

Mr. J. H. ... 697-7471

Mr. ...

R

Mr. Eugene P. Grenier

Dr. Liverman

DATE RECEIVED: 4/30/73

NO. 3576

DATE ANSWERED BY:

DESCRIPTION: Re extensive report of ... Congress on the ... following the ... the Pacific on March 3, 1971.

Re ...

REMARKS: INFORMATION

DATE	RECEIVED BY	DATE
4/30/73	<i>[Signature]</i>	
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BROOKHAVEN NATIONAL LABORATORY
ATOMIC ENERGY COMMISSION
Upton, New York

MEDICAL DEPARTMENT

TELEPHONE (516) 341-2568

7/15/54

James H. Van Dyke, Jr., M.D.
Director
Division of Biomedical and Behavioral Research
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Dr. Van Dyke:

I have finished reading the extensive report of the Hiroshima Commission on the acute poisoning following the fallout accident in the United States. I have also read the report and the quest for the Hiroshima bomb, prepared by the British. Separately I am sending you the report of Dr. Hans Knudsen who has been the resident in the United States this year.

One of the implications of Knudsen's report is to have a single report including the present status of the people from the Mar shall Islands, the American people, and the Japanese who were exposed to fallout. It is a year of exposure and we wish all of us had appeared in the past. I am sorry to mention that it is clear to me that the report of Knudsen should have followed studies on the Hiroshima victims who were exposed despite the fact that they were already being treated by the termination of the medical process. I had even given Knudsen my personal participation in the study.

When a report to the American people does not appear, I believe that it will be supported by Knudsen, Knudsen and the Medical Commission. The Atomic Energy Commission of Hiroshima are taking in various knowledge.

I am bringing this to your attention because I think it is potentially a very serious problem that eventually will reflect in favorably upon the Japanese and will be supported by information from the Atomic Energy Commission.

Sincerely yours,

Hans Knudsen
Hans Knudsen, M.D.
1954

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COLLECTION MARSHALL ISLANDS

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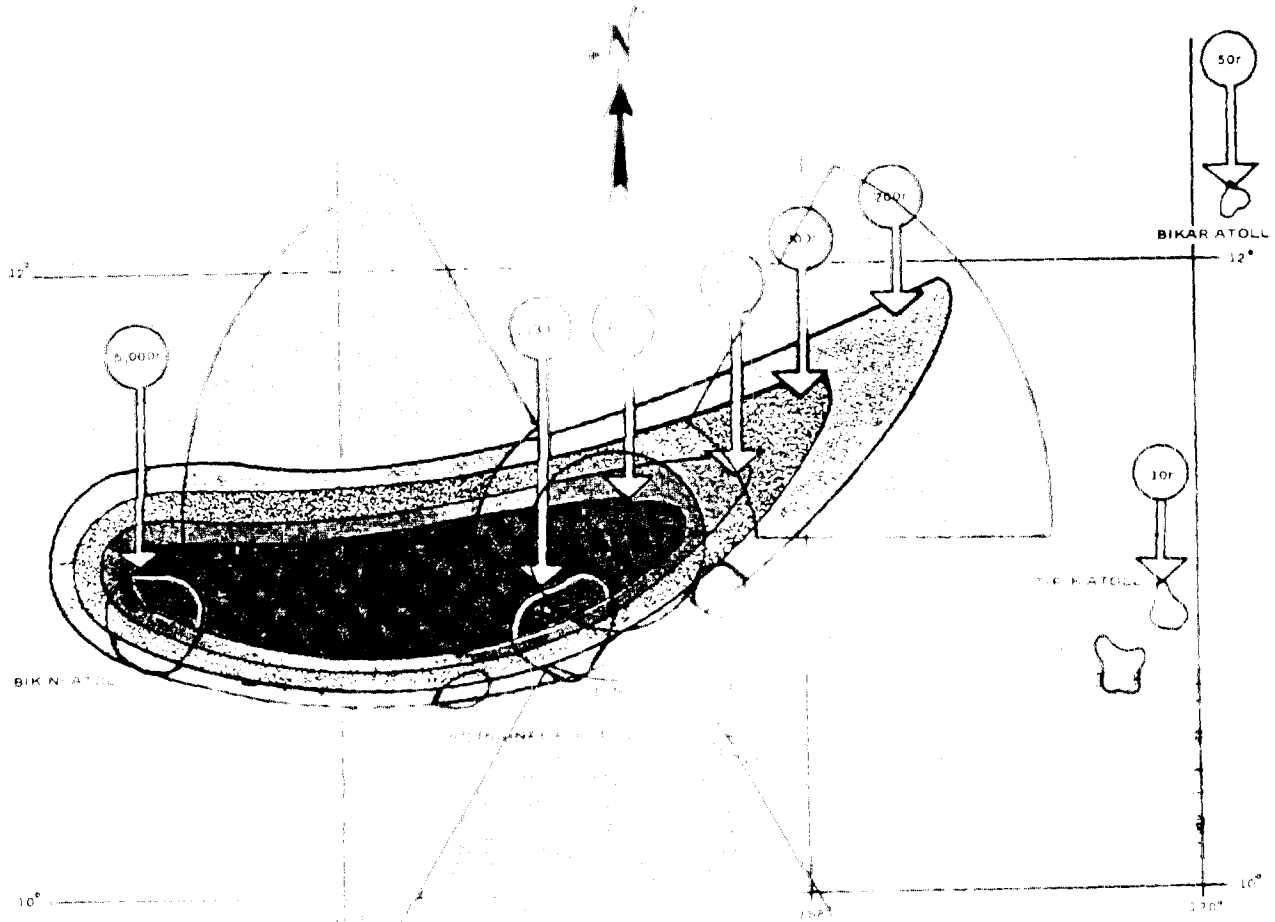
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a report on

Rongelap and Utirik

to the Congress of Micronesia



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

1014583

Journal of the Board of Directors and Officers

Reference

Report of the Board of Directors and Officers

and the Board of Directors and Officers

Reference

The Board of Directors and Officers of the Board of Directors and Officers

(Reference to the Board of Directors and Officers)

Reference

1970 Report of the Board of Directors and Officers

Reference

1014584

U.S. GOVERNMENT PRINTING OFFICE
16:50101-1
1977 O - 281-101

U.S. GOVERNMENT PRINTING OFFICE
16:50101-1
1977 O - 281-101

Total Sheet
Regulation Number and Title
November 1977

- 1. 20 General Paragraph. Paragraph 20 (b) of the "Code of Federal Regulations" (42, p. 11).
- 1. 22 General Paragraph. Paragraph 22 (b) of the "Code of Federal Regulations" (42, p. 11).
- 1. 23 General Paragraph. Paragraph 23 (b) of the "Code of Federal Regulations" (42, p. 11).
- 1. 24 General Paragraph. Paragraph 24 (b) of the "Code of Federal Regulations" (42, p. 11).
- 1. 25 General Paragraph. Paragraph 25 (b) of the "Code of Federal Regulations" (42, p. 11).
- 1. 26 General Paragraph. Paragraph 26 (b) of the "Code of Federal Regulations" (42, p. 11).
- 1. 27 General Paragraph. Paragraph 27 (b) of the "Code of Federal Regulations" (42, p. 11).
- 1. 28 General Paragraph. Paragraph 28 (b) of the "Code of Federal Regulations" (42, p. 11).
- 1. 29 General Paragraph. Paragraph 29 (b) of the "Code of Federal Regulations" (42, p. 11).
- 1. 30 General Paragraph. Paragraph 30 (b) of the "Code of Federal Regulations" (42, p. 11).

BYRON DE BONO

Letter of Transmittal	Public Law No. 40-95
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Public Law No. 40-95	Public Law

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THE SENATE
CONGRESS OF MICRONESIA

CAPITOL BUILDING, SAIGAPA, MARIANA ISLANDS 96950

PRESIDENT
Tosiwo Nakayama

February 1973

VICE PRESIDENT
Lazarus E. Sali

The Honorable Tosiwo Nakayama,
President of the Senate
Fifth Congress of Micronesia
First Regular Session, 1972

FLOOR LEADER
Ambilos Iehsi

and

YAP DISTRICT
Petrus Tun
John A. Mangofel

The honorable Bethwel Iehsi,
Speaker, House of Representatives
Fifth Congress of Micronesia
First Regular Session, 1972

TRUK DISTRICT
Tosiwo Nakayama
Andon Amaratch

Dear Mr. President and Mr. Speaker:

PONAPE DISTRICT
Bailey Otter
Ambilos Iehsi

It is a distinct honor to transmit to you by means of this letter a report by your Special Joint Committee Concerning Roncelap and Utirik Atoll. 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. Sali
Roman Tmetuch

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

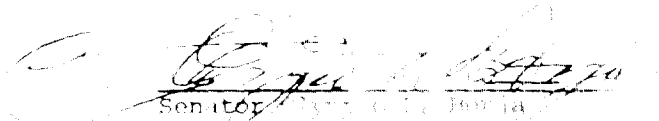
While the Committee is certain that this is the most comprehensive and extensive investigation ever made concerning this matter, it wishes to state that the report is by no means as exhaustive as it could be. Had every medical aspect of the subject been explored, the length of the report would have been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

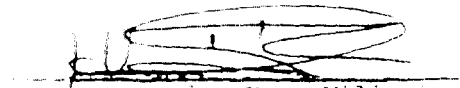
MARIANAS DISTRICT
Olympio T. Borja
Edward DLG. Pangellinan

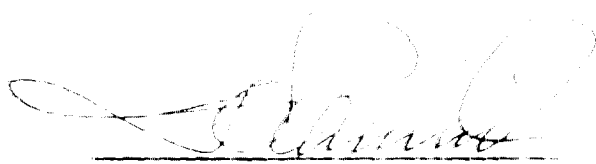
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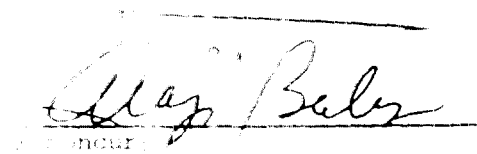
the area of compensation needs further inquiry and deserves to be the subject of a subsequent report. For these reasons, and others, this report represents the Committee's final determination in the light of present evidence. It should be noted that the Committee in completing its report in compliance with H.R. No. 4877, and any additional information which may be received after the report is written. Consequently, the Committee wishes to reserve the right to include additional information concerning medical aspects in its subsequent report on compensation. The Committee feels that this is right and proper, and that the substance of and the circumstances concerning (1) it is as follows:

Respectfully submitted,


Senator Charles McNair
Chairman


Representative Hans Wiliander
Member


Representative Dorothy Oller
Member


Representative Ataji Balos
Interpreter/Informant

- 2. 66 This is the first page of the report and should be numbered 1.
- 2. 78 In the case of the first page, the number should be 100, not 11.
- 2. 82 The second page of the report should be numbered 101, not 102. The number 102 is the number of the second page of the report, not the number of the first page.
- 2. 86 The number of pages in the report should be 100, not 101.
- 2. 88 The number of pages in the report should be 100, not 101.
- 2. 90 In the case of the first page, the number should be 100, not 101.
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- 2. 118 The number of pages in the report should be 100, not 101.
- 2. 120 The number of pages in the report should be 100, not 101.

1 Special Committee (bill) (1971)
2 Section 4 of the Constitution of the Republic of the Marshall Islands, as amended, appropriated out
3 of the General Fund of the Government of the Republic of the Marshall Islands the sum of
4 \$10,000, for the purpose of the purchase of office furniture, to be used for the
5 expenses of the Special Committee. The amount so appropriated
6 shall be expended in the several States of the Republic of the Marshall Islands, at the
7 approval of the President of the Republic of the Marshall Islands, for the purpose of
8 the purchase of office furniture. The Special Committee is hereby authorized to
9 purchase office furniture for the Special Committee members as it
10 feels are necessary. The Special Committee is hereby authorized to purchase office furniture
11 which are not essential or obligated to be purchased by January
12 15, 1971, shall be paid for the General Fund of the Government of
13 the Republic of the Marshall Islands.

14 Section 4 of the Constitution of the Republic of the Marshall Islands, as amended, shall have effect
15 upon the approval of the High Commissioner of the Republic of the Marshall Islands, and shall be binding
16 law without further approval.

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Edward I. Bennett
High Commissioner
United States Territory of the Marshall Islands

FOURTH CONGRESS OF MICRONESIA

SECOND SPECIAL SESSION, 1972

1972, 40:15
(P. L. No. 261, H. R. 11)

1571

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 thereof as 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, known as 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 of Public Law 40-33. 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, obligated for expenditure
12 before January 1, 1974, shall revert to the General Fund of the
13 Congress of Micronesia.

14 Section 2. This act shall have effect upon approval by the
15 High Commissioner, or upon its taking effect without such approval.

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22

October 20, 1972

Edward E. Johnston

Edward E. Johnston
High Commissioner
Territory of the Pacific Islands

Section 10. (a) The Special Committee shall have the power to call before it any person who shall be in a position to furnish information on the people of Benguela and to take evidence on oath and to administer oaths and shall attend to receive any and all information and aid for the people of Angola and to do so from whatever sources possible, and shall attempt to obtain compensation for the people of Angola for the wrongs and injuries which they suffer from the Government of Angola.

Section 11. (a) The Special Committee shall have the power to call, to hear and investigate, to issue subpoenas requiring the attendance of witnesses and the production of books, papers and documents, to examine and bring suits in any court of the Trust Territory of South West Africa in its own name in a civil or criminal case, to exercise all of the powers provided in Subchapter 10, Chapter 10 of the Trust Territory Code.

Section 12. (a) The Special Committee shall submit a report to the Senate and the House of Representatives on or before May 30, 1961. After such report is presented to the President or the Speaker, the Special Committee shall continue its work until the members thereof shall determine that their mission has been completed. The Special Committee shall submit a final report to the Congress in Washington on or before the 1st September Session, Fifth Congress of the Republic of Angola.

HOUSE COMMITTEE ON EDUCATION

SECURITY REPORT FOR 1970

Public Law No. 90-35
(H. R. No. 100, H. R. 1)

1000

To create a Special Committee on the Atolls of Bikini, Eniwetok, and Ujae, to report on the effects of atomic weapons on the people of these atolls, and for other purposes.

BE IT ENACTED BY THE CONGRESS OF THE UNITED STATES:

1 In the statement of David L. Bell, Director of the
2 Atomic Energy Commission, dated August 1, 1946, and in a report
3 of the Atomic Energy Commission dated August 1, 1946, it was stated
4 that the people of the atolls of Bikini, Eniwetok, and Ujae
5 and other atolls in the Marshall Islands were exposed
6 to atomic radiation from the atomic bombing of Hiroshima and
7 Nagasaki in August, 1945. It was stated that the Congress
8 of the United States has been informed that the people of
9 these atolls have suffered from serious physical ailments
10 and that they have been unable to receive the medical
11 treatment available and that they are entitled to receive
12 compensation for the injuries which they have suffered. It is
13 the policy of the United States to provide such
14 treatment and compensation to the people of the atolls of
15 Bikini, Eniwetok, and Ujae in the Marshall Islands.
16 It is the policy of the United States to provide such
17 treatment and compensation to the people of the atolls of
18 Bikini, Eniwetok, and Ujae in the Marshall Islands.
19 It is the policy of the United States to provide such
20 treatment and compensation to the people of the atolls of
21 Bikini, Eniwetok, and Ujae in the Marshall Islands.
22 It is the policy of the United States to provide such

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"They say laws don't change, but I think the
nature of things is always ever changing. Rules
change as a result of things that happen. It appears
the world will be able to change a number of times."

— Abraham Lincoln, 1858 political campaign

TOP SECRET - FROTH (SECRET)

As mentioned by the author of the report, the subject covered all the aspects of its subject matter, but it could also have been considerably longer than it is at present. Thousands of articles and other publications dealing with radiation have been published. Thousands of scientists, technicians and researchers are studying radiation and its possible effects. Among these people there are, even today, varying opinions as to the benefits and liabilities of radiation as it is used by the atomic energy industry. The scientific inquiry and discussion, the field of radiation and its many aspects is a relatively new one. This is especially true in regard to its possible effects on human beings and will continue to be a subject which will probably tempt man to experiment upon his fellow human beings. Because of these factors, this report is by no means to be considered either final or comprehensive. There never will be a "last word" on the subject. On the other hand, however, that it is perhaps the most extensive treatment ever given to the subject area, for not only does it consider practically everything which is part of the problem, but includes other related topics such as medical progress, experience in other countries, the personal feelings of the report's author, theoretical, psychological and cultural aspects, and the effects and influence of human judgment, time, circumstance and, if you will, faith. One can only believe that such a holistic approach--an approach to a field of study which is the correct one to follow concerning this subject--is an approach of the type to be concept to medicine of treating the whole man, rather than concentrating on illness or disease as a single, isolated, unconnected and unrelated phenomenon of the total functioning organism.

As mentioned, the report is a document of the type, by the same token, it is not perfect; there are a few errors, but, as a whole, the assumptions contained in it. If there are, they will be noted by those persons who are more

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experienced in the subject areas of the report, i.e., who have had available to them information or facilities available to the Committee. If there be such errors, or flaws, however, the Committee does not apologize for them, but rather asks the reader to recognize them being due to the technical nature of the area and the difficulty of condensing information into a readable form. The Committee believes that it has done the best possible job with the resources available to it and considering the available space of an event which occurred over a half-century ago, but which is still affecting the daily lives of the people involved, and any children and their descendants.

Some readers may object to the personalization 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 recollections of the people who were involved in the event itself brings into relief certain facts and circumstances and their relationships which could be missed by the usual more formal approach 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, for example, by the mere report of a highly specialized body, more understandable for the general reader. For instance, the personification of "the cloud" as if trying to get away from the radioactive cloud behaved as if influenced by "friendly" ghostly forces, or driven by pugnant or perhaps improper by some "reluctant" force, is a thing which, in the Committee's view, not even the most prominent scientists who have considered the nature of such an event has continued to "live" with and not only in 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 even more, a fact which is indicated by the amount of our volume in dealing with it and radioactive

1014597

containing a number of certain paragraphs as a result of necessary technical adjustments, but in no way to the effect that we are dealing with the material of a very high standard.

In the statement it was not possible to make an exhaustive list of those to which it applies. But it is clear that the Commission had to take into account the information in the report and other sources to give the reader sufficient knowledge to make the report and its conclusions more meaningful. The accuracy and appropriateness required in the conclusions of a report dealing with radiation in general is payable not to the officials of the Commission's constituent bodies, but to the public at large, to the public health, and to the general interest. Their assistance in writing this report was most valuable.

Relative to this, it should be made clear that the responsibility to the Commission for the accuracy of the report, its validity, its assumptions, conclusions, opinions, and recommendations, does not in any way extend to any part of this report with the exception of the constituent reports to the Commission. It is the responsibility of the constituent organizations to check the work done with which they are connected, or their respective procedures.

In commenting upon the Commission's report, the Committee would also like to draw to the attention of the reader that it is not to be seen rather interesting circumstances, which may or may not have bearing on the report itself.

One of them, mentioned earlier, involves 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 had been forthcoming despite follow-up letters by the Commission. The Commission has even this point out what is a self-evident fact. The conduct of the Atomic Energy Commission is basically irregular.

1014598

to the interests of the Zogolopology Agency, yet the basic information needed by the Committee can be readily obtained from the very same source. Coupled with this is the contradictory nature of Sicilian and American interests embodied in the Zogolopology Agency, which is manifested in the daily operations of the Agency. The Agency, in fact, the Committee, in carrying out the wishes of the Agency, Department of Sicily, has had to deal with an Agency created by the Department of Sicily. In trying to investigate the matter, it has had to request information from the Sicilian agencies and departments. This situation was further complicated by the Agency which transferred in December, 1971, and January and March of 1972, the power of the medical treatment of the Kogelapese and Sicilians had been in Sicilian political hands (a fact which is discussed in the report). As a result, the Agency has a somewhat highly charged emotional atmosphere that pervades the Agency's work and investigations since its inception. This is clearly evidenced by the Agency's absence of an enacting signature on the Deed which established the Agency, the Agency and the Committee were passively allowed to be established through mechanisms of law, rather than with official approval of the Agency, Sicily. This apprehension about the Committee and its work has, however, been lessened as it has continued its work. The Agency has adopted a more open approach that its studies should be serious, well conducted, conducted in a serious and professional manner. This has resulted in the Agency's excellent rapport and cooperation with the executive branch of the Sicilian government, although the same cannot be said to hold true in all instances involved. This has been evidenced at various times by several occasions listed below.

First, the Committee was substantially composed by the fortuitous appearance of Dr. Darling of the Agency and Dr. Brindley of the Agency, Public Health Service while on Sicily. They appeared to be joining the Agency as in Greek plays

of old. Dr. Darling advised the members of the Commission, and Mr. Steinfield the resources of the Atomic Energy Commission. While the Committee has no reasons to suspect the integrity and bona fides of the Japanese efforts, it does believe that these visitations were not done in good faith.

Second, the Committee is surprised and disappointed both that government and the United States military, upon receiving the information to be unenthusiastic, which contrasted sharply with the surprise and shock of Hiroshima and Nagasaki. The Committee has requested House and Senate committees of this Congress and has found that in addition to the special investigation of the United States and Japanese governments, few conditions in the state of resources development were far behind the United States. That of this select committee dealing with the disposition of atomic energy is:

Third, this Committee reports results of the survey of the September, 1972, survey of a somewhat earlier date, possibly as early as 1970, even before Public Law No. 40-88 was passed in 1950. Before 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 participate in the annual examination of the knowledge of the subject and give evidence to the correctness of the survey. This was a very good opportunity, the result of more than just simple conduct.

Fourth, reference is made to lack of cooperation from the AEC and DOE. The Committee finds that the information provided by the AEC is aware that the AEC, at least, is not willing to cooperate in providing information or assistance if requested from the proper government. Specifically, the Committee wishes to refer to a letter from Representative James H. Jackson of the U.S. Congress, which he read at the hearing held in the office of the Congress held in Palau in 1971, concerning the rights of the Japanese and U.S. citizens.

Senator Jackson, by law, referred the bill to the Atomic Energy Commission. The AEC then sent to the President a two-page report from the General Manager. This report contained some information furnished by the President, however, the Committee only had this portion of it, indirectly and not in response to its request.

What the committee wishes to prove by bringing these incidents is not that it has developed a psychological picture of a situation wherein it believes that information is being concealingly and deliberately withheld from it, but rather that there are certain things which have happened, of which the Committee is for the most part totally unaware, but which it believes exist nonetheless, due to the confidential nature of its business which tends 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 a narrative fashion; that is, evidence is presented, recalled and exhibited, which serves the basis for later conclusions. The report of the AEC is arranged from the general to the specific, an example of which is the general information on radiation in general which is presented in the beginning of the report and which affects later on. The Committee has not fully agreed with the AEC, but has formed opinions and conclusions in many instances regarding the report as written to reflect this.

Lastly, the word of advice, for those who wish to merely read the recommendations, because of the length of the report. The Committee would advise against this. This report is structured so that evidence and information build continuously to the concluding recommendations. Thus the recommendations are not easily understood without reading the whole report. We, the members of the Committee, suggest that those who only want to read the recommendations, skip reading the report as a whole.

1014601-

...and youth in a day created the God of life.
No one denied any, but a fact was shown, and there is no
longer to be in the world for a man of God. We were the
infidelity of the age, but we refused the responsibilities of
the brotherhood of mankind and the world.

...the world...

1014607

PRIVACY ACT MATERIAL REMOVED

CONFIDENTIAL

First and foremost, this report is dedicated to the memory of a young Marshall Hall, who was only 26 years old when the world's greatest nuclear explosion was set off a few hundred miles from his home at 11:01 A.M. on the 9th day of August, 1945 and who was eleven years old when he died during treatment for leukemia in a small hospital room at the National Institute of Health at Bethesda, Maryland on November 23, 1972. It is also dedicated to his parents and the people of Ronzelap and Hildesheim, who were exposed to radiation from the 1945 tests and to their descendants.

Also, it is dedicated to the people of the world, not only to those Japanese and American citizens who were the victims of nuclear weapons from the Hiroshima "Fat Man" and Nagasaki "Fat Boy" atomic bombings, but to those scientists who willingly or involuntarily sacrificed their health and life in order to gain new knowledge about the effects of nuclear weapons and of radioactivity. Finally, it is also dedicated to the unknown and unnamed people now and in the future, who may still be suffering the effects of weapons-testing conducted by the nuclear powers of the world in the name of national security or through the desire for the application of radioactive materials to the hydrocarbon. It is hoped that this report will contribute to the understanding of a complex, subtle, and important subject and will help to bring attention to the need for an increase knowledge of nuclear energy and its uses, to the scientific control forces of nature at his disposal, to the very forces of creation and destruction and

1014603

"They were fighting for some time, but they could
give wings to death, so that it could be seen in a flash
everywhere, both in the air."

The July 1944 of the North Atlantic, 1944
for the Kennedy.
The 1944 North Atlantic of the North Atlantic.

to the nucleus, but it, perhaps, is a very rapid decay of the atom, but one which will have a small life for any purpose. There are a few hundred different atoms and their differences is indicated by the number of neutrons (nearly always) and by their radioactivity which is measured 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 number of neutrons in their individual nuclei.

Two other numbers of atoms and their relation to radioactivity should be mentioned. Atoms may exist in different levels or particles of different energies. A second fact is that the number and arrangement of electrons determines the chemical nature of an atom. While heavy or different, there can also be atoms with the same number of electrons and, consequently, the same number of protons by changing the number of neutrons. Since they are the same in this respect, they are like chemical elements. They can form the same kinds of compounds.

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

1. Neutrons
2. α -rays
3. Gamma rays
4. Alpha particles
5. Beta particles

Neutrons: These particles are emitted during the chain reaction, which takes place during a nuclear explosion or in a nuclear reactor. A neutron has about the same mass as a proton but is uncharged. It is highly penetrating in all materials except those of very low atomic weight.

Thyrs - are a few types. They are the fragments of relatively high energy ion beams from having relatively high penetrability through matter. They may be collected from a narrow, a broad ray, or produced by electron beams and consist of the electron, X-rays.

Alpha particles - These are the most common and are called from the nucleus of various elements. They are called have a low penetrability and, when they are collected from a narrow beam, they may produce substantial local damage.

Neutron particles - These are the high energy electrons gamma rays and various types of ions. They are called from the nucleus of atoms and have a high penetrability.

radiation

The rate of absorption of a given type of radiation from a source of radiation will depend upon the distance between the source and the detector. The rate of absorption is said to be inversely proportional to the square of the distance from the source. The time for the rate of absorption to reduce to one-half of its initial value is called its half-life. Half-lives of from a small fraction of a second to many thousands of years have been observed for different radioisotopes. The half-life for cobalt-60 is about 24,000 years. Thus, after 24,000 years it will have emitted half of that remaining, and so on. The half-life of uranium-238 is about 4.5 billion years. The half-life of carbon-14 is about 5,730 years. The half-life of iodine-131 is about 8.1 days. The half-life of strontium-90 is about 28.8 years. The half-life of cesium-137 is about 30.2 years. The half-life of plutonium-239 is about 24,100 years. The half-life of americium-241 is about 432 years. The half-life of neptunium-237 is about 2.14 million years. The half-life of uranium-235 is about 704 million years. The half-life of thorium-232 is about 14.05 billion years. The half-life of potassium-40 is about 11.9 billion years. The half-life of rubidium-87 is about 48.8 billion years. The half-life of cesium-135 is about 2.3 million years. The half-life of barium-137m is about 2.55 minutes. The half-life of strontium-90m is about 49.3 days. The half-life of yttrium-90 is about 2.67 days. The half-life of zirconium-95 is about 64.03 days. The half-life of niobium-95 is about 35.01 days. The half-life of molybdenum-95 is about 62.87 days. The half-life of technetium-95 is about 211.7 days. The half-life of ruthenium-95 is about 4.42 years. The half-life of rhodium-105 is about 84.32 days. The half-life of palladium-105 is about 28.6 years. The half-life of silver-105 is about 402.7 days. The half-life of cadmium-105 is about 50.61 years. The half-life of indium-105 is about 4.96 years. The half-life of tin-105 is about 9.84 years. The half-life of antimony-105 is about 15.72 years. The half-life of tellurium-105 is about 23.56 years. The half-life of iodine-105 is about 35.36 years. The half-life of xenon-105 is about 53.12 years. The half-life of cesium-105 is about 80.91 years. The half-life of barium-105 is about 121.37 years. The half-life of lanthanum-105 is about 182.06 years. The half-life of cerium-105 is about 273.10 years. The half-life of praseodymium-105 is about 409.65 years. The half-life of neodymium-105 is about 614.48 years. The half-life of promethium-105 is about 921.72 years. The half-life of samarium-105 is about 1382.58 years. The half-life of europium-105 is about 2073.87 years. The half-life of gadolinium-105 is about 3110.81 years. The half-life of terbium-105 is about 4666.22 years. The half-life of dysprosium-105 is about 6999.33 years. The half-life of holmium-105 is about 10498.99 years. The half-life of erbium-105 is about 15748.49 years. The half-life of thulium-105 is about 23622.74 years. The half-life of ytterbium-105 is about 35434.11 years. The half-life of lutetium-105 is about 53151.17 years. The half-life of hafnium-105 is about 79726.76 years. The half-life of tantalum-105 is about 119590.14 years. The half-life of tungsten-105 is about 179385.21 years. The half-life of rhenium-105 is about 269077.82 years. The half-life of osmium-105 is about 403616.73 years. The half-life of iridium-105 is about 605425.10 years. The half-life of platinum-105 is about 908137.65 years. The half-life of gold-105 is about 1362206.48 years. The half-life of mercury-105 is about 2043309.72 years. The half-life of thallium-105 is about 3064964.58 years. The half-life of lead-105 is about 4597446.87 years. The half-life of bismuth-105 is about 6896169.31 years. The half-life of polonium-105 is about 10344253.97 years. The half-life of astatine-105 is about 15516380.96 years. The half-life of radon-105 is about 23274571.44 years. The half-life of francium-105 is about 34911857.16 years. The half-life of actinium-105 is about 52367785.74 years. The half-life of thorium-105 is about 78551678.61 years. The half-life of protactinium-105 is about 117827517.92 years. The half-life of uranium-105 is about 176741276.88 years. The half-life of neptunium-105 is about 265111915.32 years. The half-life of plutonium-105 is about 397672873.00 years. The half-life of americium-105 is about 596509309.50 years. The half-life of curium-105 is about 894743864.25 years. The half-life of berkelium-105 is about 1342115796.38 years. The half-life of californium-105 is about 2013173694.57 years. The half-life of einsteinium-105 is about 3019760541.86 years. The half-life of fermium-105 is about 4528640812.79 years. The half-life of mendelevium-105 is about 6792961219.19 years. The half-life of nobelium-105 is about 10189441828.79 years. The half-life of lawrencium-105 is about 15284162743.19 years. The half-life of rutherfordium-105 is about 22926244114.79 years. The half-life of dubnium-105 is about 34389366172.19 years. The half-life of seaborgium-105 is about 51584049258.29 years. The half-life of bohrium-105 is about 77426073887.44 years. The half-life of hassium-105 is about 116139110831.16 years. The half-life of meitnerium-105 is about 174208666246.74 years. The half-life of darmstadtium-105 is about 261312999369.11 years. The half-life of roentgenium-105 is about 391969499053.67 years. The half-life of copernicium-105 is about 587954248680.51 years. The half-life of nihonium-105 is about 881931372920.77 years. The half-life of flerovium-105 is about 1322897059381.16 years. The half-life of livermorium-105 is about 1984345589071.74 years. The half-life of tennessine-105 is about 2976518383607.61 years. The half-life of oganesson-105 is about 4464777575411.42 years. The half-life of copernicium-105 is about 6697166363117.13 years. The half-life of flerovium-105 is about 10045749544675.70 years. The half-life of livermorium-105 is about 15068624317013.56 years. The half-life of tennessine-105 is about 22602936475520.34 years. The half-life of oganesson-105 is about 33904404713280.51 years. The half-life of copernicium-105 is about 50856606902416.77 years. The half-life of flerovium-105 is about 76284910353625.16 years. The half-life of livermorium-105 is about 114427365530437.74 years. The half-life of tennessine-105 is about 171641048295656.61 years. The half-life of oganesson-105 is about 257461572443484.92 years. The half-life of copernicium-105 is about 386192358665227.38 years. The half-life of flerovium-105 is about 579288537997841.07 years. The half-life of livermorium-105 is about 868932806996761.61 years. The half-life of tennessine-105 is about 1303399210495142.42 years. The half-life of oganesson-105 is about 1955098815742713.63 years. The half-life of copernicium-105 is about 2932648223614070.45 years. The half-life of flerovium-105 is about 4398972335421105.68 years. The half-life of livermorium-105 is about 6598458503131658.52 years. The half-life of tennessine-105 is about 9897687754697487.78 years. The half-life of oganesson-105 is about 14846531632046231.67 years. The half-life of copernicium-105 is about 22269797448069347.51 years. The half-life of flerovium-105 is about 33404696172103921.27 years. The half-life of livermorium-105 is about 50107044258155882.91 years. The half-life of tennessine-105 is about 75160566387233824.37 years. The half-life of oganesson-105 is about 112740849580850736.56 years. The half-life of copernicium-105 is about 170110274371276104.84 years. The half-life of flerovium-105 is about 255165411556914157.26 years. The half-life of livermorium-105 is about 382748117335371036.89 years. The half-life of tennessine-105 is about 574122176003056510.34 years. The half-life of oganesson-105 is about 861183264004584765.51 years. The half-life of copernicium-105 is about 1291774896006879530.77 years. The half-life of flerovium-105 is about 1937662344010319296.16 years. The half-life of livermorium-105 is about 2906493516015478944.24 years. The half-life of tennessine-105 is about 4359740274023218316.36 years. The half-life of oganesson-105 is about 6539610411034827474.54 years. The half-life of copernicium-105 is about 9809415616051241111.81 years. The half-life of flerovium-105 is about 14714123424076861677.72 years. The half-life of livermorium-105 is about 22071185136115292516.58 years. The half-life of tennessine-105 is about 33106777704172938774.87 years. The half-life of oganesson-105 is about 49660166556259408162.31 years. The half-life of copernicium-105 is about 74490249840389112243.47 years. The half-life of flerovium-105 is about 111735374760583668365.20 years. The half-life of livermorium-105 is about 167603062140875502547.80 years. The half-life of tennessine-105 is about 251404593211313253821.60 years. The half-life of oganesson-105 is about 377106889767070080732.40 years. The half-life of copernicium-105 is about 565660334650605121108.80 years. The half-life of flerovium-105 is about 848490501975907681663.20 years. The half-life of livermorium-105 is about 1272735752963811442494.40 years. The half-life of tennessine-105 is about 1909103629445717163741.60 years. The half-life of oganesson-105 is about 2863655444168576645612.80 years. The half-life of copernicium-105 is about 4300483166252864968419.20 years. The half-life of flerovium-105 is about 6450724749379297452628.80 years. The half-life of livermorium-105 is about 9676087124068946278944.00 years. The half-life of tennessine-105 is about 14514130686103429418416.00 years. The half-life of oganesson-105 is about 21771196029155143127616.00 years. The half-life of copernicium-105 is about 32656794043732716681280.00 years. The half-life of flerovium-105 is about 49035191065599065021440.00 years. The half-life of livermorium-105 is about 73552786598398100032000.00 years. The half-life of tennessine-105 is about 110329179897597140048000.00 years. The half-life of oganesson-105 is about 165493769846395712070400.00 years. The half-life of copernicium-105 is about 248240659789593472102400.00 years. The half-life of flerovium-105 is about 372360989684389120128000.00 years. The half-life of livermorium-105 is about 558541484526578240192000.00 years. The half-life of tennessine-105 is about 837812226789877120288000.00 years. The half-life of oganesson-105 is about 1256718340184816003520000.00 years. The half-life of copernicium-105 is about 1885077510277222405248000.00 years. The half-life of flerovium-105 is about 2827616265415833607872000.00 years. The half-life of livermorium-105 is about 4241424398123750401152000.00 years. The half-life of tennessine-105 is about 6362136597185600641728000.00 years. The half-life of oganesson-105 is about 9543204895778400962592000.00 years. The half-life of copernicium-105 is about 14314807343677120000000.00 years. The half-life of flerovium-105 is about 21472211015515680000000.00 years. The half-life of livermorium-105 is about 32208316523273600000000.00 years. The half-life of tennessine-105 is about 48312474784910400000000.00 years. The half-life of oganesson-105 is about 72468712177360000000000.00 years. The half-life of copernicium-105 is about 108703068266048000000000.00 years. The half-life of flerovium-105 is about 163054592409088000000000.00 years. The half-life of livermorium-105 is about 244581888613120000000000.00 years. The half-life of tennessine-105 is about 366872832919680000000000.00 years. The half-life of oganesson-105 is about 550309249379520000000000.00 years. The half-life of copernicium-105 is about 825463874069376000000000.00 years. 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The half-life of copernicium-105 is about 20843927196103270400000000000.00 years. The half-life of flerovium-105 is about 31265890794154944000000000000.00 years. The half-life of livermorium-105 is about 46898836191232416000000000000.00 years. The half-life of tennessine-105 is about 70348254286848640000000000000.00 years. The half-life of oganesson-105 is about 105522381430272960000000000000.00 years. The half-life of copernicium-105 is about 158283572145409280000000000000.00 years. The half-life of flerovium-105 is about 237425358218113280000000000000.00 years. The half-life of livermorium-105 is about 356138037327170560000000000000.00 years. The half-life of tennessine-105 is about 534207055990656000000000000000.00 years. The half-life of oganesson-105 is about 801310583985984000000000000000.00 years. The half-life of copernicium-105 is about 1201965875978976000000000000000.00 years. The half-life of flerovium-105 is about 1802948813968467200000000000000.00 years. The half-life of livermorium-105 is about 2704423220952704000000000000000.00 years. The half-life of tennessine-105 is about 4056634831429056000000000000000.00 years. The half-life of oganesson-105 is about 6084952247143680000000000000000.00 years. The half-life of copernicium-105 is about 9127428370720512000000000000000.00 years. The half-life of flerovium-105 is about 13691142556080832000000000000000.00 years. The half-life of livermorium-105 is about 20536713834121280000000000000000.00 years. The half-life of tennessine-105 is about 30805070751181920000000000000000.00 years. The half-life of oganesson-105 is about 46207606126772800000000000000000.00 years. The half-life of copernicium-105 is about 69311409190164160000000000000000.00 years. The half-life of flerovium-105 is about 103967113785246720000000000000000.00 years. The half-life of livermorium-105 is about 155950670677870080000000000000000.00 years. The half-life of tennessine-105 is about 233925506016806400000000000000000.00 years. The half-life of oganesson-105 is about 350888259025209600000000000000000.00 years. The half-life of copernicium-105 is about 526332388537817600000000000000000.00 years. The half-life of flerovium-105 is about 789498582806726400000000000000000.00 years. The half-life of livermorium-105 is about 1184247874210092800000000000000000.00 years. The half-life of tennessine-105 is about 1776371811315136000000000000000000.00 years. The half-life of oganesson-105 is about 2664557716972704000000000000000000.00 years. The half-life of copernicium-105 is about 4006836575458048000000000000000000.00 years. The half-life of flerovium-105 is about 6010254863187072000000000000000000.00 years. The half-life of livermorium-105 is about 9015382294780608000000000000000000.00 years. The half-life of tennessine-105 is about 13523073442170880000000000000000000.00 years. The half-life of oganesson-105 is about 20284610163256320000000000000000000.00 years. The half-life of copernicium-105 is about 30426915244884480000000000000000000.00 years. The half-life of flerovium-105 is about 45640372867326720000000000000000000.00 years. The half-life of livermorium-105 is about 68460559290990080000000000000000000.00 years. The half-life of tennessine-105 is about 102690838936483200000000000000000000.00 years. The half-life of oganesson-105 is about 154036258404724800000000000000000000.00 years. The half-life of copernicium-105 is about 231054387607084800000000000000000000.00 years. The half-life of flerovium-105 is about 346581581410627200000000000000000000.00 years. The half-life of livermorium-105 is about 519872372115942400000000000000000000.00 years. The half-life of tennessine-105 is about 779808558173913600000000000000000000.00 years. The half-life of oganesson-105 is about 1169712837260825600000000000000000000.00 years. The half-life of copernicium-105 is about 1754569255891238400000000000000000000.00 years. The half-life of flerovium-105 is about 2631853883836857600000000000000000000.00 years. The half-life of livermorium-105 is about 3947780825755289600000000000000000000.00 years. The half-life of tennessine-105 is about 5921671238632928000000000000000000000.00 years. The half-life of oganesson-105 is about 8882506857949376000000000000000000000.00 years. The half-life of copernicium-105 is about 13323760286924096000000000000000000000.00 years. The half-life of flerovium-105 is about 20085640430386176000000000000000000000.00 years. The half-life of livermorium-105 is about 30128460645579264000000000000000000000.00 years. The half-life of tennessine-105 is about 45192690968368384000000000000000000000.00 years. The half-life of oganesson-105 is about 67789036452552576000000000000000000000.00 years. The half-life of copernicium-105 is about 101683554678838400000000000000000000000.00 years. The half-life of flerovium-105 is about 152525332018257280000000000000000000000.00 years. The half-life of livermorium-105 is about 228788000000000000000000000000000000000.00 years. The half-life of tennessine-105 is about 343182000000000000000000000000000000000.00 years. The half-life of oganesson-105 is about 514773000000000000000000000000000000000.00 years. The half-life of copernicium-105 is about 772159500000000000000000000000000000000.00 years. The half-life of flerovium-105 is about 1158239250000000000000000000000000000000.00 years. The half-life of livermorium-105 is about 1737358875000000000000000000000000000000.00 years. The half-life of tennessine-105 is about 2606038312500000000000000000000000000000.00 years. The half-life of oganesson-105 is about 3909057468750000000000000000000000000000.00 years. The half-life of copernicium-105 is about 5863586203125000000000000000000000000000.00 years. The half-life of flerovium-105 is about 8795379304687500000000000000000000000000.00 years. The half-life of livermorium-105 is about 13193068957031250000000000000000000000000.00 years. The half-life of tennessine-105 is about 19789603435546875000000000000000000000000.00 years. The half-life of oganesson-105 is about 29684405153320320000000000000000000000000.00 years. The half-life of copernicium-105 is about 44526607730000000000000000000000000000000.00 years. The half-life of flerovium-105 is about 66789911595000000000000000000000000000000.00 years. The half-life of livermorium-105 is about 100184867392500000000000000000000000000000.00 years. The half-life of tennessine-105 is about 150277301088750000000000000000000000000000.00 years. The half-life of oganesson-105 is about 225415951633125000000000000000000000000000.00 years. The half-life of copernicium-105 is about 338123927448750000000000000000000000000000.00 years. The half-life of flerovium-105 is about 507185891173125000000000000000000000000000.00 years. The half-life of livermorium-105 is about 760778836759375000000000000000000000000000.00 years. The half-life of tennessine-105 is about 1141168255139062500000000000000000000000000.00 years. The half-life of oganesson-105 is about 1711752382708750000000000000000000000000000.00 years. The half-life of copernicium-105 is about 2567628574063125000000000000000000000000000.00 years. The half-life of flerovium-105 is about 3851442861093750000000000000000000000000000.00 years. The half-life of livermorium-105 is about 5777164291640625000000000000000000000000000.00 years. The half-life of tennessine-105 is about 8665746437460937500000000000000000000000000.00 years. The half-life of oganesson-105 is about 12998619656191250000000000000000000000000000.00 years. The half-life of copernicium-105 is about 19497929484287500000000000000000000000000000.00 years. The half-life of flerovium-105 is about 29246894226431250000000000000000000000000000.00 years. The half-life of livermorium-105 is about 43870341339646875000000000000000000000000000.00 years. The half-life of tennessine-105 is about 65805512009470312500000000000000000000000000.00 years. The half-life of oganesson-105 is about 98708268014206250000000000000000000000000000.00 years. The half-life of copernicium-105 is about 148062402021309375000000000000000000000000000.00 years. The half-life of flerovium-105 is about 222093603031964062500000000000000000000000000.00 years. The half-life of livermorium-105 is about 333140404547946093750000000000000000000000000.00 years. The half-life of tennessine-105 is about 500710606821919125000000000000000000000000000.00 years. The half-life of oganesson-105 is about 751065910232878125000000000000000000000000000.00 years. The half-life of copernicium-105 is about 1126598865349317187500000000000000000000000000.00 years. The half-life of flerovium-10

connected with this is that half of the energy of each ray kind
of ion is lost in the biological material, of which is the amount of time
it takes for one half of the total number to be removed from the body, through
elimination of some bodies. In the case of radiation that is of interest
to the present material, that charged particles from energy along their path
to the medium show very particularities, which may vary both in molecular or
even atomic individuality. The absorption coefficient of different kind,
their amount of ionization may be affected along the track of the particles.
Because of the positive-negative electrical charges, their positive char-
acter is often more active than negative. In doing ionization, from one to one
hundred electron volts of energy to ionize a molecule from an atom. Usually,
the radiation energy of particles is measured in the form of (100 electron
volts = 100 eV) or (1000 electron volts = 1000 eV). Consequently,
particles in the case of very low energy are ionized thousands of other atoms
before their energy is made up and they stop.

Intensity of

The amount of radiation may be measured in a number of different ways
of particular interest to us are: (1) the intensity of the interaction of
the radiation with atoms (types of reference).

The quantity of ionization expressed in terms of the ability of the
ion gamma radiation to produce ionization is called:

The "R" is a unit of radiation dose which indicates the amount of energy
absorbed in a unit of mass, with some of which.

The "R" is the unit of dose equivalent, the dose equivalent is the
radiation potential energy and provides a common frame for comparing the
various effects of different kinds of radiation on the human body. The

external radiation, the dose represented 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 incident 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 at 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 radiation is used in specifying the strength of biological agents and the reference radiation is often moderate energy X or gamma rays. Thus, if the absorbed dose of the reference radiation is 30 times larger than the absorbed dose of the radiation of interest to produce the same effect, the RBE would be 1/30. The RBE of the other radiation is 20.

Initial Dose: 50-100 rad (100-200 rads) in the laboratory dose that will kill 50 percent of the population (LD50). This dose is usually used when the radiation is administered acutely. The dose also indicates the time span over which the observation is made following the administration. Also, it is usually used when the absorbed dose is low or very constant throughout the exposure and the magnitude of effect is not expected to just treatment of the organism. The LD50 is 40 days for mice, 200 rad. This is an average value stated in the National Council on Radiation Protection and Control report on page 104.

Reference: The Lewis Report

There are several kinds of studies available on the immediate effects of several doses of radiation. Only two studies for the different kinds of

illness it produces. Thus, fluids should be given to replace dehydration and loss of body fluids from vomiting. This may also be treated as normal burns to aid the healing process and, when the fluid, particularly, should be administered. There are other measures which may be taken, but for the most part they are expensive and not used.

Protective Measures. There are dangers in the use of, or moderate, the effect of radiation. Most of the information is still based on animal experimentation. The amount generally varies and is usually with certain chemicals before they are exposed. These generally will generally increase the animal's chance of receiving what would be a lethal dose. There are no human experiments of this type.

Recovery Agents. These are used to fight the effects of radiation and to prevent or minimize damage to the body. Some of the methods described for acute treatment, that include blood transfusion, oxygen to control bleeding, and low sodium diet. The only one for long term effects, which help the patient to live a normal life until the patient's marrow recovers, is not used. It is a mixture of various substances from Dr. George H. Bostwick, Dorr, head of the Atomic Bomb Casualty Commission in Japan, who has with it the best results. It is somewhat negative as to their effectiveness.

Removal Agents. These are used to remove the radiation from the body. The administration of these agents is the most important. The patient's blood is injected with the agent, which helps to remove it from the body. A greater than normal quantity of the substance is used. This kind of treatment is usually only effective if administered immediately after the internal exposure has taken place.

THE KNOWN INDICATED DOWNSIDE PHENOMENA OF 1950S

The following examples were indicated as the type of acute cases of radiation received by human beings and the facts of previous

Los Alamos - During 1945 few persons were acutely exposed to radiation during two accidents. One person received about 200 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 three years. The level of the people apparently recovered.

Windscale - On October 10, 1957, a British nuclear reactor sprays radioactive matter (^{131}I) in the nearby town of Sellafield. In that area was found to be slightly above the level. Radioactive was reported according to the source of information.

Oak Ridge - On June 30, 1954, an accident happened at a plant which makes radioactive materials. It was estimated that 2500 people received 200 to 365 RADS and three people 21 to 100 RADS. They all had acute symptoms, but apparently returned to normal health.

Yugoslavia - An American in accident near Belgrade in 1958, exposed six men to very high gamma rays and x-rays. They received acute effects of the radiation and one of them who received the highest exposure (the figure is not available), who died in two weeks. Definitive but there died. Four others, who received less, were given the anti-radiation which helped until their own body marrow had recovered again. The other persons recovered without injections. Experts agreed in 1960 that at the same marrow injections can help recovery from bone depression.

The year of 1934 was not particularly significant, historically perhaps, with one exception.

In 1934 the United States was thoroughly shocked by a worldwide depression which had been underway for 1929. It was and is particularly notable year for Russia, including its ambitious industrialization (characterized the international scene of the worldwide people).

In the month of January in 1934, 1934, a year-old young Anzain was probably contemplating his daily tasks, the possibility of going fishing, and the increasing presence of travelers with his presence in his islands.

A singular event, however, did take place that year which would affect the future lives of Anzain, Zerkov, and all those alike was fact, all the people of the world. It was the year of that year that German scientists at the Berlin Wilhelm Institute in 1934, in an atom of Uranium 235 (U^{235}) (54, p. 9). 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 whole new era was possible and creation and control of a whole new world had been left, without any group, control of a basic force of nature and the universe. Now this power was to be used would stretch the world.

In May of 1942, the members of the United States of America, with a simple 70%, 1942, a decision to be decided that the United States would make an all-out, massive effort to develop the first atomic bomb before Germany could (54, p. 13). The successful development of an atomic bomb by Dr. Enrico Fermi and the Manhattan Project in July 1942, at 1942, (54, p. 10) proved that the controlled chain reaction necessary to produce plutonium for the atomic bomb was possible. Early progress was

developed to produce both variable and constant rates, each of which would provide the critical control for the rate of reaction desired by the United States.

The process of the splitting of the atom, as "fission," is nearly impossible to explain, equivalent, in principle, to a bomb, which we cannot see, smell, touch, or hear because they are so small, have a fantastic amount of potential energy which when released in the course of an explosion of a single bomb is capable of flattening and blowing up everything within over hundreds of square miles, of killing and maiming millions of people immediately, and more millions by the wave and shock of the air.

In effect, however, the basic parts of the atomic bomb comes from two things: the fact that when the atom is split, and a chain reaction, even though atoms are very heavy, the weight of atoms falling, the atom and its parts, travels at very great rate in time, when a neutron strikes a fissionable atom, the atom may split, and following the splitting, may produce additional neutrons, or fission, that neutrons may produce splitting of nearly fissionable atoms, which in turn may fission to exist when the splitting of one atom produces several neutrons, the splitting of more than one nearby atom. An example of a chain reaction is when a ball is tossed into a room in which the floor is covered with a net with ping pong balls. The ball will hit one nearby ball, which in turn will hit off its neighbors, which in turn will hit other balls, and so on, and so on. When this chain reaction is also 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 uncontrolled, it results in an atomic explosion. The atomic bomb is a fission reaction, as opposed to a fusion reaction, as opposed to a regular reaction of energy which is illustrated this way: the

fission of one pound of uranium-235 is equivalent to 5,000 tons (18,000,000 lbs.) of TNT.

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

The "fusion bomb" or "hydrogen bomb" or the "super-bomb" works on a somewhat different principle, although it uses the same basic 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 element. To do this requires a huge amount of heat, roughly in the order of 100 million degrees. Since this high temperature can be attained only by means of detonation of an atomic bomb, the atomic bomb is used to provide the "trigger" for the fusion process. The fusion process, which utilizes hydrogen atoms, results in a much greater amount of energy than that of fission; 1 pound of fusion material is equal to 10,000 tons of TNT. (48 p. 15)

Scientists also discovered that the hydrogen bomb, with radioactive material in that it produced a ball of white fireball. They solved this problem with the addition of another explosive element which for the process would use. Simply put, the first atomic bomb is used to create a fireball which in turn triggers a final fusion process. This was the design of the "Fat Man" device to be tested at Nagasaki in Japan 1945.

In millionths of a second, the fusion process 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 devastation. **Regardless**

and whether a source of fire during the burst of which spread upward from 100 to 200 miles per hour at the beginning, and changing to an approacher peak velocity of the explosion or burst on the ground, the fireball will pick up with it great quantities of soil and the included materials, carrying the debris out to its highest altitude. Level 1, low or thin material will be heavy and only the lightest particles of debris to thousands of feet. It, however, could carry the heat and high velocity of the explosion, but little material drawn up into the cloud will be efficiently transported, there will be little dust fallout. Only thousands of radioactivity are sent out during the upward stroke of the explosion as it rises. However, if it is an air burst, little radioactivity will be dispersed locally since little material has been included, and some radioactivity of the more 200 radioactive products may be drawn down the top of the cloud through one or two half-lives before the cloud has passed. Generally, in an air burst the main radioactivity will be in the cloud, but shortly after water vapor in the air, and the soil high particles, the heavy, visible, will have become mixed with the fireball. A 10,000,000 (10,000,000) burst will rise to about 25 or 30,000 feet. A 100,000,000 (100,000,000) burst will rise within 10 minutes to a height of about 100,000 feet. If it was a ground burst, it will have picked up with it thousands of tons of matter and made it radioactive. The cap of the cloud will have spread far above the stratosphere where high winds will be blowing, carrying it away from the center of the cloud column. It will be carried by these winds which will carry the radioactive debris with it. The heavier particles will fall first, and lighter ones fall back down later upon the earth below, but a strong wind may carry it away.

IONIZING RADIATION

Internal Exposure

While mankind has lived for possibly millions of years in a naturally radioactive environment, it has only been since the inception of artificial sources of radioactivity such as X-ray machines, atomic reactors, and nuclear bombs that man has been specifically and intentionally irradiated, individually or on a mass basis, by man.

As discussed in the report, radiation emitted from nuclear devices or fallout from these devices will be readily absorbed, although the effects are the same whether from bombs, atomic accidents, or 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 atom's equilibrium. Particulate deposits in the area of external exposure are a source and give rise to gamma rays. These are very penetrating and can actually pass through the human body, leaving in their path ionized atoms. In effect, the thousands of these particles which pass through the human body may disrupt the cells and molecules comprising the molecules of the body's cells and their building blocks.

In regard to dosage rates in whole body (or partially) irradiation, little is known. Most data show that exposure is similar to that of from 10 rads up to thousands of rads.

From 50 to about 200 rads, symptoms are observed which usually occur within 30 days, although at the upper end of exposure rates 10 to 50 years. This is also dependent upon available material. The dose of 100 rads is not likely to cause death to occur; however, within this range a number of serious or severe effects,

having a certain probability of death, the more severe the short course would be noticed.

The group of acute effects within the 30000 range includes nausea, vomiting, diarrhea, itching and swelling of the skin, conjunctivitis, edema, loss of hair, skin burning, and discoloration, or destruction, of various kinds of blood cells due to the high degree of oxygenation of various kinds of blood cells 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, death would be expected to live not more than 30 days. About 100 percent of the exposed persons would be expected to die.

Higher doses above 1,000 rads would be expected to produce what is called hematopoietic syndrome. This is due to the effects in destroying the lining of the small intestine and the bone marrow, vomiting and diarrhea. Death would occur within a few days or a week.

Central nervous system death would occur at doses over 3,000 rads. This size of dose causes extreme weakness, headache, vomiting, lack of balance, and convulsions. Death may be immediate or after a few hours.

Should, possibly, a person survive these effects due symptoms, he would undoubtedly die of leukemia or the development of severe disorders of the bone marrow, which produce blood cells, lead to internal bleeding, anemia, and lead to resistance to infection. Such effects can also be seen at the skeletal level at a range of 100,000 rads.

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

were not close enough to be destroyed by fire (blast heat) or blast wave (pressure) would naturally be irradiated with neutrons, gamma rays, and possibly alpha particles at a rate that would decrease with the increase of their distance from the center of the explosion. The alpha particles are of biological importance only when they are carried from inhaled or ingested material. Neutrons are of importance for their effects by external sources following nuclear detonations.

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 is likely to be high. In terms of total exposure the gamma radiation, because it is able to penetrate of past the outer body, would be the most harmful. The beta radiation, which has less energy, would mainly be dangerous externally if any water, falling rain, or snow on uncovered skin of the person. Alpha particles are not so deeply penetrating (generally only the upper layer of layers of the skin) and require a sufficient quantity and if of enough particles (even down to 10,000 alpha particles) in several degrees, from field to heavy, fallout, alpha particles are dangerous in the sense that if a person received a dose of alpha particles enough to lower blood cell counts and this resulted in a deficiency of white blood cells, the person became seriously infected, the person could die in a year.

INTERNAL EXPOSURE

As has been described, many people could be exposed directly to radiation either through close proximity to the (detonated) explosion of a nuclear weapon (or source of radiation) or through exposure to radioactive fallout. A second

way of being exposed to radiation, is through external exposure, or external contamination, which is a major fraction for a year after contamination or indirect contamination.

It should be recalled that a number of radioactive isotopes in the creation of approximately 100 radioactive elements, or isotopes. Many of these are short-lived, such as cobalt (Co^{60} or Co^{57}) which has a half-life of 3.0 minutes, or a total Co^{60} or Co^{57} with a half-life of 3.0 seconds (FRP, p. 55) and actually become ineffective or return to their stable form before they can reach the ground. However, longer-lived elements such as strontium (Sr^{90}) and cesium (Cs^{137}) have half-lives of about 30 years, and cesium iodine (I^{131}) has a half-life of about eight days. Of these three elements which are among the most dangerous to man and animals, or the material which returns to earth, are being driven into the soil, or into the air. This fallout material may result in exposure to man, birds, and animals and fish should they fall into their range of distribution, into food, or if they are inhaled, they are being driven into the soil where the fallout material landed on or near the surface, especially if they are able to pick up a flake of material and ingest it, or inhale it, or if it is in the air. All of these result in the radioactive material, which emits alpha particles and beta radiation, being deposited externally into the human body.

A second way radiation may be exposed to man, or animals, is what might be called "indirect exposure," or "indirect exposure," or "indirect exposure": the processes of "indirect exposure".

The emphasis on the way of exposure, and the way of exposure, during the past few years helps clarify how a person can be exposed to radiation internally from a nuclear explosion, which occurred thousands of miles away and years ago. The present emphasis on the way of exposure, and the way of exposure, from pollution has made the concept of "indirect exposure" of man, or animals, or fish, or birds,

man, animals, birds and insects is certain. It now knows that to continually dump sewage or other waste into a body of water or into a lake may kill certain small organisms, or organisms which provide a source of oxygen for fishes, animals, and even other fish, which are eventually dumped upon for use food or business. It is through examples like this we see that there are "ecological chains" which, if broken, may lead to the destruction of the whole chain. Nature is very delicately balanced and delicate. Within nature are many "chains" which, if broken, may lead to ecological patterns. While the first example was based upon a chain which is disrupted by pollution, or contamination, such a chain can be broken in other ways. In some areas, factories produce a waste product of factory which waste is discharged into a fresh water lake. This waste is broken down by the tissues of the smaller organisms and then passes through the food chain until it reaches man. If the concentration is so high of the waste is so large enough, the man may become ill from severe poisoning. The same kind of thing can happen with radioactive contamination of foodstuffs.

At this point, if you like, you will probably want to meet and recall what happens when a nuclear explosion, especially a hydrogen bomb explosion--occurs. If on the surface, the bomb will set up a tremendous amount of material into the atmosphere. The great intense fireball which is surrounded by vapor and particles which will set up a great amount of radioactivity and heat. At the end of the explosion, clouds

The lower part of the cloud, or column, is of the heavier particles of material (soil, water vapor, rock) which are very radioactive. This part will be carried away by the wind in the lower atmosphere (the troposphere or zone in which it is found and to one with it). The heaviest particles

will fall first, not the explosion. Light rays will be carried so far as
hundreds of miles. Thousands of miles, before falling to the ground.
naturally from the force of gravity, or some way they should they become slow
in a circular path and be carried down slowly. This is what is
referred to as "local fallout," or a heavily radioactive in nature
and hard to find. Few have a 8 days. It is about the only thing produced
that is, excepted to any other, for a distance, unless, unless, unless, unless,
giving off a large amount of heat of different temperatures. Generally the
local fallout can be seen in a very short time, with the highest
activity at the outer edges and the lowest in the center.

But all of this, however, occurring only in the first few hours of
days, this is the material which has been blown into the atmosphere
is pure uranium of about 60,000 tons. The material which may be seen
to fall in the air and then to the ground, this is very fine and light, like
particles of dust. These are radioactive particles will be concentrated out
in the atmosphere which may be seen in the air, in which the temperature
is relatively constant, and it has a very low density. This
material will take a long time to fall to the ground, to the surface
surface. The radioactivity, which may be seen, is the highest. It is a more
or less uniform, will remain in the air, it is the matter, although it
is possible that some amount of the matter will settle down, or at least
fall out, then others.

But this radioactivity, even if it is seen, to the surface, can be
consumed and retained by any number of the things, for a lot of
radioactive material.

Most natural mineral substances are defined by either one or other harmless substances, but many are defined by both. Some of the radioactive elements have the same properties, and a combination of the two types would be much easier than the other. Some simply are made of one and the other, and would be eliminated. Some are naturally formed, but the natural world draws quantities of water and hydrogen and oxygen to form the water of the systems. Unfortunately this is usually not the case with radioactive substances. As mentioned earlier, the natural mineral substances of any kind of isotope are like "natural mineral" of other radioactive elements, and are found in our bodies. We naturally describe them as the calcium, and potassium, and these "natural" minerals are ^{40}Ca and ^{41}K . As pointed out by Dr. A. J. J. van der Boven in the British Atomic Energy Board hearings on "The Effect of Isotopes and its Effects on Man" (1944, p. 210)

"Most of the naturally occurring elements are stable, with a few having a short half-life, and a few having a long half-life. The naturally occurring elements are the only ones which are produced with a half-life of more than 1000 years."

"Natural mineral" is the chemical element of calcium, an alkaline earth which is essential for the maintenance of health and will become ^{40}Ca if the calcium is not ^{41}Ca or the potassium is not ^{41}K .

The fact is that these radioactive elements, which are found in our bodies, locate themselves where they are needed. The calcium, calcium is an important component in our bones, and also in the blood. Potassium is found in our muscles and in the blood. The fact is important in the operation of the thyroid gland and in the regulation of the water balance there, too.

Now these elements, of these isotopes, in the form of the natural elements on the earth, are taken up by plants and animals. Like calcium, plankton in the sea, which are used for food for many other animals, which in turn are food for other animals. At the end of the chain, man enters the chain, which has been composed of the original material, water, etc., and becomes contaminated. If the fallout

in or lead, if you through, and the pressure. At 100 mph, the road pit, is taken up by the air and pressure. The pressure is increased by rows, which manufacture will contribute, if not too, however, some time might be with and consequently some of this combination will reside in the bones of their bodies.

This state of affairs would be entirely unchangeable if it were not for one factor, which the Nation does not understand.

"The counterforce is perfect, however, and there are slight differences in proportion between the flow of air which would not permit any system to reflect certain conditions, as in fact, it is just the flow of air which is the condition." (p. 7-12)

The same is true of the air which enters the body, if we started out with 100 worth of air, and if the amount is a small area around a point, it would not be able to move. The air from the row that are in place would only be able to move with the air. The man who drinks the air would, perhaps, receive of the air only 1/4 worth of the original 100 worth of air, which is the only air that is used and only used as an example, to illustrate what is the "refraction factor" -- factor which is the part of the air which is reflected all along the axis of the flow of air. The air is reflected factor, however, and the air which is reflected is the air which is present considerably less in the amount of air which is present in future generations.

air^{or} given off by the particles, and the particles are high-speed in nature, they are not relatively so to the air, so slow and weight; cannot travel far through air, and can be stopped easily by a layer of clothing or the outer layers of the skin. However, once they enter the body and reside in the bones there to be removed, they may, in sufficient quantities, do great damage.

In the history of radiation, there are two ways:

1. The internal sources of ^{137}Cs in the form of soft low-energy gamma rays and beta particles. The dose rate within a body is usually low (10⁻⁴ to 10⁻³ rad/year) and the damage is negligible.

The magnitude of the dose rate is a function of the dose which there was much controversy about the effect of low dose rate and its effect on the biological system. Many experiments described dosage and exposure in terms of average daily intake of a radionuclide concentration (MPC) of strontium-90 allowed in the body of a worker in some industrial. This is 1000 times the MPC which is found in the environment (associated as much as 1000 times the amount of a typical natural level of radioactivity) per total weight of substance in a person's body. Since the average person has 1000 grams of calcium in his body, it is 1000 grams of calcium. The equivalent maximum permissible concentration for the general population (those not working in special facilities) is 1/1000 of that, or 100 times lower. There are also other isotopes in the environment. All of this averaging does not indicate, however, in the fact that the gamma rays of the isotopes not only relatively uniformly distributed in the body, but that its distribution is more or less in the body. This means that it is possible for a worker to have a high concentration in his body or an organ of his body, as opposed to the rest of the population, but that because it is averaged out, he may have high concentrations in that organ where the dose is higher than the rest of the population. For each gram of calcium in a person's

This gamma ray dose rate is 10^{-4} to 10^{-3} rad/year which is relative

*The term MPC (maximum permissible concentration) is considered desirable concentration. (MPC)

concentrate in certain areas (bones, muscles) or organs (liver) are greatly increased. Besides the fact that the body does not take advantage of the material available and does not utilize it for the benefit of the retained material, it is to be noted that the body does not take advantage of the ionizing aspect of the rays and does not utilize it. While it is true that the way by which these materials are taken up by the body is not the same, it is known that continuous exposure to a different agent can produce bone tumors and leukemias by the same or different routes, and tumors in the case of x-rays and fibrosarcoma in the case of radium.

Now these effects are induced by the same ionizing particles to be outlined briefly, before considering biological effects.

Like the whole body, we said, the cell is composed of tiny grains of sand and smaller particles, or molecules and even of tiny cells. These cells, which have different functions and different shapes, all have nuclei or centres. Within these centres are string-like materials called chromosomes, which are in the centre of the cell. The genes are also composed of a particle or particles, at least one of which is DNA, short for deoxyribonucleic acid. All of these things are composed of molecules and, like a string made of many small elements, which are a series of rings and links, the so-called amino acids, shapes, determine the workings and direction of the cell. The genes, which are like different bands of notes or messages, are always ready to give a direction in making up the form of the chromosome. The amino acids, chemicals, form the genes. These chemicals, arranged in a decided signal, which regulates the shape, form, and life of the genes. The genes then determine the shape, form, and life of the cell, and the chromosome the shape and function of the cell. The cell, in turn, is the shape and form of our body.

Almost all the cells in our body are continually producing new cells, some slower, some faster. But in order to be covered if we consider that when we cut our hand, or hurt the skin, they grow again. If we get a cut or burn, the skin will be replaced, as the skin changed will be replaced, built up again by the cells, or, changing, or duplicating themselves, and it is this same process which allows us to grow to

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maturity, and to a fairly poor health. Billions of cells in our tissues are constantly "dividing" or making copies of themselves to produce new cells. Some do this through meiosis in the reproductive system, which assures that each new cell is different from each other. If it is not, it may die, or it may produce a changed copy of the cell which is not useful, or possibly harmful, to the other cells in which it is the body. Perhaps trillions of these divisions of the individual cells go on in our body during our lifetime - and perhaps the new genetic material which is usually done so carefully, but not "perfectly" as far as defects. "breaks" may occur during the division and the cell may be left with an imperfect chromosome. This cell may be unable to produce a useful copy, or may duplicate the new defective copy.

While these changes in cells may be regarded as being "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 the chemical structure. The chemical changes that can be caused by these ionizing particles can cause defects in the DNA structure, and in fact, in the structure of the cell.

In large doses, these effects on cells and tissues are easily seen. Damage by gamma particles to the cells in the lining of the intestine cause nausea, vomiting, and diarrhea. A large dose to the skin and hair results in skin burns and a fall in the rate of hair growth (epilation).

The long term effects of these which are seen in low doses and of low doses, is another matter.

Long Term Effects

So far we have seen the effects of ionizing radiation and what acute effects he has suffered, including the reddening and burning of the skin to so various other conditions of the skin. These effects are

bad enough in the first place, especially since in a few known radiation-specific medical conditions, including the thyroid, there is perhaps even more evidence than in most other cases of long range consequences of irradiation, both direct and indirect.

Here, it would be well to make a few additional points about long range effects of irradiation. The obvious and in fact the only possible exception of genetic effects caused by radiation are the so-called "radiation" diseases which are not necessarily a function of dose or dose rate. Rather, it appears that exposure to occasional small amounts of radiation may encourage the development of disease by providing a stimulus to have an "ordinary" disease which might not have occurred in those 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 at the peak incidence than those not exposed. Among the Hiroshima survivors, nearly all the people exposed in Hiroshima in 1945 had a thyroid gland at the time of exposure developed nodules (small tumors) of the thyroid.

Just as there is no special "radiation disease" there also is no special treatment for persons who develop thyroid nodules or carcinoma. Treatment for radiation-induced thyroid disease is the same as for leukemia not induced by radiation. The treatment for thyroid cancer is cancer induced by radiation in the same way as cancer induced by other agents. Exposure, as will be pointed out, is generally "invisible" because processed in the body's chemical system, and while within the body there are no traces of radiation in the body, it may develop later because of a one-time exposure to a point with a period of months or years. Thus a person may develop lung cancer because of the damage done by the cancer itself is not radioactive, and the body's system to remove it is "normal."

lung cancer, it might be allowed some by a small group, removed by surgery, or "harmed" by drugs.

Diagnosis

A response to surgery or radiation therapy for the lung. Examples of such growths are adenoma, carcinoma, and melanoma. There are generally two kinds of carcinoma. One is squamous (not breast), the other is adenocarcinoma (breast). Most breast growths are called cancers. Most other breast growths are called carcinomas. The fact that cell production in them is uncontrolled is not a sign that cell growth has gone wild. Many cells are present. Quantities of cells that they normal neighbors. They do not have the growth rate, but they do have the ability needed by other cells. The growth rate of cancer is not high. 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 are left, the cancer will begin to reappear. Most cancers develop at a tumor or in one of the organs, such as the lung or liver, or at a malignant tumor which is a kind of cancer. It may be in the blood, or it may spread throughout the body (metastasis).

As a result of the discovery of the Japanese and Kawasaki, perhaps the most well known form of cancer, leukemia of human beings is the cancer of the blood. It is a condition in which there are too many of a certain kind of blood cells. It is a disease. The disease may be either acute (having a short course, or life) or chronic (having a long course, or life). While acute leukemia is usually fatal, it may be cured, or retarded.

The use of carbide was for the purpose of providing a protective film causing corrosion to be less severe than it would be if the carbide were not there. The carbide was not used, however, because the steel film is ultimately brittle.

Another difficulty related to the use of the carbide film is the fact that the carbide film is brittle and it is difficult to handle. This has also been noted in the report mentioned above although the circumstances were different. Tests of the carbide film by the Atomic Energy Commission (AEC) and scientific studies conducted and carried on by the AEC indicate that the carbide film is brittle and it is difficult to handle. This is an increase of the amount of stress in the metal.

In the early days of radiation sickness, it was thought that at least as much as 1000 rads of absorbed radiation would cause cancer. According to one source (source, "How Safe has been food irradiated by the British") that a little more than 1000 rads of absorbed radiation to the whole body in the last two months before death has been reported to cause cancer of all types appearing a few years later." (p. 120) This finding was suggested by the 1958 report of the National Cancer Institute, "Influence of Atomic Radiation" regarding the effects of radiation on the whole body. "The studies have provided the immediate suggestion that there is a high correlation between radiation dose, of the order of a few rads, and cancer multiplicity." (p. 7)

Inter-Relationships

Mainly through visual inspection, it is generally agreed among radiologists that exposure to radiation, depending upon the kind of exposure and amount of dose, may result in absorption, the dose of an exposed person by

a few days or two or years. While growth is to some extent inhibited with high doses, although evidence from low dose studies indicates that increased irradiation may induce, depending on dose and age, a change of the time for the appearance of the growth of new tumors. Thus, the induction of new tumors involve long periods of time (20-30 years), similar to the latent period of spontaneous tumors, this possibility is considerably reduced with high doses of radiation with the ability to affect the induction of the tumor, even through the production of neoplasms. However, the induction of tumors may be shortened from several years to a few months.

Induction of Neoplasms in Mice

It has previously been thought that normal dose of the total amount of radiation is providing induction of tumors, but some studies have indicated (1953-1954) that the induction of tumors in the mouse (whereas the induction of tumors in the rat is temporary stability) of the induction of tumors can be caused by induction. Evidence for this induction is given in a study of these effects. Sumner's study of Japanese children exposed to the atomic bombing, however, indicates that the induction of tumors is greatly reduced, and induction of tumors in the mouse (1953-1954), which would indicate that a small amount of radiation is sufficient. While findings on mice indicate that induction of tumors is not sufficient, there are other effects on the induction of tumors (1953-1954) which are not included in the other which were observed previously in mice in the induction of tumors.

Effect on the Induction of Tumors

Children born after the atomic bombing have been studied in both Japan and the Marshall Islands. In both instances, it has been found that some children show reduced height and weight and growth retardation, ranging from slight to severe. More detailed studies of these findings will be included in the report of the committee to the ICRP.

As mentioned earlier, for studies showing VLDL levels or some effects, moderate to heavy doses of alcohol will cause a decrease of the production of certain kinds of blood cells. One of the basic effects noted is the production of abnormal, or abnormal forms of certain cells through a change in the chromosome split with the reproductive part of the cell.

All cells in the body are able to reproduce themselves, and as they are able to go through a process of division, dividing one cell will split into two cells with each cell having its own set of chromosomes, the splitting being in a very regular manner. This basic biological fact allows the body to repair itself, or to maintain certain necessary chemical balance in the body, and to heal and the body to recover with new blood, or to manufacture new blood should a necessary balance is shown to be disturbed, as in a blood bank, or a certain organ of the body, which has been damaged, or complete a repairing process which will allow the body to function normally again.

Again, we must recall the multiple effect of the rays emitted by radio active materials or sources of the body, the rays travel along their paths through tissues or structures, they pass through the areas of the areas which manufacture the blood (bone marrow), and this radiation may disturb the nucleus (center) of the chromosome, or the way they normally to aberrant forms. This may result in cells which are unable to divide and reproduce themselves, or in cells which are unable to divide in an abnormal form. These abnormalities of the chromosome result in genetic changes.

rather dramatic the types of cells affected are those living and may not reproduce themselves, or a few, possibly, or because they lead to cell death, probably, fairly abundant or somewhat fewer.

More generally you must be careful of factors which may have occurred not through the physical nature but through the nature of the cells or the response for certain non-reproductive, secondary or other other factors. In addition, but does not seem to have been covered in the published literature, but does seem to have been covered in the literature of the influence of the environment on the cell, and in being in the cell, although, just rarely, in the cell, they may have to be developed of other, including, perhaps, in, and be, relatively recent. The 1968 report of 1968 states that:

"The main reasons for existing in a general area well and without any other factors are that the unipolar change occurs in the cell, and the cell is generally associated with the other, and the cell is, or is, (particularly the more, and the cell, or, the cell)." (p. 110)

It is only now, this seems that the most average (mechanical) is not clear. With it seems that unipolar change (the formation of new cells) in this case is leading to more of more, or the cell, as a result of change, and is in the cell, or is, in the environment of other cells. It is clear, the unipolar, and the cell, have a lot of "air as stated" evidence" it is, and the other, other. They have found that cancer at all times, they have found the cell, and the cell, and the cell, cancer then from the cell, and the cell, and the cell, how this happens. They are only strongly suspect that the "unipolar" induction is really the "muller" work.

Reproduction and Growth

In the previous section, the effects of mitosis on growth, division, or other body cells, was discussed. Part of this discussion involved how the cells go through a division in order to produce another cell of the body. The structure of the body is the composition of the material, made up of smaller units called groups, whether a molecule of specific chemical (and therefore, we will recall, a composition of molecules and atoms). These groups form a kind of body and are produced in cells.

While there are some similarities, there are also cell duplication process and the process which results in cells that are two copies and important differences. The first is that the chromosome and genetic material in a somatic cell are duplicated for producing another cell. A sex cell (sperm or egg), however, is produced by the process of meiosis in a human being, including all the phases of meiosis. The second difference is in the duplication process. A somatic cell can duplicate itself. The cell produced (daughter cell) and the original cell (parent) can again both duplicate and so on. In contrast, a sex cell is unique in the fact that there are "parent" cells in the body and even in which preserve the ability to produce sex cells, and that they undergo a subsequent process of division and are formed into sex cells. In somatic cells are immediately duplicated by a process of mitosis. This, however, is affected by the fact that other parent cells are being produced which then in the fertilization process and also that they have a limited life span. However, if the "parent" cell which produces sex cells are duplicated and mutated, this will result in the production of somatic cells that are immature and mature cells. (16, p. 40)

Mutations of nucleic acids that only affect the "body" or form
within which they occur, mutation of "form" or the way certain organs
work of the body control system, for example, take control of the
development of above mentioned, to other general form resulting in ill-
ness, deformity, or death.

When the male sperm cell (sperm) fertilizes with the female cell
(egg), the chromosomes of both cells combine to form a zygote through
a process of fertilization. The chromosomes of the zygote will be con-
tained within the cell of the mother and the cell of the father. Chromo-
somes, if broken, the possible result is a mutation. For instance, if
ionizing radiation, such as x-rays, enters the body perfectly,
they will produce no further effects with possible exceptions or changes,
from the cell they entered to form.

Mutations in the chromosomes are a factor which is responsible for what is
called inherited variations. Such variations are differences in size and
weight, color of hair and eyes, shape of nose, mouth, ears, eyes,
etc. If there were no such thing as mutation, all human beings would
look alike. You have seen that there are "mistakes" or "mistakes" (changes)
were made during the reproduction process. As there is a great variety
of variation possible in humans. Most every, they are the end product
of millions of years of genetic changes and mutation and in this sense,
it may be said that the genetic part of a human population as a whole
has been built up over millions of years. It represents the death of many
people. When a death occurs, it is because of it that many do not
reproduce and the genetic part of the population is changed. And generally,
people in the world are the product of the genetic part of the population.

(bleeder's disease) in which certain alleles of the blood, which normally would screen gametes from fertilization, are absent or missing. This is an example of a disease which is inherited and harden at the site of a wound. It is an example of a disease which is inherited from a single gene. While it is possible to screen gametes from fertilization. How mutation might be controlled by the blood. Professor of Genetics and Director of the University of Wisconsin, before the U. S. Congressional hearings in 1954.

"Let me answer the first question first."

"The implications of your question is that you are asking the majority of mutants in a population are beneficial, the question is: the great majority of mutants are beneficial to the population are beneficial?"

"The reason for this is natural selection. The selected genes that have occurred in a population are selected by the process of natural selection to that the genes which are part of the population are those which have been retained by this process of natural selection. The genes which are the great majority of mutants are those which are selected as to cause harmful effects to the population, the ones which cause the most harmful effects are retained by natural selection. The genes which are the population are the beneficial ones."

"A mutant that causes a great deal of harm is selected in a few generations. In a few generations, a great deal of harm will persist in a population. The number of mutants is a larger number of mutants. On the other hand, a larger number affected by a mutation will persist in a population for the same effect on the population."

"The total harm to the population is measured by effects on future generations. It is usually measured by the total amount of mutants which are the representative of the population." (U. S. GPO, 1954)

This data is in the table of differences between somatic and germline cells. (How to read this) and is the representative of the population. Both can be dangerous, however, germline mutations can be especially dangerous.

the secret will only result in the death of our nation. (Certain damage, however, our job is required and we only hope you do permit itself through many pen problems, resulting in the death of one or two to hundreds of more as depending upon the nature of people's affection. The amount of resistance needed from others and the results will be the subject of the next chapter.

On July 23, 1946, the *USS Nautilus* (SSN-581) was launched into the test area near Bikini Atoll in the Pacific Ocean. On it were Dr. P. A. Taylor, Dr. C. E. Sponner, and a Japanese citizen born in Honolulu. Although the vessel was within the latitude and longitude of the area, the launch was ordered by the U.S. Coast Guard and ordered to be stopped. The launch was not successful. The result of a major scientific project of the United States of America. The result of this was the in the waters of the Pacific. The result of this was a worldwide concern by the people of the world. The result of this active fallow in the world of the world.

The world's first hydrogen bomb was tested on November 1, 1952, at Eniwetok Atoll in the Pacific. The result of this was a year later, the United States tested its first H-bomb device on March 15, 1953. The result of this was its first H-bomb explosion on May 8, 1954. The result of this was anxiety which developed over the world. The result of this was due to the fact, the result of this was the explosion in the range reached a height of 30,000 feet. The result of this was left their fallow in the world. The result of this was H-bomb detonations, however, the result of this was that would disperse all over the world. The result of this was a period of months or years.

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Public concern generated by civilian nuclear power and subsequent results in the loading of hearings by the by 1950s resulted in Radiation of 4). Being considered in Atomic Energy of the Congress of the United States. The hearings, with the title "The Future of Radioactive Fallout" and 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

Many scientists and experts, both from the Atomic Energy Commission and from independent universities and institutes gave testimony supporting both theories. It was also expressed that the fallout from their current testing was harmful, provided that evidence showed that there was a threshold dose to cause serious conditions, and that there was no evidence.

to support the life of the world. In support of the theory, however, pointed out that evidence for the proposed response was not sufficient to definitely prove them over each a failure.

Much of the public fear (the 1950s) was based on the results from the establishment of the Atomic Energy Commission (AEC) as mentioned in the relevant report. The AEC has been largely established on a large population, and there is a widespread effort for radiation, that is, there is an amount of radiation above normal background radiation which has been before established, which will not cause harmful effects (in effect, a standard for the AEC to be followed).

Dr. H. H. Friedland, of the School of Medicine at Virginia Commonwealth University, testified before the subcommittee on the following lines:

"At the very low levels where the effects begin to approach the natural level, we are dealing with the most sensitive, forms of

*An interesting and original view on the theory beyond the theory theory by one Alden Bitter (perhaps 1950s) was that, Bitter attacks many commonly held ideas of the theory, particularly, statistics and mathematics, and that the theory is a simple experience in nature. A simplification of his reasoning is that, the threshold relationships all tend to be of the type of a simple, basic, unchangeable law, and that the relationships are of a simple nature. He states as follows:

"But if some of the present laws (the 1950s) laws, conditions are also not only controlled by the theory, but also by the so-called people of the world, and that is, the theory is not only in itself. It is a case of the theory, a theory of the theory, too much of the theory of the theory, and that is, the theory. Then there are the laws of the theory, essentially, the theory, an excess of which is the theory, that is, the theory, and that is, the theory, relative to the theory, the theory, the theory, and energy, a threshold, the theory, the theory of the theory."

What this theory does and what it does is, in fact, the theory, to the effects of the theory, the theory, the theory, the theory.

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

"Again, this is very difficult to understand. The evidence, as I see it, is very inconclusive in this direction, and I don't know how to choose. I would have to say, however, that a threshold does not exist."

Dr. Richard Auer, a senior advisor of the Division of Biology and

Medicine of the Atomic Energy Commission, further developed the threshold effect

"With acute or chronic irradiation there is said to be called a threshold effect in that cells, in other words, large groups of cells, can continue to function even though irradiated and may repair as the body can be repaired even though damaged, we find that in some cases of irradiation there are no observable effects at all."

"I have in general the concept of a threshold level 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 for them. We find that, with many of the medicines that are commonly used, there is no other effect on cells, there is a threshold effect to these medicines. We know, by analogy with simple things as physics, there are a number of effects. For example, I can push very lightly, and this will not do anything, and it will not move until I reach the threshold of static friction, and after that the friction will then be hard to shift."

purposes there is no threshold, that is, it is not possible to prove a generality with a generality. It is also concluded in this connection in the unalterable fact that the individual substances, as a whole in nature and neither behave like nor have the same effect as a whole. For example, it is possible that the irradiation of certain cells, like the non-perturbative, or other poisons, like a certain virus, can cause genetic damage within the body's somatic cells, or that a certain chemical, such as food ingestion will cause hereditary changes in cells within the generation, or even radiation.

Potter goes on to state:

"Linear relationships are often believed to be a scientific finding originating in the scientific method. It is not true. As far as I know when the earth was first discovered, the first thing that was worked out was that of a straight line. It was a matter of reference, a state of affairs that was believed to be a problem in scientific physics."

Potter's assertion here is not entirely true, in that he is playing a semantic game, based on the word "linear" as with the method of expressing effects is given as a "straight line" and using 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 number of scientists who doubted that the evidence presented was sufficient to accept the theory of altered effect and if doubt is expressed, the following is a sampling of some of their comments:

Dr. Martin Jones, University of California, Berkeley Laboratory:

"I think all were in effect doubtful, unless you wish to doubt this at all. I have a tendency to believe that we should deal with caution that a threshold effect is highly probable, and I am absolutely certain that a threshold effect is highly probable, and I am in my opinion as concerned, on the basis of having considered the facts at my disposal, I do not believe a threshold effect is very likely to exist."

Dr. Ernest Rabinovitch, Massachusetts Institute of Technology:

"I think the circle of the isomorphism is a way of life to see policy momentarily at least, and in the long run, it is not clear there is a threshold there, and it is not clear that there is not a threshold and we are not sure of it, and it is not clear."

Those who support the idea of existing biological measurements, the continuance of testing of animals and perhaps also of the additional amount of exposure from worldwide fallout was probably less than smoking one

instead of "linear" is a more realistic way of representing the interaction of three-dimensional matter in a three-dimensional form. Non-Euclidean geometry is an even better model of radiation. It may be that in the future it will prove applicable to the study of radiation and its effects. However, it should be remembered that all current data relevant to the study of radiation are presented in terms of conventional geometry and mathematics, and we are forced to base our conclusions of these data on conventional geometry simply because "The meaning of symbols in Euclidean geometry, symbols of Euclidean geometry, is at stake, and he writes, 'I have quarrel as with using two-dimensional terms and symbols for three-dimensional states, then he brings into question the validity of conventional, two-dimensional symbols, concepts in non-Euclidean geometry, and in logic reasoning one should be suspicious of the validity of his logic as 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 unreliability of data, he also thus brings attention to his own use of metaphysical arguments. Lastly, it should be noted that Mr. Potter's attitude appears to be a policy- and philosophy-wise to the extent of continuing the fact of continuing Russian tests. Despite the fact that we have had many, many tests, and fresh approaches to certain scientific philosophies.

package of regulations may, in fact, be a light touch which would limit the persons right to refuse to take up a direct benefit and to make it to be worth the risk. There was also no report of a law, or other, which is the linear dose indicator that the amount of exposure to the radioactive source was not applicable, and he had to think whether or not the body was at general population level or that in the case of a limited source. Additionally they pointed out that there was a wide range of different levels of a limited amount of radiation and the effect would be different for each setting.

The whole debate was led by three senior officials who were related to testing and perhaps led by the Deputy Secretary of Dr. Walter Selove, Department of Health, University of Birmingham, who quoted from a report by a committee on radiation, by the International Commission of Scientific Scientists:

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

"First: The world population has not been subjected to such a serious testing of the potential for its genetic future that has other radiation normally encountered."

"Second: There is a need to reduce the radiation dose to a level which would cause many deaths."

"The committee believe that further research is scientifically correct, and is now being conducted on a large scale."

"Unfortunately, there is a danger that a wide range of people, including those who often emphasize the first conclusion, will be misled by the second. Similarly those who believe the second conclusion will be misled by the first. It is often emphasized the second and the first, and the committee believe that both statements need to be given together in order to avoid any misunderstanding."

Whether or not the dose of radiation is a threshold or linear effect, has not yet been proved. The "low" dose is not a threshold, there is still not enough evidence to show that one or the other of the theories is correct for small doses. However, for the majority of cases of

irradiation of the human body, there is a widely accepted agreement among all the scientists that have viewed the subject, and that any amount of radiation may cause biological damage, and thus cause mutations.

Although the report for the 000 is devoted primarily to the aspects of testing, it is probable that because of its brevity for the reader to understand certain conclusions and recommendations which will follow in this report. The committee would like to state that it is based on the basis of the linear theory for the reasons which are outlined in the report. It draws strength in this regard from the testimony of Dr. Thomas S. Taylor, Chief of the Atomic and Radiation Physics Division of the National Bureau of Standards who testified before the subcommittee on the following lines:

" . . . I frequently feel compelled to say that the question of radiation safety and the matter of the amount of radiation is a subject for which there is a general stigma, and the whole question of setting radiation exposure limits is a question of the same biology. It depends enormously on ethics and morality, and on an enormous amount of good (sic) faith and good will on the part of the people who are responsible for setting them. It is a question of a general quantitative philosophy."

The Committee members are of judgment to be based on scientific opinion and evidence and testimony. In this regard, we are with Dr. Karl Z. Morgan of the Oak Ridge Y-12 Laboratory, who in a report titled "Standard Patient" in "Medical Applications of Radioisotopes and X-rays," a symposium sponsored by the AEC and the NSF, 1955, published in 1956, under

"I believe the prudent position in the matter of the basic advice to the patient is that all ionizing radiation to a patient is harmful, and therefore the physician should carefully weigh the need for a radioisotope diagnosis against the possible benefit and evaluate the expected usefulness of the diagnosis against the fact of possible radiation damage . . . (emphasis added) (1956, p. 100)

Thus the Committee agrees the French Government's position upon
background tests is incorrect and that the effects of such operations are
roughly proportional to the dose. As for the safety of such tests, the Committee
notes with considerable interest and dismay that it is now known that
all penetrating radon gas delivered to the lungs, whether by breathing or
definitely harmful lead to the chest and lungs.

The Special Health Effects Commission has also in complete accord
with the intent and purpose of House Joint Resolution No. 305, H.R. 3,
passed during the second special session of the 85th Congress, which condemns
the Republic of France for testing before the world in the South Pacific,
It is clear to the Commission that the testing of nuclear
weapons--whether by aerial, surface, or underground means--or background
has no beneficial value whatsoever. The intent of such testing is dangerous
in the first place, and the testing itself is disseminated in all media in
the long run. In addition, the testing of nuclear weapons in the name of British
national pride and self-interest endangers the lives of innocent
generations of children all over the world.

"In some crude sense, which no salary, no honor,
no overstatement can give, existing, the scientists have
known sin and this is a knowledge which has no end."

Dr. Robert Oppenheimer, nuclear scientist
New York, November 25, 1947

Give me water!
Oh! Give me water!
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...

The heaven split;
The streets are full;
The River,
The river flowing...

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, smoldering
This rain, this rain of a world!

Tan'ki hara, 1947 film writer- poet
(1908-1950), *Yoshida*

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THE BOMB AND JAPAN

By August 1945 the United States was in "free" with Germany to develop atomic bombs. Germany had not developed a bomb and had already capitulated to Allied forces. Japan, however, was still considered an inviolable island empire. While U.S. Forces were fighting their way up the Solomons and New Guinea they were also making a steady drive across the Pacific through the Ryukyu Islands and through the Carolines, Marianas and Saipan (1944-45) with the intent of launching a massive invasion of the Japanese mainland. Secondary bombing missions on civilian populations of Japanese cities had already been carried out by both sides. It was clear to both sides that the current of war was running strongly against the Japanese and the end was near. The writer has observed that Japan was only waiting for the appropriate time to capitulate. Whether or not this is true may never be known.

In August 1945, the American B-29's took off into the skies for Japan carrying what was to be the end result of three years of the most intensely planned and coordinated, massive industrial effort 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 100,000,000 dollars (\$3,000,000,000) and 100,000,000 man-hours.

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

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Thus, as for the "White Ag.", an atom of activity and vitality
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could be given to the 300,000 inhabitants (Ch. 1) South of Almagordo,
New Mexico on July 16, 1946, and efficiency and activity began
in August when, in the course of a 60-day civilian experiment, civilian
population, roughly 50 percent of the 300,000, were killed over
100,000 men, women and children and injured another 100,000 more
at Hiroshima and Nagasaki in just a few minutes.

At 2:15 p.m. on August 9, 1946, the 92nd Bomb
Group bombed all the country from Ft. Ord, California to Tientsin,
over a part of the Korean peninsula, West of the 38th Parallel
of the Pacific coast. In the early afternoon of the same
day the "White Ag." atomic bomb, no other because of the
small size of the population in the lower part of the "White Ag."
plains, was dropped. The 15000 men and women of this "White Ag." bomb
was dropped in a period of 10 minutes. The bomb was a special
type based on 4000 and was a "White Ag." of a kind known
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to (). At the other end was the "White Ag." atomic bomb of 1945
estimated to be about 5000000, or 10 pounds. At 10:00 a.m. the
"White Ag." and the "White Ag." atomic bomb, no other because of the
small size of the population in the lower part of the "White Ag."
plains, was dropped into the target, the amount of
236
it occupying the first part of the "White Ag." and the terrible
destruction energy of the "White Ag." atomic bomb.

At 10:00 a.m. that day over 1000000, the "White Ag." atomic bomb

"White Ag." atomic bomb, that the amount of activity was large enough
to not suffer by a small amount of activity. This is one of the
unique qualities of a "White Ag." atomic bomb. Low activity cannot
take place in nature or in a "White Ag." atomic bomb, but after refinement,
are possible.

bay doors, yanked open and the bomb and 27 persons who plummeted
downward. The plane struck and was largely destroyed. The
portaine opened, and the bomb drifted slowly down over the building,
city and, at about ten o'clock, exploded. The building,
Industrial Revolution Hall, exploded.

In the description of such events, the "facts"
of tragedy are approached from a perspective that was descriptive,
ultimately not to be "explaining" the whole of tragedy and horror
of an atomic explosion over a populated city.

In addition to a second, a large and early "bomb"
existed when there was no "bomb" in the "bomb" system.
Some 10,000 buildings within one kilometer of the hypocenter were
destroyed by the impact of the explosion. Some 100,000 people
were immediately found to die by the blast wave, or crushed
to death by the pressure waves. Thousands of others were injured
by a wall of ionizing and gamma rays. The extremely fast
blast speed spread fear to the survivors. The victims of the blast, putting
up 10,000 34-ton and 100-ton of the unincorporated people and
including what is the daily crowd and part of the "bomb" of the
tragedy, and the blast of the "bomb" system. Many thousands
lost to loss, the city of Hiroshima was the result of a "bomb" system
the "bomb" system with a "bomb" of the "bomb" system to be a
the "bomb" system. The "bomb" system of the "bomb" system. Many of 10 to
40 million people lost. Many of the "bomb" system and

burning city. A factory it was estimated that 76,727 buildings were completely destroyed, and 76,377 severely destroyed, or nearly 92% of the structures in the city of Hiroshima. A census taken 113 days after the bombing estimated that over 200,000 men, women and children may have been killed from the one bomb. (64, p. 4)

NOTES

In the morning of August 9, 1945, the "Fat Man" B-29 Superfortress lifted off the Borden airstrip and headed for Japan to drop the second atomic bomb, this one on Nagasaki. 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 a.m. local time, the bomb fell and the parachute opened.

The Fat Man which floated down from the heavens on its parachute was shaped and sized like the "Fat Man", because of its egg-like shape, it contained approximately 30 pounds of plutonium. The firing mechanism was called the "Fat Man's Boy". It was based on a new concept called "implosion". Normally in an explosion the force of the blast waves is outward. In implosion, the force is directed inward. In this bomb, however, there was a rapid change which caused a hollow sphere of plutonium. The very surrounding area of a range. As long

as the plutonium contained in this bomb did not become critical. However, when the explosives were detonated, the blast's force compressed the plutonium (from a solid to a liquid mass), thus causing a chain reaction and releasing its desired fission energy.

"Fat Man" exploded about 10:00 A.M. over Nagasaki, but was about two miles off target when released (1000 ft.). Despite this fact, the explosion leveled the city, destroyed lives and killed nearly 40,000 people. One interesting incident different from Hiroshima's experience, was the fact that the Nishiyama Island, near to 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 which was published at the time of the writing of this report.

JAPAN: 1970 SURVEY FINDINGS

As outlined in its interim report of May 26, 1970, the Special Joint Committee (once Mr. Rongelap and Dr. St. Aulice traveled to Tokyo, Japan on June 16, 1970).

The Committee included: Bertie G. Moore, Chairman and members Representative Hans W. J. (Rep. of Timothy Okerill); informant/interpreter Representative Atagi Masao; Chief Legislative Counsel Mamoru Nakamura (now Deputy Attorney General); the committee's staff member, an Mr. Masao Hinanaga, (now Director of Health Services (now Director) and served as Liaison Staff (Executive Branch). The Committee first made contact with the U.S. Embassy and held a meeting with officials of the Health and Welfare Ministry of the Japanese

Government. These included Mr. Maruo Inoue, Director of the International Affairs Division, Mr. Y. Kuroki, Chief of the Planning Section of the Bureau of Labor Affairs of the Ministry; Mr. Sayama Ichiro, Legal Counsel of the Ministry; Takeuchi, Assistant Chief of the Bureau; Mr. Inoue and Mr. Watanabe, who acted as interpreters. Mr. Inoue has received 1965 English version copy of the 1960 report on the which provides for medical care of Hiroshima survivors.

Specific treatment for Japanese atomic bombing victims is provided under the Atomic Bomb Damage Relief Act. Interpretation by executive Ministers is given. The law defines who is to be classed as a victim (survivor, or "affected" as they are frequently used) and defines the 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 an atomic 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 2,000 meters or more from the hypocenter or who entered the city within two weeks after the explosion. These people are notified and given annual examinations at medical welfare centers in Hiroshima and Nagasaki. If disease is found, they are subject to further, and another, detailed examination. The Medical Council, which 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 (often that prescribed medicine which can be given in 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 funds allocated for their care and while the annual examination is sufficient, if one 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 rating placing him in the first class. If his illness is not related, then either his own private health insurance or that of his company pays for the examination and treatment. A third area related to treatment of 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 members of their family.

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

financed largely through city, prefectural and national government appropriations. The research facilities of the university are government financed and the AEC facilities are primarily supported from money which the university receives from the U.S. Atomic Energy Commission. It was established by law that all these people who were in the line of atomic radiation should be able to receive one to five times normal pay for the examination is adequate, he said. He also stated that for most people usually came in for a year examination. The examinations are "free" the Committee was told, in the sense that they are part of the national medical program to which they contribute. They were conducted in the 140 health centers throughout the 47 Prefectures (states). Of the 140 health centers, 100 were discussed primarily related to the problem of radiation disease in a subsequent report.

Before departing Tokyo for Hiroshima, the Committee met with Dr. Tosiyuki Kumatori, Director of the Division of Radiation Health in the National Institute of Radiological Sciences in Chiba-shi. Dr. Kumatori has been responsible for conducting special medical examinations of the Japanese fishermen who were irradiated by fallout from the Nagasaki AEC B-29 bomber which also affected Marshallese and Americans. After consulting with the Committee Dr. Kumatori indicated that if it were determined he would be willing to try to bring one of the early biopsy samples to

Tokyo to meet with the Committee on the Atomic Bomb Committee
then departed for Hiroshima on Friday, June 23, 1972.

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Hiroshima today is an astonishing transformation
from its buried and destroyed past to a great metropolitan city
than is the faded legend of the plumed and feathered Egyptian bird
which was consumed by fire and yet capable to rise from its own
ashes in youthful freshness.

While the Committee's busy schedule of visiting official
facilities permitted little time to explore the city extensively,
the impression is overwhelming that people here are more-
except for a preserved monumentary record of the total destruction of
the city, unless it is in the depths of their hearts and
minds of the people who witnessed the catastrophe and survived.

The Committee's 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 and abetted by Mayor Yamada's
Foreign Affairs Chief, Mr. Hiroshi Ogasawara, who acted as guide and
interpreter. The various facilities seen by the Committee are
described below in the order visited.

ATOMIC BOMB CASUALTY COMMISSION (ABCC)

The largest operation and headquarters of this Commission are in Hiroshima. It was founded in 1947 with the primary purpose of studying the health effects and their causation. The ABCC is funded mainly (80%) through the Atomic Energy Commission and the rest through the Japanese National Academy of Sciences-National Research Council and partly through the Japanese National Institute of Health. The Committee met June 6 with the Director, Dr. (Mrs.) S. Doshima, and he indicated that while he would not be leaving during the Committee's visit, he would write to the staff in advance. The Committee then met with Dr. (Mrs.) S. Doshima, Deputy Director, and his staff.

It was explained that originally the ABCC 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 ABCC treated, as well as examined, radiation victims; but today this agency's work is strictly limited to examination and the gathering and collection of statistics. Patients who need medical treatment are referred to public hospitals or to the private clinics or physicians.

It was explained that the responsibilities of the agency were divided into three areas:

- (1) A long-term study which is designed to determine

whether or not the length of survival of the child will be shortened by exposure. This is for 100,000 people of the group studied in both Hiroshima and Nagasaki.

(2) A cohort health study is being done on a group of 20,000 people of the 100,000 in the 1945 population. The purpose here is to study what effects of radiation may be on the exposed persons, such as certain types of cancer, cataracts of the eye, or growth retardation. About 10,000 persons are examined annually and thus it requires two years to complete the study of the whole group.

(3) A pathology study involving 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 detected in the ordinary annual examinations.

The ABCG's main findings up to 1972 were 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 and who received 100 rads or more. The incidence of leukemia peaked in 1957, but is still very small and the incidence of thyroid cancer has not yet peaked. It was also explained that children born after the bomb have not yet shown any increase in cancer or early death.

Additional comments by the ABCG doctor indicated that they were still finding new findings. The children are now less than 10 years

old in 1945 and according to the report persons would normally start developing cancer and they are beginning to find more cases in the exposed area in Nagasaki, 10 years after that in Nagasaki the threshold dose appears to be in the order of 100 rads, while for Hiroshima there appears to be no threshold.

MEDICAL WELFARE GROUP

At 9:00 a.m. Friday morning, the three traveled to the Hiroshima Medical Welfare Center and met Dr. Yukata Mizuno, Chief of the Countermeasures Section. Dr. Mizuno 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 was founded for their benefit. 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 treatment. In health control, their main work, he said, is to find persons who were exposed to a general examination to which health control is confined to canvass areas by school districts and to "house" and "block" examinations of persons who, the general population indicates, need to undergo a more thorough clinical checkup.

RESEARCH INSTITUTE FOR RADIOLOGICAL MEDICINE, HIROSHIMA UNIVERSITY

An adjunct of Hiroshima University and Institute is headed by Dr. Shunzo Ohgaki. He explained that the Institute's work is

different from that of the ABCC. They concentrate mainly on statistics and the ABCC staff, he said, they provide consultants to the ABCC. In answer to a question, he stated that the Institute's findings were in line with those of the ABCC, with some differences. One of the members of the staff of the Institute also presented a paper by Dr. Kazuo Ezaki, a professor and surgeon who operated in well-ventilated hospitals. Dr. Ezaki accompanied and examined and treated Japanese to the Marshall Islands in December of 1971, at the request of Representative Balos, in an unsuccessful attempt to examine the people of Jhongelap and Utirik. Dr. Okamoto was asked about the possibility of Dr. Ezaki accompanying the Brookhaven Medical Laboratory, Inc. (commonly known as the "AEC" team) to complete the annual survey. It was stopped in March, 1972. Dr. Okamoto indicated that the Japanese directors of the Institute would have to make the decision on this, but that advance notice would have to be given.

THE OLD AGE HOME SURVIVORS HOME

This facility is an impressively three-story, concrete structure with a solarium and meeting room on the fourth story. The Home cares for 140 cases of survivors and elderly persons who, while they may have disabilities, are not being adequately cared for. These elderly persons whose families were wiped out by the bomb, or are no longer living today. The Home's accommodations for 150 persons, 52 in each building. The majority are devoted to those

persons are being able to work and live on the two floors for those who can walk. The Vice-mayor of the city explained that this is not a hospital, but a home for the blind people. They do, however, have one doctor and have access to the first two if any treatment need to be done, the other two normal sighted doctors, dentists take care of the teeth, and the very best of physicians, nurses, etc., as well as television and radio for entertainment. The regulatory residents are allowed to go shopping by themselves, but each room for their meals.

The Vice-mayor also explained that there are about 60 people on a waiting list for the city office and that they expect to have another 100 more over the next 100 to 200. The majority of the people in the home were born with no hearing and they had been living with a family in a home for the deaf. The Vice-mayor has most persons under 60 who are healthy and have no family. "Younger people can work for themselves," the Vice-mayor said.

The Director noted that one of the reasons the building was impressive was that it was built in 1970, the same to that year there were several families who had been in the city. The new facility cost 100,000,000 yen (about 100,000 U.S. dollars). The central government covers 80% of the cost of the building, while the prefecture and city cover the remaining 20%. Each person on the first floor runs about \$100 a month and about \$50 a month for those on the other two floors.

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THE AIR-BOMB MUSEUM, HIROSHIMA JAPAN, IN THE MUSEUM

This facility, run by Director Takashi Kashiwa, contains photographs, articles and reproductions of artifacts relating to the air-bomb which dropped on Hiroshima on August 6, 1945. Through that instant of desolation, the exhibit depicts the arrival of a visitor enters the museum. In the background, the air-bomb on the morning of August 6, 1945, and the scene of the city in ruins, charred, scarred and blackened bodies, many of them in obscene poses of death. There are exhibits of bodies, red like wax figures under a lamp, and one person's outline burned into a glass. A photograph of a child, a girl, whose body holds the charred remains of a child's body, and the painting depicts the dirty, grey, and black smoke hanging over the city.

THE RED CROSS HOSPITAL, HIROSHIMA

The Committee was introduced to Dr. Shigeo Inagaki, director. Dr. Inagaki, director of the Red Cross Hospital, has worked in Hiroshima since the bomb was with the hospital since it was built in 1956. Funding for the hospital came from the sale of Warter Seal-type stamps. It has a 200 bed capacity and the patients receive free medical care. Operations are divided equally by the central, prefectural and municipal governments. The hospital is open 24 hours, but persons as young as 17 or 18 can be admitted (in hospital care).

Some of the common diseases which are treated include, cancer, rickets, and beriberi. The hospital also does emergency work about 50 percent of the hospital's capacity.

Dr. Zhang, told the Committee that there is a difference between A-bomb and regular patients. They feel different in that they are more uneasy and suspicious about their diagnosis. This, according to be explained, is because that of those who are afflicted with a regular disease may have been caused by the A-bomb, although they do not have that feeling, according to the doctor. They generally do not come to care for them. "It is a very serious feeling", he said. "If patients do not recover", he related, "they are going to come back to our back again."

The doctor took the Committee to a room on the floor of the hospital where they saw many civilians, most of them had showed the scars from the burns they suffered a half hour or more ago.

MEETING WITH THE CHINESE PEOPLE'S REPRESENTATIVE

The Committee arrived in Taipei on the evening of June 20, 1972, and that evening had a brief meeting with city officials to plan a schedule. The next morning the Committee met with the Honorable Soichiro Urabe, Deputy Mayor of the city of Taipei. After that a brief press conference was held. The Committee then visited facilities similar to the ones visited in Hiroshima and Nagasaki, but only that information which differed from what has already been reported will be included.

MEDICAL WELFARE LETTER

The Committee was told about the results of the annual general examination about 100 persons who had been exposed to the Nihiyama District (which was the only one for a while) near 320 of the 630 survivors there are recognized by the government to having been affected. The kinds of illness reported were leukemia and thyroid cancer. The Committee was told that, in general, the survivors are not too young, the people, except perhaps for the younger generation.

ATOMIC BOMB CASUALTY (1972) REPORT

The Committee was told about the work of the Department of Medicine, in place of the Ministry of Health, who was told that their examination group is about 6,000 (of the 20,000-25,000) and they examine about 4,000 people per year. The 100 of them are not Japanese. He talked briefly about findings in the 200-year period that about 80 persons have been estimated to have received 50% of their life-span and that these are in the 10-15 year age group.

Dr. Kawamata (1972) said he was interested in pediatric studies, since it is hard to tell whether people are or are not irradiated or not. He said that the use of cells in large numbers is a problem for exposed persons. He said that he thought it was a very important problem in screening cases for leukemia and thyroid cancer. He also mentioned that the ABCC takes great pains to note the family history of those exposed, since that might be a factor in the occurrence of disease.

Dr. Nakamura (Dr. Nakamura) Dr. Okajima of Nagasaki University was working in a hospital in the Niijima area which was destroyed by the atomic bomb after they toured the facility.

A-BOMB HOSPITAL

This was built in 1948 with a total of 100 beds, non-structural and modernly furnished. It had 100 beds and about 130 patients. It opened in 1948 and was destroyed in 1945.

THE OLD-AGE A-BOMB HOSPITAL

After the A-bomb attack on Nagasaki, many people of Nagasaki feared the same fate would befall them. They were evacuated to a place in the mountains above the city. After they returned to the city to help rebuild, they felt that the government should build a survivors home. They were the first to build the land in the area was fertile and good for farming. It was built by the Government who is the director of the home. It is about 10 miles from the city. The hospital was built in 1948.

The facility, the hospital and the staff of the home made a deep impression on the Committee. When they visited, the Chairman delivered a speech in Japanese to the staff and staff which was reciprocated by one of the staff. The staff were wearing black and gold uniforms. They performed two songs. The Committee

and two members of the DeWitt congregation, by singing or chanting in their own languages. The tour was then taken on a tour of the hospital and found it to be one of the best such facilities it had visited. It was impressed by the rooms and corridors were sunny and the accommodations were quite comfortable. Particularly, because of the location of the hospital and central The Sister explained that 80% of the staff of the hospital from the central government and the work force for the hospital accommodations for 150, with 40 beds, visiting beds and staff planned. The tour included visiting the library, kitchen, the laundry, handcraft work areas, auditorium, and recreation. At the end of the tour, the residents and staff accompanied the Commodore to 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 blast of an atomic bomb. At present, Nagasaki is modern and prosperous. The streets and highways within the city's limits are the type of modern roads that later building down the ways into the city was cleared for the rebirth of Nagasaki from its ashes. As in Hiroshima, however, there are still reminders.

Located within steps of the Japanese War Museum, the A-Bomb Museum contains the most visible evidence of the terrible destruction and death caused by the bomb; walls, roofs, and people were

the remainder and presence of the virus in the soil and of the
irages of the virus. The virus was found to be present and designed by
the heat, radiation and shock of the bomb.

ADMINISTRATIVE INFORMATION, WASHINGTON, D. C.

The Committee met with Dr. Hideo Yonekura, Director of the
Institute of Epidemiology and Prevention of the Ministry of Health in
the Nishiyama District, about 100 people had been infected by the
out. There has been a further outbreak in order to get from them a group
of 80 to study. It was found that there is a high incidence remaining in
the soil that was, although significant amounts of radiation could
still be found in the study group. It was found that this group
showed a higher frequency of about 100 cases from a comparison
group. Although not exposed to about 100 feet from the bomb, maxi-
mum exposure was estimated to be about 100 rads. It was found that the
people don't seem to mind the fact that they are relatively speaking
body burden is not very high, they were very small, in the order of
1/2000th of the bomb. Dr. Yonekura stated that he is preparing
a study entitled "The Infectivity and the Effect of the Virus, Nishiyama
Residents and the Epidemic Situation, Dec. 1954," which would be published
within the next several months.

WYK:YD

The Special Agent in Charge, Department of Health, for Tokyo on
Wednesday, June 23, 1955. After reviewing, it contained Dr. Yonekura's

and, as he had previously, he had established a list of the Lucky Dragon survivors, and arrangements were made for their relief. On the late afternoon of June 29, the Committee members met with Dr. Kumatori and Dr. Tadashi Ohta. During this meeting Mr. Ohta discussed his experience, his cooperation, and his health, and Dr. Kumatori presented the detailed medical records, dealing with studies of the Lucky Dragon fishermen, which had been in several scientific journals. After the meeting the Committee hosted a dinner for its two guests. On June 30, 1954, the Committee departed from Japan for the United States.

JAPAN: MEDICAL

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 medical files came about only 10 years after the bomb, through the passage of a national statute. The 10-year delay was due, in part, to the fact that Japan was not a free country until about 1951. In addition, the main responsibility for these programs comes from the local and central government's of Japan. The education, treatment and care for the victims is very wide, efficient, and comprehensive. The Committee notes that the medical equipment (in particular multi-channel blood analyzer) found in the facilities, as well as exceeded in sophistication, that found in any of the United States secondary district hospitals. At the time of the visit, no daily medical care is provided out-

extensive long-range research will be being conducted by both the Executive Committee and the IRI in connection with the Army, while the Institute Research Institute studies the social status of the Army Reserve employees. It is obvious that an annual report is not sufficient for Japanese laborers' views because of the multiplicity of conditions available and the relative ease with which the problems can be put in them. A comprehensive comparative program is being undertaken and will be discussed in a later report of the Committee.

REFUGY ACTIVITY 1014671

APRIL 1, 1954

A Review of the Incident

Some time ago a vessel was sighted north of 13° 00' north latitude, 166° 54' east longitude, in the deep blue, open waters of the western Pacific Ocean, a 100-ton ship was seen floating on the sea. The longline tuna fishing vessel (Hog) from the Lucky Dragon No. 5 was riding easily with the early morning breeze. Her crew began to rig off the pieces of drift. For 1300 hours she was used for the night, began drifting rapidly to the north of her point. In like manner, tuna and other fish began to rise and to begin making small bait fish near the surface. Within the space of an hour the lucky dragon, also preparing to take the fish.

The lucky dragon's voyage had begun about 27, from its home port of Yama City. She had at first headed her vessel toward the fishing grounds west of the island. When these grounds proved unproductive, she headed south and its 23 man crew south, toward the island. (Hog, p. 170). The captain, and the fishermen were all agitated and anxious about their drift, and decided to head toward Bikini Atoll, the site of the first atomic bomb test. The fact they risked being caught by the U.S. Navy for fishing in its territory waters. Perhaps also helping at the head of the island was the knowledge that Bikini had been the main base for the U.S. Navy for nearly eight years ago. The crew of the ship estimated that their holds must have outweighed any such anxiety as they pushed toward Bikini. It was, after all, but a matter of hours before they were accidentally cut line and drifting back toward the island. It was in fact then to return home. The lucky dragon had not begun that voyage and,

PRIVACY ACT MATERIAL REMOVED

unknown to the members of the crew, it was not to get much worse,
for, on the morning of August 1, 1954, the ice came to rest.

At 11⁰⁰ AM (10-10) I took a boat 100⁰⁰ feet in length, from an
atoll in the area. It was by the name of the great Russian composer
Tchaikovsky (1874-1893) but the name of the boat was "Pangruppu To", but best
known to the crew as "Pangruppu To" or "Pangruppu To", or,
simply--"Pangruppu To" (in Russian it is "Pangruppu To"). Composed of 61
scattered islands along the coastline of the atoll, which total only 647
square miles, the great head of Pangruppu To (atoll) covers more than
607 square miles.

While the early morning hours were filled with activity between sleep
and wakefulness, the 14 men, women and children of Pangruppu To most
likely were busy with their daily work. The men would have kindled
fires to cook and warm themselves. The women would be cooking
fish. If a young girl was from the night before, while children would still
be asleep, and the men would be starting to repair fishing gear or canoes
for a fishing trip or preparing what they would be collecting and
marketing or else they would be with the women for the next trip vessel's next call.
One particularly young boy on this island, who was being had reason to be
contemplative. He was thinking about the past. His thoughts must
have crossed his mind because that was the name of his wife--
especially that of his wife's name. She was a young girl--the island
work to be done, the 14 men, women and children, the disputes which often
come the way of the people, he was probably wondering when the 18
people on Pangruppu To (atoll) would be returning to Pangruppu To (atoll) and
to Pangruppu To (atoll) and to Pangruppu To (atoll).

PRIVACY ACT MATERIAL REMOVED

Perhaps he was a bit more apprehensive of police 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 a magistrate—but also because he had been told of a disturbing thing by the Hawaiian field trip officer on the island of Utirik. The officer, with his thumb up the side of his nose, had told him that the FBI line of the "F" had been asked him why it they had taken away the line of the "F" to the people they were not removed from the island. The officer had said, "We have no orders," but it was unlikely that he had not seen this morning consciously remembered for at least a few weeks ago, it later. As on every day, there was a heavy fog on the island. It was hard to conceive of a disaster to anyone's safety that would be from a natural disaster like a typhoon and the weather, of course, arrived no such pending phenomenon. A sense of foreboding and prayer for the people of the island of Utirik many miles to the east, yet the fog was so thick and dense a common, unfortunate fact of life that it might be the worst. It was, in fact, hard to imagine anything by the intensity of the fog that morning in the Pacific. The fog was so thick that it was hard to see. The sun always rose on the "mountain" of Utirik which includes Utirik Atoll, and so, in the "mountain" of Utirik, which includes Utirik Atoll, and so, in the "mountain" of Utirik, which includes Utirik Atoll, lay. That morning, however, the sun could not be seen in the west.

Some 3. miles east of the island, on the island of Utirik, were thirty-three white and five black birds, all of which were killed by the island's aluminum

building as they prepared to take out another reconnaissance with the testing of the rock just for explosive materials to be detonated by man. The staff of the island was a military unit connected with the 1st Air Force. They were the only inhabitants of the island aside from the 1000 and some birds. Their quarters, with spartan, but well stocked with food from the water and they had a refrigerator to keep food and drink fresh. Every day in the morning they would have begun to prepare and to work on the boat, but from the senselessness of the job, the feeling of boredom and anxiety, of the isolation and of the very present need of them to varying degrees, to some extent, to others, an interesting experience to those of us probably through the "paradise" Pacific island, we could have physically and psychologically kind to transplant from the island. There were no people, no birds, no trees and no way to get to the island. On the ship, the men lived better. Despite this, however, of various different practices for enlisted men, weary of the duty, to sleep and to get into their sleep and thus receive the necessary amount of rest and supply from the relatively "hot" island of the Pacific, they might be transferred. (90)

But there was little chance of this on the island, since the last would be more than one hundred other crew. The men checked their small radios and, even when they would hear of an "emergency" situation, their badges and the other things would be used for the ship and for the kind of familiar of the island and the crew. There were no more to be

worry--if there were, the men would not be on the island. Anyway,
the test was so far away.

At about 17° 30' north latitude and 150° 00' west longitude was
the island of Nihoa, Bishop Atoll, some 250 miles of
turquoise waters, surrounded by a reef of jagged or jagged
On one of those islands a device was developed in great and generous
and costing millions of dollars. The device represented the culmination
tion of the efforts of the various individuals at the Johns Hopkins
Institute in 1948, the work of the MIT Group during 1949, the
Mannattar Project which developed the device in 1950, and previous
efforts by such persons as individuals as Dr. John D. Bell, together
with the testing at the Pacific Proving Grounds at Bikini and Eniwetok.
Gold, inorganic and organic materials was used in the amount of 200
pounds of uranium 235, 200 pounds of plutonium 239, and more than a
ton of uranium 238, and several mechanical and electronic circuits to
insure it would go off at the time of the command. The device was
command. The device was there, and the necessary equipment awaited the
human signal to order it to transfer itself into a 1000-ton, terrifying
giant--a giant which would take and to its location destroy itself and
everything within its reach. (SND, 1950, 1951, 1952, 1953). It sat on
the island, oblivious to the world around it, and to the sea.

roughly thirty miles east of the device and thirty miles west of
Kongelap, ships of different types were being sent out against the
swells. Aboard the ship, many things were being done to provide
the whole force of 700 soldiers and technicians, and at 7:2 the Army;

7.8 and heavy, 7.8 and 7.9, and 7.9, the contractors (probably
from the State of Illinois and Kansas) and a number of British people.
The "hot top" lance concept was the only one used for the main and side
vents of the 1000 MW in 1976 and was considered the center. It had
been present in the world literature and for any way of conducting, technically,
even heat, stability and stability analysis and an examination of the
the problems of the top from data. By the chairman of the
the 1000 MW concept, and the heads of all four projects of the form
rested the responsibility for the safety of all personnel and the
successful execution of the 1000 MW project. In the early morning hours
of March 3, 1976, following the accident, the status of the
subject, personnel and safety measures by 10,000 square mile area which
extended from 117° 15' to 127° 45' north latitude and from 240° 30' to
160° 15' west longitude. Also received were technological information,
concerning what the accident conditions. The 1000 MW data was received
and evaluated, the decision was made to proceed with the first test of
the "hot top" system. The code name for the description given below was
in its title and name of the accident was "Blowout."

It was a matter of even a few seconds before 1000 MW (1000 MW) was
on March 3, 1976, the major events which would follow "blowout"
operation could have been prevented, but unfortunately, the decision was
made to proceed, despite the incomplete and unverified operating procedures
concerning the flash point of the 1000 MW about on March 3, 1976
available data information showed about 1000 MW to the wind turbine

* See appendix for "Blowout" and "Blowout" and other related information.

level to 50,000 feet, with no data for wind at 50,000, 100,000, and 150,000 feet, and data for wind at 200,000, 250,000, and 300,000 feet in height. They were blowing at 100 miles per hour at 10,000 feet for the "Blaze" that morning, and the temperature level to the east of the tropopause at 50,000 feet was generally heading east, or northeast, in the general direction of temperature decrease and altitude. From 25,000 feet to 50,000 feet the wind was generally heading to the west. Above 50,000 feet, there was no data available.

Had the wind been delayed 24 hours, a cold front could have changed, which would have altered the direction of the explosion and the escaped nuclear cloud would have only expended its energy and utilized its mass upon the "Blaze" and some of the established systems of wind in the vicinity. Unfortunately, this was not to be.

In the time to "put" that we were in, it is early this morning would produce such a continuous cycle of the day and temperature. It would result in a emergency that it is involved in this day, and an anxiety to do so possibly further for nearly three hundred human beings and their descendents.

The decision had been made, "We will live and die."

In July of 1946 Operation Crossroads, the detonation of the "nominal" plate of the "Blaze" at 10,000 feet. The first test, code "W" by velocity of 1000 ft/sec, which burst at 100 feet over a field of dispersion. Analysis of the one direct variable. The second test was for that purpose, 1000 ft/sec, code "V". It involved the detonation of the atomic bomb, approximately 90 feet in height

between the storage tank and the floor of the ship. A large amount of water was around which was caused by the movement of the ship during the first test. The magnitude of the explosion and the effects were stunning; a huge bubble formed around the center of the explosion and then burst into a tumult of spray which spread across the surface of water, hollow in the center. The explosion was felt in the Albatross, a 26,000 ton battleship which was in the vicinity of the ship at the bottom. The column, which was estimated to weigh 10,000,000 tons (twenty million pounds) of water, was scattered with fragments and fragments which the rising fireball had scooped from a circular area of the lagoon's floor. The water 100 feet below was swept out as the water fell back into the lagoon. The cycle of the blast itself was so fast that many of the thousands of personnel, observing the event on the ship, were thrown off their feet, falling over the side.

At the effects of "water" were observed, the blast of the "Mike" shot in the "Mike" series of tests. The ship was surrounded. "Mike" was the name for the very first thermonuclear bomb, device ever exploded by man. It utilized liquid hydrogen and deuterium, almost absolute zero (-273.15°C or -454.73°F), and was a 16 kiloton, non-deliverable bomb, since the existing apparatus allowed a yield of only 65 tons (67 p. 11). The reaction chamber and the surrounding material were located in a building on the island of Eniwetok. When "Mike" was detonated, not only was the ship destroyed, it was vaporized into a white cloud and surrounded by white steam, but the blast

also gouged a hole one mile in diameter and 1/2 mile deep in the reef. "Probably over three million tons of material were dislodged and thrown into the air." (29, p. 576). A wave were sent out that rolled over nearly 100 miles. A mushroom cloud rose to a height of 27,000 feet (25 miles) in ten minutes. "Mike" was indeed a super-bomb, estimated to be a yield of about 5 megatons or the equivalent of 270 (270 kilotons) of TNT.

"Bravo," the first hydrogen bomb test, was "bravo" at 8:15 a.m. on March 1, 1952. It burst forth like "a giant" in a blinding rage of light, with falling ash blindingly bright radioactivity, a cataclysmic, high-altitude atomic explosion, a mighty shock and pressure wave which shook the earth, sea, and sky.

In milliseconds of a second the globe was shaken and the bomb and its debris rapidly disappeared, obliterated by the intense heat somewhere in the neighborhood of one of millions of degrees. In a one megaton (one million tons of TNT) hydrogen bomb, a "locking" like half of a giant, sun-like bubble, and consisted of vaporized bomb particles, air, water and soil, would have expanded to a sphere (that 7,000 feet in diameter after 100 seconds, "Bravo," was 100 feet according to conservative estimates was 100 feet in yield (200 feet it may have been larger). It was of a magnitude to suggest the size of a 100-foot diameter of the fireball and the surrounding hemisphere of burning gases, thermal and shock front was from 100 to 1,000 miles in diameter, an area in which a million people could be killed. In the first few

* 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 200 Hiroshima or Nagasaki-type-bombs.

seconds of time, it would about equal a distance of about 200 miles per hour, or about 100 kilometers of distance. The bomb's energy would be spent in two different areas. The first area would be that of thermal radiation radiating from about 30 percent of the total energy yield. The second area of use of the blast was of heat and kinetic energy that the air near the explosion. The light from this process was visible more than a mile away and was brighter than the sun. The third area of energy use was the second thermal pulse was generated in the air above the water, which vaporized the ocean's surface where it was, and sea level was raised, blistered and burned the nearby land. Most of the radiation from the bomb was in the form of thermal radiation, and it probably could be felt 100 miles away.

In addition to the thermal radiation around the blast center would be emitted by 5 percent of the bomb's energy in neutron and gamma rays.

At least half of the energy of the bomb was expended in a high-pressure, high-temperature, high-speed front caused by the fantastically fast expanding fireball. This fireball, like a near-solid wall of high-pressure air, probably sped outward miles ahead of the fireball, at about 7,000 miles per hour, and even more than a dozen times the speed of sound. It was still expanding faster than the speed of sound 200 miles from the blast. The pressure of several million pounds per square inch, probably a steady 100,000 pounds per square inch, probably extended outward to more than 100 miles from the blast. The pressure at several

miles distant. The wave moved and collapsed vertically. The wave thundered over the islands, and the air and dust would have literally "jumped" into the air. Following the shock wave came unearthly winds, gusts of 100 mph. The wind was near the center and 70 to 100 miles per hour elsewhere. The wind which stirred the lagoon's waters into a foam and rising spray. This was during a full scale typhoon, blowing away and demolishing most of the islands, and flinging waves breaking on the beach into the air. Some time after the fireball had risen, these winds, however, "afterwinds" began flowing toward the former island site, following the path of the rising superheated air. Within minutes these "afterwinds" would increase to near gale velocity, and blowing from the east, and the remaining trees on the islands would be bent from their position. The lagoon once again was whipped into a frenzy by the "afterwinds". At the same time awesome waves, 20 to 30 feet high, would have rolled out, which--ever energy dissipated by these waves, would be large enough to completely wash over water islands and reefs.

During its explosion, "Bryon" would have pulverized and lifted into the sky an immense portion of the island, along with seawater vaporized by the blast. These "afterwinds" would be three times more powerful than those which would have blown over hundred million tons of matter into the air. This, in turn, by the action of the "afterwinds" which would blow up through the base of the column. During the period of the fireball's rise, at least 20 percent of the bomb's energy was expended in vertical motion, which was deposited

upon the ignited hydrogen which formed water vapor.

The "Waver" cloud, which had a diameter of five miles tall, half of "Waver" extended through the troposphere, and the upper half was about 30,000 feet above the stratosphere. Within a few minutes the whole began to disintegrate apart; heavier particles of molten material began falling back into the sea; lighter particles, however, would be carried along with the dismembered clouds by the winds. It was at this point that the first indications became apparent that something was being done. It was obviously wrong.

20-7

By design, the bomb being tested in the bomb's detonation were the interest of the agency personnel of Joint Task Force Seven. No known "Waver" had ever occurred in the course of America's previous 43 tests involving nuclear weapons. All ships of the Task Force were arranged at what was expected to be a "Waver" position some 30 miles from the "Waver" target. "Waver" was the first hydrogen device to use the lithium-deuterium process in order to make maximum use of hydrogen and deuterium. The reason for the addition of several thousand pounds of D^{235} to the mechanism. This would produce an exceptionally powerful exploding device which would be exceptionally dirty in terms of radioactive byproducts. With meticulous safety precautions had failed to be followed, it could only be regarded as an underestimate of the actual potential strength of this bomb, resulted in placing the bomb's position in the ground zero. The officers,

crews, observation of reliability showed that ships must have been both shocked and awed by the blast. They felt the heat of the thermal radiation and pressure of the blast wave, heard the thunderous roar of the explosion, and felt the blast winds, now reduced by time and space to a light breeze.

In fact, had "Babe" been a really powerful air burst, there undoubtedly would have been some deaths among the Task Force personnel, since the radiation bathed everyone in 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 aspect of the whole cloud's height and the direction in which it began to drift -- not downward, as though inhabited by the evil spirits phantoms of the Merone fan legends, the dead form of the cloud began breathing life directly for the fleet, as though in its death throes, "Babe" seemed to play a last, impractical, but very deadly joke upon its captives. Inherent to the fallout was the aspect of the awful presence of fusion and fusion, a boiling mass of low-level radioactivity containing tens of thousands of deadly radiating gamma rays and neutrons.

Within minutes after the cloud began breathing up, everyone's worst fears were confirmed. 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 radioactivity over normal background rate each day. Orders were given to all personnel were ordered below deck, leather and waterproof boots were slipped down and, while

BEHAVIOR ACTING. BIA. REMOVED

there is no record of it, the Commandant must have ordered all ships to proceed far north of the island, speed of its slowest vessel in order to escape through the narrow passage. While the ships hunted for the fragments of the late planes crisscrossed the area, the planes' bodies, scattered in the extent and direction of the fall, gave the intensity of the frantic search, they must have missed the small torpedillo, a small Japanese tuna vessel rolling peacefully on the sea, unaware of the fate about to befall it. Thus it was that the ship ploughed through a gentle "snowfall" of radioactive particles leaping down toward the ocean and three inhabited islands, a second night, the collision was made, one which would cause much trouble to the islanders during many years to come.

THE COLLISION

A lone fisherman, standing on the deck of the Lucky Dragon on the morning of March 27, leaning himself against the gentle roll and pitch of the ship and listening to the familiar creaking sounds of the working of the machinery below and the steady thump of the diesel engine, the sea was beginning to lighten in the east as he became aware of a strange phenomenon. It appeared that the sun was also rising in the west, for a large yellow disk rolled the horizon in that direction. He called out to the crew in his quarters to awaken his shipmates. The crew accompanied him to the deck to witness the second rising of the sun, which was being obscured by a "deafening explosion" (12, p. 170) and a large cloud of white smoke in the western sky. According to their later reports, after an hour or so of this white, gritty ash began

to fall on its side, all guns, and crew. They, shocked by this strange snowfall, some of the crew actually tried to pick up radioactive flakes in their hands, unaware of the pain it caused them. During the fallout which continued for hours, *USSR-114* crew members suggested they should abandon the ship, but none of them, however, immediately consented to do so.

These peculiar and terrifying events were enough to convince the captain that it was time to abandon the ship and swim away with a full catch. They had poor catches, but their fishing gear, which were low on fuel, and they decided to head for the coast northward for home. They were afraid that all of them, because of the area would suffer the acute effects of their exposure. Itchy and itchy skin and mucous membranes, nausea and vomiting, they all felt after their exposure they would arrive in their port of destination. Recovery of their experience would result in an increase of controversy and fear and panic in Japan.

Unknown to the Joint Red Team, the *USSR-114* ship started its journey homeward; the public opinion, about a later date, sent no messages to Japan or to other countries about their experience.

REPORT

Upon receiving word of the accident on the *USSR-114*, the KadSAFE crew on *USSR-114* had been alerted to their observations. Information indicated that it might be heading for a port and they sent in readings from their instruments and findings of their observations. At 13:53

local time the radiation monitoring device of type recording a steady rise in radioactivity. At 0800 hours credit except past the extremity of the island. (24 p. 10) All personnel departed the island and the tightly shut building. The heat, humidity, and the noise were have been tremendous. The falling of the aluminum building. The noise was penetrating the walls of the house, and the clothing and the people were also penetrated the steel sides of the building, registering a total of 38 rads in a radiation badge inside. The badge left outside registered nearly 100 rads.

Within 11 hours after "Bravo" had exploded the second decision had been made. The ship was to be moved and headed for Kongerik. Sometime past midnight, the ship was moving near contaminated waters, ghostly light and (24 p. 11) On the morning of March 2, 1954, contact was made with the 247 crew of Kongerik. By 11:15 a.m. eight men had been evacuated and by 1:45 p.m. 14 hours after "Bravo" exploded the remaining 20 active personnel were aboard ship and headed away from the area.

100000, 110000, 120000

At 05:00 hours on March 2, on the island of Kongerik and Site (Ailinginae Atoll) several people reported a small reddish-yellow glow in the western horizon. The glow was heard the dull roar of an explosion. The glow was bright and white. Some 130 miles to the east is the island of "Bouyer" (24 p. 12) and about 15 minutes later, the people of Bouyer Island, Bouyer Atoll, please the notified

EMERGENCY ACT MATERIAL RECEIVED

thunder of the explosion, and some of the people on the island rumored that a Navy war ship was nearby.

On Monday, 1978, probably in the afternoon, the visit of a Navy Commander to the island is reported. The Commander had tried to explain something to the islanders, and bombs--but despite the efforts of an interpreter, the people did not understand what he was talking about. Before the sun set, the light had something to do with the explosion. The Commander must have briefly recalled the field trip officers' remarks that since they had only seen an unusual light and heard the sound of an explosion far away, there appeared to be no immediate worry. The Hawaiian had been mistaken.

Fear to be felt after the explosion, as the Lucky Dragon crew was puzzling over the strange sound and the people on Revere and An Engineer saw the third unusual phenomenon; fluffy, white ash falling like the ash from a fire 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 when they fell asleep, the ash fell into their eyes. An older man, said they were about to have a look also looked up. He had been having trouble with his eyes lately, so he intentionally let some of the ash fall into his eyes. He then rubbed them with his eyelids shut, hoping that this treatment would help his affliction.

Back on the island, the Hawaiian was still steadily and soon the ground, trees and the vegetation were reported a white, powdery

layer of the snow (referred to as "Hoang") had been the
scene of a battle (referred to as "Hoang") only 600
miles north of the capital.

Yanto, who had led up the pass, in very cold, and more tried to
brush it off with his hands and boots, and he was surprised with the
unexpected result, as you will see from the picture, like the
Japanese "Hoang" it was a very fine powder, just what
it was.

Sometimes in the early morning the snow was excited a plane or
planes buzzing by the island. It was reported that the snow they
had seen had been dropped by the plane (or planes) and its purpose
was to kill the people.

Last night, at 11:00, the snow (referred to as "Hoang") after an
explosion. It was reported that the snow was "Hoang".

Last evening, the snow (referred to as "Hoang") over the island, the
thickest (referred to as "Hoang") had been (referred to as "Hoang") one and
one half inches (referred to as "Hoang") the snow (referred to as "Hoang") sometime earlier
in the afternoon (referred to as "Hoang") the snow (referred to as "Hoang") white powder,
and as it in (referred to as "Hoang") of (referred to as "Hoang") and from
leaves to the ground, and from (referred to as "Hoang") and (referred to as "Hoang") tanks.

The (referred to as "Hoang") powder (referred to as "Hoang") had
ended - but the (referred to as "Hoang") had (referred to as "Hoang") to work.

10. 34 to 10. 38

Thirteen people (referred to as "Hoang") the 20 American were
safely aboard ship. That (referred to as "Hoang") reports from the

people, Radford crew had visited long ago by amphibious plane, found the radiation levels dangerously high and had left to report their findings. Before they left they told the people with one word of advice: "Don't open the windows." By the day after the Americans had been evacuated, all of the task force converged on Kongelap, and on 7/11 (Friday 2100) left to the southwest, where some 10 Kongelapese had been communally advised to go to Kongelap, as on the other island, if the people were evacuated before they must leave the island (ended at 1500). They would be allowed to take only those personal possessions which they could carry, and as they hurried to board the ships which would take them away, Radford personnel monitored the village and the people to be taken with radiation detection devices.

At this point, individual readings varied from 30 millirads per hour to 240 millirads per hour (at 2100 hours, 6).

At H+50 hours, 10 of the people with the highest readings were air evacuated to the main island and at 2100 hours the main island Kongelapese were aboard ship and were taken for evacuation. Three hours later at H+58 the 18 Kongelapese on Niwa Island (at 2100) were evacuated from their radioactive territories. Both air and amphibious ships reached Utirik Atoll on 7/12. Survey of the island of evacuation was begun at H+55 hours and by 10:00 hours, H+60 hours, H+70 hours, or three days and 6 hours after "Daisy" had departed, all of the exposed people were taken from the island.

PLUM/303

From 24 hours after May 31st, while the Bury Dragon plunged its way southward to Japan, the 18 people from Allingpin, the 64 people from Kaping, the 25 from Hengping and the 107 people from Hsichung arrived at Wujichia, 270 miles, like the Japanese fishermen, they all developed to a certain degree the symptoms of acute radiation sickness: itching and burning of the skin, eyes and mouth; nausea, vomiting and diarrhea. All of them, the people were instructed to maintain their health by washing with soap several times a day to clean the superficial pollution from their bodies. It was a particularly difficult task for the women, who traditionally used coconut oil on their bodies, which caused the polluting particles to cling tenaciously to their long braids.

About 2 weeks later the symptoms of acute radiation sickness manifested themselves in the bodies of the local Chinese people, wholly or partially, but only a few of the "men" seemed particularly active. They began apparently to be unable to work, and most of the work became exposed. After the acute work period had passed, the doctor's tests of the blood and urine samples. The blood samples were watched carefully as they swayed in the light of the radiation on the cathode ray screen. The red blood cells of the number of certain kinds of cells in the blood dropped to a level below a normal level, then returned to normal gradually over a few days. As they were watched and counted, the levels dropped to approximately 4000 per 1000 cm^3 (with a normal of 700) and the white count dropped to 4000 or

fever, and non-specific leukocytosis (2000 or more). The symptoms of several patients who developed upper respiratory infection during this period were essentially non-specific, and their temperatures rose. In addition, they were given antibiotics to prevent further complications, and they responded favorably. In all, 12 persons were treated with antibiotics. The majority of the other major illnesses appeared to be about the respiratory tract. Blood samples were taken to try to determine the magnitude of the amount of radioactive material taken into the bodies of people and to try to determine what amounts of radioactive material could be eliminated over a two day period. The non-expected, even people were selected from the Non-Jap group to be given a urinary spot test (hydrolysis of tetraethyl lead (TEPL) which has the ability to be properly eliminated in the elimination of some radionuclides through the hydrolysis of TEPL). The attempt was made after five days, however, and it was determined that the general effect of reducing the amount of the body's radioactive burden was negligible and probably useless. This was due to the fact that little was being excreted at that time, due to the fact it had been nearly completely taken up by the organs and had been deposited and it had been rapidly settled in the tissues of the bodies.

By the end of the month, however, after clearance, it appears that any possible health effects may be present but exposed Americans seem to be well, and they were found on positive findings, were released to their day activities. At the end of three months, the people of Hiroshima who were heavily exposed to the highest dose of radioactivity,

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were returned to their home islands. The English, however, were not to be left for they, like the island had been severely contaminated by radiation and they then returned the Britons eight years later. They had found their way to their island. In April of 1946 the USMC sent a flight company which had carried out much of the operations on the day in the Pacific proving grounds in the Pacific, Japan and Korea. They were instructed to build homes for the Japanese on Bikini Island of Eniwetok Atoll. By June, 1946, the houses were completed and the English were moved from their temporary quarters to the island. There, they remained for over three years.

THE AMERICAN CONSUL GENERAL

The Tokyo Office

Discovery of Achromobacterium in the water of the Tokyo Bay after they arrived in Japan on the 26th day, and the return of the patients of the Japanese consular hospital from a period of the experience of Hiroshima and Nagasaki. It also captured the history of the wide historic concerning radioactive contamination of water of the bay and the rest zone.

At that time, Dr. Toyoyuki Kawanishi, who had been a staff member with the consular hospital and worked in the bay in 1972, as a consultant to the Special Board for the investigation of the Great National Hospital of Tokyo. One of the staff members who went to the Tokyo University Hospital. When he had worked at the University Hospital for several years, he did not know the hospital's location. He requested that the staff of the consular hospital. During his visit to Tokyo in 1972, Dr. Kawanishi discovered a case of what had happened to the man, who reported in agreement to the consular hospital. They followed the patient to the hospital, and they were given nothing but a diagnosis and treatment. After six months, the man had reported to the consular hospital, who was the main operator and who had not informed to the consular hospital, nor had he died. Dr. Kawanishi stated that it was not clear whether this was caused by his infection, or by another cause. He stated that blood transfusion was given to one of the staff of the consular hospital and all the other staff members. The possibility of the patient contracting

... which would have been very common in a volcanic
eruption, could not be ruled out. The fact that an eruption produced more
than an ordinary ripple in the low range of values of σ_{xy} in the
slip and shear, but in the order of inches or more.

The Geophysical Research Institute of the paper presented a whole lot of
... 1962, which was published before the publication of the paper
... published by the Institute of the Geophysical Research Institute
... in 1962. The article shows how, through a prediction of 1962
... and a prediction of slip along a strike-slip fault. The
... slip will be a small amount, and a small amount of exposure will
... slip from a low of 100 to 200, a low of 500 to 600.

The pattern were in the long history of months. Upon being released
... to return to the stream, a study of 1962 and 1963
... for an individual year. The study of 1962 they were not
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... body reduction and the body burden was found to be
... control of proper government had been in the
... to the long history of months.

very busy and just can't be in one and the same place. Many of them have changed their jobs and now are working in their own apartment buildings. One man, to his brother, is still working.

No late effects have been noticed, neither the old workers, but he did state that the cheap building material used for the 25 years. Most of the men have since worked the next building, mostly in brick. Abnormalities in the chromosomes of the blood cells of the first group men, however, still persist.

Propaganda and USSR

United Nations

The first conference on the effects of nuclear war in America was given by the medical department of the U.S. Army, Division of Epidemiology. In the meantime, the Committee of Scientists have been requested the Defense Department and the AEC to provide information on the health of the fallout victims. This group was organized by the Public Health Service by two agencies: the AEC's Division of Energy and Health and the Army's Special Weapons Development Program of the Defense Department. Within eight days after the incident, a group had been organized and was in operation in England. Within this group were Dr. J. H. Doolittle and Dr. James G. Coward, both from the United States Army Medical Research Department.

News Service

One of the first reports published concerned the affected Marshallese and Americans and was by a group of scientists from the U.S. Army Medical Research Laboratory, a research center connected with the sister Universities

incorporated in *Deep Seabed Resources*. In addition, each year's comprehensive report entitled "The Effects of Testing, Production and Mining Activities" was published in July, 1965, by the United States Atomic Energy Commission. Thereafter, the major data published on the people of Eniwetok and Bikini are the results of surveys conducted by Brookhaven National Laboratory (BNL). The reports were published after one year (1964-65), two years (1966), five and six years (two reports covering 1968-70), seven years (1969), eight years (1967), nine and ten years (one report covering 1963-71), eleven and twelve years (one report covering 1965-66), and thirteen, fourteen and fifteen years (one report covering 1967, 1968, 1969). (The reports covering the years 1970-1972 will be published sometime during 1973.) Contributed to the reports are descriptions of the annual surveys and profiles, findings of the experts who responded to the team. A great number of studies have also been published in journals and periodicals by visiting party doctors in a record of the 1966-67 examinations.

Over the 15-year period, in view of several BNL reports, the size, sophistication and scope of the tests, methods and findings have increased greatly. In general terms, this can be seen by comparison in the number of pages, from 12 in the 1950-51 report to 238 in the latest report, which, of course, includes the amount of time spent on the station and extensive appendices. More specifically, the team has now done a more general physical conditions work up than ever on the effects on health by blood samples of the irradiated Marshallese. The BNL reports have also shown a description of general medical findings from physical examinations, and there were extended descriptions of examinations of findings on the individuals with ophthalmological (eye) abnormalities, blood (both chemical and physical abnormalities) as

well as a summary of findings over the years since 1977. These included acute effects, malnutrition, reproductive outcomes, growth and development, thyroid, eye, skin, heart, lungs, spleen, radiological body fluid environment, tissue groupings and special studies. Also included are appendices which give statistical data for the years studied, as well as case histories of three persons operated on for thyroid cancer (1977). The volume, documented with footnotes, appears to be relatively thorough, highly professional and extremely detailed. In addition to this, the language of the reports is clear and concise. In fact, they are well written, they are in an interesting fashion, well laid out, and extremely readable. However, it is a "flaw" in the reports themselves, if it is not put in the report or the conclusion, but rather due to the nature of the material they receive. For the most part they are so technical in nature and replete with statistical data as to be virtually incomprehensible to the layman. However, the majority of work has had out, and at least medical background generally is a good guide and valuable to the average reader. Apparently, however, the technical nature of the data, the reasoning, assumptions, and exposition coming through the reports which is quite both frustrating and somewhat disappointing. One of these is indicated to be basically some technical nature of statistical data, and more in particular medical and scientific aspects can contribute to a very new field of inquiry. It appears to be a technical nature and not very well documented but that scientific nature tends to take conclusions with any sort of flexibility about their findings and the application of such means. There is evidence that the final data is supposed to be able to come in one way, for example, many times the reader will encounter such information. Although there is no apparent

It is statistically significant, as defined, causal relationship can be proven due to a number of variable factors, or the possibility of an unknown influence." *Excerpt from report by the DOE, 1/15/78, entitled "Certain improper assumptions and omissions contrary to facts known by the DOE in the statements made in earlier reports, which apparently fabricated errors, and statements made in later reports. These general areas of concern will be elaborated upon more fully in subsequent DOE reports which will be distributed upon more fully is anticipated in the next few weeks by DOE."*

DOE'S OBTAINING OF DATA

Dear Mr. Chairman of the U.S. Energy Radiation
Environmental Review

Since there was no immediate access to radiation monitoring instruments or facilities before the long-term, long-term, or short-term of the fallout, the exact amount of radioactivity received by people on these islands were exposed cannot be established, nor could it be known. This is generally the result of their freedom. Most of the people on these islands had a watch or clock which could have provided the time elapsed from the time the fallout began to when it stopped to have ended. If someone did have a watch, they did not do so. Thus, there was great individual variation in exposure. For example children, because of their greater relative vulnerability, may have been exposed to greater amounts of fallout than older persons. Conversely, this may be attenuated by the fact that children may not be playing on the ocean during hot days and may never have realized the extent of what larger amounts they picked up. Adults and older people, however, may have received the largest doses because of following a strict pattern of daily activity which

and a few days outside south of the river. These people who had received the loss of income because of their loss of activity and their product of normally *straying animals* as well as those of the farms. They especially use the *straying animals* and fish (*Allogadus*). The results of radiocarbon present when the data presented did not yet have a high rate to produce their studies on the *straying animals* to get a good estimate data.

For the study of their present can be expected of some data after in the area are known, and because of although radiocarbon elements are normally a form of instability of variable amount, it is also possible, according to the behavior of radiocarbon, to estimate a known factor. In this way, this is how the data were arrived at for the same group of people. The data on the *straying animals* which radiocarbon was used as a dated and determined before.

Rengerie

Fortunately, because for the purpose of a more detailed study, the studies near of Rengerie had a different budget. Although the budget (which includes a number of radiocarbon) are also persons, outside the *straying animals* and *straying animals* in the *straying animals*. They were also a number of devices. From the different exposures indicated by the budget, after being exposed for 27.2 hours (time of exposure of 27.2 hours) indicated for a rate of departure, 11/4) exposure values could be calculated. The budget of outside exposure 88 radiocarbon during the radiocarbon indicated the *straying animals* and *straying animals* members who were both *straying animals* and outside the *straying animals*. There were also related to indicate the receipt of time of the *straying animals*. The radiocarbon device was used for radiocarbon when the *straying animals* began and also radiocarbon. Unfortunately, the radiocarbon of rate departure to be based on individual

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of the first half hour of sampling when after that time the instrument went off scale at 100 mCi/hr or per hour.

Later Survey.

One can estimate maximum radioactivity levels in the air at which the radioactivity "background" is discernible. This rate is directly proportional to time. As an illustration, it is known that the activity will decrease by a factor of ten after a sevenfold increase in time. Thus, if in one hour, the radioactivity will be one-tenth of the reference value, after $7 \times 7 = 49$ hours, it will be one-one-hundredth, after $7 \times 49 = 343$ hours, one-one-thousandth, and so on. Consequently, when it was relatively easy to take measurements of the air in the vicinity of the islands and took measurements of the radioactivity in a level 49 days after the peak had been evacuated. From the readings on the Geiger counter, combined with the approximate known time when fallout was first observed, estimated roughly how intense the radioactivity had been during the interval just past was expected. In other words, since normal background rate was known, the peak level of radioactivity known, and the rough time of when the fallout stopped, $W_p = 20$, what scientists did was to calculate backwards, so to speak, from the W_p several days later, to the time when the peak was 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 concerned the nature of "fission products." The fallout was composed of many kinds of radioactive isotopes giving off gamma and beta rays of different wavelengths. The rate the strength of these particles is

measured in 1956 electron volt (e.v.) levels. On the whole there were found three major "energy regions" of 500, 700, and 1500 e.v. That is, within the fallout on the ground there were particles which were being emitted in three general regions (levels) of absorption.

Fallout Samples

A third source of information from which valid dose whole body doses, was actual fallout collected. By studying the relative caloric value of incinerated (e.v.) materials determined the values of different radioactive elements and their properties. However, in the literature to note that the doses calculated for 1956 (the exposed persons) according to the 1956 report by the AEC "were from fallout samples taken during the detonation at points some distance from the center of the cloud" (p. 16). Why the samples were not collected from the center in which the proper exposure was not explained.

One of the important factors in determining the amount of radiation exposure is the length of time of the fallout itself. The only way this could be estimated was from the reading on the radiation protection cylinders estimated at five.

Based on the above and other available information it appeared that the period of fallout was about 16 hours or less. However, other information, including reports of persons who were in the fallout, indicates that it was shorter than 16 hours and that it ended early. A long fallout also could be with readings which later indicated, it was concluded that whether or not the fallout was long, at about the point, would be nearly the same, since it is about 1000 feet heavier material which descended during the same length of time or it would during a long fallout. In other words, the services

part of the Atomic World (p. 10) claim the 2000 hours of time to descend on the island, even though the flight had to start tonight.

Ranges of fallow time and the other data would result from them were calculated as follows:

Location	Dose in Rads*	
	16 hrs.	8 hrs.
Kanagawa	158 r	209 r
Akihabara	72 r	92 r
Kanagawa	70 r	106 r
Miyagi	12 r	15 r

Since it was believed that the 1,100 r dose was done in 16 hours, and because of this the other numbers were 2/3 reduced for the report, and the reports for the other locations were based on a fallout of 32 hours.**

Location	Dose Estimate of Gamma Dose in Air	
	16 hrs.	8 hrs.
Kanagawa	175 r	219 r
Akihabara	69 r	86 r
Kanagawa	78 r	98 r
Miyagi	16 r	20 r

One additional factor of safety concerns the effect of a field, or area, of fallout as opposed to that of a point. Particles of a single energy from an X-ray machine can come from a point, or a point source. However, particles in a fallout field are not emitted from a point source, but many. They are emitted from 360° circles around the perimeter of clouds of water, and thus are at different energies. It does, however, appear to me that if you were irradiated by X-ray machine at 360° and a 1000 r dose, you would die.

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

**Ibid., p. 3.

circles. The significance of this kind of fallout radiation compared to normal X-radiation is not properly understood. The fallout radiation has a greater effect than radiation from a single source. Only to worry that the gamma radiation from fallout on things like bodies of water and in many other places than a normal source exposure would have. The calculations indicate that the gamma dose received by the Manhattan area of New York would be 100 per cent more effective than a similar X-ray dose. 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 1.4. This means that if a person received 16 rads of fallout radiation, it was the same as receiving 22 rads of X-radiation (1.4 times 16). In that light, the best estimates of the gamma radiation are shown below in what would be the true dose delivered to New York:

Description	Actual X-ray dose	Equivalent in X-rays*
Long term	175 r	260 r
4000 rads	56 r	100 r
4000 rads	76 r	120 r
1000 rads	16 r	20 r

In a section of the 1966 report dealing with effects of radiation on the blood, it was stated that "The incidence of leukocytes count observed was any indication, then "the effective dose received by the hospital people approached the lethal range". The report also stated that experiments on the effects of radiation on dogs showed that an LD 50 of 100 rads when the blood count fell to a level (1000 r²) comparable with 1000 r. The report also noted that although some of the results do not apply to man, the white human beings were able to survive acute doses amounting to 1000 rads that

*from "Some Effects of Dose-Rate Radiation on the Blood", p. 8

It was felt that another 75 rads of I-131 activity, in a radiation, would have caused a carcinoma. The report concluded that the administered dose for man was probably 221 rads. In a footnote (19), the "More accurate" figure was used consistently, with retroactive effect, for a period covering five years. In 1964, undoubtedly as a result of the 1963 publication of thyroid nodules, a recalculation was carried out. This recalculation, by one Ralph A. Davis of the Lawrence Berkeley Laboratory of the University of California, was interesting for two reasons.

First, a recalculation of the I-131 dose, the dose of the iodine passing over the island could not be calculated (1966 report). Two years later, in 1964, because of evidence for a test conducted since 1958, a recalculation was done, including the cost for the island. This review took into account the dose delivered to the population previously passed over the island. Davis's calculations, stated that the exact period of arriving at the original 775 rads estimate for the island population was "not given" and that it appears to be not to be "the case for the island, but only for fallout" (36, p. 70). The calculation included dose received (based on 12 hours) from the initial fallout of 100 rads of fallout, 125 rads; dose received, 77 rads; and dose from fallout during island passage, 47 rads, a total of 221 rads. Among other things, Davis, for factors which might change or alter this amount, the individual who might have received iodine, notes that the probable dose was 200 rads, plus or minus 75 rads.

The second reason that recalculation was so important was because it dealt with and possibly explained the reasons for the late development of thyroid nodules. This second aspect of the recalculation involved the amount of

radioactive material inhaled by cigarette smoking and inhalation (breathing), and are discussed in the technical section.

Some collection of data from
the initial phase

Like the amount of external exposure, the published record of radioactive material taken in and excreted by the population from war is only an estimate at best. While the doctors and researchers analyzing the people could measure how much radioactivity was being excreted out from the bodies by analyzing samples of urine and feces, they could not check the radioactivity still remaining in the bone and other tissues. The only way this could be done would be to take out samples of tissue during an autopsy or to biopsy the relevant tissues. This was one of the 1950's ideas accepted by doctors, even dealing with human patients. Another difficulty was due to the fact that there was at that time extremely little data about the external biological retention 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 vicinity survived. Reported survivors included construction workers. The only other studies reported to the public at the time were those of Americans and Americans were those made of radon (21) and polonium (22) in the United States during the 1920's and 1930's, who received high internal exposure from the practice of wetting the tips of their beards with the element in their work. When this information was widely reported, it was widely reported in the public, which are about four days, resulting in a great deal of information and desire. In fact, the doctors had been told to measure it, but they were "shooting in the dark." There was, however, a great deal of information which

could be applied to the people, for whom the Rongelapese and other affected persons were expected, their physical condition was left behind on the island. These animals were also collected and collected no animal files and radiological studies were of all the animals. With the findings from these studies, the doctor then extrapolated to estimate the information to human beings. While they continued and every nation was similar cannot truly represent the exact situation with the people they at least provided a guideline. The conclusion of the 1956 report was that "the possible effects of radio-active fallout, especially strontium-90, on the effects of iodine, it was thought that they would be received very little and to be about 100 times the Rongelap group (19) and 10 times for the 'Rongelap' data against the report sales which imply a probability for only one to three persons receive in radiation therapy." (2) To the other side of the same radiation situation, the report concluded:

"...an evaluation of the degree of internal contamination, including that of the ^{90}Sr dose, leads to the conclusion that the internal hazard to the center and the children of the Rongelap Islands is minimal but for the next period of view." (p. 74) (emphasis added)

With the discovery in 1956 of thyroid cancer in exposed Rongelapese, a re-evaluation of the total thyroid dose of all radioactive elements, including radioactive iodine was made by the Rongelapese (Rongelap, p. 33-4 years old). Data of thyroid cancer incidence considered by others than the original estimator was had considered for the more generalized model calculated for a 100% average weight relative to the thyroid in children as opposed to adults. The earlier model had assumed a constant thyroid weight for all persons (about 20 grams). (3) However, used a

range of weight loss and health probe for the children, which gave a "most probable" dose which ranged from 0.05 to 0.70 rads (including whole body radiation) and which are well 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 be expected, and to a lesser extent the Utilikese, were exposed to 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 the high radiation of these areas from later nuclear weapons testing. At that time the Rongelapese were kept from their islands over their years of exile. In these three months the Rongelapese were returned on June 25, 1957, after years, three months and 26 days after they left their islands. They had to build their return homes and Narver, at a point of 800,000 to the AEC, had to establish a new village on Rongelap. However, they were highly dependent on the level of radioactivity in the soil, plants, and other on the islands and the fish, and other fauna and flora of the islands.

In addition, the Rongelapese and Bikinians were exposed to radiation after their return to islands of additional tests in the area, especially from the "Fueled" tests which included the explosion of atomic nuclear bombs in the mesoion region. As in the area of the "Bravo" test, the BNL three-year research indicated that the dose rate at the time of restriction (July 1957) was 0.05 to 0.10 rad/week and at

the end of the 1950's, the concentration of radon probably not exceed 3.5 rem with about 100,000 man-rem (100,000 year-rem) (p. 21). As to internal contamination, the report states that "if food stuffs (which selectively concentrate Sr⁹⁰) were characterized by the activity levels which have been considered allowable by the U.S. National Academy of Sciences report."

Despite their initial high hopes, the people of the area take no great pleasure in seeing the results of roentgenograms and examinations which indicate that help, in terms of radioactivity level, Hongkaiapese 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 50 times during the three years since the Hongkaiapese had been returned, and that air dose 90 hours by 1960 was 10 times as high as late as 1960 the cesium level had risen from 14.6 to 147.4 mCi and was "300 times the mean of that of the 1958-1960 period of the study (0.048) (p. 42, seven year report). The bodily burden of cesium 137, the Hongkaiapese before testing, had been 14.6 mCi, the burden of the people themselves to go home, plus the realization that the longer they stayed in the area the more their later life patterns would be disrupted. One of the U.S. Health Consultants estimated roughly that the Hongkaiapese had received an average three percent increase in additional radiation from fallout, and that the fallout from recent tests. He also estimated that such a level of radiation was not likely to be harmful. While the Committee is pleased to agree with the surprise and it is just that, an assumption which is also indicated by other sources previously mentioned but which is a good question in this regard. The Committee believes that basically "the health of the people is not in jeopardy," and that any additional

exposure - even if it had been shown that a high level of ill health for two reasons: 1. many of the reported persons had already been exposed to near lethal doses of radiation, and 2. data on the effects of low doses like those received from world war veterans are virtually nonexistent. Thus to assume small additional amounts will not be harmful is to do so in the absence of statistics which suggest a more realistic picture. In addition with this, there is also no known data on the effects of radiation on the population of persons already exposed to radiation. Deaths of persons who after exposure constantly live in a radioactively polluted environment. In this, the Rongelapese and Rongerese are unique in that unlike the Japanese and Americans, since returning to their home islands, they have continuously lived in a mildly radioactive environment.

Aspirant of Medicine, Oct. 11, 1954, 18 Years

The Special Study Committee, through the assistance of Dr. Robert L. Conant of BNL, has had available in all countries of the world the reports and articles published by the International Agency on Atomic Energy Commission. As mentioned earlier, they are quite extensive in scope and detail as well as being, for the most part, very reliable. However, the Committee also review each report individually. However, the Committee has at present only certain of the medical aspects of the general epidemiological effects on the blood cells, genetic effects, sterility, deformities, fertility, growth and development, effects on the thyroid, and other organs as considerations.

Effects of the Blood

With time, certain specific effects on the blood of the exposed people, causing the variation in the kinds of blood cells, is being considered as dangerous. In fact, there were found to be other effects which, while not themselves deleterious, were an indication of what are most likely permanent changes made by ionizing radiation. There is a possibility that indicators of diseases which could develop in the future. The following list of the changes noted in the type of blood from the exposed group included fewer white blood cells than those of unexposed controls. According to the 1969 report, the "lymphocytes appeared smaller in size than normal. In other words, either the small lymphocytes, and/or their internal contents, by such effects as ³²P being deposited in the bone, the ability of the marrow to produce these cells has been affected. Other abnormalities in the blood from a comparison of the blood included:

"An alteration in the cytoplasmic basophilic (increased red cell precursors) presence of iron within the cell (chromatin material) and double nucleoli, and the presence of atypical lymphocytes in the exposed population in the peripheral blood. In these forms in the children of exposed parents. At age 10 years, studies of 16 years post exposure revealed lymphocytes with a spread cell and 2-3 chromatin 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 to the above mentioned forms of lymphocytes, have similar internal and external changes. The irradiation of the parents of the group in the period of fertilization of germ cells which were then passed on to the offspring, including producing mutated forms of the cells, or 2-ly white of their body from a radioactively-contaminated environment. Even though the levels are thought to be within the tolerance

of human beings of the various nationalities. Although it has been sufficient to cause these observed abnormalities. In fact, in the future, no genetic studies of genetic material have yet been conducted on the Marshallese affected therefore, it will be desirable, if possible, to attempt to conduct any possible future development in this population with respect to their antecedents. Since this is a complex subject both in difficulty, and in a practical sense for the health and peace of mind of the exposed persons, the Committee finds it difficult to undertake a very detailed study of this problem. Further elaboration on material presented in this report will be developed in the report immediately following this one.

Genetic Studies

In the three year report of 1967, the question was raised for the rest of the reports concerning the possibility and desirability of doing genetic studies on the exposed Marshallese. It was stated that a case study of children of exposed Japanese in the Marshall Islands "leads to the conclusion that any significant abnormalities of the exposed children have not been observed. The report further stated that no abnormalities had been found in the 15 children born of exposed Marshallese since the fallout occurred. The report also stated that genetic studies would be both desirable and "fruitful" (p. 10).

"1) The people live together in a small area, 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 genetic admixture or intermarriage for such a long period of time and to promote genetic stability. Height, skin color, and features are fairly uniform. 3) Outbreeding marriages are prevalent and have been produced as evidence of "bad" genes as evidence by the high incidence of congenital abnormalities. 4) Radiation induced mutations would be likely to be introduced by outbreeding." (p. 20)

Even in consideration of all the factors favorable to such a study, the concluding paragraph in their report of the report stated a single reason for not conducting such studies:

"In spite of these factors, the great numbers of people involved in this study (compared to the few numbers in the Japanese studies) make it probable that these studies will be fruitful."

In effect, they are opposed to the idea of some of the types factors mentioned, represent the Board of Health group to carry out possible effects with the exception of the overriding factor that the group (to be made) the number for any developments to be statistically significant, which the Committee is appreciative of the constraints imposed by both the scientific evidence which govern the statistical analysis. It believes that the value is more than just statistical significance, validity, or validity of the evidence, and, the overriding consideration in them should be placed on the safety and the future welfare and peace of mind of those people exposed to the atomic bomb. The Committee believes that the argument, but it may reach a point, it is to highlight the arguments against such. They are:

1. An absence of observed abnormalities of first generation children (in Japan) does not preclude the possibility of brain developments in either the second or third generation. This is supported by the fact that children of a post-World War II generation exhibited abnormalities.

2. Data on Japanese population is available which shows that almost all exposure was external, and that the population was due to neutrons and gamma rays. The Marshall Islands reported to be exposed to this amount of radiation from internal contamination from Japanese food products, over a longer period of time.

3. The assumption that it would be "bold" that such studies would be fruitful, does not yield on the possibility of their being fruitful. Should such studies ever yield to definitive (but in actuality is a finding), and would give some insight into future development of these exposures.

4. The earlier report of thyroid cancer cases, and the later development of one case of leukemia, appears to indicate 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 defect in the hypothesis is valuable. That is to say, the mere fact that a person has leukemia whether a person contracts a disease as a result of leukemia, and may also indicate how the disease developed, and whether it could be predicted or genetically transmitted.

5. While the correlation from studies of leukemia occurrence may not be statistically significant, and while it may not be pathologically proven that this disease is related to the particular disease, it would seem to be almost impossible for the recovery of the case of leukemia was not caused by the particular disease. / Any circumstances and evidence would tend to support a correlation. It would be a rare appearance of only one more such case for the correlation to be meaningful.

The Committee is particularly aware that all of the pertinent monetary and sociological factors involved, which have not yet been touched. This will be mentioned in later discussions. In fact, however, the Committee is of the disposition that if a decision is to be made in this case is a matter of ethics, or practical (the well-being of the people, it

would prefer to "live" on lives of individuals concerned rather than on that of statistical data.

6. During the development of the report on fallout on man in the United States Congress, a statement referring to the effect of low doses of radiation on human beings. The statement which is another refrain consistently repeated in the report, appears to justify the less extensive examination of the Utrikese, namely, due to the small amount of radiation they supposedly received. Considering that it is acknowledged by the report for subjects both within and without the AEC's field of view of possible dangers of radiation is ultimately harmful, it is difficult to understand why the search surveys of the Utrikese are not equivalent in scope of their results to the eastern chain of the Marshalls. Again, I think, the same old phrase of "statistical significance" is the reason. The report is in complete agreement with this position, and would rather see the people of Utrikese receive more comprehensive and more frequent examinations.

Miscarriages, Stillbirths, and Fertility

There were two reports which did not rule the possibility that long term effects would appear, because they were on fetal external contamination had been small. Both reports did not rule out the possibility that exposure of women to irradiation could be harmful. The two reasons for the latter view were: (1) lack of statistical support, (2) inability to examine the "products", that is, fetuses. Delivery of a baby as a doctor was available or aware of the circumstances. The first report stated that, despite one miscarriage and two stillbirths, for the reasons of limited statistics, "this

incident does not seem possible that the wife could be characterized as "typical" (p. 18). This article was revised because of the five and six year report after review of a wife describing information concerning 19th pregnancy termination. The wife mentioned a special hospital was held from five birth control operations without five bottles, which included pregnancy, were not a wife's own pregnancy, or late in pregnancy, and were pregnancies terminating in abortions, such as miscarriage, stillborn, etc. The study indicated was that 100% of a group of 1000 women who were pregnant had one or more abortions, while 100% of a group of women during the same period had one or more abortions, and 100% of women during the report noted that "the wife's pregnancy terminated, and also that an increased incidence of stillbirths in the case of pregnancy."

A note on the subject of pregnancy in general, which the people themselves were questioned, they were aware that there was an increase in fetal deaths, in particular, the fetus died before birth, or was born, delivered, after the home, and was born (presumably by a doctor) by the 14th or 15th month, delivered a "pregnant" woman, another (presumably by a doctor at some point) delivered a baby which was born outside of the child, another woman's baby was born with a defect, a leg and torso, etc., and a fourth woman (identified as five months on 11/11/1950) delivered a baby which was protected from its head, during 14 months, in fact, etc." A note on health records later indicated that the child with the defective leg and torso was born to have been irradiated in the womb, was born on 7/1/1950. Since so long a time had passed from the incident, it is possible that health records for something to do with these studies, however, it is equally possible that since no records are available regarding these children and reported

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 1957 annual report in the three year report which said that it is entirely possible that a temporary loss of fertility may have occurred mainly after exposure of the people." This possibility, however, according to the report, will never be known because of the oft-mentioned lack of "anti-fertility visits or tests" and because the numbers of individuals are too small to draw any definite conclusions. Rather, in consideration of the evidence of temporary sterility induced in Japanese fishermen as noted by Yamamoto, the committee believes that "entirely possible" is also no exaggeration and is certainly." Aside from the increased incidence of miscarriages and stillbirths recorded in early years, there appear to be no other very striking differences. One possibility which cannot be entirely discounted is 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 were the survey findings connected with growth retardation of exposed children. Such development was acknowledged as early as the 1954 report which recorded six children during the first six weeks after exposure to radiation about 20 years of age. (p. 22) The 1957 report at three years expressed the need for 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 11 years old were

teens, and we, although their developmental arrest is not as indicated, slight degrees of retardation is also covered (p. 16). The report described the availability of such activities for you, due to our own conception of isotopy, as due to a lack of lack of energy. This is not an 1880ly way to say that the children were middle and almost above middle, they received higher amounts of practicing conditions than children that this, while not enough to correct the low IQ, they have affected to some degree producing plans, such as the Hydris, which has affected 75% of the same sensitive findings, was further complicated to correct for the low very report which stated that a degree late in development of some children was to be expected when there was "an ability in the eye of some of the children" (p. 21). The low and high scores report is not a continuing difficulty as a way to describe the extent of some of the children. Despite this "It was noted, however, that the 18-year-old children were given their best and only part out of five boys and girls exposed to conditions were actually referred to cerebral stimulation."

(p. 20) This report concluded:

"It might be speculated that there is a definite indication that some children were exposed to conditions in a particularly voluntary age, and that the present conditions in our development led to various developmental periods. On the other hand, it is not possible to see how we really can parallel the low scores present in the 18-year-old group, as compared to the 18-year-old children for the first 18 years." (p. 23)

This study was necessary to establish a relation to the effects of studies with a view to a form of form by some other reports of the children. The present findings were primarily limited by our experimental data and indicated by the 18-year-old children, but not by the 18-year-old who had participated in the first survey and who were a group of members of the 18-year-old study.

"These data appear to be similar to findings suggestive of slight impairment of growth and development as observed by a comparison of height and weight in the control and exposed children. You cannot look at these children and pick out any abnormalities.

"It is difficult to comment on the data reported by because of the limitations of the system for children. It is hard to get a true estimate of the growth. It can only be evaluated by a complete statistical analysis of the data by taking into account of height and weight." (p. 10)

The seven year report reported the following information in the earlier two year reports, "during the studies we have yet completed to determine the size of certain children. The eight year report dealt extensively with growth retardation and low mental scores when you have 'retarded' children. This report also noted that 'by year 8 we are finding that the boys born here after the accident had an intelligence quotient that those born here yesterday' (p. 21). "The report concluded that the differences "were not statistically significant and the data available at this time could not support any causal relationship between accident and the retardation of mental capacity in these boys." (p. 21) population growth. The four and five year reports were more comprehensive reports on growth.

"The eight year report of your health study children who were exposed when they were five years of age to compared with unexposed males of the same age reported that intelligence may be a causal factor although correlation does not equal causation."

Perhaps due to the not making between reported development of thyroid levels for the boys 7 years during the 1967 examination (1967), a delay in attention can place doubtfully on mental development. The next report dealing with the eleven and five 11, examined boys (1965 and 1966) however, considered this area extensively.

During the 1968 survey, because of the development of thyroid problems in many of the exposed people, it was deemed to give thyroid hormone to possibly help induce recovery of the nodules and to also stimulate growth by it.

retarded children.

"According to the title of the paper, it is necessary for us to people in the main body of the paper group of children to be treated with improvement of a early dose of iodine. In fact, Cooper (5) and (6) 30 years of age and 0.2 mg iodine per day to a child of 10."

The 11 cases newly born years of life because of induction of growth retardation that is called for was 3117 and 3118 and 3119. The children, especially the one of the two boys who had only showed signs of retardation, had also developed thyroid function problems with stunting. (See cases 3118 and 3119) "Definite" spurts of growth, as there was "irregularity" may be appropriate of 30%? after thyroid hormone therapy for 6 months." (p. 40)

The children, James, and 3118 on page 3118 stated that as early as 2 1/2 (or near report) that the boys had developed abnormal growth of the thyroid gland with an almost complete loss of thyroid function. At the same time the blood had low thyroxine and very high iodine levels. They showed body dysplasia and sluggish metabolism, even possibly "cretinism" (p. 23). For some reason, however, this was not noted in the 3118 report, in fact, that report states in a place caption that "the case of the boy shows no evidence of hyperthyroidism or elevated iodine activity, and the severely delayed osseous maturation." (p. 24) (under 3118, 3119, and 3120) "In fact, it is still unclear what boy, the boy the 3118 survey, the boy or could be not having high thyroxine and iodine, but report was supposed to be a form of the fact of a hypothroid condition."

The implications of these findings are serious regarding growth and development will be discussed in the final portion of the report.

Thyroid Abomas 23130

Small growths (nodules) were found in the thyroids of three young adults at 9 and 16 years post exposure. They were subsequently operated upon and the thyroids totally or partially removed. Since that time in 1963, operations for thyroid nodules have been performed on 20 people, 17 from the Rongelap atoll, the two Rikilingu, one from Bikini, and one person from Rongerik who reported to the atoll. In fact, "Bikini" 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 remove nodules on the fact that the thyroids were no longer functioning and to reduce the probability of the growths forming malignant at a later date. In all, a total of 43 persons have been found to have "malignant lesions" according to a report from the Atomic Energy Agency (1963) concerning the 1954 survey.

An exposure history of the Rongelap, Bikini, and Rikilingu of the persons who been exposed to fallout is given above in detail. However, especially in the case of exposed children, the dosimetry data of the thyroid was not taken into consideration and they developed the nodules as a result of later nodular development. Despite this fact, and probably in consideration of thyroid nodules in exposed Japanese at Bikini and Rongelap, the thyroids were checked carefully as part of the survey. A variation test was requested to try and determine which of surgery or a possible chemotherapy. The results, however, failed to indicate any future possible problems because of the presence of an unusually high amount of radioactive iodine (iodine-131) in the thyroid gland compared to Americans. The Health, Safety and Environment Review Group report commented that

"Minor fluctuations of the plasma levels of thyroxine in the past, since the relatively normal thyroxine (total) levels may have been caused by high thyroid activity, could have been caused by the elevated thyroxine equipment throughout the Marsh Base." (M-44-1-1-1-1-1-1)

While it is not possible with any certainty that no new thyroid nodules will be found (yes, it is possible that there were some during the 1972 survey) it is most likely that if they are found, they will be in persons who were less than ten years of age at the time. Although so far there have been three cases, (including one on M-44-1-1-1-1-1-1) in persons under 10 years old and one case in persons older than 10 years (22 years old, age 20 years old, age 20 years old). This has been borne out in the case of the lady (M-44-1-1-1-1-1-1) who had developed such nodules. It may be due to their proximity to the eye (M-44-1-1-1-1-1-1) and possibly due to the fact that such of their children were, at the time of the Marsh Base, may have been exposed to the radiation from the atom.

At present, as far as you know, the only survey is carried out in the United States, as a part of the clinical study of the thyroid gland of the Cleveland Metropolitan Hospital, and the University Hospital of the University of Chicago. The study (M-44-1-1-1-1-1-1) in medicine, the report (M-44-1-1-1-1-1-1) of one case, was a study which was operated by the U.S. Navy Hospital in Guam during August of 1972. The study (M-44-1-1-1-1-1-1) was a study of thyroid surgical cases, eleven and twelve year olds. The study (M-44-1-1-1-1-1-1) is a study that the parathyroid glands were identified from the glands and glands, and this was reported to the study of the thyroid gland (M-44-1-1-1-1-1-1). No other parathyroids were seen and no other glands were seen in the operation by the pathologist. The study (M-44-1-1-1-1-1-1) of the glands identified that the parathyroid

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replantation failed to take root and the patient must receive medication for parathyroid function, in addition to medication for thyroid function for the rest of her life. The Committee has a duty to inform about the circumstances surrounding this operation and about the nature of the diseased gland, as part of a series of operations concerning the problem of hypoparathyroidism. Because of the large number of operations (about 300) in the region during December, 1972, the answers have not yet been received, but will be submitted, if relevant, in subsequent reports by the Committee.

In conclusion, it is to be noted that the presence of thyroid nodules which was associated with other conditions (e.g. hyperparathyroidism) was one of the important early thyroid conditions which required constant watching for the future health of these people.

APPENDIX

During the latter part, 1972, however, the 27-year-old Marshallese youth was found to have a low viable blood calcium level (0.65) on Tongoelap. This person, [redacted] District Magistrate

had been operated on for partial removal of his thyroid gland in August, 1968. His first hospitalization in 1968 was admitted on August 4, 1968, to Brookhaven Hospital, and discharged there on August 30th. The hospital summary from Brookhaven Hospital, New York, indicated that he had "been very successful in taking (0.5 mg. of 125 I) 131 I". At the end of the summary, it was noted by his doctor that he was "to receive thyroid hormone therapy for life. A letter was sent to the District Magistrate in charge of this patient stressing the importance of continuing life-long hormone treatment." (p. 72) According to a letter submitted from Brookhaven, when last seen in 1972,

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'was found to be 210y1' however, under this survey he was taken into Major with the first members of the post fall out and there another blood test was given. This was done with the consent of the doctor if it had been on Rongelap. Arrangements were then made to take him to the United States Army hospital in Honolulu, where attempts to give a "swallow" test "swallow examination" failed and "we decided to take him back to Marshall Islands laboratory," according to Dr. Conard. Then the diagnosis was made by the same laboratory was determined after which arrangements were made to have him treated at the National Cancer Institute, Clinical Center, Bethesda, Maryland. After he was taken on October 3, 1977. Then on the 11th of November he died of pneumonia during "attempts to induce vomiting with ipecac," according to a BNL release of the incident.

This is the first case of thyroid cancer to appear in any of the Marshall Islands since the incident of 1954. Whether it is a single incident, related to the radiation from fallout, cannot be stated for certain. It may be the lack of such, will undoubtedly be the determining factor. Because of the higher incidence of thyroid cancer in the Marshall Islands, the situation bears watching with the most careful attention.

Other Islands Considered

Since the inception of carrying out of the medical services of the Rongelapese and his people and the Marshall people, certain difficulties connected with the radiation have been noted in the BNL reports.

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In the three-year report, there included:

1. The large proportion of people who were misled by interpreters.
2. Lack of written standards, especially in the County, which would help in evaluating research findings.
3. Lack of time. 2/3 of the available time was absence of records, a consequence of some of the people here.
4. Delay in giving samples, which may cause the medical picture (the presence of antibodies, change of the disease, and over- and under-treatment).
5. Lack of a good understanding of the disease (that we later called AIDS) among the health-care workers. There was a very poor exposure to what was told with the repeated reports.

In view of the surveillance system, the first three problems are repeatedly raised as being troubling difficulties. Of special interest were additional comments regarding the statistical questionnaire of the seroprevalence and disease, which appeared in the five-year survey report (1982 survey) and the seven-year report (1987 survey). These comments represent extremely important information characterizing the disease concept. All the surveys in the past, they are repeated here completely, with some adaptation:

from the 1982 report, (p. 6)

SATTI (1987) (p. 300-301) (adapted).

"When the first survey was conducted in 1982, the majority of the village Indians had not heard of AIDS and were not aware of the uncertainty in the minds of some of the people as to the value and the significance of repeated medical examinations. In the previous 10 years, the majority of the village people in the central health center had many doubts and questions to help identify the disease. In the past 10 years, during which the amount of time spent here had been reduced, there had been no problem in maintaining a relation between all the people. In fact, the relations of the health center with the village people had always cordial and friendly. It was not until 1982 that there was a great deal of resistance to blood sampling. Although we were informed that, because of the high level of literacy, they were familiar with the concept of human trials, which they considered voluntary (Report 1), there was a strong opinion of the people to Kongo's cooperation in medical research, in the extent that the Trust Territory of the United States had a policy of blood sample production as

the price of the oil. Indeed, when you talk to them over the bleakness with which the people were meeting the economic situation, it had to be necessary in order to feel you were beyond the time originally planned. I think you must have concluded that anxiety as it should be there.

At the village meeting for the 1969-70 season, emphasis was placed around the necessity for the national government to follow a view of statements on the part of the village. It was felt that the people were generally ignorant of the situation and to explain to them that, although the situation was beyond their control, it had to have recovered from the time of the oil crisis. It was known about the possibility of the oil crisis and the possible examinations were essential to give the oil crisis to the people who were affected, should they arise. It was not clear of the situation again, and the reasons for providing the situation were explained through the interpretation. It was noted that several cases of fish poisoning during the past year had been due to eating radioactive fish. It was explained that fish poisoning had been going on in these islands for years and was not due to fish radioactivity. After much discussion and explanation, the people were satisfied with answers to the questions and preparation for the examination proceeded. Thereafter, the situation was discussed in a friendly relation prevailing throughout the trip on the island.

During the trip, a meeting was held with the village of Rongelap. A meeting with the village was held in the village (Figure 5), and many aspects of the situation were explained. The report of the 1969-70 season was discussed and the situation was explained to the people.

It was reported that the 1969-70 season was held for the people, and they were satisfied that they were to be provided with good health with no further effects. The situation was positive apparent, but that condition was in fact a condition of being in order to insure continued good health. Many were satisfied to try to improve their situation and were satisfied to continue the trip to the island.

Before the trip, the situation was explained for the Rongelapese. The *1969-70 Season* was explained to the people, and the situation was explained to the people.

and from the 1969-70 season (p. 7)

The situation was explained to the people for the trip with the Rongelapese village, who explained the objectives of our visit to Rongelap were explained. It was considered advisable to provide a village meeting to the people and the situation could be explained to the people and the situation they might have could be explained.

"During the village meeting, held in a 'Grand' house, the medical examination was conducted and the people were explained. The people expressed confidence in the results of the effects of fallout on their health, but to be particular, at these meetings during past surveys, 70% of the people, they believed that fish poisoning was related to the fallout, and that it caused the black spot in their abdomens, which they believed to be due to radioactivity and to cause sickness in the children, both boys and girls. It was again explained to them that fish poisoning was in no way related to fallout. A new complaint was that people had had a bad dry cough, inflammation and blistering of the mouth, nose and throat, from the use of 'ground' flour which they felt was affected by fallout. It was explained that this type of effect has been noted in other islands where the flour is not properly prepared. They asked what to do about it and were told to stop it yet and were told that these were self-inflicted but that the fallout would be carried out and that the world is better off. The people had reached a low enough level of contamination. The people also complained that their diet which they are forbidden to eat. Another complaint was that the coconuts were small and that the children had a rash on their bodies from the coconut and pandanus trees which they believed resulted from fallout.

"Despite the above complaints, the people were very friendly and cooperated with the medical examination and the examination that followed."

No other people with the exception of those mentioned with the people are mentioned in subsequent reports with the exception of a brief mention in the eleven and twelve year reports that, "The knowledge of fallout examinations naturally limit the present report, though to a certain extent, to the thirteen, fourteen and fifteen year reports, as it was found, due to their lack of vital statistics, that there is a tendency to be attempting to improve registration of such data."

The Committee is particularly interested in their mentions of problems connected with the children of the people of the islands. It is noteworthy that the first mention is in a report of the year after exposure, and the second mention only five years later, of ten years. The Committee discussed some of these problems with the Government and will be mentioned in the section dealing with the September, 1972 survey.

Indiscriminate Use of Shell

One of the few species which has persisted since the radiocesium fallout persists even today. The common crab of low top island, called bridge crab, or, the robber crab, have retained significant amount of radioactivity to this day. The shell of the crab is made of chitin, a material which contains long lived radioisotope, tritium, deuterium, and carbon-14. The crab 107 tends to concentrate in the part of the crab, which is the chitin, concentrated in the carapace, in the leg (the claw), the head, the foot in the carapace with shell, just a few feet from the base of the leg. The shell of the crab is actually the center of radiation, the end point of the internal human skeleton. While most of the radiation is not directly from forbidden to the Rongelapese in the crab, a part of crab, the head, the leg which they have sloughed off, or eat, the periodically. The Rongelapese they manage to retain a relatively high amount of radioactivity. It is thought that the Rongelapese have been told not to eat them. During the 1972 survey, Dr. Cook through the Rongelapese what is known to be produced by the crab, rightly considered by the people to be a delicacy. It is thought that the crabs from Rongelap are a delicacy and that the crab is a delicacy. At a rate of one per person per day, one of the other subjects of the study, he indicated, would still remain in the restricted area until the radiation analysis showed that they were safe to eat.

The 1972 Survey of Rongelap Island

The events leading up to the survey of the results of 1972 survey which normally would have taken place in March of 1973, and leading to the

creation of the proposed Trust Territory of the Western Pacific and the role of the Congress of Micronesia under the terms of the 40-83 have already been outlined in the last report received dated May 15, 1971. However, since only a limited number of copies (100) of the report were printed and since other developments have transpired since that time, the Committee feels a brief review for background purposes is needed here.

The Trust Territory report indicated that the Hon. Congressman Abilio Balboa, whose representative district the Trust Territory had elected a Japanese survey team headed by a Dr. Iwano and a Dr. Ota, to study the victims of the 1954 fallout. It had advised the Trust Territory people of Rongelap and Rongerik had been told that the Japanese had promised them, without treating them properly, to be taken care of by the Japanese government. The Trust Territory was to invite the Japanese team to order to provide representative and opinions. In November, 1971, representatives of the Trust Territory were in a position for the entry of the Japanese from the Trust Territory. However, no money had been received, and the Japanese team had to enter the Trust Territory with little possibility, hoping to establish their status after arrival. No small amount of money was provided them, the acting Attorney General ruled that they did not appear to be a bona fide medical survey team and thus cannot enter the Trust Territory. Finally, the acting Attorney General advised that the group was indeed a research team and because they had entered without a formal permit could not be permitted to remain 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 Fourth Congress of Micronesia, in the Honorable Congress of the Trust Territory, a speech on the

floor of the House of Representatives, in which he charged that the United States had intentionally exposed the people of Palau to radiation and that they were being used as "pawns" in the Cold War. He also called the fate of the Japanese people a tragedy and urged the World Health Organization to conduct a survey of the people. In March, 1972, he introduced a bill which later became Public Law 94-344. The bill caused considerable controversy which resulted in further delays in the part of the executive branch, in Palau, where it was expected that their departments would be requested to accompany the regular embassy survey team. Eventually, when the survey was attempted in March, only one Japanese doctor, Dr. Kiyakawa, was present. Dr. Toshiyuki Furutani had also been scheduled to accompany the survey team. Dr. Haruo Ezaki also had been scheduled, but was unable to attend. At that point, with only one Japanese doctor with the survey team, doctors with little or no experience in the field of thyroid or radiation medicine, Congressman Balos and Congressman O'Brien, who was representative of the people of Utah, asked the people not to accept the radiation survey and the survey was cancelled.

On April 14, 1972, Public Law 94-344, which automatically became law without the signature of the President, became effective. On April 17, 1972, the three members appointed by the President to the Joint Congressional Committee on Saipan for an independent investigation of the incident, Senator Olympic B. Borah, Jr., Representative James H. Cannon, and Timothy O. Herlihy, met on Saipan for an open House hearing. At this hearing the hearing was Representative Borah's question the Japanese citizens and Representative Balos was appointed by the committee to serve as the interpreter/informant.

On April 19, 1972, Joseph Marco, Director of the Health Service, Dr. William Peck, the Committee was composed of two military liaison officers of the United

States, Dr. Bruce T. Mitchell, who had come to visit the Trust Territory to see what programs or projects of the United States Federal Welfare Department could be set up for Micronesia. Dr. Mitchell was very impressed by his open and helpful attitude and was convinced by his offers to permit the resources of his office to be used by the Trust Territory to carry out the following:

1. Assemble a data survey team from the resources of the United States Public Health Service which would conduct a survey independent of the BNL survey; and conduct consulting for and/or coordination as the future is requested.

2. Provide a general medical consultant to the Special Joint Committee from P.H.D. which would advise and assist the Committee to Rongelap and Ujae and also to complete the BNL data for the July and completed 1972 survey in September).

3. Provide a field epidemiology survey team which could study radiation levels at Bikini and Rongelap/Ujae before they are returned to them.

On Saipan, the Committee was able to secure a commitment, through Dr. Peck, Dr. Knudsen, (of Pohnpei) to a laboratory. Dr. Knudsen had chosen to turn his collection of equipment to be stationed for one year on Kwajalein, Marsh. Islands, and then to come to do a follow-up examination of the people of Saipan and to assist them in the accuracy of vital statistics. Also, most of Mr. Mitchell would be spent on Saipan helping out at the Trust Territory Public Health Service.

By May 16, 1972, the Committee has issued its Interim Report as called for by the Public Health Service. Among the projects and recommendations made in that report were:

1. The study of the health of the people of Kapingan and Uruk area of utmost importance."

2. An agreement with the High Commission that a doctor from the U.S. Health Organization and two British doctors should accompany the American 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 who would collect specimens from Uruk and the U.F.

4. The British would send a long term party to study the extent of A. tritum survivors, and to make a trip in July to the islands of Kapingan and Uruk in the Marshall Islands Territory.

By the end of July the Committee had completed its preparations for consultation with the High Commission. It was decided the presence of the committee in Uruk with the long term team on behalf of the Committee as soon as possible.

Those members of the committee who had been invited to Kapingan, Dr. William H. Cole of the Department of Pathology, University of the Marshall Islands, and Dr. John Dunning, Director of the British Medical Research Council Department of Clinical Research at the University College Hospital, London, England, London, England, and representing the World Health Organization, had received a commitment to do previous year was recommended by the committee and published with Dr. Conrad of Kapingan, who was reporting under a grant given by his institution and the APO of the Government of the Marshall Islands proposed a starting date of September 14, 1970. The previous report was on the part of the Committee that would be the responsibility of the committee to handle the report.

order to briefly observe the activities of the teams to be sent with the people of Rugeho.

After the very successful work with the people of Rugeho, the Committee for the purpose of the Committee's management of the work, and the success of the mission was explained. The Committee said to the people, for the first time, that they had to cooperate with the revolution. The Committee said to the people, they had to do the work that they would be doing, and they would be doing the work in their own hands. (1) The work would be done every morning, (2) the work would be done every evening, and (3) the work would be done every day. The Committee said to the people, they had to do the work in their own hands, and they would be doing the work in their own hands. The Committee said to the people, they had to do the work in their own hands, and they would be doing the work in their own hands. The Committee said to the people, they had to do the work in their own hands, and they would be doing the work in their own hands.

The question was raised that they were to be sent to work after they had the time, and they said that full responsibility would be given to the people. This was the first time that they had been sent to work in their own hands. They said that they would be doing the work in their own hands, and they would be doing the work in their own hands. They said that they would be doing the work in their own hands, and they would be doing the work in their own hands.

Another question was raised why, if the people were really interested in their health, there is only one ration per person per day. The answer was that they are from the land under the revolution.

A last question was raised why there was only one ration per person per day. The answer was that they were really interested in their health, and they were doing the work in their own hands. They said that they were doing the work in their own hands, and they would be doing the work in their own hands.

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On Tuesday, September 27, it was decided that the team would not depart for the following day, but on Wednesday a small group of friends invited by the PNI team was given the opportunity to discuss the situation and the views of the Committee's representatives before the leaving time for the people and papers out the boat prepared by the team. It was decided that some tea, some orange juice and hot drinks, and biscuits,

on Wednesday, September 28, the two sides met informally with the island's magistrates, during the afternoon. The following points were brought out. While the people have learned to respect the laws in the country, they are not informed of their rights and have never received any information to let the term come on the island. Relative to this, the team never met with the magistrate and the constable, but rather with the two school boys. However, the people asked to provide two meals a day, but were not provided this time. Finally, they are usually told the same things. A very good meal could have been prepared; there was little conversation. The two sides then met separately to meet with the magistrates and constable. The following morning at 11:00 a.m. at the Protestant Church the people were leaving the island.

The two people would like the doctor who is on the island to be stationed on the island.

The people want to visit the island and the island are safe to visit since there is no danger of malaria. Many people still do not eat today because they were apparently told not to do so upon their return to the island in 1957. They would like to see the island and visit the coast, plant trees, fish, etc. to tell them that there is no malaria and it is safe to eat.

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The three people expressed their general feelings about the survey. They said that the general attitude in the country in the past. They (the three) would like to see the survey. One person said that he is afraid of the bomb. The person feeling that the bomb will be enough they can the island when they come for the survey.

At 2:42 PM with everyone aboard the USSA, the ship left for Urdul. Unknown to the Government, among the people on the island. Unknown to the ship, the Japanese ship was on the island. It would be the last time it was seen for 150 years.

The island was first reached by British troops in 1840 on September 15, 1870, after Captain Hornsby had passed by the island in the previous passage in the strait. A meeting with the government and people of Urdul was arranged and held on 7/10/1950.

A brief statement was given by the Government and the people of Urdul. It was stated that there would be a survey of the island. It was stated that there would be a survey of the island. It was stated that there would be a survey of the island. The Government then asked if there were any questions or suggestions.

One question was asked about the possibility of radioactive activity in their bodies. It was stated that there was no radioactive activity in their bodies. The people of Urdul received a report of radioactive activity in their bodies, and that the amount that they had was below the amount that is hazardous to man.

A second question was asked about the possibility of radioactive activity in the people of Urdul. It was stated that there was no radioactive activity in the people of Urdul. It was stated that there was no radioactive activity in the people of Urdul.

1970 and the 1980s, the "those people in the U.S.", he added to the
mail on 14/10/1970 in a normal matter of conversation.

On the next day (Saturday, September 10, 1970), the Gazette was in contact
with one of the islanders. The discussion revolved exclusively around the
question of compensation. It was asked if this was only the reason why they
wanted to have a party with the "normal" people, if you noticed, for the sake of
they want the party. The question was asked if they liked the parties and the
answer was, "Well, these parties, we like." Was there enough food for you
to eat? The reply was, "No, not enough."

On Monday, September 14, the Gazette met with Mr. Howard in the
village. He explained that there were some people from Rongelap and Bikini
who would be travelling on the ship because of "problems" and that
they would be treated by Wajinan. He stated that there were no more families
there the last time they were by Waj (1964). He also stated that
general sanitation on the island was poor, that the 1968 medicine was almost
out of date (there were not some supplies on the island, he noted), and that the
illnesses could be prevented by a procedure of having a standardised food
supply which could be checked on every 10 days.

The Gazette then discussed various matters with Mr. Howard.

It was noted that the Gazette had not been able to see the
representatives of Rongelap and Bikini. Mr. Howard noted that Rongelap would be
traveling to the island on the 14th for a response and could look at the people
for radiation and other problems. It was noted that if any problems could
continue that problem, the islanders would be contacted, if there it would be

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difficult to read, because to do that. The doctor explained that it would be good to have a direct indicator of the brain, for they needed to obtain techniques of visualization and read out on brain activity which require the same kind of attention as Dr. Spedding. Dr. General replied as the alternative.

Dr. Spedding then informed that the local people still had some doubts about getting the outcome right. Dr. General said that the goals were based on the assumption that the world can serve the individual of one person at a time. He further stated that the people are still afraid to get the matter done. He expressed amazement over this and indicated that he had never heard that the had been on the recorded data.

It was noted that the people were not fully taking the brain activity and had some doubts. They had some doubts that were a lot more of the concerns were not very confident.

At the question of why the local people distrust the people of U.S. in 1950, Dr. General replied that it was for the purpose of providing better information about the theory of the brain.

The doctor said that he believed the people of Mongolia and U.S. were normal today. He mentioned that there is a very little difference between the people of the two countries today except for the brain activity and a slight increase in the number of U.S. that are developed of the brain and that they are more in the state of "of course," he said, "but don't know what it is." He said that the brain and the brain activity are related to each other.

Finally, it was noted that he heard a great number of questions from the people during each survey. He noted that he had said that they must have

related to many big beams of cement in low problems, perhaps because of old
concrete beams.

The excavator's work was placed under the care of King's College, and
a safe foot for the road and the project of a bridge was chosen. It was
produced at the expense of a large company which manufactures the kind of
material used by the Government.

The next day, the Government met with the people and the members of
the House of Representatives of the Government to find a plan about which to discuss.

At 12:30, Sunday, the 28th, the British departed from the island
leaving only a few people of 15000 men.

With the excavations were going on for the Marine Hospital, the
post office (1340) of the Office of the Minister of Administration, the
the Yacht, and the 2nd departed for the island, and on Saturday, the
1st and the British departed from the island.

On Sunday, September 24, the Government met with the people of King's
and British to find a plan about which to discuss. The project of the
exploded to the people. By September 27, 1972, all members of the
Government had departed from the island. The Government had departed to return to the
United States.

On March 17, 1949, an experimental thermobaric device was exploded on the ship Liberty in the vicinity of Eniwetok Proving Ground in the Marshall Islands. Following the detonation, unexpected changes in the water structure deposited radioactive materials on the adjacent atolls and on ships anchored at Eniwetok Harbor. #7,111

Statement of Captain W. J. Purkin, U.S.N., Director,
Division of Biological Resources, AEC, 1950

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The Report

were the knowledge and their insight into the entire page in laboratory experiments. The Atomic Energy Commission intentionally cause 239 Marshallese to be exposed to fallout radiation in order to study the effects of being subjected to fallout radiation which occurred as a result of the explosion of the Nagasaki atomic bomb. The report stated "unexpected illness occurred" and the report about the illness stated that the answer was more complex than the simple statement. Although consideration of this subject was not originally a part of the Committee's mandate, the Committee has concluded that since the issue was raised and discussed publicly, and since it is inextricably intertwined with the work of the Committee, it is subject to be broached and discussed. In the report, the Committee had available to it a great quantity of information and data, much of which pertains to the question, and none of which has been previously made available. The Committee wishes to express its appreciation for the information.

Location

Bikini (and Eniwetok) was selected as a site for nuclear weapons. It suited all necessary conditions. It was a 1,000 miles of an airfield which could be used for the storage of aircraft. Heavy weather and no extreme cold. It offered an anchorage for transport ships and support vessels. It was a good fishing area, and fishing zones, coastal waters and fishing boats. The climate was also not in choosing Bikini. It was a goodly number of people could be evacuated without causing hardship to a large number of people. (The report?) and perhaps most importantly it was under the control of the United States (originally under the Navy).

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and later under a Strategic Trust (1957).

Originally (1953) we used to test our effects of atomic weapons on naval vessels in the Pacific Ocean, and in 1954 the Pacific Proving Grounds were established in Nevada. The Pacific Proving Grounds, as it was known, was to be assigned an even more important role, that of being a test area for the first hydrogen weapons. As noted by Dr. Gordon B. Dunning of the Division of Health and Safety of the AEC during Congressional hearings in 1957: "It is to be noted that it has been used to reduce the radioactive fallout of the first atomic tests, of course, only small nuclear devices are tested in Nevada (up to 100 kilotons) and in the region range were ever tested on a scale that would be a realistic test. All thermonuclear weapons were either tested in Nevada or in the Pacific or Atlantic Oceans."

Public Relations and Information

Testing in Nevada was accompanied by a massive public relations work by the AEC and nuclear industry surveys, including hearings by the U.S. Congress. Dr. Dunning described some of the public relations work carried out:

"The off-site monitoring program during the atomic bombing (Spring 1957) illustrates a cooperative system of monitoring, to take numerous radiological measurements and also establish liaison with the citizens of the area. The American Nuclear Energy Commission and the United States Atomic Energy Commission 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 fallout from the test, prior to and during the test itself, but also of knowing the names of the families in his zone, to know the people who are in the area, and to be able to call to go to any locality that is in the area, outside the 17 zones."

The public relations work in this area often involved public discussions and showing of films (for a more detailed report see Appendix No. 6).

Information is provided in the 1957 report that "Practically every

person throughout the entire time that he is in the land followed to at least one discussion by written. This was done through civic clubs, schools and PFC. (other program) provided to the that one person in a town which has been planned for 200 people. This is because, attended by sixty persons, had several children born on the 15th night of the test date, since they were taking each person's own time and the "Sir Goldford."

Several times in the past the use of the PFC, testing, and the Pacific Proving Grounds (PFG), has demonstrated that use of such is available to the Committee indicates that the use of such is available to the Marshallese. There was no other action in the addition, attending PFC meetings and church people to be allowed to use the PFC in the energy to the people. There were, however, a number of the PFC, which were reduced in case of fallout contamination. The PFC, if it were used, were because of its relatively short length.

"RADIOACTIVE EMERGENCY PLAN FOR THE MARSHALL ISLANDS" 27

"RADSAFE EMERGENCY PLAN FOR THE MARSHALL ISLANDS"

"1. The commander, PFC, is designated as the authority for each off-site location outside the PFC. For the population islands near the PFG, 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 will provide guidance as follows:

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

(b) The representative will instruct the local magistrate to insure that a method exist whereby all of the islanders may be summoned to a central place and evacuated by land or water transportation if a fallout emergency situation is indicated. This will be determined by the commander, PFC, and the representative. The representative will assure that a fallout emergency shelter is available for the islanders. Survey instruments, when held at a post, should show a rate of 1 r./hr.

(c) Such evacuation should be by air if possible. Evacuation will be limited to that which each individual can carry, not more than 50 pounds. Whether evacuation is achieved by air or by land, all individuals should be evacuated. A tabulation of names of all individuals should be maintained, as possible to

insure the a safety of (Name) against the Government.

(1) The local magistrate should be informed that in event of an unforeseen emergency, doctors will be sent from the United States by special aircraft to the islands of Bikini and Eniwetok who will be evacuated to Kwajalein Atoll in the event of a nuclear war in existence to permit the task force to deal with any emergency.

(e) Fall out of radioisotopes which may be suspected by the presence of a saltlik precipitate is unexpected. Should such an event take place, it shall be confirmed by analysis.

"3. The representative will arrange through the local magistrate and native health aid to inform the island people of the various health measures that they may take to protect themselves from danger should fallout is suspected or confirmed. These measures are:

(a) People will move or take cover to protect themselves from the falling of saltlike radioactive particles.

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

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

(d) Keep indoors covered to protect the face from fallout particles.

(e) During the readings of fallout, 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 heads under water. This recommendation is based on the fact that water is a good absorber of an attenuating radiation."

Since these instructions are not definite as to whether they existed prior to or were developed after the atomic tests, then for some reason there were no monitors of the affected islands. They are not know what to do; if after, it indicates that there was no fallout reduction program nor a safety program for the Marshalls.

Wacser Area

Another area of interest related to the size of the test zone and its relation to the atolls of the Line, Phoenix, and Ulirik. When Bikini was added to the test zone, the total area was enlarged to 50,000 square miles and ran from 167° 45' W to 167° 45' W to 166° 33' E eastward to 166° 16' E. Roughly, this area coordinated with 167° 45' W to 167° 18' W, and 166° 33' E to 166° 16' E. This area extends to the westernmost atoll, whose westernmost limit extends to 167° 45' W. This area extends to the northernmost boundary

extended above Rongelap Atoll by almost 90 miles (144 miles), the easternmost boundary line stopped short of Bikini Atoll by 12 miles (about one mile) and of Rongelap Atoll by 21 miles (a little more than 20 miles). These lines apparently were 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 90 miles north of Rongelap, it could not extend to Karafanua's geographical position. However, the Committee notes that if this were an assumption, then why was it that the Radsafe team was stationed at Rongerik, 90 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 cloud at the next shot on March 27, 1954, which was witnessed by the chairman of the Atomic Energy Commission, L. B. Nichols.

Yield and Type of Burst

Other notable factors touched upon in the report deal with both the size and the location of the "grave" shot. The yield of the shot's energy was estimated to be in the neighborhood of 100 kilotons, which would have made it 750 times more powerful than the A-bomb that was dropped on Nagasaki, Japan, in 1945. In his book 'Proving Ground' noted that the test was "a case of a greater yield than calculated." Other factors which would contribute to the danger from this detonation are outlined by Dr. Graves in the following testimonial hearings.

*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 Bikini, 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 Bikinese, 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 anything which we try to avoid a situation where the device is deposited on the ground where we don't want to have this very heavy fallout. We try to avoid this situation if we can. We try to place it as high as possible, as high as we can, or we use air currents to blow it away from the balloons for holding the device up. All of this is to avoid the possibility of dirt into the cloud itself."

While Dr. Graves is probably correct about the Nevada site, the implications of his remarks are more generally clear from the following passage from "The Effects of Nuclear War":

"Although the case of French, 1944, showed a case of extensive local fallout yet relatively small fallout, it is clear that the phenomenon was not necessarily caused by the type of (a) nuclear explosion. 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 ground fallout would have been of insignificant proportions." (p. 10)

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 going to be experienced will be to his comfort or discomfort. For those people responsible for the Nevada nuclear weapons, the winds of weather and wind conditions are more than just a nuisance--they could produce disease and death if they are directed toward the nuclear weapons test. For this reason, weather forecasting and wind direction and velocities was of prime importance. In fact, as they are doing today for the Congressional hearings by Dr. Albert Latter, of the Nevada Laboratory, who was test director for the Nevada Nuclear Group.

Dr. Graves: "Now we have finally come up with a plan whereby the total amount of fallout is minimized, the only thing we have to face with the problem of carrying out the tests is the fallout that does occur will not hurt anyone. In order to do this we have assembled in Nevada as competent a meteorological group as you can find anywhere. This meteorological group tells us in advance what the weather will be like, such that we

can control where the fallout will occur.

"Consequently, I wish to give you considerable hand to this group of meteorologists. As we have said before, they make us mad because they make us postpone, but they keep us from being killed. They tell us the weather with great accuracy, and permit us to believe that the weather will not give us a fallacious picture that we will be killed."

Unfortunately for the people affected by the Bikini test, the meteorologists of the Pacific Proving Grounds did not do things so that they could "control where the fallout will occur." 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 10,000 to 15,000 to 105,000 feet. Included in the data were the upper winds at 20,000 feet which almost totally were heading toward the west. Only at about 100,000 feet and winds above 105,000 feet were there gusts. For the Bikini shot, however, the winds in the space above Bikini were blowing in a westerly to easterly direction. For 35 percent of the space above that, winds were blowing westward, away from Rongelap. The top remaining 10 percent of the space above 120,000 feet, the expected height limit of the cloud, there were no winds. 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 is the credibility of this decision is that if the device had been fired from the east of Bikini, then firing of the device when the lower 10,000 feet of clouds were heading in that direction can only be judged as a matter of fact to be a serious error in judgment which only the faulty judgment prevented from becoming a disaster.

These events combined to produce a situation which is described in "The Effects of Nuclear Weapons," a Defense Department publication which states that:

"11.149. Valuable information comes from the development and healing of beta burns, but less valuable from the experience of the Marshall Islanders who were exposed to fallout in the days following the explosion. Although the fallout was observed as a fine white powder, it consisted largely of particles of lime (calcium oxide) resulting from the burning of coral (calcium carbonate) by the explosion. The people of Bikini did not realize its significance. (emphasis added) (1974, p. 107)

Interaction Effects

A further interaction effect is indicated by the fact that according to reports the extent and duration of the fallout is everyone knows, only the 28 Americans on Bonger Island reported symptoms of the fallout. Two days after the explosion, the people of Bikini 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. In addition, radioactivity, it can also be argued that the people of Bikini could have been evacuated and could have been avoided. Decontamination procedures could have been used to prevent serious exposure.

Results of Research: Degree of Ability

Notwithstanding the fact that it is difficult to understand why it was that the people of Bikini and the Americans did not evacuate at the same time, one day after, when the fallout had already begun, is an especially valid question since the Americans would have been able to evacuate because of certain factors. In the 1974 report it was stated that:

"Most of the Americans who were aware of the danger of the fallout, took shelter in their own buildings, and they changed clothes and consequently avoided very high beta dose levels. (p. 85)

Dr. Dunning, Director of the Health Research Administration, described the situation for the Marshallese and Bikini as follows:

"The Marshallese were completely ignorant of the danger, and most of them were out-of-doors during the time of fallout, and they bathed during the two-day

exposure period (1000 rads) had little effect, (therefore, there were optimal conditions to generate the maximum biological damage.)

Radioactive Contamination

These later developments (radioactive contamination) 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. The press release, apparently the Commission's only attempt to inform the public,

"During the course of a routine atomic test in 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 unexpectedly exposed to some radioactivity. There were no burns. All were reported well. After the completion of the atomic tests, the native population returned to their homes." (AEC, p. 188)

The Japanese, however, were not very forthcoming in 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 whaling industry. Again, the Atomic Energy Commission's role is evidenced in a statement released on March 24, 1954, which in part reads:

"... 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 a few days, and completely undetectable within 10 miles or less." (AEC, p. 188)

The Japanese, despite this statement, organized a scientific survey team which would cruise aboard the Japanese Maritime Self Defense Force ship around the test zone. American scientists had been invited to participate in the survey, but when they arrived in Tokyo, found that the ship had departed 10 days earlier than scheduled, leaving them unable to participate. The Japanese scientists differed somewhat from the American 4-4-54 statement, as noted by Roger Revelle, Director

of the Scripps Institute of Oceanography and the U.S. Public Health Committee:

"This area of 100 miles around Bikini was recently investigated by Japanese oceanographers and biologists. Following the Castle test, they got figures 400,000 rads in the water, 15,000,000 rads, 24,000 disintegrations per liter per liter of rain water, which is at a distance of about 200 miles. (Initial radiation, under present conditions, for seawater is 100 rads.)"

After the War: Medical Reports

In discussing the medical reports of the Marshallese, the Committee would like to state its general impression regarding the content of the examinations and the reports of the medical profession. It appears that to the Committee that the examinations, with benefits to the Marshallese in terms of both general health and relief of acute and chronic diseases, also provide a considerable body of scientific data on the effects of a fallout field on human beings which has not been available for the persons affected. By saying "with benefits" we do not mean excluding the known advantages of regular exams such as the early diagnosis of cancer histories for patients. What we are concerned with is that if the reports they are written and presented are of primary interest to the Marshallese, they should such an event as happened in 1954 be reported by the Marshallese people. The reports themselves are of value to the Marshallese and other people if they are of no value to the Marshallese.

Why Many to Emigrate

Like the reports of the Marshallese, the reports of the Marshallese and the radioactivity in the water, it appears that in general the reports have tended to minimize effects, or other aspects of the problem. Dr. Jones, denotes seen "too small" to have any effect, the size of the dose is "too small" to

statistical significance, although the exposure was brief over a long period of time, and exposures were found to be greater than when near lethal. It is to the credit of the authors that at least one of the authors disapproved most of these minimizing statements, even though the language tends to indicate a conservative, minimizing attitude in the report. The authors may see this as a mere game of semantics, but the first, however, would prefer to say that it is not particularly concerned with the words of words themselves and their connotations, but rather the psychological implications of mind which they imply. The Committee is of the opinion that there are two possible reasons for this tendency, which are discussed below.

The Marshall Islands Nuclear Catastrophe

As mentioned before, the authors tended to minimize events or facts in order to be reassuring. This was done in part because of the habit of the news media seizing upon the sensational, interesting part of an event. Most "newsworthy" events are usually negative, and most people are not interested in what is going on or what is going to happen. The Bravo event occurred at a time when the public's interest was focused on the development of nuclear weapons and their psychological and social implications in the post World War II "cold war." The event at Bikini, 1954, and the other event it caused in Japan most certainly had its main headline in the public mind. Whether it is justified or not, it is easy to see why the Newsweek was so "reassuring." It is also easy to see why an official report of the Government of the Marshallese also tended to "minimize" the effects of fallout, and the only report that the first major report dealing with the event was published by the Atomic Energy Commission. This report set the tone followed by other reports.

While most of the information has been furnished by an organization which appears to be independent of the Atomic Energy Commission, it is a fact that the annual reports and the reports in general were financed through a contractual arrangement with the Commission, and it would be refreshing to find such reports doubting the validity of our "rules" dealing with radioactivity set by the Commission, or by the kind of accident of indifference to which the AEC is well represented, as well as to find a generalization of accepted guidelines (MPC for example) not to be found. "What are the answers in the reports any doubt as to the need to raise questions of safety, or the appropriateness of returning the responsibility to their shoulders, or the fact that in that area ended. It is presumed to be possible that those who carry out the terms of the contract are of a like mind as those who administered the contract. This is not to say that the AEC would not be shocked by the fact that someone as to force that institution not to express opinion which is in agreement with the AEC's views or positions--however it is not to say that the contract might be shifted to a different institution. While the contract is not a terribly good one, it might be said that the man who chose to sell Datsuns does so because he liked the car, or believes they they are better, or, however, he drove around in a Volkswagen, he was not necessarily a fan of the product he sold and the Datsun company would wonder about the possibility.

Specific Aspects

As mentioned before, there appeared to be a definite order or purpose for the examinations. This, too, is rather surprising, particularly out of the nature and significance of the appearance to take place in the case of the Marshallese. Most human beings have a tendency to have some negative feelings which govern their behavior. One way of describing this is to say that they have "approach-avoidance"

concept in elementary physics. Though we see the object as part of a situation, and we simultaneously wish to isolate the object from the situation, but at the same time we have strong feelings to isolate the object or study the situation. For a number of major sciences, the force of these impulses is stronger than the other, which results in our first course or its other course of action. By means of this theory, it appears that there are two motives, or influences apparently at work in the character of the disease. These influences might be characterized by saying that the very influence of medicine, the doctors were interested in finding their patients as quickly as possible for any illness or dysfunction. It would be desirable to have a more natural scientific curies to find out why the disease occurred, its variability such effects to document the effects of that disease, and of its processes--before administering treatment. The two impulses, the duty and scientific curiosity were perhaps not satisfied in a patient who received immediate treatment given concerning blood infection. So the infection, as a part, was also with regard to the growth and development of the disease, a period of several years.

Concerning the blood infection, the following are the results:

"2.31 Clinical Observations and Pathology (continued)"

"Between the 33rd and 36th post-exposure days, 46 percent of the individuals in Group 1 (Benedap) had a granulocyte level of 1000 per cubic millimeter or below. The low point observed during this period was 700 granulocytes/mm.³ During this interval the advisability of giving prophylactic antibiotic therapy to the doctored 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 early stages.

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

(3) There was insufficient knowledge of the number of granulocytes required by man to resist infection and the degree of granulocytopenia." (emphasis added)

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

It is hoped that such can be obtained from a detailed report of the Committee.

To the layman, the above statement, as it appears, appears to be unnecessary and therefore somewhat of a waste, appears to be somewhat contradictory. If there was no accurate knowledge of the number of cells required by man to prevent infection, how could it be known that such 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 patients developing resistance to the drug 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 it were not for 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, development might be prevented from occurring. This belief was 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, relatively early administration of Thyroxine, or a decreased number of which would have corrected the retardation of growth experienced by some of the Rongelap children, especially cases three and five. Early response to what appeared to be growth:

retardation, yet the first writing that appeared was an order for this retardation for more than eleven years after the 1936 trial. Despite the fact that the reports consistently mention the fact of the child's severe retardation, these latter two cases were withheld. In these two reports there are listed birth dates, the report that following the appearance of antibodies, according to the administration's policy, would have been awarded to the child's mother even if it had not been difficult to obtain. Why the doctors had to wait until the appearance of the antibodies in order to realize the value of administering the next to the promised vaccine is not clear.

Another matter of concern to the Committee is the information in the three-year report which states that:

"Eight sera obtained from children who were used in a study of immunological response to tetanus toxoid as the primary stimulus of tetanus toxoid had been 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 was injected and the sera were obtained for the two groups. Results by the Committee are fully described." (p. 6)

In other words, these eight children were given a supposedly safe amount of tetanus toxoid and their blood samples were taken just before a second injection. The concentration of the antibodies after the first and second injections was an indication of another factor of the blood to combat infections (such as tetanus) and, of this nature, is especially concerned about is whether the people understood about the danger and whether or not they did, if there was any danger, anyway of the vaccine. Assuming there was no further danger, the Committee questions whether or not this study was to the people involved. Granted, even a study which would be a quest for greater medical care of the people, which did prove that the conditions were poor, which would leave them open to disease, whether or not the disease would normally be a simple infection. However, since all children used in the series of people involved is too small for statistical analysis, in any other life it, it is curious

why the test either was not adjusted to account for multiple (great statistical significance) or even adjusted at all (less statistical significance). To all intents and purposes, it appears that this test was not what it was described to be. "Right? Inadequate people, a very poor study."

Thyroid Health

Concerning the health of thyroid glands in the people exposed (20 cases, four with multiple nodules), the text here is concerned with three particular areas of aspect:

One, it finds it difficult to believe that statistical correlations involving this gland did not take into account the growth phase of the children. Many times, especially when dealing with the specific radioisotopes such as Sr^{90} , mention is made that the retention time of the gland may differ from that estimated for adults because of the natural growth of growth. How was it that the many experts who worked in this field for many years never accounted for this factor until it was statistically incorporated in the development of nodules in 1963 and 1964. True, the committee is made up of clinicians and scientists, despite the rigors of their disciplines, and are subject to the usual just to errors; however, the committee should have been able to recognize such a simple fact was overlooked for a time and only as a result of the disaster were faced with a development which was unexpected in the light of earlier assumptions.

By the same token, for the other three it is difficult to believe that inconsistent findings of nodules in the thyroid gland were not investigated. Mention was made of the possibility of the nodules being benign, or the findings were attributed to a "benign" condition. From a hindsight point of view, it would appear that a consideration of the iodine content of iodine and considering the fact that the thyroid gland has been investigated with more detail the reasons for such positive findings which should have appeared to

be inconsistent with earlier observations. It is also suggested that unusually high levels may have caused thyroid abnormalities. It is noted that thyroid function was not normal prior to the expected period. (Added) Again, baseline information was lacking. Finally, considering the magnitude of the studies both to the scientific world and to the public, it appears that a certain amount of research should have been done in the future, where prudence was obviously not fully observed.

Finally, in the final report submitted to the Committee with the thyroid, the Committee is extremely disappointed to have to report that the thyroid gland was accidentally severed in the procedure. In view of the fact that this fact Secondly, the Committee is concerned as to whether the incident had any connection with future thyroid operations being performed in the United States as opposed to the Naval Hospital in England. Finally, the Committee's query will be answered by Dr. Comar.

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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 complete research in this area to determine whether these deliveries were possibly cases of fetal radiation. Again, the question of statistical qualifications and standards is raised; however, the Committee is of the opinion that despite the number of stillborns, this situation should have had closer attention. The Committee notes that there are certain kinds of effects of radiation which may be observed in the products of miscarriages; examination of such may not have confirmed their relation to radiation, but it would then have been a matter of some concern if a high level had been used to indicate that there possibly was a radiation effect.

As to fertility, no one would have known that a Japanese doctor working with a group that was not the subject of statistical significance should come up with such a detailed analysis of sperm-tozoa production after irradiation of the testis. In fact, while the AEC-Brookhaven teams apparently felt it is necessary to compare fertility with the irradiated Marshallese and Americans, with the exception of a note in the consideration of the private and personal lives of the testis examinations connected with such studies, it is doubtful that the subject was ever even discussed except generally in terms of gonads, and almost only in terms of statistics.

Conditions

The circumstance that led up to the detonation of "Bravo" on a clear March morning in 1954 was a combination of how circumstance, time, error and human error all related to a major historical event in this case a tragedy.

The location of the testing site was a major factor, 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 Nevada site, which provided the same flexibility and safety for smaller yield weapons. Unfortunately, unlike Nevada, there was no Public Relations or information program, and no one was talking with the people. In Nevada, tests were cancelled in order to avoid amounts of local fallout. In the Marshalls, however, the yield of the hydrogen bomb explosion, to that time, was detonated on the ground, and as we boasted, they could practically control where the fallout would fall. Instead, someone made the decision to go with an immediate picture of the wind, but wind shift was not "unexpected" since wind was known to be at the upper level of wind. Furthermore, the test danger was in the Marshalls, and it was at the eastern boundary to

save convenience to persons past and present, the decision to adjudge was also responsible for a bias in the way the data were handled, and poor judgment resulted in the Rongelap and Rongerik reports for the days, and the Utrikese for three days after the explosion, and only one day. Whether these actions and events were the result of carelessness, poor judgment, miscalculation, and faulty assumptions, or whether they were knowingly done, is a matter which is a conscious and knowledgeable reader of the report will have to judge for himself in the light of this report.

As to the medical reports, the thoroughness of the medical examinations and conservative and realistic assumptions have to be judged on both our seriousness of the original exposure and the significance of the effects which are related to irradiation. While the scientific field has not yet reached a violation of the general principles of medicine, which are generally understood, supposed to serve as a guide for the physician, and the care of a physician, there have been many instances of medical errors which did not necessarily prove of direct benefit to the patient, and which are shown in the three-year reports. (p. 20)

"The group of irradiated Rongerik people is an extremely valuable source of data on human effects which have resulted from all the possible modes of exposure. Even though there is no radioactive contamination of Rongelap Island as a result of periodic visits of human habitation, the levels of activity are higher than those of any other inhabited locations in the world. The habitation of the people on the island will afford most valuable ecological data on the effects of radiation." (p. 20)

and in the four-year report. (p. 20)

"The habitation of these people on Rongelap Island affords the opportunity for a most valuable ecological study of human beings. Since only small amounts of radioactive material are necessary for these studies, the various radionuclides present on the island can be traced from the soil through the food and into the human body, where the distribution and organ distribution, biological half-life, and excretion of the various radionuclides can be studied." (p. 20)

It is also the result of the remarkable similarity of the uniqueness of the experiences of the isolated groups. It is, however, a tendency, perhaps more unconscious than conscious, but even if it is a tendency to let scientific curiosity at times become fanaticism, and even if it is a tendency, the Committee would also like to say that such visits and investigations do not always included the Rongelapese. In the past investigations, by other investigators and members of the teams themselves, have had to include the Rongelapese for comparison purposes. Even Dr. David H. Johnson has had to be used as a "guinea pig" as disclosed by the group. In the Rongelap twelve-year report (p. 159):

"Since facilities for a metabolite laboratory were not available on Rongelap Island, one of us (H.J.M.) tried several native food items (pandanus fruit and coconut meat and shell) 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 over a seven-day period was twenty times higher than normal and strontium-90 to cesium-137, sixty times higher than normal."

In concluding this report it is noted that by the very nature of their experience and conditions and by the nature of the unique set of circumstances surrounding the daily lives of the two groups, the people of Rongelap and Utirik are "guinea pigs" in the sense that no other group of people in the world have been exposed to the same amount of any differing kinds of radioactivity, and no other group of people in the world have been exposed to the same amounts 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 the only treatment as only of secondary importance; or whether they are, by virtue of their location, a group of people who are being exposed to fallout for the sake of humanitarian aims is a decision the Committee will leave to the reader. In closing, the

Committee wishes to cover a full spectrum of the various types and I think these are by their experience, an extraordinary group of people and they deserve no less than extraordinary care, interest, and attention.

Biological Observations

Today, nearly 10 years after the event, there are few outward signs of radiation among the people, especially those who were on Bikini in the 1950s. There are no obvious deformities or congenital defects, only non-healing wounds on the arms of one of the men who was examined in 1954, and evidence of the illness. This is in stark contrast to the acute and chronic diseases suffered by the people of Hiroshima and Nagasaki, for example, by the leukemia patients, elderly patients with cancer, children with leukemia, skin lesions, or gross malformations of the fetus. While in the Marshall Islands, it is clear that the effects of the nuclear fallout were not primarily those of acute biological operations which have been observed in the past. None of these removed thyroid glands, but many of the patients and while these glands may have been removed, for other nodules or cancer, it still remains to be seen if such developments may occur. As to the chronic diseases, it is clear that while late, administrative of the Marshall Islands has effected persons to return to their homes and to the extent, to the extent they can be helped, it is possible that radiation induced effects are still to be seen in the often mentioned lack of vitamin B12 deficiency in the diet of the people. Examination of the people, while the disease is expressed, is a concern and a serious concern of the people of immediate

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treatment and subsequent chemotherapy, which in fact, as evidenced by the reports of the department, (NY 100-10000) the examinations are thorough and conducted in a proper and humane manner.

Especially referring to the Committee, it must have been to the Brookhaven Laboratory the appearance of this case of acute myelogenous leukemia. The Committee hopes that the persons responsible for the investigation will give the development the attention which it deserves for the benefit of the people involved. The Committee takes note of a story in the Tuesday, November 21, 1972, edition of the New York Times by the science writer Walter Sullivan, which dealt with the death of Jeffrey. 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 could have been detected at a less advanced stage."

The phrase "could have been detected" is a fact that the annual survey had been only a first step in the direction previously mentioned. While it is possible that the visit might have been accomplished at the same time as the Seattle visit, the understanding of the Committee that all forms of leukemia are ultimately fatal, and that acute leukemia includes many of the more basic forms. In addition, the Committee would like to refer to the record that if the period of surveys be extended to the detection and remission of leukemia or serious disease, the public consideration should be given to having these tests conducted on a just a once-a-year basis.

One aspect of the booklet which is the subject of this report which has not been widely addressed to date is the problem concerning the psychological effects of exposure to atomic fallout from nuclear weapons. Dr. William Dement, now Director of the Center for Sleep and Dream Laboratory Department of Psychology, University of California, Berkeley, has been in this area of research for a considerable time. Although his original intention in studying the psychological aspects was in connection with experimental investigation of sleep, it has developed to be a wide and interesting field of inquiry for him. During his recent visit to Japan and the Marshall Islands, he observed

In more recent years, particularly in the islands of the Japanese exposed to the atomic bombing of Nagasaki in 1945 and the long-range Japanese and British bombers in 1942 and 1945. While figures differ, it is generally estimated that over 100,000 people died in Japan as a result of the atomic bombing and that were literally vaporized by the blast of the atomic bomb. In Nagasaki, others died from heat and the atomic bomb. In the Marshall Islands, flying debris from the atomic bombing of the islands spread through all the islands later, but many died from lack of adequate medical care, food, water, and shelter. The people in the Marshall Islands were not exposed to radiation from either the atomic or missile or the bomb of approximately 1945. Despite these differences, however, there are some similarities in these cases: the radioactivity produced by the bomb or missile falls upon those exposed. Today, the atomic bomb and missile effects of

PRIVATE ACTIVITY INFORMATION

the bomb dropped about 1944 or 1945 in the Marshall Islands, people are still in the local area and this apparently caused by H-bomb fall in nearby 1950s or 60s.

In Hiroshima, several of the survivors who were to meet with them in a place where they were a bomb survivor and director of the Hiroshima Atomic Bomb Museum mentioned the uneasiness of the group of survivors like himself felt about the future of the island, which was shared by "all survivors".

Later, when the first lady of the people of Rongelap and Ujae, the people joined the group and whether or not the people who were exposed to the bomb had any exposure. The answer at meetings of both islands was "Yes, because we have a cold, or some other kind of sickness, and it is the bomb."

The committee was most impressed by the answer given by the Lucky Dragon survivors, who were in Tokyo with Dr. Kumatori, who had studied his own experience. He was first asked if he had any observations he submitted to the committee when he returned to his home. Was his mind at ease? His medical history, as translated, were, "Psychologically, I feel very satisfied." He was then asked if he felt when he came to his normal illness. Did he think of the bomb in the following way? "Immediately."

The committee also believed that the long term or long term effects of the bomb in the islands of Rongelap and Ujae is that of the people they have been exposed to. It is the un-

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known, the possibility of their being shocked that is just as real to them as the actual exposure, both of which are registrations. In the three years to date, there were no indications of the "psychic effects" of the prohibition, but a study has revealed the differences between the two populations of the Marshallese, "relative calm and rapid adjustment" which the Marshallese exhibited in adapting to their new environment. This is in contrast to the fact that "There was little reaction or expression of concern over radiation exposure. It would appear that, in the opinion of the Marshallese that there has been little or no significant effect of this momentous event."

The Committee agrees that the emotional state of the Marshallese cannot and does not appear to first be of the nature, who, in addition to witnessing the death and destruction of their loved ones, also lost friends, relatives and extended families. This is due to the "uncertain feeling," which is being felt by all of them. The Committee feels that the people of the Marshallese are still in a state of equal amount of anxiety, if not more so than the Japanese, especially in view of the uneasiness about the future, but there are other factors which will be discussed later.

Information, Committee on Atomic Energy

It is noted that in 1953, in connection with the annual examinations conducted by the Marshallese Government, a report indicated that the Marshallese are still a little concerned about their exposure, which shows that there would seem to be in

agreement, the problem is rather difficult and perplexing problem. In Japan today, there are American facilities existing for the up to date care of Atomic victims, which the people can easily reach and they find they are in Japan, the Atomic Bomb Casualty Commission published reports in both Japanese and the English language published by the staff at these facilities in Japanese cities, that is, the people receive an extensive explanation on why the Americans assisted by a Micronesian medical staff member, and to assist their examinations until the next year.

Originally, the people exposed generally understood what was being done for them and why. There was no need to explain that the bomb had affected the skin they were having themselves the skin ulcerations and hair falling out, or that they had weakness, nausea, and diarrhea. However, as the examinations progressed the people became perplexed. Every year the team comes and they tell them that they are healthy, but that they must keep on going because if everything is still all right. When they come again the next year the process is repeated. Why the people have to go on, if we are healthy, does the team return every year. This is only a small indication of the vast lack of understanding of the people involved as to just what did happen to them, and what the possible consequences of their exposure are.

While the Council has realized that the problem of radiation, as applied to psychologic illness is highly complex and a sophisticated subject which would require the services of a translator into

terms which would be meaningful to the people of Bangladesh, 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 aspects of the examinations and of the test itself.

Tare and I spoke to the (nurses) staff of the hospital who did not understand anything about their exposure to the kind of the exposure, the possible effects on themselves and on the environment of their environment. It is usually, however, in the past, and indeed why the team did not explain such things to the people. The requested reply was that even the specialists, who were trained in medicine, would have difficulty understanding what is meant by such things. This may be true, if it were expected that the team could do anything about the exposure and its effects during the brief of their visit. However, the Committee already feels that such things are possible and should be carried out, either through the use of simple text, pictures, analogue and other means, and if 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 is going on (and also to help the patient's mind. Unfortunately, this has never been done in the Bangladesh. It has effectively resulted in a situation where a teenager whose parents avoid telling him about his condition, only to have the son or daughter ill and the parents ill and the family, in-laws, and innuendo. In other words, such information does not produce a healthy

state of mind. In fact, the incidence of the thyroiditis, their
has been especially low with the island of Utrikere, the Utrikere,
and those Rongelap and Bikini (the two islands under control) or com-
parison groups.

This fact is illustrated by the fact that during the public
meeting at Utrikere, the people were told that the people with the
people of Rongelap. For about a half a century two decades,
these people would have been subjected to the same exposure and
how it differed from those of the other islands, this is not the
case. This incidentally despite the fact that the members of the team
that the people are in good health (except for those who are operated
on for thyroid nodules) has resulted in this exposure to the people
of the islands. These people have been roughly grouped into three categories:

1. Rongelap people. Perhaps because of the visible effects
of their exposure, the people seem to have a good understanding
in certain areas of their situation. This is a group of people
who generally express a desire for help and medical attention
ranging from having first-aid stations on the island to having
more frequent medical examinations. However, this people still
need to have explained to them the degree of their level of
understanding the consequences of their exposure in the past and
possible effects. This is already shown by the fact that the seven
year report which reported the health of the islanders that some of
the people at times have been concerned only because of the fact they

had been reported and to the (b) (7) (D) further evidenced by statement in the report made by the doctor to the effect that some of the people who were taking the medicine regularly for the rest of their lives, and the doctor's opinion that this medicine. The Committee is at first surprised and very disturbed at the apparent lack of warning given by the people concerning prescribed medicine which are available to the future health and welfare. It is a very serious matter which should have been corrected long ago and now which should be allowed to exist in the future.

2. The report indicates that there appear to exist two lines of thought, with the people's examinations should be discontinued because they are healthy and were not a part of a large group of examinations were the Rongelapese, and the other relative to the fact that the Rongelapese since their return appear to be in good health for the time to continue to be in good health, and the fact that several influences. One is the fact that the Rongelapese were compensated by the United States Government and the other is the fact that the subject to be removed to the United States and the other to the knowledge that they were transferred and that the Rongelapese were removed from the island. They mention the fact that the Rongelapese who go to the United States and that they would like to know if they might not be in the United States and that it would be further compounded by the fact that the Rongelapese were taken to the U.S. for a physical examination. The Rongelapese were found to

contain malignancy, and, while all are, while some would suggest that this single case (the thyroid) may have been the only "normal" case of thyroid cancer, it is difficult for the people to believe this while they are told of what happened to the other. Again, misunderstanding is allowed to persist. The doctor and explanation persists in the minds of the people, and in view of the general uncertainty about their future, further of health is needed.

3. The next step is to get the thyroid cancer out of the necessities in the examination and further information. The first step is to have a group of people who are of similar background, age, and sex but not exposed to the nuclear radiation of the area. These people represent what is known as a "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, with the other (the control) group is not. By studying both groups, scientists can tell how the effects of the influencing agent have worked on the experimental subjects. In a similar fashion, those people are used as the "control" group. They 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 this group which was the most vocal in expressing dislike of the examination. They indicated that they resented being examined, if necessary, if such examinations were to be continued in the future they should be compensated for them. While the Committee on the Health of the People, its major concern is that the people should understand that the control group is helpful to them, and that the examination is not due to a lack of

information--a situation which must be resolved.

Cultural aspects

As it will be recalled, Dr. Compton's view is that perhaps the team had failed in their ability to fit people to the special situation and the certainties involved with it. They must accept. The Committee believes that this result is a number of reasons.

First, it should be remembered that the Panel's test event involved a great number of military personnel, and it is concluded the later examinations in which Dr. Compton was directly involved (and later Commander) in the Medical Council indicated a strong bias of the Japanese military was undoubtedly strong on the minds of the Japanese and Utrikese and the examinations were accepted as such. It is of course at the beginning and as a matter of habit later on, even though the emphasis gradually shifted from military to civilian in the teams. Thus, while Dr. Compton appears to be a thoughtful and considerate man, the examinations as conducted by the Committee are conducted in a military manner ("they act as if they are they are the military 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 a great influence on the communication.

While this report is provided as a guide to the readers of this report, it is neither a list for the utilization of those informed or unaware nor-Micronesians who are interested with the activities described in this report. It is simply a way to get a better generally practiced "Micronesians" like that of people in general, but to give offense is directly and indirectly a function of a situation. The results of this report which give a positive answer to a question or a way to avoid a situation or to the questioner or will avoid the possibility of a direct or indirect concerning a problem either to resolve public matters or to avoid that the problem will resolve itself without person. Finally, for Micronesians, especially Americans, are not to risk anything and to Micronesians already indicate the kind of words or actions to be taken like "Isn't it a nice day?", or "Don't you think this is a good idea?", or invariably met with an affirmative "Yes, it is a good idea." The intention of the person being considered, that while it is a concern not 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 thing after the matter is over, or the activity ceased. The person of this nature in contact with Micronesians may leave with the impression that he is not in touch with the people, that he is an outsider and his views are not accepted. He may be quite surprised to find that they are actually in opposition to his own, but the proper manner of life or the manner in which he is conducting it. In the future, it may appear that the people are "too far" to have "left behind" or "back"

or have established the reliability of a source in a conversation. It results from a lack of understanding of a reply to another person's cultural differences. Misunderstandings can occur and like direct answers. Misunderstandings can occur and like direct behavior in conversation with those cultural differences. Often, however, these differences are not recognized and become serious problems in communication. For example, it is believed that this has been true in the case of the British Embassy of the case of the Embassy in Hong Kong and Utrik, and in a number of other cases where serious problems in communication and interaction. Because of this, it is believed it to be an important aspect of the problem. It will be discussed in the next section under recommendations.

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At the outset, it is clear that the principal concern of the United States of America, either through the Department of Defense, the Department of Energy, the Atomic Energy Commission, the Department of the Interior and the Environmental Protection Agency, is directly responsible for the nuclear testing and suffering, damage and possible health hazards by the people exposed to the fallout from the March 1, 1954 "Fat Man" hydrogen bomb test. Whether or not any fiduciary relationship exists between the United States of America and the people of the Republic of the Marshall Islands and all burdens connected with the fallout of their people, the fact that they are still lack of the necessary resources to deal with the fallout.

Several times during the past few years, through written communications, we verified the presence of the opinions of certain people, who had been surveyed, with the usual surveys that the Marshall Islands had been surveyed for the examinations since similar surveys were conducted in the United States and in the neighborhood of 1,000 people were surveyed. The primary argument posed by one concerned party is that they are not surveyed, and that the Congress of Micronesia should have the resources to conduct surveys estimated to cost from 200,000 to 300,000 dollars per year. It is noted in the report that it is essential to have the necessary resources to conduct nuclear tests

in their homes. Did the Rongelap and Rongerik ask for the bomb to be detonated and to be buried under the thousands of fish bones, thyroid nodules and cancer and leukemia? Did they ask to receive a gift from the United States? Did they ask to be confined to their islands for more than ten years before receiving the compensation? Did they ask to be deprived of their ancestral lands and to have their lives, health, and their children's health destroyed? Did they ask the Government to make known its feelings about the incident? Is the Government primarily responsible for the suffering which has been shared equally on a moral level with the Government of the United States? Government, if it is, in fact, possible to separate the United States of America from the Trust Territory of the Pacific Islands, the Committee is of the opinion that a substantial amount of money which the Government should be spent for the good and welfare of the people of the Territory and not a penny should be diverted from the Trust Territory funds for the purpose of funding a propaganda campaign by other agencies and institutions of the United States Government.

The Committee also is particularly sensitive to the nature and intent of the Government's actions. Through its extensive investigations the Committee has discovered that the Government has not only failed to experience that which is experienced by the Rongelap and Rongerik but has also failed to acknowledge that as a sad but true fact that nothing can be done about the condition of the people except that they face the fact of their situation. Some effects may not develop for many years but they will develop. As Mr. Keating commented about the Rongelap situation, "People do not say '50 year health check'."

Other effects may not appear until the second or third generation. Thus the Committee believes recommendations, the extent of which is to provide for care and treatment for the individual victims of war.

Secondly, the Committee is aware that of the many reports issued from the Congress in the past, others which have been studied were not carried out or they were ignored. There may be criticism on the part of the executive branch and the Congress for this reason. In this regard, the Committee has made every effort to make its recommendations specific and practical; that should meet with acceptance from the agencies concerned, and which can be implemented without unduly delay. It is the hope of the Committee that its life be extended until such time as the recommendations are carried out to the most desirable extent possible. The Committee will also allow the Committee to study the subject area of concern more thoroughly before presenting its report on that subject to the Congress.

Finally, the Committee wishes to state that this Committee and this report would not have been possible without the assistance of many persons, both Americans and Marshallese, who have assisted the Committee. The Committee finds the AEC and the people of the Marshall Islands who have remained in virtual ignorance for nearly twenty years, and the Committee notes that many Marshallese who have not received a year of education in their examinations for nearly eight years and who have not been aware of the complaints of the people and their own situation, never took the initiative to correct this situation. The Committee also expresses its concern that the Marshall Islands Legislative Assembly has apparently

never taken positive action regarding the matter which, incidentally, a
situation which is the subject of this report. The Committee, however, should
not be expected to reply that district activities should only be handled at the
district level. The Committee is only too large to carry out the requirements of
its mandate and it may have failed to identify a local problem. The
Committee also wishes to note its displeasure with action by certain Micronesians
at the Headquarters Administration level. Specifically, the Committee notes that
the expression of its opinion survey for the West Territory Administration in
December of 1974 may have ultimately resulted in the delay of the annual
survey scheduled for earlier dates. While it is not intended to place on
the possible procrastination of the visit by the Administration in the matter
may have been a consideration, the Committee and the Administration should be
the people of the Territory, but it is not intended to denigrate
experience results. It is likely, one of the factors mentioned above which
impeded by a number of the field of 1974. The Committee on the
territory. The Committee is also displeased to note certain action and
a allegation made by the West Territory Administration in connection with
the aborted March, 1975, survey. The Administration, which did arrive in
time to join the rest of the West Territory Administration in August
including such results as the survey by the West Territory Administration ever
heard of this. This does not indicate that the Committee that he
has little background in the field and would like to see that he was not particularly
interested in the general problem. However, he was introduced to someone
something about the survey. The Committee would be pleased that the
was persuaded by his wife's influence and to carry on the West survey.
The Committee has good reason to believe that he has not and he has said that
during his meeting with the Committee, he failed to mention his to go on the trip

and did not discourage him. These points made by the committee would also
like to cover the executive branch. The witness High Commissioner DeLong, the
Deputy High Commissioner Muler, the witness, Dr. William Focht and Dr. Harold
Kusner in fact have been responsible for past negligence to the
Committee ~~and~~ in relation.

The committee would like to make one final point before moving on
to the recommendations, which has already been covered the issues connected
with the concept of searching and inspecting. It is not the case that complaint
or charge is passed in the ~~initial~~ investigation by someone connected with the
annual survey that it is an administrative matter. The fact that it is
inserted into what is a purely medical and not a legal matter. The committee
does not agree with this attitude. The committee would like to remind the
who hold this attitude of the various understandings of the word "political".
The original Greek word was not political, and in general the connotation of
the word "political" is to the exercise of a public authority and the
enforcement of laws and regulations. In other words, a political act
is any action which takes place in the public sphere of the community,
virtually any action, but political action only in effect as it affects
other persons. In a broad general sense, the word "political" is defined
and meaning of other communities, the concept is very broad political
actions. It is particularly in the special area of action. The committee
representatives of the House of Representatives in the House have been
committee in the interest of the community with the intent to safeguard,
their health and welfare. This is a function of the government. In the
past, however, much of the work of the committee was directed by public and
more concerned with the health of the community. They understand that they

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Public Agency Conditions

The committee believes that because of psychological indications, new threat which includes, and the impact of the case of Indonesia, it strongly recommends that the United States should consider the Dr. Knudsen-- on a one or two year contract basis, to assist the Indonesian and Othirikes during the time interval the yearly contract. The committee has been advised that findings were made in the 1950's by Dr. Knudsen. The committee believes that Dr. Knudsen's work would be most valuable. The Department of the Interior, Bureau of the Office of the Director, Public Health Service has about 40,000 people, 12,000 of which are professional occupations. Also, the committee does not believe that the office of mining should stand in the way of this proposed plan. The estimated cost exceeds several times the amount budgeted for the health facilities of the Pacific Islands. Arrangements for the proposed plan should be made through the Department of the Interior and the Bureau of the Public Health Service.

As an alternative proposal, should the United States be unable to fulfill--which is one of the doubts--the Committee then would favor the recommendation of the United States to the United States to the island republics, the cost of which would be paid by the U.S.

It is the recommendation by the Committee that the United States should Commission special study in addition to the current study for the United States hospital facilities and they for the purposes of providing the additional resources providing services available by or to be provided to the examination of the United States and the United States.

The committee further recommends that the United States Agency Commission increase its funding under contract of the United States and the United States.

Laboratory so that Dr. Good may be able to carry out of the recommendations made by this report. Every one with a wife and work or children as he may feel will be transferred to the people of the island.

Recommendations

In order to carry out the needs of the people of the island it should be known that the BSI team is really interested in not only the health of the people but is also respectful of the culture and traditions of the people in these matters which will be discussed below, first in general terms:

1. Prior to the survey, through the District Commissioner of the Marshall Islands District, the BSI team should obtain the permission of the people of the island and the community.
2. Permission by the community and the people of the island should be asked in order to help in their gathering and in the gathering of specimens results from the last visit a few months ago.
3. During such a visit, the BSI team should ask the people if they would like to have an interview party. Asking the people if they want to have the party, they should be prepared to provide for the party (like fish and breadfruit). Conversely, if the community does not wish to have such food as hot dog and beer, the BSI team should provide for the people to prepare for the party.
4. The Committee also strongly recommends that the BSI team give serious and careful consideration to the recommendations of the consultants, Kuzaki, Kumatori, Cole, and to the BSI team if they are to be given what action it proposes to take concerning them.
5. The Committee also recommends that the BSI team, during March, 1973, survey, as an interim measure, the BSI team should provide each person examined

a written statement for the balance of the current findings for 1977 and 1978. The findings should be made available to exposed children of exposed and control persons, which may fully and completely by the March, 1984, release. These written reports should be made available to the public.

Medical and Psychological Services

1. The Committee recommends that the Government should construct, and equip and staff, an additional health center, a dispensary, and other health services in the island, which will enable the residents to have access to all of the health and personnel and is able to provide them with services. The cost of such shall be borne by the United States Government.

2. In connection with this project, the Committee noted the deteriorating condition of a number of structures found on the island site. The Committee recommends that the Government should, after consultation with the Japanese, take steps to repair and reconstruct and improve one of the buildings of the island.

3. In regard to the health of the island, it is recommended that the Trust Government of the island should formulate an education program which will provide facilities for the Japanese and Okinawese. The content of such program should be thorough and should be designed to provide an education to satisfy the curiosity of the people involved, and for the purpose of not asking the Japanese every year. The program should include the fact which the Committee has been made aware of by the various Japanese experts, and testimony by the United States Government, that such

examinations may be made for the year 1961.

4. As a condition for any (future) right to land during the First Regular Session of the 1961 (1962) National Assembly will provide free transportation, by way of air line for a period of 1 year and their survivors, their descendants, and those who were in the same group; if they will report to the local health center in the territory, under this law, will also be responsible for the care of the survivors and descendants, and will provide the necessary services they are all at places available to the health center for health.

5. It is recommended that the Department of Health, that health aides or Rongelap and Rongerik should be given the responsibility of record keeping and certain other responsibilities (for example of the abortion, for example). The health aides required to report weekly report by radio to Manus and will also report weekly (with the exception) on every island in the vessel.

6. It is also recommended that the Department of Community Development encourage self help projects in the areas of agriculture, fisheries, and handicraft production in the islands of the Rongelap and Rongerik.

Department of Migration

1. It is recommended that the Department of Migration must the law introduced by the Government which will provide for free transportation, housing, and per diem to expatriate members of the Rongelap and Rongerik groups.

2. The Department of Migration should also report through the Special Joint Committee which is conducted with the Department of Health Services, cause to be made to establish a record of persons who have been in Marshallese and English with the name, the address, name of the family, as described in

the public has to this day, the two offices to the Department of Health Services to the extent of the staff needed.

3. It is recommended that the Governor through the Special Joint Committee, cause to be published a copy of this report and its recommendations in the Hawaiian language and that copies of the same be distributed to the people of Honolulu and Oahu.

4. The Committee recommends that out to the proper nature of the effects of radiation and the special attention of the affected Islanders, that members of the special committee either accompany the Governor's Commission to assure that its recommendations are carried out and that in the same time, it encourage further development of the Wildlife Board (Hawaii District Legislature) by sending its members to observe those from the Joint Committee.

5. The Commission reports that it is not to be referred in scope and that its life be extended to January, 1971.

The People of Honolulu and Oahu

1. To the people of Honolulu and Oahu, the Special Joint Committee recommends that they form a Joint Advisory Committee composed of members of the regular island council and other interested persons. This is a common practice in many of the Councils and other groups like these, the people involved should be able to express their concerns or agitate for correction of any faulty conditions in the program.

MEMORANDUM

First of all, the Committee wishes to express its thanks and appreciation to the administrator, staff, faculty, and the people of Berkeley and U.C.B. for their cooperation and assistance to the Committee. It is to their people that the Committee has traveled and studied and it is hoped that this report and the recommendations will help justify some of their investments so that they may face the future, rest on the knowledge that they have given the government of Micronesia, and the world, the benefit of their special circumstances.

The Committee is also grateful to all the persons or agencies for their assistance during the last six months. They are listed below in alphabetical order, according to country of jurisdiction.

USA

The Committee wishes to extend its appreciation to Dr. Eric Pochin, M.D., CDE, Acting Director of the Division of Medical Research, Council's Department of Medical Research at University College Hospital Medical School, London, England. The Committee is grateful to the Director of the Division for his assistance, Dr. Pochin to the Committee.

OTHER

Tokyo

We are also indebted to Ambassador Inoue, Dr. Dr. David Brown, Second Secretary, Medical Section of the United States Embassy in Tokyo, and in the government of Japan to Dr. Dr. Yamashiro,

Director of the International Atomic Energy Agency of the Ministry of Health and Welfare, Mr. Tetsuzo Kato, Director of the Learning Section of the Agency of Public Health, Dr. Takashi Ishikawa, Deputy Director, Mr. Masahiko Nakagawa, Director of the Agency of Public Health, Assistant Chief of the National Institute of Health and Welfare within the Division of the Ministry.

The Committee would also like to wish to extend thanks to Mr. Shigeaki Kato, Director of the Center for Research Division of the Japanese Red Cross Society for his helpful answers for his answer and especially to the staff of the Center who provided the information. Mr. Kato also provided the information for including Mr. Kuroki as a member of the Committee. The Committee is especially appreciative of having the opportunity to meet and talk with Mr. Shigeaki Kato a former member of the Tokyo Council.

The Committee wishes to also extend its appreciation to Mr. Warren Fisher, Mr. John J. Kelly, Mr. David Green, and Dr. Yoshiko Kato of the American Legation for their kind and helpful assistance to the Committee during the study in Japan.

Hiroshima

The Committee would like to extend its sincere appreciation to the Honorable Ichiro Kamekura, Governor of Hiroshima Prefecture, and the Honorable Hiroshi Morita, Mayor of Hiroshima City for their Foreign Affairs Office, Mr. Masao Obara.

A note of appreciation is also extended to the Atomic Bomb Casualty Commission for Hiroshima including Dr. George W. Burling,

former Director, the Chief of the Division of Atomic Energy, Dr. Hata,
Associate Director, the Institute of Physical and Chemical Research, Tokyo, and Mr. Oda.

Also in Hiroshima, the Director of the Hiroshima City Health Center,
Director of the Hiroshima Municipal Hospital, Dr. Yamada,
Ministry of Health, the Director of the Hiroshima Prefecture
Health Center, the Director of the Hiroshima Prefecture
Health Center, the Director of the Hiroshima
Peace Memorial Hospital, the Director of the Hiroshima
Hospital.

Our special thanks go to Dr. Hata, now Professor in the
University School of Medicine, for his kind and generous
to the Committee. His special help in the field of
supervisor, the Director of the Hiroshima Prefecture
for Nuclear Medicine and the Director of the Hiroshima
to take leave from the Hiroshima Prefecture.

Nagasaki

The Committee would like to express its appreciation to the Honorable
Yoshitaka Matsuda, Mayor of Nagasaki, for his kind and helpful
Mayor Toshiro Imai for his kind and helpful assistance in the
assistance in the field of Atomic Energy, the Director of the
grateful to the Director of the Department of Atomic Energy,
Atomic Energy Commission, Dr. Yoda, Director of the
Director of the Hiroshima Prefecture Health Center, the Director
of the Nagasaki Municipal Hospital, the Director of the Nagasaki

the National Academy of Sciences, and Dr. John C. H. King, Director of the State Department Institute of the Harvard University School of Medicine.

W. W. R. (NY) (NY) (NY) (NY)

The Committee is particularly pleased with the efforts of the Department of State, the assistance of newly appointed Secretary for Territorial Affairs, Mr. William H. C. ... and the assistance of the Interior for ... nature the participation of the ... Population England with the Brookings Institution.

Deserving credit should be given to Mr. ... Surgeon General of the ... offers of assistance to the ... to Mr. ... of the ... Medical Health ... by Dr. ... U.S. Public Health ... materials of the ... and for the ...

The Committee ... with two agencies of the ... lack of cooperation ... should be stated ...

concerning a certain aspect of the quality of the products of Utrix, it, along with the purchase of certain raw materials, failed to respond to a request for a full identification and materials in a letter dated April 1, 1972, which was routed through the Office of the High Commissioner. Available information concerning this due to bureaucratic delay or indifference. The name of the manufacturer named is not known. The office does not have a file which permits for the record its extent, quantity of production, or date of manufacture and expressions of regret that this information will be available in the future.

The Committee would like to express its appreciation to Dr. Cronkite and Dr. Robert Z. Cooper of the United States National Laboratory of Long Island, New York, for their assistance in this matter. We are especially grateful for the cordial and helpful response to the Committee's request for information regarding the hospitalization during the September survey. Also our thanks go to the staff of the medical and support staff of the Broadmoor Hotel, including Antonia Lowery, Larsen, Susan and Jean, and the staff of the restaurant William Scott, Douglas Clarendon, and Mike Meyer.

THE HON. MEMBERS OF THE

The Committee wishes to express its appreciation to Mr. Victor L. Vito, President and Director for Development of the University of Guam, for his advice and assistance, and also to the staff of the University of Guam for the availability of the University of Guam, which has been invaluable to the writing of this report.

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Saipan

As noted at the meeting, the Committee has been advised by High Commissioner ... Coleman, and ... Special note is ... Services ... Japan as ... and advice ... Mizutani, ... the September ... committee was ... ment of Resour ... ful to Resour ... Director ... Mr. Perrin Weilbacher.

Marshall Islands

The Committee ... help and assistance ... Districts ... Administrator ... tive Liaison ... Mr. Jack Town ... Administrative ... Anien; the ... of the ... of the ... of

Micronesians: Mr. M. J. ...
Captain Willie M. ...
September survey ...
Health Services ...
nician: Mr. Nelson ...
Mr. Kimura ...

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Appendix 3

Memorandum of Understanding on the Joint Use of the ...

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MEMORANDUM FOR THE RECORD
DATE: 09/20/77

SPECIAL JOINT COMMITTEE
CONCERNING RONGELAP &
UTIRIK ATOLLS
(Public Law 40-331)

Senator Olympia T. Borja, Chairman
Representative Timothy Olker
Representative Hans Wilander

September 20, 1977

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 interim 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 Brookhaven National Laboratory medical team including:
 - a. your (his) indication as to whether you feel examination on a one-on-one basis is (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 areas of interest, the Committee requests that you:
 - a. comment based upon your own knowledge of this particular

Memo

survey, whether you feel that type of treatment (surgery, medicine, etc.) is adequate or all that is needed, or is inadequate and you consider further treatment; and

b. from your knowledge, experience and review of pertinent literature, give us an adequate and complete history of past medical treatment.

Additionally, the Committee would like to receive comments on:

1. The advisability of returning the Rongelapese and Utrikese to their islands pending testing, including aerial descent and their consequent exposure to high radiation levels in light 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 people 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 both whole-body and thyroid.

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 are normal medic-legal doctor-client relationships; 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 any personal use or 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, Congress of 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. A bill for the same shall be submitted to the 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 May 1954

/s/ _____
William H. Cole

/s/ _____
Samu Ezaki

/s/ _____
Joshiyuki Kumatori

/s/ _____
E. Pochin



DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
RADIOLOGICAL HEALTH DIVISION
WASHINGTON, D. C. 20201

OCT 27 1972

Senator Olympia D. Berja
Chairman, Special Joint Committee
Concerning Fong-Lay and Utirik Atolls
Congress of Micronesia
Saipan, Marianas Islands, U.S.I.

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 August 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 evacuation of the exposed
persons of Fong-Lay and Utirik 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 Willander, Vice Chairman of the Special
Joint Committee.

I trust my report will be of assistance to your Committee
in its continuing deliberations concerning Fong-Lay 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
Division 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 REACTORS AND ATOLLS, CONGRESS OF MICRONESIA, AND 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 23, 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	70
Unexposed Ebeye persons (total of 100)	10
Children of exposed Rongelap Atoll	30
Children of unexposed Ebeye Atoll	10

In addition, approximately 1000 Marshallese, and children were examined and treated for ailments 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 on 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 handicap 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, the 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 for Utirik complaints, 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 at 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 Health Aides with standardization of the facility, 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 diseases. The facilities available on both Rongelap and Ujae do not afford the opportunity for a good physical examination of the ship and, until this situation is corrected, such deep distrust and mistrust by the people will continue. This was quite evident when I visited the Rongelap Island with members 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, related 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 Ujae precludes examination with, for example, modern x-ray machines. In view of this, 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 a new method of delivery of good health care has been developed and proven highly successful in other developing countries.

The medical record system presently is totally unsatisfactory. A medical record should be established for all persons, both exposed and non-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 updated record of immunizations should be maintained to prevent outbreaks of diseases which could be prevented especially children's immunizations. The tragic poliomyelitis epidemic of 1973-74 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 Island Hospital Laboratory Medical

Team for an expedition to the area prior to the visit of the physician. It is not possible for such written information to be readily available. If a document may alleviate misunderstanding it may be prepared.

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

3. OPINION ON THE REPORTING OF EARLY LATE RADIATION EFFECTS ON THE PEOPLE OF RONGELAP AND UTIRIK ATOLLS

The Bravo thermonuclear device in the Operation Castle test series was detonated on a small island on Bikini Atoll on March 1, 1954. This produced a yield of 15 megatons TNT equivalent and contaminated an area approximately 330 miles by 60 miles with radioactive fallout. This large area included Rongelap and Utirik Atolls. The reported exposures to the people on these islands caused by the U.S. Atomic Energy Commission in July 1954 are as follows:

Rongelap	375 rads	about 100 people
Ailingme	60 rads	about 100 people
Rongerik	75 rads	about 100 (USAF Personnel)
Utirik	14 rads	about 100 people

The people of Rongelap received an 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 fallout contamination by fallout material. The presence of vegetation and partial shielding by trees on Rongelap resulted in a reduction in contamination

In addition to the whole body gamma exposure and beta burn of the skin, a significant amount of radioisotopes was absorbed by ingestion and inhalation. The most calculations were begun at least ten days after the detonation by determination of radioactivity in pooled urine samples. Such samples were returned to the United States for radiochemical analysis. Such analysis was continued and, at six months following the exposure, minute amounts of radioactivity were detectable in urine. Radioactive iodine was the most common of the measured isotopes and, by extrapolation, a dose of 100 rads to the thyroid gland of the exposed children was calculated. In addition, both groups received 170 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 Joint Committee on Atomic Energy, Congress of the United States, were carefully reviewed with particular attention to methods used in the calculations. Granted that much of the data were determined by post-detonation calculations and extrapolation, one must conclude that the published figures are reasonably accurate. It was not possible to reevaluate the data but the authors have found no gross errors.

By the Spring of 1957, the majority of Rongerik Atoll had been made by the Applied Fisheries Laboratory of the University of Washington and the Naval Air Warfare Center Defense Laboratory. A decision was made to allow the people 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 Cross-Craft 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 Rongerik as a result of this test.

In early 1959, field measurements made by the Laboratory of Radiation Biology 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 up 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 yearly dose level of 500 mrad.

per year to an individual, it was recommended to the people that land and food contamination be minimized because of their selective absorption of strontium-90 and cesium-137.

It is a fact that the radioisotopes of iodine I-131, I-132, I-133, and I-134 contribute a significant dose to the thyroid gland, resulting in the development of nodules in the thyroid gland in 18 of 17 exposed persons in Rongelap, with the preponderance in individuals who were less than 10 years of age at the time of exposure. In the United States, a thyroid abnormality was discovered in 1954 in a child of Rongelap. Subsequent surgical exploration was carried out in Hawaii, and the United States on 18 of the children of Rongelap, three to have cancer of the thyroid gland. In a double-blind study, boys were found to have developed thyroid atrophy and hypothyroidism. In an effort to prevent the development of thyroid nodules, the exposed persons were administered thyroxine on a continuing basis. In view of the surgical and medical treatment of the thyroid gland, the life expectancy 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 are plentiful in the fission products and are relatively long-lived. Body burdens for cesium-137 and strontium-90 in a biochemical assay of the exposed Rongelap group in 1969 are similar to an increase since similar evaluations in 1954. 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 difficult at present to predict the ultimate result of the increased body burden of potentially carcinogenic substances. It is generally considered that the biological hazard from cesium-137 is a great deal less than 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. Pathological effects of strontium-90 in the muscle mass of the body are not definitely known at the present time.

At this examination, a nodular goiter gland was detected in a Rongelapese girl who was 11 years of age at exposure and the first nodular thyroid gland was exposed on Ailingnae when she was about 10 years of age. Unfortunately, the first case of thyroid development in Rongelap among the exposed

Rongelapes 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 exposure. 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 unable 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, M.D.

San Francisco, October 18, 1972

PRIVACY ACT NOTICE (REMOVED)

CURRICULUM VITAE

WILLIAM S. DUFF, MD.

BIRTHDATE

1917, Bethesda, Maryland

MEDICAL EDUCATION

University of Virginia Medical School, College of Medicine, 1937

INTERNSHIP AND RESIDENCY

Virginia Mason Hospital, Seattle, Washington, 1937-1938
Resident in General Medicine, Mary Hitchcock Hospital, Seattle, Washington,
1938-1939
Fellowship in Pathology, Mayo Clinic, Rochester, Minnesota,
1947-1951-1951

CIVILIAN PRACTICE IN MEDICINE

General Practitioner-Neurologist, KIRK Hospital, Kirkland, Washington,
1939-1945
Chief of Radiology, Washington Children's Hospital, Washington, D.C., 1954-1968
Assistant Professor of Radiology, Johns Hopkins University,
Baltimore, Maryland, 1968-1972
Staff Radiologist, Johns Hopkins Hospital, Baltimore, Maryland, 1969-1973

MILITARY SERVICE

U.S. Navy Medical Corps, 1947-1956
Rank: Commander, USN (ret.), 1956
Last duty station: Chief of Radiology, U.S. Naval Hospital,
Bethesda, Maryland, 1954-1956
Retired from U.S. Navy on 30 years of service received in
combat in the Pacific Theater.

SCHOLARSHIPS AND HONORARY DEGREES

E. I. Dulant Award, 1952-53, University of Virginia
Richard Henry St. John Scholarship, 1953-54, University of
Virginia Medical School
Alpha Omega Alpha Honor Medical Society, 1937

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ALUMNI ASSOCIATIONS AND OTHER GROUPS

Mayo Alumni Association
University of Virginia Medical Center Association
President, Navy Country Club (Virginia) Association, 1966
Board of Directors, Navy Club - 1967-1968
Executive Director, Honor Country Club Board of Governors, 1968
Advisory Committee, Navy Country Club Board of Governors, 1969-1972

SEMINAR AND CONFERENCES

Radiology Symposium, Naval Hospital, Quantico, U.S. National Naval Medical Center, Bethesda, Maryland, 1964
American College of Radiology, Washington, D.C. Chapter, 1964-1965-1966

PROFESSIONAL AND SCIENTIFIC SOCIETIES

American Medical Association - Fellow, 1967
American College of Radiology - Fellow, 1967
Executive Committee of the Council, 1968
Councilor-at-Large, Washington Chapter, 1967, 1968
Committee on Educational Affairs, Health and Protection, 1970-1972
Councilor-at-Large, Public Health, 1967-1971
Member, Task Force on Incentives, 1970-1972
Member, American College of Radiology Residents Workshop, Washington, D.C., 1968
Chairman, Veterans College of Radiology Residents Workshop, Johns Hopkins Hospital, 1970
Fellow, ACR, 1967
Diploma of Fellowship, Board of Directors, 1968
District of Columbia Medical Society
Chairman, Board of Directors, 1967
Vice-Chairman, Board of Directors, 1966-1968
Chairman, American Radiology Association, 1967
Chairman, Board of Directors, Board of Directors, 1966
New York Academy of Sciences, 1965
Eastern Radiology Society, 1965
Louis MacKall Medical Society, Washington, D.C., President, 1967-1968
Advisory Committee, Chairman, Planning Conference of X-ray Technicians, 1967-1968
Honorary Member, Department of Radiology, Society of Radiological Technicians, 1967
Radiological Society of North America, 1967
Committee on Accreditation, ACR, 1970
American Roentgen Ray Society - 1970

PRESENT POSITIONS

Associate Director
Bureau of Entomological Health, WHO

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

ARTICLES, BOOKS, ETC.

"Macrocytic Anemia in Zanzibar with Hemoglobinuria"; William S. Cole, M.D.;
Clinics of the Victoria Hospital, Dar-es-Salaam, 1957.

"Tuber Dorsalis: The Strange History of the 'Cancer of the Back'";
William S. Cole, M.D.; Clinics of the Victoria Hospital,
16:3:1957.

"The Plasma Proteins Following Double Hemiparalysis"; Airoé Chamatin,
J. C. Hernandez, and William S. Cole, M.D.; *Annals of the Royal College of Physicians*, p. 323-347,
1938.

"Massive Hemorrhage from Peptic Ulcer"; Robert C. Mansford, M.D., and
William S. Cole, M.D.; *Annals of the Royal College of Physicians*,
10:7:1938.

"Peptic Ulcer: A Study of 1,033 Cases"; R. Mansford, M.D.,
M. F. Dwyer, M.D., Robert C. Mansford, M.D., and William S. Cole, M.D.,
Radiology: 56:277:1951.

"A Manual of Radiology (Europe)"; William S. Cole, M.D.; Mayo Clinic
Press, Rochester, Minnesota, 1948.

"Carcinoma of the Larynx: Correlation of Clinical and Roentgenologic
Doses of I-131"; John Hogg, M.D., William S. Cole, M.D., Alex
Horwitz, M.D., Robert C. Mansford, M.D.; *Archives of Otolaryngology*;
59:333; Mar 1954.

"Opportunities and Problems in the Present Practice of Radiology";
American College of Radiology Workshop, Washington, D.C., Nov. 23, 1965.

"Aggressive Approach to Resectable Bronchogenic Carcinoma";
Theodore H. Wilson, Capt. MC (Ret), David R. Johnson, Capt. MC-LON,
William S. Cole, M.D.; *The Journal of Thoracic Medicine*, Vol. 36, August 1966.

"The Judicious Use of Radiation in the Tropics"; William S. Cole, M.D.;
(Presentation at WHO, November 1965). *American Journal of Public Health*,
Vol. 59, No. 7, July 1969.

HIOGASHIMA UNIVERSITY SCHOOL OF MEDICINE
Kasugicho 3, Higashi-ku, Japan

April 18, 1977

Senator Dymally, D. Calif.
Chairman
Special Joint Committee
Concerning the Proposed U.S.S.R. Arms
Congress of Men
Saipan, Marianas, U.S.P.N. 96986

Dear Senator Dymally:

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

Enclosed is a copy of my report on the cases of kongelap and
Utrik. As for the report on the two cases of thyroid nodules,
I will submit a report in a separate form to the Joint Board on
the details of the matter.

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

Thank you again.

Sincerely,
A. Kasahira

A. Kasahira, M.D.
Professor
Department of Surgery

Enclosure:

Report on Visit to Hong Kong and U.S.S.R. Arms

HE:amk

REPORT ON VISIT TO RONGELAP AND UTIRIK ATOLLS

At the request of the Special Committee (Concerning Rongelap and Utirik Atolls) of the Government of Micronesia, I participated as an observer of the Brookhaven Navy Medical Survey Team and made observations at Ebey Island (11 September), Rongelap Island (12-13 September) and Utirik Island (14-15 September). In this report, I wish to report my findings in sequence to the Special Committee by the Committee.

As I stated in the meeting with the Committee held on board the Militob on the evening of 10 September, I would like to limit my opinions mainly to that of a doctor, which is my specialty, and not attempt to answer items outside my specialty. As a doctor, I do not have the results on the specimens obtained during the survey. It is requested that it be understood I shall present my opinion on the basis of published medical literature and my current observation on Rongelap.

1. a. A regular physical examination as is being held on an annual basis is appropriate; however, on atolls with limited hygiene facilities, it is desirable to conduct a minimum of 2 to 4 physical examinations per year. A health consultation at the same time, if necessary, to strengthen the health and hygiene education for the local residents, independent of the regular yearly visits.

b. The standards of the present survey have been modified slightly in accordance with special requirements. The present policy is considered satisfactory, except for one point. This is that almost no autopsies are performed. Autopsy is one of the most effective methods to detect the effects of the A-bomb. Though there are technical difficulties involved in performing such in this remote district and difficulties in securing the consent of the local people, I do hope that the medical survey team and the Government of Micronesia can cooperate in overcoming these difficulties and attempt to perform autopsy on the whole body. I strongly recommend study be carried on thyroid glands at least, where disturbance of the gland is obvious.

c. The examiners willingly conducted physical examinations and their attitude was excellent. It was noted that members of the medical survey team were eager to discuss the results of examination in full detail so that they might be better understood. However, when the opinions of these examiners were summarized, I received the impression that some of them did not seem to have a complete comprehension of the results. This is considered not due to inadequate 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 were directly reported for the health preservation of the examinee.

d. From the above point of view, the following countermeasure can be considered. A pamphlet which contains the contents

of laboratory tests which should be prepared for each individual and retained by the Government of Marshall Islands at any time as required by doctors on a number of other occasions. I recommend also that more highly qualified health care workers on the islands and have doctors visit the islands regularly for examination and consultation, and that the Government should continue to maintain the health of the population.

2. a. Surgical Treatment:

Surgical Treatment:

The operations for thyroids that have been conducted are appropriate. It is usually the case with a tumorous goiter that operation is performed only after the tumor becomes enlarged causing disturbances. Therefore, for small benign nodules goiters, in many of the exposed, total thyroidectomy is not operationally required. It is enough to closely follow the course and perform an operation only when cancer is strongly suspected. However, for the following reason, the treatment given in the past is considered to have been appropriate:

(1) Since the present operation is done examination is made per year, it is not possible to make definite follow-up observations. Therefore, it is safer to perform total thyroidectomy on cases with even the slightest suspicion.

(2) From the biopsy specimens prepared from surgical material, I received the impression that some parts of the thyroid cell abnormality. Considerations must be given to the possibility of such areas developing into cancer in the future. From the point of view of preventing radiation induced cancer from occurring, it is preferable to perform such operations.

Medical Treatment:

(1) Treatment with thyroxine after operation of the thyroid is considered as having been properly administered in view of the fact that the patients failed to show symptoms of hypothyroidism.

(2) Administration of iodine for prevention of thyroid diseases is also considered to have been administered, though some patients were found not to be taking the medicine as prescribed by the doctor. This is considered due to the fact that the necessity for a means to more effectively control the radiation induced cancer was stated in 1-d was keenly felt.

b. The above medical opinion is given on the basis of my knowledge, experience and reference from available literature.

A. Additional Comments:

Item 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100.

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Item 1. List of my operating hours stated above.

Item 2. List of my general and speciality.

NOTE. The Medical Survey Team of Brookhaven National Laboratory - AEC is conducting the survey with a primary purpose 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 an inconveniently located areas. It shall make me very happy if what I have written will serve as some reference in achieving early and complete accomplishment.



Shiro Ezaki, M.D.

Professor

Department of Surgery

Yamagata University

Faculty of Medicine

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CURRICULUM VITAE

Name: F. Y. W. YUAN

Date of Birth: 1914

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 Imperial University School of Medicine
(Surgery Department)

December 1948 Assistant, Hiroshima Imperial University School of Medicine
(Surgery Department)

October 1951 Assistant Professor, Hiroshima University School of Medicine
(Surgery Department)

April 1962 Lecturer, Hiroshima University Research Institute for
Clinical Medicine (Surgery)

October 1970 Professor, Hiroshima University School of Medicine
(Surgery Department)

NATIONAL INSTITUTE OF RADIOLOGICAL SCIENCES

5-1-7, Honcho, Tsukuba, Ibaraki, Japan

Fourth Olympic Medical Congress
Congress of Microbiologists
Japan - Micronesian International Conference, October 27, 1972

Dear Director, Berlin:

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.

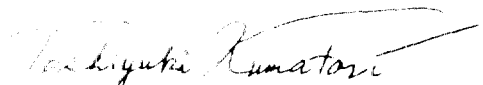
I appreciate your kind information. Dr. Conard also finds nothing of the results of the survey. I regret the occurrence of a leakage.

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

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NATIONAL INSTITUTE OF NATURAL SCIENCES

Biological Department, United States

Report to the Special Joint Committee Concerning
Biological and Health Aspects of the Nuclear

This report is prepared in response to the request from the
Special Joint Committee. The material in this report has been arranged
in the same order as the subjects of a Biological Memorandum of
Understanding which was signed on September 10, 1974.

Comments on

1-a. I think that a colony examination of the exposed Marshallese
on once a year basis is justifiable in the present situation.
However, since the biological information of the Rongelapese
and Utrikese has already been obtained, it is necessary to
take the health of other islanders into the purpose. Those who
bear the responsibility of health control of the Rongelapese and
Utrikese should inform the local health department and
Dr. Conrad of their circumstances periodically. These actions will
be very useful for the future epidemiological study.

1-b. The present Administration can be the authority which seems to
attach importance to thyroid function examination to protect the health
of exposed people. However, who will be in charge of the radiation health
control for next week in the field of present health control and that
detection of health effects by the clinical records as necessary.

FEDERAL INSTITUTE OF ENVIRONMENTAL SCIENCES

Research and Development Division

It is desirable, in addition to radiologic other examinations to the present one, to conduct chest X-rays, exposure to all residents, liver function test, more detailed hematology examinations, cytogenetical study, etc. Without any kind of special equipments and man power will be needed the performance of such activities. Moreover, closer cooperation of the islanders is required, because more frequent blood sampling and other procedures cannot be avoided.

1-c. The AEC, the AEC team and the observers had meetings to discuss several problems with the islanders and Utrikese before the beginning of the examination. I think that these meetings were helpful to understand the needs of the community. Nevertheless, I still feel that the difference of language is the biggest obstacle which may sometimes result in misunderstanding.

In general, the islanders who are engaged in health control of the Rongelap and Utrikese should be well trained. With the help of these people, better relationship between the AEC team and the people being examined will be much more improved.

1-d. As mentioned in the end of paragraph 1-b, more detailed examinations should be made if possible. I propose that Trust Territory Government make the islanders enough rooms to complete the examinations. It is also that the islanders engaged with an automatic

NATIONAL INSTITUTE OF PAEDIATRIC SCIENCES

1000 Reservoir Road, Bethesda, Maryland

The majority of the patients in the adult, pediatric and other small examination rooms including the laboratory were in a dark room.

With the aid of the bibliography of the results of examinations will be available more quickly than at present.

2-a. It is felt that the present facilities of ABC team is adequate.

Most remarkable side effects of the exposure of Marshallese were thyroid adenomas. The results of the treatment of these abnormalities are quite adequate according to the Brookhaven National Laboratory Report.

2-b. The Bone biopsy was done in the following three ways, external irradiation by γ rays, β rays to skin, and internal irradiation. The treatment of the thyroid glands by γ ray and β ray irradiation were done as follows:

According to the present literature, when the uptake of radioactive iodine is completed, the thyroid gland, i.e. NaI should be given to the subjects immediately after irradiation as possible. The Bone biopsy were examined about 7 days after the initial exposure. Even if the subjects had been given a dose of NaI containing 200 mg of stable iodine, it is felt that the majority of radioactive iodine might not have been completely absorbed.

NATIONAL INSTITUTE OF ENVIRONMENTAL SCIENCES

Washington, D. C. 20541

Part of the responsibility for the atomic generation was done 18 years ago. I don't think that the law should without giving them inorganic information to explain.

Additional comments are:

1. The responsibility of the Japanese and British is considered to have been increased by the fall of the bombs following test explosion after their related to dropping and to the explosion. The amount of fallout was not expected to be great. At that time, namely in 1954 and 1957, the population was in need of knowledge in their home islands and wished to know the truth. I feel that it is not necessarily wrong to have made the mistake.
2. On the other hand, progress of cytogenetical studies have been continued since 1966 by the National Cancer Division. The chromosome analyses are done by 2-day culture of peripheral lymphocytes. Some of the results are summarized in Part III of the report. We found intimate correlation between the frequency of various chromosomal aberrations and extent of exposure to dose of 100 rads to that of neutrophils which indicates the severity of early radiation exposure.

According to the report by Ito et al. (BNL 50023, p. 137), correlation of chromosome aberrations and severity of early radiation

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1-1-1 Higashi, Tsukuba, Ibaraki, Japan

syndrome was not reported. However, Dr. T. Sasaki, Dept. of Human Cytogenetics, Tokyo Medical and Dental University, has found a difference between the 15-band *prophase I* (M₁) and group of the exposed Marshallese (radiation-induced chromosome communication 3: 3-21, 1968, in Japanese) from the 15-band *metaphase* (Science 157: 445-447, 1967) group for the estimation of the estimate for atomic bomb exposure with good accuracy for exposure (Nature 229: 1189-1193, 1966).

Taking above mentioned facts into consideration, I would like to suggest that it is difficult to establish a correlation on the selected cases in near future, although it is important 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 by WHO are not reasonable.

In addition to these comments, I would like to make a proposal that Trans. Delegation (Government of Japan) to United Nations to have an international committee for the study of radiation exposed people including the WHO members. I believe that such a meeting is useful to discuss several subjects as follows.

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U. S. & Japan Co-operation in Science and Technology

I cordially would like to take this opportunity to express my
gratitude and appreciation for the results obtained, which have been obtained
under the cooperation of the Ministry of Education, Science and Culture, Government
of Japan, who have rendered me an excellent many difficulties.


Yoshiyuki Kumatori, M. D.

NATIONAL INSTITUTE OF RADIOLOGICAL SCIENCES

1-1-1, Honcho, Aomori, Aomori 030, Japan

Wife of Professor T. Higashiyama

I was graduated from School of Pharmacy, 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 hygiene in the School of Dental College.

In 1952 I was elected President of the Journal 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 health effects for about 2 years in Oxford University, England. I also visited other countries, especially U. S. A. for the study until October 1967.

In 1959 I was invited to Director of Laboratory of Clinical Investigation, National Institute of Radiological Sciences. In October, 1962, I was invited to participate in meeting on "Diagnosis and Treatment of Radiation-Induced Pathology" 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 and reported to Head of Division of Radiation Health, National Institute of Radiological Sciences. In March, 1966, I was invited to attend several European countries as a member of a part of the organization "Medical Supervision of Former A-bomb Victims". In August, 1970, I attended to the 13th International Symposium on Dermatology which was held in Munich, Germany. I have been doing follow-up studies on above mentioned Japanese fishermen and published many papers on the health effects of heretofore mentioned radiation effects on human beings.


Toshiaki Kuratori, M. D.

stored in the computer for retrospective studies. The original program in the *Biocom* is processed to an *IBM 370/158* for automatic interpretation. For each cell, a drawing and a photograph and display of an *IBM 370/158* or on a plotter (Fig. 8). The above program is also programmed in an online mode for the automatic interpretation initiated at the keyboard of the computer/plotter/writer equipment. The program is available and allowed to the general public, possibly for the employment of physicians in the diagnosis of the findings in the case of the photographs of the diagnosis. Lines of the program are available to the physicians in the form of a program for interpretation which can be used by the above-mentioned methods. It is available in Japanese.

Chromosome Abnormalities of Japanese Fishermen Exposed to Fallout Radiation in 1954

Toshivak, E. (1977) *Chromosome Abnormalities of Japanese Fishermen Exposed to Fallout Radiation*

Twenty-one Japanese fishermen were exposed to fallout radiation in the Japanese Archipelago in 1954. The fishermen were irradiated externally by the radioactive materials deposited on the land externally from their coastal area. It is extremely important to know the radiation dose to the body surface. Although the radiation dose is very difficult to estimate, the radiation dose of each person was estimated to be 600-1,000 rads in 10 days, nearly 60 rads/day, was estimated on the first day. The external radiation dose may play an important role in the induction of chromosomal aberrations.

Follow-up studies of the fishermen have been performed in a retrospective manner. The number of persons examined in 1964 was 21, which corresponds to about 20% of exposed fishermen.

The cytogenetic method used here was that since 1964. The chromosome analysis was done by the culture method of peripheral blood lymphocytes. 72 hrs. after the exposure in 1954, 1964 and 1965, 2 day-culture method was adopted. The result of chromosome analysis is summarized in Table 1. The frequency of metaphase cells was 2.5% which was not so high compared with that of

normal persons. The frequency of stable chromosome aberrations was remarkable 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 data of 1969 survey. The aberration rate was calculated of the stable cells (300 cells on an average) per 1000 cells in each case for the calculation of χ^2 test. As shown in Fig. 9 the close correlation of stable cell percentage and external dose was observed ($P < 0.001$). In addition a similar correlation 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)

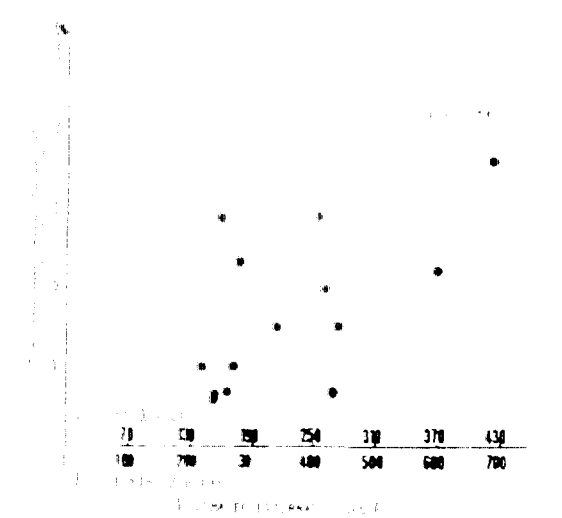


Fig. 9. Correlation between chromosome aberrations (C-aberrations) and estimated external doses.

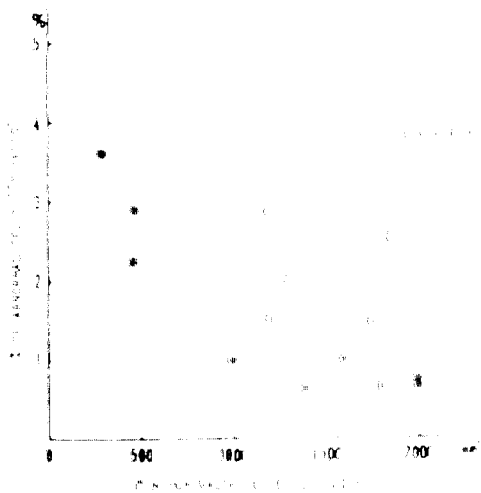


Fig. 10. Correlation of karyotypic abnormalities (46, XY, t(11;17)(p13;p11)) in peripheral lymphocytes and bone marrow cells.

Common Clone Cells with Structural Chromosome Aberrations in Peripheral Lymphocytes and Bone Marrow of Irradiated Humans

By: M. H. Linn, (1) and P. B. Beatty, (2) and J. K. Dixon, (1)

The presence of a clone of dividing growth cycle leukemic cells, known to be of clonal origin, in peripheral lymphocytes and bone marrow, but not in peripheral lymphocytes which are stimulated to undergo cell division by PHA. The evidence has not ruled out the idea lymphocytes might be derived from a separate clone with the former three cell lines, although there is a common stem cell. In addition, the other two of the presence of a clone of dividing hematopoietic stem cells has been suggested.

As a means of working out the problem of the derivation of lymphocytes from hematopoietic bone marrow cells, human cells which were exposed to individuals who showed presence of identical cells with structural chromosome aberrations in bone marrow were studied to see if they did and whether or not clone cells were in peripheral lymphocytes and bone marrow as well.

The results of the comparative analysis between the bone marrow and peripheral lymphocytes of the three cases are reported in Table 1, Figure 10

and Table 2. Common clone cells in the two tissues did not have t(11;17) and T13.

In case RT1, one of the fishermen exposed to the atomic bomb at Nagasaki, 1954, a clone with a karyotype of 46, XY, met occurred in the bone marrow (90%) with a frequency of about 10%. In the peripheral lymphocytes of the 600 cells (0.58%) showed the karyotype of the clone.

In case RT2, a patient as injected with Thorotrast in the past, of the 317 cells (4%) in the bone marrow and 1% of the 3,790 cells (2%) in the blood cultures showed the identical karyotype of 46, XY, Gq-, t(11;17)(p13;p11).

In case RT3, a cervix cancer with hypoplastic leukemia and bone marrow therapy, 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 a clonal karyotype, but none of the 273 cells cultured in the blood cultures showed this karyotype.

The identification of cells with the same radiation induced marker among the dividing cells in peripheral lymphocytes and in bone marrow in the three cases of Table seem to be conclusive evidence for the presence of a lymphohematopoietic stem cell which is giving both lymphoid and bone marrow stem cells.

The present data from irradiated humans clearly demonstrate that B-A responsive peripheral lymphocytes are the progeny of the same stem cell for peripheral lymphocytes and they do not explain the presence of the same clone in peripheral lymphocytes of case RT1. The chromosome in chronic granulocytic leukemia of the clone cells of case RT1 which was observed as the majority of the cells in the peripheral lymphocytes was a serious problem to be solved.

(Unpublished)

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Department of Clinical Research
University College Hospital Medical School
1 University Street, London WC1E 6JJ

HKC
Medical Research Council

Telephone 01 - 287 9391 ext 188

reference

310 November 1972

TO: The Council
The Special Group Committee (see also
Report of R. H. Hill, M.D.,
University of Warwick)

Sir,

I have pleasure in reporting to you on the medical examinations made during September 1972 by the members of the UK's National Laboratory team and their consultants, and on the results specified in the Memorandum of Understanding between the representative Hans Wiliander and the consultants to your Committee.

I have examined the case files for the 100 in 100, and either observed or inspected the examinations, including that of the thyroid gland, of many of the people examined in the 100 and 1000, and of about 60 of the 100 people who have been or will be examined. I have examined microscopic sections of thyroid glands removed at operations on these people, and have studied reports on previous operations to estimate the radiation dose.

I will come to the aims of the 100 and 1000 in the Memorandum of Agreement but think it may be useful to the Committee if I refer first to the aims of the representative of the 1000.

It seems to me that the aims of the 1000 have had, three aims which are to be pursued independently.

(a) A primary purpose is to establish at an early stage any radiation-induced morbidity, so that any treatment can be given, e.g. by removal of benign nodules to prevent malignant development, and of malignant nodules to prevent metastases beyond the thyroid or the neck, or to start on supportive treatment designed to prevent such changes occurring (e.g. hypothyroidism, "thyroiditis").

(b) It is also to maintain a record of the frequency of any observed thyroid or other change, particularly to the radiation exposure of thyroid glands. The statistical analysis to be made anyhow as under (a), thus involves a detailed examination or study except of the normal incidence of changes of thyroid in people who have not been exposed, and of the radiation dose which they have been received by those exposed. It is a matter of very great importance in the proper planning of radiation protection that we should know the changes that may

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(continued)

occur after a given exposure and the frequency with which they occur. This incidence of pulmonary fibrosis has been widely recognized importance, for example by the International Commission on Radiological Protection, and in the United States by the National Commission on the Effects of Atomic Radiation, which has been conducting special clinical examinations that are being in the hospital at present.

(c) In addition to treatment, or to special treatment, for any condition detected by the general medical examinations, although unrelated to radiation, a team of highly trained and strongly qualified and equipped medical personnel made general comprehensive examinations in any case of detected or suspected radiation condition. In fact, the team would visit the area of radiation exposure as well. In fact I think that this general medical examination of the visit clearly occupied a major part of the medical services. A general "sick-call" for any ill members of the community was conducted and held on each day (in Rongelap and Rongerik), and each patient's condition was discussed in detail by the whole group in the afternoon. In addition to the different findings (clinical examination, blood counts, etc.), the rather full clinical examination of the radiation exposed persons was also supplemented by eye examinations and electrocardiograms, chest and chest X-ray and urine examinations in many cases, and these tests were of great value in general medical surveillance, as indicated by the fact that many of the patients which were unrelated to radiation had other medical conditions.

Coming to the points made by the Japanese side of agreement:

1(a). It is difficult to say to what extent an interval is necessary, but past studies have been made on this visit in two people, and particularly in the two women who had depressed thyroid function (the latter diagnosis is supported partly by the chemical analysis of the blood samples, and partly by the clinical picture). Further prompt action: for the nodules, to determine by surgical procedure that they are benign and that they cannot be a malignant growth, and if appropriate operation if either should prove to be malignant, and if there is depression of thyroid function, I would like to start on a low dose of thyroxine ("Synthroid") dosage.

I understand that the radiation exposure has been found to have a significant decrease in white blood cell count, and this will require immediate investigation and probably further treatment.

The thyroid nodules of the type of benign follicular radiation are relatively slow growing, and if not treated, the apparently successful complete removal of all that have gone, which has been reported is reassuring. Whether this would be the case for the next few years of frequent examinations is uncertain. There is no doubt that in many cases, however, even at this stage after exposure, by following up the patients regularly, since annual thyroid examinations help to establish if a malignant nodule is detected early enough for it to be completely removed before it has spread too far.

to be removed.

11(3). General examination: It appeared to me to be extensive, detailed and careful. In particular, the clinical examination of the thyroid was undertaken by a member of the team and one observer, with the aid of the microscope. For other observers also in any case of doubt, the laboratory has used highly sensitive modern methods of estimating thyroxine, as well as any actual, depression of thyroid function (by measuring the iodine concentration of the thyroid stimulating hormone as well as of the thyroid hormone itself). They are in general of the same type as those that I use in my own work in excess of 1000 patients. Apart from additional tests that were occasionally done to reserve of thyroid function (by injection of thyroid stimulating hormone in a few cases), these are the orthodox and the tests commonly used in advanced thyroid clinics - provided thyroid examinations are specially arranged outside the Trust facilities. It should be noted that

I therefore have seen other types of tests which should be added, or any present ones deleted. The fact that tests for radiation effects which have been added could be deleted as a matter of opinion whether any tests carried out in general medical care and surveillance, and particularly those for radiation effects, for example by electrocardiogram or tests of the respiratory system, be deleted. If an expert team of the necessary qualifications on these islands in any case, and if these tests detect thyroid disease that had not otherwise been detected, I think it would be unwise to delete them, even though from the narrower point of view of radiation would probably not impair the necessity for of these tests regard to purely radiation induced effects. While a full range of medical examination is available to these (and other) islanders through the resources, therefore, it would seem to me wrong to diminish this general health protection, even though the size of the team could be reduced if the work were confined to radiation effects alone and if specific and general surveillance were excluded. As it stands, I think it could be held that the exposed islanders may actually have a better health than other islanders, in spite of non-radiation diseases detected and treated and despite the radiation induced thyroid diseases that have required treatment.

11(4). Working relations: It was clear between most members of the team and the people examined, an impression of trustfulness could easily be created, but it should be considered that in many examinations that I saw were inconspicuous. It was particularly obvious that Dr. Conard was being greeted most cordially and with a gentle and charm in dealing with children and young people. In general the difficulties seemed to be only of a technical nature, for example, I find in London in examining a patient with whom I have no common language: namely that one cannot verbally appreciate what the patient indicate in detail

what examinations were conducted to help to explain the purpose of each of such.

It was of course the value that Dr. Polya had first obtained from a few who had been examined, and had of any symptoms they had, a certain amount of the nature of the "benign" examinations. In addition, if any abnormality was suspected, was suspected from the examination, he would, or did, ask a few additional questions to amplify the history, and he was, of course, fully understood the position and was completely satisfied. Dr. Polya stated that this arrangement was introduced in the 1972-73 period, and he expects that difficulties in communication will have been avoided, particularly in view of his generally good health and his positive personality.

On the other hand, Dr. Polya stated that irradiated people had questioned why they were irradiated, and should be exposed to flood sampling, and other things, and he stated he heard this since, if so, it would be good that they had been clearly asked for, or understood that, or the nature of the help that such help would be valuable, or at least, in the eyes of their irradiated fellow people. The point is that if, for example, thyroid nodules were common in irradiated people, and if they progress to malignant forms, the possibility of a cure, or of a cure, in the exposed people might be quite different from that of the nodules were rarely seen in the unexposed. It is, of course, particularly important in view of communication in the case of a person who is irradiated, and who has asked for and interpreted the results of their tests.

1(c) The results of the examination of nodules removed at operation and the results of the examination with the diagnoses - of benign or malignant forms - this has to be done by the pathologists who have examined or prepared the reports, and the men who are internat (that is, the experts in the pathology)

2(a) The results of the examination of the nodules have been of normal and orthodoxy, and appear to be of the

in particular,

(i) The treatment of any significant depression of thyroid activity by a synthetic form of the preparation, in this case 'Synthroid' - is a routine, and the usual blood test (free thyroxine and iodine and, when the test is available, thyroxine stimulating hormone) enable the doctor to be satisfied that he is giving the whole weekly dose of Synthroid, and that the slow release tablets, given the slow utilisation of the hormone, and the slow release, that the appropriate average will be maintained that of the whole weekly dose. It is of course important that the doctor should check that correct supplies of tablets are being collected and given.

(ii) Temporary cessation of thyroid 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 1988. The test which was used was in my view longer than needed and I have discussed this point with Dr. Conard. I find that the number of tests over 3 months were used (1 of which were actually done) for the 4 patients for the tests. The effect of this would have been decidedly not, substantial if you have a return of any hypothyroid symptoms, and at least if you have a return of any hyperthyroid symptoms or tumour tissue in the thyroid.

(iii) The administration of thyroid preparations to decrease the likelihood of developing thyroid cancer is generally accepted practice and the concept was a common one. The basis for this practice is a feedback loop (the feedback loop of the thyroid cells by the TSH which produces thyroxine stimulating hormone) and it is not known how much hormone is necessary. It cannot be completely effective because it is not known how much is necessary. This year in a young woman who was treated for thyroid cancer.

(iv) The removal of thyroid tissue in general medical practice if they arise in the thyroid gland is generally accepted practice and often also in older people if they do not have a history of thyroid administration. When they do arise after thyroid cancer, it is only occurring rarely in individuals of the age and day of life, there is a much stronger case for removal of the thyroid gland if possible malignancy.

2(b). The second proposed criteria for continuing on these lines appear appropriate and adequate. I do not have the opinion in the team that the nodules really needed to be removed by the time of my leaving. My view is that they should be removed so that whatever removal of thyroid tissue is left behind under the microscope by their histological nature (benign or malignant).

A particular problem arises regarding the completeness of removal of any thyroid tissue. In the four people from whom thyroid cancer was removed, the removal was complete in detail at the time of operation. Subsequent histological examination was used to exclude any remaining tumour tissue. There is evidence to suggest that at any. They have in addition had some of the thyroid tissue removed showing no concentration of radioactive iodine. The thyroid gland is normally found except in positions consistent with remaining thyroid tissue. I have discussed in detail with Dr. Conard certain additional sensitive tests that we currently use for the administration of thyroid cancer. These present greater difficulties than those currently used, either because of the high concentrations of a characteristic of thyroid cancer which is normally in the blood

of many of the assumptions on which the results were based themselves involve appreciable uncertainties. In addition, no specialized linear scanning method was available for measuring energy deposits.

(On the above mentioned points in the above conditions report to comment.)

1. In spite of the study method used, the likelihood that further tests of the thyroid gland in the exposed and "irradiated" might have added substantially to the data is being suggested, if only because this assessment of the present situation is based on planning arrangements laid down in 1954 and by these is based on a study of current meteorological reports, but not on a power of the time of the fission/fusion yield, etc. In retrospect, however, the manner in which the spread radiation and body burden of radioisotopes appeared to be that in fact the amount of whole body radiation was about 10% of that initially received, and that of that initially received, probably less than 3% of that initially received, probably from a raised background or from subsequent intake. The average increase in thyroid radiation is likely to have been very small. I have not attempted to make any exact calculation of radiation dose, and the above estimate shows that the radiation dose did not exceed the dose which the exposed received.

2. The health care situation in the Marshall Islands of the exposed people and of the unexposed people of the "control" illustrated the value that periodic medical examinations can have for people living in relatively isolated and remote areas in a part of the world. The present practice of arranged periodic medical visits to the Marshallese and to the unexposed people is of importance for detection and treatment of chronic illnesses, and also for the control of the frequency of acute infectious diseases. In the management of some of the acute infectious diseases, the management of health care is of importance. This point is particularly visible in the case of your consultant. I wondered however whether the management of acute infectious diseases, and appropriate arrangements for diagnosis, and the cooperation between dispensaries and hospitals in the area, might be of value. It would be economical, practicable and possibly introduce a new type of health care only after discussion of different possibilities, but which could provide a valuable form of continuing, transferred, transferable, and transferable health care in the isolated situation of the Marshall Islands. The possibility of a system of maintaining equipment and of providing health care might be given to hospitals, and the question of how to provide training and health care reviewed in detail by your consultant.

3. I cannot comment on the accuracy of the physical estimate of external radiation exposure, or the dose of radiation which they are derived. These dose estimates are very approximate, but are probably based on early and otherwise reliable data, and are probably a reasonable estimate of the decrease in the radiation dose which they are a reasonable estimate

of the relevant period of exposure.

The problems of internal exposure to the iodine isotopes depend upon three general assumptions:

(i) The size of the thyroid gland, into which the radioactive iodine was taken up, and the age of the gland size varies with age. Estimates of gland size taken from various countries do not vary greatly, and the data used here are based on Marshallese children, in the absence of direct data, and by using age values.

(ii) The nature of radiation which enters the body, and whether by inhalation or by absorption of water or food (this affects the time and duration of exposure). The type of radiation present at any time since the accident is viewed as based on physical grounds, and the associated half-lives and decay rates are taken as reasonable.

(iii) The amount of these isotopes incorporated in the thyroid and hence the radiation exposure to glands of any given size here the estimate has to be based on the results of the amounts excreted in urine in the period of 30 to 60 days after exposure, and on assumption as to the proportion of the initial uptake that will be excreted during that period. The original assumption was that 0.05 to 0.1% of the total 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 it appears that the actual iodine from the normal thyroid and its excretion in the urine is probably a figure of 0.00%, in good agreement with the estimate based on the original assumptions. I have also seen a calculation by Dr. J. H. Sherman based directly on measurements of iodine excretion in Marshallese people. This gives a slightly higher, and therefore a lower estimate of radiation exposure as based on the measured amount excreted. It should also be added that, if the thyroid radiated dose differs from any of these (normal) values, it would be so by excretion of the excretion of iodine from the gland, and perhaps also by excretion of the excretion excreted in the urine. Both these changes would affect the estimate of thyroid dose. The average thyroid dose may therefore be lower than estimated, and it seems unlikely to have been significantly higher. It is emphasized however that these are estimates of the dose to the gland from internal radiation. Doses received by the thyroid gland are likely to have differed considerably from this estimate, especially for their age, owing to individual differences in size of thyroid gland, and if contaminated water drunk was absorbed, and in the absorption rate 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 felt however that, to give a full picture which your Committee has been dealing with, which will be returned, it was

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preferable to give the basis for my conclusions, even if the detail is technical, rather than to give general conclusions without supporting reasons. I hope that my comments will be in accordance with the information and opinion that you require, and if you will not hesitate to raise with me any other questions that the Committee may wish.

Yours sincerely,

John Pochter CSM MD FRCP.

Dr. F. A. O'NEILL, M.D., M.B., B.S., F.R.C.P.

Director of the (S. 1314) Medical Research Council's Department of Clinical Endocrinology, in Peter B. Pugh Hospital Medical School, London; and Consultant Endocrinologist in University College Hospital, and in the Westminster Hospital, London.

Fellow of the Royal College of Physicians since 1946, and member of its Council from 1964 to 1968. Member of the Association of Physicians of Great Britain and Ireland, of the Royal Society of Medicine, and of the British Medical Association. Chairman of the Ethics Committee of the South-West Hospital.

Engaged since appointment in the Department in 1946 in clinical work, in thyroid endocrinology, in medical teaching, and in research, particularly into the aetiology, diagnosis and treatment of thyroid disease, the function of thyroid hormones, and the study of the diagnosis of thyroid cancer; and author of various papers on thyroid endocrinology.

Member of the Executive 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-Chairman (1959-61) and Chairman (1962-65) of this Commission and member of its Committee on Biological Dose.

Member formerly Chairman of the Medical Research Council's Committee on the risks against radiation, and member of its Committee on Biological Dose.

Member of the British Institute of Radiology, and Honorary Member of the Faculty of Biologists' Institute of Radiation Protection Association and the papers of Biophysical Society.

UK Representative on United Nations Panel of Experts 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 Board of Trustees

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BROOKHAVEN NATIONAL LABORATORY
ASSOCIATED UNIVERSITIES, INC. BROOKHAVEN, N.Y. 11725

MEDICAL DEPARTMENT

TELEPHONE (516) 345-3577

October 10, 1972

Senator Glynn S. Sotelo
Chairman, Special Select Committee
Concerning Rompin & Priril Atolls
Congress of Micronesia
Saipan, Marianas Islands, 96950

Dear Senator Sotelo:

Thank you for your letter of October 7, 1972. I was glad we were able to successfully complete the medical examinations of the Rongelap and Rongerik people. I am sorry you were not able to be with us. I have extended to you and your 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 observatory program who have been actively in the medical examinations and contributed significantly to the success of the survey.

I am enclosing a copy of the report of the October 7, 1972 letter summarizing the preliminary work of the medical examinations. I am most regretful that the leaflets could not be distributed only assure you that every effort is possible to help you in the future.

With regard to your return visit to Rongelap and Rongerik, 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. I am sure you will know what you want to leave.

If I can be of any further help, please let me know.

Sincerely,

Robert A. Conard, M. D.

RAC:le



BROOKHAVEN NATIONAL LABORATORY
 FEDERAL BUREAU OF INVESTIGATION
 U.S. DEPARTMENT OF JUSTICE

MEDICAL DEPARTMENT

TELEPHONE (516) 345-3577

October 28, 1977

Mr. Milton L. Jop
 Staff Officer
 Special Agent in Charge (Contracting)
 Rongelap and Ujae Atoll
 Congress of Micronesia
 P.O. Box 1000, Saipan, MP 96950

Dear Mr. Jop:

Thank you for your letter of October 4, 1977. You requested a rough summary of the survey. The following summary must be considered preliminary in nature. The medical records and equipment have not yet arrived from the States. I understand that the quarantine camp at the lagoon was held up the Militobi department from leaving, and the medical material was to be airshipped from.

Your letter also stated that the health survey we were able to complete at Rongelap and Ujae and Ujae and Ujae people at Eneye. In addition, the following examinations were performed at Rongelap, Ujae and Ujae.

Group	Rongelap	Ujae	Majuro
Rongelap (examined)	25	4	9
Children (examined)	3	4	14
Ujae	2	6	30
Rongelap (examined)	2	2	8
Children (examined)	2	4	6
Total	34	20	67

In addition, a large number of other people were examined and treated for various ailments. Sick call each morning at Rongelap and Ujae. At Rongelap and Ujae, severe gastrointestinal infection, primarily diarrhea, upper respiratory infection and, in some cases, pneumonia were treated. At least a dozen children were hospitalized. In addition, a number of people were treated at sick call at Rongelap. At Ujae, a number of children (26 in one month) were hospitalized for various ailments. At

Mr. Brian Farley

2000 01/14/1979

Majuro also treatment was recommended in terms of the people examined to the local medical centers. In the future, by trying to promote a better communication between the examining physician and the Marshallese examined, an attempt was made at the end of each examination to explain to the person being examined in detail the general results of the examination and give the treatment recommendation.

At each island there was a conference with the physicians, including the medical case workers, Dr. K. H. [redacted] the health aide, to evaluate all cases examined and to recommend treatment and disposition. In some cases, the health aide was advised of any further treatment. In other cases, Dr. K. H. [redacted] was asked to see all cases on his return visit to the island. In other cases, refer to the Majuro hospital were recommended for further examination and treatment. At Rongelap there were two hospital cases and 11 pre-five cases. We took them with us on the Militoli 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 Fanelap women were being further examined. Two of the pre-five cases were found to have conditions that could be treated on the island and they were to be returned to the other case for further consultation.

There were important findings in a number of people who lived at Majuro. Two young exposed girls had evidence of thyroid nodules since last examined in 1975. They were [redacted] (female, age 19) who had been exposed at one year of age on Rongelap. The other girl was [redacted] (female, 17) who had been exposed on Rongelap at age 12. Surgical removal of the nodules is indicated if necessary. Dr. Brown Dobyns at the Cleveland Metropolitan General Hospital, was operated on many of the other Marshallese thyroid cases and 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 19-year-old male, age 19, who was exposed at one year of age on Rongelap. He was found to have a low white blood cell count at the beginning of the survey. The 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 68 he was found to be healthy. In view of the alarmingly low blood count and after consultation with his father, we took [redacted] with us to the Army Hospital in Honolulu. They were unable, however, to get a successful examination of the examination and we decided to take him to the Brookhaven Health Laboratory. I am sorry to report that the diagnosis of acute lymphocytic leukemia was

PROXY ACT MATERIAL REF ID: A60000

Mr. Brian Parlow, AEC, Washington, D.C., October 25, 1977

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 boat left the coast down by hospital plane to Maryland. Lab. gear were sent along along with the mother and father of the patient to Washington, D.C. as soon as possible at AEC expense. Also, John Monibor, health aide at Majuro was requested as interpreter. The father, John Angain and Sebeo, arrived Friday, October 28, and with the patient. We have not yet been notified of their arrangements for their return travel.

Examination of the Utrik 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 in any normal population.

At both Rongerik and Utrik, 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 personnel 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 records 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 our records or other 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 revisions.

1014844

THYROID LESIONS IN MARSHALL ISLANDS TO RONGELAP
(APRIL 1970 - 1972)¹

Marshall Island group (radiation dose-gamma)	Age at exposure	Estimated thyroid dose (rads) ³	Persons examined ²	Thyroid surgery	Malignant lesions ² percent
Rongelap (175 rads gamma exposure)	0-10	500-1400	19 (17/19)	15	5.3 (1/19)
	10-20	335-1000	8 (7/8)	0	-
	20-30	315	26 (2/26)	2	7.7 (2/26)
	30-40	270	53 (33/53)	17	5.7 (3/53)
Rongelap (on Ailingnae Island-69 rads gamma exposure)	0-10	200-1000	6 (1/6)	0	-
	10-20	132 ⁴	8 (1/8)	1	-
	20-30	100	14 (1/14)	1	-
Utirik ⁵ (14 rads gamma exposure)	0-10	46-80	5 (1/5)	0	-
	10-20	22 ⁴	6 (4/69)	1	1.4 (1/69)
	20-30	100	124 (4/124)	2	0.8 (1/124)
Rongelap unexposed	0-10	0	6 (1/6)	0	-
	10-20	0	13 (7/13)	1	-
	20-30	0	19 (1/19)	1	-
Likiep unexposed	0-10	0	31 (0/31)	0	-
	10-20	0	106 (5/106)	0	-
	20-30	0	137 (0/137)	0	-

¹ Dose from 131, 132, 134, 137 plus gamma dose.

² Based on number living. In parentheses number of cases/total number in group.

³ One child 10-17 years of age at exposure received estimated thyroid doses between 132 and 200 rads.

⁴ Fifteen children 10-17 years of age at exposure in this group received estimated thyroid doses between 22 and 49 rads.

⁵ The more energetic shorter-lived isotopes of fission contributed less to the total thyroid dose in the Utirik group due to later migration. One might surmise therefore that the biological effect of the thyroid dose received would be less in that group.

⁶ 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.

1014845

Journal of the

United States of America
by the Senate

1014846



DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
WASHINGTON, D. C. 20492

August 27, 1971

SURGEON GENERAL
OF THE
PUBLIC HEALTH SERVICE

Senator Olympic M. Borja
Chairman, Special Joint Committee
Concerning Rongelap and Other 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 to the Congress of
Micronesia in whatever way may be appropriate.

Sincerely yours,

Jesse W. Steinberg, M.D.
Surgeon General

Enclosure



DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OFFICE OF RADIATION
PROTECTION AND CONTROL
WASHINGTON, D. C. 20450

July 31, 1972

Senator Olympia B. Borja
Chairman, Special Joint Committee
Concerning Rongelap and Utirik 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 Maturu, Utirik, Rongelap, and Kwajalein (Fiji) Atolls on July 20-21, 1972.

In order to conduct the subject matter I have made my observations and recommendations on the findings on Rongelap and Utirik although we interviewed some of these people on Maturu and Ebeye.

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 15, 1972.

Sincerely yours,


William A. Cole, M.D.
Associate Director
Office of Radiological Health

Enclosure

1014848

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
MICROFILMS, ON JULY 30, 1961

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. Borja, Chairman
Representative Timoteo Ukeriff, Member
Representative Hans Williander, Member
Representative Atafu Salos, Interpreter
Dr. Masao Kumagai, Deputy Director of Health, Trust Territory
Mr. Brian M. Farley, Researcher, Trust Territory
Dr. William M. 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 16 Rongelap people on a fishing trip received an estimated 69 rads of whole-body radiation; and 157 people on Utirik received an estimated 16 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 Laboratories 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 in 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. Borja, 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 1963 and little is to be expected. 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 all 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 will have independent physicians from Japan, WHO, and the Institute of Health Research accompany the team.

The Health Aides of Rongelap and Utiirik have difficulty in administering the prescribed thyroid medication due to the lack of written records on the patients. The Aide on Rongelap stated he thought the records were in the trailers but were not available to him. 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 both Utirik and Rongelap since the explosion. Those statements stated this occurred during the first year after returning to their Island. Specific dates and instances could not be determined. Apparently there were four abnormal babies born to five exposed women of Rongelap who were not pregnant at the time of exposure. After much discussion among themselves, the spokesman for the women stated that there appeared to be a decrease 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 10, have developed thyroid nodules requiring surgery. Although biopsy reports indicate only 1-3 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 Atoll believe that they have sustained physical injury from the radiation and are entitled to just compensation. Those now living on Majuro and Ebeve stated they wanted to return to their home but were afraid of the radioactivity that remains.
2. The exposed people of Rongelap Atoll believe 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 Ebeve will not return to their home because of the residual radioactivity and the fear of a third explosion.

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 Branch Officers.

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.

ZP33018 JK 2

Statement of the U.S. Institute for the Control of Nuclear Energy as a Result of
March 1, 1954 (and other)

(From National Security Council and the Department of State, 1957)

1014854

"The estimated whole-body gamma dose to natives evacuated from the island of Utirik following the March 17, 1954, detonation at the Pacific Proving Ground was about 15 roentgens over a period of about 10 days, but no beta burns appeared. It is fair to assume that direct contact with fallout took place due to their mode of living, including wading 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. On the beach the personnel readings averaged about 1 mR per hour, whereas on the ship they probably included some contribution from the ground contamination although the wading through the surf and boarding the ship probably averaged about 1 mR per hour gamma.

"The 18 natives from the island, Ailinginae, received an estimated whole-body gamma dose of 15 roentgens in about 10 days. Of these, 14 later experienced slight beta burns, 7 moderate burns, and none showed epilation.

"In the case of the Korogap natives, the estimated whole-body dose was about 170 roentgens in about 10 days. About half the water 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 140 mR per hour and 1 was 100 mR per hour (at H+ about 55 hours). The remaining 98 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 and women stationed on Eniwetok Island, Rongerik Atoll, received about 400 roentgens, based on film badge readings. Three members of the group were reported to be in part of the time in another section of the island where fallout was heavier and these received somewhat higher doses. Seventeen of the twenty-four 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 for much of the time they were under evaluation. This reduced the direct radiation dose as well as the whole-body gamma dose. A film badge hanging on the center pole of a boat at one end of the island read 98 roentgens. A film badge based on the readings at another part of the island indicated a somewhat lower dose. Personnel had remained in the open for the period of time from fallout (about H+2.5 hours) to evacuation (at about H+34 hours). Upon arrival at Kwajalein, personnel gamma dose rate reading was as high as 70 mR per hour at about H+35 hours.

"The above data suggest that there may be possible a rough bracketing of gamma-beta dose to natives evacuated from the island of Utirik to natives from

Utirik received no radiation which by gamma dose of 15 roentgens and showed no evidence of burns. On the other hand, 13 natives on Sifo Island, Ailinginae Atoll, received about 75 roentgens whole-body gamma dose of 75 roentgens, with 14 personnel showing 100 percent burns, 2, moderate burns, 2, no burns, 3 with moderate epilation, and 10 with no epilation. In addition, Rongelap native received 170 roentgens whole-body gamma dose, and about 90 percent showed some degree of burns and 100 percent some degree of epilation.

"It is to be recalled that (1) the natives probably were out of doors and received the full fallout; (2) they were hair, seminaked, perspiring bodies, including bare feet, and (3) they were, for most, would tend to collect and hold fallout without regard to the time of delivery of essentially all of the doses within 3 days. Therefore, it may be speculated that the fallout on the main island (about 300 statute miles) would consist of smaller particles which would have a lesser possibility of overlapping of radiation fields from these particles."

10/10/57

10/10/57

(From Radioactive Isotopes and their Applications, by W. G. Sturges, 1957)

1014857

TEMPERATURE, WIND VELOCITY AND DIRECTION OF WIND

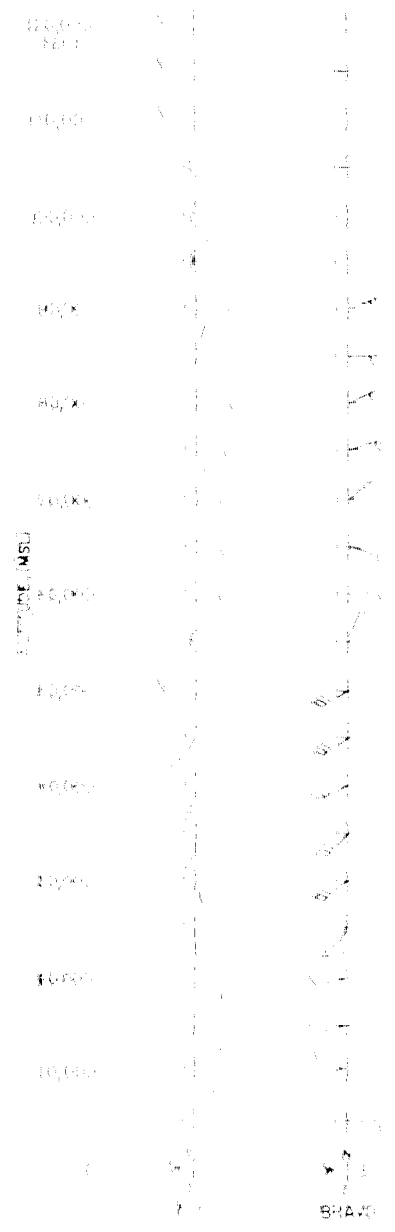
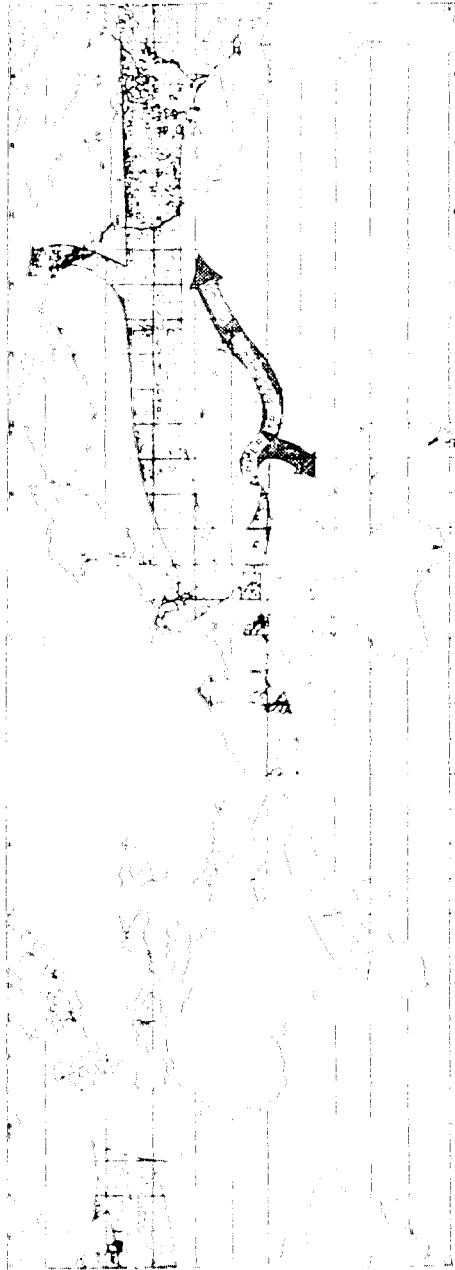


Figure 1. Temperature, wind velocity and direction of wind. The wind direction is given in degrees true. The wind velocity is given in knots. The temperature is given in degrees Fahrenheit.

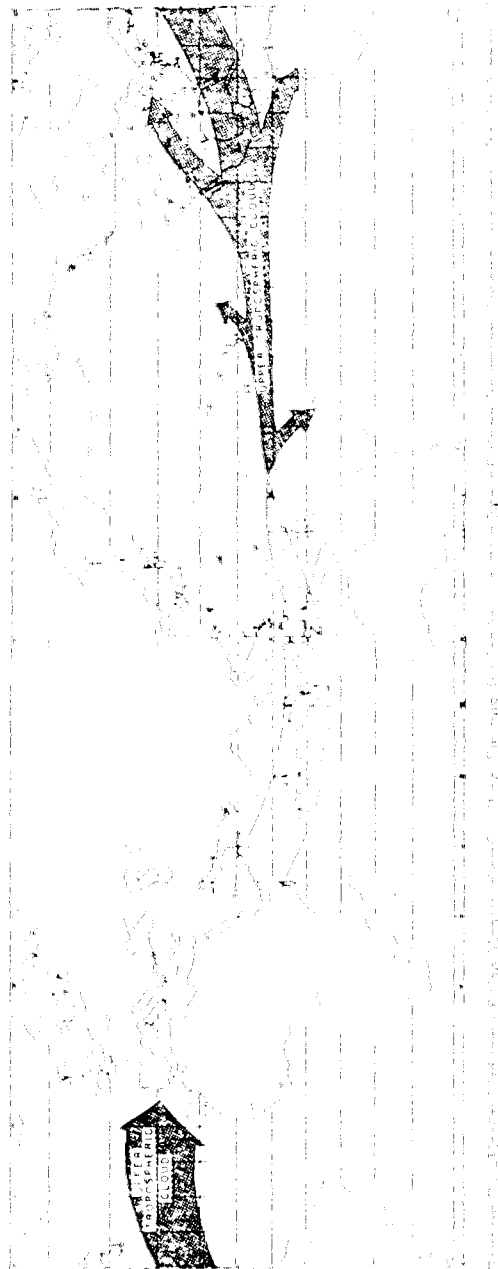
MAP OF THE MOUNTAINS AND HILLS OF THE MOUNTAINS



The figures indicate the number of days of heavy rain and the first heavy observation of heavy rain.

1014859

ENCLOSURE (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14) (15) (16) (17) (18) (19) (20) (21) (22) (23) (24) (25) (26) (27) (28) (29) (30) (31) (32) (33) (34) (35) (36) (37) (38) (39) (40) (41) (42) (43) (44) (45) (46) (47) (48) (49) (50) (51) (52) (53) (54) (55) (56) (57) (58) (59) (60) (61) (62) (63) (64) (65) (66) (67) (68) (69) (70) (71) (72) (73) (74) (75) (76) (77) (78) (79) (80) (81) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (98) (99) (100)



1014860

Appendix No. 6

Atomic Energy Research Administration
Advanced Research Program

(From Radicals in Solution and the Molecule, G. N. Pinner, 1957)

1014861

PUBLIC RELATIONS

"It was recognized that adequate public relations is necessary to the successful operation of the Nevada program. The off-site program was designed to facilitate good public relations. This was accomplished by contact and talks prior to the series, by the system of zone commanders who were largely responsible for good relations within a specified area by maintaining a file of complaints reported immediately and, of course, by the general program 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 to go to for information and with complaints. Off-site personnel were able to carry out a continuous educational program since full advantage of their area and the community was taken and they were asked to be on the program of civic clubs and other organizations, to furnish material for the program and newspapers and to aid in other programs.

"Prior arrangements made to the start of 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 series, most of these communities were revisited by a group consisting of the Test Manager, Scientific Advisor, Test Director, Support Director, Information Director, Off-Site Operations Chief, and a senior PHS officer. A series of talks were given in Caliente, Prater, and Tonopah, Nev., and St. George and Lake City. In these talks the value of continental measurements to the area was stressed and the precautionary measures to be taken with respect to public safety were outlined. People were informed of the presence of monitors in their community and that these men were expected to become a part of the community during the series and of the manner in which they would be in regard to public safety. Information was given on the following:

"From 7 to 12 days before the initiation of the series, the monitors with their equipment were taken into the communities, familiarized themselves with the area, made arrangements for the day-to-day job of public relations.

Liaison arrangements were made to keep those health officials who might be particularly concerned informed of the activities at the test site. The States normally involved were Nevada, Utah, California, and Arizona, and the State health officers of these States were advised regularly by phone or mail of any development that might affect areas under their jurisdiction. The personnel advised in these instances were:

Nevada: Dr. Daniel G. Darby, State health officer.
Utah: Dr. George J. Spandlow, State health officer.
California: Dr. John H. Kinsey, State health officer.
Arizona: Dr. H. C. Johnson, State health officer.

In addition to these arrangements, contacts were made with affected USPHS of interest relative to test results obtained.

Activities of the personnel and personnel conducted a public-relations program on an informal and on a part-time basis. They formed a wide acquaintance in the respective areas, participated in local events and to a certain extent in the community seriously; as an example, the marriage of a female who became a Sunday school teacher and her husband in Alamogordo featured a ceiling in one of the hotel rooms. An intimate acquaintance with the people in the area was good practical public relations work while it may not have altered completely their public opinion regarding the tests, it at least made the explanation of what was going on more acceptable.

PUBLIC RELATIONS AND COMMUNITY OPINION

Every opportunity to reach the public through talks and film showings was accepted. Practically every evening throughout the off-site area saw at least one film and 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 enthusiastic reception. From the remarks made to the personnel, it appears that general feeling was that, for the first time, the public was being shown exactly what happened during a shot.

A complete listing of public relations contacts is not available, but the partial list of telephone numbers included in table 2 will indicate the scope of this activity.

Table 1. FBI, FBI-related Movies

Year	Location	Date	Room	Attendant
1949	NYC	Feb. 20	Target Room	100
1950	NYC	Feb. 20	Room 30	100
1951	NYC	Feb. 20	Room 30	100
1952	NYC	Feb. 20	Room 30	100
1953	NYC	Feb. 20	Room 30	100
1954	NYC	Feb. 20	Room 30	100
1955	NYC	Feb. 20	Room 30	100
1956	NYC	Feb. 20	Room 30	100
1957	NYC	Feb. 20	Room 30	100
1958	NYC	Feb. 20	Room 30	100
1959	NYC	Feb. 20	Room 30	100
1960	NYC	Feb. 20	Room 30	100
1961	NYC	Feb. 20	Room 30	100
1962	NYC	Feb. 20	Room 30	100
1963	NYC	Feb. 20	Room 30	100
1964	NYC	Feb. 20	Room 30	100
1965	NYC	Feb. 20	Room 30	100
1966	NYC	Feb. 20	Room 30	100
1967	NYC	Feb. 20	Room 30	100
1968	NYC	Feb. 20	Room 30	100
1969	NYC	Feb. 20	Room 30	100
1970	NYC	Feb. 20	Room 30	100
1971	NYC	Feb. 20	Room 30	100
1972	NYC	Feb. 20	Room 30	100
1973	NYC	Feb. 20	Room 30	100
1974	NYC	Feb. 20	Room 30	100
1975	NYC	Feb. 20	Room 30	100
1976	NYC	Feb. 20	Room 30	100
1977	NYC	Feb. 20	Room 30	100
1978	NYC	Feb. 20	Room 30	100
1979	NYC	Feb. 20	Room 30	100
1980	NYC	Feb. 20	Room 30	100
1981	NYC	Feb. 20	Room 30	100
1982	NYC	Feb. 20	Room 30	100
1983	NYC	Feb. 20	Room 30	100
1984	NYC	Feb. 20	Room 30	100
1985	NYC	Feb. 20	Room 30	100
1986	NYC	Feb. 20	Room 30	100
1987	NYC	Feb. 20	Room 30	100
1988	NYC	Feb. 20	Room 30	100
1989	NYC	Feb. 20	Room 30	100
1990	NYC	Feb. 20	Room 30	100
1991	NYC	Feb. 20	Room 30	100
1992	NYC	Feb. 20	Room 30	100
1993	NYC	Feb. 20	Room 30	100
1994	NYC	Feb. 20	Room 30	100
1995	NYC	Feb. 20	Room 30	100
1996	NYC	Feb. 20	Room 30	100
1997	NYC	Feb. 20	Room 30	100
1998	NYC	Feb. 20	Room 30	100
1999	NYC	Feb. 20	Room 30	100
2000	NYC	Feb. 20	Room 30	100
2001	NYC	Feb. 20	Room 30	100
2002	NYC	Feb. 20	Room 30	100
2003	NYC	Feb. 20	Room 30	100
2004	NYC	Feb. 20	Room 30	100
2005	NYC	Feb. 20	Room 30	100
2006	NYC	Feb. 20	Room 30	100
2007	NYC	Feb. 20	Room 30	100
2008	NYC	Feb. 20	Room 30	100
2009	NYC	Feb. 20	Room 30	100
2010	NYC	Feb. 20	Room 30	100
2011	NYC	Feb. 20	Room 30	100
2012	NYC	Feb. 20	Room 30	100
2013	NYC	Feb. 20	Room 30	100
2014	NYC	Feb. 20	Room 30	100
2015	NYC	Feb. 20	Room 30	100
2016	NYC	Feb. 20	Room 30	100
2017	NYC	Feb. 20	Room 30	100
2018	NYC	Feb. 20	Room 30	100
2019	NYC	Feb. 20	Room 30	100
2020	NYC	Feb. 20	Room 30	100
2021	NYC	Feb. 20	Room 30	100
2022	NYC	Feb. 20	Room 30	100
2023	NYC	Feb. 20	Room 30	100
2024	NYC	Feb. 20	Room 30	100

Table 1. - Public relations - Movies - September

Name	Locality	Date	Rate	Collection
Florida	Manatee County	Sept. 25	10.00	50
	Manatee County	Sept. 26	10.00	100
	Manatee County	Sept. 27	10.00	100
	Manatee County	Sept. 28	10.00	100
	Manatee County	Sept. 29	10.00	100
	Manatee County	Sept. 30	10.00	100
	Manatee County	Sept. 31	10.00	100
	Manatee County	Sept. 32	10.00	100
	Manatee County	Sept. 33	10.00	100
	Manatee County	Sept. 34	10.00	100
	Manatee County	Sept. 35	10.00	100
	Manatee County	Sept. 36	10.00	100
	Manatee County	Sept. 37	10.00	100
	Manatee County	Sept. 38	10.00	100
	Manatee County	Sept. 39	10.00	100
	Manatee County	Sept. 40	10.00	100
	Manatee County	Sept. 41	10.00	100
	Manatee County	Sept. 42	10.00	100
	Manatee County	Sept. 43	10.00	100
	Manatee County	Sept. 44	10.00	100
	Manatee County	Sept. 45	10.00	100
	Manatee County	Sept. 46	10.00	100
	Manatee County	Sept. 47	10.00	100
	Manatee County	Sept. 48	10.00	100
	Manatee County	Sept. 49	10.00	100
	Manatee County	Sept. 50	10.00	100
	Manatee County	Sept. 51	10.00	100
	Manatee County	Sept. 52	10.00	100
	Manatee County	Sept. 53	10.00	100
	Manatee County	Sept. 54	10.00	100
	Manatee County	Sept. 55	10.00	100
	Manatee County	Sept. 56	10.00	100
	Manatee County	Sept. 57	10.00	100
	Manatee County	Sept. 58	10.00	100
	Manatee County	Sept. 59	10.00	100
	Manatee County	Sept. 60	10.00	100
	Manatee County	Sept. 61	10.00	100
	Manatee County	Sept. 62	10.00	100
	Manatee County	Sept. 63	10.00	100
	Manatee County	Sept. 64	10.00	100
	Manatee County	Sept. 65	10.00	100
	Manatee County	Sept. 66	10.00	100
	Manatee County	Sept. 67	10.00	100
	Manatee County	Sept. 68	10.00	100
	Manatee County	Sept. 69	10.00	100
	Manatee County	Sept. 70	10.00	100
	Manatee County	Sept. 71	10.00	100
	Manatee County	Sept. 72	10.00	100
	Manatee County	Sept. 73	10.00	100
	Manatee County	Sept. 74	10.00	100
	Manatee County	Sept. 75	10.00	100
	Manatee County	Sept. 76	10.00	100
	Manatee County	Sept. 77	10.00	100
	Manatee County	Sept. 78	10.00	100
	Manatee County	Sept. 79	10.00	100
	Manatee County	Sept. 80	10.00	100
	Manatee County	Sept. 81	10.00	100
	Manatee County	Sept. 82	10.00	100
	Manatee County	Sept. 83	10.00	100
	Manatee County	Sept. 84	10.00	100
	Manatee County	Sept. 85	10.00	100
	Manatee County	Sept. 86	10.00	100
	Manatee County	Sept. 87	10.00	100
	Manatee County	Sept. 88	10.00	100
	Manatee County	Sept. 89	10.00	100
	Manatee County	Sept. 90	10.00	100
	Manatee County	Sept. 91	10.00	100
	Manatee County	Sept. 92	10.00	100
	Manatee County	Sept. 93	10.00	100
	Manatee County	Sept. 94	10.00	100
	Manatee County	Sept. 95	10.00	100
	Manatee County	Sept. 96	10.00	100
	Manatee County	Sept. 97	10.00	100
	Manatee County	Sept. 98	10.00	100
	Manatee County	Sept. 99	10.00	100
	Manatee County	Sept. 100	10.00	100

Table 1. Public relations--Movies--Continued

Topic	Location	Date	Attendance
<p>1. Public relations</p> <p>2. Public relations</p> <p>3. Public relations</p> <p>4. Public relations</p> <p>5. Public relations</p> <p>6. Public relations</p> <p>7. Public relations</p> <p>8. Public relations</p> <p>9. Public relations</p> <p>10. Public relations</p> <p>11. Public relations</p> <p>12. Public relations</p> <p>13. Public relations</p> <p>14. Public relations</p> <p>15. Public relations</p> <p>16. Public relations</p> <p>17. Public relations</p> <p>18. Public relations</p> <p>19. Public relations</p> <p>20. Public relations</p> <p>21. Public relations</p> <p>22. Public relations</p> <p>23. Public relations</p> <p>24. Public relations</p> <p>25. Public relations</p> <p>26. Public relations</p> <p>27. Public relations</p> <p>28. Public relations</p> <p>29. Public relations</p> <p>30. Public relations</p> <p>31. Public relations</p> <p>32. Public relations</p> <p>33. Public relations</p> <p>34. Public relations</p> <p>35. Public relations</p> <p>36. Public relations</p> <p>37. Public relations</p> <p>38. Public relations</p> <p>39. Public relations</p> <p>40. Public relations</p> <p>41. Public relations</p> <p>42. Public relations</p> <p>43. Public relations</p> <p>44. Public relations</p> <p>45. Public relations</p> <p>46. Public relations</p> <p>47. Public relations</p> <p>48. Public relations</p> <p>49. Public relations</p> <p>50. Public relations</p> <p>51. Public relations</p> <p>52. Public relations</p> <p>53. Public relations</p> <p>54. Public relations</p> <p>55. Public relations</p> <p>56. Public relations</p> <p>57. Public relations</p> <p>58. Public relations</p> <p>59. Public relations</p> <p>60. Public relations</p> <p>61. Public relations</p> <p>62. Public relations</p> <p>63. Public relations</p> <p>64. Public relations</p> <p>65. Public relations</p> <p>66. Public relations</p> <p>67. Public relations</p> <p>68. Public relations</p> <p>69. Public relations</p> <p>70. Public relations</p> <p>71. Public relations</p> <p>72. Public relations</p> <p>73. Public relations</p> <p>74. Public relations</p> <p>75. Public relations</p> <p>76. Public relations</p> <p>77. Public relations</p> <p>78. Public relations</p> <p>79. Public relations</p> <p>80. Public relations</p> <p>81. Public relations</p> <p>82. Public relations</p> <p>83. Public relations</p> <p>84. Public relations</p> <p>85. Public relations</p> <p>86. Public relations</p> <p>87. Public relations</p> <p>88. Public relations</p> <p>89. Public relations</p> <p>90. Public relations</p> <p>91. Public relations</p> <p>92. Public relations</p> <p>93. Public relations</p> <p>94. Public relations</p> <p>95. Public relations</p> <p>96. Public relations</p> <p>97. Public relations</p> <p>98. Public relations</p> <p>99. Public relations</p> <p>100. Public relations</p>			

Source: Public relations records, 1950-1960.

In aid of the health conditions of the large number of individual contacts were made. The incidence of reports of this indicates the public's belief in the value of the program. During a routine check on a government building in Grandfield, Nev., the warden reported that "there are a lot of people at the test site, and they are making a lot of noise over in a small place like Grandfield." It would be noted, however, that although relations developed in the area were generally good, there are some possible areas of concern. An example of this is the attitude of the newspaper editor in Grandfield, who contrary to efforts to improve his quality of his relations, highly critical attitude toward the activities.

Other news releases were distributed in the news release of the Air Force. These releases were widely used by monitors. However, the most widely used piece of material was the little yellow booklet, "What to Do if You Hear a Bomb Blast in the Region." Thousands of these were distributed through hotels, post offices, motels, and by other means throughout the Grandfield area and in parts of Arizona and California. These releases were well received. In fact, some people took the releases and distributed copies to distribute on their own. Many of these releases were picked up by tourists and were probably carried to other parts of the region.

Special investigations were conducted to that numerous incidents requiring investigation were reported. These were of three types, as they affected a great number of people, or individuals. All that came to the attention of the Air Force program were investigated and are documented in the files.

With respect to health conditions, a significant number of complaints were from first responders. The nature of these complaints (nature of radio activity) for Grandfield was generally of the nature of complaints where blast damage was reported. Some of these complaints were mailed and these are being processed in the central area. In those cases where contamination of individuals was reported, such as on vehicles, the zone personnel (including the Air Force) were able to satisfy people during the investigation of these complaints.

A number of cases of radiation sickness were reported. These were investigated by the Grandfield Area Commander, Dr. Clinton T. Howell, who is a physician. It was reported that it became apparent that a physician should be called to medical personnel to also act as medical officers. In response to this, a qualified doctor with an M.D. degree was called to the area within the off-site program. The case papers of these individuals claim of personal radiation injury.

There were no reports of radiation sickness. All investigations were made in accordance with the Air Force program. This procedure eliminated any possible criticism of the Air Force's activities, increased the public's confidence in the program, and had much to educate the local population in the area of radiation safety.

Appendix No. 7

Photographs

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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 Oikerill, 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 Oikerill, 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 Olkeriii, 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. Kumagai (l) and Chairman Borja (r) compare notes as the Committee heads back to Saipan from Japan.



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 Lekoji died of leukemia in November of 1972.



Some of the Paraphernalia of the survey team aboard the Militobi during the September survey.



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 Utirik.



Dr. Conard on the bridge of the Millitobi, at the beginning of the September survey.



Members of the BNL team aboard the M/V Millitobi (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 Wiliander, Chairman Borja, Representative Balos, Health Aide Joe Saul, Laboratory Technician Nelson Zetika and Dr. Kumangai.



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 was 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.

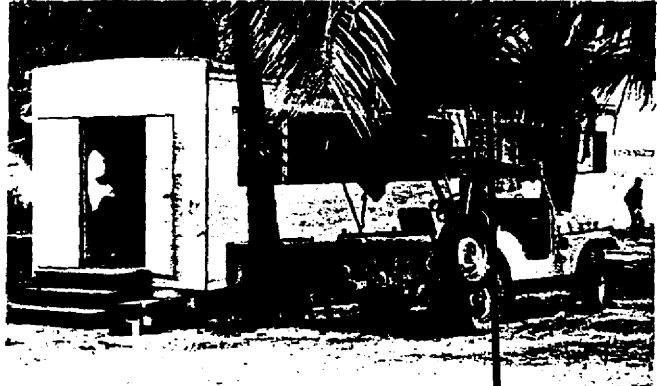


A patient giving her medical history to Dr. Ezra Wikton.

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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 Shonber taking a blood sample.

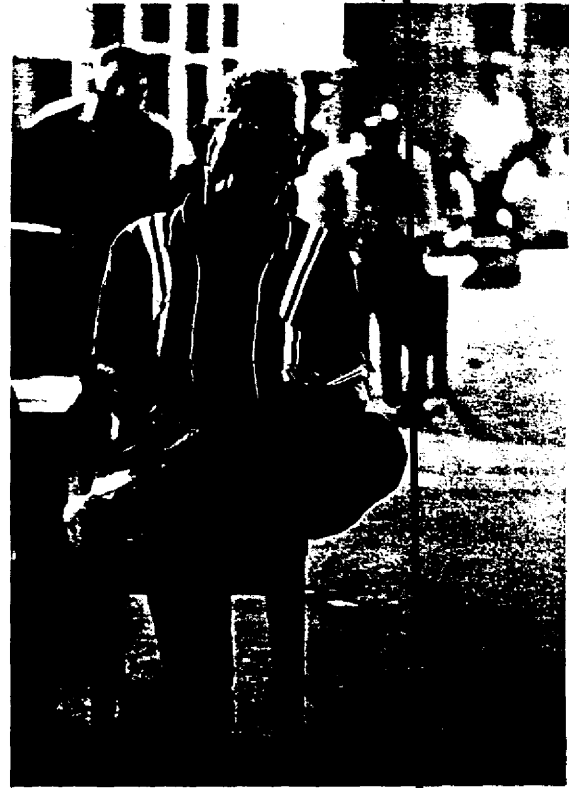


Dr. Kumatori (I) and Dr. Ezaki during the September survey.

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Dr. Conard checks for thyroid nodules during examination of a resident of Rongelap.



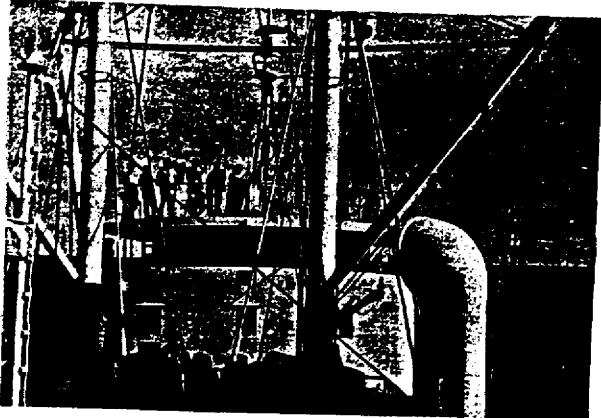
An attentive listener at the meeting of the committee with the people of Rongelap.



The people of Rongelap at a public meeting requested by the Committee.



Captain Willie Poznanski preparing to pilot the Militobi through the Utrik Pass.



Members of the survey team with Captain Willie on the flying bridge of the Millitobl as it navigates the tricky pass at Utirik.



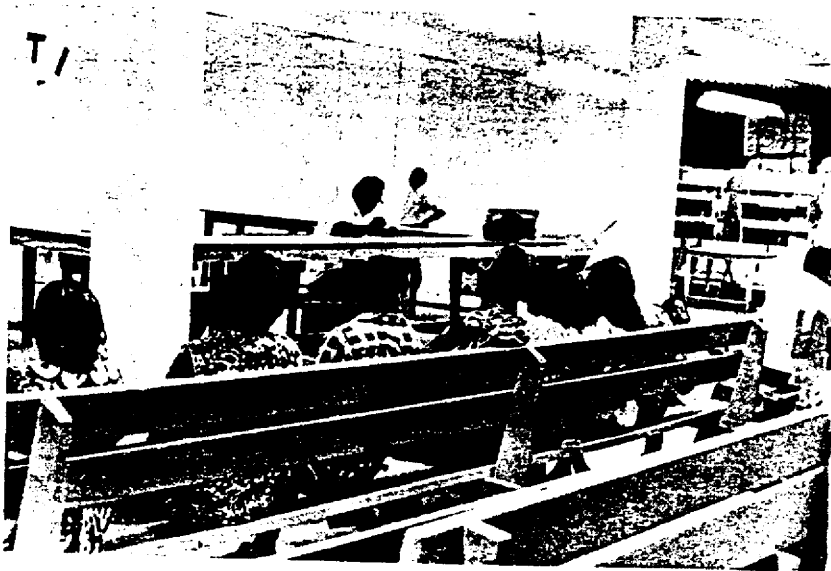
The village pathway at Utirik.



The Committee and the people of Utirik after an island meeting, in July.



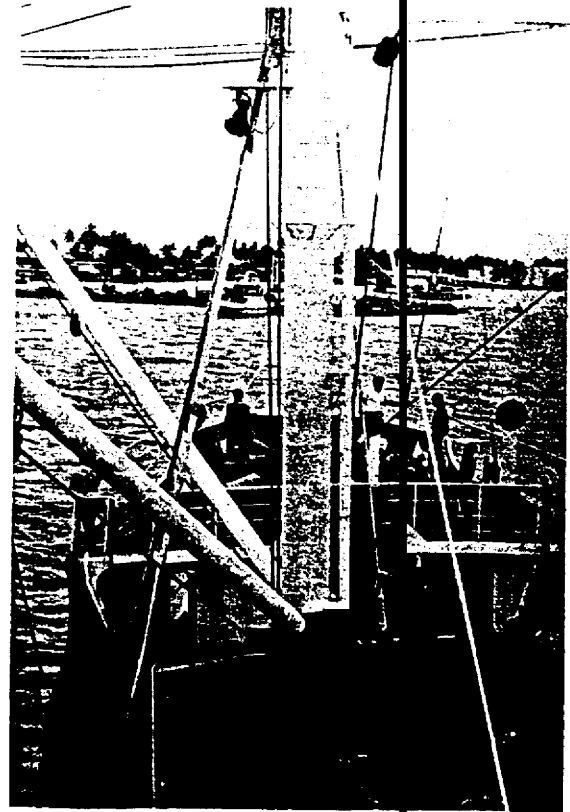
Another view after the same meeting.



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 Miltobi returns to Majuro after the Rongelap and Utrik 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 Zetka, Dr. W.W. Sutow, Assistant Medical Equipment Repair Specialist Kosang Mizutoni, Dr. Robert A. Conard, Dr. Haruo Ezaki. Second Row, standing: Laboratory Technician Supervisor Sebio 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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