generally acknowledged that over 200,000 people died in Japan as a result of the atomic bombing. Some were literally vaporized by the blast of the atomic bomb, others died from heat and radiation. Some were killed by flying debris, from the explosion, which fell from the sky and spread throughout the cities. Many died from lack of adequate medical care, food, water, and shelter. The people in the Marshall Islands were also exposed to atomic bomb in 1945. In a booklet or booklet of the atomic bomb in 1945. In spite of these differences, however, there are many similarities in these cases: the radioactivity caused by the atomic bomb affects upon those exposed. Today, the atomic bomb is still a major cause of

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# PRIVACY ACT NOTICE

the bomb. Despite their family life, they are today in the Marshall Islands, people of 1944 being found with diseases apparently caused by B-bomb fallout nearly 20 years later.

In Hiroshima, where the incident took place, they met with [redacted] who is a survivor of the atomic bombing and director of the Atomic Bomb Casualty Commission. [redacted] mentioned the unpleasant feeling of war victims like himself felt about the fact that nothing which is being done shared by "all survivors".

Later, while in Hiroshima, they visited the people of Roncelap and Utrik, the two cities posed the question whether or not the people who were exposed to atomic bomb fallout exposure. The answer at meetings of both islands was that "Whenever we have a cold, or some other kind of sickness, we think of the bomb."

The committee was most impressed by the answer given by the Lucky Dragon survivors, who were interviewed while standing in Tokyo with Dr. Kumatori, who asked about his own experience. He was first asked to be interviewed about the examinations he submitted to the Institute where he had been treated. Was his mind at ease? Did medical examinations, as translated, were, "Psychological examinations, made of them, are satisfied." He was then asked how he felt when he thought of his illness. Did he think of the bomb? He followed up by saying "Immediately."

The committee also believes that one of the long term effects of the atomic bombing of Hiroshima and Utrikese is that of the anxiety they have about the future. It is the un-

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known, the uncertainty of their future and that as just as real to them as the radiation exposure, both physical and psychological. In the three years to date, there were no observations of the "psychic effects" of the radiation, but a study has revealed the differences between the two groups of individuals, the "relative calm and rapid adjustment" which the Marshallese exhibited in adapting to their new life after their relocation and the fact that "There was little reaction or expression of concern over radiation exposure. It would appear that even in the case of the relocated Marshallese that there has been little or no significant psychological effect of this momentous event."

The Committee agrees that the relocation of the Marshallese cannot and does not seem to have first affected only those who, in addition to witnessing the death and destruction of their land, also lost friends, relatives and their whole families. The Committee notes the "uncertain feeling," which is being experienced by the Marshallese, the Committee feels that the people of the group are still suffering from a great amount of anxiety, if not more than the Japanese, possibly because of the uneasiness about the future, but there are other factors which will be discussed below.

The Committee notes that the Marshallese are still in the process of adjusting to their new life. The annual examinations conducted by the Bureau of Education in the past year report indicated that the long time period of the Marshallese has caused little concern about their education, with those twenty percent who would prefer to be in

agreement, the problem is rather difficult and perplexing problem. In Japan today, there are numerous facilities existing for the medical care of Atomic victims, which the people can easily reach and they have been in Japan, the Atomic Bomb Casualty Commission published reports in both Japanese and the English language and the staff of these facilities are Japanese citizens. Today the people receive an extensive examination every year, Americans assisted by a Micronesian medical staff and have to wait their examinations until the next year.

Originally, the people expressed great curiosity what was being done for them and why. There was a need to explain that the bomb had affected the skin they were getting themselves the skin ulcerations and hair falling out, as well as weakness, nausea, and diarrhea. However, in the examination every year the people became perplexed. Every year the team comes and they tell them that they are healthy, but that they had seen some disease if everything is still all right. When they come again next year the process is repeated. Why the people have seen some disease if we are healthy, does the team return every year. This problem is a small indication of the vast lack of understanding of the people involved as to just what did happen to them, and what the long term consequences of their exposure are.

While the Committee organized the medical examination, as applied to physical medicine, highly sophisticated and sophisticated subject which would require the effort and money to translate into

terms which would be meaningful to the general population, it seems that this might probably be the only way in order to resolve not only some of the anxiety and concern on the minds of the people, but some of the practical and technical problems of the examinations and of the test itself.

There are many in the community who feel that the people did not understand anything about their exposure and the need of the exposure, the possible effects on themselves and on their children and on their environment. It is usually, possibly, the case that, as indicated why the team did not explain such things to the people, the reported reply was that even the people themselves, who were well educated, would have difficulty understanding what is said to them. This may be true, if it were expected that the team should say anything about the exposure and its effects during the brief of their visit. However, the Committee already finds that a great deal more is possible and should be carried out, either through the use of simple text, pictures, analogies and other means which are necessary to convey to the people a better understanding of the situation. It is, after all, a widespread practice in the world to be possible to explain to the patient what he should do to take care of himself and the patient's mind. Unfortunately, this has never been done in the Hong Kong case. It has effectively resulted in a situation which is similar to that of a teenager whose parents avoid telling her about her pregnancy, only to have the son or daughter go on to be married into a family of poverty, disease, and innuendo. In other words, such information is not to produce a healthy

state of mind. In terms of the incidence of thyroid nodules, this has been especially true with the group of people from the Utrikens, and those from Rongelap (and Bikini) who were under medical control, or comparison groups.

This fact was also noted by the panel during the public meeting at Utrik. The panelists very thoughtfully reported with the people of Rongelap that should anyone in the area nearly two decades, these people would have never understood why they had exposure and how it differed from those nodules. It is not the case. This is certainly despite the knowledge of the members of the team that the people at Rongelap (and Bikini) had been operated on for thyroid nodules. It is a fact that the people of the islands, who are now living in the United States, can be roughly grouped into three categories:

1. Rongelapese people, perhaps the most, of the visible effects of their exposure, the people seem to have a good understanding in certain areas of their condition. It is a group of people who generally express a desire for professional attention ranging from having the Rongelap stationer's attention to having more frequent medical examinations. However, this people still need to have explained to them on their own terms their level of understanding the consequences of their exposure in the past and possible effects. This is already being done in the seven year report which has had the health officials admitted that some of the people at times have been ignorant of the results of the fact they

had been reported not to be (p. 24) This is further evidenced by statement in the report made by the doctor which led to the effect that some of the people who were taken to the hospital regularly for the rest of their lives, and were in a hospital for their medicine. The Committee is also disturbed by the fact that the people are very disturbed at the apparent lack of warning given by the people concerning prescribed medicines which are available for their future health and welfare. It is also noted that the people should have been corrected long ago and now which they should have been allowed to exist in the future.

2. The people of the island, who were taken to the hospital, there appear to exist two lines of thought, with the people who were taken to the hospital should be discontinued because they are healthy and were not a part of the large group of people who were the Rongelapese, and they should receive medical attention as well as the Rongelapese since they are exposed to the same radiation for the time to continue radiation, where further radiation is caused by several influences. The fact that the Rongelapese were compensated by the United States Government for the people of the island, a subject to be referred to the United States, and the other is the knowledge that they were compensated and that the Rongelapese were removed from the island. They mentioned the fact that the Rongelapese who go to the hospital and they would like to go there, if they might not be the Rongelapese, and it is further compounded by the fact that the Rongelapese were taken to the hospital for a thyroid examination. Upon removal to the hospital, it was found to

contain malignancy, and while it is true that one would suggest that this single case should not be taken as the only "normal" case of thyroid cancer, it is difficult for the public to believe this while they are aware of what happens to the people. Again, **misunderstanding** as to the true nature of the disease and explanation persists in the public mind, and it is difficult to remove the general uncertainty about the disease because of the complexity of the situation.

3. The unexpected consequences of thyroid cancer and the necessities in the examination and control group. The first step is to have a group of people who are not exposed to the radiation, and who are of similar age, sex, and sex but not exposed to the radiation. These people represent what is known as the "control" or "comparison" group. In laboratory experiments with mice, dogs, guinea pigs or flies there are usually two groups: one group is exposed to a chemical or other influencing agent, while the other is the control group. By studying both groups, scientists can determine the effects the influencing agent has had on the exposed group. In a similar fashion, those people who are not irradiated are examined and give blood and urine samples, and are a group which the doctors can use in comparison with the exposed people. It was that group which was the most vocal in expressing dislike of the examination. They indicated that they resented being examined, and requested that if such examinations were to be continued in the future they should be compensated for them. While the Committee on the part of the people, its major concern is that the people should understand that the role of a control group is helpful to them, and that the people should be aware of a lack of

information--a situation which must be recognized.

#### Cultural aspects

As it will be recalled, the Committee believes that perhaps the team had failed in its adjustment to the peculiar and special situation and the certainty of success which it felt they must accept. The Committee believes that this result is a number of reasons.

First, it should be remembered that the Board, last event involved a great number of military personnel, and also included the later examinations in which Dr. Conrad was a military officer (and later Commander) in the Medical Corps and participated in the training of the Japanese military was undoubtedly steeped in the mind of a military Japanese and Utiwikese and the examinations were accepted as a matter of course at the beginning and as a matter of fact later on, even though the emphasis gradually shifted from military to civilian in the teams. Thus, while Dr. Conrad appears to be a thoughtful and considerate man, the examinations as conducted by the Committee were conducted in a military manner and they were taken by them and carried out with an almost military precision and efficiency.

Second, the short amount of time of the white coupled with their annual occurrence leaves little time for contact with the people. Also, it should be noted that the results of the examinations may not be ready for dissemination for several weeks after the exam has taken place.

Lastly, the Committee would like to call attention to cultural differences which have caused difficulties in communication.



While this is not a typical way of life, as understood of this report, it is certainly best for the education of those enlightened or unaware non-Micronesians who are in contact with the activities described in this report. It is simply my best guess as to a generally practiced "Micronesian code" like that of people in general, not to give offense, especially indirectly, by a question or situation. The results of all those who have been asked will give a positive answer to a question or a question which they do not wish to answer; or will avoid the question by some other means concerning a problem either to avoid the problem or to avoid the problem, but the problem will resolve itself without personal involvement. For Micronesians, especially Americans, are afraid to ask questions and to Micronesians already indicate the lack of interest in the question. "Isn't it a nice day?", or "Don't you think this is a good day?", are invariably met with an affirmative, "Yes, it is a good day." The feeling of the person being asked is that while it is not necessary to give offense by contradicting the views of another person, it is also customary to express one's views either directly or indirectly concerning a person or a highly active matter. As a result, the activity ceased. Thus, a person of opinion, in contact with Micronesians may leave with the impression that he has not hit with the people, that he has not hit and his views are not accepted. He may be quite correct in his view, but they are actually in opposition to his own. The person may not be able to see the manner in which he is being interpreted. In fact, however, it may appear that the people are his friends and have told him that he helped his back.

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or have established it as the best, ability of a person to understand. It results from a lack of understanding of a culture or another person's cultural values. Different cultures have different ways of answering questions and different ways of showing respect and appreciation. In addition, there are differences in the way that people communicate. Often, however, these differences are not recognized and become a problem in communication. For example, it is believed that the Japanese tend to be indirect in their communication, while the Americans tend to be direct. In the case of the Japanese, this is because of the concept of "Honne" and "Tatemae", and in the case of the Americans, it is because of the concept of "Individualism". It is important to understand these differences in order to avoid communication problems. It will be discussed in the next section under recommendations.

CONFIDENTIAL

General Statement

At the outset, it should be noted that, from a strictly legal point of view, the recommendations of the Commission on the Atomic Energy Act of 1946, which were adopted by the United States of America, either through the Department of Defense or the Department of the Interior, the Atomic Energy Commission, and the Federal Bureau of Investigation, are not directly responsible for the health and suffering, disease and possible death, which have resulted from the fallout from the March 1, 1954, hydrogen bomb explosion, whether or not any fiduciary relationship has existed between the United States of America and the people of the Marshall Islands. The United States of America is also directly responsible for the health and suffering and all burdens connected with the victims of their people, who have suffered with lack of the necessary medical care and hospitalization.

Several times during the previous year, the Commission, through written communication, has verified its position regarding the opinions of certain people, who have expressed their views on the annual surveys that the Marshall Islands have conducted for the examinations since similar surveys conducted in the United States have cost in the neighborhood of \$100 per examination. The only real argument posed by one concerned party (Rongelapese) was that the Congress of Micronesia should have the expense of such surveys estimated to cost from \$100,000 to \$125,000 per year, which would be a waste that it vehemently rejected and expressed its disapproval. Did the Rongelapese use of nuclear waste in the area for to conduct nuclear tests

in their homes. Did the developers and financiers ask for the funds to be  
detracted from the education fund? Did they ask for the banks, thyroid nodules  
and cancer and other ailments to which the people are a gift from the United  
States? Did they ask for the money to be given to them for more than ten years  
before receiving the money? Did they ask for the money to be deprived of  
their ancestral lands and to have their lives taken? Did these people  
ask to annihilate the people of the Territory for the sake of their  
children? Did they ask for the money to be given to them to make  
known its feelings and wishes to the people of the Territory? Is it  
responsible for the people of the Territory to be shared equally on  
a moral level with the people of the United States? Government,  
if it is, in fact, possible to separate the people of America from  
the Trust Territory of the Pacific Islands, the Committee is of  
the opinion that a large amount of money should be spent by the Congress should  
be spent for the good and welfare of the people of the Territory and that  
penny should be spent for the Territory and its people for the purpose  
of funding an educational program by which the people of the Territory  
of the United States Government.

The Committee also wishes to draw attention to the nature and  
intent of its recommendations. Through its extensive investigations the  
Committee has discovered that the people of the Territory, as that experienced  
by the Rongelase, are suffering from various ailments, it is a sad  
but true fact that the people of the Territory are suffering from the condition  
of the people except that they have never been exposed to the effects of  
not developed for many of the years of the Territory. As Mr. [Name]  
**commented** at one of the hearings, "I don't know if it's 10 years or 20 years."

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Other effect may not appear until a later or third generation. Thus the Committee has been recommended to, in effect, to provide for care and treatment for as needed, as a matter of course.

Secondly, the fact that many of the army reports issued from the Congress in the past, after which the conditions were not carried out or they were ignored. There may be a failure on the part of the executive branch and the Congress in the past. In this connection, the Committee has made a study of things which it felt were possible and practical; that should meet with a conviction that the people are concerned, and which can be implemented in a relatively short period of time to the benefit of the people. Finally, the Committee is not recommending that its life be extended indefinitely without remedy, but rather that after the action taken or not taken, continued in the past, 20% of them are carried out to the most favorable extent possible. This resolution will also allow the Committee to take the subject of the committee more thoroughly before presenting its report on that subject to the Congress.

Finally, the Committee wishes to mention that the Committee and this report would have been examined by certain persons, both Americans and Marshallese, that is, the committee. The Committee finds the AEC and the quality of clinical trials. It is involved to remain in virtual ignorance for nearly twenty years, and the Committee notes that many Marshallese do not know how to read. In these examinations for nearly eight years, our White House has been aware of the complaints of the people and their needs. After that, we took the initiative to examine this situation. The Committee also expresses its concern that the Marshall Islands National Legislature has apparently

never taken part in action regarding the matter, and, generally, a  
situation existed in the Territory during 1970. This situation, however, should  
not be construed to imply that similar conditions would only be limited to the  
district level. The situation is only the legal identity of the requirements of  
its remote areas and, as such, it is a local problem. The  
Committee also takes account of the displacement which follows for certain non-Micronesians  
at the Headquarters level. Specifically, the Committee notes that  
the expansion of the agency survey for the District Administration in  
December of 1970 may have also resulted in the delay of the census  
survey scheduled (one month later). While there is no interpretation of  
the possible probability of the visit by such an observer to the extent  
may have been a consideration, the Committee does not wish to draw attention to  
the people of the Territory, but rather to the fact and a demerit of  
experience in the Territory, and of the fact that the presence of such  
inspired by a desire to do the field of work and the need to do so on the  
territory. The Committee is also disposed to refer to the fact that the  
allegation made by the District Administration 24 July, when in connection with  
the aborted March, 1970, survey. The non-arrival of the observer who did arrive in  
time to go to the field in March was an important reason in August  
including such persons as Dr. Johnson, Dr. Brown and Dr. Smith. It is  
heard of the fact that the observer told members of the Committee that he  
has little background in the field and that he was not particularly  
interested in the present problem. However, he was introduced to someone  
something about the area. The executive branch has changed that the field  
was persuaded by the "local" informant and to go on the field survey.  
The Committee has questioned this situation and has been told that  
during his meeting with the observer, he failed to go to the field to go on the field.

and did not discourage him. These points made by the Executive Board who  
like to cover the executive branch. In the High Commission, Deputy  
Deputy High Commissioner, Mr. T. O'Connell, Mr. William York and Dr. James  
Kumari. In fact, the High Commission, to provide assistance to the  
Committee ~~and~~ its activities.

The Committee will like to make one final point before returning  
to the recommendations which has already been made. The issue connected  
with the report of Secretary and Deputy Secretary, the Director, Complaint  
or charge by persons in the Administration by persons connected with the  
annual survey that it is inadvisable that political issues be being  
inserted into what is a purely medical and public health matter. The Committee  
does not agree with this attitude. The Committee would like to remind the  
who will be reminded of the values and the meaning of the word "political".  
The original Greek word was not political, and was a general description of  
the word political in the sphere of a public body and the  
enforcement of laws and regulations for the benefit of political actors  
is any action which bears upon the public affairs of the state, which  
virtually was active in a political action and effects by its action  
other persons. In a more general sense, it is both a political action  
and a matter of other considerations, the concept is very broad political  
action, which is not in the sphere of a public body. The word  
representatives of the state, and the state. Only actions have been  
committed in the interest of the state, with the intent to injure,  
their health and welfare. A consideration of the recommendations in the  
past, however, appears to have been undertaken with a view to being  
more concerned with the future of the state. They continue to have

are with the will of the people involved. The Commission will then, as with the case of the other, the Ministry of the Interior, in the part that reacted here, will be able to make a study of the situation about existing problems. Instead of this, in 1951, there was a study of the issues of the Commission and trying to find out what was the situation how the situation would be handled. In the case of this, the Commission is please to give the Commission a copy of the executive branch with this committee of the papers which has been prepared, including the reports and instructions by the executive branch of the governing bodies and difficult in identifying the people of the group and others. The Committee is happy to make this report. One can hope that it will be increasing of general interest. The Commission of Legislative Council of the Trust Territory Council of the Territory, as well as the subject of the report, as well as other recommendations regarding the interests and well-being of the people of the Territory.

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The Committee also notes that the Office of the Scientific Committee on Radiation Effects has made a report of the findings of its work on the health effects of radiation and deposition of radionuclides, dated 1954, called from the "Report of the Scientific Committee on the Health Effects of Radiation" as suggested by the Commission.



Public Health Conditions

The committee believes that because of governmental limitations, new typhoid and cholera outbreaks, and the spread of malaria, it strongly recommends that the Government of the Territory of Hawaii, through the Office of the Governor, should contract with the American Red Cross and the United States Public Health Service to provide medical assistance to the Territory of Hawaii during the time of typhoid, cholera, and malaria epidemics. The committee believes that this is a valid recommendation, and hopes that the Government of the United States, through the Office of the Assistant Secretary of Health Service, has about 40,000 troops, 12,000 of them in the Pacific Islands. Also, the committee believes that the Government of the Territory should stand in the way of this project, for the Government of the Territory has several times the amount of budget for the health services of the Pacific Islands. Arrangements for medical assistance should be made through the Department of the Interior and the Bureau of Indian Affairs.

As an alternative measure, should the Government be unable to fulfill its obligations, the Government should make the recommendation of the committee to the United States Public Health Service, which is the only agency which can provide medical assistance to the island people, the cost of which would already be borne by the Government.

The committee also recommends that the Government of the Territory should provide medical assistance to the people of the Territory, hospital facilities, and other facilities for the purpose of providing additional medical assistance to the people of the Territory, and that the Government should provide additional medical assistance to the people of the Territory.

The committee further recommends that the Government of the Territory increase its funding of medical assistance to the people of the Territory.

Laboratory so that the Government may be able to carry out the recommendations made by this report and carry out such other work as studies as he may feel will be beneficial to the people of the islands.

1. Medical and Biological Laboratory

In order to convey to the people of the islands the message that the PSL is primarily interested in the health of the people but is also respectful of their and of their Government's views in these matters which affect the islanders, it is recommended that:

1. Prior to the survey, through the District Administrator of the Marshall Islands District, the PSL should request the permission of the people of the island to be surveyed.
2. Permission by the Administrator of each of the islands should be asked in order to hold the survey parties on the basis of experience results from the last visit a few years ago.
3. During such a visit, the PSL should inform the people if they would like to have an island party. Areas for the party should be selected; they should be arranged to provide for the islanders (fish, fish and breadfruit). Conversely, it is recommended that no provision be made for food as hot dogs and bread for the islanders. The PSL should ask the people to prepare for the party.
4. The Committee should request that the Government give serious and careful consideration to the recommendations of the consultants, Kumatori, Cole, and the PSL, and if they do not agree, what action it proposes to take concerning them.
5. The Committee is of the opinion that the 1954 survey, 1954, survey, as an interim measure, the PSL should examine each person examined

a written statement in the light of the evidence findings from 1977 and 1978. The findings relate to the children for exposed, children of exposed and control persons, which has fully what is stated by the Marsh. They refer to their written reports. In March 1978 will be discussed by the Board.

10. Power 1978-1979

1. The Committee noted that the power to buy equipment, construct, and repair buildings, and other facilities, a dispensary, and other facilities - health, police, and other, which will enable the medical services to be improved, and personnel and other facilities, and other facilities. The cost of such shall be borne by the Government.

2. In connection with this, the Committee noted the deteriorating condition of a number of buildings on the island site. The Committee noted that these buildings, after consultation with the Director, should be repaired, and other facilities and improve one of the inhabitants of the island.

3. In connection with this, the Committee noted that it is recommended that the Trust be encouraged to provide a school, which is an education program which will provide facilities for the people and utilize the facilities of their type. It should be thorough and should be made to be a school, and it should satisfy the curiosity of the people, and other facilities are not asked of the Government every year. In this regard, the fact which the Committee has seen, and other facilities, various Japanese experts, and other facilities, and other facilities, that such

examinations may be held for the year 1960.

4. As provided by law (introduced by the Government during the First Regular Session of the 47th Congress) all coast territory will provide free transportation, by ship or by plane in a special ship and plane survivors, their descendants, and those who were taken to the coast of a certain group; if they wish, they may go to a certain territory, the coast territory, under this law, will also be responsible for the care of the survivors and descendants, and for the education and training of the children for all the places available to the children according to law.

5. It is recommended to the Government that the AK, that health aides or health workers should be given the same training as record keeping and certain other responsibilities (for example of the health, for example). The health workers required to be trained, possibly report by radio to Moscow and to the other parts of the country (with the exception) on every health vessel.

6. It is also recommended that the Bureau of Community Development encourage self help projects in the areas of agriculture, fisheries, and handicraft production in the islands of the 47th Congress.

#### Department of Education

1. It is recommended that the Department of Education should be introduced by the Government which will provide for free transportation, housing, and per diem to experts of other countries and persons.

2. The Department of Education should also provide, through its Special Joint Committee which is connected with the Department of Health Services, cause to be related to the Department of Education in Marshallese and English with the name of the Department of Education, as described in

the public and to this end, the allocation to the Department of Health Services the priority of the affected area.

3. It is recommended that the Commission through the Special Joint Committee, cause to be published a survey of the impact and its recommendations in the Marshland, Mangrove and the community of the area dated to the people of Rongelap and Bikini.

4. The Committee recommends that due to the nature and the effects of radiation and the special situation of the affected Marshland, that members of the Special Joint Committee accompany the Commission to assure that its recommendations are carried out and that at the same time, it encourage further development of the Marshland, Bikini and Rongelap District Legislators to join the Commission to carry out the Special Joint Committee.

5. The Commission recommends that its report be released in scope and that its life be extended to January, 1975.

#### The People of Rongelap and Bikini

1. To the people of Rongelap and Bikini, the Special Joint Committee recommends that they form a group composed of the regular island village council, the other elected persons. This is a common practice in many of the islands and that through groups like these, the people involved should be able to express their concerns or agitate for correction of what they consider to be unjust.

MEMORANDUM

First of all, the Committee would like to give its thanks and appreciation to the contributors, mainly the people, and the people of Pongalan and Ulu, for their cooperation and assistance to the Committee. It is for their support that the Committee has been able to travel and studied and it is hoped that the report and the recommendations will help to give a view of their problems and that they may face the future, rest on their knowledge and the people and the government of Micronesia are not made aware of the special situation of their special circumstances.

The Committee is also grateful to all the persons or agencies for their assistance in the latter part of its work. They are listed below in alphabetical order according to the country of jurisdiction.

JAPAN

The Committee wishes to express its deep appreciation to Dr. Ikuo Pochin, M.D., CMB, Jap., Director of the Division of Medical Research, Council's Department of Medical Research, University College Hospital Medical School, London, England. The Committee is grateful to the Director of the Division of Medical Research, Dr. Pochin to the Committee.

JAPAN

Tokyo

We are also indebted to Mr. Masahiko Inoue, Mr. David Brown, Second Secretary, Technical Section of the Defense Attaché Embassy in Tokyo; and in the government of Japan to Mr. Masahiko Inoue, Mr.

has been of the highest quality. He is a member of the Ministry of Health and Welfare, the Japanese Red Cross, and the Japanese Red Cross of the Imperial Order, Health, and Welfare Division, and is a member of the National Diet. He is also a member of the National Diet. He is also a member of the National Diet. He is also a member of the National Diet.

The Committee would like to express its sincere thanks to Mr. Tetsuzo Iwano, who heads the Health and Welfare Division of the Japanese Red Cross, for his helpful assistance in arranging and conducting the trip. It is also a pleasure to thank Mr. Tetsuzo Iwano, Director of the National Diet, for his kind and helpful assistance in the trip. The Committee is especially grateful for having the opportunity to meet and talk with Mr. Tetsuzo Iwano, Director of the Health and Welfare Division.

The Committee wishes to express its appreciation to Mr. Warren Fisher, Mr. John J. Kelly, Mr. David Brown, and Mrs. Yoshiko Kato of the American Legation in Tokyo for their kind assistance to the Committee during the stay in Japan.

#### Hiroshima

The Committee would like to extend its sincere appreciation to the Honorable Ichiro Miyake, Governor of Hiroshima Prefecture, and the Honorable Hiroshi Miyake, Mayor of Hiroshima City for their kind assistance during the stay in Hiroshima.

A most interesting and informative presentation of the Atomic Bomb Casualty Commission in Hiroshima, including Dr. George B. Stirling,

Former Director, and the present Director, Dr. Shiro Hama, Associate Director, and the Doctor, Dr. S. H. Hama, and others.

Also in Hiroshima: The name of the Director, Dr. Hama, Director, Director of the Hiroshima Atomic Bomb Hospital, Dr. Yutaka Mizuno, Chief of the Section Chief of the Hiroshima International Welfare Center, Dr. Masao Mizuno, Vice Director of the Hiroshima Atomic Bomb Hospital, Hiroshima Atomic Bomb Hospital, Director of the Hiroshima Peace Memorial Hospital, and Dr. Masao Mizuno, Director of the Hiroshima Hospital.

Our committee is also indebted to Dr. Shiro Hama, now Professor in the Atomic Energy Department of the Hiroshima University School of Medicine, for his assistance as a consultant to the Committee. He was especially qualified to do so, first as a supervisor, and second, through his close contacts with the Institute for Nuclear Medicine and Biology, Hiroshima, for allowing us to be able to take leave from the Institute to work with the Committee.

### Nagasaki

The Committee is also indebted to the Government of the Japanese Prefecture of Nagasaki, Japan, for his kind invitation to the Deputy Mayor, Masao Hama, for his kind invitation to the Committee, and for the assistance in arranging the itinerary for our visit. We are most grateful to Mr. S. Hama, Director of the Department of Medicine, Atomic Bomb Casualty Commission, Nagasaki, and to Mr. Masao Hama, Director of the Nagasaki Atomic Bomb Hospital, and to the Director of the National Atomic Bomb Hospital, the National Atomic Bomb Hospital, Nagasaki.



the Bureau of Aeronautics, and to the Bureau of Aeronautics, Director of  
the Atomic Energy Institute of the University of California at  
Medicine.

COMMITTEE ON THE PROGRESS OF THE WORK

The Committee is authorized with regard to the efforts of the  
Department of Defense and the activities of the Army Assistant Secretary  
for Territorial Affairs, to obtain the necessary information and the assistance  
of the Interior Department and other agencies in order to coordinate  
the performance of the various projects and to coordinate with  
the Brookhaven Laboratory.

Deserving special mention in this report is the work of Dr. James  
Surgeon General of the United States Army, who has been very helpful for his  
offers of a program for the committee. The committee are also due  
to Dr. William H. Taylor, Director of the Division of Radiological  
Health, who has assisted in various ways as a special consultant  
by Dr. Steinfeld, who has assisted in the work of the committee and the  
U.S. Public Health Service in the field of the committee's work.  
Materials of the committee are translated from English into Russian,  
and for the purpose of such translations are available to the committee  
through the Library of Congress.

The Committee would like to express its appreciation of appointment  
with two agencies of the United States Government, namely the Depart-  
ment of Defense and the Atomic Energy Institute, for their apparent  
lack of cooperation in the field of the committee's work. While it  
should be stated that the work has been carried on to some extent

concerning the receipt of the above-mentioned specimens of Strain 11, along with the purchase of certain items which, unfortunately, failed to arrive as reported for the identification and materials in a letter of the 14th of 1972. Although received through the Office of the High Commissioner, the delay in their arrival is due to bureaucratic machinery of the Government. The name of the individual named is not known. The Office will continue to search for the records to establish the source of the specimens and to insure and express the hope that this situation will be clarified in the future.

The Committee would like to express its appreciation to Dr. Cronkite and Dr. Robert Z. Cooper of the Federal Medical Laboratory of Long Island, New York, for their assistance in the continuation. We are especially grateful for Dr. Cronkite's cooperation in the Committee's request for information regarding his hospital during the September survey. Also we would like to thank the medical and support staff of the Brookhaven Laboratory, Dr. Goulson Lowery, Larsen, Suter and Jackson, the head of the staff, Herbert William Scott, Douglas Clarence and Miss Baker.

#### THE HIGH COMMISSIONER

The Committee would like to thank Dr. Victor L. Vito, Vice President for Research and Development of the University of Guam, for his advice and assistance, and also the staff of the University of Guam, for the material for the University of Guam, which has been invaluable to the writing of this report.

Saipan

As noted elsewhere, the Committee is very thankful to High Commissione ... Deputy High Commissione Peter S. Coleman, and ... Dr. ... Special ... Dr. ... Japan as ... and advice ... Mizutani, ... the September ... committee was ... of the Department of Resource ... thankful to ... Director ... Mr. ... Weilbacher.

Marshall Islands

The Committee ... help and assistance ... Districts ... Administrator ... Administrative ... Anien; the ...

Micronesians: Mr. M. J. [unclear], Director of Health Services, Pohnpei; Mr. J. [unclear], Captain Willie M. [unclear], Director of Health Services during the September Survey; Mr. [unclear], Director of Health Services; Mr. [unclear], Laboratory Technician; Mr. [unclear], Laboratory Technician; Mr. [unclear], Laboratory Technician; Mr. [unclear], Laboratory Technician; Mr. Kimura Rikio, [unclear], Health Agent.

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*Appendix*

Memorandum of Understanding on the Transfer of Technology

1014801

MEMORANDUM FOR THE RECORD  
DATE: 9/25/72

SPECIAL JOINT COMMITTEE  
CONCERNING RONGELAP &  
UTIRIK ATOLLS  
(Public Law 40-33)

Senator Olympio T. Borja, Chairman  
Representative Timothy Oiker  
Representative Hans Wittenger

September 23, 1972

Memorandum of Understanding

To : Medical Consultant to Special Joint Committee Concerning  
Rongelap and Utirik Atolls, Republic of Micronesia

From : Vice Chairman, Special Joint Committee

Subject: Submission of Report

As per the Special Joint Committee's Media Report of May 16, 1972, the Committee would like to request that you submit a report to it discussing the following areas of interest:

1. Method of examination of patients at Rongelap and Utirik used by members of Frank Owen National Health Service medical team including:
  - a. your (sic) indication as to whether you feel examination on a one-to-one basis is (or is not) an island situation; and
  - b. whether you feel the present examination methods are adequate to protect the health of those examined, including whether you feel certain tests should be added, or if certain tests being now conducted are not necessary; and
  - c. your discussion on the doctor-patient relationship between the team and the people being examined and also any observable problems in communication between you; and
  - d. any other comment you may wish to make in this area.
2. Relative to the area of interest, the Committee requests that you:
  - a. comment based upon your observations of this particular

Memo

survey, whether you feel that type of treatment (surgery, medicine, etc.) is adequate or all or improved, or is inadequate and your reasons therefor; and

b. From your knowledge, experience and review of pertinent literature, discuss the adequacy and quality of past medical treatment.

Additionally, the Committee would like to see your comments on:

1. The advisability of returning the Rongelapese and Utrikese to their islands pending testing, whether they had ceased and their consequent exposure to high radiation, the amount of residual background radiation; and

2. Any other comments or suggestions relating to professional medical aspects of the team's work, either of a general or specific nature, or any information comparing the medical examination and treatment of these groups with that you are familiar with; and

3. Your professional opinion as to the behavior of AEC reports as to the validity of the original amounts of radiation exposure, and residual amounts not whole-body measurements.

The Committee asks that you prepare your report separately, upon return to your present place of work. It should be written without soliciting the opinions of the other consultants to the Committee or doctors connected with the AEC or Brookhaven, other than for informational purposes and that this report be submitted to the Committee no later than 50 days after your departure from the Rongelap Islands District.

It is agreed that all reports, information and correspondence between the Special Joint Committee and its consultants will be treated confidentially as in a normal medic-legal doctor-client relationship; provided, however, that the Special Joint Committee may, upon its discretion, make public any and all information received from said consultants without naming them unless they so agree and that such publication will release the consultant from any restriction on using said information for his personal use and benefit. It is furthermore, provided that those consultants who are required by their supervisors or superiors to do so will make available copies of their reports with the understanding that the information contained therein is confidential in nature. The reports, when completed, should be sent to Chairman Olympio T. Borja, U.S. Congress, Micronesia, Saipan, Mariana Islands, 96950. Any expenses connected with the work of the consultants will be reimbursed or defrayed by funds of the Special Joint Committee Concerning Rongelap and Utrik. Authority is hereby given to the Military Government.

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Memo

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(Attendance by consultants to  
Special Joint Committee)

/s/  
Hans Willander, Vice Chairman  
Special Joint Committee Concerning  
Rongelap and Bikini Atolls  
Congress of Micronesia

/s/  
William H. Cole

/s/  
Sane Ezaki

/s/  
Joshiyuki Kumatori

/s/  
E. Pochin

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DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE  
PUBLIC HEALTH SERVICE  
RADIOLOGICAL HEALTH CENTER  
WASHINGTON, D. C. 20492

OCT 27 1972

Senator Olympia D. Berja  
Chairman, Special Joint Committee  
Concerning Fongelap and Utirik Atolls  
Congress of Micronesia  
Saipan, Mariana Islands, U.S.I.C.

Dear Senator Berja:

It is my pleasure to submit my report (Attachment No. 1)  
as a Consultant to your Committee in accordance with the  
Memorandum of Understanding of September 21, 1972,  
(Attachment No. 2).

I have combined portions of my response to the multiple  
questions in an attempt to more concisely state my  
observations on the methods of contamination of the exposed  
persons of Fongelap and Utirik Atolls, as well as on the delivery  
of health care to the entire population of those atolls.  
The latter observation is made in response to the verbal  
request of Mr. Hans Wilander, Vice Chairman of the Special  
Joint Committee.

I trust my report will be of assistance to your Committee  
in its continuing deliberations concerning Fongelap and  
Utirik Atolls.

As requested by you, I have attached a resume of my  
professional background.

With best personal regards, I am,

Sincerely yours,

William E. Cole, M.D.  
Associate Director  
Bureau of Radiological Health

3 Enclosures

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Attachment No. 1

REPORT OF WILLIAM H. COLE, M.D., MEDICAL CONSULTANT TO THE SPECIAL JOINT COMMITTEE ON NUCLEAR POWER PLANTS, HONOLULU AND UTIRIK ATOLLS, CONGRESS OF MICRONESIA, IN THE U.S. PUBLIC HEALTH SERVICE, BUREAU OF RADIOLOGICAL HEALTH, FOOD AND DRUG ADMINISTRATION, DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

In accordance with the Memorandum of Understanding, dated September 31, 1972, I submitted reports. The observations and opinions expressed are the result of my visits to Ebeye Island, Rongelap Atoll, Utirik Atoll, and Majuro Island, Marshall Islands, Trust Territory of the Pacific Islands, from September 14, 1972, to September 25, 1972, with the Brookhaven National Laboratory Medical Team. During this interval the following Marshallese were examined:

Exposed persons - Rongelap Atoll	12
Exposed persons - Utirik Atoll	76
Unexposed Rongelapese (total of 100)	18
Children of exposed Rongelapese	30
Children of unexposed Rongelapese	10

In addition, approximately 100 Marshallese, and children were examined and treated for diseases not related to radiation exposure. For example, more than 60 pairs of charity-donated eyeglasses were distributed to the people of Rongelap and Utirik.

The visit of the Medical Team coincided with a serious outbreak of upper respiratory illness and an acute gastroenteritis infection of both Rongelap and Utirik. In addition, a widespread epidemic of influenza occurred among those people and the personnel of the Medical Team, resulting in a quarantine of the involved islands. This proved to be an additional hardship in the conduct of the examinations by the Medical Team when it arrived at the Majuro Memorial Hospital, Majuro Atoll.

1. METHOD OF EXAMINATION OF THE PEOPLE OF RONGELAP AND UTIRIK ISLANDS BY THE BENJAMIN NATIONAL LABORATORY MEDICAL TEAM

The annual examination of the people of Rongelap and Utirik is considered adequate for the detection of radiation-induced diseases. As a result of fallout exposure in March 1954, this method of examination has detected several thyroid abnormalities in 21 Marshallese in the past and resulted in the discovery of two additional cases at the most recent examination. The first case of acute myelogenous leukemia was discovered at this examination and the patient taken to the hospital of the Medical Research Center at Brookhaven National Laboratory, Upton, New York, and subsequently transferred to the National Institutes of Health, Department of Health, Education, and Welfare, for observation and treatment.

Examinations performed by the Benjamin National Laboratory Medical Team are considered to be fully adequate for its purpose. The history and physical examinations are performed under difficult circumstances on the islands with the lack of any facilities on Utirik compounds, the problem. The permanent facilities available at the hospitals on Rongelap are much more adequate for the examinations. The blood and urine tests performed by the American and Marshallese technicians are adequate and accurate. Additional examinations not related to radiation-induced disease could be added as clinically indicated. As regards the treatment of radiation-induced disease and, in particular, the thyroid abnormalities occurring in exposed persons who were under the age of 10 at exposure, a available record indicate the treatment to have been excellent. The surgical care rendered to these individuals in Guam, Hawaii, and the United States is comparable to the best afforded in this country.

An annual medical examination with diagnosis and treatment of diseases endemic to the Marshall Islands not related to radiation is inadequate to preserve the health of the people. Much more medical training of the District Territory Health Aides with standardization of the community, surgical supplies, and medications is necessary. If much improvement is to be expected, frequent visits by medical officers of the District Headquarters are imperative.

There is difficulty in communicating with the people on the purpose of the general examination for the detection of radiation-induced disease. The facilities available on both Rongelap and Utiirik do not afford the opportunity for a good physical examination of the island, until this situation is corrected, such as the lack of and mistrust by the people with the examination. This was quite evident when I visited the Rongelap Island with the aid of the Special Joint Committee in early 1971. The language barrier increases the difficulty for both the patient and examining physician as the physical examination is conducted.

## 2. OBSERVATION RELATIVE TO THE DELIVERY OF PAST AND PRESENT HEALTH CARE

In regard to the diagnosis and treatment of disease endemic to the Marshall Islands, cancer and not related to radiation, the methods for delivery of good health care are totally inadequate. The difficulty in transporting heavy diagnostic medical equipment ashore at Rongelap and Utiirik preclude examination of the island. For example, modern x-ray machines are in need of consideration should be given to the procurement of a "hospital" ship with such equipment permanently installed. This method would also allow additional clinical examinations to be performed as well as treatment of surgical procedures. Such a facility would afford visiting medical personnel clean living accommodations and now available. This method of delivery of good health care has been a proven and proven highly successful method of developing countries.

The medical record system observed is totally unsatisfactory. A medical record should be established for all persons, both exposed and not exposed. That information pertinent to the exposed population should be placed in such a record and available for the visiting Medical Officers of the Trust Territory. An applied record of immunizations should be maintained to prevent outbreaks of diseases which could be prevented in early childhood immunizations. The tragic poliomyelitis epidemic of 1973 on Utiirik is an example of the necessity of such a program.

Consideration should be given to the preparation of a document in Marshallese on the purpose of the annual examination by the Rongelap and Utiirik Laboratory Medical

Team for an evaluation to the post prior to the visit of the physician. It is not possible for such written information to be readily available. It is doubtful any alleviate misunderstandings or any in criticism.

The dispensary on Rongelap and Utiik should be upgraded with standardization of supplies, supplies and medications. The hospital on Ailingmae is inadequate to deliver good health care to the 1,000 residents of the island. The construction of the new hospital should be expedited as rapidly as possible. Additional medical training of the Health Aides on Rongelap and Utiik is also necessary. In my opinion, without it, even the scheduled visits by the Medical Officers from the District Headquarters cannot prevent possible serious outbreaks of disease on the outer islands.

3. OPINION ON THE REPORTED / RADIATION LATE RADIATION EFFECTS ON THE PEOPLE OF RONGELAP AND UTIIK ATOLLS

The Bravo hydrogen bomb as part of the Operation Castle test series was detonated on a small island on Bikini Atoll on March 1, 1954. This produced a yield of 25 megatons TNT equivalent and contaminated an area approximately 330 miles by 60 miles with radioactive fallout. This large area included Rongelap and Utiik atolls. The reported exposures to the people on those islands caused by the U.S. Atomic Energy Commission in July 1954 are as follows:

- Rongelap            375 rads (whole body dose)
- Ailingmae        68 rads (whole body dose)
- Rongerik         78 rads (whole body dose) (USAF Personnel)
- Utiik             14 rads (whole body dose)

The people of Rongelap received a skin exposure to such a degree to produce burns and partial epilation of the scalp, the result of a significant dose. The external beta dose was the result of direct skin contamination by fallout material. The presence of vegetation and partial shielding by trees on Ailingmae resulted in a lower skin contamination

In addition to the whole body gamma, alpha and beta burns of the skin, a significant amount of radioisotopes was absorbed by ingestion and inhalation. The dose calculations were begun at Bikini about 100 days after the detonation by determination of radioactivity in pooled urine samples. Such samples were returned to the United States for radiochemical analysis. Fuel analysis was continued and, at six months following the explosion, minute amounts of radioactivity were detected in the urine. Radioactive iodine was the most numerous of the detected isotopes and, by extrapolation, a dose of 100 rads to the thyroid gland of the exposed children was estimated. In addition, both groups received 1700 rads from external gamma irradiation.

Articles on this subject, published by the U.S. Atomic Energy Commission, the Brookhaven National Laboratory, the Department of Defense, and testimony before a special Subcommittee on Radiation of the Select Committee on Atomic Energy, Congress of the United States, were carefully reviewed with particular attention to methods used in dose calculations. Granted that much of the data were determined by post-detonation calculations and extrapolation, one must conclude that the published figures are reasonable estimates. It was not possible to reevaluate the data but the available information is as follows:

By the Spring of 1957, sea breezes from Banzigap Atoll had been made by the Applied Fisheries Laboratory of the University of Washington and the Naval Air Defense Laboratory. A decision was made to allow the natives to return to their island on June 1, 1957, with the belief that permanent residence would not be detrimental to their health. The last nuclear device of the Operation Crosscut tests was detonated on Eniwetok on July 26, 1958. The available data indicates that only a small and insignificant amount of radiation background levels occurred on Bikini during the period of the test.

In early 1959, field measurements made by the Laboratory of Radiation Physics of the University of Washington and the Brookhaven National Laboratory, Medical Team. Subsequently, three additional radiation surveys were conducted by the Laboratory of Radiation Biology from 1959 to 1960. The maximum gamma dose level in September 1959 was recorded as 0.04 mrad per hour or approximately 0.36 mrad per year, well within the accepted maximum possible dose rate of 500 mrad

per year to 40 individuals. It was recommended to the people that land and food from Rongelap be discontinued because of their selective absorption of  $^{137}\text{Cs}$  and  $^{90}\text{Sr}$ .

It is a certainty that the radioisotopes of iodine I-131, I-132, I-133, and I-135 contribute a substantial dose to the thyroid gland, resulting in the development of nodules in the thyroid gland in 19 of 17 exposed persons in Rongelap, with the preponderance of individuals who were less than 10 years of age at the time of exposure. The first thyroid abnormality was discovered 1 1/2 years after exposure. Subsequent surgical exploration was carried out in the Hawaiian Islands and the United States on 18 of the victims, 16 of whom were found to have cancer of the thyroid gland. In a different group, boys were found to have developed thyroid atrophy of the gland resulting in hypothyroidism. This effect is probably the development of thyroid nodules. The exposed subjects were administered thyroxine on a continuing basis. In view of the surgical and medical treatment of the thyroid gland, the standard of care afforded was comparable to the best available in the United States.

The long term delayed effects of radiation are in the main the result of the radioisotopes strontium-90 and cesium-137. These two isotopes were plentiful in the fission products and are relatively long lived. Body burdens for cesium-137 and strontium-90 were measured by a radiochemical assay of the exposed Rongelap group in 1968 and there was an increase since similar evaluations in 1964. In addition, there was no significant difference in the body burdens of the exposed and unexposed persons living in Rongelap, indicating an equilibrium had been reached. It is impossible at present to predict the ultimate result of this increase in body burden of potentially carcinogenic substances. It is generally considered that the biological hazard from cesium-137 is as great as strontium-90, a beta emitter that is selectively deposited in bone. There are animal experiments which indicate that strontium-90 in sufficient quantities may produce bone cancer and possibly leukemia. Late clinical effects of strontium-90 in the muscle mass of the body are not definitively known at the present time.

At this examination, a nodular thyroid gland was detected in a Rongelapese who was 11 years of age at exposure and the first nodular thyroid lesion was exposed on Ailingnae when she was only 10 years of age. Unfortunately, the first case of acute myelogenous leukemia among the exposed

Rongelapese was discovered at the examination. This case of leukemia occurred well below the peak incidence expected as the result of radiation exposure but radiation cannot be dismissed as the causative agent. In my opinion, the discovery of this disease in an exposed person on Rongelap is an extremely disturbing event at this late date following the acute radiation exposures. One of the most difficult problems at the moment is determining the effect of continued low dose irradiation of a given population. It is prudent to assume that there is no level below which some damage may be produced. Although I am not able to conclude with certainty that this case of leukemia resulted from radiation, it would appear that this is the case. Certainly it demands the continued annual examination of all exposed Marshallese for the foreseeable future.

*William H. Cole*  
 William H. Cole, M.D.

San Francisco, October 18, 1972



PRIVACY ACT (WHERE APPLICABLE) - REMOVED

(UNCLASSIFIED)

WILLIAM S. BROWN, MD.

BIRTHDATE

1917, Red Oak, Virginia

MEDICAL EDUCATION

University of Virginia Medical School - Doctor of Medicine, 1937

INTERNSHIP AND RESIDENCY

Virginia Mason Hospital, Seattle, Washington, 1937-1938  
Resident in Department of Medicine, University of Washington, Seattle, Washington, 1938-1939  
Fellowship in Radiology, Mayo Clinic, Rochester, Minnesota, 1947-1948-1949

CIVILIAN PRACTICE AND TEACHING

General Practitioner - Red Oak, Virginia, 1939-1941  
Chief of Radiology, Washington University, Washington, D.C., 1954-1968  
Assistant Professor of Radiology, Johns Hopkins University, Baltimore, Maryland, 1968-1973  
Staff Radiologist - Naval Medical Hospital, Baltimore, Maryland, 1969-1973

MILITARY SERVICE

U.S. Navy Medical Corps, 1947-1954  
Rank: Commander, USN (ret.), 1954  
Last duty station: Chief of Radiology, Naval Hospital, Bethesda, Maryland, 1954-1958  
Retired from U.S. Navy because of wounds received in combat in the Pacific Theater.

SCHOLARSHIPS AND HONORARY DEGREES

E. I. DuPont Foundation, 1952-1954, University of Virginia  
Richard Henry Stoddard Scholarship, Department of Radiology, University of Virginia Medical School  
Alpha Omega Alpha Honor Medical Society, 1937

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ALUMNI ASSOCIATIONS AND PROFESSIONAL GROUPS

Mayo Foundation Alumni Association  
University of Virginia Medical Alumni Association  
President, Army Country Club Officers Association, 1966  
Board of Directors, Mayo Foundation, 1967-1970  
Executive Director, Army Country Club Board of Governors, 1968  
Advisory Director, Army Country Club Board of Governors, 1969-1972

SEMINAR AND CONFERENCES

Radiology Department, Naval Hospital, Naval U.S. National Naval  
Medical Center, Bethesda, Maryland, 1964  
American Cancer Society Education Course, Washington, D.C. Chapter,  
1964-1965-1966

PROFESSIONAL AND SCIENTIFIC SOCIETIES

American Medical Association - Fellow, 1967  
American College of Radiology - Fellow, 1967  
Executive Director of the College, 1967-1968  
Councilor for the Washington Chapter, 1961-1968  
Committee on Educational Methods, American College of Radiology, 1970-1972  
Councilor for the District of Columbia Chapter, 1964-1972  
Member, Task Force on Technicians, ACCR, 1970-1972  
Member, American College of Radiology Residents Workshop,  
Washington, D.C., 1965  
Chairman, American College of Radiology Residents Workshop,  
Johns Hopkins Hospital, 1970  
Fellow, ACCR, 1967  
Diploma of the American Board of Radiology, 1967  
District of Columbia Medical Society  
Chairman, Task Force on Technicians, 1970  
Vice-Chairman, Committee on Technicians, 1967-1968  
Chairman, American Scientific Association, 1968  
Chairman, Board of the Hospital Board, 1967, 1968  
New York Academy of Sciences, 1965  
Eastern Radiology Society, 1967-1968  
Louisiana Radiology Society, New Orleans, LA, President, 1967-1968  
Advisory Committee Chairman, Planning Committee of Early Technicians,  
1967-1968  
Honorary Member, Hospital of Colorado Society of Radiological  
Technicians, 1967  
Radiological Society of North America, 1967  
Committee on Technicians, ACCR, 1970  
American Roentgen Ray Society - 1972

PRESENT POSITIONS

Associate Director  
Bureau of Entomological Health, HHS

Executive Secretary, Medical Education Advisory Committee  
Bureau of Entomological Health, HHS

ARTICLES, BOOKS, 1930-50

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Clinics of the Veterans Affairs Hospital; 10:101937.

"Tuber Dorsalis: The Dorsal Branch of the Thoracic Dorsal Nerve";  
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16:3:1937.

"The Plasma Proteins Following Periodic Hemodialysis"; Alfred Gannutin,  
J. C. Hartman, and William S. Cole, M.D.; J. Lab. Clin. Med., p. 223-247,  
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William S. Cole, M.D.; J. Lab. Clin. Med. 10:715-718.

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M. F. Dwyer, M.D., Robert D. Williams, M.D., and William S. Cole, M.D.;  
Radiology; 35:222-232.

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Press, Rochester, Minnesota, 1948.

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Doses of I-131"; E. J. Long, M.D., William S. Cole, M.D., Alice  
Horwitz, M.D., Robert D. Williams, M.D.; Archives of Gynecology;  
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"Opportunities and Limitations in the Practice of Radiology";  
American College of Radiology Workshop, Washington, D.C., Nov. 23, 1963.

"Aggressive Approach to Patients with Metastatic Carcinoma";  
Theodore H. Wilson, Capt. MC USA; David H. Johnson, Capt. MC USA;  
William S. Cole, M.D.; The Journal of Pathology, Vol. 86, August 1966.

"The Judicious Use of Radiation in the 1950's"; William S. Cole, M.D.;  
(Presentation at 73rd, November 1955), Journal of Public Health,  
Vol. 59, No. 7, July 1959.

HIOGOSHIMA UNIVERSITY SCHOOL OF MEDICINE  
Kasugakita 3-chome, Hiroshima, Japan

August 18, 1977

Senator Olympia M. Torgler  
Chairman  
Special Joint Committee  
Concerning Micronesia and the Marshall Islands  
Congress of Micronesia  
Saipan, Marianas, Saipan, 96906

Dear Senator Torgler:

Thank you very much for the letter extended to me during my recent visit to Washington. I would like to thank you for your assistance.

Enclosed is a copy of my report on the islands of Kongelap and Utrik. As for the legend on the two islands of thyroid nodules, I will submit a report to the Board of Health (Board on the details of the legend).

If you and the committee have any questions, please do not hesitate to let me know.

Thank you again.

Sincerely,  
*H. Hosaka*

H. Hosaka, M.D.  
Department of Surgery

Enclosure:

Report on Visit to Kongelap and Utrik Islands

HE:amk

REPORT ON MEDICAL SURVEY AND PUBLIC HEALTH

At the request of the Special Committee (Concerning Rongelap and Utiirik Atolls) of the Ministry of Health, I participated as an observer of the Brookhaven Naval Party (led by Surgeon Lt. J. G. Burge) team and made observations at Ebey Island (17 September), Rongelap Atoll (18 September) and Utiirik Island (19 and 20 September). In my report, I wish to report my findings in sequence as they are being presented to the Committee.

As I stated in the meeting with the representatives held on board the Militobu on the morning of 10 September, I would like to limit my opinions mainly to that of the disease which is being studied, and not attempt to answer items outside of my specialty. As the results of the survey have the results on the specimens obtained during the survey, I have stated that it be understood I shall present my opinion on the literature of pathological literature and my current observations on the islands.

1. a. A detailed physical examination as is being held on an annual basis is appropriate, however, on the islands with limited hygiene facilities, it is desirable to conduct a minimum of 2 to 4 physical examinations per year. It is also desirable to have the same time, it is necessary to strengthen the health and hygiene of the local residents, independent of the medical survey.

b. The standards of the present survey have been modified slightly in accordance with special requirements. The present policy is considered satisfactory, except for some minor details. It is that almost no autopsies are performed. Autopsy is one of the most effective methods to detect the effects of the disease. Though there are technical difficulties involved in performing autopsies, the present strict and difficulties in securing the consent of the local people, I hope that the medical survey team and the Government of Micronesia can cooperate in overcoming these difficulties. If it is possible to perform autopsy on the whole body, I strongly recommend study be given to the thyroid glands at least, where disturbance of the gland is obvious.

c. The examiners willingly and spent physical examinations and their attitude was friendly. It was observed that members of the medical survey team were having difficulty in explaining the results of examination in full detail so that they might be easily understood. However, when the opinions of these examiners were sought, they perceived the impression that some of them did not seem to have a complete comprehension of the results. This has suggested need for more adequate efforts on the part of the medical survey team, but due to the barrier of language and lack of knowledge by the local people, it is suggested to devise a mechanism whereby the results of examination can be relayed to the local people for the health preservation of the islands.

d. For the point of view, the following countermeasure can be considered. A memorandum should be prepared containing the contents



Item 1. List of my opinion based on stated above.

Item 2. List of legal observations of my specialty.

NOTE. The Medical Survey Team of Brookhaven National Laboratory - AEC is conducting the survey with a purpose to be done in a way considered appropriate from the medical point of view and not only contributing much to the treatment and prevention of disease among the exposed people, but also is providing service to the healthy people among the local people in general. I am deeply impressed by the great effort being devoted to this difficult work which is being carried out in the inconveniently located areas. It shall make me very happy if what is stated will serve as some reference in achieving your noble accomplishment.



Shiro Ezaki, M.D.  
Professor  
Department of Surgery  
Yamagata University  
Faculty of Medicine

CURRICULUM VITAE

Name: K. K. K.

Date of Birth: 1905

Present Address: Hiroshima-shi

Permanent Address: Gifu-ken

Education:

October 1945 Graduate School of Medicine, Hiroshima University School of Medicine

Positions Held

October 1945 Assistant, Nagoya University School of Medicine  
Surgical Department

December 1948 Lecturer, Hiroshima University School of Medicine  
Surgical Department

October 1951 Assistant Professor, Hiroshima University School of Medicine  
Surgical Department

April 1962 Professor, Hiroshima University Research Institute for  
Medical Science (Surgery)

October 1973 Professor, Hiroshima University School of Medicine  
Surgical Department



NATIONAL INSTITUTE OF RADIOLOGICAL SCIENCES

4-1-8 Honcho, Aomori, 050-8595, Japan

Centre Olympic "72" Group  
Congress of Micronesia  
Palapa, Marianas International Center, Saipan, Northern Mariana Islands      October 27, 1972

Dear Ronald Starling:

I have the honor to submit the report concerning the medical examination of exposed Marshallese. Also enclosed please find our short presentation as a reference for the additional comments, paragraph 2.

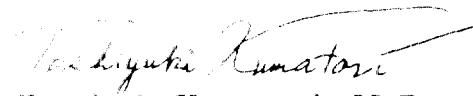
I appreciate your kind information. Dr. Conard also finds merit of the results of the survey. I regret the occurrence of a leakage.

With the understanding that the information contained is confidential in nature, a copy of this report was given to Dr. T. Masuda, Director of our Institute, by his request.

I hope this report will be of use for the future medical examinations.

Respectfully submitted,

Yours sincerely,

  
Toshiyuki Kumatori, M. D.  
Head, Division of Radiation  
Health

Enc  
TAK

NATIONAL INSTITUTE OF ENVIRONMENTAL SCIENCES

1101 Zeno Drive, Durham, North Carolina

Report to the Special Joint Committee Concerning  
Ecological and Health Aspects of the Project of Microwaves

This report was prepared in response to the request from the  
Special Joint Committee. The report which this report was arranged  
in the same order of the subjects of the original Memorandum of  
Understanding which was held on September 10, 1972.

Comments on:

1-a. I think that a check should be made on the proposed Marshallese  
on once a year. It is particularly important to understand situation  
However, since the knowledge of the situation of the Rongelapese  
and Utrikese is not completely known, it is necessary to  
take the health of the people of the islands for the purpose, those who  
near the capability of health control of the Rongelapese and  
Utrikese should be in the hands of the government and  
Dr. Conrad of the government must be involved. These actions will  
be very useful for the following reasons:

1-b. The present Administration can be the situation which seem to  
attach importance to the health of the people to protect the health  
of exposed people, however, with a view to the fact that the radiation health  
control for many years in the field of public health control and that  
detection of health effects in the exposed people as necessary.

FEDERAL INSTITUTE OF ENVIRONMENTAL SCIENCES

Health, Safety, and Environment Division

It is desirable, in addition to the other examinations to the present, to carry out chest X-rays, fluoroscopy to all residents, liver function test, more detailed histological examinations, cytogenetical study, etc. Without adequate equipment and man power will be needed in order to carry out these. Moreover, closer cooperation of Vastana and Utiukese is needed, because more frequent blood sampling and other procedures cannot be avoided.

1-4. The Utiukese AEC team has been observed and meetings to discuss environmental problems with the Utiukese and Utiukese before the beginning of the examination. I think that these meetings were helpful to establish the relationship. Nevertheless, I still feel that the effectiveness of the Utiukese is the biggest obstacle which may sometimes be a hindrance to the progress.

In general, the Eskimoes who are engaged in health control of the Rovigela and Utiukese should be more trained. With the help of these people, the doctor-patient relationship between the AEC team and the people being examined will be much more improved.

1-5. In order to do the examination in paragraph 1-4, more detailed examination is required in the Utiukese. I propose that Trust Territory Government should build a clinic has enough rooms to complete the examination. The clinic should be equipped with an automatic

# NATIONAL INSTITUTE OF BIOLOGICAL SCIENCES

1000 L Street, N.W., Washington, D.C.

blood analysis, and roentgen and x-ray studies, and other small examinations, including roentgenography, were made in a dark room. With the use of the above part of the results of examinations will be available more readily than at present.

2-a. It is felt that the present facilities of AEC are adequate. Most remarkable side effects of the group of Marshallese were thyroid gland nodules. The results of the treatment of these abnormalities are quite adequate according to the Brookhaven National Laboratory Report.

2-b. The Rongelapets were irradiated in the following three ways, external irradiation by  $\gamma$  rays,  $\beta$  rays to the skin, and internal irradiation. The treatment of the Rongelapets by  $\gamma$  ray and  $\beta$  ray irradiation were as follows:

According to the present knowledge, when the uptake of radioactive iodine is expected, the administration of stable NaI should be given to the subjects as soon as possible after irradiation as possible. The Rongelapets were given stable NaI 7 days after the initial exposure. Even if the subjects had been given 100 mg of NaI containing 200 mg of stable iodine, it is felt that the amount of radioactive iodine might not have been much reduced.

## NATIONAL INSTITUTE OF ENVIRONMENTAL SCIENCE

1017, Z. Chono, Anjo, Aichi 486, Japan

The biological monitoring of the Japanese population was done 18 years ago. I don't think that the Japanese will not give them inorganic information regarding

Additional comments are:

1. The responsibility of the Japanese government (JRE) is considered to have been increased by the fall-out due to the following test explosion after their refusal to suspend and to stop the nuclear power. The amount of fallout was not so small to ignore it. At that time, namely in 1956 and 1957, the Japanese government should have taken up in their home islands and wished to have done, I feel that it is not necessarily wrong to have made the mistake.
2. On the other hand, progress of the cytogenetical studies have been continued since 1966 by the Institute of Gene Division. The chromosome analyses are done by 2-day cultures of peripheral lymphocytes. Some of the results are summarized in the 11th of this paper. We found intimate correlation between the frequency of chromosomal aberrations and extent of exposure dose as determined from of neutrophils which indicates the sensitivity of early  $G_0$  to radiation.

According to the report by Ito et al. (BNL 50022, p. 127), correlation of chromosome aberrations and sensitivity of early radiation

NATIONAL INSTITUTE OF ENVIRONMENTAL SCIENCE

1-1-1 Higashi, Utsunomiya, 342, Japan

syndrome was not reported. However, Dr. T. O. Sasaki, Dept. of Human Cytogenetics, Tokyo Medical and Dental University, has found a difference between the 15-leucocyte group (48-70) and group of the exposed Maruzumi no (radiation 2000 r) group (Communication 3: 3-21, 1968, *Environmental Health Agency Council (Science 157: 445-447, 1967)* and the 15-leucocyte group for estimate for atomic bomb victims with about 20 years after exposure (*Nature 220: 1189-1193, 1963*).

Taking above mentioned facts into consideration, I would like to suggest that a special field research should be done on the selected cases in near future, particularly in regard to be expected to detect the late effects.

3. Since I am not a specialist in the field of radiation dosimetry, I asked an authority of our institution. According to his opinion, the ways of estimation described in 1960 report are reasonable.

In addition to these comments, I would like to make a proposal that Trust for Japan (Government of Japan) and United Nations to have an international committee which should study of radiation exposed people including the 15-leucocyte method. Such a committee is useful to discuss several subjects as follows.

NATIONAL INSTITUTE OF BOTANICAL SCIENCES

U. S. & Japan, Zoology, A. O. S. O. Japan

Truly, I would like to take this opportunity to express my  
gratitude for the excellent results which have been obtained  
under the cooperation of the Ministry of Land, Territory, Government  
and Community, and the other authorities, even though many difficulties

  
Yoshiyuki Kumatori, M. D.

NATIONAL INSTITUTE OF RADIOLOGICAL SCIENCES


1-1-1, Chohma, Anagawa, Chiba 270, Japan

Member of Professorship (1970) - 1971

I was graduated from School of Medicine, Tokyo University in 1940 and received a degree of Doctor of Medicine. After the graduation, I entered the first Department of Internal Medicine Tokyo University as a research fellow. In October 1945 I went to Hiroshima for the survey of the victims of A-bomb victims and spent a half year in the Department of Dermatology. From 1948 to 1951 I was an instructor of the Department of Dental College.

In 1952 I was elected President of the National Institute of Tokyo. When Bikini radiation accident occurred, I was in charge of the treatment of Japanese fishermen exposed to radiation in March 1954. In 1956 I got the position of Director of the Government and studied radiation biology for about 3 years in Oxford University England. I also visited other countries, especially U.S.A. for the study in October 1967.

In 1959 I was invited to Chief of the Laboratory of Clinical Investigation, National Institute of Radiological Sciences. In October, 1962, I was invited to the meeting on "Diagnosis and Treatment of Radioactive Poisoning" by the international Atomic Energy Agency. In March 1963, I went to the Marshall Islands to observe the examination of the exposed Marshallese with U.S. Atomic Energy Commission. In 1964, I was appointed to Head of Division of Radiation Health, National Institute of Radiological Sciences. In 1965, 1966, I was invited to several European countries as a member of a panel of experts on "Medical Supervision of Man from Overseas". In August, 1970, I attended to the 13th International Congress of Dermatology which was held in Munich, Germany. I have been doing follow-up studies on above mentioned patients for over 20 years. I have published many papers on the subjects of hereditary and radiation effects on human beings.

  
Tadaaki Furumori, M. D.



stored in the punched paper tape for retrospective studies. The original film exposed in the film, then processed to an optical density of 0.4, was micro-pretreated by means of a wetting red net for 10 min and displayed on UHF for 10 min or over a plate (Fig. 8). The above procedure for slide preparation is an original method for the first time and was initiated at the school of life science and computer typewriter equipment. The microscope (100x) was allowed to photograph the slide prepared 100x and employed the program of photography of the slide and the finds made by means of the photographs for diagnosis. These findings were made by the physician in the school of life science and the information which were obtained by the above-mentioned methods. (Data available upon request).

**Chromosome Abnormalities of Japanese Fishermen Exposed to Fallout Radiation (1954-1963)**

Tashiyak, E. et al. (1971) J. Radiat. Environ. Health Phys. 10: 1-10

Twenty-two Japanese fishermen were exposed to fallout radiation by the atomic bombing of Nagasaki, 1954. The fishermen were irradiated externally by the radioactive materials deposited on the land and internally from the food which they ate. The external dose to organs and by the food which they ate to the body surface. Although the external dose was extremely low, very difficult to measure, the external dose rate of each person was estimated to be 0.001-0.01 rad/day, nearly 600-6000 rads/year, was estimated on the body. The external dose rate was estimated to be an important role in the radiation syndrome.

Follow-up studies of the fishermen have been performed since 1954. The number of persons exposed to fallout radiation was 21,742, which corresponds to about 10% of exposed fishermen.

The cytogenetic method used by us since 1964. The chromosome analysis was done by the culture method of lymphocytes in the medium did 72 hrs. culture. After 1956 examinations, 2 day culture method was adopted. The result of chromosome analysis is summarized in Table 1. The frequency of metaphase cells was 1.4%, which was not so high compared with that of

control group. The frequency of stable and unstable chromosome cells was remarkably high. Compared with that of a normal person, the frequency of stable cells was 10-20 times higher, and fairly correlated with normal examination.

From the above results, it was suggested that a close correlation might exist between chromosome aberration rate and the externally irradiated dose of each person. This correlation was examined by the analysis of 1969 survey. The aberration rate was calculated of the stable cells (300 cells on an average) of each person in each case for the calculation of dose rate. As shown in Fig. 9 the close correlation of stable cell percentage and external dose was observed (P<0.001). In addition a similar relationship existed between these aberration rate and minimum values of neutrophils, which were observed at the critical stage (4-7 weeks after exposure) and almost corresponded to the severity of the radiation syndrome of each fishermen. Fig. 10 shows this relationship (P<0.01).

Although the significance of chromosome abnormalities should be elucidated by further follow-up studies, it is noted that the examination of chromosome abnormalities is valuable for the risk assessment of radiation exposed persons.

(Unpublished)

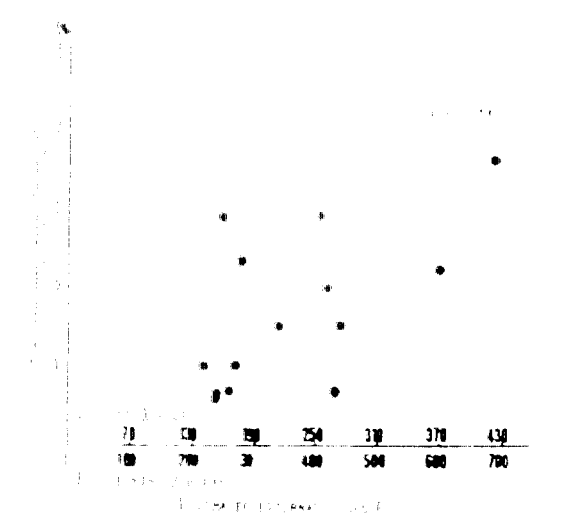


Fig. 9. Correlation between chromosome aberrations (C#) and estimated external doses.

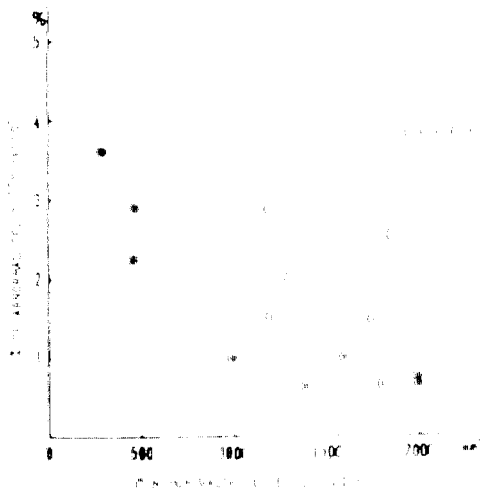


Fig. 10. Correlation between number of chromosome aberrations (X) and number of clone cells (Y) in irradiated humans.

**Common Clone Cells with Structural Chromosome Aberrations in Peripheral Lymphocytes and Bone Marrow of Irradiated Humans**

By M. M. Kohn, (a) and P. H. Taniguchi, (b) and J. H. Kohn, (a)

By the irradiation of cells of dividing growth cycle leukemia cells known to be in a state of prophase II, erythrocytes are formed in peripheral lymphocytes and bone marrow, but not in peripheral lymphocytes which are stimulated to undergo cell division by phytohemagglutinin. The evidence has not been clear that these lymphocytes might be derived from a separate source with the former three cell lines, and that there is a common stem cell. In this study we will offer evidence that the presence of a multipotential lymphohematopoietic stem cells has been suggested.

As a means of approaching the problem of the derivation of lymphocytes from the irradiated bone marrow cells of humans, the following experiments were conducted on individuals who showed presence of identical cells with structural chromosome aberrations in bone marrow were studied to determine if and whether or not clone cells were present in peripheral lymphocytes and bone marrow samples.

The results of the comparative analysis between the bone marrow and peripheral lymphocytes of the three cases are presented in Table 1. In case

RT1, both common clone cells in the two tissues displayed the same 4,YY and Th3.

In case RT2, one of the fishermen exposed to the atomic bomb at Nagasaki in 1954, a clone with a 4,YY and Th3 karyotype occurred in the bone marrow with a frequency of about 10%. In the peripheral lymphocytes of the 600 cells (0.58%) showed the same karyotype of the clone.

In case RT3, a patient injected with Thorotrast in the past had 30% cells (4%) in the bone marrow and 1% of peripheral lymphocytes (2%) in the blood cultures showing identical karyotype of 46,XY, Gq-, Th3, Th4.

In case RT4, a cervix cancer with hypoplastic erythropoiesis and chemotherapy, nearly 100% of the cells in the bone marrow were members of a single clone with a karyotype of 46,XX, t(Bp+Co-) and Th3, Th4, Th5, but none of the 273 cells in the peripheral lymphocytes cultures showed this karyotype.

The identification of cells with the same radiation induced markers among the dividing cells in peripheral lymphocytes and in bone marrow in case RT1 and RT2 seem to be conclusive evidence for the presence of a lymphohematopoietic stem cell in the dividing both lymphoid and bone marrow stem cells.

The present data from irradiated humans clearly demonstrate that B-are positive peripheral lymphocytes and erythrocytes of the same stem cell for peripheral lymphocytes, but they do not explain the presence of the same Th3 chromosome in chronic granulocytic leukemia of the clone cells of case RT1. Why Th3 is absent in the majority of the cells in peripheral lymphocytes is a serious problem to be solved in the future.

(Unpublished)

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CONFIDENTIAL

Department of Clinical Research  
University College Hospital Medical  
School  
1 University Street, London WC1E 6JJ

HKT  
Medical Research Council

Telephone 01 - 287 9300 ext 188

reference

6th November 1977

To: The Council  
The Scientific Committee (through  
Rajapur and H. Hill) Agents  
General of Harwell

Sir,

I have pleasure in reporting to you on the medical examinations made during September 1977 by the staff of the National Laboratory team and their consultants, and on the results specified in the Memorandum of Understanding between the consultant Hans Wiliander and the consultant to your Committee.

I have made the same first examination of the thyroid, and either observed or supervised the examination, of the majority of the thyroid gland, of most of the people exposed to the accident, and of about 60 of the 8 people who have been or will be examined. I have also examined microscopic sections of thyroid glands removed at operations on these people, and have studied reports on previous examinations of the histology of radiation dose.

I will comment on the above in detail in the Memorandum of Agreement but I think it may be useful for the Committee if I refer first to the aims of the programme of the National Laboratory.

It seems to me that the service of the National Laboratory has had, three aims which are to a large extent interdependent.

(a) As a primary purpose to evaluate at an early stage any radiation-induced malignancy, and to see what treatment can be given, e.g. by removal of lymph nodes to prevent malignant development, and of malignant nodes to prevent metastases, and to see if the thyroid or the neck, or to see if any operative treatment is designed to prevent such changes occurring (e.g. by giving "thyroid").

(b) In addition, to maintain a record of the frequency of any observed thyroid or other change, in relation to the radiation exposure of thyroid glands. This material is of course to be made anyhow as under (a), this record involves a full clinical examination or study except of the normal changes of thyroid gland in people who have not been exposed, and of the radiation dose that they have been received by those exposed. It is of great importance in the proper planning of radiation protection programmes to know the changes that may

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occur after a given exposure and the frequency with which they occur. This incident is of course of the greatest importance, for example in the case of nuclear fallout, in biological protection, and in the field of environmental medicine, and the effects of Atomic Radiation, particularly in view of the special clinical examinations that are made in the hospital.

(c) The following treatment, or special treatment, for any condition detected by the general medical examinations, although unrelated to radiation, is available in a strongly qualified and equipped institution. In many cases, extensive examinations in any case, to determine the exact nature of the condition, the team would wish to carry out a number of special examinations as well. In fact I think that this was the main purpose of the visit: clearly occupied a major portion of the day. A general "sick-call" for any ill members of the community was held on each day (in Rongelap at 11:00), and each patient's case was discussed in detail by the whole group. In the field of different findings (clinical examinations, blood examination, etc.), the rather full clinical examination of the radiation exposed persons was also supplemented by eye examinations and electrocardiograms, and chest X-ray and urine examinations in many cases, and these had a significant value in general medical surveillance, as indicated by the special tests which were unrelated to radiation, which were of course.

Coming to the point, there is a general agreement.

(d) It is difficult to say to what extent an interval is necessary, but tests which have been done on this visit in two people, and particularly further, the results of the examination of thyroid function (the latter being supported partly by the chemical analysis of the blood samples) and the condition of the nodules, rather prompt action: for the nodules, to determine by surgical procedure that they are benign and that they cannot be malignant, or to carry out appropriate operation if either should prove to be malignant. In the case of depression of thyroid function, I would like to start with a low dosage of thyroxine ("Synthroid") dosage.

I understand that the radiation exposure has been found to have a significant leucopenic effect, and this will require immediate measures, probably in the form of transfusion.

The thyroid nodules of the type of those called radiation are relatively rare, and even if they are not, the apparently successful complete removal of them has given the impression of being reassuring. Whether this would be the case in the case of the present examinations is uncertain. There is no doubt that it is possible, however, even at this stage after exposure to radiation, to detect a nodular lesion, since annual thyroid examinations are being carried out. If a nodular lesion is detected early enough, it can be completely removed before it has spread too far.

to be removed.

11(B). General examination: I appeared to me to be extensive, detailed and carefully done. In particular, the clinical examination of the thyroid was undertaken by one of the team and one observer, with the others of the team and the other observers also in any case of doubt. The laboratory tests used highly sensitive modern methods of detecting any trace amount of any actual depression of thyroid function (by measuring the basal concentration of the thyroid stimulating hormone as well as of the thyroxine itself). They are in general of the same type as the methods that I use in my own work in the detection of depression of thyroid function. Apart from additional tests that were occasionally done to serve of thyroid function (by in effect thyroid stimulation, and in a few cases), these are the orthodox routine tests commonly used in advanced thyroid clinics - provided thyroid work is done in a specially arranged outside the Trust facilities. It showed no abnormality.

I therefore do not see other types of tests which should be added, or any present ones deleted. The fact that tests for radiation effects which might be added could be done as a matter of opinion whether any tests carried out in general medical care and surveillance, and particularly for the detection of radiation effects, for example by electrocardiogram or test for liver function, should be deleted. If an expert team of such necessary capabilities were available on these islands in any case, and if they were able to detect a disease that had not otherwise been detected, it would not be appropriate to delete them, even though from the narrower point of view of radiation deletion would probably not impair the necessary care of these patients. As regards to purely radiation induced effects, where a small amount of medical examination is available to these (and other) islands free of charge, therefore, it would seem to me wrong to diminish this present health protection, even though the size of the team could be reduced if the work were confined to radiation effects only, and if such a reduction and general surveillance were excluded. As regards the fact that it could be held that the exposed islanders may actually have a better health than other islanders, by virtue of non-radiation diseases detected and treated and despite the radiation induced diseases which have required treatment.

11(C). With a little remark I was able between most members of the team and the people examined, an atmosphere of trustfulness could easily be created, and I should consider that in many examinations that I saw were inconceivable. It was particularly obvious that Dr. Conard was being greeted as a friend, and his own gentleness and charm in dealing with children and young people was very evident. In general the difficulties seem to be only of the kind, for example, I find in London in examining a patient with whom there is no common language: namely that one cannot verbally express the symptoms and indicate in detail

what examination was conducted to help to explain the purpose of such an exam.

It was of a surprising value that the first examination first obtained from a patient who had been examined by a doctor of any symptoms they had, a doctor who had the means of the "standard" examinations. In addition, if any abnormality was detected, it was suspected from the examination to be a thyroid condition. The patient's questions to amplify the history of the condition were the only ones that the doctor understood the position and was completely able to understand that this arrangement was unusual for the 1972 situation. I do not expect that difficulties in communication will have been a problem for any of the patients, particularly in view of the high proportion of the patients who are of a positive personality.

On the 14th of October, 1972, a group of irradiated people had questioned why they should have been asked to be exposed to a blood sample and other tests. I was asked to hear this since, if so, it would imply that they had been clearly asked for, or understood that the value of the tests was that such help would be valuable, or at least, in the long term, of their irradiated fellow people. The patient's question that if, for example, thyroid nodules were common in irradiated people, and if they progressed to malignant forms, they would not expect to see them appearing in the exposed people might be quite valid. It is true that nodules were rarely seen in the unexposed population, but the lack of a means of communication at the time of the examination, and the fact that they were asked for and interpreted as a matter of fact, is a matter of fact.

(c) The thyroid nodules removed at operation and the thyroid gland in the patients with the diagnoses - of benign or malignant forms - that have been made by the pathologists who have examined or reported on them, and the patients who are interned in the hospital, are expected to be of pathology.

(d) The thyroid gland in the patients who have been of normal and orthodoxy, and the thyroid gland in the patients who have been of pathology.

In particular,

(1) The treatment of any rigidities or depression of thyroid activity by a synthetic form of the preparation of the case 'Synthroid' - is a routine, and the thyroid gland test (if the patient has iodine and, when the test is available, then the patient is given a stimulating hormone) enable deficiencies to be detected. In addition, the whole weekly dose of Synthroid is given in a single tablet, and the patient given the slow utilisation of the hormone, and the patient is given the appropriate average will be given a total of 100 mg. daily given daily. It is of course important that the patient is given the correct supplies of tablet, and the patient is given the appropriate supplies.

(ii) A temporary cessation of the administration of Synthroid is necessary when tests for residual tumour are needed in patients who have been treated for thyroid cancer. This was done in the four affected patients in 1948. The only other method then used was in my view longer than needed and I believe I raised this point with Dr. Conard. I fitted 10 patients on Synthroid for 3 months were used (1 of whom died of the disease) for the tests. The effect of this withdrawal of Synthroid was not, substantiated by the return of any of the hypothyroid symptoms, and at least in all 10 cases no evidence of the persistence of tumour tissue was observed.

(iii) The administration of Synthroid preparations to decrease the likelihood of the development of cancer is generally accepted practice and the reports were made on this basis. The basis for this practice is a theoretical one (the stimulation of the thyroid cells by the high blood concentration of Synthroid stimulating hormone) and it is not known for certain how likely this is. It cannot be completely excluded that some malignant tumours in this year in a young woman who was treated by this method.

(iv) The removal of "benign" tumours in general medical practice if they arise in an elderly patient or in an elderly people and often also in older people if they do not respond to thyroxine administration. When they do respond to thyroxine administration and if only occurring rarely in units of well people of the average age and day of life, there is a much stronger case for removal of the tumour to avoid possible malignancy.

2(b). The section proposed on the basis of the finding on these lines appear appropriate and adequate. I do not share the opinion in the team that the nodules really removed from the elderly people (by the time of my leaving thyroid cancer) be removed since they are whatever removal of thyroid tissue and of lymph nodes is necessary by their histological nature (benign or not proved).

A particular problem arises as to how to test for the completeness of removal of any thyroid tissue. Each of the four people from whom thyroid cancer was removed were examined in detail at the time of operation, and by careful examination of the specimen to exclude any remaining tumour tissue and to evidence any remaining tumour tissue. They have in addition had several RBC which are expected as showing no concentration of radioiodine in the thyroid gland. The results of these tests indicate tumour tissue to be removed in all the cases. There have been found except in positions considered as remaining tumour tissue. As we have discussed in detail with Dr. Conard certain additional sensitive tests that we currently use for the administration of these tests present greater difficulties than those that are used, either because of the high concentrations of a characteristic radioiodine in the blood or normally in the blood





of the relevant portion of exposure.

The kinetics of internal exposure to the thyroid phases depend upon three aspects of absorption:

(i) The size of the thyroid gland, which the radioactive iodine was taken up in, and the age of the gland (size varies with age). Estimates of gland size taken from various countries do not vary greatly, and the rates used for the Marshallese children, in the absence of direct data, are probably reasonable.

(ii) The species of radioiodine which enters the body, and whether by inhalation or ingestion (and the effect this affects the time and duration of exposure). The type of radioiodine present at any time since the release is the present basis of physical grounds, and the assumptions and duration of exposure are reasonable.

(iii) The amount of thyroid iodine incorporated in the thyroid and hence the radiation exposure to glands of any given size here the exposure had to be based on the amounts of the amounts excreted in urine in the period of 100 days after exposure, and on assumption of the proper fraction of initial uptake that will be excreted during that period. The original assumption was that 0.01 to 0.2% of the initial uptake would be excreted on that day. I have recalculated this figure on the basis of the best later estimates of which I am aware and am specifically for the iodine from the normal thyroid and its appearance in the urine is probably a figure of 0.00% in good agreement with the estimate of the original assumptions. I have also seen a calculation by Dr. J. H. Berman based directly on measurements of iodine excretion in Marshallese people. This gives a slightly higher figure, and the estimate of radiation exposure as based on the measured excretion. It should also be added that, if the thyroid radiation dose differs from any of these (normal) values, it would be affected by excretion of iodine from the gland, and perhaps also by excretion of iodine excreted in the urine. Both these changes would affect the estimate of thyroid dose. The average thyroid dose may thus be somewhat lower than estimated, and it seems unlikely to have been significantly higher. It is emphasized however that these are estimates of the effective dose from internal radiation, based on the best available data. It is likely to have differed considerably from the external dose for their age, owing to individual variations in size of thyroid gland and of contaminated water drunk, and in the amount of iodine from the thyroid gland.

I apologize for the considerable length of this report and recognize that most of it deals with technical or medical detail. I feel however that, on general grounds of the type which your Committee has been dealing with, which it has returned, it was

CONFIDENCE

preferable to state the basis for an opinion, even if the detail is technical, than to give a bare conclusion without supporting reasons. I hope that my comments will be equated with the information and opinion that you require, and if they will not hesitate to raise with me any other questions that the Committee may wish.

Yours sincerely,

Dr. J. W. Foster, CMI, MD, FRCP.

Dr. E. A. Rieu (1904-1980) (M.D.) (Ireland)

Director of the (British) Research Council's Department of Clinical Endocrinology in Westminster Hospital Medical School, and consultant endocrinologist in St. Mary's University College Hospital, and a former Lecturer in the University of London.

Fellow of the Royal College of Physicians since 1949, and member of its Council from 1966 to 1972. Member of the Association of Physicians of Great Britain and Ireland, of the Royal Society of Medicine, and of the Irish Medical Association. Chairman of the Ethics Committee of the School of Hospital.

Engaged since appointment in the Department in 1946 in clinical work in thyroid and other endocrine disorders in medical teaching, and in research, particularly into the aetiology, diagnosis and treatment of thyroid disease, the function of the thyroid gland, and the study of the diagnosis of the disease and the early stages of thyroid cancer; and author of various papers on thyroid endocrinology.

Member of the Endocrine Thyroid Group of the Thyroid Club of London, and (corresponding member) of the International Thyroid Association.

Member of the International Commission on Radiological Protection, formerly Vice-President (1959-61) and President (1962-66) of this Commission and member of the Committee of the Council on Base.

Member formerly Chairman of the Joint Medical Research Council's Committee on the effects of ionizing radiation and member of its Committee of Enquiry (1961).

Member of the British Institute of Radiology, and Honorary Member of the Faculty of Biologists (London) and the British Protection Association and the European Association of Biologists.

UK Representative on United Nations Panel of the Committee on the effects of Atomic Radiation since 1956, and formerly Chairman of its Biological Section.

1950-1951

Proceedings of the 1950-1951 Session  
of the National Academy of Sciences

1014840



BROOKHAVEN NUCLEAR LABORATORY  
ASSOCIATED UNIVERSITY HEALTH CENTER, UPTON, NEW YORK 11973

MEDICAL DEPARTMENT

TELEPHONE (516) 345-3577

UPTON, NY, 1972

Senator Olympia Snowe  
Chairman, Special Select Committee  
Concerning Rongelap & Utirik Atolls  
Congress of Micronesia  
Saipan, Marianas Islands, 96950

Dear Senator Snowe:

Thank you for your letter of October 17, 1972. I was glad we were able to successfully complete the medical examinations of the Rongelap and Utirik people. I am sorry you were not able to be with us. Please extend to your Senator Willander and other members of the committee the warmest of our appreciation for their efforts in helping make a most successful survey. I am also most grateful for the help of the distinguished physicians of the medical observation program who have been actively in the medical examinations and administration of the island to the success of the survey.

I am enclosing a copy of the report and a separate letter summarizing the preliminary work of the medical examinations. I am most regretful about the loss of the Rongelap and Utirik and only assure you that everything possible is being done for aid.

With regards to your return visit to Rongelap and Utirik, I would like very much to send an official statement to the peoples of these two islands concerning the results of our examinations in September. I will have the statement translated into Marshallese and will send you the translations prior to your departure. You will know where to send the report to leave.

If I can be of any further help, please let me know.

Sincerely,

*Robert A. Conard*  
Robert A. Conard, M. D.

RAC:ls



BROOKHAVEN NATIONAL LABORATORY  
 ASSOCIATED UNIVERSITY OF CHEMISTRY AND PHYSICS  
 UPTON, NEW YORK 11973

MEDICAL DEPARTMENT

TELEPHONE (516) 345-3577

October 13, 1972

Mr. Bill Leiby  
 Staff Member  
 Special Infectious Diseases Consultant  
 Rongelap and Utrik Atoll  
 Congress of Micronesia  
 P.O. Box 1000  
 Majuro, Marshall Islands 96960

Dear Mr. Leiby:

Thank you for your letter of October 4, 1972. You requested a rough sketch of the survey. The following summary must be considered preliminary in nature. The medical records and equipment that you received from the islands. I understand that the quarantine camp at the Utrik Atoll was held up the Militobi department of the Utrik Atoll. The camp material was to be airshipped from Utrik.

You will remember that during the survey we were able to complete the examination of the Rongelap and Utrik people at Eberle Island. The health examinations were performed at Rongelap, Utrik and Majuro.

Group	Utrik	Utrik	Majuro
Rongelap (adult)	27	0	9
Children of Rongelap	3	0	14
Utrik	0	40	30
Rongelap (adult)	0	2	8
Children of Rongelap	0	0	6
Total	30	42	67

In addition, a large number of other people were examined and treated in visiting sick call at sick call each morning at Rongelap and Utrik. At Rongelap a number of severe gastrointestinal and respiratory complaints were upper respiratory infection and, in some cases, pneumonia were treated. At least a dozen children were hospitalized. A total of 100 people were treated at sick call at Rongelap. At Utrik a number of children (26 in one month) were hospitalized and treated for various ailments. At

Mr. Brian Farley, 2000, 10/14/1993

Majuro also treatment was recommended and the people examined to the local medical facilities. In the islands, in trying to promote a better communication between the examining physicians and the Marshallese examined, an attempt was made at the beginning of each examination to explain to the person being examined the general results of the examination and the recommended treatment.

At each island there were conferences with the physicians, including the medical case workers, Dr. Kiff, and the health aide, to evaluate all cases examined and to recommend treatment and disposition. In some cases, the health aide was advised on further treatment. In other cases, Dr. Kiff was asked to treat all cases on his return visit to the island. In other cases, referrals to the Majuro hospital were recommended for further examination and treatment. At Rongelap there were two hospital cases and at Bikini five cases. We took them with us on the flight to Majuro. None of these people appeared to have conditions related to radiation exposure. When we left Majuro at the end of the survey, the two Rongelap women were being further examined. Two of the Bikini cases were found to have conditions that could be treated within the island and they were to be returned to the other case for further medical consultation.

There were important findings in another group of people who lived at Majuro. Two young exposee girls had thyroid nodules since last examined in 1976. They were (female, age 19) who had been exposed at one year of age on Rongelap. The other girl was (female, age 12) who had been exposed in Rongelap at age 12. Surgical removal of the nodules is not necessary. Dr. Brown Dobyns at the Cleveland Metropolitan General Hospital, who operated on many of the other Marshallese thyroid cases, has agreed to operate on these as soon as it is possible to arrange transportation of the patients to Cleveland. Preliminary arrangements have already been started for this.

The third case was a boy, (male, age 19, who was exposed at one year of age on Rongelap. We found to have a low white blood cell count and the surgeon's white count later in the survey was even lower. This boy had previously had thyroid surgery for removal of benign nodules of that gland in 1965 and when last examined in March 67 he was found to be healthy. In view of the alarmingly low blood count and after consultation with his father, we took him with us to the Army Hospital in Honolulu. They were unable, however, to get a successful examination examination and we decided to take him to the Brookhaven Laboratory. I am sorry to report that the diagnosis of acute lymphocytic leukemia was

PRIVACY ACT MATERIAL BEING REVIEWED

Mr. Brian Farber, Director, Office of Radiation Protection, October 25, 1972

established. In view of the extent of treatment that would be needed for this patient, we arranged to have him admitted to the National Cancer Institute, Clinical Center, Bethesda, Maryland. This is the leading hospital in the United States for treatment of such cases. On October 25, a food plane was sent down by hospital plane to Maryland. Arrangements were being made that the mother and father of the patient be sent to Washington, D.C. as soon as possible at AEC expense. Also, John Moninger, health aide at Majuro was requested as interpreter. The father, John Wajain and Sebeo, arrived Friday, October 27, and with the patient. He have not yet been notified of the arrangements for their return travel.

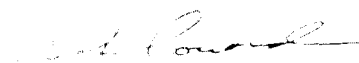
Examination of the Mirik people did not reveal any unusual or unexpected conditions that might be related to radiation exposure. The incidence of thyroid abnormalities was quite low and not different from that to be expected from any population.

At both Rongerik and Mirik, recommendations were made to the Trust Territory health services concerning requisition of certain additional drugs and equipment and checking of drugs and so on. A better arrangement for local medicine keeping on the islands was discussed including data from our medical examinations, thyroid treatment and transfer of such information when individuals move to another island. These matters are still under discussion.

After our reports have arrived and analyses of blood data have been made we will be in a position to report more comprehensively on findings of the past survey. If you need any further help at this time please let me know.

With best regards,

Sincerely,



Robert A. Conard, M. D.

RAC:ls

P. S.: I am enclosing an updated list of thyroid lesions to include the latest examinations.



THYROID LESIONS IN MARSHALL ISLANDS TO BANGON  
(AGE OF EXPOSURE 0-17)

Marshall Island group (radiation dose-gamma)	Age at exposure	Estimated thyroid dose (rads)	Number of children percent <sup>2</sup>	Thyroid surgery	Malignant lesions percent <sup>2</sup>
Rongelap (175 rads gamma exposure)	0-10	400-1400	1/19 (1/19)	15	5.3 (1/19)
	10-20	335-1000	1/8 (1/8)	0	-
	20-25	300	2/26 (1/13)	2	7.7 (2/26)
	25-30	200	3/53 (3/53)	17	5.7 (3/53)
Rongelap (on Ailingnae Island-69 rads gamma exposure)	0-10	200-1000	1/6 (1/6)	0	-
	10-20	132 <sup>3</sup>	1/8 (1/8)	1	-
	20-25	100	1/14 (1/14)	1	-
Utirik <sup>5</sup> (14 rads gamma exposure)	0-10	46-800	1/55 (1/55)	0	-
	10-20	22 <sup>4</sup>	1/69 (1/69)	1	1.4 (1/69)
	20-25	100	1/124 (1/124)	2	0.8 (1/124)
Rongelap unexposed	0-10	0	1/6 (1/6)	0	-
	10-20	0	1/53 (1/53)	1	-
	20-25	0	2/94 (2/94)	1	-
Likiep unexposed	0-10	0	1/31 (1/31)	0	-
	10-20	0	5/106 (5/106)	0	-
	20-25	0	5/137 (5/137)	0	-

<sup>1</sup> Dose from 131, 132, 134, 135 plus gamma dose.

<sup>2</sup> Based on number living. In parentheses number of cases/total number in group.

<sup>3</sup> One child 10-17 years of age at exposure received estimated thyroid doses between 132 and 200 rads.

<sup>4</sup> Fifteen children 10-17 years of age at exposure in this group received estimated thyroid doses between 22 and 45 rads.

<sup>5</sup> The more energetic short-lived isotopes of fission contributed less to the total thyroid dose in the Utirik group due to large distance. One might surmise therefore that the biological significance of the thyroid lesions present would be less in that group.

<sup>6</sup> In addition to thyroid lesions, one case of acute myelogenous leukemia was discovered in a 19-year-old Rongelap boy who had received 175 rads gamma radiation at 1 year of age.

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DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE  
WASHINGTON, D. C. 20492

August 27, 1970

SURGEON GENERAL  
OF THE  
PUBLIC HEALTH SERVICE

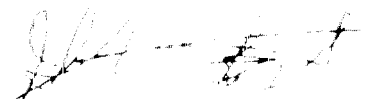
Senator Olympic B. Borja  
Chairman, Special Joint Committee  
Concerning Rongelap and Ujae Atolls  
Congress of Micronesia  
Saipan, Mariana Islands (Guam)

Dear Senator Borja:

Enclosed is the report of Dr. William S. Cole,  
summarizing his recent visit to the Trust Territory.

I hope this report and Dr. Cole's attendance at your  
recent Subcommittee's investigation will be useful  
to you. We, of course, continue to be available to  
assist the High Commissioner if the Congress of  
Micronesia in whatever way may be appropriate.

Sincerely,  
Jesse

  
Jesse A. Steinberg, M.D.  
Surgeon General

Enclosure



DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE  
PUBLIC HEALTH SERVICE  
BUREAU OF RADIATION PHYSICS AND HEALTH  
WASHINGTON, D. C. 20201

JULY 20, 1972

Senator Olympic B. Borja  
Chairman, Special Joint Committee  
Concerning Rongelap and Utiirik Atolls  
Congress of Micronesia  
Saipan, Mariana Islands 96930

Dear Senator Borja:


The attached document represents my report to you as an invited radiological consultant from the United States Public Health Service during the visit of your Committee to Mafua, Utiirik, Rongelap, and Kwajalein (Ebeve) Atolls on July 18-21, 1972.

In order to conduct the subject matter, I have made my observations and recommendations on the findings on Rongelap and Utiirik although we interviewed some of these people on Mafua and Ebeve.

My report will be released to you through the office of Surgeon General Jesse W. Steinfeld, Department of Health Service, as you requested at the Executive Session of your Committee on July 20, 1972.

I trust my report will be of assistance in the preparation of your official report to the Special Session of the Congress of Micronesia on August 13, 1972.

Sincerely yours,

  
William S. Cole, M.D.  
Associate Director  
Bureau of Radiological Health

Enclosure

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20

REPORT OF FIELD TRIP TO THE MARSHALL ISLANDS, TRUST TERRITORY OF  
THE PACIFIC ISLANDS, AS A RADIOLOGICAL CONSULTANT TO THE SPECIAL  
COMMITTEE CONCERNING RONGELAP AND UTIRIK ATOLLS, CONGRESS OF  
MICRONESE, ON JULY 24, 1954

Introduction

This is a report of my observations and recommendations based on a field trip in the Marshall Islands, Trust Territory of the Pacific Islands, with the Special Committee composed of the following individuals:

Senator Olympia T. Berja, Chairman  
Representative Tamatoa Tikerifi, Member  
Representative Hans Willander, Member  
Representative Atala Balos, Interpreter  
Dr. Masao Kumagai, Deputy Director of Health, Trust Territory  
Mr. Brian M. Farley, Researcher, Trust Territory  
Dr. William N. Cole, Radiological Consultant  
Mr. Henry Moses, Majuro Atoll, Interpreter

The purpose of the visit to Rongelap and Utirik Atolls was to interview those people living on those islands at the time of the detonation of the thermonuclear device at Bikini Atoll on March 1, 1954. This resulted in exposure to fallout radiation of those people due to an unpredicted shift in winds at the time of the explosion. Sixty-four persons on Rongelap received an estimated 175 rads of whole-body radiation and severe contamination of the skin; an additional 18 Rongelap people on a fishing trip received an estimated 68 rads of whole-body radiation; and 157 people on Utirik received an estimated 18 rads of whole-body radiation. Twenty-three Japanese fishermen aboard the vessel, the Lucky Dragon, also received significant whole-body radiation. These data are reported by the Brookhaven National Laboratory Medical Survey Team.

In the 18 years following the radiation exposure, an undetermined number of the exposed persons have died and others have moved to different atolls. The Committee for this reason interviewed people on Majuro and Ebeve. The four sessions were attended by approximately 300 people including exposed persons, families of deceased exposed persons, and numerous persons of the control groups. Although the interviews were carried out through Marshallese interpreters, there was little difficulty following the proceedings.

The Chairman of the Committee, Senator Olympia T. Berja, presided at each of the four sessions. At the close of each session, he stated the purpose of the visit of the committee was as follows:

1. To determine the extent of personal injury to the people of Rongelap and Utiirik Atolls as a result of radiation exposure.
2. To determine the extent of the damage to the land and trees.
3. To obtain additional medical examinations and treatment.
4. To obtain reasonable and just compensation for personal injury and damage to the land and trees of Rongelap and Utiirik Atolls.

### Observations

#### A. Medical Problems:

The examinations conducted by the medical team from the Brookhaven National Laboratory are not resented by the involved people, both exposed and control groups. I am deeply concerned that the Marshallese have apparently lost confidence in the medical examinations and the aborted effort in March 1966 did little to restore it. I am of the opinion that a major source of trouble has been a lack of understanding by the people of the purpose of the examinations. At all four sessions, it was repeatedly asserted by the people that they were not informed of the findings and that treatment and medications were not available. The people attribute any and all sickness to the effects of the radiation and believe that the medical team should treat them. The control groups appear to most resent the examination because of the lack of understanding as to its purpose. For example, the people of Utiirik asserted they were told they were not injured and therefore not entitled to compensation, yet were forced to submit to the examinations. As a result, many refused to be examined. They resent the taking of large samples of blood and feel that they should receive compensation for the procedure.

I repeatedly heard that the involved people will submit to additional examinations in September or October and that independent physicians from Japan, WHO, and the National Institute of Health will accompany the team.

The Health Aides of Rongelap and Utiirik have difficulty in administering the prescribed therapy medication due to the lack of written records on the patients. The Aides on Rongelap stated they thought the records were in the trailers but were not available to them. There are apparently no records in Marshallese for the use of the Health Aides or Medical Practitioners that periodically visit the Atolls.

At all four sessions, the women repeatedly stated that there have been more miscarriages and abnormal babies on Utirik and Rongelap since the explosion. Those women who stated this occurred during the first year after they returned to their Island. Specific dates and instances could not be determined. Apparently there were four abnormal babies born to the exposed women of Rongelap who were not pregnant at the time of exposure. After much discussion among themselves, the physician for the women stated that there did have to be a change in the number of miscarriages on Rongelap.

According to statements made at the sessions, approximately 19 exposed persons living on Rongelap at the time of the explosion, who were under the age of 40, have developed thyroid nodules requiring surgery. Although biopsy reports indicate only 2-3 of these to be malignant, the involved patients believe that all have cancer. They are not able to distinguish between benign and malignant lesions. It is apparent that some of these patients are not taking thyroxine as instructed. I emphasized at all four sessions that the prescribed medication was necessary for their health and welfare.

In summary, the apparent lack of communication and understanding between the people and the medical team has been a major problem. There have been difficulties with interpretation between English and Marshallese in the past, but this is not the major factor.

#### B. Compensation:

Although I did not actively participate in the sessions devoted to compensation, the following complaints were registered:

1. The exposed people of Utirik and Ebeye believe that they have sustained physical injury from the radiation and are entitled to just compensation. Those now living on Majuro and Ebeye stated they wanted to return to their home but were afraid of the radioactivity that remains.
2. The exposed people of Rongelap have believed that the compensation paid to them in 1964 was adequate because of the thyroid abnormalities that have developed since that time. The Rongelapese now living on Majuro and Ebeye will not return to their home because of the residual radioactivity and the fear of a future outbreak.

3. The people of both Atoll and the land and trees were damaged by the radiation and the trees should receive just compensation for this damage. They should agree to have such compensation placed in trust for the good of both groups.

4. The control groups believe they should receive compensation for submitting to the medical examination.

C. Recommendations:

As a physician concerned with the health and welfare of the exposed people, I urge that the next medical examination proceed without further delay. In order to have the examination proceed without difficulty, the following recommendations should be seriously considered by the Special Joint Committee:

1. Independent physicians from Japan, WHO, and the U.S. Public Health Service should accompany and rate individual reports to the Special Committee.

2. The physicians from Japan should be:

Dr. Haruo Ezaki, University of Hiroshima  
Dr. Toshiyuki Kumatori, National Institute of  
Radiological Sciences

The importance of the presence of these two physicians cannot be overemphasized. In my opinion, if they are not present the involved people will refuse to be examined. Due to possible complications in clearance of these physicians, the proposed date of September 7, 1954, may have to be delayed.

3. The Director of Health, Trust Territory of the Pacific Islands, should be requested to send Medical Officers with the examining team to treat local diseases. Such treatment would be advantageous from a public relations standpoint and should lead to more cooperation by all concerned.

4. Every effort must be made to improve communication between the physician and the people under study. A better understanding of the purpose of the examinations would remove an apparent major source of resentment now evident. A written translation of the major findings into Marshallese should be made for the use of the Health Aides and the Medical Personnel.



Page 5

5. The Trust Territory should provide additional medical examinations and treatment to the people of Utirik and Rongelap. This would supplement that provided by the annual surveys by the Brookhaven National Laboratory Medical Team.

APPENDIX B

Statement of Dr. W. H. Rouse Ball, Secretary of the Royal Society, on the Result of  
Their 1904 Investigation

(From *National Geographic Magazine and the Smithsonian Miscellany*, Dec. Program, 1907)

"The estimated whole-body gamma dose for those evacuated from the island of Utirik following the March 1, 1954, detonation at the Pacific Proving Ground was about 15 roentgens for a period of about 10 days, but no beta burns appeared. It is fair to assume here that direct contamination took place due to their mode of living, including swimming that was common due to air currents. Gamma dose rate readings were taken over the bodies of natives at about H+78 hours both on the beach and after boarding the ship. In the latter case the personnel readings averaged about 1 mR per hour, and this probably included some contribution from the ground contamination. The wading through the surf and boarding the ship, the levels averaged about 1 mR per hour gamma.

"The 18 natives of this island, Ailingiap, received an estimated whole-body gamma dose of 15 roentgens in about 10 days. Of these, 14 later experienced slight beta burns, 2 had mild burns, and none showed epilation.

"In the case of the Rongelap natives, the estimated whole-body dose was about 170 roentgens in about 10 days. All of them later experienced beta burns to some degree, but slight to severe, and about half of the natives showed epilation from slight to severe.

"The 16 natives from Rongelap evacuated directly by air to Kwajalein had personnel gamma dose-rate levels generally below 1 mR per hour although 1 was as high as 1.40 mR per hour and 1 was 1.40 mR per hour (at H+ about 55 hours). The remaining 10 natives evacuated by sea were reported to have personnel readings that "averaged" 60 mR per hour before decontamination. The picture is further confused because some of the natives had bathed and some had not before the arrival of the evacuation fleet.

"Most of the 28 United States servicemen stationed on Eniwetok Island, Rongerik Atoll, received about 400 roentgens, based on film badge readings. Three members of the group were away for a part of the time in another section of the island and were reported to have received somewhat higher doses. Seventeen of the twenty-eight personnel showed only slight, superficial lesions with no questionable cases of epilation. It should be pointed out that the personnel were in help boats during some of the fallout time and returned to the time place after the initial evacuation. This reduced the direct radiation dose and hence the whole-body gamma dose. A film badge hanging on the center pole of a boat at the end of the island read 98 roentgens. The readings based on personnel readings at another part of the island indicated somewhat lower doses. Personnel had remained in the open for the period of time from fallout (about H+7.5 hours) to evacuation (at about H+34 hours). Upon arrival at Kwajalein, personnel gamma dose rate reading was as high as 20 mR per hour at about 100 hours.

"The above data thus show that there is a reasonable rough bracketing of gamma-beta dose levels for those evacuated from the natives from

Utirik received an estimated whole-body gamma dose of 25 roentgens and showed no evidence of burns. On the other hand, the natives on Sifo Island, Ailinginae Atoll, received about 75 roentgens whole-body gamma dose of 75 roentgens, with 14 personnel showing first degree burns, 2 moderate burns, 2, no burns, 3 with moderate epilation, and 11 with no epilation. In addition, Rongelap native received 170 roentgens whole-body gamma dose, and about 90 percent showed some degree of burns and 10 percent some degree of epilation.

"It is to be recalled that: (1) the natives probably were out of doors and received the fallout; (2) they were hair, seminaked, perspiring bodies, including bare feet, and hence, standing for most, would tend to collect and hold fallout without much delay; (3) the time of delivery of essentially all of the doses was 1 to 3 days; (4) it may be speculated that the fallout on the more distant islands (about 300 statute miles) would consist of smaller particles and hence, a lower possibility of overlapping of radiation from the other islands."

7/24/57

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(From Railroad No. 1-2-1000 and 1-2-10000 of New York, 1957)

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MEASUREMENTS OF WIND VELOCITY AND DIRECTION AT 2000 FT

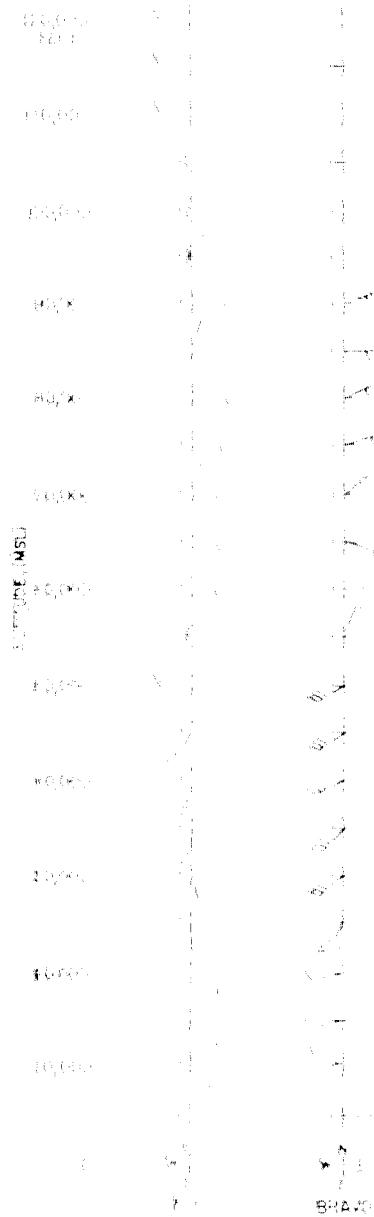


Figure 1. Wind velocity and direction at 2000 ft. The wind velocity is in m/s and the direction is in degrees.

MAP OF THE TROPICAL ISLANDS OF THE PACIFIC OCEAN

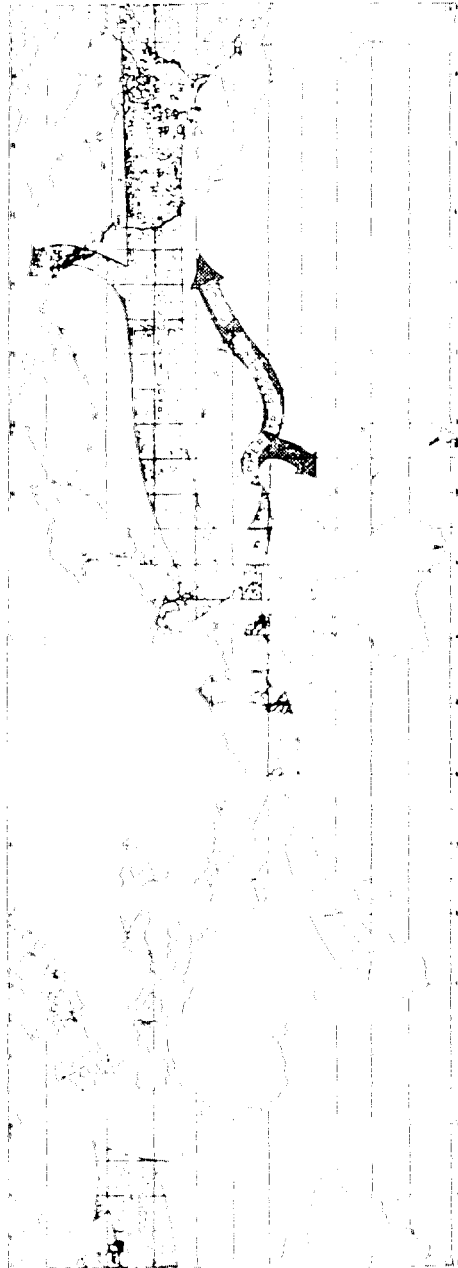
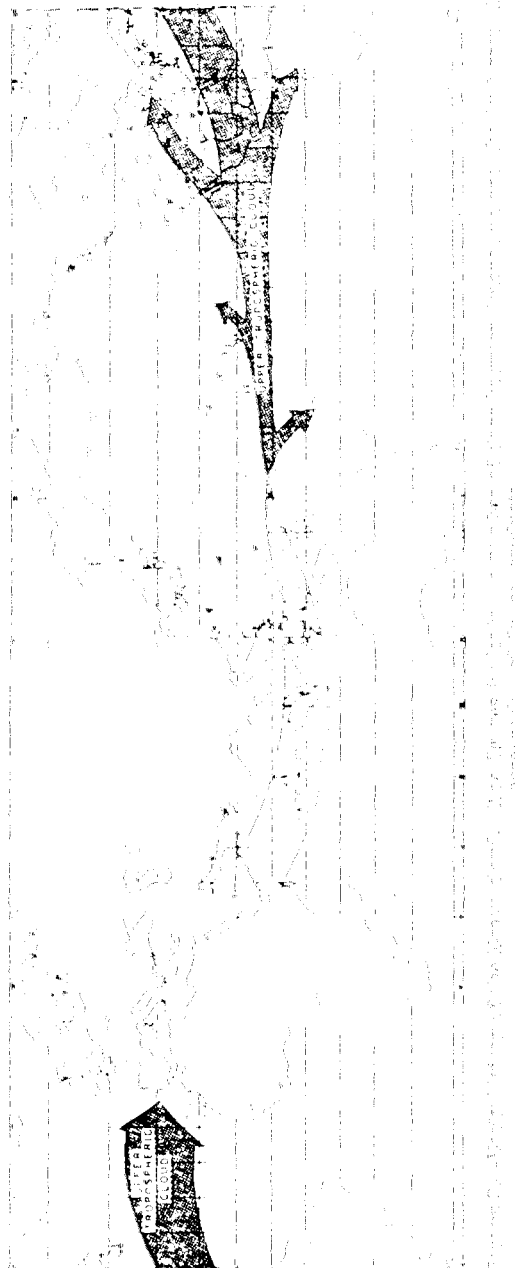


Figure 2.—Early history of the M.L. cloud. The figures indicate the number of days of heavy occupation and the first month of observation for each island.

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APPENDIX No. 6

Atomic Energy Research and Development Administration Program  
for Science Training in 1957

(From Radicals by DeGroot and De Groot, in *Science*, D.M. Bennett, 1957)

1014861

## PUBLIC RELATIONS

"It was recognized that adequate public relations is necessary to the successful operation of the Nevada Test Site. The off-site program was designed to facilitate good public relations. This was accomplished by contact and talks prior to the tests, by the system of zone commanders who were largely responsible for good relations within a specified area by following a set of instructions reported immediately and, if necessary, by the general public relations carried out by the Joint Office of Test Information.

"The public relations program during the operation laid the general ground work for a continuing public relations program to be carried out in the interim period.

"In general, relations with the off-site communities were good. People were particularly appreciative of the fact that monitors were permanently stationed in their communities. Comments expressed to monitors indicated that local population felt more secure with this arrangement with respect to radiation hazards. They appreciate having a local contact in person for information and with complaints. Off-site personnel were able to carry out a continuous educational program since full advantage of their presence in the community was taken and they were asked to be on the program of civic clubs and other organizations. They were furnished material for the program and newspapers and to aid in special programs.

"Prior arrangements made to the public in the series, all of the large population centers in the area were visited by off-site personnel to inform people of the forthcoming tests and the manner in which off-site problems would be handled.

"Immediately before the start of the tests, most of these communities were revisited by a group consisting of the Test Manager, Scientific Advisor, Test Director, Supervisor of Test Information, Director, Off-Site Operations, Chief, and a representative PHS officer. A series of talks were given at Caliente, Frenchman, and Tonopah, Nev., and St. George and Salt Lake City. In all these talks the value of continental measurements to the test site was stressed and the precautionary measures to be taken with respect to public safety were outlined. People were informed of the presence of station monitors in their community and that these men were to be a part of the community during their stay and that they were to be in regard to public safety. Information to be given to the public was given.

"From 7 to 10 days before the initiation of the tests, the monitors with their equipment moved into the communities, familiarized themselves with the area, made arrangements to take over the job of public relations.

Liaison activities were arranged to be made to keep those health officials who might be particularly concerned, informed of the activities at the test sites. Representatives normally involved were Nevada, Utah, California, and Arizona, and the principal health officers of these States were advised regularly by phone or mail of any situation that might affect areas where their jurisdiction was concerned. Personnel advised in these instances were:

Nevada: Dr. James D. Farley, State Health Officer  
Utah: Dr. George J. Lundberg, State Health Officer  
California: Dr. Richard Keegan, State Health Officer  
Arizona: Dr. G. C. Campbell, State Health Officer

In addition to these arrangements, contacts were made with affected USPHS officials and other test site officials.

Activities of the personnel in the off-site personnel conducted a public-relations program on an informal and on a part-time basis. They formed a wide acquaintance in their respective areas, participated in local events and took part in instructional programs as part of the community seriously; as for example, the marriage of Wendell who became a Sunday school teacher and his wife in Alamogordo. Wendell entered a ceiling in one of the hotel rooms. In addition, a close contact with the people in the area was good practical public relations work. While it may not have altered completely the public opinion regarding the tests, it at least made the explanation of what was going on more acceptable.

#### PUBLIC OPINION ABOUT THE TESTS AT THE OFF-SITE

Every opportunity to reach the public through talks and film showings was accepted. Practically every day throughout the off-site area saw at least one film and had had at least one discussion by monitors. This was accomplished through clubs, schools and PTA, and other groups. In this connection, it should be stated that the new film Atomic Tests in Nevada received an excellent reception. From the remarks made to the personnel, it appears that general feeling was that, for the first time, the public had seen exactly what happened during a shot.

A complete listing of public relations contacts is not available, but the partial listing of telephone calls included in table 7 will indicate the scope of this activity.

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Statewide Film Festival Movie

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In addition to these conditions, a large number of individual contacts were made. The following examples of this indicates the public response to the program. During a routine check on a shipment from the Nevada Test Site, the wearer reported that "the people of the test site, even though they are used to living in a small place like Goddard, are much better adjusted, however, and although relations throughout the country are generally good, there are a number of areas of criticism. An example of this is the attitude of the newspaper editor in Goddard, who contrary to other newspapers in Nevada, has published highly critical articles about our activities."

Other radio spots were also used in the news release of the Joint Public Affairs Information Agency used by monitors. However, the most successful piece of radio material was the little yellow booklet, "What Do You Expect to Find in the Test Site Region." Thousands of these were distributed through post offices, motels, and by other means throughout Nevada, Utah, and in parts of Arizona and California. This material was well received. In fact, some people thought it was a publicity effort. The poster comes to distribute on their own. Many of them have been picked up by tourists and were probably carried to other parts of the nation.

Special investigations were conducted in that numerous incidents requiring investigation occurred in the areas of three types, as they affected the public interest, as follows. All that came to the attention of the JPAI program were investigated and are documented in the files.

With respect to public health, a number of complaints were from first responders to the transient nature of radioactivity from fallout and generally were in all cases where blast damage was minimal. Some health studies were mailed and these are being processed by the center. In other cases where contamination of conditions were reported on vehicles, the zone persisted throughout the area and it was able to satisfy people during the period of the investigation.

A number of cases of radiation sickness were reported. These were investigated by the Chief Medical Officer, Dr. Clinton T. Howell, who is a physician. His presence was so useful that it became apparent that it was a good idea to have medical personnel to also act as monitors. In the case of radiation, a qualified doctor with medical background should be available within the off-site program for the purpose of handling the claims of personal radiation injury.

From a public health viewpoint with the JPAI program, all investigations were made in cooperation with the local health procedure. This eliminated any sense of criticism of the JPAI program, increased the public confidence in the program, and it was able to educate the local people on the JPAI program and its objectives.

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The general procedure was to have the material brought to the local doctor's office, all necessary orders and permits provided the transportation. These field doctors were then notified and arrived at a decision. Any reports were mailed to the Department of Agricultural Engineering, etc.

"In no case of those examined, were there any specimens that could be definitely said to be of infectious origin. The cases turned out to be some common ailment, often with the same cause. However, the reports of eye infections were so persistent and of such a nature that they should be investigated in order to prevent or reduce the percentage of those that this is due to such conditions.

"Reports of high mortality livestock were received by some personnel and investigated during the month of May 1944. (M. J. Grant, Kahn and Col. Beaman) from the 7th Division of Lawrence Agricultural Farm of the Division of the War Relocation Authority, of the Utah State Agricultural College. Reports of high mortality of livestock damage will continue to be reported for some time after the tests since livestock deaths are such a frequent occurrence in the life of the area. This work is the responsibility of the cooperation services of a veterinarian with professional assistance of a sound investigative program."

Appendix No. 7

Photographs

1014870.



The Committee in Tokyo during June. From left to right (l to r) are: Acting Legislative Counsel Mamoru Nakamura, Dr. Kumatori, Representative Ataji Balos, Chairman Olympio T. Borja, and Mr. Matashigi Oshi, a former crew member of the Lucky Dragon.



In Hiroshima near the Peace Park Memorial, (l to r) Representative Balos, Acting Legislative Counsel Nakamura, Chairman Borja, Representative Timothy Oikeriil, staff member Brian Farley, and Dr. Masao Kumagai.



At the Office of the Governor of Hiroshima Prefecture, Chairman Borja (l) explains the Committee's mission to the Honorable Itsuo Nagano (r) while interpreter looks on (center).



The Committee poses for a picture with the staff of the Hiroshima ABCC (l to r) Dr. Kato, Dr. Maki, Dr. Steer, Chairman Borja, Dr. Allen, Representative Oikeriil, Dr. Kumagai, Dr. Belsky, Representative Balos, Acting Legislative Counsel Nakamura, Staff member Farley and Dr. Wada.



At the Hiroshima A-bomb Red Cross Hospital are: Dr. Shigeto, Chairman Borja, Foreign Affairs Chief Kaoru Ogura, and the other members of the Committee.



At the Institute for Nuclear Medicine and Biology of Hiroshima University are (l to r) two unidentified staff members, Representative Okeriii, Staff Member Farley, Dr. Noamasa Okamoto, Director of the Institute, Representative Balos, Dr. Ezaki, Acting Legislative Counsel Nakamura, and Representative Hans Wiliander.



The remains of the Industrial Promotion Hall in Hiroshima, now preserved as a monument.



The Committee on the steps of the Nagasaki ABCC. In the center of the group wearing white is Dr. Sadahisa Kawamoto of the ABCC department of medicine.



Elderly survivors of the Nagasaki A-bomb honor the Committee with a dance at the Old Age Survivors Home in Nagasaki.



Dr. Kumangal (l) and Chairman Borja (r) compare notes as the Committee heads back to Saipan from Japan.



Some of the Paraphernalia of the survey team aboard the Militobi during the September survey.



At the Majuro dock prior to departing for the Islands in July. In the foreground, partially facing away from the camera is the former magistrate of Rongelap, John Anjain, whose son Leko died of leukemia in November of 1972.



Dr. Cole of the U.S. Public Health Service aboard the M/V Hafa Adai as the Committee departed for its first visit to Rongelap and Utiirik.



Dr. Conard on the bridge of the Militobi, at the beginning of the September survey.



Members of the BNL team aboard the M/V Militobi (l to r) Dr. Kundsén, Dr. Sutow, Dr. Conard, Dr. Cole (consultant) and Dr. Larsen.



View of the end of Rongelap Island showing former RadSafe site constructed after the 1954 incident.



Decorations and flags were a part of the welcome the people of Rongelap gave the Committee during its July trip.



The Committee during the July trip to Rongelap (l to r) Henry Moses of the Marshall Islands District Administrator's Office, Dr. Cole, Representative Willander, Chairman Borja, Representative Balos, Health Aide Joe Saul, Laboratory Technician Nelson Zetika, and Dr. Kumanaai.



The AEC jeep and trailer on Rongelap.

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The AEC diesel tractor used to load and unload equipment during the surveys on Rongelap.



The A-frame building used by the BNL team as living quarters during its stay on Rongelap.



The small trailer on Rongelap used for the taking of blood samples.



One of the two large trailers on Rongelap. This one has a room for the taking of X-ray photographs, and a section used as a mess hall.



The generator, in another building on Rongelap, which provides electricity for the team's work during the survey.



A patient giving her medical history to Dr. Ezra Wiklon.

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A resident of Rongelap having his X-ray photograph taken.



The other large trailer used as an examination room during the survey.



Trust Territory Laboratory Technician Sebjo Shoniber taking a blood sample.



Dr. Kumatori (I) and Dr. Ezaki during the September survey.

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Dr. Conard checks for thyroid nodules during examination of a resident of Rongelap.



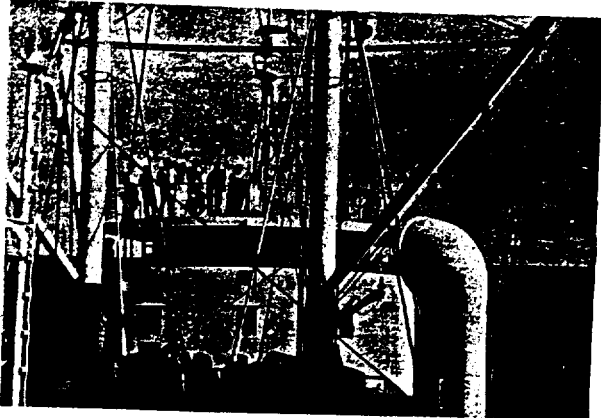
An attentive listener at the meeting of the Committee with the people of Rongelap.



The people of Rongelap at a public meeting requested by the Committee.



Captain Willie Poznanski preparing to pilot the Militobi through the Uirik Pass.



Members of the survey team with Captain Willie on the flying bridge of the Millitobi as it navigates the tricky pass at Utirik.



The village pathway at Utirik.



The Committe and the people of Utirik after an island meeting, in July.



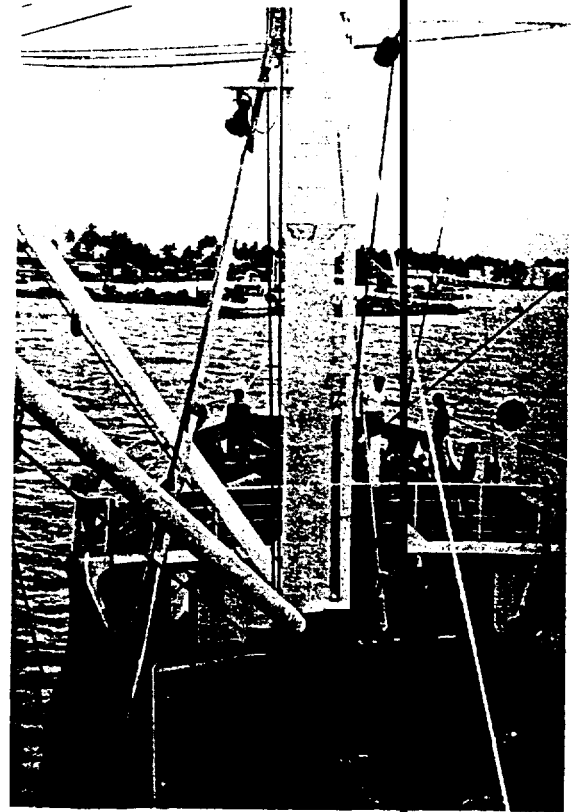
Another view after the same meeting.



Chairman Borja and people from Rongelap and Utirik during a July meeting in Ebeye.



Committee member Willander talking with Dr. Rikon during the September survey.



The Millitobi returns to Majuro after the Rongelap and Utirik survey.



The Committee's consultants: (l to r) Dr. W.S. Cole (United States), Dr. Kumatori and Dr. Ezaki (Japan), and Dr. E.E. Pochin (United Kingdom) prior to their departure from Majuro at the end of the survey.

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September survey team (l to r) First Row: Dental Aide Kumura Riklon, Health Aide Joe Saul, Laboratory Technician Nelson Zetika, Dr. W.W. Sutow, Assistant Medical Equipment Repair Specialist Kosang Mizutoni, Dr. Robert A. Conard, Dr. Haruo Ezaki. Second Row, standing: Laboratory Technician Supervisor Sebjo Shonlber, BNL staff member Mike Makar, Dr. Jetton Anjain, BNL staff member William Scott, Dr. Ezra Riklon, Dr. Knud Knudsen, Dr. William S. Cole, BNL staff member Doug Clareus, Dr. Austin Lowery, Dr. E.E. Pochin, Dr. Toshiyuki Kumatori, and Dr. Larsen.

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