Vol 4

MEDICINE, HEALTH AND SAFETY 3 RADIATION

Vol. 4 Correspondence beginning with 8-16-60 to 12-31-61
Vol. 5 Correspondence beginning with 1-1-62 to

MH&S 3 Radiation Vol. 2

	Date	To	From	Class	Pgs.	No.	To	From	Class
1	1-18-62	AEC 604/61	vee						
2	1-22-62	AEC 604/62. Radiation Protection Activities of Federal Agencies	vee						
3	1-2-62	AEC 604/60 Radiation Exposure Guidance for NTR Mgr.	vee	c					
4	2-15-62	Health Implications of Fall-Out	vee						
5	2-27-62	AEC 604/63	skw	ouo					
6	2-28-62	Effects of Enhanced Radiation Weapons	vee	s	3				
7	4-3-62	AEC 604/64 Radiation and Health American Medical Associa Effect of Radiation on Health	vee						
8	4-26-62	Natl. Cmtee on Radiation Protection & Measurements	vee						
9	6-12-62	AEC 604/65 Off-Site Radiation Exposure Criteria for NTS Radiation Exposure Criteria for NTS NTS Off-Site Radiation Exposure Criteria for Off-Site Radiation Exposure for NTS	skw	s	10				
10	6-29-62	AEC 604/66	skw						
11	6-12-62	Radiation Study of Indian Nationals. Indian Nationals, Radiation Study	skw						

[redacted]

[redacted]

AEC 604/66

June 29, 1962

COPY NO. 36

ATOMIC ENERGY COMMISSION

IODINE-131 LEVELS IN MILK

Note by the Secretary

The General Manager has requested that the attached memorandum from the Deputy Director, Division of Operational Safety, be circulated for the information of the Commission.

W. B. McCool
Secretary

AEC 604/66

SPECIAL REREVIEW FINAL DETERMINATION Class UNCL.	Reviewers	Class.	Date
	Jose Diaz		12/3/80

By G Hahn 5/3/85

DISTRIBUTION	COPY NO.
Secretary	1
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Asst. GM Operations	12
Asst. Gen. Mgr. R&D	13
Asst. Gen. Mgr. Adm.	14
Asst. to the GM	15
General Counsel	16 - 20
Biology & Medicine	21
Congr. Liaison	22
Public Information	23 - 24
Inspection	25
Military Application	26
Operational Safety	27 - 31
Radiation Standards	32
D. C. Office	33 - 35
Secretariat	36 - 41

[redacted]

6-29-62

[redacted]

[redacted]

OPTIONAL FORM NO. 10
5010-108

UNITED STATES GOVERNMENT

Memorandum

TO : Those Listed Below DATE: June 27, 1962

FROM : Gordon M. Dunning, Deputy Director
Division of Operational Safety

SUBJECT: IODINE-131 LEVELS IN MILK

OS:DIR:GMD

On June 26, 1962 the Public Health Service reported informally to us that they had found 1240 micromicrocuries of iodine-131 per liter of milk at Spokane, Washington. The tables below summarize the recent data for Spokane and other relevant places.

The following summarize the points in regard to the high level at Spokane, Washington.

1. PHS has agreed to recheck the high number and if they have saved the sample they will send part of it to our Health and Safety Laboratory for cross checking. (You will recall that in a smiliar instance for rain water PHS agreed to a similar arrangement, but apparently it is necessary to clarify this point for the various types of collections since there are different PHS personnel involved.)

2. We have checked Hanford and Idaho Operations Offices and find nothing unusual at either locality in regard to release of iodine-131.

3. The Weather Bureau has run preliminary trajectories which indicate the possibility that the debris from Des Moines shot on June 13, 1962 at NTS could have been carried into the Washington State area.

Addressees:
D. A. Ink, AGM
E. J. Bloch, AGMO
N. H. Woodruff, Director, OS
Forrest Western, Director ORS
D. C. Clark, Director, PI
Brig. Gen. A. W. Betts, Director, MA

[redacted]

[redacted]

[redacted]

4. We have requested PHS to compile the data on milk for all of their stations in the West to better determine how widespread is the iodine in the milk. Also, PHS has agreed to look at the data decay on their air filters to give another crude estimate at time of origin of the fallout.

5. It is still too early to come to a conclusion but the preliminary evidence strongly suggests that the high levels of iodine-131 in milk came from Des Moines shot at NTS. If this eventually proves to be true, we have some serious problems. As you recall, Dr. Edward Martell testified at the recent Congressional Hearings that the high iodine levels in the country were due principally to the Nevada tests. This hypothesis probably will be proven incorrect as soon as a study is completed. However, if the Des Moines event did cause these levels it will only add substance to Dr. Martell's hypothesis for other tests at NTS. You will also recall that the Des Moines event released substantially greater amounts of radioactivity than the other underground events at NTS. Also, since it was detonated underground, the activity was not carried to relatively great heights and thus was not widely dispersed as it would be for a detonation in the open. Among other things, this should put us on warning to watch carefully any future planned shots of this type.

Recent Iodine-131 Levels in Milk (micromicrocuries per liter)

Spokane, Washington		Seattle, Washington	
June 11	< 10	June 16	10
June 21	1240	June 20	440

Portland, Oregon		Idaho Falls, Idaho	
June 12	< 10	June 12	< 10
June 19	120	June 14	30
		June 17	< 10

[redacted]

[redacted]

[redacted]

Total Estimated Intake Iodine-131 From Milk
Since September 1961 to June 19, 1962
(Micromicrocuries)

Minneapolis, Minnesota	31,020
Des Moines, Iowa	30,230
Kansas City, Kansas	28,880
Other stations	< 24,000

[redacted]

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON 25, D.C.

JUN 2 8 1962

Honorable Melvin Price
Chairman, Subcommittee on Research,
Development and Radiation
Joint Committee on Atomic Energy
Congress of the United States

Dear Mr. Price:

During discussion before your Subcommittee on June 4, questions were raised concerning the role of the Commission in investigating the populations living on the thorium-bearing monazite sands of Kerala in Southwest India.

As stated in the testimony, the U.S. has frequently called attention to the potential value of studying these populations. The sands have been used as a source of thorium for many years and their significance radiobiologically was noted at the 1955 Atoms-for-Peace Conference. Dr. Shields Warren of the U.S. Delegation to the U.N. Scientific Committee on the Effects of Atomic Radiation, offered the Indian delegation every assistance on behalf of the U.S. Atomic Energy Commission as early as 1957. There was additional recognition of the importance of studying these populations during the 1958 Atoms-for-Peace Conference and at the twice-yearly meetings of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR); also, the World Health Organization convened a special conference on "Investigation of Areas of High Natural Radiation" (1955), but the impetus from it was small. The latest report of UNSCEAR, which will be published in September, will have only a few additional data on the Kerala area. There are always many difficult practical problems involved in the scientific study of such populations. The Indian Government is, of course, in the best position to evaluate these factors as they relate to the Kerala region.

If we can provide additional information please let me know.

Sincerely yours,

SIGNED, A. R. LUEDECKE

General Manager

cc: General Manager
AGMIA
AGM/RD
Cong. Liaison (2)
DIA
Secretariat (2)

cc: Chairman
Comm. Graham
Comm. Haworth
Comm. Olson
Comm. Wilson

DIR.DBM: DIA CONG.LIAISON AGM/RD AGM OGM
CLDunham:Ne RXDonovan
Retype 6/21/62

Info mtg 162

79-829

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M.L. 5-3 Pub Jet

Congress of the United States

JOINT COMMITTEE ON ATOMIC ENERGY

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WALLACE F. BENNETT, UTAH

June 25, 1962

Honorable Glenn T. Seaborg
Chairman
U. S. Atomic Energy Commission
Washington 25, D. C.

Dear Dr. Seaborg:

I am forwarding for your information a copy of a letter which was recently sent by Congressman Price and myself to Secretary Ribicoff in his capacity as Chairman of the Federal Radiation Council.

The letter raises certain questions concerning the applicability of the Radiation Protection Guides established by the Federal Radiation Council to fallout from nuclear testing and, in addition, requests further information on the legal authority to invoke countermeasures.

If you have any comments, particularly with respect to the applicability of the Radiation Protection Guides to fallout, we would appreciate an expression of your views.

Your cooperation is appreciated.

Sincerely yours,

Chet Holifield

Chet Holifield
Chairman

Enc.

Cy ltr from Price and Holifield to Ribicoff dtd 6/18/62

6-25-62

Holifield's letter.

CHET HOLIFIELD, CALIF.
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Congress of the United States

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GEORGE D. AIKEN, VT.
WALLACE F. BENNETT, UTAH

June 18, 1962

Honorable Abraham Ribicoff
Chairman
Federal Radiation Council
Washington, D. C.

Dear Mr. Chairman:

In reviewing the record of our recent hearings on "Radiation Standards, Including Fallout," there are apparently a number of unresolved questions, which had also been left open after our 1960 hearings on "Radiation Protection Criteria and Standards." The need for resolving these matters is increased by the recent resumption of atmospheric nuclear tests by the Soviet Union and the United States.

Our first question concerns the relation between the Radiation Protection Guides (RPG) promulgated by the Federal Radiation Council and the incidence of radioactive fallout as a result of nuclear weapons testing.

At the 1960 hearings, Dr. Chadwick, then secretary of the FRC, was asked by Mr. Holifield whether the new RPGs applied to "problems which may develop in relation to fallout . . ." His response was:

> "Sir, as indicated in the testimony, special problems would require special consideration by the Council."

When requested by the Committee to further clarify this matter, the Federal Radiation Council commented as follows:

> " . . . The Council is aware that the numerical values of the Radiation Protection Guides and Radioactivity Guides may also be interpreted to apply to normal peacetime situations in contrast to 'normal peacetime operations.' When used in

COPY

this way, the Guides may be considered to define environmental levels consistent with normal peacetime situations based on the levels of environmental radioactivity regardless of its source. In this sense, the graded series of ranges related to the intake of radioactive materials provided in Report No. 2 may be taken to indicate the general conditions under which special consideration must be given and possible corrective actions considered."

The testimony on this point at our recent hearings continued to be clouded. The testimony of Dr. Russell Morgan implied that countermeasures should be ordered when radiation doses reached, or showed signs of reaching, the levels prescribed in the radiation protection guides. The thrust of the recent National Advisory Committee on Radiation (NACOR) report is to the same effect.

Surgeon General Terry's statement, in releasing the NACOR report, was as follows:

"If daily intakes are above this level (Range II of the RPG) and into Range III and are likely to persist, then exceeding the RPG becomes a distinct possibility, and in such circumstances countermeasures are to be considered."

It is thus the implication of the Surgeon General's statement, the NACOR report, and Dr. Morgan's testimony, that the FRC's radiation protection guides may be applicable in determining when unacceptable concentrations of radioactive nuclides from fallout have been reached.

On the other hand, we have seen plain evidence from the Introduction to Report No. 1 of the Federal Radiation Council that, "Only peacetime uses of radiation which might affect the exposure of the civilian population are considered at this time." Report No. 2 repeated the statement contained in Report No. 1 that, "The guides recommended herein are appropriate for normal peacetime operations."

Furthermore, the guides have been repeatedly described as consistent with, and based on, the same evidence as NCRP levels and recommendations, which are universally acknowledged to be based on non-military activities.

Moreover, testimony at our hearings, particularly that of Dr. Gordon M. Dunning of AEC, emphasized that the

COPY

RPGs are based on a balancing of risk against benefit in the context of peacetime operations and that to use them in deciding when to invoke countermeasures against fallout is an "improper use of those guides." Dr. Dunning emphasized that the question of the applicability of the guides to fallout "should be clarified at once before there is further confusion and before there may be an ill-advised action taken by some regulatory body."

We deem it of utmost importance to have your response to the following questions:

(1) Are the numerical values of the radiation protection guides established by the Federal Radiation Council the sole or principal criteria now used in evaluating when undesirable levels of radioactive nuclides from fallout have been reached?

(2) If so, is this use of the present numerical values of the guides sufficient to indicate when and what action is appropriate to protect public health?

(3) If not, is the development of further or supplementary criteria needed; and if so, is it the responsibility of the Federal Radiation Council or of the Public Health Service or others to develop and implement such criteria?

You are undoubtedly aware that the Chairman of the Joint Committee, in a letter to the President dated January 16, 1962, suggested that the FRC should review the possible effect of fallout from proposed U.S. testing (copy attached). We, of course, do not necessarily believe that the FRC guides should constitute the criteria if they were not so intended. However, we do believe that all significant additions of radioactivity to the environment including fallout should be reviewed by the FRC and evaluated against appropriate standards.

The other important matter left open after our hearings is, where does the legal responsibility and authority lie for invoking countermeasures?

During the testimony of the Surgeon General, he was asked the following question by the Committee staff:

COPY

"Does the Public Health Service have the legal authority to initiate such countermeasures as banning the sale of fresh milk and requiring special processes to decontaminate food stuffs?"

His reply was:

"We certainly have the responsibility for the surveillance and for making the recommendations. I am not absolutely certain just exactly where our legal [authority is] or how far our legal authority extends."

It was noted in the hearings that the actual implementation of countermeasures would have to be accomplished by state health authorities, but no indication was given as to whether the states have the necessary authority and means of administration to accomplish the countermeasures.

We believe it is extemely important that this matter be clarified, in order to alleviate public concern over the hazards of ionizing radiation and to minimize the possibility of uncoordinated and ill-advised actions being taken should certain radionuclides reach undesirable levels in the environment.

We wish, therefore, to request your views on the current status of legal authority and responsibility for invoking countermeasures or taking any other action, including any recommendations you may have in this regard.

Because we regard these matters as being of considerable importance and urgency, we would request your consideration at the earliest possible date. To that end we would like to suggest that our respective staffs should meet together on June 21 or June 22 to explore these problems further.

Your cooperation is appreciated.

Sincerely yours,

Melvin Price, Chairman
Subcommittee on Research,
Development and Radiation

Chet Holifield
Chairman

MH.S-3

FEDERAL RADIATION COUNCIL
EXECUTIVE OFFICE BUILDING
WASHINGTON 25, D.C.

June 22, 1962

MEMORANDUM FOR: Members of the Federal Radiation Council

SUBJECT: Request for Information from the Joint Committee on Atomic Energy

On June 20, 1962 the Secretariat received the attached letter signed by Chairman Holifield of the Joint Committee on Atomic Energy and Chairman Price of the Subcommittee on Research, Development, and Radiation. The letter requests that the Council furnish replies to three specific questions, noted on page 3, and the Council views on the current status of legal authority and responsibility for invoking countermeasures or taking any other action.

As noted in the last paragraph of the letter, it is suggested that the respective staffs meet on June 21 or 22 to explore these problems further. Mr. Ramey was contacted by telephone, and since schedules did not permit a meeting on the 21st or 22nd, he suggested June 29 at 2 p.m.

The subject of the attached letter will be offered as an agenda item for the next Council meeting.

C. C. Palmiter

C. C. Palmiter
FRC Secretariat

Attachment

Transmitted to Commissioners
By Memo: 6-28-62

6-22-62

Encl. No. 5-3

Reference Section

OPTIONAL FORM NO. 10
5010-104

~~OFFICIAL USE ONLY~~

UNITED STATES GOVERNMENT

Memorandum

TO : Brig. Gen. A. W. Betts, Director
Division of Military Application

DATE: June 20, 1962

FROM : W. B. McCool, Secretary Original signed W. B. McCool

SUBJECT: AEC 604/65 - OFF-SITE RADIATION EXPOSURE CRITERIA FOR NEVADA TEST SITE

SYMBOL: SECY:WLW

1. We informed your office on June 20, 1962, that at Meeting 1854 on June 15 the Commission approved in principle AEC 604/65 and suggested appropriate staff action confirming established policy.

2. The General Manager has directed you to take the action required by the above decision. Copies of pertinent correspondence should be provided the Office of the Secretary.

cc:
Chairman
General Manager
Deputy General Manager
Asst. General Manager
General Counsel

~~OFFICIAL USE ONLY~~

6-20-62

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JAMES T. RAMEY, EXECUTIVE DIRECTOR

Congress of the United States
JOINT COMMITTEE ON ATOMIC ENERGY

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WALLACE F. BENNETT, UTAH

June 18, 1962

Honorable Abraham Ribicoff
Chairman
Federal Radiation Council
Washington, D. C.

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> this way, the Guides may be considered to define environmental levels consistent with normal peacetime situations based on the levels of environmental radioactivity regardless of its source. In this sense, the graded series of ranges related to the intake of radioactive materials provided in Report No. 2 may be taken to indicate the general conditions under which special consideration must be given and possible corrective actions considered."

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RPGs are based on a balancing of risk against benefit in the context of peacetime operations and that to use them in deciding when to invoke countermeasures against fallout is an "improper use of those guides." Dr. Dunning emphasized that the question of the applicability of the guides to fallout "should be clarified at once before there is further confusion and before there may be an ill-advised action taken by some regulatory body."

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You are undoubtedly aware that the Chairman of the Joint Committee, in a letter to the President dated January 16, 1962, suggested that the FRC should review the possible effect of fallout from proposed U.S. testing (copy attached). We, of course, do not necessarily believe that the FRC guides should constitute the criteria if they were not so intended. However, we do believe that all significant additions of radioactivity to the environment including fallout should be reviewed by the FRC and evaluated against appropriate standards.

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"Does the Public Health Service have the legal authority to initiate such countermeasures as banning the sale of fresh milk and requiring special processes to decontaminate food stuffs?"

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We wish, therefore, to request your views on the current status of legal authority and responsibility for invoking countermeasures or taking any other action, including any recommendations you may have in this regard.

Because we regard these matters as being of considerable importance and urgency, we would request your consideration at the earliest possible date. To that end we would like to suggest that our respective staffs should meet together on June 21 or June 22 to explore these problems further.

Your cooperation is appreciated.

Sincerely yours,

Melvin Price

Melvin Price, Chairman
Subcommittee on Research,
Development and Radiation

Chet Holifield

Chet Holifield
Chairman

Rec'd 6-25-62

Enclosure

C
O
P
Y

JOINT COMMITTEE ON ATOMIC ENERGY
Congress of the United States

January 16, 1962

Dear Mr. President:

I would like to endorse the suggestion that our Staff Director, Jim Ramey, made to Mac Bundy and Adrian Fisher to the effect that prior to any formal decision or announcement by you on the resumption of atmospheric testing a review of the extent of the fallout hazard be made by the Federal Radiation Council. At the time of any such announcement of the resumption of atmospheric testing a "white paper" should be issued which would not only explain affirmatively why we are resuming testing but also explain the extent of the fallout hazard (which would be minimal).

As you know, there is still a great deal of confusion and misinformation on the fallout hazard from weapons testing. The Joint Committee's fallout hearings in 1957 and 1959, and our hearings on the radiation standards in 1960, helped to put these hazards in proper perspective. In the latter hearings several suggestions were made that any possible significant addition of radioactivity to the environment should be reviewed in advance by the Federal Radiation Council, even though it would fall within acceptable maximum limits. This would prevent various uses from gradually absorbing the present safety factor under our existing maximum permissible dosages. Such a review would be helpful to you in your evaluation of the hazards versus the benefits of resumption of atmospheric testing.

A "white paper" written in simple terms might have some effect on the scientific community as well as the public at large. We are presently considering the desirability of holding public hearings later in this year which would update our 1959 fallout and 1960 radiation standards hearings.

Following our executive hearings on Thursday and Friday, January 18 and 19, on the status of our plans and preparations for testing, we will probably wish to communicate with you further.

Sincerely yours,

Chet Holifield
Chairman

The President
The White House

MN 5-3

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OPTIONAL FORM NO. 10
5010-104
UNITED STATES GOVERNMENT

Memorandum

TO : File

DATE: June 12, 1962

FROM : W. B. McCool, Secretary

SUBJECT: LETTER TO SENATOR ANDERSON RE RADIATION STUDIES

SYMBOL: SECY:JCH

This is to confirm my conversation with Dr. Charles Dunham, Director, Division of Biology and Medicine, on June 6, 1962, concerning the Chairman's request at Information Meeting 162 on June 6, for preparation of a letter to Senator Anderson in response to the Senator's query at the current Radiation-Fallout Hearings re a radiation study of certain Indian nationals.

cc:
Chairman
General Manager
Deputy General Manager
Asst. General Manager
Asst. Gen. Mgr. for Research and Development
Asst. to the General Manager
Director, Biology & Medicine
General Counsel

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6-12-62

CLASSIFIED DOCUMENT CROSS-REFERENCE SHEET

DATE: 6/12/62

TO: Staff Paper

FROM: AEC 604/65

THIS CLASSIFIED DOCUMENT HAS BEEN REMOVED FROM THE FILES AND PLACED IN A CONSOLIDATED CLASSIFIED FOLDER OF THE SAME TITLE.

Mi/4.5-3

United States Senate
Minority Leader

June 6, 1962

The Honorable Glenn T. Seaborg
Atomic Energy Commission
Washington 25, D. C.

Dear Dr. Seaborg:

I would appreciate any information or comments you might have regarding the discussion of food contamination by fallout contained in the attached letter from Mrs. Sam Lazrvshy, 7914 South Burnham, Chicago 17, Illinois. Please return her letter with your reply.

Sincerely,

Everett McKinley Dirksen

Enclosure

Transmitted to Commissioners
by Memo: 7-13-62

6.6.62

7914 S. Burnham
Chicago 17, Ill.
May 18, 1962

Honorable Senator Dirksen
United States Senate
Capitol Bldg.
Washington D C

Dear Senator Dirksen:

You are a fearless adversary whose main concern is the welfare of those who are your constituents. This is the reason I am writing to you.

Fight for the rights of all the people, especially the children, to live as sane, decent human beings, without Radiation Exposure.

The parents who care the most and who are trying to raise the healthiest adults will fail because all the primary foods -- milk, vegetables, fruits-- all vital foods -- will be contaminated by fallout.

I am certainly not a crank and despise communism more than anyone but feel if we bring pressure to bear on our enemies in another fashion all mankind will benefit.

After all, Russia doesn't want a generation of freaks and idiots any more than we do.

I know we can count on YOU!

Sincerely yours,

(Mrs.) Sam Lazowsky

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON 25, D.C.

July 2, 1962

Dear Senator Dirksen:

This is in reply to your letter of June 8, 1962, forwarding a letter from Mrs. Lazrvshy and requesting comments on her discussion of food contamination from fallout.

There is no question that some, but very slight, radioactive contamination of food occurs from fallout. Contamination of food occurs also from radioactive substances that are naturally in our environment. In addition, we receive radiation from outside the body, both from natural sources as well as from fallout. Since radiation exposure is not a new experience to man, the basic questions are: how much more exposure do we receive from fallout, and how serious may the effects be. The total radiation to the average American from all fallout to date has amounted to only two to three percent of that from natural sources of radiation plus medical and dental x-rays.

Both the second and third paragraphs of Mrs. Lazrvshy's letter suggest that she may be unaware that people are and have always been unavoidably exposed to the same kinds of radiation from many natural sources, including radioactive material in foods. We accept additional exposure to radiation when we are assured that they serve sufficiently useful purposes, as in the common use of x-rays for medical treatment and for dental and medical diagnosis. The basic question with respect to the control of exposures of people to radiation is whether the reasons for accepting any avoidable exposure are sufficient to justify any additional risks to our health and welfare which might possibly result.

The last paragraph of her letter refers to the observation that exposures of experimental animals to large amounts of radiation have produced observable increases in the incidence of genetic changes in their offspring. These increases are generally proportional to the exposure. While the exposure to radiation from fallout to be expected from weapons tests are much too small to produce observable increases in the incidence of genetic effects, geneticists believe that small increases probably do occur.

To appreciate the significance of the genetic effects of radiation, it is necessary to understand that most of the genetic changes which normally occur are believed to be unrelated to exposure to radiation. About five percent of all children born alive have some physical or mental abnormality. About one-half of all defects at birth are believed to be of genetic origin.

Since the genetic risks from exposure to fallout are the same kinds of genetic risks with which we would be faced if there were no fallout, or no exposure to radiation from any other source, the pertinent question is: How much might these risks be increased by exposure to fallout? This and other questions relevant to Mrs. Lazrvshy's letter have been discussed in the attached report entitled Health Implications of Fallout from Nuclear Weapons Testing Through 1961, by the Federal Radiation Council.

In Table II, Page 9, of the Report, it is estimated that among the total number of children that may be born to persons now living in the United States, from 4,000,000 to 6,000,000 may exhibit some gross physical or mental defect from all causes. Of the total number of defects which will occur, it is estimated that from 20 to 500, perhaps about 100, might be due to exposure to fallout from all weapons tests performed through 1961. In terms of risk the chance that a child will be born with a gross genetic defect, as the result of exposure of his parents to fallout from all tests held through 1961, is estimated to be only one in a million, as compared to the chance (five in a hundred) that he will be born with such a defect from some other cause.

We hope these comments and the attached report will be helpful to you and to Mrs. Lazrvshy. We will be pleased to furnish you with any additional information you may wish.

Sincerely yours,

/s/ Robert E. Wilson

Acting Chairman

Honorable Everett N. Dirksen
United States Senate

DATE:

INDEX: MH&S-3-Radiation

[redacted]

TO:

FROM:

SUMMARY: AEC 496/89: JCAE HEARINGS ON RADIATION STANDARDS, INCLUDING FALLOUT. Correspondence between the JCAE and the Federal Radiation Council with re to the Council's participation in the JCAE Hearings, "Radiation Standards, Including Fallout".

FILED:

INDEXER: O&M-7-JCAE Vol. 3

REMARKS: date of paper: 5-31-62

U. S. ATOMIC ENERGY COMMISSION

CORRESPONDENCE REFERENCE FORM

5-31-62

☆ U. S. GOVERNMENT PRINTING OFFICE: 1949 - 77088

CLASSIFIED DOCUMENT CROSS-REFERENCE SHEET

DATE: 6/4/52

TO: Mtg w/ Adm Rickover on Visits of Nuclear Vessels

FROM: to Pedts

THIS CLASSIFIED DOCUMENT HAS BEEN REMOVED FROM THE FILES AND PLACED IN A CONSOLIDATED CLASSIFIED FOLDER OF THE SAME TITLE.

MAY 22 1962

Dear Senator Humphrey:

This is in reply to your letter of May 1, 1962 concerning monitoring of strontium-90 in milk.

The Atomic Energy Commission has as plans to make regular public announcements of the amount of strontium-90 in milk. As you know, the U. S. Department of Health, Education, and Welfare has statutory responsibilities in this field including the issuance of warnings if levels of radioactivity should ever become unacceptably high. The Atomic Energy Commission is cooperating fully with this and other agencies in the exchange of information and evaluation of the data.

Members of the staff of the Atomic Energy Commission have been pleased to participate in several briefings and discussions with representatives of the milk industry. Enclosed is a copy of background material (Fallout from USSR 1961 Nuclear Tests) presented by a member of the Commission's staff at a meeting of the milk industry at Beltsville, Maryland on December 18, 1961, as well as additional materials that you may find helpful.

For a number of years the Commission has measured the amount of strontium-90 in pasteured or liquid milk at four localities (Ferry, N. Y., New York City, Meadow, N. D. and Honolulu, Hawaii) and also has measured the total diets, including milk, at three other localities (New York City, Chicago and San Francisco). These studies are a part of a long range research effort to gain a better understanding of the phenomenology of fallout. These data are reported in the unclassified technical quarterly reports of the Commission's Health and Safety Laboratory located in New York City, and submitted for inclusion in Radiological Health Data monthly reports issued by the U. S. Public Health Service.

Data from AEC sponsored research studies indicate that in the United States 20-50 per cent of the strontium-90 in the total diet may be from milk and milk products but at the same time

Transmitted to Commissioners
by Memo: 5-31-62

over 60 per cent of the daily intake of calcium also comes from milk. The body requires about a gram of calcium per day. If calcium is available in the total diet, it will be preferentially selected by the body over strontium. Thus, the ratio of strontium-90 to calcium in the diet is the important factor. Dietary studies by Dr. C. L. Comar at Cornell University indicate that a non-milk diet would most likely have as much as three times the strontium-90/calcium ratio as does milk.

Even though it is not the most highly contaminated foodstuff, milk is probably the best indicator of diet contamination levels for routine monitoring purposes. This is because its chemical composition is very uniform, it is produced throughout the country and throughout the year, and it is an important and widely used food, particularly for young children. The ratio of strontium-90 to calcium in the total diet can probably be more reliably estimated from measurements on milk, with suitable correction factors, than from any other single food item.

In comparison all of the relevant studies in this field have shown that water is not a good indicator of potential levels of strontium-90 in the human bones. Firstly, the concentration of strontium-90 is relatively low in water as compared with many other food items. Secondly, the normal calcium content of water is very low so the ratio of strontium-90 to calcium is relatively high. This second factor can give an erroneous impression of a serious degree of contamination since it is the amount of strontium-90 relative to the calcium in our total diet that is of principal importance in determining the amount of strontium-90 that may be deposited in the bones.

I will, of course, be pleased to furnish you with any additional information you may wish.

Sincerely yours,

(Signed) Glenn T. Seaborg

Chairman

The Honorable Hubert H. Humphrey
United States Senate

May 22, 1962 - Retyped in
Chairman's Office ABFritschies

Enclosures
1. Ion Exchange Process for Removing Radioactive Strontium from Milk
2. TID-14377 "Fallout From USSR 1961 Nuclear Tests"
3. "Fallout and Our Food Supply"

Mtl. S. 3

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OPTIONAL FORM NO. 10
5010-104

Reference Section

UNITED STATES GOVERNMENT

Memorandum

TO : File

DATE: May 15, 1962

FROM : W. B. McCool, Secretary Original signed W. B. McCool

SUBJECT: ESTABLISHMENT OF SPECIAL COMMITTEE TO STUDY EFFECTS OF HIGH ALTITUDE EXPERIMENTS

SYMBOL: SECY:AHE

1. At Information Meeting 152 on May 9, 1962 the Chairman requested establishment of a special committee to study the effects of high altitude experiments. The Chairman further noted that Dr. Van Allen is to be a member of this committee.

2. The Committee to Study the Effects of High Altitude Experiments met on May 14, 1962.

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Copy filed: Mtl. A-7-Testing Program

27515

EMIL T. HOLLY, ILL.
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Mno 5-3

Congress of the United States

JOINT COMMITTEE ON ATOMIC ENERGY

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WALLACE F. BENNETT, UTAH

May 9, 1962

Dr. Glenn T. Seaborg
Chairman
Atomic Energy Commission
Washington 25, D. C.

Dear Dr. Seaborg:

I am forwarding to you the enclosed letter that I received from Mr. Earl L. Morrow, which I believe raises a very serious problem, if true.

Without commenting on the matters enumerated by Mr. Morrow, I am sending you a copy of a letter which I have already written to him, and would sincerely hope that you would have your experts look into this matter to determine the real situation.

Trusting that you will give this your immediate attention, I am,

Sincerely yours,

John

John O. Pastore
United States Senator

JOP:ls

Enclosures

Transmitted to Commissioners
by Memo: May [illegible]

5-9-62

COPY

May 9, 1962

Mr. Earle L. Morrow
Old Baptist Road
RR #2
North Kingstown, Rhode Island

Dear Mr. Morrow:

I am very happy to acknowledge your letter of May 5, and hasten to observe, as you well know, that I do not have the scientific competence to pass judgment on the very serious problem which your letter poses.

I am very much concerned about this matter, and feel that it should be pursued so that we may scientifically determine the true situation. Therefore, I am following your suggestion and I am referring your letter -- and I hope it meets with your approval -- to Dr. Glenn T. Seaborg, Chairman of the Atomic Energy Commission, for his study and comments.

I shall be in touch with you again when I hear from Dr. Seaborg.

With every best wish, I am,

Sincerely yours,

John O. Pastore
United States Senator

JOP:ls

Earle L. Morrow
Old Baptist Rd.
RR#2
No. Kingstown, R. I.

May 5, 1962

Senator John O. Pastore
301 PO Annex
Providence, R. I.

Dear Senator:

I consider you a friend of man. You have helped me before directly. I wish now in the limits of my ability to inform you of facts that disturb me.

I am a Phi Beta Kappa: Summa Cum Laude:graduate of Dartmouth College in 1931 where I majored in Mathematics and Physics and was the only student picked by my professors to give the graduation speech, (my name then was Earle Morawski-- changed since then for business reasons): a Rhodes Scolarship candidate who lost. I hate at times even to mention the above-- but I realize if people do not know your mental qualifications there is little attention paid to your conclusions.

I have one simple problem that you can help solve because it takes additional knowledge for me as a father of three growing children to know when to let them go out in rain and when I cannot. To substantiate the need of this information that should be given to the public I am listing the following:

About four to five years ago I walked through the woods, near my home,after a rainfall that must have been loaded with radioactive material from one of our tests in Nevada. Within two months I had the complete pattern of my shoes imprinted in radiation burns upon my feet. I have confirmed the fact that they are radiation burns, from a doctor. That year was the same year all the pollen of the oak trees was destroyed leaving not a single acorn on any oak tree in this part of the world. All the squirrels on my land died and I heard that the squirrels were moving in mass from Roger Williams Park to find food. In addition I accidentally met an expert from the Permutut Corp., which has been hired to study the water situation by the state of Rhode Island. He informed me that in our area of Rhode Island in North Kingstown the radioactivity of the ground water supply has increased beyond that of any other part of the United States. This was the final confirmation I needed to confirm my conclusions that the acorns died and indirectly all the squirrels and that my feet were burnt radioactively from a single fall-out that landed on Rhode Island in a concentrated area.

Con.

Now I have observed that when the jet stream moves over our part of the Earth and the atmospheric conditions are correct a formation of a train of clouds will appear in the upper atmosphere. These will move across the sky in a single line, these clouds form as though the upper atmosphere were a Wilson chamber: a single streak of white condensation takes place and proliferates into a fair size cloud in seconds. I have watched this strange formation of clouds at least a dozen times: the most fantastic dienlay I watched was about five days after the Russians exploded the 50 megaton bomb.

In that I am quite certain these individual particles for known physical reasons will be sucked into the jet stream and that they will predominately fall out onto the Earth out of the jet stream is it not logical that if the known path of the jet stream exists as part of the knowledge of the Weather Bureau that they could warn the U. S. Public as part of their rainfall prediction when it is and is not necessary to keep out of the rain.

Certainly this service of saving our children, at the present day, of unnecessarily being radiated in a form that could cause future damage to their bodies should be available to the public. And in that I believe the greatest danger involves a fallout in rainy weather under the jet stream it should be a predictable thing under Weather Bureau service.

We donot wish to keep our children out of a rainstorm when there is no danger from radioactivity. Neither do we wish to send them out into unnecessary destruction to their bodies. I believe that any scientific investigation of the above will confirm what I have said.

I think too that you know that if the statistical average fallout indicates that there is no danger to human beings that the statistics can be utterly false if the statistics are averages and do not indicate concentrated fallouts. If, as in the acorn case and my Burnt feet 99% of that fallout landed on Rhode Island to the disastrous effects we know are true it is not important that if you average this fallout over the United States no harm would have been done. Nature is a fantastic violater of the law of statistics and therefore let us not violate this law of nature,, in reference to averaging the fallout of Rhode Island with the United States.

I will be most Thankful for Your serious consideration.

Sincerely,

Earle L. Morrow

Earle L. Morrow

MoS. 3

Dc 12

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DARRELL ST. CLAIRE, CLERK

United States Senate

COMMITTEE ON FOREIGN RELATIONS

May 1, 1962

Dr. Glenn T. Seaborg, Chairman
Atomic Energy Commission
Washington 25, D. C.

Dear Dr. Seaborg:

I understand that the Atomic Energy Commission will be making regular public announcements of the degree of Strontium 90 in milk. To single out this particular product is most unwise and unfair.

A series of announcements as to the degree of Strontium 90 in milk over the next few months could and possibly will lead to economic disaster for the dairy industry. Already there is considerable fear about Strontium 90 in milk. This has reduced milk consumption, causing an economic burden for the government, a decline in income for the dairy producer, and a serious economic problem in rural America. It is my view that the constant publication of Strontium 90 in milk is perhaps the most important single cause of the decline in milk consumption.

I respectfully suggest that it would be more practical for the Atomic Energy Commission to simply issue an assurance that whenever there appears to be excess radioactivity in foodstuffs, a warning would be issued. Furthermore, if it is necessary to continue these announcements, no one item of food, such as milk, should be singled out. It would be better if a determination could be made as to whether using water as a medium instead of milk would be just as accurate.

I do respectfully urge that prompt attention be given to this serious situation. Milk producers are terribly disturbed, and rightly so. Announcements from the Atomic Energy Commission can do irreparable damage to this industry. And might I add that if this radioactivity is as serious as these announcements would lead

Transmitted to Commissioners: 5-7-62

S-1-62

people to believe, then the question of further testing nuclear weapons becomes all the more a serious moral and political issue.

I welcome your suggestions and counsel.

Sincerely yours,

Hubert H. Humphrey

Hubert H. Humphrey

REPORT NO. 3

health implications of fallout from nuclear weapons testing through 1961

May 1962

Report of the

FEDERAL RADIATION COUNCIL

REPORT NO. 3

health implications of fallout from nuclear weapons testing through 1961

May 1962

Report of the

FEDERAL RADIATION COUNCIL

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CONTENTS

	Page
Report of the Federal Radiation Council	1
Appendix A	5
Appendix B	7
Acknowledgment	10

REPORT OF THE FEDERAL RADIATION COUNCIL

HEALTH IMPLICATIONS OF FALLOUT FROM NUCLEAR WEAPONS TESTING THROUGH 1961

The Federal Radiation Council has considered available information on radiation doses and possible health effects of atmospheric nuclear weapons testing. Before discussing the estimates made in this report in detail, it is appropriate to point out the difficulties of being precise in this field.

Although a large and expanding program for measuring radiation levels at a number of locations throughout the United States has been in effect for a number of years, the application of such data to the whole country, to an extended time period, or to the entire population involves assumptions than can not be completely validated. Furthermore, while a considerable body of information has been accumulated on the effects of radiation on animals and man, the possible effects of low doses delivered at low dose rates are insufficiently known to permit firm conclusions about the extremely low exposures resulting from fallout. Current experimental techniques are not good enough to detect biological effects at the low levels of worldwide fallout from nuclear tests.

Any possible manifestations resulting from fallout radiation will not be unique, for all of the diseases and disabilities known to be caused by radiation also occur for other reasons. Whatever effects might be produced by fallout could only be reflected in statistical increases in the number of conditions already present in the population. Any individual effects would be so diluted by space and time that they would not be recognizable among the much larger number of identical effects arising from other causes, among which they would be interspersed.

Finally, any proper understanding of estimates in this field must take into account the many different ways in which similar or even identical data can be expressed. Many of the apparent differences among scientists arise from different forms of presentation. Two approaches have been used. One estimates the risk of damage to a single person. This risk is extremely small in comparison with others which people normally accept. The second approach considers possible effects on a large population for a year or a generation or for several generations totaling hundreds of years. Even a very small proportion of affected individuals will, in a very large population for a long period of time, amount to an impressive total number of individuals.

Estimated Radiation Exposure from Testing

Any consideration of possible health effects from fallout must begin with the radiation doses to which people are exposed as a result of such tests.

A sharp distinction must be made between the devastating effects of "local" fallout in a nuclear attack on an unshielded population and the effects of fallout from weapons testing. Weapons testing creates far smaller total amounts of fission products so that its fallout is far less than that which would result from nuclear war. Furthermore, the tests are planned to avoid local fallout or to confine it to locations where it will have minimal effects. Hence, in weapons testing the problem is largely confined to delayed fallout which decays greatly in the upper atmosphere and is dispersed at low concentrations over the earth's surface. This report is concerned primarily with the effects of such delayed fallout.

Dose estimations must take into account exposure from all sources; external, and internal through ingestion of food and water and inhalation. Some radioactive elements may concentrate to different extents in various parts of the body. Those which tend to concentrate in a certain organ will selectively irradiate that organ. Thus a thyroid dose, for example, represents the sum of the whole-body dose from a variety of substances plus the extra dose from iodine-131, an element which tends to concentrate in the thyroid gland. In addition, some elements are taken up more effectively at one age than another. For example, the proportion of strontium-90 retained in the growing bones of children is greater than that retained in the bones of adults ingesting the same foods. Furthermore, different sources of radiation give off different kinds of radiation having different biological effects, so that doses cannot be directly compared. These points should indicate the difficulty of referring to any one exposure level from a particular source without identifying what kind of a dose and what part of the body is involved.

Estimates of doses from fallout from tests through 1961 in millirems, a unit of ionizing radiation dose, are given in Table I and discussed further in Appendix "A". Because of uncertainties and the variety of necessary assumptions, these estimates are expressed as ranges of values within which the average exposure over the United States is expected to lie. The values given apply to the United States, and are somewhat higher than those for most of the rest of the world. Doses to the whole-body and reproductive cells represent an average for all age groups in the entire population. Doses to bone and bone marrow are average values for those who were infants at the time of highest concentrations of the particular isotopes irradiating these organs; values averaged for all age groups will be lower.

The half-life of radioactive iodine, the principal source of the thyroid dose, is only 8 days and peak dose rates persist for a relatively short period of time. For this reason thyroid doses are n included in the table. Doses to the thyroid from the major past tests were estimated to have rang from 100 to 200 millirems per year during and immediately following periods of testing. These v apply only to individuals who were infants at the time of highest concentration of radioactive iodin The average value for all age groups was about a tenth as much. Although data from which thyroi doses during 1957-58 can be estimated are limited, it is likely that there was much geographic va tion, and in some limited areas of the United States the average thyroid doses were probably man times the national average.

The whole-body dose due to the carbon-14 produced by all tests through 1961 has been included not separately listed in Table I. It is estimated to total from 10 to 15 millirems during the first t year period. The dose rate will decrease much more rapidly than would be predicted on the basis the carbon-14 radioactive half-life of 5,700 years because of the absorption of the radioactive car dioxide from the atmosphere into the ocean. After about 200 years the dose rate from carbon-14 have been reduced to a total of about 0.75 millirem during a thirty-year period.

To put these dose levels in some perspective, Table I compares them with exposures from nat background and with the Radiation Protection Guides of the Federal Radiation Council. The compa sons indicate that doses from fallout have generally been a small fraction of the Guides for popu groups.

Background radiation arises from naturally radioactive materials such as carbon-14 and potass 40 in the human body, radium in the earth's crust, and cosmic radiation from outer space. Man h always been exposed to these radiations. Natural background radiation varies from place to place with elevation and with radioactive content of local materials. In the United States these values h been observed to range from 70 to 200 millirems per year. The value for background radiation g Table I is a weighted average for the entire United States population.

The estimated values given in Table I for whole-body exposures from fallout are considerably than the exposures from natural sources. Over a period of 30 years the average whole-body dose all testing through 1961 will be between 60 and 130 millirems compared to 3,000 millirems from ground. Thus testing through 1961, including the contribution from carbon-14, will, over this thir year period, increase exposures over natural background by less than five percent. Seventy-year age bone doses, when similarly compared, are increased less than ten percent. Any further testi will, of course, increase the exposure.

The fact that exposure from some sources is generally accepted without question should not in be a reason for accepting exposure to added levels of man-made radiation. However, comparison exposure levels with those of natural background does provide some indication of the significance increases from fallout. One normally considers variation in exposure from natural sources to be little significance. For example, a resident of the East Coast contemplating a move to a high-alti location in the West is unlikely to know or attach any importance to the fact that his exposure to b ground radiation will be appreciably increased—more than twenty-five percent at elevations above mile.

Another basis of comparison is the radiation exposure received from medical diagnostic proce in the United States. It has been estimated that a person in the United States will accumulate a ge cally effective dose of the order of 1,000 millirems over a thirty-year period. There are, howev wide fluctuations in the exposures to the reproductive cells from the diagnostic procedures.

Estimates of Biological Effects

Much available evidence indicates that any radiation is potentially harmful. However, effects l increasingly difficult to demonstrate below 10,000 millirems, and impossible to detect by present niques at the very low dose levels from fallout. Nevertheless, it is virtually certain that genetic can be produced by even the lowest doses. These effects in the children of exposed parents and a ture generations may be of many kinds, ranging from minor defects too small to be noticed to sev disease and death.

In the case of somatic effects, i.e., effects directly on the persons exposed, the evidence is ins cient to prove either that there is a dosage level below which no damage occurs (the "damage thr hypothesis) or that there is some risk of damage at any dosage level, no matter how low (the "no old" hypothesis). It may well be that some effects are of one kind, some of the other. Dose rate portant; a protracted dose is much less effective than the same total dose given in a short time.

Estimates have been made by national and international groups of scientists of the number of p ble adverse health effects that might occur from various exposure levels. Tables II and III apply

of these estimates to the exposure levels from all testing through 1961 to indicate the possible adverse health effects in the United States population that might result from this testing. United States figures have been used because knowledge of dose levels and of health effects occurring in the absence of testing is more complete for this country than on a worldwide basis. For convenience in expressing the concepts and calculations in this report, the population of the United States has been taken as approximately one-tenth of the population in the same latitudes of the northern hemisphere, and as one-twentieth of the population of the entire world. The figures in Table II on the possible number of adverse health effects from testing through 1961 may be multiplied by 10 to provide a rough estimate of comparable worldwide effects with the exception of carbon-14, for which a factor of approximately 20 must be applied.

Table II and Appendix "B" give numerical estimates of the effects of fallout on one category of genetic effects—severe physical and mental defects. This category includes the hereditary component of such things as congenital malformations, blindness, deafness, feeblemindedness, muscular dystrophy, hemophilia and mental diseases.

In Table II the estimated numbers of radiation effects are given as three values. The upper figure is the best estimate based on radiation-induced mutation rates in mice, and on the spontaneous incidence of these defects in man. The other figures represent the range within which the true value may reasonably be expected to lie.

As shown in the table, about ten percent of the number that may result in all time from weapons test through 1961 are estimated to occur in the first generation—the children of parents exposed to this fallout. The remaining ninety percent occur in decreasing numbers in succeeding generations. Somatic effects appear only in the irradiated individual himself, and not in his offspring. The manifestations of particular concern are leukemia and other types of cancer.

The radiation dose from carbon-14 is spread over an enormous period of time extending through many thousands of years. The number of mutations from carbon-14, when exposure over all time is considered, is estimated to be greater than from other radioactive elements produced in nuclear detonations. These mutations will, however, be distributed over a much longer time with a much smaller number in any one generation.

In addition to the gross defects listed in Table II, there may be an unknown but probably a considerably larger number of mutations with less obvious effects such as minor physical abnormalities, mild diseases, impairment of physiological functions, and reduced resistance to infection or other stresses of life. Part of this damage will result in a lowered probability of survival at various ages.

Reduced viability of this kind has been consistently found in mouse experiments. The best data on mice are for the infant and embryonic deaths. To the extent that mouse data can be applied to man, the results indicate that the radiation-induced mortality of embryos and infants in the first generation after irradiation is probably larger, perhaps five times larger, than the number of induced defects of the type estimated in Table II. Numerical estimates are not given for such effects because of uncertainties as to the comparability of these effects in mice and humans. This is the viewpoint of those who have done much of the experimental work in this field.

Mutations which have a mild effect on the individual may cause substantial damage in the aggregate. This is because the mildness permits these mutations, such as slight reductions in viability and other less obvious effects, to persist in the population longer than mutations with severe effects, and thus to affect a correspondingly greater number of persons. There are no data which would permit these effects to be assessed with sufficient accuracy to permit numerical estimates.

If, however, numerical estimates are made of all these genetic effects, both those which are likely and those which are more speculative, the aggregate of these estimates when counted as the total number of individuals affected throughout the world in future generations leads to very large numbers. Likewise, large numbers can be obtained when other effects or deaths from any cause are totaled over large populations and many generations. On the other hand, it must be emphasized again that whatever the genetic effects of fallout radiation from weapons testing through 1961 may be, the total effect will certainly be considerably less than that occurring inescapably from background radiation. This, in turn, is considerably less than the effects from other factors which determine the total natural mutation rate.

Estimates for two kinds of somatic effects, leukemia and bone cancer, are given in Table III. As mentioned earlier, it is not known whether or not there is a threshold dose below which these diseases are not produced. If a threshold exists, fallout radiation may produce no additional cases, and the lower limits of zero reflect this possibility.

The upper estimates in Table III are made by assuming the effect of a low dose, delivered at a low dose rate, to be proportional to the effect of a high dose delivered at a higher dose rate. The estimates for the upper limits are probably too high because no allowance had been made for the possibility that a

given dose is less effective when received slowly over a long period of time. Thus the range of n bers given in Table III is reasonably certain to bracket the correct value.

There are other possible somatic effects of radiation such as malignancies (other than leukem bone cancer) and general effects such as life shortening. Among these malignancies is cancer of thyroid, a possible effect from exposure to radioiodine. Table III includes no data on the possibl cidence of this effect because estimates, like those recognized by national and international grou scientists for possible leukemia and bone cancer effects, have not been made for cancer of the th However, from what little is known about the effect of radioiodine, including data obtained from h exposures at very high levels, the likelihood of any possible thyroid effects has been considered about the same as other malignancies for comparable exposures. Even less information is avail to possible increases in all these other effects than is available for leukemia and bone cancer.

To put these estimates of possible adverse health effects in some perspective, Tables II and II include the total number of these same effects occurring in the United States from all causes.

Conclusions

We cannot say with certainty what health hazards are caused by fallout from nuclear testing. expect there will be some genetic effects; other effects such as leukemia and cancer are more s tive and may not occur at all. We can observe that, compared to the number of these same adve biological effects occurring wholly apart from testing, the additional cases that might be caused ing are a very small quantity. We conclude that nuclear testing through 1961 has increased by s amounts the normal risks of adverse health effects.

APPENDIX "A"

EXPLANATORY MATERIAL ON DOSE ESTIMATIONS

The estimates of radiation doses attributable to fallout from tests of nuclear weapons given in Table I have been based on extensive observations and studies through 1961. These estimates include exposures from fallout which already has occurred and from material from past tests yet to be deposited. Estimates are based on measurements of radionuclides in air, rain, soil, water supplies, food and people.

Table I gives estimates of radiation doses from fallout resulting from tests through 1961. The dose ranges given in this table represent estimates made using somewhat different but plausible assumption concerning such factors as fallout distribution, the effects of weathering and shielding, and the movement of radioisotopes from the environment to man. It is believed that the best estimates that can be made at the present time would lie within the ranges given.

In the cases of whole body and reproductive cell exposures, radiation doses are relatively independe of age, except for the fact that children born in the past two or three years will have missed much of th exposure from earlier tests experienced by older persons. A large fraction of the dose to the whole-body and reproductive cells from a particular test may be received within a period of months after fallout occurs. The contribution of radioiodine to the dose to the thyroid gland is much larger in the case of infants than in older persons and is effectively complete within a few weeks after a nuclear test

Radiation doses to the bone and bone-marrow from a particular test will be received at decreasing rates over a period of a lifetime. Early concentrations in the bone will be greatest for those children who are less than one year of age at the time that peak concentrations of fallout occur in food. The average bone and bone marrow doses to such children as estimated in Table I are much larger than th average to the whole population.

It is estimated that carbon-14 resulting from tests through 1961 will produce a radiation dose to the whole body including the reproductive cells of 10 to 15 millirems in the first 30 years, which is less than one percent of the 30 year genetic dose to the present population from natural background.

While carbon-14 decays very slowly with a radioactive half-life of 5,700 years, its availability as a source of radiation exposure initially decreases rather rapidly because of absorption of carbon dioxide from the atmosphere into the oceans. In a period of one or two hundred years, the exchange between the atmosphere and the ocean approaches an equilibrium with most of the carbon-14 in the oceans. Thi mixing will reduce the carbon-14 due to weapons tests to about two percent of the natural carbon-14 concentration in the atmosphere, biosphere and oceans. The radiation dose rate at this time will be about 0.025 millirem per year, or 0.75 millirem per generation. Although the dose rate is very small, it will continue at a rate which decreases with the radioactive decay of carbon-14 through hundreds of generations.

Doses to the whole-body and reproductive cells were averaged, weighted according to population; bo and thyroid doses were averaged over that portion of the population who were infants at the time of highest concentrations of relevant radioisotopes in the diet. Average doses to older children and adults and thus to the total population, were smaller. Some local averages, particularly in the case of the thyroid, were much higher.

All one year doses are for the year, within the period covered, in which the highest yearly doses we. received. The highest one-year doses to the whole-body and skeleton from tests prior to 1961 were experienced in 1958-1959. The highest one-year doses to the whole-body and to the skeleton from the 1961 tests are expected during 1962 and 1963.

TABLE I

Estimated Radiation Doses in the United States

(Doses expressed in millirem)

Tissue or organ	From all tests through 1961	From natural background	FRC Radiatior tection Guides normal peacet operations Population gr
Whole body			
1 Year	10- 25	100	170
30 Years	60-130	3,000	5,000
70 Years	70-150	7,000	11,900
Reproductive cells			
1 Year	10- 25	100	170
30 Years	60-130	3,000	5,000
70 Years	70-150	7,000	11,900
Bone			
1 Year	30- 80	130	500
70 Years	400-900	9,100	35,000
Bone marrow			
1 Year	20- 40	100	170
70 Years	150-350	7,000	11,900

*The Radiation Protection Guide for whole-body exposure of individual radiation workers is 5,(millirems per year.

APPENDIX "B"

DISCUSSION OF THE NUMERICAL VALUES IN TABLES II AND III

The estimates of genetic effect are based largely on the reports of the Committee on Genetic Effects of the National Academy of Sciences, contained in the Academy's 1956 and 1960 Summary Reports on the Biological Effects of Atomic Radiation. The Summary Reports concluded from the available scientific information that the genetic effects of exposure of a population to small doses of radiation are proportional to the average dose to the reproductive cells of potential parents.

The Committee reported that normally some four to five percent of children born have or will develop a severe physical or mental defect. Of these defective children about half, or two percent of the total number born, are thought to have traits whose frequency in the population is directly dependent on the mutation rate.

The Academy Committee utilized data on mutation rates in mice and estimated the effects on human populations, assuming that human radiation-induced mutation rates are the same as in mice. The 1956 Report estimated that if the parents of the present generation were exposed to 10,000 millirems, this average dose would give rise to some 50,000 additional defective children among 100 million children born. The total number for all future generations, assuming no change in the size of population, was estimated as 500,000.

Recent data have shown that radiation given at a very low rate produces fewer mutations than the same total dose given quickly. Since the earlier estimates were based on high dose rates, they should be reduced accordingly. The results from recent experiments with mice indicate that when both parents are irradiated the best estimate of the number of mutations should be only 1/6 as large as with high dose rates.

An application of these modified estimates to the reproductive cell exposures estimated to occur from past weapons tests, approximately 100 millirems over the first 30 years, leads to an estimate of 110 cases of serious inherited defects in the first generation of 130 million births. The estimates of radiation doses in Table I apply only to radiation received by the present population of the United States.

At least four physical phenomena contribute to making the radiation doses to future generations from these tests much smaller. In fact, in a few decades the exposure per generation from residual radioactivity produced by these tests will have dropped to less than one percent of the exposure to the current population.

In the case of the whole-body and reproductive cells, about 50% of the 30-year dose from tests through 1961 has resulted from exposure to radiation from relatively short-live gamma-emitting materials outside the body. As a result of radioactive decay, these will have essentially disappeared within a few years.

It is estimated that about 20 percent of the 30-year dose is from cesium-137 in the diet. Most of this results from the direct deposition of fallout on vegetation. When the deposition rate is low, the availablility of cesium-137 is small. This factor, together with its short retention time in the body, makes this radioisotope a small contributor to internal irradiation. About 25 percent of the 30 year dose is due to cesium-137 outside the body. The dose rate from this source decreases with time, not only as a result of radioactive decay with a half-life of 27 years, but also because of decreasing availability due to migration into the earth or into streams, storm drains, etc. The dose rate from this isotope may be reduced by 1/2 to 1/10 after 30 years in addition to radioactive decay.

It is estimated that carbon-14 resulting from tests through 1961 will produce a radiation dose of 10 to 15 millirems in the first 30 years, about 10 percent of the 30 year genetic dose from fallout to the present population. The radiation dose rate, after equilibrium with the oceans has been reached, will be about 0.025 millirem per year, or 0.75 millirem per generation. Although the dose rate is very small, it is of interest because it will continue at a rate which decreases with the radioactive decay of carbon-14 through hundreds of generations.

In addition to its radiation effects, carbon-14 may produce mutations through disruption of the normal chemical structure of the gene when the atom of carbon-14 is converted into nitrogen. The contribution from this effect appears to be small in comparison to the radiation effect, and is too speculative to provide a firm basis for numerical estimates.

The current total incidence of deaths due to leukemia in the United States is about 12,000 per year and that of bone cancer is about 2,000 per year. These amount to average rates for all ages of 7 cases per one-hundred thousand persons and 1.1 cases per one-hundred thousand persons, respectively.

It is assumed that the incidence of these diseases as a result of exposure of the blood-forming tissues and the bone, respectively, to radiation is proportional to the exposure. Observations of ber of cases of leukemia resulting from very large doses of radiation suggest that up to ten perc the normal incidence of leukemia may be due to exposure to radiation from natural sources, amc to an average of 7,000 millirems in 70 years. The same assumption has sometimes been made f cancer. These assumptions were made, for example, by the United Nations Scientific Committee Effects of Atomic Radiation (1958) in estimating an upper limit to the number of cases of leukem bone cancer that might be expected from low levels of exposure such as those from fallout from : testing of nuclear weapons.

On this basis, one could estimate that if an average lifetime exposure of 7,000 millirems to th blood-forming tissues of the population of the United States results in a total of about 84,000 case leukemia in the period of an average lifespan of 70 years, the average lifetime exposure to fallou be expected to result in a total of up to 2,000 cases of leukemia, averaging about 30 per year. Th average exposure to the population as a whole from fallout is estimated to be about 175 millirem: bone marrow, about half the value calculated for infants, as shown in Table I. A corresponding e for the number of cases of bone cancer from a population weighted lifetime dose of about 450 mil would give an upper limit of 700 cases in 70 years, averaging about 10 cases per year.

For comparison, there are about 1,700,000 deaths each year in the United States from all caus these, up to about 1,400, or about 10% of the total due to leukemia and bone cancer from all cause attributed to radiation exposure from natural sources. The possible additional 40 deaths from th causes, as estimated above, illustrate the degree of risk to an individual from fallout in compari risks already present.

TABLE II

Effect of Fallout on the Number of Gross Physical or Mental Defects in Future Generations in the United States

(No allowance has been made for future increases in population)

(1) Estimated number of cases due to all causes (hereditary and non-hereditary) in children of persons now living	(2) Estimated number of additional cases in the first generation (children of persons now alive) caused by all tests through 1961		(3) Estimated total number for all future generations from all tests through 1961		(4) Risk to an individual of the next generation from all tests through 1961
	Fallout	Carbon-14	Fallout	Carbon-14	
4,000,000-6,000,000	100 Range (20-500)	10 (2-50)	1,000 (200-5,000)	2,000 (400-10,000)	1/1,000,000

The upper figures in columns 2 and 3 are best estimates based on radiation-induced mutation rates in mice, and on the spontaneous incidence of these defects in man.

The lower sets of figures represent the range within which the true value may reasonably be expected to lie.

TABLE III

Certain Malignant Diseases in the Next Seventy Years in the United States

	Estimated total number of cases from all causes (present incidence)	Estimated number of cases caused by natural radiation	Estimated number of additional cases from all tests through 1961	Risk to an individual of developing the disease due to all tests through 1961
Leukemia	840,000	0-84,000	0-2,000	0-1/100,000
Bone Cancer	140,000	0-14,000	0-700	0-1/300,000

ACKNOWLEDGMENT

The Federal Radiation Council has been assisted in this study by several special advisors, and by the following consultants selected by the National Academy of Sciences:

Dr. Howard L. Andrews
Dr. Victor P. Bond
Dr. James F. Crow
Dr. Lester Machta
Dr. James V. Neel
Dr. William L. Russell
Dr. Shields Warren

GT-280

APR 26 1962

Dr. Lauriston S. Taylor
Chairman, National Committee on Radiation
Protection and Measurements
National Bureau of Standards
Washington 25, D. C.

Dear Dr. Taylor:

The Atomic Energy Commission proposes a change in its representation on the National Committee on Radiation Protection and Measurements to reflect changes in assignments of responsibility within the A.E.C. since the present representation was determined. We propose that Dr. Paul C. Tompkins, Deputy Director of our Office of Radiation Standards, replace Dr. Kelley D. Glass, Special Assistant to the Director, Division of Biology and Medicine. Dr. Charles L. Dunham, Director, Division of Biology and Medicine, would continue as a member of the Committee.

In view of the fact that Dr. Tompkins was one of the U. S. Public Health Service representatives on the Committee before his transfer last December to the A.E.C., you are familiar with his qualifications for this activity.

Sincerely yours,

SIGNED, A. R. LUEDECKE

General Manager

RECEIVED
U.S. Atomic Energy Commission
Germantown, Md.
APR 27 1962
Office of the Secretary

cc: H. L. Price, Director of Regulation
A. R. Luedecke, General Manager
Office of the Secretary (2)
C. L. Dunham, Director, BRM

RS:DIR	BRM	REG	GM
Western:rsb	Dunham	HPrice	
4/20/62			

FORM AEC-204
(9-47)

DATE:

INDEX: MH&S-3-Radiation

[redacted]

TO:

FROM:

SUMMARY: AEC 496/87: HEARINGS ON RADIATION STANDARDS, INCLUDING FALLOUT, Letter to Seaborg from the Executive Director, JCAE with re to the plans for the forthcoming hearings on Radiation Standards. Attached also is Summary-Analysis of the Radiation Standards Hearings held in 1960.

FILED:

INDEXER: O&M-7-JCAE

REMARKS: date of paper: 4-26-62
date of letter: 4-23-62

U. S. ATOMIC ENERGY COMMISSION

CORRESPONDENCE REFERENCE FORM

4-26-62

☆ U. S. GOVERNMENT PRINTING OFFICE—1955—362408

MHo S-3

JACK WESTLAND
[illegible], WASHINGTON

ROOM 1418
NEW HOUSE OFFICE BUILDING

MEMBER:
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS

JOINT COMMITTEE ON ATOMIC ENERGY

Congress of the United States
House of Representatives
Washington, D. C.

April 18, 1962

Hon. Glenn T. Seaborg, Chairman
Atomic Energy Commission
Washington 25, D.C.

Dear Dr. Seaborg:

I am enclosing a copy of a letter and a leaflet which I recently received from Mr. and Mrs. Stuart O. Pierson of Seattle regarding radio active fallout, upon which I would appreciate receiving your considered comments.

Sincerely yours,

Jack

Jack Westland
Member of Congress

JWet

4-18-62

5244 36th NE
Seattle 5, Washington
April 12, 1962

Hon. Jack Westland
House Office Building
Washington, D.C.

Dear Representative Westland:

We would like to ask you a question about the enclosed leaflet, which we received in the mail today. If this leaflet is truthful (is it?), why hasn't the Administration made public such facts about fallout?

We do not understand why, if this country must resume atmospheric nuclear testing, every effort is not being made to protect the people from the effects of the tests.

It seems only reasonable that the people should be warned against using fresh milk during the tests; and that all milk companies should be required to decontaminate their milk. Why aren't these things being done?

Sincerely,

Norma M. Pierson
Mr. & Mrs. Stuart O. Pierson

4-13-62

IODINE 131

Iodine 131 is a radioactive poison appearing directly after nuclear explosions, which has a half-life of 8 days. This means that in 8 days it is half decayed, half as dangerous. In 26 days, about 90% is gone.

This radionuclide collects in the thyroid gland, where it can cause cancer. Nobody knows exactly how much will cause disease, and since it takes from 7 to 20 years for it to show up, estimates are difficult. But it is likely that over 1,000 children may get thyroid cancer from past testing alone. Every additional amount adds to the risk.

Children and babies are about 10 times more vulnerable, and they are also more susceptible. Individuals too may be even more sensitive than the average. The U.S. Government's "radiation protection guides" for Iodine 131 are based on this lower tolerance of children.

Range 1 - 0-10 micromicrocuries per day
Range 2 - 10-100 " " "
Range 3 - 100-1,000 " " "

During the past Russian tests, several cities averaged well over the Range 2 limit, at which control actions are supposed to be considered. St. Louis, Minneapolis, Omaha, New Orleans and Palmer, Alaska averaged 500 or above during September and October, 1961. No action was taken. These and other "hot spots" suffer high amounts repeatedly. Unusual weather conditions can make any area hotter than average.
(For details, see January, 1962 Bulletin of the Committee for Nuclear Information, 6504 Delmar Blvd., St. Louis 30, Missouri)

Children can be protected to some degree by the use of canned or powdered milk during the danger period right after tests. It is also advisable to throw away outer leaves of leafy vegetables, wash thoroughly, peel when possible. Control measures, such as the use of storage feeds and storing or processing milk, could also be helpful on the part of farmers and milk companies.

If the tests are close together, mothers may wish to avoid use of fresh milk and fresh milk products completely until 2 weeks after the testing period is over, especially since it is difficult to tell when the Iodine 131 would arrive from test sites.

Nothing much can be done about Strontium 90, which has a much longer half-life of 28 years...except decontamination of milk by a newly invented machine. Only 2 milk companies (in New York State) are currently using this machine. However, you can consider these possibilities:

Natural breastfeeding of infants. Humans discriminate against radiation much more than cows, and a careful diet by a mother will help reduce Strontium 90 intake substantially, especially if continued for 6 months or more. Write for further information.

Soy milk, now available evaporated in cans, has about 1/5 to 1/4 the amount of Strontium 90 in cow's milk. This is obtainable at drug or health food stores, and is often used today for allergic babies.

Calcium supplements. See your doctor about this. There are some easy-to-take powdered calcium products, as well as pills. Ask for mineral type.

-.-

"Until massive experiments with careful controls are performed on humans, we shall remain uncertain about the effects on people of low doses of radiation. Since no one wants to see such experiments performed, we must be guided by the results of experiments with laboratory mammals (such as mice and donkeys) and by fragmentary observations arising from observation of Japanese A-bomb survivors or survivors of industrial accidents. Much of the data available gives support to the idea that even the lowest doses of radiation cause irreparable biological damage with respect to the induction of mutations, the increase in susceptibility to cancers of various kinds, and a generalized shortening of life expectancy. IT SEEMS TO US TO BE GROSSLY UNFAIR FOR ANY PERSON OR AGENCY SPEAKING AUTHORITATIVELY TO STATE THAT FALLOUT FROM NUCLEAR TESTS IS HARMLESS."

Franklin W. Stahl, Associate Professor
George Streisinger, Associate Professor
Institute of Molecular Biology
University of Oregon
Eugene, Oregon

This fact sheet from SEATTLE WOMEN ACT FOR PEACE, 46[illegible] NE 40th, Seattle. LA 2-6709
LA 3-9404

NUCLEAR TESTS COST LIVES

OUR CHILDREN ARE PAYING THE PRICE OF ATOMIC TESTING IN CANCER, LEUKEMIA AND DEFORMITIES !!!

RADIOACTIVE IODINE 131

— APPEARS RIGHT AFTER TESTS

— CAN CAUSE THYROID CANCER

— IS 18 TIMES MORE DANGEROUS TO BABIES THAN TO ADULTS

PROTEST

TO SHOW YOUR CONCERN ABOUT TESTING

PROTECT

TO LESSEN THE RISK OF THYROID CANCER

DO NOT USE FRESH MILK

FOR 8 DAYS AFTER EACH TEST

STOCK UP NOW ON CANNED AND POWDERED MILK TO MEET YOUR FAMILY'S NEEDS

SEATTLE WOMEN ACT FOR PEACE LA 2-6789
4600 NE 40th Seattle 5, wn. LA 3-9404

WE URGE WOMEN EVERYWHERE TO SUPPORT OUR CAMPAIGN AGAINST NUCLEAR FALLOUT! SHARE YOUR CONCERN OVER "CLEAN FOOD" WITH YOUR MILK COMPANY! CLIP AND SEND THIS MESSAGE TO YOUR MILK COMPANY TODAY! DISCUSS THIS VITAL ISSUE WITH YOUR FRIENDS, NEIGHBORS!

To my Milk Company:

Our family is concerned by the mounting evidence that our milk and milk products are becoming increasingly poisoned by radioactive fallout from nuclear atmospheric tests. We submit to you that out of fear many families, including our own, will curtail or discontinue consumption of milk, thus creating an economic hardship on the dairies. Milk concerns have been justifiably proud of providing children and adults with an essential food that is clean, healthful and reasonably priced. We believe you will want to maintain your moral integrity, and keep faith with consumers by once again providing us with a clean food. This can only be done by petitioning the government not to resume nuclear atmospheric testing, so that milk can once again take its place on the diet of every American. We urge you to meet with the President, and submit your concern against the resumption of nuclear tests.

Sincerely,

Name: _____

MNoS-3

UNCLASSIFIED

April 3, 1962

AEC 604/64

COPY NO. 67

ATOMIC ENERGY COMMISSION

RADIATION AND HEALTH

Note by the Secretary

The Director of Regulation has requested that the attached report by the American Medical Association be circulated for the information of the Commission. Copies had been forwarded to the Commissioners by memorandum dated March 28, 1962.

W. B. McCool
Secretary

AEC 604/64

DISTRIBUTION	COPY NO.	DISTRIBUTION	COPY NO.
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Commissioners	2-6,72	Military Application	36
General Manager	7-8	Operational Safety	37
Dir. of Regulation	9	Peaceful Nuclear Expl.	38
Deputy Dir. of Regulation	10	Production	39-40
Deputy Gen. Mgr.	11	Radiation Standards	41
Asst. Gen. Mgr.	12	Reactor Development	42-50
Asst. GM-Plans & Prod.	13	Manager, Naval Reactors	51
Asst. GM Operations	14	Research	52-53
Asst. Gen. Mgr. R&D	15	Albuquerque Oprns.	54-56
Asst. Gen. Mgr. Adm.	16	Brookhaven Office	57
General Counsel	17-21	Chicago Operations	58-59
Biology and Medicine	22	Oak Ridge Operations	60-62
Compliance	23-29	San Francisco Oprns.	63
Congr. Liaison	30	D.C. Office	64-66
Public Information	31-32	Secretariat	67-71
Inspection	33		

4-3-62

UNCLASSIFIED

American Medical Association

535 NORTH DEARBORN STREET • CHICAGO 10, ILLINOIS

WHITEHALL 4-1500

COMMUNICATIONS DIVISION

Jim Reed, director

F. J. L. Blasingame, M.D.
executive vice president

Herbert H. Howard, M.D.
assistant
executive vice president

TO: Sunday Editors

In view of the probable resumption of nuclear testing in the atmosphere, the American Medical Association has conducted a definitive study of the known facts regarding the possible effect of radiation on health.

We have called upon the combined knowledge of the top American specialists in radiation medicine to provide answers to those questions that are uppermost in the minds of most of us, and that are most often mentioned in news reports in connection with the proposed bomb tests.

The results of this study are presented in the attached article and photographs. The article deals solely with the health aspects of radiation. It does not touch on the political aspects of nuclear weapons testing.

We believe this study meets a real need for specific information to the American public on the effects of radiation on health.

Jim Reed
Director of Communications

UNCLASSIFIED

NEWS RELEASE from
THE AMERICAN MEDICAL ASSOCIATION
535 North Dearborn Street • • • Chicago 10, Illinois • • • Phone: WHitehall 4 - 1500

FOR RELEASE SUNDAY, MARCH 25, 1962

RADIATION AND HEALTH

Prepared by

The American Medical Association

Ever since a nuclear bomb atomized the heart of Hiroshima, man has been attempting to decide just what he has unleashed upon himself.

Radiation has generated more opinion, contradiction and heat among physicians and scientists today than any other subject--and raised more questions. Are we radiating ourselves into oblivion? Will atomic fallout shorten our lives, deform our children, give us cancer? Is our food being poisoned? Do X-rays and radiation therapy do more harm than good?

It is not possible to get point-blank answers to these questions for we haven't built up a sufficient mass of knowledge yet. Radiation has been known in the laboratory since before the turn of the century, but detailed studies of the effects on man are fairly recent. Not until the threat of extinction boiled up in the first atomic fireball was there any sense of urgency.

When a few years ago we first began to get an inkling of what radiation could do there was consternation. Many thought doom was assured. Indeed, some still do.

Physicians and physicists have recently come up with some new guide lines that give a somewhat less leaden hue to life with the atom than the gloomy prophecies of a decade ago. Some of the "hard facts" about radiation have been found to be neither hard nor fact.

For instance, it was once stated positively that any ionizing radiation (that produced by fission, X-rays, uranium, etc.) shortens life. Experiments with rats seemed to bear this out and a study of the life span of radiologists, who work with X-rays and radioactive substances, seemed to offer further confirmation. It appeared they didn't live as long as medical men in other fields. A re-evaluation of the old data and investigation of some new, later turned up a flaw in the initial study and it developed that radiologists tend to outlive other physicians. At this point the whole subject was thrown into confusion, proving only, as one researcher put it, that "you can't directly translate what happens in a rodent to what would happen in a man."

In many ways this is typical of present ionizing radiation studies. For above all, radiation is a study in

contradiction. No other form of energy combines such destructive potentials with so many possible benefits.

The one axiom that seems to stand up in all the radiation furor is this: Excessive exposure to ionizing radiation (or to almost anything else) is dangerous. Used in moderation, radiation (or almost anything else), is not dangerous.

Dr. Marshall Brucer, who retired recently as Chairman of the Medical Division, Oak Ridge Institute of Nuclear Studies, at a recent meeting of the American Medical Association, pointed out: "If I were to throw a man into the middle of the Pacific Ocean he would drown. Therefore, I might say that water is dangerous because it kills people. On the other hand, if I were to withhold a glass of water from a man for a long time he would also die; therefore, I might say that water is necessary to life.

"The same thing may be said of radiation. If I were to expose a man to the radiation from an atomic bomb, I could kill him. Therefore, we can say that radiation is dangerous. But if I withhold a necessary X-ray examination from a sick man, I could also kill him. Therefore, we can say that radiation is necessary for life."

Dangerous or not, the fact is that radiation is inescapable. It comes from the ground, the air, the vast reaches

of outer space. We eat it, drink it and are pelted with it from the very walls of our homes and offices. It is passed to us by our mothers before we are born and radiates from our bodies after we die.

There is nothing we can do about this "background" radiation. It is part of the world in which we live. Only when man-made radiation is added to the background radiation do the effects begin to tell.

Medical research into radiation suffers from the fact that the number of human beings who have received heavy exposure is relatively small. There are the surviving bomb victims of Hiroshima and Nagasaki, but the amount of exposure they received is not known precisely. Most of the data we do have has been sifted from atomic plant mishaps, medical exposure and observations of the small group of Marshall Islanders caught by a freak of wind and weather in the heavy fallout from the Bikini bomb test of 1954.

From these studies it has been determined that massive doses of radiation increase the likelihood of leukemia, bone tumors, cancer of the thyroid, and can also disrupt the delicate reproductive chain so that there are more miscarriages and more children born with congenital defects.

There is no concrete opinion, however, on how much these hazards are increased over their usual occurrence. Nor do we know the range of radiation doses that can produce these effects. The best that can be said at the moment is that substantial exposure produces some increase, but at lower levels, such as diagnostic X-ray, there is no objective evidence of harm to man.

The increase in leukemia, for instance, is actually based on a very few cases of the disease. The problems connected with these studies were perhaps best summed up by Dr. Robert M. Heyssel, who spent two years in Japan on our Atom Bomb Casualty Commission, and Dr. A. Bertrand Brill of the Donner Laboratory of Medical Physics at the Univeristy of California.

"Considerable controversy, which has unquestionably been sharpened by the fallout debate, exists concerning the interpretation of (leukemia) data," they reported. "There is general agreement that fallout cannot account for the recent world-wide increase in leukemia, but public misinformation has clouded this situation.

"Part of the scientific disagreement lies in the manner of collecting data....There is also argument about the validity of the various estimates of dose. A final problem

arises from the fact that the basic nature of leukemia and the process by which it comes into being are unknown."

By far the most perplexing unknown is the extent of radiation damage, if any, from the small but persistant doses of radioactivity to which we are continuously exposed in our day to day lives. Studies in this field become very tenuous. For instance: if mild, long-term radiation from X-rays actually does stimulate bone cancer, it is probable that man's life span isn't long enough for it to show up.

Also wrapped up in the study of this "chronic" radiation--as opposed to "acute" radiation from atomic accidents--is the question of damaged genes. In other words, are we now irradiating ourselves to such an extent that in a few, (or a hundred) generations, radiation-induced mutations will change the shape of the human race?

Scientifit "purists" on the subject maintain that we are; that any radiation, no matter the amount, is damaging to the genes.

An equally-eminent group maintains that up to a certain point radiation produces no noticeable effects; that there is a "threshold" and only after the level of radiation crosses this threshold does it become dangerous.

Although proof is lacking either way--it will take studies of several generations to produce any meaningful statistics--the threshold theory appears to be gaining. As Dr. George R. Meneely, former director of the Radio-isotope Center of Vanderbilt University Hospital and now director of Scientific Assembly for the AMA, pointed out: "If radiation has no threshold, then it is the only noxious substance known to man that doesn't. When a supposed hazard is so small as to be undetectable you can hardly say there is a hazard."

Of all the radiation hazards produced by man, none has stirred more fear than fallout.

The firey upsurge of an atomic blast sucks dirt and rocks into the boiling malestrom where it is vaporized by the heat and carried miles into the sky by the mushroom cloud.

Some of these dust particles, only 1/10,000 of an inch, soon condense into sand-size granules which fall downwind from the blast for a distance up to several hundred miles. This heavy fallout is extremely "hot" and can deliver a killing dose of radiation. However, under standard bomb testing conditions, and barring accidents, it presents no great immediate problems.

Of far more concern to public health officials and scientists is the microscopic debris that does not condense. This can hang in the atmosphere for as long as ten years. After a big bomb explosion this debris is blown by high-altitude winds into dusty bands that encircle the globe. Over long periods of time this dust finds its way back to earth.

Altogether about 90 different radioactive substances are released in substantial quantities when a nuclear device is triggered. Most of these materials quickly lose their radioactivity. A few don't.

Of the long-lived elements, strontium 90 and cesium 137 have raised the most concern. Neither is normally found in living organisms but both closely resemble elements which are necessary to life. Chemically, strontium 90 is akin to calcium. In fact the body can't tell the difference and so uses this radioactive substance as it would calcium in building bones and teeth. For this reason strontium 90 has been linked with leukemia and bone cancer.

Cesium 137, on the other hand, is delivered to the muscles and soft tissues of the body, just as if it were potassium and provides particular hazards to the genes.

Another dangerous product of a nuclear blast is iodine 131. Like ordinary iodine it concentrates in the thyroid

increasing the danger of cancer to that gland. Iodine 131 has a much shorter life than the other two and if it remains suspended as fallout for a period of several months loses much of its radioactivity.

Unlike the heavy fallout, the danger from microscopic fallout is not that it will come in contact with our bodies--its radiation would have difficulty passing through a sheet of paper let alone our skin. These specks can work their harm only after getting inside our bodies with our food.

Food and radiation has received particular attention since the massed series of nuclear explosions set off by the Russians last fall. As a result of these tests the level of strontium 90 in our food and milk is expected to increase appreciably as the spring rains wash down much of the debris still in the atmosphere.

The Public Health Service, to be on the safe side, has drafted proposals that could be used in case of contamination, particularly of milk. These include federal subsidies to install decontamination equipment in dairy plants; a system for allocating purified milk to children and delivery of government surplus grain to farmers so that cattle would have uncontaminated feed.

Government fallout experts don't expect these standby controls will have to be used, although there is some possibility of a few "hot spots" developing in scattered sections of the country.

The Russian series probably will not boost overall radiation levels any higher this spring than they were in 1958 when the three-year moratorium on nuclear testing began. If this proves to be true, then there's probably not much to worry about. No harmful effects from the pre-1958 fallout have ever been objectively demonstrated.

Perhaps the best way to put fallout into perspective is to consider it in relation to all sources of radiation.

According to Dr. Lauriston S. Taylor, chairman of the National Committee on Radiation Protection and Measurements, about half of the total radiation delivered to our reproductive systems comes from medical sources--almost exclusively X-rays--and 40 per cent comes from background radiation. The remaining 10 per cent is delivered in about equal amounts by (1) luminous watches, buttons and other such devices; (2) nuclear power plants and engines, atomic wastes, etc.; (3) fallout.

The mere fact that man is essentially an earth-bound creature subjects him to four times as much radiation as the fallout from all the nuclear devices exploded since

1945. A square mile of dirt and rock a foot deep contains about three tons of uranium and six tons of thorium--both radioactive materials. In comparison, bomb testing by all nations up to 1958 produced about four and a half tons of fission products.

Not just the earth but our entire universe is shot through with radiation from cosmic rays, which are produced by the sun and stars and flash through space with the speed of light. Fortunately, most of these rays are filtered by our atmosphere. Otherwise life on earth as we know it would be impossible.

Ironically, every living thing does contain at least some of this cosmic-induced radiation. As the rays plunge into the nitrogen of our atmosphere, seven to fifteen miles above the ground, minute chain reactions are produced that lead to the formation of carbon 14. This radioactive carbon becomes intermingled with ordinary carbon and the two are used interchangeably in the life-building processes.

Despite the high yield of radiation from X-ray machines, Dr. Taylor is quick to point out that scientists and medical men are little concerned because there are essential offsetting benefits--improving and protecting health.

What does concern him and many physicians are the effects from unwarranted use of X-rays, such as shoe-fitting machines, which offer no beneficial return. At least 33 states and the District of Columbia have banned X-ray shoe-fitting machines or have strictly regulated them.

Other states are taking action to assure that other X-ray practices produce as little harm as possible, and 27 states have strong radiation codes. In general the medical profession agrees that medical radiation exposure should be kept at a minimum, but there is concern that some state legislatures might go too far. Said Dr. Russell H. Morgan, chief radiologist at Johns Hopkins Hospital and chairman of the Surgoen General's National Advisory Committee on Radiation:

"Any legislative proposal that tends to limit a physician's authority, that tells him when he may or may not use X-ray equipment, represents the least desirable, the least tenable approach. Unless the physician has freedom of decision in examining and treating his patient, he will be hampered in his professional responsibilities. Medical practice would be in serious jeopardy."

In general, radiation is a form of electromagnetic waves and essentially belongs to the same family as light

and radio waves. While radio waves and light produce no effect on the body, radiation does. It disrupts the atoms and molecules which make up body cells.

When a unit of radiation flashes through a cell, it deranges and excites some of the cell's atoms so that they no longer retain their stable, normal properties and become highly reactive to neighboring atoms. The inter-reaction of these atoms quickly produces new substances strange to the chemistry of the cell, such as peroxides, which relay the disturbance to other molecules and cells. Thus the area and scope of the injury is enlarged quickly.

A particle of radiation may also sever the rope-like chromosomes of the cell which contain the genes or heredity factor. When this occurs, the chromosomes immediately attempt to rejoin. In their hurry to reunite the severed pieces may become scrambled. Then, when the cell divides, the scrambled genes are passed on to the new cell and a mutation is formed.

Generally, the more complex a living organism the greater its susceptability to radiation. Thus a snail, a relatively simple animal, can stand 60 times more radiation than a man and it takes ten times more radiation to kill a lizard than a human being.

Yet a dose of radiation that would kill a man if delivered to his whole body can be delivered to a fraction of his body with little effect. Also, a much larger quantity of radiation can be tolerated if it is delivered at intervals, instead of all at once, allowing the body's defense mechanism to repair some of the damage between doses. This means that by narrowing the area and spreading the doses, radio-therapists can treat cancerous tissue with many times the radiation that, if delivered all at once to the whole body, would kill the patient.

Mechanical devices which replace the normal function of body organs are promising to expand the use of radiation in medicine. If an organ--a cancerous kidney for instance--can be removed from the body and kept alive, it can be subjected to massive radiation many times the normal lethal dose, then returned to the body where it takes over its normal function. Researchers have already proved they can do this with animals. A dog which had its stomach removed, dosed with radiation and replaced can still digest dog biscuits with ease.

Radiation, in fact, has proven to be a strange blessing to some atomic workers accidentally exposed to a lethal dose. In radiation sickness, where death does not

occur in the first few days, the most serious problem becomes the loss of blood-manufacturing tissue, particularly in the bone marrow. If blood manufacturing is not stepped up immediately, the victim will die of anemia.

The fact that the victim has received heavy radiation now comes to his aid. In the normal body, any attempt to transfer bone marrow substance from one person to another would be fruitless. The body's defense mechanism would reject such transplanted marrow as "foreign." But the same dose of radiation which has killed off the blood-producing marrow, also kills off the defense mechanism so that the body will accept and use the transplanted marrow.

Some scientists say that this suggests whole new possible areas of use for radiation in medicine.

Any use of radiation is inescapably linked with unknowns and imponderables. Ever since Wilhelm Conrad Roentgen accidentally discovered the X-ray in 1895, man has been finding new uses for it and new dangers from the radiation which it sets loose. At long last he has begun to stockpile his knowledge with the ultimate view not of liquidating himself, but of self-improvement.

"Over-emphasis on radiation hazard could easily cause us to curtail the use of roentgen rays in medicine, in which case medicine as we now know it would disappear," warned Dr. Brucer of Oak Ridge. "It might cause us to curtail the use of roentgen rays in dentistry. It could cause us to stop radiation therapy and diagnoses with radioactive isotopes. All these things help to make modern medicine truly modern. The neglect of these things would be even more dangerous than under-emphasis of radiation safety."

Atomic wars and weapons tests are political matters. We can only watch and work for lofty world leadership.

As far as medicine and science are concerned, while we can't afford to ignore radiation, neither can we allow ourselves to be scared to death by it.

-0-

MNOS-3

March 1, 1962

MEMORANDUM FOR ~~COMMISSIONER HAMOND~~ The Record

Subject: AEC 604/63 - "HEALTH IMPLICATIONS OF FALLOUT FROM NUCLEAR WEAPONS TESTING

The material from which the Secretariat prepared the above paper has been returned to ~~your office~~ Mr. Hamond's office, and the stencils used in the reproduction, together with 3 copies of the Report remaining after distribution within the AEC and to the Federal Radiation Council, are ~~forwarded~~ filed with this memorandum.

The distribution of AEC 604/63 was as follows:

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W. B. McCool
Secretary

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3-1-62

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON 25, D. C.

MA.5.3

March 1, 1962

The Record

MEMORANDUM FOR ~~COMMISSIONER HAWORTH~~

Subject: AEC 604/63 - "HEALTH IMPLICATIONS OF FALLOUT FROM NUCLEAR WEAPONS TESTING

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Secretary

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February 15, 1962

REPORT OF THE FEDERAL RADIATION COUNCIL

HEALTH IMPLICATIONS OF FALLOUT FROM NUCLEAR WEAPONS TESTING

The Federal Radiation Council has considered available information on radiation doses and possible health effects of nuclear weapons testing. Before discussing the estimates made in this report in detail, it is appropriate to point out the difficulties of being precise in this field. Available data are generally based on measurements made at particular places and times; application of such data to a whole country, a whole year or a whole population necessarily involves assumptions that have not been completely validated. Such extensions of limited data can at best lead to conclusions that apply to most people but not all: deviations above and below the average are inevitable. Furthermore, knowledge of the effects of low-level radiation on human beings is too limited to provide firm conclusions. The only way to predict with assurance what the human effects of radiation will be is to have factual evidence that takes years to accumulate. Since this is not available, we have to rely on our very limited human experience and animal experimentation. But even data obtained from animals are limited and their application to man is uncertain.

Finally, any proper understanding of estimates in this field must take into account the many different ways in which similar or even identical data can be expressed. Many of the apparent differences among scientists that have been reported arise from different forms of presentation. Thus a single prediction of the adverse health effect of a particular radiation dose can be expressed on the one hand as the probability of the effect happening to a single person, or on the other hand the number of persons in this country likely to be affected in a single year, or the number throughout the world, or the number for several generations totaling hundreds of years. For example, this report will discuss certain scientific estimates of possible genetic effects of fallout. These estimates indicate that testing through 1961 may result in about one neonatal or embryonic death per 160,000 live births in the first generation. These same estimates would mean that in the United States, among the offspring of potential parents now living, there may be 600 neonatal and embryonic deaths, most of the latter occurring so soon after conception that the pregnancy is unnoticed; throughout the world for all later generations the total number of such cases may be of the order of 60,000.

February 15, 1962

Estimated Radiation Exposure from Testing

Any consideration of possible health effects from fallout must begin with the radiation doses to which people have been exposed from testing through 1961.

A sharp distinction must be made between the devastating effects of "local" fallout in a thermonuclear attack on an unshielded population and the effects of fallout from weapons testing. Weapons testing creates far smaller total amounts of fission products so that all fallout is far less than that associated with potential nuclear war. Furthermore, the tests are so conducted as to avoid local fallout or to confine it to locations where it will have minimum effects. Hence, in weapons testing the problem is confined to delayed fallout which decays greatly in the upper atmosphere and is dispersed at low concentrations over the earth's surface. This report is concerned only with the effects of such delayed fallout.

A second point that must be understood is that radiation doses are not uniform for all parts of the body. There are many different radioactive substances that give off rays which reach the body -- either directly through the air or from radioactive substances in food and liquid we consume. Some of these substances give an equal amount of exposure to all parts of the body. So-called whole-body doses are thus the composite effect of radiation from all such substances, i.e., external as well as internal. Other substances, however, tend to collect in certain specific parts of the body and concentrate their radiation there. Thus a so-called thyroid dose, for example, represents the sum of the whole-body dose from a variety of substances plus the extra dose from iodine-131, an element which collects in the thyroid gland. Furthermore, different sources of radiation give off different kinds of radiation having different biological effects, so that doses cannot be directly compared. This point should indicate the difficulty of referring to any one exposure level from a particular source without identifying what kind of a dose and what part of the body is involved.

Estimates of the average exposure of the United States population to radiation from fallout from all nuclear testing through 1961 are given in Table I, and discussed further in Appendix "A". Because of the uncertainties and the variety of necessary assumptions, these estimates are expressed as ranges of values within which the average exposure over the United States is expected to lie.

February 15, 1962

Health Implications of Fallout

The principal difficulty of estimating the health implications of fallout is that so little is known about the effects of radiation exposures at levels as low as those which have resulted and are likely to result from weapons testing through 1961. In fact, the evidence is insufficient to prove either that there is a level of dosage below which no manifest damage occurs (the "damage threshold" hypothesis) or that there is some risk of manifest damage occurring at any level of dosage (the "no threshold" hypothesis).

To be prudent we have made the assumption that even the relatively low levels of exposure from fallout involve some increased risk of injury to exposed population groups. We are not certain that injury will occur; we assume that it might. We also assume that the amount of injury that might occur increases as the exposure level increases.

Once these assumptions are made, the question becomes whether there is any one level of exposure at which the risk of injury is so great that it may be called the "danger point." Since we are assuming that some danger might occur at every level of exposure, the term "danger point" is really misleading -- especially if that term is thought to mean a dividing mark between safety and peril. Each level of exposure may in a sense be a danger point since there may be some risk of injury at every level. And because there are many different protective measures that could be taken to minimize exposure to radiation from types of sources and different levels of possible radioactivity, there is no one danger point at which all protective measures should be put into effect.

The only sense in which the idea of a danger point is useful is that of an unacceptable risk. We mean by this that at a certain level of exposure, the risk of injury is so great that the time has come to take protective steps appropriate to that particular level or to refrain from increasing the risk any further. Deciding upon this point is not a matter of mathematics; it is a matter of judgment. Even in this sense the "danger point" will vary depending on the different circumstances that might exist at any one time. Therefore, contrary to an opinion which appears to be commonly held, there is no one level of exposure to fallout which, under all circumstances, can properly be called the "danger point."

February 15, 1962

On the assumption that there is some increased risk from exposures to fallout, it would be desirable to predict that risk with precision. This cannot be done with confidence. The long-term effects of radiation do not differ from certain disease conditions normally present in the population. We can say that additional exposure to radiation is expected to result in some increases in the frequency of genetic mutations and it might increase the incidence of leukemia and cancer. There is no evidence to indicate that other adverse health effects, if they occur at all, have significant consequences. Because none of these adverse health effects is caused solely by radiation and because their occurrence in the entire population as a possible result of fallout is too small to have been observed and counted, it is impossible to predict their magnitude with any confidence. We can make reasonably good estimates of radiation doses resulting from fallout, but once we turn from dose levels to their effects on man, we can only estimate what effects are possible. In the absence of more definite knowledge, we believe the most useful way to discuss possible health hazards is to: (1) compare radiation doses from fallout with natural background and with the Radiation Protection Guides of the Federal Radiation Council to put these dose levels in some perspective, and then (2) set forth with proper qualifications the estimates of adverse health effects from fallout considered to be possible and put these figures in some perspective by comparison with the number of cases of such effects occurring in the absence of fallout.

Comparison of Dose Levels

Natural background means radiation from natural sources, including radioactive materials in the earth's crust and cosmic radiation from outer space. Human exposures to such radiations, thus have always been with us. Levels of exposure to natural sources of radiation vary from place to place, both with elevation and with radioactive content of local materials. These levels of radiation are estimated to result in whole-body doses averaging 100 millirems (units of radiation dose) per year to residents of the United States and running up to several times this value in limited regions of the world where large amounts of naturally radioactive materials are concentrated. Average exposure of population groups to radiation from fallout, with the exception of radioiodine, have generally been considerably less than exposures to natural sources, as noted in column 3 of Table I. For example, the average dose of genetic significance from all testing through 1961 will be between 60 and 130 millirems and the genetic dose from natural background received over a period of 30 years (the average length of exposure per generation) will be 3,000 millirems; thus, past testing will increase this dose between 2 and 5%. The 70-year average bone dose (significant in terms of possible bone malignancies) when similarly compared to natural background will represent an increase of between 4 and 10%.

February 15, 1962

Many persons stress the fact that exposures to most radiation from fallout are far less than those to which the human race has always been subjected. Others emphasize that radiation from natural sources might account for certain human ills and the fact that this natural background is generally accepted without question should not in itself be a reason for accepting exposure to added levels of man-made radiation. However, comparison of exposure levels with those of natural background does provide some measure of the significance of small increases in exposures of radiation. As an individual, one normally considers variations in exposure from natural sources of little significance. For example, a resident of the East Coast contemplating a change of residence to a community at a high elevation in the West, is likely to attach little importance to the fact that higher levels of cosmic radiation at elevations above one mile would result in more than a 25% increase in his exposure to radiation from natural sources.

Another basis of comparison sometimes used in efforts to evaluate the hazards of fallout is the current Radiation Protection Guides for normal peacetime operations, limiting exposure of occupational workers and members of the general population to radiation from sources other than natural background and medical X-rays. Table I indicates that doses from fallout have been lower than, generally a small fraction of, the Radiation Protection Guides for population groups (Column 5).

Estimates of Health Effects

Estimates have been made by national and international groups of scientists of the number of possible adverse health effects that might occur from various exposure levels. These estimates are discussed in Appendix "B". Table II applies some of these estimates to the exposure levels from all testing through 1961 to indicate the possible adverse health effects in the United States population that might result from this testing. United States figures have been used because knowledge of dose levels and of health effects occurring in the absence of testing is more complete for this country than on a world-wide basis. It is assumed that the United States population is about one-tenth of the world population in those latitudes of the northern hemisphere principally affected by fallout. The figures in Table II on the possible number of adverse health effects from testing through 1961 may be multiplied by 10 to provide a rough estimate of comparable world-wide effects on the assumptions that average exposure levels throughout the world approximate those in the United States and that the influence of various population factors, such as rates of birth, death, and disease is relatively the same.

February 15, 1962

With respect to genetic effects, geneticists agree that there will be some effects even at the lowest levels of exposure. The estimates in Table II are considered to be reasonable in light of present knowledge, although the estimates of some geneticists may be higher or lower by a factor of about five. With respect to leukemia and neoplasms of bone, the likelihood of their occurrence is more uncertain, and at dose levels as low as those from testing through 1961, these effects may not occur at all. Therefore the values for these effects are expressed as a range from zero up to the figures indicated in the table.

To put these estimates of possible adverse health effects in some perspective, Table II lists in column 1 the total number of cases of these diseases or abnormalities occurring in the United States during comparable time periods from all causes other than testing. Column 2 of this table gives estimates of the possible number of cases within the total number which might be a result of natural background radiation. For example, during one generation, there will be in the United States 2,000,000 cases of tangible genetic defects from all causes; of these 40,000 might be caused by natural background radiation; testing through 1961 might cause an additional 125 cases in the first generation.

Conclusions

We cannot say with certainty what health hazards are caused by fallout from nuclear testing. We expect there will be some genetic effects; other effects such as leukemia and cancer are more speculative and may not occur at all. We can observe that, compared to the number of these same adverse health effects occurring wholly apart from testing, the additional cases that might be caused by testing are a very small quantity. We cannot, however, disregard this quantity. We conclude that nuclear testing through 1961 has increased by small amounts the normal risks of encountering some adverse health effects.

Attachments

February 15, 1962

HEALTH IMPLICATIONS OF FALLOUT
FROM NUCLEAR WEAPONS TESTING

APPENDIX "A"
RADIATION DOSES FROM FALLOUT

The following estimates of radiation doses attributable to fallout from tests of nuclear weapons conducted through 1961 have been based on observations and assumptions of persons who have made extensive studies of the subject. These estimates include exposures from fallout which has already occurred and from material from past tests yet to be deposited.

Estimates are based on measurements of radionuclides in air, rain, soil, water supplies, and food, and of radionuclides in people. These observations not only provide a basis for estimating doses to persons to whom they are applicable, but also provide reasonable projections as to the results of future explosions under similar conditions.

In presenting these estimates, it would be desirable to indicate the degree of precision. However, the estimates include assumptions which make the degree of precision uncertain.

Table I gives estimates of radiation doses from fallout resulting from tests prior to 1961, from tests of the 1961 USSR series, and from all tests prior to 1962. For these estimates it is assumed that the total energy yield of the 1961 USSR series was 120 megatons (MT) and a fission yield of 25 MT. The dose ranges given in Table I represent estimates made by different persons using somewhat different assumptions rather than reflecting the degree of uncertainty of the estimate. It is believed, however, that the best estimates that can be made at the present time would lie within the ranges given.

Fallout of the longer lived radionuclides from the USSR tests of 1961 is expected to reach its peak in the spring of 1962. It is assumed that the dissemination of the debris will be like that from USSR tests in earlier years. If much of the fission material produced in the 1961 tests is from a single test of high yield, fallout in the United States may be substantially less than estimated.

In the cases of whole body and gonadal exposures, radiation doses are relatively independent of age, except for the fact that children born in the past two or three years will have missed much of the exposure from earlier tests experienced by older persons. A large fraction of the whole body and gonadal exposure from a

February 15, 1962

particular test may be received within a period of months after fallout occurs. The contribution of radioiodine to the dose to the thyroid gland is effectively complete within a few weeks.

Radiation doses to the bone and bone marrow from a particular test will be received at decreasing rates over a period of a lifetime. Early concentrations in the bone will be greatest for children less than one year of age at the time that peak concentrations of fallout occur in food. It is estimated that children born in early 1962 will receive radiation doses to the bone and bone marrow greater than those received by children born in earlier years. The average bone and bone marrow doses to such children estimated in Table I are much larger than the average to the whole population.

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TABLE I — ESTIMATED AVERAGE RADIATION DOSES OF ESPECIAL INTEREST 1/
(All radiation doses are expressed in millirems)

Tissue or organ	Column 1 From tests prior to 1961	Column 2 From USSR tests of 1961	Column 3 From all tests through 1961 7/	Column 4 From natural background	Column 5 FRC Radiation Protection Guides for normal peacetime operations: Population groups	Column 6 FRC Radiation Protection Guides for normal peacetime operations: Radiation workers
Whole body 2/ (including gonads)						
1 year 3/	10 - 15	10 - 25	10 - 25	100	170	5,000
30 year	45 - 100	20 - 45	60 - 130	3,000	5,000	150,000
70 year	50 - 130	25 - 60	70 - 150	7,000	11,900	---
Bone 4/						
1 year	25 - 50	35 - 75	35 - 75	130	500	---
70 year	300 - 600	250 - 500	400 - 900	9,100	35,000	---
Bone marrow						
1 year	15 - 25	20 - 40	20 - 40	95	170	---
70 year	125 - 300	100 - 225	150 - 350	6,700	11,900	---
Thyroid gland						
1 year 5/	100 - 200	75 - 150	100 - 200	100	500	---
"Total" 6/	175 - 350	75 - 150	200 - 400	---	---	---

Notes Footnotes below are expanded in Appendix "A"

1/ Doses are averaged over individuals in age groups receiving highest exposures, and over United States.
2/ These doses are received by all portions of body and contribute to organ doses listed separately.
3/ These one-year doses received in 1959 and 1962 respectively.
4/ Bone and bone marrow doses from 1961 tests are to persons who are infants in 1962; doses from tests prior to 1961 and from all tests prior to 1962 are to persons who were infants in 1959.
5/ Infants on fresh cow's milk in 1957-58, averaged over United States. Local doses as high as 2,000 millirems have been estimated.
6/ Except for "whole body contribution" doses to the thyroid from all past tests are essentially complete.
7/ The ranges shown in Column 3 are not derived from addition of Columns 1 and 2 since the persons receiving the maximum doses from tests prior to 1961 are not the same receiving maximum doses from the USSR tests of 1961; these two are only partially additive.

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February 15, 1962

HEALTH IMPLICATIONS OF FALLOUT
FROM NUCLEAR WEAPONS TESTING

EXPANDED NOTES ON ESTIMATES GIVEN IN TABLE I

Footnote

1/ Averages are taken over the continental United States. Whole body and gonadal doses are averaged over the whole population; bone and thyroid doses over that portion of the population who were (or will be) infants at the time of highest concentrations of relevant radionuclides in the diet. Average doses to older children and adults, and thus to the total population, would be smaller. Some local averages, particularly in the case of the thyroid, are much higher. Since the persons receiving maximum bone and thyroid doses from earlier tests are not the persons receiving maximum doses from the 1961 tests, the two sets of doses are only partially additive.

2/ External sources and cesium-137 within the body irradiate the whole body more or less uniformly. The skeleton and thyroid gland receive additional radiation from radionuclides concentrated within these organs. Doses estimated for bone and thyroid include the "whole body" contribution.

3/ All one-year doses are for the year, within the period covered, in which the highest yearly doses were received. The highest one-year doses to the whole body and skeleton from tests prior to 1962 were experienced in 1959. The highest one-year doses to the whole body and to the skeleton from the 1961 tests are expected during 1962 and 1963.

4/ (No additional discussion of footnote 4/ Table I.)

5/ These are estimates of radiation doses to thyroids of infants on fresh cow's milk in 1957-1958, averaged over the United States. Average doses to thyroids of infants on canned or powdered milk, or on mother's milk, and to thyroids of older children were much less. In some areas of the United States average doses to thyroids in 1957-58 were several times the United States average, reaching about 2,000 millirems.

6/ "Total" doses to the thyroid of especial interest from all past tests are essentially complete. The average lifetime of iodine-131 produced in a test is only about 12 days. For these reasons, iodine-131 from the 1961 tests contributed much less to total doses to thyroids of children who were infants in 1957 than to thyroids of children who were infants in 1961.

7/ (No additional discussion of footnote 7/, Table I.)

February 15, 1962

HEALTH IMPLICATIONS OF FALLOUT
FROM NUCLEAR WEAPONS TESTING

APPENDIX "B"

BIOLOGICAL EFFECTS

Table II gives numerical estimates of possible health effects from fallout in comparison with the natural occurrence of these effects.

Genetic Effects

The following estimates of genetic effects are based in part upon a report by a Committee on Genetic Effects of the National Academy of Sciences, contained in the Academy's 1956* Summary Reports on the Biological Effects of Atomic Radiation, and in part on more recent observations by Dr. W. L. Russel, a member of the Committee.** The Academy's report noted that all presently available scientific information leads to a conclusion which, for the purposes of this memorandum, may be stated as: the genetic effects of exposure of a population to radiation are proportional to the average total gonadal dose to potential parents.

The Academy's report gave a quantitative estimate of the proportionality in terms of the following example: Of 100,000,000 children who will be born to potential parents now living in the United States, about 2,000,000 will experience some physical or mental defect as the result of "spontaneous" genetic mutations which have been induced by natural causes excluding man-made radiation. The report estimated that if these potential parents were to be subjected to gonadal doses of radiation averaging 10 roentgens, this average dose would give rise to some 50,000 additional instances of tangible inherited defects in the next generation and a total of about 500,000 instances in all future generations. (This estimate assumes no change in the size of the population.)

*The 1960 report of the Academy on the same subject made no numerical estimates of these effects.

**Russell found that, at low dose rates, the genetic effects per unit of radiation dose to the gonads are one-fourth or less than in the case of high dose rates (greater than rates of the order of one roentgen per minute) upon which previous estimates had been made.

February 15, 1962

Dr. Russell's subsequent finding, that at dose rates lower than about one roentgen per minute, the frequency of genetic mutation is about one-fourth that previously assumed, would reduce these estimates by a factor of about one-fourth. If one applies these modified estimates to the gonadal exposures estimated to occur from past weapons tests, approximately 100 millirems received over a period of thirty years, assuming the same constant of proportionality, one may estimate that the exposure to fallout from weapons testing through 1961, would result in an additional 1,250 cases of tangible inherited defects of which about 125 would occur in the first generation.

In addition to the tangible inherited defects in live births discussed quantitatively by the National Academy of Sciences Committee, genetic mutations result in such effects as embryonic and neonatal deaths, still-births and childhood deaths. One geneticist, Dr. James Crow, a member of the NAS Committee, estimated at the Joint Committee on Atomic Energy Hearings of 1957 (pp. 1021-23) that in the aggregate the number of these effects might be of the order of 10 times the number of tangible inherited defects appearing in live births. Some more detailed estimates are included in Table II. The fractional increase of such effects as a result of exposure to radiation is believed to be the same as the fractional increase in tangible inherited defects in live births.

Leukemia and Bone Cancer

The current total incidence of leukemia in the United States is about 12,000 cases per year and that of bone cancer is about 2,000 cases per year. These amount to average rates for all ages of seven cases per one-hundred thousand persons and 1.1 cases per one-hundred thousand persons, respectively. If it is assumed that the incidence of these diseases as a result of exposure of the blood-forming tissues and the bone, respectively, to radiation is proportional to the exposure, observations of numbers of cases of leukemia resulting from very large doses of radiation suggest that as much as ten percent of the normal incidence of leukemia may be due to exposure to radiation from natural sources, amounting to an average of 6.7 rems in 70 years. The same assumption has sometimes been made for bone cancer. These assumptions have been made, for example, by the United Nations Scientific Committee on the Effects of Atomic Radiation (1958) in estimating an upper limit to the number of cases of leukemia and bone cancer that might reasonably be expected from low levels of exposure, such as those from fallout from the testing of nuclear weapons. On this basis one might estimate that if an average lifetime exposure of 6.7 rems to the blood-forming tissues of the

February 15, 1962

population of the United States results in a total of about 84,000 cases of leukemia in the average lifespan of 70 years, an average lifetime exposure of about 350 millirems to the bone marrow would result in a total of about 4,400 cases of leukemia averaging about 65 per year. Actually, the estimated upper limit would be considerably smaller than this since the value of 350 millirems using the computation is an estimated dose for a class of individuals considered to receive the highest bone marrow doses from fallout rather than for the entire population.

A corresponding estimate for the number of cases of bone cancer from lifetime dose of about 900 millirems would give an upper limit of 1,400 cases in 70 years, averaging about 20 cases per year. Considering that the number of deaths per year is about 1,700,000, an average of 85 additional cases per year of leukemia and bone cancer would represent a very small additional chance of an individual contracting one of these diseases as a result of fallout from weapons testing.

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TABLE II — ESTIMATES OF HEALTH IMPACT IN THE UNITED STATES OF RADIATION FROM NATURAL BACKGROUND AND NUCLEAR TESTING THROUGH 1961 1/

Part 1 — Genetic effects among the offspring of potential parents now living, based on the assumption of 100,000,000 live births over the next generation *

Effects	Column 1 Total number of cases in the U.S.	Column 2 Possible number of cases in U.S. within total estimated to be due to natural background radiation 2/	Column 3 Possible number of additional cases in the U.S. which might be assumed to result from all tests through 1961 2/
Genetic Effects			
tangible inherited birth defects	2,000,000	40,000 3/	125
stillbirths and childhood deaths 4/	7,500,000	150,000 3/	300
embryonic and neonatal deaths 4/	17,500,000	350,000 3/	600

1/ Worldwide health impact of fallout from nuclear weapons testing through 1961 would be roughly ten times the United States figures, assuming that average exposures to that portion of the world population in those latitudes of the northern hemisphere principally affected by fallout approximate those in the United States and that the influence of various population factors, such as rates of birth, death, and disease is the same.

2/ The values for genetic effects are believed to represent the best estimates available and not likely to be in error by more than a factor of five.

3/ A large number of birth defects also occur from non-genetic causes and they are approximately equal in number to the genetic cases.

4/ Inconsistencies in reporting and collating mortality data of this type have resulted in overlapping in these two categories: i.e., some cases of neonatal deaths are included in the number of cases of childhood deaths and conversely some stillbirths are included with the embryonic deaths. Therefore, these two categories, not being mutually exclusive, are not additive.

* The bases for this assumption are given in the National Academy of Sciences' Summary Reports on the Biological Effects of Atomic Radiation (1956)

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TABLE II — ESTIMATES OF HEALTH IMPACT IN THE UNITED STATES OF RADIATION FROM NATURAL BACKGROUND AND NUCLEAR TESTING THROUGH 1961 1/

Part 2 — Malignant diseases in the next seventy years (an assumed lifespan)

Effects	Column 1 Total number of cases in the U.S.	Column 2 Possible number of cases in U.S. within total estimated to be due to natural background radiation 2/	Column 3 Possible number of additional cases in the U.S. which might be assumed to result from all tests through 1961 2/
Malignant diseases			
leukemia	840,000	0 - 84,000	0 - 4,400
neoplasms of bone	140,000	0 - 14,000	0 - 1,400

1/ Worldwide health impact of fallout from nuclear weapons testing through 1961 would be roughly ten times the United States figures, assuming that average exposures to that portion of the world population in those latitudes of the northern hemisphere principally affected by fallout approximate those in the United States and that the influence of various population factors, such as rates of birth, death, and disease is the same.

2/ The top-of-range values for malignant diseases represent maximum upper limits of these effects, using conservative assumptions.

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AEC 604/63

February 27, 1962

COPY NO. 19

ATOMIC ENERGY COMMISSION

HEALTH IMPLICATIONS OF FALLOUT FROM NUCLEAR WEAPONS TESTING

Note by the Secretary

The attached report of the Federal Radiation Council is circulated for information at the request of Commissioner Haworth. The report is to be treated as an internal document, with access on a strict need-to-know basis.

W. B. McCool
Secretary

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February 15, 1962

REPORT OF THE FEDERAL RADIATION COUNCIL

HEALTH IMPLICATIONS OF FALLOUT FROM NUCLEAR WEAPONS TESTING

The Federal Radiation Council has considered available information on radiation doses and possible health effects of nuclear weapons testing. Before discussing the estimates made in this report in detail, it is appropriate to point out the difficulties of being precise in this field. Available data are generally based on measurements made at particular places and times; application of such data to a whole country, a whole year or a whole population necessarily involves assumptions that have not been completely validated. Such extensions of limited data can at best lead to conclusions that apply to most people but not all: deviations above and below the average are inevitable. Furthermore, knowledge of the effects of low-level radiation on human beings is too limited to provide firm conclusions. The only way to predict with assurance what the human effects of radiation will be is to have factual evidence that takes years to accumulate. Since this is not available, we have to rely on our very limited human experience and animal experimentation. But even data obtained from animals are limited and their application to man is uncertain.

Finally, any proper understanding of estimates in this field must take into account the many different ways in which similar or even identical data can be expressed. Many of the apparent differences among scientists that have been reported arise from different forms of presentation. Thus a single prediction of the adverse health effect of a particular radiation dose can be expressed on the one hand as the probability of the effect happening to a single person, or on the other hand the number of persons in this country likely to be affected in a single year, or the number throughout the world, or the number for several generations totaling hundreds of years. For example, this report will discuss certain scientific estimates of possible genetic effects of fallout. These estimates indicate that testing through 1961 may result in about one neonatal or embryonic death per 160,000 live births in the first generation. These same estimates would mean that in the United States, among the offspring of potential parents now living, there may be 600 neonatal and embryonic deaths, most of the latter occurring so soon after conception that the pregnancy is unnoticed; throughout the world for all later generations the total number of such cases may be of the order of 60,000.

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February 15, 1962

Estimated Radiation Exposure from Testing

Any consideration of possible health effects from fallout must begin with the radiation doses to which people have been exposed from testing through 1961.

A sharp distinction must be made between the devastating effects of "local" fallout in a thermonuclear attack on an unshielded population and the effects of fallout from weapons testing. Weapons testing creates far smaller total amounts of fission products so that all fallout is far less than that associated with potential nuclear war. Furthermore, the tests are so conducted as to avoid local fallout or to confine it to locations where it will have minimum effects. Hence, in weapons testing the problem is confined to delayed fallout which decays greatly in the upper atmosphere and is dispersed at low concentrations over the earth's surface. This report is concerned only with the effects of such delayed fallout.

A second point that must be understood is that radiation doses are not uniform for all parts of the body. There are many different radioactive substances that give off rays which reach the body -- either directly through the air or from radioactive substances in food and liquid we consume. Some of these substances give an equal amount of exposure to all parts of the body. So-called whole-body doses are thus the composite effect of radiation from all such substances, i.e., external as well as internal. Other substances, however, tend to collect in certain specific parts of the body and concentrate their radiation there. Thus a so-called thyroid dose, for example, represents the sum of the whole-body dose from a variety of substances plus the extra dose from iodine-131, an element which collects in the thyroid gland. Furthermore, different sources of radiation give off different kinds of radiation having different biological effects, so that doses cannot be directly compared. This point should indicate the difficulty of referring to any one exposure level from a particular source without identifying what kind of a dose and what part of the body is involved.

Estimates of the average exposure of the United States population to radiation from fallout from all nuclear testing through 1961 are given in Table I, and discussed further in Appendix "A". Because of the uncertainties and the variety of necessary assumptions, these estimates are expressed as ranges of values within which the average exposure over the United States is expected to lie.

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February 15, 1962

Health Implications of Fallout

The principal difficulty of estimating the health implications of fallout is that so little is known about the effects of radiation exposures at levels as low as those which have resulted and are likely to result from weapons testing through 1961. In fact, the evidence is insufficient to prove either that there is a level of dosage below which no manifest damage occurs (the "damage threshold" hypothesis) or that there is some risk of manifest damage occurring at any level of dosage (the "no threshold" hypothesis).

To be prudent we have made the assumption that even the relatively low levels of exposure from fallout involve some increased risk of injury to exposed population groups. We are not certain that injury will occur; we assume that it might. We also assume that the amount of injury that might occur increases as the exposure level increases.

Once these assumptions are made, the question becomes whether there is any one level of exposure at which the risk of injury is so great that it may be called the "danger point." Since we are assuming that some danger might occur at every level of exposure, the term "danger point" is really misleading -- especially if that term is thought to mean a dividing mark between safety and peril. Each level of exposure may in a sense be a danger point since there may be some risk of injury at every level. And because there are many different protective measures that could be taken to minimize exposure to radiation from types of sources and different levels of possible radioactivity, there is no one danger point at which all protective measures should be put into effect.

The only sense in which the idea of a danger point is useful is that of an unacceptable risk. We mean by this that at a certain level of exposure, the risk of injury is so great that the time has come to take protective steps appropriate to that particular level or to refrain from increasing the risk any further. Deciding upon this point is not a matter of mathematics; it is a matter of judgment. Even in this sense the "danger point" will vary depending on the different circumstances that might exist at any one time. Therefore, contrary to an opinion which appears to be commonly held, there is no one level of exposure to fallout which, under all circumstances, can properly be called the "danger point."

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February 15, 1962

On the assumption that there is some increased risk from exposures to fallout, it would be desirable to predict that risk with precision. This cannot be done with confidence. The long-term effects of radiation do not differ from certain disease conditions normally present in the population. We can say that additional exposure to radiation is expected to result in some increases in the frequency of genetic mutations and it might increase the incidence of leukemia and cancer. There is no evidence to indicate that other adverse health effects, if they occur at all, have significant consequences. Because none of these adverse health effects is caused solely by radiation and because their occurrence in the entire population as a possible result of fallout is too small to have been observed and counted, it is impossible to predict their magnitude with any confidence. We can make reasonably good estimates of radiation doses resulting from fallout, but once we turn from dose levels to their effects on man, we can only estimate what effects are possible. In the absence of more definite knowledge, we believe the most useful way to discuss possible health hazards is to: (1) compare radiation doses from fallout with natural background and with the Radiation Protection Guides of the Federal Radiation Council to put these dose levels in some perspective, and then (2) set forth with proper qualifications the estimates of adverse health effects from fallout considered to be possible and put these figures in some perspective by comparison with the number of cases of such effects occurring in the absence of fallout.

Comparison of Dose Levels

Natural background means radiation from natural sources, including radioactive materials in the earth's crust and cosmic radiation from outer space. Human exposures to such radiations, thus have always been with us. Levels of exposure to natural sources of radiation vary from place to place, both with elevation and with radioactive content of local materials. These levels of radiation are estimated to result in whole-body doses averaging 100 millirems (units of radiation dose) per year to residents of the United States and running up to several times this value in limited regions of the world where large amounts of naturally radioactive materials are concentrated. Average exposure of population groups to radiation from fallout, with the exception of radioiodine, have generally been considerably less than exposures to natural sources, as noted in column 3 of Table I. For example, the average dose of genetic significance from all testing through 1961 will be between 60 and 130 millirems and the genetic dose from natural background received over a period of 30 years (the average length of exposure per generation) will be 3,000 millirems; thus, past testing will increase this dose between 2 and 5%. The 70-year average bone dose (significant in terms of possible bone malignancies) when similarly compared to natural background will represent an increase of between 4 and 10%.

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February 15, 1962

Many persons stress the fact that exposures to most radiation from fallout are far less than those to which the human race has always been subjected. Others emphasize that radiation from natural sources might account for certain human ills and the fact that this natural background is generally accepted without question should not in itself be a reason for accepting exposure to added levels of man-made radiation. However, comparison of exposure levels with those of natural background does provide some measure of the significance of small increases in exposures of radiation. As an individual, one normally considers variations in exposure from natural sources of little significance. For example, a resident of the East Coast contemplating a change of residence to a community at a high elevation in the West, is likely to attach little importance to the fact that higher levels of cosmic radiation at elevations above one mile would result in more than a 25% increase in his exposure to radiation from natural sources.

Another basis of comparison sometimes used in efforts to evaluate the hazards of fallout is the current Radiation Protection Guides for normal peacetime operations, limiting exposure of occupational workers and members of the general population to radiation from sources other than natural background and medical X-rays. Table I indicates that doses from fallout have been lower than, generally a small fraction of, the Radiation Protection Guides for population groups (Column 5).

Estimates of Health Effects

Estimates have been made by national and international groups of scientists of the number of possible adverse health effects that might occur from various exposure levels. These estimates are discussed in Appendix "B". Table II applies some of these estimates to the exposure levels from all testing through 1961 to indicate the possible adverse health effects in the United States population that might result from this testing. United States figures have been used because knowledge of dose levels and of health effects occurring in the absence of testing is more complete for this country than on a world-wide basis. It is assumed that the United States population is about one-tenth of the world population in those latitudes of the northern hemisphere principally affected by fallout. The figures in Table II on the possible number of adverse health effects from testing through 1961 may be multiplied by 10 to provide a rough estimate of comparable world-wide effects on the assumptions that average exposure levels throughout the world approximate those in the United States and that the influence of various population factors, such as rates of birth, death, and disease is relatively the same.

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February 15, 1962

With respect to genetic effects, geneticists agree that there will be some effects even at the lowest levels of exposure. The estimates in Table II are considered to be reasonable in light of present knowledge, although the estimates of some geneticists may be higher or lower by a factor of about five. With respect to leukemia and neoplasms of bone, the likelihood of their occurrence is more uncertain, and at dose levels as low as those from testing through 1961, these effects may not occur at all. Therefore the values for these effects are expressed as a range from zero up to the figures indicated in the table.

To put these estimates of possible adverse health effects in some perspective, Table II lists in column 1 the total number of cases of these diseases or abnormalities occurring in the United States during comparable time periods from all causes other than testing. Column 2 of this table gives estimates of the possible number of cases within the total number which might be a result of natural background radiation. For example, during one generation, there will be in the United States 2,000,000 cases of tangible genetic defects from all causes; of these 40,000 might be caused by natural background radiation; testing through 1961 might cause an additional 125 cases in the first generation.

Conclusions

We cannot say with certainty what health hazards are caused by fallout from nuclear testing. We expect there will be some genetic effects; other effects such as leukemia and cancer are more speculative and may not occur at all. We can observe that, compared to the number of these same adverse health effects occurring wholly apart from testing, the additional cases that might be caused by testing are a very small quantity. We cannot, however, disregard this quantity. We conclude that nuclear testing through 1961 has increased by small amounts the normal risks of encountering some adverse health effects.

Attachments

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February 15, 1962

HEALTH IMPLICATIONS OF FALLOUT
FROM NUCLEAR WEAPONS TESTING

APPENDIX "A"
RADIATION DOSES FROM FALLOUT

The following estimates of radiation doses attributable to fallout from tests of nuclear weapons conducted through 1961 have been based on observations and assumptions of persons who have made extensive studies of the subject. These estimates include exposures from fallout which has already occurred and from material from past tests yet to be deposited.

Estimates are based on measurements of radionuclides in air, rain, soil, water supplies, and food, and of radionuclides in people. These observations not only provide a basis for estimating doses to persons to whom they are applicable, but also provide reasonable projections as to the results of future explosions under similar conditions.

In presenting these estimates, it would be desirable to indicate the degree of precision. However, the estimates include assumptions which make the degree of precision uncertain.

Table I gives estimates of radiation doses from fallout resulting from tests prior to 1961, from tests of the 1961 USSR series, and from all tests prior to 1962. For these estimates it is assumed that the total energy yield of the 1961 USSR series was 120 megatons (MT) and a fission yield of 25 MT. The dose ranges given in Table I represent estimates made by different persons using somewhat different assumptions rather than reflecting the degree of uncertainty of the estimate. It is believed, however, that the best estimates that can be made at the present time would lie within the ranges given.

Fallout of the longer lived radionuclides from the USSR tests of 1961 is expected to reach its peak in the spring of 1962. It is assumed that the dissemination of the debris will be like that from USSR tests in earlier years. If much of the fission material produced in the 1961 tests is from a single test of high yield, fallout in the United States may be substantially less than estimated.

In the cases of whole body and gonadal exposures, radiation doses are relatively independent of age, except for the fact that children born in the past two or three years will have missed much of the exposure from earlier tests experienced by older persons. A large fraction of the whole body and gonadal exposure from a

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particular test may be received within a period of months after fallout occurs. The contribution of radioiodine to the dose to the thyroid gland is effectively complete within a few weeks.

Radiation doses to the bone and bone marrow from a particular test will be received at decreasing rates over a period of a lifetime. Early concentrations in the bone will be greatest for children less than one year of age at the time that peak concentrations of fallout occur in food. It is estimated that children born in early 1962 will receive radiation doses to the bone and bone marrow greater than those received by children born in earlier years. The average bone and bone marrow doses to such children estimated in Table I are much larger than the average to the whole population.

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TABLE I ESTIMATED AVERAGE RADIATION DOSES OF ESPECIAL INTEREST 1/
(All radiation doses are expressed in millirems)

Tissue or organ	Column 1 From tests prior to 1961	Column 2 From USSR tests of 1961	Column 3 From all tests through 1961 7/	Column 4 From natural background	Column 5 FRC Radiation Protection Guides for normal peacetime operations: Population groups	Column 6 FRC Radiation Protection Guides for normal peacetime operations: Radiation workers
Whole body 2/ (including gonads)						
1 year 3/	10 - 15	10 - 25	10 - 25	100	170	5,000
30 year	45 - 100	20 - 45	60 - 130	3,000	5,000	150,000
70 year	50 - 130	25 - 60	70 - 150	7,000	11,900	---
Bone 4/						
1 year	25 - 50	35 - 75	35 - 75	130	500	---
70 year	300 - 600	250 - 500	400 - 900	9,100	35,000	---
Bone marrow						
1 year	15 - 25	20 - 40	20 - 40	95	170	---
70 year	125 - 300	100 - 225	150 - 350	6,700	11,900	---
Thyroid gland						
1 year 5/	100 - 200	75 - 150	100 - 200	100	500	---
"Total" 6/	175 - 350	75 - 150	200 - 400	---	---	---

Notes Footnotes below are expanded in Appendix "A"

1/ Doses are averaged over individuals in age groups receiving highest exposures, and over United States.
2/ These doses are received by all portions of body and contribute to organ doses listed separately.
3/ These one-year doses received in 1959 and 1962 respectively.
4/ Bone and bone marrow doses from 1961 tests are to persons who are infants in 1962; doses from tests prior to 1961 and from all tests prior to 1962 are to persons who were infants in 1959.
5/ Infants on fresh cow's milk in 1957-58, averaged over United States. Local doses as high as 2,000 millirems have been estimated.
6/ Except for "whole body contribution" doses to the thyroid from all past tests are essentially complete.
7/ The ranges shown in Column 3 are not derived from addition of Columns 1 and 2 since the persons receiving the maximum doses from tests prior to 1961 are not the same receiving maximum doses from the USSR tests of 1961; these two are only partially additive.

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February 15, 1962

HEALTH IMPLICATIONS OF FALLOUT
FROM NUCLEAR WEAPONS TESTING

EXPANDED NOTES ON ESTIMATES GIVEN IN TABLE I

Footnote

1/ Averages are taken over the continental United States. Whole body and gonadal doses are averaged over the whole population; bone and thyroid doses over that portion of the population who were (or will be) infants at the time of highest concentrations of relevant radionuclides in the diet. Average doses to older children and adults, and thus to the total population, would be smaller. Some local averages, particularly in the case of the thyroid, are much higher. Since the persons receiving maximum bone and thyroid doses from earlier tests are not the persons receiving maximum doses from the 1961 tests, the two sets of doses are only partially additive.

2/ External sources and cesium-137 within the body irradiate the whole body more or less uniformly. The skeleton and thyroid gland receive additional radiation from radionuclides concentrated within these organs. Doses estimated for bone and thyroid include the "whole body" contribution.

3/ All one-year doses are for the year, within the period covered, in which the highest yearly doses were received. The highest one-year doses to the whole body and skeleton from tests prior to 1962 were experienced in 1959. The highest one-year doses to the whole body and to the skeleton from the 1961 tests are expected during 1962 and 1963.

4/ (No additional discussion of footnote 4/ Table I.)

5/ These are estimates of radiation doses to thyroids of infants on fresh cow's milk in 1957-1958, averaged over the United States. Average doses to thyroids of infants on canned or powdered milk, or on mother's milk, and to thyroids of older children were much less. In some areas of the United States average doses to thyroids in 1957-58 were several times the United States average, reaching about 2,000 millirems.

6/ "Total" doses to the thyroid of especial interest from all past tests are essentially complete. The average lifetime of iodine-131 produced in a test is only about 12 days. For these reasons, iodine-131 from the 1961 tests contributed much less to total doses to thyroids of children who were infants in 1957 than to thyroids of children who were infants in 1961.

7/ (No additional discussion of footnote 7/, Table I.)

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February 15, 1962

HEALTH IMPLICATIONS OF FALLOUT
FROM NUCLEAR WEAPONS TESTING

APPENDIX "B"

BIOLOGICAL EFFECTS

Table II gives numerical estimates of possible health effects from fallout in comparison with the natural occurrence of these effects.

Genetic Effects

The following estimates of genetic effects are based in part upon a report by a Committee on Genetic Effects of the National Academy of Sciences, contained in the Academy's 1956* Summary Reports on the Biological Effects of Atomic Radiation, and in part on more recent observations by Dr. W. L. Russel, a member of the Committee.** The Academy's report noted that all presently available scientific information leads to a conclusion which, for the purposes of this memorandum, may be stated as: the genetic effects of exposure of a population to radiation are proportional to the average total gonadal dose to potential parents.

The Academy's report gave a quantitative estimate of the proportionality in terms of the following example: Of 100,000,000 children who will be born to potential parents now living in the United States, about 2,000,000 will experience some physical or mental defect as the result of "spontaneous" genetic mutations which have been induced by natural causes excluding man-made radiation. The report estimated that if these potential parents were to be subjected to gonadal doses of radiation averaging 10 roentgens, this average dose would give rise to some 50,000 additional instances of tangible inherited defects in the next generation and a total of about 500,000 instances in all future generations. (This estimate assumes no change in the size of the population.)

*The 1960 report of the Academy on the same subject made no numerical estimates of these effects.

**Russell found that, at low dose rates, the genetic effects per unit of radiation dose to the gonads are one-fourth or less than in the case of high dose rates (greater than rates of the order of one roentgen per minute) upon which previous estimates had been made.

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February 15, 1962

Dr. Russell's subsequent finding, that at dose rates lower than about one roentgen per minute, the frequency of genetic mutation is about one-fourth that previously assumed, would reduce these estimates by a factor of about one-fourth. If one applies these modified estimates to the gonadal exposures estimated to occur from past weapons tests, approximately 100 millirems received over a period of thirty years, assuming the same constant of proportionality, one may estimate that the exposure to fallout from weapons testing through 1961, would result in an additional 1,250 cases of tangible inherited defects of which about 125 would occur in the first generation.

In addition to the tangible inherited defects in live births discussed quantitatively by the National Academy of Sciences Committee, genetic mutations result in such effects as embryonic and neonatal deaths, still-births and childhood deaths. One geneticist, Dr. James Crow, a member of the NAS Committee, estimated at the Joint Committee on Atomic Energy Hearings of 1957 (pp. 1021-23) that in the aggregate the number of these effects might be of the order of 10 times the number of tangible inherited defects appearing in live births. Some more detailed estimates are included in Table II. The fractional increase of such effects as a result of exposure to radiation is believed to be the same as the fractional increase in tangible inherited defects in live births.

Leukemia and Bone Cancer

The current total incidence of leukemia in the United States is about 12,000 cases per year and that of bone cancer is about 2,000 cases per year. These amount to average rates for all ages of seven cases per one-hundred thousand persons and 1.1 cases per one-hundred thousand persons, respectively. If it is assumed that the incidence of these diseases as a result of exposure of the blood-forming tissues and the bone, respectively, to radiation is proportional to the exposure, observations of numbers of cases of leukemia resulting from very large doses of radiation suggest that as much as ten percent of the normal incidence of leukemia may be due to exposure to radiation from natural sources, amounting to an average of 6.7 rems in 70 years. The same assumption has sometimes been made for bone cancer. These assumptions have been made, for example, by the United Nations Scientific Committee on the Effects of Atomic Radiation (1958) in estimating an upper limit to the number of cases of leukemia and bone cancer that might reasonably be expected from low levels of exposure, such as those from fallout from the testing of nuclear weapons. On this basis one might estimate that if an average lifetime exposure of 6.7 rems to the blood-forming tissues of the

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population of the United States results in a total of about 84,000 cases of leukemia in the average lifespan of 70 years, an average lifetime exposure of about 350 millirems to the bone marrow would result in a total of about 4,400 cases of leukemia averaging about 65 per year. Actually, the estimated upper limit would be considerably smaller than this since the value of 350 millirems using the computation is an estimated dose for a class of individuals considered to receive the highest bone marrow doses from fallout rather than for the entire population.

A corresponding estimate for the number of cases of bone cancer from lifetime dose of about 900 millirems would give an upper limit of 1,400 cases in 70 years, averaging about 20 cases per year. Considering that the number of deaths per year is about 1,700,000, an average of 85 additional cases per year of leukemia and bone cancer would represent a very small additional chance of an individual contracting one of these diseases as a result of fallout from weapons testing.

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TABLE II — ESTIMATES OF HEALTH IMPACT IN THE UNITED STATES OF RADIATION FROM NATURAL BACKGROUND AND NUCLEAR TESTING THROUGH 1961 1/

Part 1 — Genetic effects among the offspring of potential parents now living, based on the assumption of 100,000,000 live births over the next generation *

Effects	Column 1 Total number of cases in the U.S.	Column 2 Possible number of cases in U.S. within total estimated to be due to natural background radiation 2/	Column 3 Possible number of additional cases in the U.S. which might be assumed to result from all tests through 1961 2/
Genetic Effects			
tangible inherited birth defects	2,000,000	40,000 3/	125
stillbirths and childhood deaths 4/	7,500,000	150,000 3/	300
embryonic and neonatal deaths 4/	17,500,000	350,000 3/	600

1/ Worldwide health impact of fallout from nuclear weapons testing through 1961 would be roughly ten times the United States figures, assuming that average exposures to that portion of the world population in those latitudes of the northern hemisphere principally affected by fallout approximate those in the United States and that the influence of various population factors, such as rates of birth, death, and disease is the same.

2/ The values for genetic effects are believed to represent the best estimates available and not likely to be in error by more than a factor of five.

3/ A large number of birth defects also occur from non-genetic causes and they are approximately equal in number to the genetic cases.

4/ Inconsistencies in reporting and collating mortality data of this type have resulted in overlapping in these two categories: i.e., some cases of neonatal deaths are included in the number of cases of childhood deaths and conversely some stillbirths are included with the embryonic deaths. Therefore, these two categories, not being mutually exclusive, are not additive.

* The bases for this assumption are given in the National Academy of Sciences' Summary Reports on the Biological Effects of Atomic Radiation (1956)

TABLE II — ESTIMATES OF HEALTH IMPACT IN THE UNITED STATES OF RADIATION FROM NATURAL BACKGROUND AND NUCLEAR TESTING THROUGH 1961 1/

Part 2 — Malignant diseases in the next seventy years (an assumed lifespan)

Effects	Column 1 Total number of cases in the U.S.	Column 2 Possible number of cases in U.S. within total estimated to be due to natural background radiation 2/	Column 3 Possible number of additional cases in the U.S. which might be assumed to result from all tests through 1961 2/
Malignant diseases			
leukemia	840,000	0 - 84,000	0 - 4,400
neoplasms of bone	140,000	0 - 14,000	0 - 1,400

1/ Worldwide health impact of fallout from nuclear weapons testing through 1961 would be roughly ten times the United States figures, assuming that average exposures to that portion of the world population in those latitudes of the northern hemisphere principally affected by fallout approximate those in the United States and that the influence of various population factors, such as rates of birth, death, and disease is the same.

2/ The top-of-range values for malignant diseases represent maximum upper limits of these effects, using conservative assumptions.

OPTIONAL FORM NO. 10
5010-104

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UNITED STATES GOVERNMENT

Memorandum

TO File

DATE: February 15, 1962

FROM W. B. McCool, Secretary

SUBJECT: FRC's MEMORANDUM TO THE PRESIDENT ON THE HEALTH IMPLICATIONS OF FALL-OUT

SYMBOL: SECY:AHE

1. At Information Meeting 116 on February 14, 1962, Commissioner Haworth reported that in a discussion the previous night with Dr. Jerome Wiesner, Special Assistant to the President for Science and Technology, it was decided that the memorandum from the FRC to the President on Health Implications of Fall-out should not go to the President and that the report is to be revised and considered a Federal Radiation Council report only.

cc: Chairman
Director of Regulation
Deputy Director of Regulation
Director, Radiation Standards
Commissioner Haworth

2/15/62

Copy filed: MH.S.S. Radiation Exposure

~~OFFICIAL USE ONLY~~

Mtg S-3

OFFICIAL USE ONLY

OPTIONAL FORM NO. 10
5010-104
UNITED STATES GOVERNMENT

Reference Section

Memorandum

TO : File

DATE: February 1, 1962

FROM : W. B. McCool, Secretary Original signed W. B. McCool

SUBJECT: AEC ANALYSIS OF DOD PAMPHLET ON FALL-OUT PROTECTION

SYMBOL:SECY:AHE

At Information Meeting 111, January 31, 1962, the Chairman reported on his conversation with Mr. McGeorge Bundy, Special Assistant to the President, regarding AEC analysis of the DOD pamphlet on fall-out protection and requested preparation of an edited version of the AEC analysis for transmittal to Mr. Bundy. Dr. Dunham informed me on February 1, 1962 that the edited report was in preparation.

cc: Chairman
General Manager
Deputy General Manager
Assistant General Manager
Asst. to the General Manager
Asst. Gen. Mgr. for RD
Director, Biology & Medicine

2-1-62

Copy filed: Mtg S-3. Laboratory Tactical

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Mt. S. 3

UNCLASSIFIED

January 22, 1962

AEC 604/62

COPY NO. 62

AEC 604/62

ATOMIC ENERGY COMMISSION

WHITE HOUSE PRESS RELEASE ON RADIATION PROTECTION ACTIVITIES OF FEDERAL AGENCIES

Note by the Secretary

The Director, Office of Radiation Standards, has requested that the attached White House Press Release be circulated for the information of the Commission.

W. B. McCool
Secretary

DISTRIBUTION	COPY NO.	DISTRIBUTION	COPY NO.
Secretary	1	Public Information	34 - 35
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Deputy Dir. of Regulation	10	Operations Analysis	40
Deputy Gen. Mgr.	11	Plans	41
Asst. Gen. Mgr.	12	Production	42 - 43
Asst. GM-Plans & Prod.	13	Radiation Standards	44
Asst. GM Operations	14	Raw Materials	45 - 46
Asst. Gen. Mgr. R&D	15	Reactor Development	47 - 55
Asst. Gen. Mgr. Adm.	16	Manager, Naval Reactors	56
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Biology & Medicine	22	D. C. Office	59 - 61
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Congr. Liaison	33		

1-22-62

X-Oem-12-President, Exec.

UNCLASSIFIED

IMMEDIATE RELEASE JANUARY 13, 1962

Office of the White House Press Secretary

THE WHITE HOUSE

THE WHITE HOUSE TODAY MADE PUBLIC THE FOLLOWING MEMORANDUM TO THE PRESIDENT FROM ABRAHAM RIBICOFF, SECRETARY OF HEALTH, EDUCATION AND WELFARE, AND CHAIRMAN OF THE FEDERAL RADIATION COUNCIL

MEMORANDUM FOR THE PRESIDENT

SUBJECT: Radiation Protection Activities of Federal Agencies under Radiation Protection Guidance for Federal Agencies Promulgated by the President

In line with its statutory responsibility to advise the President on radiation matters directly and indirectly affecting health, including guidance to Federal agencies on radiation standards, the Federal Radiation Council in 1960 established the following system of reporting by Federal agencies on their radiation protection activities:

1. A regular annual report by each agency on August 1 as to any operating criteria or regulations revised, adopted, or promulgated during the previous year under the Radiation Protection Guidance for Federal Agencies promulgated by the President.

2. Prompt notification of the Council of the adoption or promulgation of any new or revised operating criteria or regulations in areas covered by approved Radiation Protection Guides. Cases involving levels in excess of such guides are to be noted.

The following Federal agencies having radiation protection responsibilities which might fall under the Radiation Protection Guidance for Federal Agencies promulgated by the President submitted an annual report:

Atomic Energy Commission
Department of Agriculture
Department of Commerce
Department of Justice
Department of Labor
National Aeronautics and Space Administration
Department of Defense
Federal Aviation Agency
Department of Health, Education and Welfare
Department of the Interior
Interstate Commerce Commission
Office of Civil and Defense Mobilization
Post Office Department
Department of the Treasury
Veterans Administration

Replies indicate that the Federal agencies are conducting their radiation protection activities in accordance with the Presidential guidance, and that as of the date of their reports no deviations from the guides were in effect.

Recommendation 7 of Radiation Protection Guidance for Federal Agencies promulgated by the President on May 13, 1960 states:

MORE

"The guides may be exceeded only after the Federal agency having jurisdiction over the matter has carefully considered the reason for doing so in light of the recommendations in this paper."

Consistent with the recommendation, the Federal Radiation Council will continue to follow the practices of the Federal agencies as set forth in these reports and will bring to your attention such matters as seem appropriate.

/s/
Abraham Ribicoff
Chairman

# # # # #

MLoS-3

[redacted]

[redacted]

AEC 604/61

January 18, 1962

COPY NO. 24

AEC 604/61

ATOMIC ENERGY COMMISSION

RADIATION EXPOSURE LIMITS AT NTS

Note by the Secretary

The Director, Division of Military Application, has requested that the attached memorandum be circulated for the for the information of the Commission.

W. B. McCool
Secretary

SPECIAL REREVIEW FINAL DETERMINATION Class.: UNCL.	Reviewers	Class.	Date
	Joe Doe		12/3/80

By: J. Dann 5/3/85

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[redacted]

1-18-62

[redacted]

[redacted]

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON 25, D. C.

December 29, 1961

MEMORANDUM

TO : K. F. Hertford, Manager
Albuquerque Operations

FROM : Brigadier General A. W. Betts, USA
Director of Military Application, Headquarters

SUBJECT : ADDITIONAL GUIDANCE WITH RESPECT TO RADIATION EXPOSURE LIMITS AT NTS

SYMBOL : MA:GJK

My memorandum of December 20, 1961, stated the criteria which should be followed in planning radiation exposures for personnel at NTS.

The purpose of this memorandum is to provide guidance regarding procedures to be used when it is necessary to exceed established criteria for planned operations. Any proposed planned exposures which are in excess of the criteria stated in my December 20 memorandum must be approved by AEC Headquarters prior to implementation. Plans with supporting information should be forwarded to DMA. DMA will then take action within AEC Headquarters and will issue appropriate instructions as a reply.

Certain exceptions to established radiation exposure criteria may be authorized by the Test Manager in emergency situations where immediate decisions and actions are required. Present authority under Manual Chapter 0524, Section 034b is quoted:

> "034 Managers of Operations:
>
> b. request and justify specific exceptions for planned or anticipated radiation exposure in excess of the limits of established guides, except in emergency situations where immediate decisions and actions are required."

As you know, Chapter 0524 is currently under revision. When revised, the authority of the Test Manager will be as written in any current version which may later be issued.

[redacted]

JAN 5 1962

Honorable Gale W. McGee
United States Senate

Re: Preston Mitchell, et al. v. United States
Civil No. 4458, U. S. District Court for
Wyoming

Dear Senator McGee:

In August, 1960, you made inquiries concerning Preston Mitchell of Aladdin, Wyoming, and these inquiries were answered at that time by the Atomic Energy Commission. Subsequent events may be of interest to you, particularly in view of the belief expressed in your letter of August 26, 1960, that an effort should be made to dispel any doubts that the Mitchell family was subjected to radiation injury.

Mr. and Mrs. Preston Mitchell individually and as parents of six children filed suit on April 27, 1961, under the Federal Tort Claims Act for (1) $80,282 plus interest for damage to sheep located on their ranch, and (2) $974,240 for permanent and partial disability, pain and suffering and loss of future earnings. The petition alleged that unidentified AEC employees on April 27, 1959, "did negligently and carelessly cause radioactive substances and materials to contact, impact with and fall on plaintiffs and upon their real and personal property" at Crook County, Wyoming. Soon after the initiation of the action, arrangements were made for the taking of soil samples, the examination of livestock and plants, the obtaining of sheep for examination and autopsies and the obtaining of various of Plaintiffs' records. Depositions of the Plaintiffs' doctors on July 27, 1961, established that the doctors made no definite diagnosis of radioactivity, and that laboratory studies performed during the period in which Plaintiffs claimed they were acutely affected showed no radiation exposure.

Arrangements were made for medical examinations, radiosolids studies and whole body counts of Mr. and Mrs. Mitchell and two of their children at Los Alamos Scientific Laboratory on September 6, 1961. The results were negative and showed no traces of internal radioactivity. The diagnosis indicated selenium poisoning.

CONFIRMED TO BE UNCLASSIFIED
BY AUTHORITY OF DOE/OC
Joe Dray 5/20/81
REVIEWED BY DATE
By: T Fehner 3/25/86

1-5-62

The last of the results were sent to the Assistant United States Attorney in Wyoming on November 29, 1961. The soil sample testing revealed no greater radiation on the Mitchell ranch or on surrounding properties than is normal for the area of Eastern Wyoming and Western South Dakota. Urinalyses performed on samples from the Mitchell family revealed uranium, beta and strontium-90 values in the normal range. The results of the radioassays of the bones taken from the sheep of the Mitchell flock produced no indication that the injury to livestock claimed by Mr. Mitchell was the result of environmental radioactivity.

All of the tests were completed prior to the recent series of Soviet bomb testing and the results therefore represent true values.

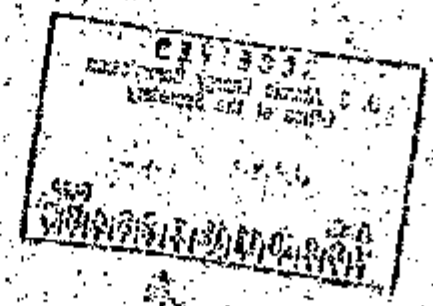
The Defendant moved for judgment on the pleadings on December 22, 1961, and, on the basis of the results of the tests, Plaintiffs' counsel agreed to the granting of the motion. On that date the Court granted the motion and entered a judgment on the pleadings for the Defendant, thus terminating the action.

Sincerely yours,

SIGNED, R. E. HOLLINGSWORTH

Deputy General Manager

bcc: General Manager
Cong. Liaison (2)
SECY



JAN 3 1962

Mr. James T. Ramey
Executive Director
Joint Committee on Atomic Energy
Congress of the United States

Re: Preston Mitchell, et al. v. United States
Civil No. 4496, U. S. District Court for
Wyoming

Dear Mr. Ramey:

An action filed by a Wyoming rancher and his family earlier this year involving claims of radiation injury has now been resolved in favor of the Government. Mr. and Mrs. Preston Mitchell individually and as parents of six children filed suit on April 17, 1961, under the Federal Tort Claims Act for (1) $80,221 plus interest for damage to sheep located on their ranch, and (2) $974,240 for permanent and partial disability, pain and suffering and loss of future earnings. The petition alleged that unidentified AEC employees on April 17, 1959, "did negligently and carelessly cause radioactive substances and materials to contact, impart with and fall on plaintiffs and upon their real and personal property" at Crook County, Wyoming. Soon after the initiation of the action, arrangements were made for the taking of soil samples, the examination of livestock and plants, the obtaining of sheep for examination and autopsies and the obtaining of various of Plaintiffs' records. Depositions of the Plaintiffs' doctors on July 27, 1961, established that the doctors made no definite diagnosis of radioactivity, and that laboratory studies performed during the period in which Plaintiffs claimed they were acutely affected showed no radiation exposure.

Arrangements were made for medical examinations, radionuclide studies and whole body counts of Mr. and Mrs. Mitchell and two of their children at Los Alamos Scientific Laboratory on September 6, 1961. The results were negative and showed no traces of internal radioactivity. The diagnosis indicated selenium poisoning.

The last of the results were sent to the Assistant United States Attorney in Wyoming on November 29, 1961. The soil sample testing revealed no greater radiation on the Mitchell ranch or on surrounding properties than is normal for the area of Eastern Wyoming and Western South Dakota. Urinalyses performed on samples from the Mitchell family revealed uranium, beta and strontium-90 values in the normal range. The results of the radioassays of the bones taken from the sheep of the Mitchell flock produced no indication that the injury to livestock claimed by Mr. Mitchell was the result of environmental radioactivity.

All of the tests were completed prior to the recent series of Soviet bomb testing and the results therefore represent true values.

The Defendant moved for judgment on the pleadings on December 22, 1961, and, on the basis of the results of the tests, Plaintiffs' counsel agreed to the granting of the motion. On that date the Court granted the motion and entered a judgment on the pleadings for the Defendant, thus terminating the action.

Sincerely yours,

Neil D. Naiden
General Counsel

bcc: SECY
Dr. E. H. Forgotson
T. O. Fleming
Congressional Liaison (2)

RECEIVED
U. S. Atomic Energy Commission
Office of the Secretary

OGC	OGC	OGC
Farbstein:mp	Oulahan	Naiden
12/27/61	12/ /61	12/ /61

MCS-3

[redacted]

[redacted]

AEC 604/60

January 2, 1962

COPY NO. 24

ATOMIC ENERGY COMMISSION

RADIATION EXPOSURE GUIDANCE FOR NTS MANAGER

Note by the Secretary

The General Manager has requested that the attached memorandum from the Director of Military Application be circulated for the information of the Commission.

W. B. McCool
Secretary

SPECIAL REREVIEW FINAL DETERMINATION Class: UNCL.	Reviewers	Class.	Date
	Jose Diaz		12/3/80

By: J. Howe 5/3/85

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[redacted]

[redacted]

AEC 604/60

1-2-62

X. MRB-7- Testing Program

[redacted]

[redacted]

UNITED STATES GOVERNMENT

Memorandum

CLASSIFICATION CANCELLED
Date 7/13/73
For The Atomic Energy Commission
Chief, Technical Information Branch
Assistant Director
Division of Classification
DATE: DEC 16 1960

TO : A. R. Luedecke
General Manager

FROM : Brigadier General A. W. Betts, USA
Director of Military Application

SUBJECT: RADIATION EXPOSURE GUIDANCE FOR THE NTS TEST MANAGER

MA:T:WCM

In my memorandum to the Commission, subject: "Radiation Exposure at NTS Tunnel 'B' and 'B'" dated November 28, I stated that we would, in the very near future, make a recommendation as to whether the radiation criteria should be revised for the current weapons test program or whether additional steps can be taken to continue operations under the current criteria.

After careful consideration we have decided that in view of the revision of the NOUGAT schedule which is currently being discussed, no relief from established criteria should be requested at this time. Briefly, the current criteria allow for an accumulated whole body exposure of (N-18) times 5 rem, where N is the man's age at his next birthday but at a rate not to exceed 3 rem per thirteen weeks. A thirteen week period may be taken as a running thirteen weeks or any predetermined quarter of a year based on the calendar.

Records at the Nevada Test Site are maintained on a calendar year basis with the quarters beginning on the first of January, first of April, first of July, and first of October. Although some individuals received more than 3 rem during last quarter of 1961, none had a yearly exposure in excess of about 8 rem whole body exposure for calendar year 1961. No individual in tunnel operations at NTS has exceeded the limitation of the formula (N-18) 5 rem.

The Office of General Counsel and Division of Operational Safety concur in the interpretation of the criteria described herein.

[redacted]

CONFIRMED TO BE UNCLASSIFIED
DOE NSI DECLASSIFICATION REVIEW E.O. 12958
BY: [illegible] 12/31/98

SPECIAL REREVIEW FINAL DETERMINATION Class: UNCL	Reviewers	Class.	Date
	Joe Diaz		12/3/80
	[illegible] Sanchez		12/3/80

By: [illegible] 5/3/85

[redacted]

MHoS-3

OPTIONAL FORM NO. 10
5010-104
UNITED STATES GOVERNMENT

Reference Section

Memorandum ~~OFFICIAL USE ONLY~~

TO : Dr. Charles L. Dunham, Director
Division of Biology and Medicine

DATE: January 2, 1962

FROM : W. B. McCool, Secretary Original signed W. B. McCool

SUBJECT: LETTER TO DOD CONCERNING BOOKLET "FALLOUT PROTECTION"

SYMBOL: SECY:DCR

1. At Information Meeting 98 on December 29, 1961, following a report by the General Manager on the booklet "Fallout Protection", the Commissioners requested preparation of a letter to the Department of Defense correcting certain misstatements of fact contained in the booklet.

2. The General Manager has requested you to take the action required by the above request. A copy of this letter together with other pertinent correspondence should be provided the Office of the Secretary.

cc:
Chairman
General Manager
Deputy General Manager
Asst. General Manager
Asst. Gen. Mgr. for R&D
General Counsel
Asst. to the Gen. Mgr.

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Copy filed: MHoS-3 Radiation Fallout

1-2-62