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TAB 7
Chronology of Congressional Hearings
on Radiation Experiments

TAB 7
Congressman Edward Markey Report -
"American Nuclear Guinea Pigs: Three Decades of Radiation Experiments on U.S. Citizens"

99th Congress COMMITTEE
2d Session COMMITTEE PRINT Print 99-NN

AMERICAN NUCLEAR GUINEA PIGS: THREE DECADES OF RADIATION EXPERIMENTS ON U.S. CITIZENS

REPORT

PREPARED BY THE

SUBCOMMITTEE ON ENERGY CONSERVATION AND POWER

OF THE

COMMITTEE ON ENERGY AND COMMERCE
U.S. HOUSE OF REPRESENTATIVES

NOVEMBER 1986

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LETTER OF TRANSMITTAL

U.S. HOUSE OF REPRESENTATIVES, SUBCOMMITTEE ON ENERGY CONSERVATION AND POWER,
COMMITTEE ON ENERGY AND COMMERCE,
Washington, DC, October 24, 1986.

Hon. JOHN D. DINGELL
Chairman, Committee on Energy and Commerce, Rayburn House Office Building, Washington, DC

DEAR MR. CHAIRMAN: I am forwarding to you, for the Committee's use, a report prepared by the staff of the Energy Conservation and Power Subcommittee titled, "American Nuclear Guinea Pigs: Three Decades of Radiation Experiments On U.S. Citizens." This report describes material contained in Department of Energy documents on radiation experiments using human subjects.

A review of these documents reveals the frequent and systematic use of human subjects as guinea pigs for radiation experiments. Some of these experiments were conducted in the 1940's and 1950's, and others were performed during the supposedly more enlightened 1960's and 1970's. The report describes in detail 31 experiments during which about 695 persons were exposed to radiation which provided little or no medical benefit to the subjects. The report notes that it seems appropriate to urge the Department of Energy to make every practicable effort to identify the persons who served as experimental subjects, to examine the long-term histories of subjects or an increased incidence of radiation associated diseases, and to compensate these unfortunate victims for damages.

This report is the result of an ongoing Subcommittee examination of the health and safety policies of the Department

of Energy. The previous Subcommittee Chairman, Mr. Ottinger, requested from the Department documentation on experiments involving human test subjects and radiation, which were funded by DOE or its predecessor agencies. During the 99th Congress, the Subcommittee initiated an intensive review of the documents, and requested further information on specified experiments. This report is the result of that intensive review.

It should be noted that this report was prepared by the Subcommittee staff for discussion purposes and may not represent the views of all Committee members. I believe the Committee and others will find this report to be extremely useful in examining issues of radiation health and safety and victims' compensation.

Sincerely,

EDWARD J. MARKEY, Chairman

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AMERICAN NUCLEAR GUINEA PIGS: THREE DECADES OF RADIATION EXPERIMENTS ON U.S. CITIZENS

SUMMARY AND CONCLUSIONS

Documents provided by the Department of Energy reveal the frequent and systematic use of human subjects as guinea pigs for radiation experiments. Some experiments were conducted in the 1940s at the dawn of the nuclear age, and might be attributed to an ignorance of the long term effects of radiation exposure or to the atomic hubris that accompanied the making of the first nuclear bombs. But other experiments were conducted during the supposedly more enlightened 1960s and 1970s. In either event such experiments cannot be excused.

These experiments were conducted under the sponsorship of the Manhattan Projects the Atomic Energy Commission, or the Energy Research and Development Administration, all predecessor agencies of the Department of Energy. These experiments spanned roughly thirty years. This report presents the findings of the Subcommittee staff on this project.1

Literally hundreds of individuals were exposed to radiation in experiments which provided little or no medical benefit to the subjects. The chief objectives of these experiments were to directly measure the biological effects of radioactive material; to measure doses from injected, ingested, or inhaled radioactive substances; or to measure the time it took radioactive substances to pass through the human body American citizens thus became

nuclear calibration devices.

In many cases, subjects willingly participated in experiments but they became willing guinea pigs nonetheless. In some cases, the human subjects were captive audiences or populations that experimenters might frighteningly have considered "expendable": the elderly, prisoners, hospital patients suffering from terminal diseses or who might not have retained their full faculties for informed consent. For some human subjects, informed consent was not obtained or there is no evidence that informed consent was granted.

For a number of these same subjects, the government covered up the nature of the experiments and deceived the families of deceased victims as to what had transpired. In many experiments, subjects received doses that approached or even exceed presently recognized limits for occupational radiation exposure. Doses were as great as 93 times the body burden recognized at the time the experiments were conducted.

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1 This report does not necessarily reflect the views of the Members of the Committee

A later section of this report, Description of Human Radiation Experiments, provides details on 31 experiments, during which about 695 persons were exposed. Expenments are listed by Category and Number as designated by the Department of Energy. Some of the more repugnant or bizarre of these experiments are summarized below

During 1945 to 1947, as part of the Manhattan Project, 18 patients who were diagnosed as having diseases which gave them expected survivals of less than 10 years were injected with plutonium, to measure the quantity retained by the human bed. These experiments were carried out at the Manhattan District Hospital at Oak Ridge, Tennessee; Strong Memorial Hospital in Rochester, New York; the University of Chicago; and the University of California. San Francisco. Despite the original diagnoses, seven of these patients lived longer than 10 years, and five lived longer than 20 years. Internal investigations by the Atomic Energy Commission found that informed consent was not granted in the initial experiments, since even the word "plutonium" was classified during World War II; and living patients were not informed that they had been injected with plutonium-until 1974. (Category 1.001, Number 1)

From 1961 to 1965 at the Massachusetts Institute of Technology, 20 subjects aged 63 to 83, were injected or fed radium or thorium to estimate internal doses and to measure passage of

these substances through their bodies. Many of these subjects came from the nearby Age Center of New England, a research facility established to investigate the process of aging and the needs of the elderly. These experiments thus represent a perversion of the Center's original purpose, since feeding the subjects radium and thorium did not benefit them as individuals or the elderly population as a whole. (Category 1.002, Number 118).

During the 1960s, at the Los Alamos Scientific Laboratory, 57 normal adults were fed microscopic spheres containing radioactive uranium and manganese. These experiments were designed to determine how fast such spheres would pass through the human body after ingestion. It was believed that particles of this size could be produced by the atmospheric reentry and burnup of rockets propelled by nuclear reactors, or of radioactive power supplies. (Category 1.003, Number 106).

During 1946 and 1947, at the University of Rochester, six patients with good kidney function were inject with uranium salts to determine the concentration which would produce renal injury. One patient was diagnosed as being in a "hallucinatory state," another was considered suffering from "emotional maladjustment," and a third, admitted to the hospital for a fifth time, was described as follows: "As he had no home, he agreed willingly to enter the metabolic unit for special studies." (Category 1.003, Number 119).

From 1963 to 1971, 67 inmates at Oregon State Prison and 64 in mates at the Washington State Prison received x-rays to their testes to examine the effects of ionizing radiation on human fertility and testicular function. These experiments were conducted by the Pacific Northwest Research Foundation and the University of Washington. Subjects had to agree to receive vasectomies after completion of the experiments. The Energy Research and Develop-

ment Administration planned to begin medical follow up of the irradiated prisoners, but these plans were dropped in 1976 at the request of the U.S. Attorney in Portland after several irradiated inmates filed suits against state and federal governments. (Category 2.001, Number 2 and Category 2.002, Number 189).

From 1953 to 1957, at Massachusetts General Hospital, Boston, approximately 12 terminal brain tumor patients were injected with uranium to determine the dose at which kidney damage began to occur. Most of the patients were described as comatose or in a "semi-coma." (Category 9.001, Number 166).

From 1963 to 1965, at the Atomic Energy Commission National Reactor Testing Station in Idaho, radioactive iodine was purposely released on seven separate occasions. In one of these experiments,

seven human subjects drank milk from cows which had grazed on iodine-contaminated land. This experiment was designed to measure the passage of iodine through the food chain into the thyroids of human subjects. In a second experiment, three human subjects were placed on the pasture during iodine release, and seven subjects were placed on the pasture in a third experiment. In addition, "several" individuals were contaminated during yet another experiment when vials of radioactive iodine accidentally broke. Cows grazed on contaminated land and their milk was counted in four of the experiments; in the remaining three, radiation measurements were made only int he pasture. (Category 10.001, Number 173).

During May 1945, at the Clinton Laboratory, Oak Ridge, Tennessee, two groups of 10 subjects were exposed to beta rays, to determine the dose that would begin to cause reddening of the skin. (Category 11.001, Number 51).

During 1951 and 1952, at least 14 human subjects were exposed to tritium in air, by immersion of body parts in water, or by drinking. These experiments were designed to measure the retention or excretion of tritium by the human body. The experiments were carried out by the Los Alamos Scientific Laboratory, or the General Electric Company in Richland, Washington. (Category 11.001, Numbers 112, 123, 125, 126, 127).

During 1956, the US Air Force sent manned planes through radiation clouds from atomic bomb tests at Eniwetok and Bikini Atolls in the Pacific to measure radiation doses in the clouds and to the crew. (Category 11.001, Number 133).

During the early 1950s. Foster D. Snell, a consulting firm, carried out experiments for the U.S. Army by placing "synthetic" radioactive soil on the hands of about 118 subjects, and measuring the ability of different cleaning agents to remove the contamination. (Category 11.001, Number 134).

From 1961 to 1963, at the University of Chicago and Argonne National Laboratory, 102 human subjects were fed real fallout from the Nevada Test Site; simulated fallout particles that contained strontium, barium, or cesium; or solutions of strontium and cesium. This experiment was designed to measure human absorption and retention of these radioactive substances. (Category 11.001, Number 186, Part A).

During the early 1960s. at the Oak Ridge Institute for Nuclear Studies, 54 hospital patients with normal intestinal tracts

were fed lanthanum-140. This experiment was designed to measure the rate at which this radioactive substance passed through the body. (Category 11.001, Number 186, Part B).

During the late 1950s, at Columbia University and Montefiore Hospital, the Bronx, 12 terminal cancer patients were injected with

radioactive calcium and strontium. This experiment was designed to compare the distribution of these two substances among body tissues after autopsy. (Category 12.001, Number 15).

In 1967 at the Hanford Environmental Health Foundation and the Battelle Memorial Institute, both at Richland, Washington, radioactive promethium was administered to 14 subjects by injection or drinking. These experiments were designed to measure the passage of this substance through the body and the ability of a drug (chelatirig agent) to increase the removal of promethium. (Category 12.001. Number 110).

During 1963, at the Battelle Memorial Institute, Richland, Washington, five subjects were injected with radioactive phosphorus. In addition, five subjects were fed fish from the Columbia River which contained radioactive phosphorus, produced and discharged into the river by reactors at the Atomic Energy Commission's Hanford Site. These experiments were designed to estimate the doses to humans eating contaminated fish. (Category 1001, Number 111).

In many of the reported experiments, radiation was used as treatment for diseases which were resistant to more conventional methods. Most frequently, radiation were used in attempts to treat cancer, leukemia, or other malignant disorders of the, blood. The Subcommittee staff does not question these applications, since patients were irradiated in an attempt to treat their diseases, and in some cases the treatment was successful. In these cases the radiation exposure was meant to carry some medical benefit for patients, and observation of the effects of exposure, which enhanced understanding of radiation effects, was incidental to the treatment. In some cases, however, long term medical follow up of the surviving patients, which might have provided information for useful comparison with other treatments that might seem promising, was not conducted.

The studies provided by the Department of Energy demonstrate the need for long term medical follow-up.Category 10.00 1. Number 69, describes a retrospective study on the health of humans exposed to radioactive iodine, and includes as a study population the group of Marshallese Islanders exposed to fallout from early atomic bomb tests. This report notes that thyroid nodules, produced by exposure to radioactive iodine, did not first appear among inhabitants of the atoll - with the highest fallout until 9 years after the testing. Nodules began appearing some years later among inhabitants of atolls where the doses were lower; and after 22 years, nodules were still being observed.

If there is one thing the government can do for these experimental victims and their families, even at this late date, it is to conduct long term medical follow up of populations exposed to radioactive material. That practice has been adopted by the Defense Depart-ment through its Nuclear Test Personnel Review, a registry

for military personnel exposed to fallout from atmospheric nuclear tests. The primary objectives of the Review are to identify the

appproximately 200.000 Defense Department personnel involved in suchtests. to determine their exposures, to identify incidence of death or illness, and to assist veterans in claims for compensation. If this effort can be carried out for military personnel acting in the line of duty, surely a similar effort should be possible for the far smaller number of peaceful atomic soldiers used as human subjects in radiation experiments.

RECOMMENDATIONS

1. It seems appropriate to urge the Department of Energy to make every practicable effort to identify the persons who served as subjects for the experiments described below, to examine the long term histories of subjects for an increased incidence of radiation-associated diseases, and to compensate these human guinea pigs for damages they have suffered.

These victims face severe obstacles to compensation under current law, embodied by the Federal Tort Claims Act. The Department of Energy should therefore be encouraged to work with the Subcommittee to develop legislation that provides adequate compensation.

2. Human experiments of this nature must never be repeated. Many of these experiments would not be allowed under current federal guidelines, and it is gratifying that experiments of this nature apparently did not continue after the early 1970s.

Two overriding principles for human experimentation must be followed: The first is that the risks of the experimental treatment must be reasonable in relation to anticipated benefits. The second is that subjects must be fully informed, and capable of understanding the benefits and risks of the treatment. Current federal regulations embody these principles, with exceptions that are clearly spelled out in cases where knowledge from the treatment might benefit society as a whole. The Appendix to this report describes these federal regulations.

The Subcommittee is gratified that the Department of Energy follows current regulations in its own experiments. However, the sad history of human radiation experimentation makes it clear that standards that were acceptable forty years ago appear repugnant today. It therefore seems appropriate to urge that all applicable federal agencies. including the Department of Energy, frequently review their regulations to ensure that human experimentation is conducted under the highest ethical standards.

BACKGROUND

The investigation into human radiation experiments began as part of an ongoing Subcommittee examination of the health and safety policies of the Department of Energy. In June 1984, Representative Richard Ottinger then Subcommittee Chairman, requested from the Department a list of experiments involving human test subjects and radiation, which were funded by the Atomic Energy Commission. the Energy Research and Development Administration, or the Department of Energy. The former two agencies were predecessors of the Department of Energy. DOE responded to this initial request in September 1984, enclosing summaries of many different

experiments. In October 1974, Chairman Ottinger requested further clarification and information on the human experiments provided. DOE responded to this request in January 1985, providing supporting material and fuller descriptions of many of the experiments, and in some cases reporting more experiments.

In January 1985, Representative Edward J. Markey became Sub. Committee Chairman, and initiated an intensive review of all the documents released by the DOE. Chairman Markey also requested further information on individual experiments in August, November and December 1985, and in March 1986.

Review of Released Documents

The initial information released by the Department of Energy consisted of summary factsheets on each of several human radiation experiments. Each factsheet contained an experiment title designation of federal agency or agencies funding the experiment, a list of institutions conducting the experiments, description of the experiment objective, a short description of the experiment, and where known, the status of long term medical follow up of experimental subjects.

In response to the Subcommittee's October 1984 request for further information, DOE released additional material including dates when experiments started and ended, names of responsible government officials, and in some cases supporting documents, such as scientific references or project reports. DOE also released some material on experiments not previously reported in the summary factsheets.

DOE placed the experiments reported in 12 different categories:

1. Metabolism and Biological Effects of Plutonium, Polonium.

Thorium, Uranium, Radium, and Lead-212.
2. Testicular Irradiation.
3. Whole-body Irradiation for Treatment of Leukemia and Lymphoma.
4. Teletherapy with Particle Beams.
5. Other Teletherapy Studies.
6. Treatment of Polycythemia.
7. Hematological Effects.
8. Neutron Capture Therapy.
9. Other Radiation Therapy.
10. Biological Effects of I-131.
11. Other Biological Effects Studies.
12. Metabolic and Physiological Studies.

In many of the reported cases radiation was used as treatment for diseases which were resistant to more conventional methods. Most frequently, radiation was used in attempts to treat cancer, leukemia, or other malignant disorders of the blood. The Subcommittee staff does not question these applications, since patients were irradiated in an attempt to treat their diseases, and in some cases the treatment was successful. In these cases, the radiation exposure was meant to carry some medical benefit for patients, and observation of the effects of exposure, which enhance understanding of radiation effects, was incidental to the treatment. The Subcommittee staff readily acknowledges the

scientific advancement produced by such observations and commends those scientists and physicians who engaged in such research.

In many of the cases where radiation was used for medical treatment, there was little long term medical follow up of the irradiated patients. In part, this may have been due to the fact that the benefits of medical radiation were clear: irradiated patients in some cases showed higher survival rates than patients treated with other methods. But since radiation can also cause cancer, long term follow up on surviving patients may have provided information for a useful comparison with other present treatments or with treatments that might seem promising in the future.

The follow up provisions of one particular experiment, designated Category 4.004, Number 179, should be noted with approval. The objective of this project is to determine the effectiveness of neutron beam irradiation as compared to standard irradiation for the management of certain malignant tumors. This project is funded by the National Cancer institute and is carried out at the Fermi National Accelerator Laboratory, a facility owned by the Department of Energy.

This project began in 1975 and is continuing today. Approximately 1400 patients have been referred to the program.

Prior to treatment, patients must agree to comply with long-term follow up requirements, which include regular physical examinations and laboratory tests. Every effort is made to contact patients who miss scheduled appointments, and fewer than 1 percent of patients treated at this facility are currently considered lost to follow up. The follow up efforts at this Fermilab project should be applauded, and they represent a model that should be duplicated in other DOE investigations of medical therapy.

In many of the other human experiments which DOE reported to the Subcommittee, however, subjects received little or no medical benefit from their exposure. These experiments fall into two general categories: in one group, human subjects were injected with or fed radioactive material, and its passage through the body was monitored. The major objective of these experiments was to compare results with mathematical models predicting radiation doses for occupational or accidental exposure. Although these experiments did provide information on the retention and absorption of radioactive material by the human body, the experiments are nonetheless repugnant because human subjects were essentially used as guinea pigs and calibration devices. In a second group of experiments, the administration of radioactive material was actually intended to cause damage to the human body, and the experimenters sought to correlate the amount of damage done with the dose received:

In some of the experiments described, the human subjects were captive populations: the elderly, prisoners, and hospital patients who might not have retained their full faculties for informed consent. In other experiments, the subjects were volunteers, but they were willing guinea pigs nonetheless.

The human radiation experiments are described in detail in the following section.

DESCRIPTION OF HUMAN RADIATION EXPERIMENTS

Category and Number labels below are as designated by the Department of Energy in its responses to the Subcommittee. In many cases, occupational exposure limits are provided for comparison with the doses or amounts of radioactive material received by subjects. Present dose limits are taken from Title 10, Code of Federal Regulations, Part 20. The maximum permissible body burden is an occupational limit for the allowable amount of a given substance that may be internally deposited in an individual. It is generally recognized among the scientific community that doses to the general population should be no more than one tenth the allowable doses to radiation workers. Values presented below for maximum permissible body burdens are taken from NCRP-22, a handbook of the National Committee on Radiation Protection, which is a nongovernmental organization that recommends standards for

radiation exposure.

In addition the experiments described in the Summary and Conclusions of this report, many experiments are of special concern because of the circumstances of the persons used as subjects, or because of the doses which some subjects received, relative to present occupational limits. In experiments where the radioactive material administered was greater than the present maximum permissible body burden, doses are classified as potentially greater than present occupational limits, since not all of the material administered might have remained in the body. These experiments of special concern are listed below, and are followed by descriptions of all experiments.

Category 1.001, Number 1. Subjects were diagnosed as terminal within 10 years; one subject was a child; no evidence of informed consent: potential doses much greater than occupational limits.

1.002. Number 118. Subjects were elderly; potential doses greater than occupational limits.

1.003. Number 12. Subjects were terminal patients; potential doses greater than occupational limits.

1.003. Number 119. Subjects were hospital patients; some doses produced kidney damage.

2.001. Number 2 Subjects were prisoners; doses were greater than occupational limits.

2.002. Number 189. Subjects were prisoners; doses were greater than occupational limits.

3.001. Number 49. Doses were greater than occupational limits.

9.001. Number 166. Subjects were terminal brain tumor patients. And most were comatose: some doses produced kidney drainage.

10.001. Number 173. Radioactive iodine was intentionally released to the environment.

11.001. Number 51. Doses were greater than occupational limits.

11.001. Number 53. Doses were greater than occupational limits.

11.001. Number 121. Subjects were hospital patients; doses were greater than occupational limits.

11.001. Number 123. Potential doses were greater than occupational limits.

11.001. Number 127. Potential doses were greater than occupational limits.

11.001. Number 133. Doses were greater than occupational limits.

11.001. Number 186. Part B. Subjects were hospital patients; potential doses were greater than occupational limits.

Category 12.001. Number 15. Subjects were terminal cancer

patients: potential doses were greater than occupational limits.

12.001. Number 109. Potential doses were greater than occupational limits.

12.001. Number 128. Potential doses were greater than occupational limits.

Category 1. Metabolism and Biological Effects of Plutonium, Polonium, Thorium, Uranium, Radium, and Lead-212

CATEGORY 1.001, NUMBER 1

Plutonium injections into humans

During 1945 to 1947, 18 patients were injected with plutonium. These experiments were carried out by the Manhattan Project. The following hospitals were involved in the experiments. With the number of patients involved for each indicated:

Manhattan District Hospital, Oak Ridge, Tennessee (1).

Strong Memorial Hospital, Rochester, New York (11).

Billings Hospital, University of Chicago (3).

University Hospital, University of California. San Francisco (3).

According to an Energy Research and Development Administration (ERDA) fact sheet of February 1976, the rationale for this experiment was that several thousand Manhattan Project workers had been involved in handling plutonium. Accurate information was needed on the retention and excretion of internally deposited plutonium for setting safety criteria, and animal experiments had produced conflicting data which could not be extrapolated to humans.

In choosing subjects, the original criteria specified that subjects should be older. With relatively short life expectancies. All subjects chosen were diagnosed as having existing diseases that gave them an expected survival of less than 10 years. Most were over 45, but one subject was five years old, and another was 18. The oldest patients were 68. The quantities of plutonium injected ranged from 1.6 to 98 times the body burden value recognized at the time of the experiments. Where a body burden is the permissible occupational limit for an internally deposited radioisotope. 13 of the patients received between 7 and 10 body burdens. Patients were monitored for their excretion of plutonium. They received no medical benefits from the injections.

In 1967, a Berkeley radiobiologist learned that one of the injected patients had lived for 20 years. She investigated the whereabouts of other patients, and in 1972 published a scientific paper noting that four patients were then alive. In a subsequent follow up investigation, The Department of Energy determined that

9 patients died within 3 years, one in 8 years, one each in 11 and 14 years, and four after 20 years. One was lost to follow up. And one was still living as of October 1983. In one case. The original diagnosis of disease later proved to be inaccurate.

In 1974, following the report that four patients were still alive, the Atomic Energy Commission conducted internal investigations to determine if the experimental patients had granted informed consent for their exposures. A report transmitted in August 1974 found that experimenters had failed to obtain informed consent in several instances. Formalized standards for patient consent to experimental procedures did not exist prior to 1946. In addition, even the word "plutonium" was classified until the end of World War II The AEC, which succeeded the Manhattan Project, established a policy of formalized patient consent in 1947. One patient, injected in 1947 was the only subject injected after the AEC had been formed. This patient's hospital record contained a statement by attending physicians that the individual had been properly informed of the experimental nature of the injection. The AEC could find no records of consent for any other patient, and determined from oral testimony that at least one patient had not been informed.

On this issue, a June 1983 Department of Energy memo concluded that:

The issue of informed consent, if raised, will be difficult to deal with in the light of present DOE and Federal policies and procedures regarding human subjects. These are vastly more codified and explicit than any guidance available all the time the injections are given, and the procedures used at that time would not meet standards adopted and currently applied by DOE and other federal organizations. (Memo from Nathaniel F. Barr to Alvin W. Trivelpiece, Director, Office of Energy Research, Department of Energy, June 3O, 1983.)

In 1973, the Center for Human Radiobiology (CHR), Argonne National Laboratory, initiated a follow up study of surviving patients and a program to exhume deceased patients for whom permission could be obtained. These studies were designed to examine how much plutonium remained in the bodies of subjects. The 1974 AEC investigations found that even by 1973 standards, informed consent had not been obtained for these studies. A memorandum dated December 21, 1972 from [name deleted], Argonne National Laboratory, to [name deleted]. Center for Human Radiobiology, contained the following instructions in regard to studies on the surviving patients:

Please note that outside of CHR we will never use the word "plutonium" in regard to these cases. These individuals are of

interest to us because they may have received a radioactive material at some time is the kind of statement to be made, if we need to say anything at all [emphasis in original]. (Quoted in Division of Inspection Report 44-2-326, U.S. Atomic Energy Commission, August 16, 1974. p. 19.)

Consequently, patients alive in 1973 were not informed that they had been injected with plutonium in the 194Os. Relatives of deceased patients were told that exhumation was necessary to determine the composition of an "unknown" mixture of injected radioactive isotopes. Injection was also represented as having been an experimental treatment for the patients' diseases a statement that is not true. As a second AEC investigation concluded:

Relative to the study undertaken in 1973, informed consent was not obtained from surviving patients were the subject of the study.

Consent, following improper disclosure, was obtained from the next of kin of an exhumed patient. Improper disclosure was made to the next of kin of additional deceased patients who have not been exhumed. (Division of Inspection Report 44-2-330. U.S. Atomic Energy Commission, August 12, 1974. pp. 11, 12.)

As a result of the 1974 investigation, the AEC contacted the doctors of the four living patients, and asked the doctors to inform the patients of the nature of the Manhattan Project injections. One doctor did not tell his patient because he felt the information would be detrimental to her health; this patient has since died. The other three patients were informed.

A scientific paper published in 1976 calculated doses to the injected patients, and concluded from these calculations that in spite of the apparent lack of induced tumors among the patients:

The liver doses do not appear to be high enough to be carcinogenic. But comparison of the bone-surface doses with radium doses that have induced bone tumors indicates that six of these cases have received doses high enough to be considered carcinogenic. (R.E. Rowland and P.W. Durbin. Survival, causes of death, and estimated tissue doses in a group of human beings injected with plutonium. In The Health Effects of Plutonium and Radium. J.W. Press, Salt Lake City, 1976.)

CATEGORY 1.002, NUMBER 118

Administration of radium and thorium to humans

During the period 1961-1965. Doses of the nuclides Radium-224, and Thorium-234 were given to 20 volunteers, 13 men and 7 women, aged 63 to 83. Six subjects were injected with radium. Six were injected with thorium, one ingested radium, one ingested thorium, and six ingested both radium and thorium. These experiments were

funded by the AEC and carried out at the Massachusetts Institute of Technology.

The experiments were designed to examine the metabolism from radioactive substances that might be similar to those ingested by radium dial painters in the earlier part of the 20th century, many of whom subsequently developed cancer of the jaw or mouth. The specific matter of concern was whether Thorium-228, which may have been present in dial paints, would have contributed a significant dose to painters. After the subjects were fed or injected with the radioactive substances, the substances were monitored by measuring their presence in blood, in the breath, in excreted matter, and by whole-body counting of the subjects. Patients were monitored for up to 120 days.

Doses given to patients were 0.2 to 2.4 microcuries of radium, or 1.2 to 120 microcuries of thorium. For comparison, maximum permissible bed burdens are 0.07 microcuries for Radium-224, and 20 microcuries for Thorium-234.

Most of the subjects were obtained from the Age Center of New England, Boston. A few were retired MIT employees. The subjects received no medical benefits from the experiment.

According to material received from the Department of Energy, the Age Center of New England was a nonprofit research facility established in 1954 to investigate the progress of aging and the needs of the elderly. The Center's pool of subjects consisted of several hundred "apparently healthy men and women" over the age of 50 who had declared their willingness to be studied in a variety of research projects on aging. These subjects lived elsewhere and had to be active enough to come to the Center to participate in research.

In 1957, the first published annual report of the Age Center described the following ongoing research projects: "Correlates of Anxiety

in Older Persons;" "The Nutrition of Apparently Normal Aging Persons;" "Prejudice and Older People," and "A Thematic Analysis of Later Life," which obtained the attitudes of elderly persons through questionnaire and oral interviews. The AEC experiments with Age Center subjects thus represent a perversion of the Center's original purpose: Feeding the subjects radium and thorium was of no direct benefit to the subjects or to the elderly population as a whole, and was not related to phenomena connected to the aging process.

The study was conducted in two phases. In the first phase, subjects ware injected with either radium or thorium, and the passage of the material through the body was measured. The principal reason for these experiments was to calibrate counting

equipment that would be used in the second phase, which was the oral ingestion of mixtures of radium and thorium. Excretion and whole body counting was also monitored for the phase two patients. These experiments were reported to the AEC in annual progress reports in 1964 through 1966.

In a January 2, 1985 letter to the Subcommittee Chairman, the Department of Energy reported that no follow up had been conducted on the health of the experimental subjects. The Age Center no longer exists and one professor who conducted the study had "no idea how any records of survival history could be obtained." He stated that finding the patients, if still alive, may be "like doing a missing persons search." The youngest volunteer would be approaching 85 years old today.

CATEGORY 1.003, NUMBER 12

Polonium administered to humans

From 1943 to 1947, radioactive polonium was injected into 4 hospital patients, and given orally to a fifth. Rates of excretion were measured. These studies were funded by the Manhattan Project and the AEC, and were conducted at the University of Rochester.

The objective of the experiment was to obtain data on human excretion of polonium to obtain a correlation with more extensive data from rats. Hospital patients were used as subjects because the experimented wanted persons who had not been exposed to polonium through work or accidents.

The experiments were described in a scientific publication: Studies of polonium metabolism in human subjects, Chapter 3 of Biological Studies with Polonium, Radium, and Plutonium, National Nuclear Energy Series, Volume VI-3, McGraw-Hill, New York, 1950. All subjects had incurable diseases. Patient I was suffering from lymph cancer, and was injected with 22 microcuries of polonium. Patient 2 had acute leukemia, was injected with II microcuries, and died six days later. Patients 3 and 4 suffered from chronic leukemia. And were injected with 12 and 9 microcuries, respectively. Patient 5 suffered from chronic leukemia, and ingested 18 micro curies of polonium. Excretion of polonium was followed, and an autopsy was conducted on the deceased patient to determine which organs absorbed the polonium, The age of the patients ranged from early thirties to early forties.

The isotope administered is not specified, but the most readily available isotope at the time was Polonium-210. For comparison with the doses. The maximum permissible body burden

for Polonium-210 is 0.4 Microcuries.

In January 1935, the Department of Energy transmitted to the Subcommittee summary factsheets on this, and many other experiments. The factsheet for this experiment reported no follow up on these experimental subjects.

CATEGORY 1.003, NUMBER 21

Absorption of Lead-212 by the Human Gastrointestinal Tract

Lead-212 was fed to three human subjects and gastrointestinal absorption and excretion over 24 hours were' examined. Similar measurements were made on two human subjects, injected with Lead-212, and the results for ingestion and injection were compared. These experiments were conducted to compare experimental results with existing models used by the International Commission on Radiological Protection (ICRP) and the National Council on-Radiation Protection (NCRP). Organizations which recommend radiation exposure standards. These experiments were carried out at the University of Rochester. Were funded by the AEC, and were reported in UCRL-18140, Lawrence Radiation Laboratory University of California, Berkeley. April 1963, pp. 217-232. The material from the Department of Energy on this experiment reported no information on doses, and no follow-up on the experimental subjects.

CATEGORY 1.003, NUMBER 106

Some biological aspects of radioactive microspheres in humans

During the 1960s, 57 normal adults were fed very small spheres containing radioactive Uranium-235 and Manganese-54, to determine how long it would take these spheres to pass through the gastrointestinal tract. The human subjects received no medical benefit from this experiment.

The experiment was designed to assess the potential hazards from atmospheric reentry and burn-up of rockets propelled by nuclear reactors, or of radioactive power supplies. Such burn-up could produce particles small enough to be inhaled or ingested. In order to estimate internal radiation doses' that humans might receive from such accidents, information was needed on the time that radioactive particles might remain in the body. The human subjects were all workers at 1005 Alamos Scientific Laboratory. Except for one individual who was the wife of the principal investigator.

During the experiment, subjects were given a gelatin capsule containing U-235 and Mn-54, in spheres 100-200 microns in diameter (a micron is one-millionth of a meter). Both U-235 and

Mn-54 emit radiation which would penetrate the gelatin. The Mn spheres were coated with ceramic, the U-235 spheres were uncoated. Subjects each swallowed a capsule, and feces were collected and counted to determine ho w long the capsules remained in the body. One subject repeated ingestion of the sample 10 different times to provide an estimate of variation within the same individual. "Several others" repeated ingestion

at different times of the day to provide an estimate of how results might change with time of day.

The experiment was conducted at Los Alamos Laboratory, was funded by the Atomic Energy Commission, and was reported in document LA-3365, Los Alamos Scientific Laboratory, August 1965.

The factsheet which the Department of Energy supplied the Subcommittee reported no follow up on these experimental subjects.

CATEGORY 1.003, NUMBER 119

Injection of uranium salts

During 1946 and 1947, six patients with good kidney function were injected in increasing doses with uranium nitrate, enriched in U-234 and U-235. The objectives of the experiment were to: determine the dose of uranium salt which produced renal injury; measure the rate of excretion. These experiments were carried out at the University of Rochester, Atomic Energy Project.

The experiments are described in UR-37, dated June 1948, which apparently was a project report to the Atomic Energy Commission. The human subjects received no medical benefits from these experiments, and in fact the treatment seemed designed to induce kidney injury in at least one patient. It was recognized that uranium salts could damage the kidney, and the experiment planned to identify the concentration that would produce "just detectable renal injury." (UR-37, p. 7)

The experimental subjects were chosen from a large group of hospital patients; those selected had reasonably normal kidney function. In addition, "The probability that the patient would benefit from continued hospitalization and medical care was also a factor in the choice. When higher levels of dosage were contemplated, individuals from the older age groups were preferred in view of the remote possibility that late radiation effects might occur..." (UR-37, pp. 8,9).

Patient 1 was in the hospital because of rheumatoid arthritis and urethral strictures. patient 2 was hospitalized because of acute alcoholism, "hallucinatory state," cirrhosis of

the liver, and possible neural damage. Patient 3 was a young woman "in fairly good physical condition except for mild chronic undernutrition which was thought to be secondary to an emotional maladjustment." (UR-37, p. 18) Patient 4 entered the hospital because of chronic alcoholism and bleeding from the gastrointestinal tract; 12 days after uranium injection, patient 4 was injected with citrate to examine its effect in further removal of uranium. "Unfortunately, this solution was so hypotonic" that blood appeared in the patient's urine and his temperature rose to 39.5 degrees C [108 degrees F]." (UR-37, p. 29).

Patient 5 suffered from chronic cough, had a history of rather high alcohol consumption, and was diagnosed as having pneumonia when he entered the hospital. Uranium doses had been successively increased with each new patient. Patient 5 showed trace amounts of protein in his urine, a sign of kidney disfunction, on the last day before leaving the hospital from October 1946 to April 1947. This was his fifth admission to the hospital. Previous diag

noses had included heart disease, chronic alcoholism, and pneumonia; the present admission was for an ulcer. "As he had no home, he [patient 6] agreed willingly to enter the metabolic unit for special studies." (UR-37 p. 41) Patient 6 received the largest dose, 70 microgram of uranium per kilogram weight, and clinical analysis suggested that "tolerance had been reached" for kidney injury. (UR-37, p. 55)

The summary factsheet which the Department of Energy submitted to the subcommittee reports no follow up on the experimental subjects. Funding for the experiment is not specified, but it presumably would be from the Manhattan Project, since the AEC was not established until 1947.

Category 2. Testicular Irradiation

CATEGORY 2.001, NUMBER 2

Testicular irradiation of inmates at Oregon State Prison

From August 1963 to May 1971, 67 volunteers at the Oregon State Prison were subjected to testicular irradiation by x-rays. Radiation doses ranged from 8 to 600 roentgen in single acute exposures, except that six prisoners were irradiated a second time, one a third time, and one was given weekly irradiations of 5 roentgen per week for eleven weeks. For comparison, the present occupational limit for exposure to reproductive organs is 5 roentgen per year. These experiments were carried out by the

Pacific Northwest Research Foundation. Seattle; the Atomic Energy Commission provided a total of $1.08 million for these studies.

The objective of this experiment was to obtain data on the' effects of ionizing radiation on human fertility and the function of testicular cells. It was considered that data from animals could not be readily extrapolated to humans. Studies included examination of testicular tissue, sperm counts and evaluation of urinary or blood steroids and hormones.

Prisoners ranged in age from 25 to 52. Each inmate agreed to have a vasectomy at the end of his irradiation; consent of wives was required for this procedure. All prisoners in the Oregon group did eventually have vasectomies. All volunteers were required to sign statements of informed consent. Consent procedures involved an explanation of short term and long term effects, including the possibility of testicular cancer. No Catholics were allowed as subjects. Small sums of money were paid: To prisoners $5 to $10 for each treatment, And $100 at the time of vasectomy. However, according to the Energy Research and Development Administration "records suggest that the prime incentive to participate may have been the feeling that they were making important contributions to the state of medical knowledge." (ERDA background information on AEC human, testicular irradiation projects in Oregon and Washington state prisons, March 1976, p. 2)

The prisoner irradiation program was terminated in 1973 after the principal investigator suffered an, incapacitating stroke, and because of subsequent state, reevaluation of correctional institutional involvement in experimental Programs. (C.G. Heller et al., "Protection of the rights of welfare of prison volunteers: Policies

followed throughout a 17-year medical research program, unpublished manuscript, p. 7) The same document noted that the vasectomies on subjects after the experiment were necessary "to avoid any possibility of contaminating the general population with irradiation induced mutants." (Ibid., p. 5)

In a, summary factsheet provided the Subcommittee in January 1985, the Department of Energy described the follow up of experimental subjects:

Complete recovery as shown by a return to pre-irradiated sperm concentrations and germinal cell numbers was found to be within 9-18 months for doses of 100 rad and below, 30 months for doses of 200 and 300 rad and 5 or more years for doses of 400 and 6OO rad.

The need for follow up over a longer term was recognized as early as 1971, in a letter from an AEC official to Carl Heller,

the principal investigator for the experiments. The letter concluded,

Thus I am suggesting that you prepare a protocol for the long-term follow-up of the irradiated volunteers after their release from the research program. (Frank T. Brooks, Division of Biology and Medicine, AEC. to Carl G. Heller, Pacific Northwest Research Foundation, November 30, 1971.)

In its 1976 background information material, the Energy Research and Development Administration Noted:

ERDA believes that there is a need for continued medical surveillance of prisoners involved in both sets of experiments [Oregon and Washington], and will explore with prison officials the best methods to achieve this. Among health effects which should be monitored is the possibility of testicular tumors, occurring after a long latency period (25-30 years). (ERDA background Information, March 1976, pp. 23.)

However, at the request of the U.S. Attorney in Portland, Oregon, this follow up program was cancelled after several irradiated inmates filed suits against state and federal governments. In September 1976, the District Court for the District of Oregon dismissed the suit against federal Defendants.

The experiments resulted in the publication of several scientific papers. The most recent one cited was M.J. Rowley et al, Radiation Research 59, 665-678, 1974.

CATEGORY 2.002, NUMBER 189

Testicular irradiation of inmates at Washington State Prison

During the period June 1963 to May 1970, 64 inmates at the Washington State Prison received testicular irradiation from x-rays. Each subject was irradiated once, and doses ranged from 7 to 400 roentgen. Following irradiation, tissue samples and sperm were examined for indications of damage; urine samples were examined for hormone levels. The Atomic Energy Commission requested $505,000 to support these studies, which were conducted by University of Washington Researchers.

The objective of these studies was to determine the effects of radiation on gonadal function. The studies were reportedly proposed after a radiation accident at the AEC Hanford facility. Three men were overexposed, and no clear scientific data was available to advise them on possible sterility effects. The experiments were designed to determine the minimum effective dose that would render an individual temporarily sterile.

The criteria for selection were similar to the

experiments with Oregon inmates: Participants had to agree to vasectomies after completion of the experiment. However, several of the Washington inmates subsequently did not receive vasectomies: 2 declined and were released from prison; 1 declined and remained in prison; 1 was released before the scheduled vasectomy; 1 did not undergo surgery for psychiatric reasons after mutual agreement with the prison physician; 1 who had heart problems and a life sentence was not vasectomized after mutual agreement (AEC Contract AT(45-1)-2225, Task Agreement 6, Terminal Report, January 1973, p. 3) Because of the lack of follow up information, it is not known if any experimental subjects subsequently fathered any children.

The experiments were terminated after a Human Subjects review board at the University of Washington refused in July 1969 to authorize further irradiation of prisoners. (George W. Farwell, University of Washington, to John R. Totter, Director, Division of Biology and Medicine, Atomic Energy Commission, July 16, 1969)

In the factsheet submitted to the Subcommittee in January 1985, the Department of Energy had this description' for follow up: "Recovery of cell morphology and function were found after a maximum of 501 days. It was concluded that man is very sensitive in regard to temporary sterility, but, is very resistant to complete sterility." As with the Oregon prisoners, there was no long-term follow up of subjects.

Several scientific publications resulted from these experiments. The most recent cited was T.W. Thorslund and C.A. Paulsen, in Proceedings of the National Symposium on Natural and Man-Made Radiation in Space, NASA Document NAS No. 2440, pp. 229-232, January 1972.

Category 3. Whole Body Irradiation

In most of the cases in this category reported to the Subcommittee, whole body irradiation was used as treatment for diseases which were resistant to more conventional method. Most frequently, whole body irradiation was used in attempts to treat leukemia, cancer, or polycythemia vera (a disorder characterized by excessive levels of red blood cells in the blood). The Subcommittee staff does not question the propriety of these particular applications, since patients were irradiated in an attempt to treat their diseases, and in some cases the treatment was successful. However, one case covered below appeared questionable.

CATEGORY 3.001, NUMBER 49

Blood changes in human beings following total body irradiation

During 1943 and 1944, three groups of persons were given whole body irradiation doses from x-rays. The first group was eight persons with cancer. The second group consisted of one cancer patient and two persons with arthritic conditions. The third group was three normal volunteers. The objective of the study, was to observe the changes in blood or blood cells following treatment. Although whole body irradiation was a recognized treatment for malignancies, it provided no benefit to the normal subjects, who received

doses which were greater than maximum allowable occupational exposures at the time. In addition, the treatment seemed of little use for arthritis, and the Department of Energy reported in April 1986 that x-ray irradiation for arthritis "is not considered to be standard practice." The experiments were conducted at the University of Chicago and were funded by the Manhattan Project.

The experiment is described in a scientific publication, J.J. Nickerson, Blood changes in humans following total body irradiation, in Industrial Medicine on the Plutonium Project, National Nuclear Energy Series, Vol. IV-20, pp. 308-337, McGraw-Hill, 1951. Page 309 contains the following comment on clinical treatment:

The people used in groups 1 and 2 were individuals to whom the medical profession could offer no treatment that was at all specific or known to be helpful. The x-ray exposures that were given were as likely to benefit the patient as any other treatment, or perhaps even more likely than any other. Since this manuscript is concerned only with the effects on the blood the clinical condition of the patients is not discussed at any length.

Group 1 consisted of 8 patients with cancer of the throat, mouth, breast, or larynx. These patients received total body doses of 27, 60 or 120 roentgen in single doses from x-rays. Group 2 consisted of one patient with cancer of the hand, one patient with chronic arthritis who had received no previous.known radiation therapy, and one patient with joint stiffness and pain who had received local radiation therapy to the knee. These patients received 500, 300, and 100 roentgen, respectively of total-body doses in multiple dosed from x-rays. The radiation produced no significant change in the arthritis of those two patients. Group 3 consisted of three young female subjects who were normal in every known respect. These subjects received 7 roentgen (r) on three successive days, for a total of 21 roentgen from x-rays to each of them. Patients in groups 1 and 2

showed a decrease in the number of lymphocytes in the blood following radiation treatment. Group 3 showed no change in blood elements. For Group 3, the experimenters commented that:

These cases were of particular interest to us inasmuch as they indicated that acute exposure to far more than the maximum level of 0.1 r per working day could not be expected to produce diagnostic changes in the elements of the peripheral blood which were studied (Ibid p. 336)

The summary factsheet which the Department of Energy submitted to the Subcommittee in January 1985 reported no follow up on these subjects.

Category 4. Teletherapy with Particle Beams

These experiments consist of applications of cyclotron beams in attempts to treat patients suffering from cancer or other malignancies. The treatment was applied because conventional methods of therapy had often been unsuccessful in arresting the spread of disease. In some cases, the beam therapy proved more effective than conventional methods. In other tests, this therapy offered no advantages over existing methods and was discontinued. One item is reported to the Subcommittee did seem disturbing, because experimental subjects received no apparent medical benefits. This item. in Category 4.006, is discussed below.

CATEGORY 4.004, NUMBER 179

Neutron therapy facility

The follow up provisions of this experiment should be noted with approval. The objective of this activity is to determine the effectiveness of neutron beam irradiation as compared to standard irradiation for the management of certain malignant tumors. This project is carried out at the Fermi National Accelerator Laboratory, a facility owned by the Department of Energy. and is funded by the National Cancer Institute.

The project began in 1975 and is continuing. Approximately 1400 patients have been referred to the program. Prior to treatment, patients must agree to comply with long-term follow up requirements, which include regular physical examinations and laboratory tests. Every effort is made to contact patients who miss scheduled appointments, and fewer than 1 percent of patients treated at this facility are currently considered lost to follow up. The benefits of radiation therapy when expressed as enhanced

survival rates may be obvious. However, information on longer-term effects of radiation treatment will be useful in comparing results with other techniques in use presently or which ma developed in the future. The follow up efforts at the Fermilab project should be applauded, and should serve as a model that can be duplicated in other DOE investigations of medical therapy.

CATEGORY 4.006, NUMBER 93

Biological effects of heavy ions on human nervous system and vision

During the early 197Os, human subjects were placed within neutron and ion beams at accelerators in Berkeley and Seattle. These experiments arose because astronauts had observed visual light-streak effects while exposed to cosmic rays in space flight One objective of the experiments was to explore "visual sensations" in humans from exposure to ions. Two subjects observed light flashes in neutron beams of peak energy of 640 million electron volts (MeV); six subjects observed light flashes and dim but definite streaks of 25 MeV peak energy; and two subjects observed light flashes and streaks due to helium ions impinging upon human retina.

These experiments were conducted by the Lawrence Berkeley Laboratory and were funded by the Atomic Energy Commission. They were reported in Nuclear Science Abstracts in 1972 and 1973. The summary factsheet provided by the Department of Energy reports no long term follow up on the human subjects.

Category 5. Other Teletherapy

Projects in this category involved cases where patients whose cancer was not responding to conventional treatment were treated with various types of radiation from accelerators. As before, the Subcommittee staff does not question the propriety of these experiments because they contained a real possibility of benefit for patients.

Category 6. Treatment of Polycythemia

This project was a ten-year attempt, beginning in 1939, to tree polycythemia vera with radiation. The radiation therapy seem(more successful than conventional means of treatment.

Category 7. Hematological Effects

Most of the experiments in this category involved examination of blood changes of patients who were being irradiated for purpose of diagnosis or treatment The Subcommittee staff does not question these experiments, since the patients benefited or potential benefited from the treatment, and the examination of blood changes could provide useful information in designing future treatment.

Category 8. Neutron Capture Therapy

Projects in this category involved the use of beams of neutrons to treat patients with brain tumors. The Subcommittee staff does not question these experiments since, the radiation treatments were meant to benefit patients.

Category 9. Other Radiation Therapy

Most of these projects involved the examination of radioactive isotopes for their ability to treat malignant diseases or to assist diagnosis by concentrating in tumor cells. One experiment, however raised issues of concern and is discussed below.

CATEGORY 9.001, NUMBER 166

Uranium injected into brain tumor patients

From 1953 to 1957, approximately 12 terminal brain tumor patients were injected with uranium to determine the dose at which kidney damage began to occur. These experiments were conducted at Massachusetts General Hospital, Boston, with assistance from the Oak Ridge National Laboratory and were funded by the Atomic Energy Commission.

The experiments were conducted to gain data in deriving tolerance doses for workers in uranium processing and fabrication plants. Inhaled or ingested uranium salts are known to produce kidney damage; these experiments were designed to identify the doses at which kidney damage began to occur. Data were also obtained during these experiments on the excretion and retention of uranium in the body. All subjects were terminal brain tumor patients who died within 18 months of the experiments.

An additional stated reason for conducting the experiment was as an initial evaluation of uranium toxicity in developing therapy to treat brain tumor patients with U-235. However, this does not in fact seem to be an important reason for the experiment, since no effort was made to actually treat the brain tumor patients with this isotope. Moreover, neutron capture

therapy with U-235 has never been proven as an effective treatment for brain tumor patients.

Several scientific papers resulted from this experiment. One-paper, Bernard et al., Proc. Health Physics Soc., 33-48, June 1956, reported the injection of 11 patients, 10 of whom were in coma or semi-coma. One of these patients died in 2.5 days, and one died 18 days after injection. Doses ranged from 4 to 50 milligrams (mg) of uranium. A second paper, A.J. Lussenhop et al., Am. J. Roentgenol. 79, 83-100, 1958, reported on the injection of five patients, four of whom "were in coma or semicoma and remained so until their demise." Patients were injected with 4 to 15 mg uranium. The three patients with the highest doses, 0.12 to 0.28 mg uranium per kg body weight, showed evidence of kidney toxicity. Based on comparisons with animal data, the experimenters determined that a lethal dose for humans would have been 1 mg uranium per kg.

Another paper, S.R. Bernard, Health Physics 1, 288-305, 1958, reports on the injection of eight terminal brain tumor patients, six of whom were comatose. Doses ranged from 4 to 50 mg uranium. There may be some overlap among the patients covered by the three scientific papers. This last paper referred to earlier studies (which were the experiments reported in Category 1.003, Number 119). and notes that these studies lacked some information: "autopsy data were not obtained since none of the subjects were terminal patients." (S.R. Bernard, Ibid., 288) Using terminal subjects thus provided the "advantage" that the distribution of uranium in the body could be determined after autopsy.

Category 10. Biological Effects of I-131

CATEGORY 10.001, NUMBER 69

Study of changes in thyroids irradiated with radioactive iodine

This project, begun in 1951, is a retrospective study of the health of humans exposed to I-131, chiefly for medical reasons- The study has been carried out at Case Western Reserve University, and has been funded sequentially by the Atomic Energy Commission, the Energy Research and Development Administration, and the Department of Energy. This is not considered an experiment, but the project shows clearly the necessity and usefulness of long term medical follow up of irradiated populations.

The significant non-patient population in this study is

the group Marshallese Islanders who were ex posed to radioactive iodine from atomic bomb test fallout The findings on this population were described in TID-27160, a June 1976 Progress Report to the Energy Research and Development Administration. The report noted the long latency period for the onset of clinical effects, and commented on the likely relation between exposure and thyroid nodules:

The lengthy interval in man is clearly shown in the Marshallese where In spite of thorough annual physical examination the first palpable nodule was not found for 9 years and neoplasms are still appearing at 22 years. (p. 4)

To date 6 carcinomas had been removed from 10 individuals from several atolls, 3 from an atoll with extremely low exposure. Since this is a population which seldom if ever develops thyroid nodules, the relationship to the radiation which was primarily radioiodine is most impressive. (p. 4)

At the time of the last annual report we described a 21 year old Marshallese who we had just operated for multiple benign adenomas. He was 6 months in utero when his mother was exposed to fallout. The special studies of that thyroid tissue showed

the bizarre nuclear forms recognized as evidence of radiation effect. At the time preparation of this reports we have just operated and removed several benign atypical adenomas from the thyroid of his mother who had developed masses in the last year. (p. 5)

The factor of long delay in the development of neoplasms is emphasized in both animals and men....The first Marshallese lesion did not develop for 9 years. Many of the early lesions came from the atoll with the highest fallout (Rongelap) was quite some years later that lesions began appearing in people who were on the next nearest atoll (Alingnae) where the dose had been somewhat less. While lesions were appearing on the nearer atoll the low dose received on an atoll much further away (Uterik) seemed to have produced no lesions, but in the most recent years individuals have been operated and 3 carcinomas found. These observations seem to emphasize the risk of the low dose range. (p. 5).

Nine years after the 1954 thermonuclear bomb accident, the first thyroid neoplasm appeared. (p. 6).

CATEGORY 10.001, NUMBER 165

Milk containing I-131 fed to Humans

In 1962, five human subjects drank milk containing radioactive Iodine-131 for periods of time from 1 to 63 days. In the first experiments all subjects drank daily doses of I-131 milk for periods from 4 to 63 days, Doses each day were 150 or 1840 picocuries. The largest dose was 1840 picocuries per day for 63 days, for a total of 115,920 picocuries. In a second experiment, two of the same subjects drank single doses of 92,000 picocuries each. These experiments were funded by the Atomic Energy Commission and carried out by Oak Ridge National Laboratory.

The objective of the experiment was to validate calculations which standard setting organizations were using to establish occupational radiation exposure limits. Subjects drank the milk, radioactive active iodine uptake was measured by counting the area around the thyroid and excretion of iodine was also measured. Cow milk containing radioactive iodine was obtained from an AEC Agricultural Research Laboratory. The Department of Energy reported that no follow up of subjects was conducted. These experiments were-reported in a scientific paper, S.R. Bernard et al., Health Physics, 1307-1323, 1963.

CATEGORY 10.001, NUMBER 173

Planned radioiodine exposure to humans from May 1963 to November 1965, radioactive iodine was released intentionally on seven separate occasions. On three occasions. human subjects were exposed. The experiments were funded by the Atomic Energy Commission and were conducted at the National Reactor Testing Station in Idaho.

The experiments were designed to improve knowledge of the transport of radioactive iodine, which is produced by nuclear reactors and nuclear bomb tests, through the air-vegetation-cow-milk sequence in the human food chain. This information was considered desirable in developing reactor citing criteria, in the preparation of safety analysis reports, and as an aid to planning for emergency action after a radiation accident

Seven separate experiments were conducted. The general design was that radioactive iodine released in gaseous form, and prevailing winds took the iodine over an area designated "the hot

pasture." Monitoring devices in the pasture determined the radioactivity deposited. A herd of cows was then led to the pasture to graze for several days. The cows were milked and the milk monitored for radioiodine. Humans were exposed either by drinking the milk or by direct exposure to the released iodine gas. The experiments collectively were called the Controlled

Environmental Radioiodine Tests (CERT).

During Experiment CERT-1, conducted in May 1963, one curie of radioactive iodine was released into hot pasture. Six cows were placed on the contaminated pasture. Cows were milked twice a day, and the milk from one cow saved for human ingestion. Seven human subjects each drank 0.5 liter of radioactive milk over a period of 18 days. Radioactive iodine uptake was determined by counting the thyroid of each subject. (IDO-12035, Controlled Environmental Radioiodine Tests at the National Reactor Testing Station, U.S. Atomic Energy Commission, June 1964).

Experiment CERT-2 was conducted in September 1964. Approximately one curie of radioactive iodine was again released over the hot pasture. Milk samples were again tested, but were not consumed by humans. Instead, three human subjects were placed on the pasture during iodine release, and their thyroids counted after exposure. This was not a food chain experiment, but was designed to measure the direct iodine dose from inhalation.

During Experiment CERT-3, conducted in December 1964, ad CERT-4 and -5, both conducted in June 1965, no cows or humans were exposed, and measurements were only made on the pasture. Amounts of iodine released were lower than in previous tests. CERT-4 released 0.01 curie; CERT-5 0.1 curie; and the amount released in CERT-3 was not specified. (IDO-12047, Controlled Environmental Radioiodine Tests at the National Reactor Testing Station, 1965 Progress Report, U.S. Atomic Energy Commission, February 1966)

During Experiment CERT-6, conducted in summer 1965, radioactive iodine in the methyl iodide form was released. As the experiment progress report states:

Unfortunately, several of the vials, each containing 2 curies of methyl iodide-131, were accidentally broken in transit or were leaking when received. Those that were not broken were subsequently opened in the hot cell of the Idaho Chemical Processing Plant (ICPP) and the methyl iodide (2 to 6 curies) escaped to the atmosphere from a 75-meter stack. The stack was located 4 kilometers upwind of the test grid at the Experimental Dairy Farm (EDF). (IDO-12053, Controlled Environmental Radioiodine Tests. Progress Report Number Two, U.S. Atomic Energy Commission, August 1966, p. 2.)

Six cows grazed over the 27 acre area of the EDF, and iodine concentration in their milk was determined by counting. In addition, "Several individuals were inadvertently exposed to airborne radioiodine from the leaking and broken containers, and efforts were made to obtain data on the retention of this form of iodine in humans." (Ibid., p. 2) These exposures from ruptured vials occurred over a four-day period, and a few people received multiple exposures; thyroids of these individuals were counted.

Experiment CERT-7 was conducted in November 1965; 1 curie of I-131 in the gaseous molecular form was released over the pasture at the EDF. Six cows grazed, and milk samples were counted. In

addition, seven human volunteers were placed seated on the pasture area. Uptake of radioactive material was determined by counting the subjects thyroids.

The Department of Energy reported to the Subcommittee that no medical follow up of the experimental subjects in the CERT test was performed.

Category 11. Other Biological Effects

CATEGORY 11.001, NUMBER 51

Reactions of human skin to beta rays

During April and May 1945, two groups of 10 human subjects were exposed to plastic disks containing Phosphorus-32, which emits beta rays. These disks were placed directly on the skin to expose subjects. In one set of experiments, 10 persons were exposed to 140 to 250 rep (roentgen equivalent physical); in a second set of experiments, 10 subjects received a series of four exposures each in doses varying from 635 to 1180 rep. In most instances the forearm was the point of exposure, except for three cases in the second series where the inner mid-thigh was exposed. These experiments were funded by the Manhattan Project and were carried out in Clinton Laboratory, Oak Ridge, Tennessee. (One roentgen equivalent physical of beta rays is approximately one rem. For comparison, present occupational exposure limits are 30 rem per year to the skin, and 75 rem per year to hands and forearms.)

The objective of this experiment was to determine the beta ray dose at which skin erythema (reddening of the skin) would first be seen. In the first set of experiments, 8 of 10 subjects showed a "visible reaction" of mild tanning at a dose of 250 rep. In the second set of experiments, 6 subjects showed erythema at 635 rep, and 8 showed erythema at 313 rep. These experiments were reported in J.E. Wirth and J.R. Raper, Chapter 12 Biological Effects of External Beta Radiation, National Nuclear Energy Series, Volume IV-22E McGraw-Hill, 1951.

The Department of Energy reported no follow up on these subjects.

CATEGORY 11.001, NUMBER 53

Studies of radium applied to human skin

During 1955, experiments carried out on human subjects demonstrated that the biological effects of Thorium X (Radium-224), as judged by erythema and skin pigmentation, can be increased by using an electrical current to cause greater penetration of the skin by radioactive material. These experiments were carried out at New York University and were funded by the Atomic Energy Commission.

Three subjects were exposed in these experiments. During the experiment, squares of blotting paper saturated with Radium-224 were placed on the forearms of each subject an electric current was applied for 20 minutes to the paper on the left forearm, and no current was applied to the right forearm. For each patient, the left forearm showed intense reddening after 48 hours, and some skin

pigmentation at 75 days after exposure; the right forearms showed no visible reactions at the same times. The Department of Energy estimated that doses to the right forearm were 350 rem, and 1000 rem to the left forearms. Irradiated tissues were surgically removed, and no medical follow up on subjects was conducted. For comparison with the doses, present occupational exposure limits are 75 rem per year to the hands and forearms. These experiments were reported in AECU-3061, Atomic Energy Commission, a publication presented at the Sixteenth Annual Meeting of the Society for investigative Dermatology, 1955. This publication discusses the application of Thorium X to certain skin diseases, but there is no indication that any of the subjects received medical benefit from the experiment.

CATEGORY 11.001. NUMBER 83

Analysis of illness of children receiving fetal irradiation

In 1943, a program of routine pelvis examination by x-ray early in pregnancy for 1008 mothers who were to bear their first child was carried out at Chicago Lying-In Hospital. The objective of the exposures was to make delivery and labor more predictable and easier by measuring the sizes of pelvis and fetal head. in preceding and succeeding years, no such measurements were made and these groups serve as a control population. The estimated tissue dose to the pelvis for irradiated mothers was 1.5 to 3 rem. About half of these children were also exposed to 5 x-ray films during the first day of life. The estimated dose to new-born infants was 0.5 rem.

The Atomic Energy Commission subsequently funded the Argonne

Cancer Research Hospital to conduct analyses of health of the exposed children. Between 1962 and 1965 the parents of these children were contacted and asked for information on diseases and hospitalization. The first study found an increase in benign hemangiomas, a tumor which produces skin discoloration, but no increase in congenital malformations, eye diseases, or malignant tumors. A second survey made between 1966 and 1970 confirmed the results of the first follow up. The Department of Energy commented in 1985 that, "It is hoped that further data will be obtained from these subjects and if possible from their children."

CATEGORY 11.001, NUMBER 112

Human absorption of tritium oxide through skin

During 1951, 14 human subjects were exposed over a small area (about 10 square centimeters) on the forearm (12 subjects) or abdomen (2 subjects) to a water-vapor atmosphere labeled with tritium oxide (HTO). A single subject was in addition exposed over his total skin area while breathing uncontaminated air. Absorption of tritium oxide was estimated by measurements of tritium excreted in urine. The data from these experiments indicated that humans absorbed tritium at a rate 4 times faster than measured for rats. These studies were funded by the Atomic Energy Commission and were conducted by the General Electric Company, Richland Washington.

The objective of these experiments was to determine the rate of absorption of tritium oxide through human skin. This information would assist in evaluating the hazard to individuals who might handle tritium, which had promise of becoming a widely used tracer isotope for hydrogen. The Department of Energy reported that no medical follow up was carried out on these subjects. These experiments were reported in C.W. DeLang et al., Am. J. Roentgenol. Radium Therapy Nucl. Med. 71. 1038-1045, 1954.

CATEGORY 11.001, NUMBER 121

Effects of x-rays on human fingers

During 1947, fifteen subjects were exposed in the nail fold area of the left fourth finger to doses of 200 to 600 roentgen. (For comparison, present occupational exposure limits are 75 roentgen per year to the hands.) Fourteen of these subjects were patients being treated by x-rays or radium for other purposes,

but none of them had received previous irradiation to the hands. The other subject was a staff member who occasionally prepared radium material for treatments. He was observed before and after the preparation of an item containing 130 milligrams of radium. These experiments were funded by the Atomic Energy Commission and were conducted at the University of Chicago.

The objective of the experiment was to examine the changes which may occur in the fingers of persons occupationally exposed to radiation. The left fourth finger was chosen for irradiation because the skin is fairly thin as compared to other fingers, and this finger is "less likely to have been subjected to previous trauma." Microscopic observations were made of the finger before and immediately after treatment, and for up to two weeks after treatment. Some irradiated patients showed temporary symptoms such as enlarged or broken blood vessels, or reddening of the skin. The report on the experiment noted no permanent changes to the skin of the finger, and concluded with the statement, "It is proposed that test doses be given at higher levels." (CH-3833, Effect of Single Dose X-Ray to the Nail Fold Area of Human Subjects, Preliminary Report, July 1947, p. 4) However, no further experiments were reported. The Department of Energy reported no medical follow up of the subjects.

CATEGORY 11.001, NUMBER 123

Human absorption and excretion of tritium

During 1950, human subjects were exposed to tritium in several different experiments. Subjects were exposed to tritium in air for two hours, and the increase in tritium in body fluids was followed over time. In a second experiment, the arm of a man was immersed up to the elbow in water containing tritium, and the tritium in body fluids was again followed. In a third experiment, a man drank tritium in 0.2 liters of water and absorption into the blood stream was followed. Amounts of tritium administered were up to 3 millicuries. (For comparison, the maximum permissible body burden for occupational exposure is 2 millicuries.) These experiments were funded by the Atomic

Energy Commission and carried out at Los Alamos Scientific Laboratory.

The objective of the experiment was to obtain information on the human absorption and excretion of tritium, to aid in the setting of occupational exposure limits. The exact number of subjects exposed in not clear, but it appears that one subject immersed an arm in tritiated water, one subject drank tritiated

water, and seven subjects were exposed to air containing tritium. These experiments were summarized in AECU-937, The Absorption, Distribution, and Excretion of Tritium in Men and Animals, U.S. Atomic Energy Commission, November 1950. The Department of Energy reported no medical follow up of subjects.

CATEGORY 11.001, NUMBER 125

Human absorption of tritium liquid and vapor

During 1952, the lower arms of subjects were exposed for variable lengths of time to tritiated water vapor and tritium in liquid water. Tritium activity in subjects' urine was monitored. The Department of Energy provided no further details on this experiment, and reported no following of subjects.

CATEGORY 11.001, NUMBER 126

Human absorption of tritium by lung

During 1952, three subjects were exposed in five experiments to tritiated water vapor. Subjects breathed tritium saturated oxygen for 4 to 5 minutes. The tritium retained in the body during the exposure was obtained by comparing the tritium inhaled with the tritium exhaled. Retention and excretion of tritium with time were monitored through blood and urine samples. This experiment was funded by the Atomic Energy Commission and carried out at Los Alamos Scientific Laboratory.

Subjects inhaled from 0.8 to 1.0 millicuries of tritium. This can be compared with the maximum permissible body burden of 2 millicuries.

The objective of the experiment was to obtain information on absorption and retention of tritium to aid in establishing occupational exposure standards. The experiment is reported in LA-1465, Lung Absorption of HTO by Man Upon Inspiration of HTO Water Vapor, Los Alamos Scientific Laboratory, June 1952. The Department of Energy reported no medical follow up of the subjects.

CATEGORY 11.001, NUMBER 127

Human absorption of ingested tritium water

During 1952, five experiments were conducted on three subjects in which the subjects drank water containing tritium. Retention of tritium in the body was examined by taking blood and urine samples over time and counting. The experiments were funded by the Atomic Energy Commission and were carried out at Los

Alamos Scientific Laboratory.

The objective of the experiments was to obtain data that would assist in evaluating the hazard of ingested tritium. Two subjects

subjects each drank 1.6 millicuries of tritium; the third subject drank (3.2 millicuries in three separate experiments. For comparison, the occupational body burden is 2 millicuries. The experiments are reported in LA-1464, The Absorption of Ingested Tritium Water and the Water Dilution Volume of Man, Los Alamos Scientific Laboratory. June 1952. The Department of Energy reported no follow up on the subjects.

CATEGORY 11.001, NUMBER 133

Radiation exposure of aircrews in mushroom clouds

The U.S. Air Force sent manned planes through radiation clouds ("mushrooms and stems") from atomic bomb tests to measure radiation doses in the clouds and to the crews. The detonations were part of Operation Redwing, a series of 17 nuclear tests in the multi-megaton range, at Eniwetok and Bikini Atolls in the Pacific, from May - July 1956. The planes, five different B-57Bs, made 27 passes through clouds from six different nuclear explosions, at times from 20 to 78 minutes after detonation. 16 passes were earlier than 45 minutes and 7 were earlier than 30 minutes after detonation.

Maximum radiation doses in the cloud were 800 roentgens per hour. Total radiation doses to crew members were as high as 15 roentgens by film badge. (For comparison, the present maximum annual dose for workers is about 5 roentgen; one chest x-ray represents 0.02 to 0.04 roentgen.)

The objective of the project was to obtain radiation dose information, in the event that an "operational situation" required flights through such clouds. The information was to assist Air Force commands in planning to insure the "most-effective utilization, consistent with crew safety. of aircraft in cloud areas."

Earlier operations had been conducted where drone aircraft were sent through clouds to obtain dose information. The report also mentions manned penetrations made during Operation Teapot. These passes were made from 17 to 41 minutes after detonation. The report on Redwing deletes information on doses measured during the Teapot flights, and gives no reference to any other published report on Teapot. The Redwing flights are described in ITR-1320, Preliminary Report, Operation Redwing: Early Cloud

Penetrations. Armed Forces Special Weapons Project, May - July 1956.

On November 13, 1985, the Subcommittee chairman released this document to make it available for a hearing before the Senate Veterans Affairs Committee the following day on compensation for veterans exposed to atomic tests. The document was described in subsequent press accounts.

The Department of Energy reported no medical follow up on the exposed aircrews. However, subsequent correspondence between the Subcommittee and the Defense Department provided more information. The Defense Nuclear Agency (DNA) reported that seven of the Redwing crew members received doses greater than five rem by film badge, and were notified by the Nuclear Test Personnel Review (NTPR), a program to identify veterans exposed during atomic testing. Under this program, persons with exposures greater than five rem per year are notified and encouraged to undergo a special physical examination at the nearest Veterans

Administration hospital. None of these seven have reported medical problems attributable to radiation exposure.

In addition, the Redwing aircraft were contaminated with radioactive material as a result of flying through the clouds. The planes were subsequently decontaminated by ground personnel. The DNA retains the exposure records of these personnel, as well as those of all aircrew members, and all these personnel are recorded as part of the NTPR. The DNA maintains a toll free number which veterans who believe they were exposed to atomic tests can call to report their circumstances. (Letter from Lieutenant General John L. Pickitt, Director, Defense Nuclear Agency to the Subcommittee Chairman, December 11, 1985.)

In December 1985, Chairman Markey joined with Senator Cranston to request a General Accounting Office investigation on atomic cloud fly-through operations. GAO was asked to determine how many air crew members and how many ground personnel were exposed during Redwing and other such operations, what doses these personnel received, and what follow up the Defense Department has conducted on all personnel.

CATEGORY 11.001, NUMBER 134

Radioactive material placed on human skin

In 1953, Foster D. Snell, a consulting firm, placed synthetic radioactive soil on the palms of over one hundred human subjects, and examined the ability of different cleaning agents to remove the radioactive material. The objective of this

experiment was to determine the efficiency of various cleaning agents in removing radioactive contaminants from "human skin and hair."

These experiments were performed for the Chemical and Radiological Laboratories of the Department of the Army, and were reported in a U.S. Atomic Energy Commission technical publication. Removal of Radioactive Contaminants from Human Skin, NP-4935, June 15, 1953. It appears that at least part of the reason for conducting the experiments was to provide information that could be used on a battlefield during a nuclear exchange, since there is a reference to decontamination "from the point of view of the soldier in the field." (NP-4935, pp. 165,166)

For the experiments, a drop of a liquid mixture of radioactive material was deposited on the palms or arms of human subjects. allowed to dry, and counted with a Geiger counter. The contamination was then washed off with various cleaning agents, and the skin counted again to determine efficiency of removal. Initial experiments were conducted on metallic surfaces, then on rabbits and pigs. Preliminary work was also done on hair removed from humans, and then on 16 human subjects. Most of this work was done with a suspension of "synthetic soil," a mixture composed chiefly of soil, sand, and clay, mixed with fission products. Some experiments were performed with synthetic soil which had been irradiated in a nuclear reactor, synthetic soil mixed with Carbon-14, or a sample of soil from the Nevada test site. These other mixtures did not adhere well to skin, and were not used in later experiments. In these first human experiments. solutions registering up to 2,900 counts per minute were placed on subjects forearms or

forearms or palms. These experiments showed that it was most difficult to wash radioactivity from palms, and most subsequent experiments placed the radioactive material on palms only.

Subsequent experiments were conducted on about 102 different human subjects, placing larger amounts of radioactivity, typically 10,000 to 20,000 counts per minute, on subjects' palms. A variety of detergents and hand creams were examined for their ability to remove the radioactive contamination. One set of experiments was conducted with "radiological warfare agents," composed of small pellets of zinc bromide which contained radioactive Tantalum. Droplets containing 13,000 to 49,000 counts per minute of these agents were placed on the palms of six human subjects.

One set of experiments was conducted with employees at the Monsanto Chemical Company's Mound Laboratory, Miamisburg, Ohio. A mixture of contaminants containing alpha emitters, and not further identified, was placed on the palms of four employees and

detergents tested for removal. In addition, detergents were tested on the hands of three other employees "whose hands were contaminated in the normal course of work." (NP-4935, p.152)

Except for the experiments at Mound Laboratory, the Department of Energy, had not been able to identify where these experiments were conducted or how the 118 human subjects were obtained. Subjects were male and female, and ranged in age from 18 to 66. The Department of Energy reported no medical follow up on any of these subjects.

CATEGORY 11.001, NUMBER 183

Medical follow up studies

In its factsheet on this project, the Department of Energy described follow up studies to assess the long range health of different populations which have been exposed to radiation. These studies have been funded by the Atomic Energy Commission, the Energy Research and Development Administration and, and the Department of Energy. Some of them started in the 1950s and they continue at present. The studies are being carried out at the Argonne Cancer Research Hospital (ACHR), Argonne National Laboratory. The studies are described below:

1. For 20 years, a joint study of more than 400 persons bearing a considerable body burden of radium has been under way. Most of these persons were painters of the radium dials on luminous watches at various plants in the Illinois River valley region during 1920-1930; others received radium chloride by injection or orally as a medical treatment between 1920 and 1933. Persons with a considerable body burden of radium were found to have characteristic defects, destructive changes, and tumors in the skeleton. These studies include accurate estimates of the body content of radium by using a total body counter; through analysis of the expired breath for the gas radon, a radium decay product; by film exposure form subjects' bodies; and through studies of the blood to reveal if destructive or malignant changes have taken place.

2. A long term follow up study is under way to examine about 1000 children who were exposed before birth to x-rays during pelvic

pelvic examinations of their mothers. This study, which extended over about 25 years, is described as Category 11.001. Number, 83.

3. A follow up study is under way on patients who had received radiation therapy for stomach ulcers. This study was funded by the Department of Energy, and revealed some positive findings," which are not further specified. The study is now to

be resumed under support from the National Institutes of Health.

4. During the 1950s persons who received short treatments with low-voltage x-rays for benign conditions of the head, neck, and upper thorax during childhood were studied for possible development of carcinoma of the thyroid. All of the children with cancer of the thyroid who had been treated or seen by the investigator had been irradiated previously in such a way that the thyroid gland or portions of it had been included in the radiation field.

CATEGORY 11.001, NUMBER 186, PART A

Human ingestion of fallout

Concern about problems from the ingestion of fallout led to studies using real fallout from the Nevada Test Site; simulated fallout particles that contained Strontium-85, Barium-133, or Cesium-134; and solutions of Sr-85 and Ce-134. During 1961 to 1963, real and simulated fallout and solutions of strontium and cesium were fed to 102 human subjects. Absorption and retention of the ingested radioactivity was measured by counting the bodies of subjects. These experiments were funded by the Atomic Energy Commission and were carried out by the University of Chicago and the Argonne National Laboratory. Subjects were university students or members or researchers' staffs.

Several different fallout or simulated fallout materials were prepared. One set of experiments used microscopic spheres of radioactive strontium, cesium, or barium. A total of 27 volunteers ingested the spheres. Transit time of the spheres through the gastrointestinal tract was measured by counting excreted matter. A second set of experiments used real fallout, obtained from the Nevada Test Site following land detonation of the nuclear test Small Boy, on July 14, 1962. Fallout samples were placed in gelatin capsules and were fed to 10 subjects. In these and subsequent experiments, retention of activity was followed by counting subjects' bodies.

Two types of simulated fallout were also prepared. They were distinguished by the size of microscopic spheres used, which simulated the size of fallout particles close to or far from the site of detonation. 21 subjects were fed simulated local fallout, and 22 simulated distant fallout. Finally, 22 subjects were fed solutions of strontium or cesium. The amounts of radioactive material fed to subjects in all experiments ranged from 0.4 to 2.5 microcuries of Strontium-85, or 0.5 to 14 microcuries of Cesium-134. These values can be compared with the maximum permissible occupational body burdens of 60 microcuries for Strontium-85, and 30 microcuries for Cesium-134.

The Department of Energy reported no long term medical

follow up on these subjects. These experiments were reported in a scientific paper, G.V. LeRoy et al., Health Physics 12, 449-473, 1966.

CATEGORY 11.001. NUMBER 186. PART B

Lanthanum-140 administered to humans

The paper cited in Number 186, Part A, G.V. LeRoy et al., reported an earlier study in which 54 hospital patients were fed radioactive Lanthanum-140, and the passage of material through the gastrointestinal tract was measured by counting excreted matter. It appears that the Department of Energy did not report to the Subcommittee on this experiment, but it was published in R.L. Hayes et al., Health Physics 9, 915-920, 1963, and the Subcommittee obtained a copy of the original reference from the Library of Congress, Congressional Research Service. This experiment was carried out at the Oak Ridge Institute of Nuclear Studies, and was funded by the Atomic Energy Commission.

The objective of this experiment was to measure the movement of radioactive material through the human body, and estimate the dose to the lower large intestine from materials that the body does not absorb. The experimenters noted that movement through the body varied with individuals, and these experiments attempted to measure the extent of such variation.

Subjects were fed 10 or 20 microcuries of Lanthanum-140. (For comparison, the maximum permissible body burden for occupational exposure is 10 microcuries.) Movement of this substance through the body was examined by collecting fecal samples and counting. Subjects were patients from the clinical program at the Oak Ridge Institute, and ranged in age from 7 to 76. All subjects were selected because they had normal intestinal tracts, which were not affected by their diseases. Subjects thus received no medical benefit from the experiment. To measure variability in individuals, 3 subjects were fed Lanthanum twice, and one was fed three times.

Category 12. Metabolic and Physiological Studies

CATEGORY 12.001, NUMBER 15

Strontium and calcium injected in terminal cancer patients

The material which the Department of Energy submitted to the Subcommittee on this project included ANL-104, a 1959 report from the Argonne National Laboratory. This report summarized data on

the retention by humans of calcium, strontium, and radium. One of the references cited was Schulert et al., Int. J. Applied Radiation and Isotopes 4, 144-153, 1959. The Department of Energy did not supply this reference, but the Subcommittee obtained a copy of the original through the Library of Congress, Congressional Research Service.

In these particular experiments radioactive Calcium-45 or Strontium-85 were injected into twelve terminal cancer patients, and the distribution of each substance in tissue and bone was determined at autopsy. These experiments were carried out at Columbia University and the Montefiore Hospital, Bronx, New Yore

The objective of these experiments was to measure the absorption by different parts of the body of strontium, a product of nuclear fission and a component of nuclear weapons fallout. In order to help evaluate the hazards of strontium to humans, the experiment

experimenters desired to determine the retention by different tissues of strontium compared to calcium; strontium mimics calcium chemically and concentrates in bone. As the scientific paper explained, subjects were chosen so they could be autopsied fairly soon after injection: "Since autopsy analyses were employed, the patients were, of necessity, of limited life expectancy with cancer involvement, and cannot be considered as normal healthy adults." (Schulert et al., 145)

Ten patients were injected with about 1.5 microcurie per kilo-gram body weight of Strontium-85, and about 0.4 microcurie per kilogram of Calcium-45. Total doses would have been 64 to 114 microcuries of strontium, and 17 to 30 microcuries of calcium. For comparison, the occupational maximum permissible body burdens are 60 microcuries for Strontium, and 200 microcuries for Calcium-45. These patients lived from 3 hours to 124 days. An additional terminal patient injected with strontium only survived for 251 days, and one patient injected with calcium only survived for 960 days. Patients ranged in age from 49 to 72.

CATEGORY 12.001, NUMBER 109

Technetium administered to humans

During 1965, Technetium-95 (metastable) and -96 were administered to 8 subjects. Retention and absorption of technetium were monitored by counting the.bodies of subjects and by counting excretions. Doses were administered to subjects at the University of Washington, counting was carried out by the

Pacific Northwest Laboratory, Richland, Washington. The Atomic Energy Commission funded the work of the Pacific Northwest Laboratory. Technetium is a product of nuclear fission and is present in rather high concentrations in wastes from nuclear reactor. At the time of these experiments, technetium was being separated from nuclear wastes at the federal facility near Richland, Washington. In addition, technetium was also used for medical diagnoses. The objective of these experiments was to obtain information on the retention of technetium in the body, to help assign occupational exposure limits.

Four subjects were injected, and four subjects were fed technetium. Each subject received 20 microcuries of Tc-95m and 60 microcuries of Tc-96. (For comparison, the occupational maximum permissible body burdens are 70 microcuries for Tc-95m and 10 microcuries for Tc-96.) Samples of sweat, plasma, tears, urine and feces were collected, and observations were made for up to 60 days on some subjects.

These experiments were reported in a scientific paper, T.M. Beasley et al., Health Physics 12, 1425-1435, 1966. The Department of Energy reported there was no long term follow up of these subjects.

CATEGORY 12.001, NUMBER 110

Promethium administered to humans

In 1967, Promethium-143 was administered to 14 subjects. Absorption and retention were followed by counting the bodies of subjects. and by measuring the activity in blood and excretion

samples. 6 subjects were injected with promethium and observed for retention. 2 subjects drank orange juice with promethium in solution. 6 Subjects were injected with promethium and then injected with the chelating agent diethylenetriaminepentaacetate (DTPA), and the ability of DTPA to remove promethium from the body was examined. These experiments were funded by the Atomic Energy Commission and were carried out by the Hanford Environmental Health Foundation and the Battelle Memorial Institute, both at Richland, Washington.

The experiments were conducted to determine the uptake, retention, distribution, and excretion of promethium in humans. The information obtained would help to develop an excretion model for diagnosis of promethium in humans, to form a basis for

radiation exposure, and to determine the dose from accidental exposures. These considerations were relevant to occupational exposure of persons handling promethium.

Injected subjects received 0.1 microcuries of promethium. Two subjects drank 10 microcuries of promethium. Administered preparations were mostly PN-143, but some Pm-144 was also present. Little promethium was retained by the two subjects who drank it. However, about half of the injected promethium deposited in the liver within a few minutes, and most of the remaining promethium deposited in the bone within the next 5 hour. Subjects were followed for one year, during which this distribution remained unchanged. The effectiveness of DTPA in enhancing excretion of promethium declined with time When DTPA was injected 30 minutes after promethium, it removed 90 percent of the radioactive material; after 24 hours, it removed only 25 percent; and after 80 days, it removed only 5 percent.

These experiments were reported in a scientific paper, H.E. Palmer. I.C. Nelson, Health Physics 18, 53-61, 1970. The Department of Energy reported that no follow up was conducted beyond the one year observation after the experiment

CATEGORY 12.001, NUMBER 111

Phosphorus-32 injected into humans

During 1963, five subjects were injected with Phosphorus-32. Three of the subjects were patients at the University of Oregon Medical School who received the P-32 as part of the therapy for blood diseases. The other two subjects were injected at the Swedish Hospital in Seattle for purposes only of calibrating equipment. These experiments were funded by the Atomic Energy Commission and carried out by the Battelle Memorial Institute, Richland, Washington.

The reasons for carrying out these experiments were described in a scientific paper:

Fish and waterfowl that feed in the Columbia River downstream from the Hanford reactors acquire some radionuclides that enter the river with the effluent water (1) 32-P and 65-Zn are the principal nuclides found and suckers and whitefish usually contain the greatest concentration of these nuclides. Since sportsmen obtain and eat the waterfowl and fish from the Columbia River below Hanford, a method of measuring the low level body burden of these nuclides in humans is needed. Since 65-Zn is a gamma emitter, body burdens down to 1 nc (nanocurie) can easily be measured in a whole-body counter. Foster (2) has described an experiment in which a subject ate a weekly meal

of whitefish and the accumulation of the 65-Zn in the body was studied. 32-P does not emit a gamma ray and it is much more difficult to measure. This paperdescribes a method by which body burdens of 32-P down to 40 nc can be measured. (H.E. Palmer, Health Physics 12, 605-608. 1966.
references 1 and 2 are publications designated HW-80991, 1964; and HV-SA-3060, 1963. These are probably Atomic Energy Commission documents.)

One subject was injected with 425 nc of P-32. A second subject was injected with 500 nc, then reinjected after 28 days with 425 nc more. Injection doses for the other subjects were not reported. This same scientific paper reported another experiment where humans ate radioactive fish:

One reason for developing a sensitive, in vivo counter for 32-P was to measure people who eat Columbia River fish. The significance of this Intake with relation to the maximum permissible body burden has been discussed in another publication. (1) Five subjects ate 3/4 lb each of whitefish which had been caught in the Columbia River. After allowing 1 day for absorption of the 32-P, the subjects were measured for 20 min with the [radiation] counter and showed body burdens of 70, 110, 89, 72, and 93 nc . . . . The maximum permissible body burden for occupational exposure is 6000 nc.: Ibid 607. Reference 1 is HW-80991.)

The Department of Energy reported that no follow up was conducted on these experimental subjects.

CATEGORY 12.001, NUMBER 128

Humans inhaled tritium

During 1950, six subjects each inhaled "a few" millicuries of tritium. (For comparison, the maximum permissible occupational body burden for tritium is 2 millicuries.) Tritium concentration in urine was monitored for the following 15 days. These experiments were funded by the Atomic Energy Commission and were carried out at the Los Alamos Scientific Laboratory, New Mexico.
The objective of this experiment was to investigate the rate of appearance of tritium in urine. This knowledge would help in the establishment of occupational exposure limits. No follow up on these subjects was reported.

CATEGORY 12.003, NUMBER 174

Radioactive material administered to humans to calibrate equipment

Between 1965 and 1972, 8 individuals were involved in 13 different human experiments. All eight were employees of the Idaho Division of the Atomic Energy Commission. In four experiments subjects inhaled Argon-41; in nine experiments, subjects swallowed capsules containing microcurie amounts of radioactivity. These experiments were funded and carried out by the Atomic Energy Commission.

The objective of this experiment was to calibrate instruments that measure radioactive substances inside the human body; such instruments are usually used to examine workers accidentally exposed or hospital patients receiving radioactive material for diagnostic purposes. A secondary objective of the experiments was to examine the metabolism of radionuclides ingested or inhaled by humans.

Some of these experiments were reported in scientific papers. In the first set of experiments, one subject was fed one microcurie of

microcurie of Manganese-54; another subject was fed an unspecified amount of Iodine-131 (J.L Anderson and D.G. Olson, Health Physics 13, 719-732, 1967). In a second set of experiments, individual subjects subjects were fed 3.5 microcuries of Cesium-132, 1.9 microcuries of Potassium-42, or 1.1 microcuries of Manganese-54. In addition, 4 subjects inhaled Argon-41 in amounts of 1.3 to 2.2 microcuries (D.G. Olson, Health Physics 14, 439-447, 1968). In a third experiment, one subject was fed 1.5 microcuries each of Cobalt-60 and Cesium-137 (J.L Anderson and D.G. Olson, Health Physics 23, 325-332, 1972).

The Department of Energy reported there was no medical follow up of any of these experimental subjects.

APPENDIX

Current Federal Regulations on the Protection of Human Subjects

Current regulations on the use of human subjects for experiments are described in Title 45. Code of Federal Regulations, part 46 (45 CFR 461, revised as of October 1, 1985. These regulations call for special requirements when prisoners, children, or other specified categories of persons are used as subjects.

GENERAL PROVISIONS

Experiments on human subjects must satisfy the following criteria:

(1) Risks to subjects should be minimized.

(2) Risks to subjects should be reasonable in relation to anticipated benefits, and the importance of the knowledge that may reasonably be expected to result.

(3) Subjects should be selected in an equitable manner.

(4) Informed consent shall be sought from each prospective subject or the subject's legally authorized representative. Informed consent includes a clear description of the risks and benefits of the experimental procedure. (45 CFR 46.111)

PRISONERS

Biomedical or behavioral research may involve prisoners as subjects only if the purpose of the proposed research is to:

(1) study the possible causes, effects, and processes of incarceration or of criminal behavior:

(2) study prisons as institutional structures or prisoners as incarcerated persons:

(3) conduct research on conditions particularly affecting prisoners as a class (for example, vaccine trials or other research on hepatitis, which is more prevalent among prisoners than the general population);

(4) examine practices, both accepted and experimental, which have the intent and reasonable probability of improving the health or well-being of the subject. (45 FR 46.306)

CHILDREN

a child is an individual who has not attained the legal age for consent to treatments or procedures involved in the research, under the applicable laws of the location where the research is to be conducted (45 FR 46.402)

A child may be used as a subject only upon receipt of permission from parents and assent from the child, under conditions where the child is judged capable of providing assent (45 FR 46.408). if permission and assent are obtained, research can be conducted only if one of the following conditions is met:

(1) The research poses no greater than minimal risk (45 FR 46.404).

(2) The research presents more than minimal risk, but the procedure holds out the prospect of direct benefit for the individual subject or is likely to contribute to the subject's well-being (45 FR 46.405).

(3) The research presents more than minimal risk, does not hold out the prospect of direct benefit to the subject, but the

procedure is likely to yield generalizable knowledge about the subject's disorder or condition which is of vital importance for understanding the disorder or condition (45 FR 46.406).

(4) The research presents a reasonable opportunity to further the understanding, prevention, or alleviation of a serious problem affecting the health or welfare of children (45 FR 46.407).

OTHER SUBJECTS

Where some or all of the human subjects are likely to be vulnerable to coercion or influence, such as persons with acute or severe physical or mental illness, or persons who are economically or educationally disadvantaged, appropriate additional safeguards must be included in the study to protect the rights and welfare of these subjects. (45 FR 46.111)

It should be noted that under these regulations, the experiments previously described with prisoners, and which used minors as subjects would have been strictly prohibited. In addition, many other experiments used patients with severe illness or who were disadvantaged, and there is no indication that safeguards were incorporated into the experiments to protect these subjects.

TAB 7
U.S. General Accounting Office, "Examples of Post World War II Radiation Releases at U.S. Nuclear Sites"

[COVER SHEET] United States General Accounting Office

GAO Fact Sheet for the Chairman, Committee on Government Affairs, U.S. Senate

November 1993

NUCLEAR HEALTH AND SAFETY

EXAMPLES OF POST WORLD WAR II RADIATION RELEASES AT U.S. NUCLEAR SITES.

AO/RCED-94-51FS
[Letterhead of United States Senate, Committee on Governmental

Affairs, Washington, DC 20510-0250]

December 14, 1993

The Honorable Hazel O'Leary
Secretary
U.S. Department of Energy
Washington. DC 20585

Dear Madam Secretary:

I would like to congratulate you on your continuing effort to declassify events, written material, and technologies which have heretofore been kept secret by the Department and its predecessor agencies. Your openness initiative will ultimately promote greater trust in our government.

In the spirit of promoting continued openness. I am forwarding to you a General Accounting Office (GAO) Fact-Sheet done at my request entitled Nuclear Health and Safety: Examples of Post World War II Radiation Releases at U.S. Nuclear Sites. I would like your comments on the report, and I ask for your assistance and full cooperation in declassifying and releasing all relevant information about these and any other planned radiation releases conducted by the Department or its predecessor agencies.

During the course of its investigation of the so-called "Green Run" test at the Hanford Reservation (1949). The GAO uncovered references to 12 additional planned radiation releases at 3 other government facilities. Similar to the Green Run test, none of the 12 releases were accidental and none were the result of routine plant operations. Eight of the tests were part of the U.S. radiation warfare program and four were related to atmospheric radiation tracking research.

Two of the releases related to the radiation warfare program were conducted at the U.S. Army's Dugway, Utah site. These tests were conducted between 1948-1952. The four tests related to atmospheric radiation tracking occurred at the government's Los Alamos, New Mexico facility during 1950.

In some cases, GAO was unable to uncover much specific information about the radiation releases. Therefore, I do not believe that it is currently possible to determine whether civilians or workers were unwittingly exposed to health damaging

environment. However. I believe it is incumbent upon the Department and Congress to review all relevant information in order to make these determinations.

I am asking the GAO to continue their investigation concerning all planned releases of radiation by agencies of the U.S. government. I am sure that you will do everything in your power to ensure that GAO has the full cooperation of DOE employees. I encourage you to make the review and declassification of documents regarding planned radiation release a top priority as you continue your openness initiative. Further, I would appreciate your efforts to keep my staff and I informed on the progress of this work.

As many of these planned releases were conducted jointly with the U.S. military. I am forwarding a copy of this Fact Sheet to Secretary Aspin. I will encourage him to take similar actions.

Once again, I appreciate your leadership in slaying many of these Cold War demons and I look forward to working closely with you.

Best regards,

Sincerely
[SIGNATURE]

John Glenn
Chairman

JHG/ck
enclosure
[Letterhead of United States Senate, Committee on Governmental Affairs, Washington, DC 20510-0250]

December 14, 1993

The Honorable Les Aspin

Secretary
U.S. Department of Defense
Washington. DC 20301

Dear Mr. Secretary:

In an effort to better understand the health, safety, and environmental implications of an atmospheric radioactivity-monitor test called the Green Run, conducted at the Hanford Reservation in 1949. I asked the General Accounting Office to review relevant documents of both the Department of Defense and the Department of Energy. During the course of its investigation, the GAO uncovered references to 12 additional planned radiation releases at 3 other government facilities. Similar to the Green Run test, none of the 12 releases were accidental and none were the result of routine plant operations. Eight of the tests were part of the U.S. radiation warfare program and four were related to atmospheric radiation tracking research.

I am forwarding to you the GAO Fact Sheet, Nuclear Health and Safety: Examples of Post World War II Radiation Releases at U.S. Nuclear Sites, which summarizes their findings. I would like your comments on the report, and I ask for your assistance and full cooperation in declassifying and releasing all relevant information about these and any other planned radiation releases conducted by the Department.

Two of the releases related to the radiation warfare program were conducted at the government's Oak Ridge, Tennessee facility; six were conducted at the U.S. Army's Dugway, Utah site. These tests were conducted between 1948-1952. The four tests related to atmospheric radiation tracking occurred at the government's Los Alamos, New Mexico facility during 1950.

In some cases, GAO was unable to uncover much specific information about the radiation releases. Therefore, I do not believe that it is currently possible to determine whether civilians or workers were unwittingly exposed to health-damaging does of radiation, or if there was significant impact on the

environment. However, I believe it is incumbent upon the Department and Congress to review all relevant information in order to make these determinations.

I am asking the GAO to continue their investigation concerning all planned releases of radiation by agencies of the U.S. government. I am sure that you will do everything in your power to ensure that GAO has the full cooperation of DOD employees. I encourage you to make the review and declassification of documents regarding planned radiation releases a top priority as we work together to fully understand the full impact of the Cold War. Further, I would appreciate your efforts to keep my staff and I informed on the progress of this work.

As these planned releases were conducted jointly with the Atomic Energy Commission, I am forwarding a copy of this Fact Sheet to Secretary O'Leary. I am encouraging her to make this effort a top priority in DOE's ongoing "openness initiative."

Once again, I appreciate your leadership in slaying many of these Cold War demons, and I look forward to working closely with you.

Best regards.

Sincerely,

[SIGNATURE]
John Glenn
Chairman

JHG/ck
[Letterhead: GAO United States General Accounting Office, Washington, D.C. 20548]

Resources, Community, and
Economic Development Division
B-253483

November 24, 1993

The Honorable John Glenn
Chairman, Committee on
Governmental Affairs
United States Senate

Dear Mr. Chairman:

In response to your request, this fact sheet provides information on several - planned radioactive releases that were conducted at

U.S. nuclear sites in the post World War II years, including a release at Hanford, Washington, in December 1949. The Hanford event, referred to as the Green Run test, has been the subject of public attention in the Pacific Northwest since the late 1980s. Public concern has been heightened by the longtime secrecy surrounding the event and the fact that some test details still remain classified. As agreed with your office, we are presenting information on (1) the Green Run test and (2) several other tests at U.S. sites in the late-1940s and early 1950s that involved radioactive releases./1/

In summary, the Green Run test was atmospheric radioactivity monitoring experiment conducted by the military and the former Atomic Energy Commission (AEC). A premise of the test was that aerial monitoring and sampling of a radioactive cloud, even far from the source, could give evidence of nuclear materials. Conducted on December 2-3, 1949, the test released a recorded total of almost 28,000 curies of radioactive material from a special agent fuel reprocessing operation into the atmosphere over southeast Washington and Oregon./2/ (See fig. 1.1)

For the test, some of the plant's usual radiation safety procedures were intentionally relaxed, resulting in a larger than normal radioactive release. Test participants did not consider the test to be unsafe at the time, and the radiation doses that the off-site populace might have received as a result of the test were not estimated at the time (based on the historical test documentation available to us). However, according to the AEC, in some locations, the release exceeded then-existing local Hanford limits for deposition in vegetation and animal tissue, and it may not have been permissible under today's more stringent safety standards for U.S. nuclear sites. Presently, to better understand the health effects of the test and

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/1/An identically titled classified version of this fact sheet (C-GAO/RCED-93-IFS) was issued to you on June 30, 1993.
/2/A curie is a basic unit of radioactivity that is equal to 3.7x10 exponential 10 radioactive disintegrations per second

B-253483

Please call me at (202) 512-3841 if you or your staff have any

questions. Major contributors to this fact sheet are listed in appendix II.

Sincerely yours,

Victor S. Rezendes
Director, Energy and Science Issues

[insert document starting with Contents]
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Abbreviations

AEC Atomic Energy Commission
DOE Department of Energy

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Section 1

The Green Run Test and Its Safety and Health Implications

Details of the Green Run test and its historical context indicate that it was an atomic energy intelligence collection experiment. The test occurred during a period of heightened interest in Soviet nuclear capabilities, shortly alter the first Soviet nuclear bomb detonation. The test was not considered unsafe at the time, when radiation protection standards were generally less stringent than they are today. However, at some locations, the release exceeded then-existing local Hanford, Washington, tolerances for deposition in vegetation and animal tissue, and it may not have been permissible under today's nuclear safety standards. Presently, potential health effects from the test and other iodine releases at Hanford during the 1940s are being addressed in an ongoing dose reconstruction study.

A classified report on the test was issued in stay 1950 by the former Atomic Energy Commission (AEC), but the report remained classified in its entirety-and the test remained undisclosed-for almost four decades. Details of the test and concerns about its potential health and safety effects first surfaced in the latter part of the 1980s. When references to the test appeared in other ARC documents that were declassified over the years, several Green Run-related Freedom of information Act requests and appeals were flied. As a result, the test report was largely declassified in 1989. (Several passages in the report remain classified by determination of the Air Force, on the basis that further declassification of the report could compromise Air Force missions and thereby damage the national security.)

Test Purpose and Historical Context

The Green Run test was a special test of detectability as well as a research experiment into the atmospheric diffusion of radioactive gases. As such, it was related to postwar classified military research into the nature and effects of radioactive fallout and bomb debris.

Test Purpose

The Green Run test was conducted at Hanford, Washington, on December 2-3, 1949, by the AœC and the Air Force. The test took place in a postwar climate of U.S. concern about Soviet nuclear capabilities following the first detected explosion of a Soviet nuclear weapon in August 1949. According to a test participant, a premise of the test was that aerial monitoring and sampling of a radioactive cloud, even long distances from the source, could give evidence of nuclear materials. The diffusion of the released gases was to be monitored in order to develop air, ground, and aquatic methods of collecting data on nuclear operations and weapons

tests. The radioactive cloud was generated by a special spent fuel reprocessing operation.

For the test, the plant's radiation emission control procedures were intentionally relaxed. The spent fuel used in the test was aged about 16 days instead of the usual longer period of up to 90 or more days, which accounts for the term "green" run (i.e., the test involved the reprocessing of "green" fuel). In addition, the plant's off-gas water scrubbers-used to minimize the release of radioactive off-gases from the stack--were not operated. According to the test report issued in May 1950, as a result of these steps, the test released about 27,800 curies of radioactive production off-gases, including about 7,800 curies of iodine and about 20,000 curies of less hazardous xenon, into the atmosphere in southeast Washington and Oregon. The total recorded iodine release was about twice the almost 4,000 curies predicted in pretest calculations. During the test, despite unexpected adverse weather patterns that developed and limited the range of diffusion, the radioactive cloud was detected by an aircraft over 100 miles northeast of the site. After the test, radioactive iodine was found on vegetation over large areas of southeast Washington and Oregon, as shown in Figure 1.1

[GRAPHIC Figure 1.1: Area Where Radioactive Iodine Was Found on Vegetation Following the Green Run Test Area of lower

contamination, e.g., 5-30 picocuries per gram in Spokane. Area of higher contamination, e.g., 35-55 picocuries per gram in Pendleton, 50-260 in Walla Walla, and as high as 600 in Richland. Source: Hanford Environmental Dose Reconstruction Project Fact Sheet, Mar. 1992.]

Historical Context

As a research experiment into atmospheric diffusion, the test was related to postwar classified AEC/military research into the nature and effects of radioactive fallout and bomb debris. Such research began as early as the Operation Crossroads test series in the Pacific Ocean in 1946--during which, fallout was monitored aerially by the Air Force and on the surface by naval vessels--and continued throughout succeeding

atmospheric testing series. Effective instrumentation was an important aspect of research into radioactive effects, and at the time of the Green Run event the AEC and the military services were conducting several field instrument development programs to support their nuclear weapons research efforts. According to a test participant, the test was also generally related to research into the safety and health effects of nuclear detonations and nuclear production operations.

The Green Run test was preceded by other aerial radiation.monitoring tests that involved routine production releases of radioactive material The test was a follow-up to a series of aerial.monitoring tests conducted by the Air Force and the AEC during November 1948 to March 1949 at Oak Ridge, Tennessee, and at Hanford. For these tests, no special releases were conducted. The tests involved monitoring off-gases from routine production operations. At Oak Ridge, during 20 overflights by a C-47 aircraft between November 1948 and February 1949, reactor and separations off-gases were tracked up to 17 miles downwind. At Hanford in March, during three similar overflights, routine separations off-gases C (with stack scrubbers in operation) were detectable for less than 2 miles--results considered so disappointing that further Hanford overflights were discontinued. In a report on the test series' the authors concluded that further use of similar Hanford operations as a source for aerial trackIng was not practicable. Logically, the Green Run test with Hanford scrubbers not operating--provided the needed stronger source./1/

In addition, according to a former AEC official, monitoring overflights for the purpose of cloud tracking were conducted wherever sources of atmospheric radiation could be found in the United States, and probably at most or all AEC nuclear production sites. Routine close-in monitoring overflights at AEC sites began in the early 195Os and developed into a regular monitoring program having. among other things, environmental, safety, and security and safeguards purposes Also, aerial radiation monitoring by Air Force aircraft was practiced in conjunction with the many nuclear bomb tests conducted at the Nevada Test Site and in the Pacific Ocean during the Late 1940s and throughout the 1950 For example, according to one source, during Operation Sandstone in the Pacific in April-May 1948, a fallout tracking test called Operation.

/1/ Also in 1949, at an undetermined time before July 28, aerial monitoring tests of routine production effluents were conducted at the Harshaw uranium Refining Plant in Cleveland, Ohio. Overflights detected particles, likely uranyl fluoride, 1,150 yards downwind from the source in concentrations of 0.71 micrograms per cubic meter. Also in 1949, on an undetermined ate, aerial effluent monitoring the Mallinkrodt Uranium Refining Plat in St. Louis, Missouri, detected uranium concentrations of 0 micrograms per cubic meter in the atmosphere 3,000 feet downwind from the plant.

The Green Run Test and Its Safety and Health Implications

Fitzwilliam monitored radioactive fallout gases for several thousand miles at levels many times above background levels.

Safety and Health Implications

Routine Hanford radiation safety procedures were intentionally relaxed for test purposes. Specifically, in order to calibrate means of detecting Soviet production from Hanford plant operations, the cooling period for Hanford spent fuel was shortened from 90 or more days to only 16 days to simulate presumably less efficient or careful Soviet operations, and separations off-gas scrubbers were not operated. Furthermore, while the release was conducted on a weekend, which may have limited the number of workers on-site, the off-site populace was not forewarned of the event or made aware of it for several decades.

The test was also conducted despite less-than-optional weather

conditions, which limited the test results and may have exposed greater-than-expected numbers of the population to the radioactive cloud. Prevailing wind patterns prior to the test had been inopportune, and wind shifts during the test caused the emission of gases close to the ground, including directional shifts over populated areas in southeast Washington and greater-than-expected deposition at the Hanford site. Because of shifting winds, long-distance tracking of the cloud for several hundred miles was not possible. Two AEC contractor officials responsible for conducting the test differ in their recall of who decided that the weather for the test was acceptable. According to one, AEC contractor officials judged the wealthier to be acceptable. According to the other, the AEC did not wish to proceed -but the Air Force made the decision to conduct the test./2/ The recorded total release of iodine 131--about 7,800 curies--was about 2 times the predicted quantity. However, the accuracy of the recorded amounts has been questioned, and they have been recalculated./3/

According to officials conducting the test, the amount of the release was not considered unsafe at the time. While the release was extremely concentrated, since it occurred over a 12-hour period, regulatory limits on the amount of such emissions did not exist at the time. In fact, the release was a small fraction of the total releases that occurred during wartime and immediate postwar Hanford operations, before radioactive iodine removal

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/2/The AEC's Hanford contractor, General Electric Company, had a Health Instruments Division with the day-to-day authority to decide when reactor fuel could be processed.

/3/In June 1992, in the journal Health Physics, Maurice Robkin, a participant in the Hanford Dose Reconstruction Project, estimated the amount of iodine released to be about 11,000 curies, well over twice the predicted quantity. He calculated the release of xenon to be about 16,000 curies, for a total of about 27,000 curies.

systems were installed. For example, during 1945, production releases estimated at over 45,000 curies of iodine per month occurred at Hanford. By one estimate, the Green Run test accounted for about 1.1 percent of the total radioactive iodine released during 1944-49.

Test participants said the release was considered to be well within

the standards of the time for human exposure to radiation./4/ In some locations, the release reportedly exceeded then-existing local Hanford limits for radioactive deposition in animal tissue and vegetation. According to the test report, the release resulted in iodine deposition in animal thyroids up to 80 times above the limit of 4 microcuries per kilogram of tissue. The then-existing local Hanford tolerance for continuous deposition on vegetation--9 microcuries per kilogram--was temporarily exceeded in the areas of Yakima, The Dalles, Spokane, and Blue Mountains. Based on post-test documentation available to us, radiation doses that the off-site population might have received as a result of the test were not estimated at the time.

In regard to today's more stringent radiation standards, which are not directly comparable to those of the 1940s, it has not been determined whether the test exceeded present limits for off-site radiation doses and emissions./5/ The effects of the Green Run release and other postwar--Hanford radioactive iodine released that may have had effects on the off-site population are being addressed in an ongoing dose reconstruction study, directed by the Centers for disease Control, focusing on Hanford operations and releases from the site's beginning in 1944./6/ In regard to deposition standards that exist today, post-test deposition on vegetation in Richland, Walla Walla, and Pendleton reached levels above the threshold of 50 picocuries per gram listed in recent Environmental Protection Agency guidance for the interdiction of foodstuffs, applicable to accidents

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/4/At about the time of the test, the National Committee on Radiation Protection--whose recommendations the AEC followed--recommended (but did not immediately publish) a public external doses limit corresponding to about 1.5 rem (roentgen equivalent man) annually, or 10 percent of its recommended worker limit of about 15 rem annually. We were unable to document a then-existing specific limit for internal radioactive iodine doses. Rem is a measure of the dose of any ionizing radiation to body tissues in terms of its estimated biological effect relative to a dose of 1 roentgen of X-rays.

/5/Per 40 C.F.R. 61.92, applicable to the Department of Energy under departmental order 5400.6 our pathway radiation doses to the off-site populace are limited to 0.01 rem annually.

/6/Preliminary dose estimates from the study indicate that, during 1945-47, when routine Hanford iodine releases were conducted that totaled up to several dozen times more than the Green Run release, doses exceeding present limits may have been received by downwind infants through the air-pasture-cow-milk-thyroid pathway. According to DOE, at the time, scientist shad not identified this

as a pathway for significant doses of radioactive iodine to individuals.

[insert page 12]

or other mishaps at both civilian and Department of Energy (DOE) nuclear plants./7/

Furthermore, if proposed today, the test (including procedures that intentionally increased the amount of the release) might not be permissible under the principle of limiting radiation effects from nuclear production operations to levels "as low as reasonably achievable (10 C.F.- 20.1, and DOE Order 5400.5). This principle was not operative in 1949, at the time of the Green Run test in addition, if proposed today, such a test would appear to be imprudent from the point of view of operational safety procedures. DOE has categorized the test as one of the 14 most significant safety-related incidents in Hanford's history.

Our work did not document that the test was intended to be a radiation warfare experiment or a field test of radiobiological effects on humans. In particular, we examined still-classified passages in the Green Run test report and found that they did not refer to any such intentions or operations.

Section 2
Details and Other Releases

In addition to the Green Run test, we documented 12 other planned radioactive releases that occurred during post World War II nuclear weapons-related tests conducted at three U.S. sites: Oak Ridge, Tennessee, Los Alamos, New Mexico, and Dugway, Utah. Eight of the releases were conducted as part of the U.S. radiation warfare programs. Four others were related to atmospheric-radiation-tracking research. Like the Green Run test, none of these releases were accidental, and none resulted from routine production operations at nuclear sites./1/

Releases During the Radiation Warfare Program, 1948-52

We documented eight planned radiation releases conducted during the postwar U.S. radiation warfare program. Two of these releases occurred at the AEC's Oak Ridge site, and six others at the U.S. Army's Dugway, Utah, test site. The releases were conducted as part of a research program -- conducted by a joint AEC-military panel on radiation warfare. Specific program participants (and

roles) included the AEC (study and production of radioactive sources, study of biomedical effects), top military leadership (dissemination methods and protection measures), the Armed program), the Air Force (aerial delivery of device), and the Army (design, selection, testing of tactical device). Field testing of a radiation warfare device continued through at least 1952, as discussed below. The program appears to have ended in 1954 because it was not considered a high military priority.

Early on, the limitations of the concept of an offensive radiation warfare device were seen. For example, problems were seen related to preparing sufficient quantities of a suitable radioisotope for use in an offensive device. In some respects, chemical and biological weapons were perceived to be potentially as effective as a radioactive device, and logistically more convenient. During the program, the idea of using an air-dropped, cluster-type radiation warfare munitions for tactical area exclusion (up to 25 square miles) was pursued, with the Army being the principal proponent.

Concurrently in the early 1950s another logistically simpler kind of radiation warfare was foreseen. There was growing knowledge of fallout effects from so-called "dirty" atomic bombs, which advanced their potential for area exclusion and further limited the perceived need for a

_____

/1/These events were classified at the time of their occurrence over four decades ago. We were unable to document some event details, including in some cases the radionuclide involved and the extent of atmospheric diffusion during the release.

non-bomb radiation warfare device.2 Such "dirty" fallout effects were first witnessed at an underwater detonation during Operation Crossroads in 1946, and they were further studied through surface and catering tests at the Nevada Test Site. For example, November 1951 ground-level detonations in the Buster-Jangle test series were conducted in Nevada to-determine the military effects of atomic blasts. The enormous potential of "dirty" fallout came to be recognized after the Bravo detonation in the Operation Castle test series in the Pacific in 1954.

The second test was conducted on an undetermined date in July 1948 following the first test. The second test concerned the effectiveness of gamma-emitting sources distributed uniformly over an area. One thousand separate small sources were to be prepared, consisting of metallic tantalum rods or wires in suitable containers, each of a uniform strength of 300 curies (a total of

300 kilocuries for the test). The overall grid pattern area was to be 300 yards on a side or greater and was to be varied for different measurements. (We were unable to document specific test results.)

Dugway Releases

During 1949-52, the military conducted six tests of radiation warfare ballistic dispersal devices containing radioactive agents at the U.S. Army's Dugway, Utah, site. The principal agencies involved in the tests were the Army Chemical Corps, the AEC, and the Air Force. The tests were conducted concurrently with four series of non-radioactive drop tests over Great Salt Lake to test the dispersion of various types of spheres to be used in a cluster munition. The spheres for the drop tests carried

/2/According to a former Hanford, "dirty" atomic bomb at or near the surface to propel amounts of dust particles into the atmosphere.

fluorescein dyes whose patterns in the water were photographed and analyzed.

The first and second live tests were conducted on October 22 and November 30, 1949, and their specific purpose was to obtain information about the uniformity of ballistic dispersal from an air-dropped device over an approximately 1-square-mile area. For both tests, 300 curies of tantalum 182 particles were prepared by the EAC's Oak Ridge office. For the first test, the particles were charged to a strength of 260 curies, and for the second test, to 1,506 curies. The particles were loaded into a 2,000 pound cluster device for each test. The devices were dropped by the Air Force from an altitude of about 15,000 feet, bursting at about 1,300 feet, resulting in dispersal areas about 50 percent greater than anticipated. For the first test, a 0.6-square-mile area as covered, with annular (circular) effects noted. The mean radius of contamination was 5O0 yards, with the main area of contamination being within a circle 200 yards in diameter. For the second test, contamination covered a 0.8 square mile area, with a less pronounced annular effect because some of the tantalum particles were smaller than those used in the first test.

Four additional test events were conducted during 1950-52, for each detailed documentation is unavailable./3/

- During September 1950, two tests of a 2,000-pound ballistic dispersal device were conducted.
- In November 1951, an undetermined number of drop tests from various altitudes were conducted using spheres filled with a radioactive agent with various physical characteristics.
- In May 1952, a further series of drop tests was conducted.

/3/We were unable to document other details of these tests, including the specific radioactive agent used. However, by 1952, the radiation warfare program had turned from tantalum and protactinium to zirconium-niobium as the radioactive agent under primary consideration. In addition, the program in 1962 projected a single-aircraft delivery capability of up to 15 megacuries, dispersed over 3 to 4 square miles, or 10-square miles using four aircraft.

The 1951 and 1952 tests resulted in primary radioactive patterns 250 yards in diameter, with contamination well beyond this distance. The series were conducted during periods of calm winds.4

In conjunction with radiation warfare tests at Dugway, monitoring instruments easily detected a ground tantalum source of a few thousand curies at an altitude of 6,000 feet- We found no documentation of whether the Dugway releases were detected off-site.

Releases During Atmospheric Radiation-Tracking Tests at Los Alamos,

We documented a total of four atmospheric tracking tests conducted in Releases During 1950 at Los Alamos. In March and April of that year, the Air Force Atmospheric Laboratory, exploded three simulated nuclear devices at the Los Alamos site, resulting in atmospheric fallout. The purposes of the detonations were to (1) study implosion dynamics and track a radioactively gaseous cloud as long as possible, (2) study the rate at which the ionization produced by the radioactive matter decreased and diffused, and (3) analyze the fallout of radioactive material from the cloud. The tests were conducted on March 24 and 29, April 6, involving small simulated bombs containing unstated types and amounts of nuclear materials, presumably radioactive lanthanum 140 in kilocurie amounts. Resulting radioactive clouds were tracked downwind by a

B-17 aircraft carrying an experimental ionization-measuring apparatus. On July 19, another radiation detection test was conducted near Los alamos using an unidentified 400-curie radioactive source. The source was detected overhead and a few miles distant.

Fallout from the March 24 and April 6 tests went off-site over sparsely populated areas. The cloud from the March 24 test was tracked as far as the small town of Watrous, New Mexico, about 70 miles east of Los Alamos. The cloud from the March 29 test was tracked westward for an unstated distance. Information was not available concerning whether it went off-site. The cloud from the April 6 test was tracked northward for

/4/We also documented plans for two further tests (though we could not document that the events occurred) as follows. Mass drops of spheres containing a radioactive agent were planned for October-November 1952. Two clusters of 263 spheres each (each sphere containing 0.8 pounds of tantalum oxide pellets at a strength of 15 curies per pound, for a total of about 6,300 curies in the clusters) were to be prepared at Oak Ridge for air drops together from 30,000 feet. Another mass drop was planned for 1953, upon completion of an integrated munition system with ground-handling equipment at Dugway. For the test, six clusters of 263 spheres each were to be dropped, with planned centers of impact of the sphere groups to be 500 to 750 yards apart. Each sphere was to contain 0.8 pounds of tantalum oxide, at a strength of 75 curies per pound (about 95,000 total curies)

about 10 miles. Information was not available concerning whether he radiation from the July 19 test was detected off-site. We found no documentation of potential health effects from the four tests.

As requested by the Chairman, Senate Committee on Governmental Affairs, we developed information on (1) the Green Run Lest, including test details and potential health effects, and on (2) several other tests at U.S. nuclear sites in the late l94Os and early 1950s that involved radioactive releases. We focused on releases related to special tests conducted at nuclear sites rather than on accidental releases or routine, continuous releases related

to sites ongoing nuclear production operations. In addition, our scope did not include nuclear bomb detonations of which were conducted in Nevada and in the Arctic Ocean during the 1950s and 196Os.

Our scope and methodology included interviewing knowledgeable sources and examining pertinent unclassified and classified documents. We interviewed active and former Department of Energy (DOE), Atomic Energy Commission (AEC), and Department of Defense personnel as well as nongovernment sources with knowledge of matters related to the request, including several Green Run test participants. We examined documents in DOE, Air Force, and Defense Nuclear Agency archives, as well as the National Archives and archives of the Massachusetts Institute of Technology. Our results are based on diverse sources of information and are limited by their dependence on necessarily selective records examinations, owing to lack complete, definitive AEC or U.S. military documentation of the radiation events that occurred at U.S. nuclear sites in the postwar years. As a result, other planned radioactive releases not documented in this fact sheet may have occurred at AEC and other U.S. nuclear sites during those years.

Appendix II
Major Contributors to This Fact Sheet

Resources, Community, and Economic Development Division, Washington, D.D.

Jim Wells, Associate Director
Doris E. L Cannon, Assistant Director
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Tab 7
Prior Statements by Senator John Glenn

Summary, Statement and Prior Statements of Representative Edward Markey

Senator John Glenn
News Release
For immediate Release: Contacts: Jack Sparks (202) 224-5635

Byran McCleary, (202) 224-9799

STATEMENT BY SENATOR JOHN GLENN RE;
SECRET RADIATION EXPERIMENTS
JANUARY 6, 1994

On December 15, I released information detailing how the government conducted 12 deliberate, yet secret, releases of radiation in the--1940's and 1950's. The results of that investigation revealed that the government had released radiation into the environment in parts of New Mexico, Utah and Tennessee.

Since I made that information public, there have been new revelations that the U.S. government conducted secret radiation tests on humans - - some unknowing and unwitting.

These startling revelations have led the White House to order an unprecedented review and release of government records on secret radiation tests. I applaud President Clinton and Energy, Secretary Hazel O'Leary for their quick response and efforts so far to get as much information out as quickly as possible. It is heartening to see both a White House and Department of Energy that understands the importance of making this information public.

The idea of conducting tests on human beings without consent is an issue T have been concerned with for a long time. In the late 1970s, I chaired a number of hearings which examined radiation protection problems. This included an inquiry as to possible damages inflicted on American servicemen in connection with atmospheric nuclear weapons tests.

My concern also led me to propose, in the 1980's, legislation. which would have taken the management and funding of radiation research programs away from the Department of energy and placed them in health related agencies, such as the National Institutes of Health. However, I was fought by the Reagan and Bush Administrations at every turn on these attempts.

Right now I think it is critical that we work towards finding out - what happened with these experiments and making that information public. To this end, as Chairman of the Governmental Affairs Committee, I will hold hearings over the next several weeks to closely examine these tests and the government's efforts to declassify this information.

The recent revelations raise some other serious questions which I plan to address as we look at this issue.

Number one: We know that radiation testing - - presumably with informed consent - - continues within the government. But do we

know, with 100 percent certainty, that testing without consent does not continue to this days somewhere deep in the bowels of the federal government?

As Chairman of the Governmental Affairs Committee, I have uncovered horror story after horror story of government contractors running wild with little or no supervision from an agency. At times, I've felt like the contractor was running an agency rather than the other way around.

I realize we have strict rules and regulations concerning the use of humans in scientific experiments. What I want to know is are these rules being followed? How are they enforced?

We need to know from the Administration that they are doing everything possible to assure that no improper testing - - whether through government sponsored labs, contractors or elsewhere continues. No other answer is acceptable.

Let me make myself clear that I am talking about more than radiation testing. I am calling for a government-wide review of all testing programs - from drug tests at FDA to military tests at DOD - to determine if any improper experiments on humans persist to this day.

If anyone is still conducting experiments outside government regulations, and I hope this is not happening, I have one question: though you may think the tests are safe, would you offer your own children to be used as subjects?

Number two: we need to take a hard look at the safety guidelines dictating current government tests on humans. I think the recent disclosures of what occurred with human radiation tests should prompt the government to re-evaluate its current testing standards. Do our regulations and guidelines ensure the safety of the people used in the tests?

Number three: we need to review our country's laws and regulations - pertaining to informed consent. We must make certain that the laws we have now say that improper testing is illegal and will land you in jail. The laws must be very clear on this point.

These are some of the major questions for which I believe we

need answers. I have spoken with DOE officials and extended an invitation to Secretary 0'Leary to appear at our first hearing on radiation testing.

Again, I applaud the President and Secretary 0'Leary for their efforts so far. I look forward to working with this Administration on uncovering the facts of these experiments. We must do everything within our power to make amends for this unfortunate legacy of Cold War.

Senator John Glenn

News Release

For immediate Release: Contacts: Jack Sparks (202) 224-5635

Len Weiss, (202) 224-9799

Good morning. Today the Governmental Affairs Committee holds the first in what will likely be a number of hearings into the government secret radiation experiments. The Committee will also examine the guidelines and laws that are in place governing the use of human subjects in any type of experiment - not just those with radiation.

To allay fears and restore shaken confidence, there are three areas we must investigate --

First. What actually happened during the human radiation experiments conducted in the past? Apparently these experiments were of ten conducted without the knowledge or permission of the persons involved.

Secretary O'Leary has already taken major steps to find and release records that will let us know what happened, and what can and should be done about it now. In addition, the President has informed an Interagency Working group and advisory Committee to take the same determination across government. I commend them for their efforts.

Second. What human radiation experiments are going on now? And what are the protections for the people involved? Are current laws adequate? Are they being scrupulously followed? How do we know? What kind of monitoring systems are in place? Do we need new laws to fill any existing weaknesses or loopholes?

Third. What kinds of other human experiments - - in areas having nothing to do with radiation are being conducted? And do these experiments have the proper consent of the people involved? A large number of Federal agencies are or were involved in such -

research. For example: FDA, NIE, CDC, VA, DOD, DOE, CIA, and NASA to name a few.

The same questions we ask about human radiation experiments, past and present, can and should be asked about other research on our own people.

As a result of this hearing, and others to follow if - necessary, I hope to be able to assure people in my homestate of Ohio, and those around the country, that their government is no longer conducting experiments unknown to the individual and that may not abide by strict ethical, scientific and legal guidelines.

Over the past two months, we have seen a virtual avalanche of revelations describing secret radiation experiments conducted by the U.S. government on humans -- some unknowing and unwitting.

Some of these reports - - to make a gross understatement are very disturbing, It is quite upsetting to learn that your own country could carry out such experiments on its citizens, without their knowledge.

All the revelations of the last few months, which include a GAO report I released in mid-December documenting 12 previously known deliberate releases of radiation, have created a great deal of confusion. We hope to be able to clear up some of this confusion today.

A crucial issue is how to get the information on these tests out to the public. The people who were used in these experiments should be found and informed of exactly what went on, and if necessary provided with medical treatment. That is the important first step towards making any amends.

However, I would caution against an immediate rush to naming and identifying these people. We must also have an appropriate plan in place to assist them.

But it is also of concern when we hear reports that, due to attention on this issue, there are cases of citizens apparently refusing to accept therapeutic and diagnostic radiation treatments, for fear that they are being used as guinea pigs by the government. Tens of millions of proven, beneficial and safe -applications of radiation are given in the U.S. every year. These treatments have been developed by the medical profession and approved by the government. If someone has a question about a particular procedure or treatment, that person should consult with his or her own

doctor.

Again, I want to commend both the White House and Department of Energy for their efforts so far in this area. The Administration is starting the task of uncovering the truth, even at the expense of so-called 'government secrets.' In particular Secretary O'Leary deserves the thanks and support of Congress and the American public for tackling such an explosive issue with - compassion and forthrightness.

Having made repeated requests of the past two Administrations over this issue - - requests routinely ignored - it is quite refreshing to see the administration being open and putting the truth first.

Nevertheless, getting at the truth is going to be difficult. One problem is whether documentation still exists on many of these tests. The Department f Energy's own hotline, set up to receive calls from people who may have been involved in radiation testing, has logged thousands of cases. These thousands of cases must be checked with literally millions of government records. It is truly a monumental task.

My office alone has received a large volume of letters and phone calls form people who believe they have been the subjects of radiation experiments. I've also received letters from various "atomic veterans" with information about specific tests or questions regarding their individual cases. I will pass these letters along to the appropriate agencies and ask that they investigate the allegations.

There are also privacy concerns for the records of those people involved in the tests. It would set a very poor precedent for the U.S. government to release privileged medical information on any citizens without their prior consent.

The issue of secret radiation testing also should initiate a review of our current testing guidelines. Obviously, many people in government thought the standards that permitted many of these radiation tests were adequate. 20/20 hindsight gives us a different perspective. Will our current guidelines stand up to that same 20/20 hindsight?

For example, since 1991 all Federal agencies have adopted strict guidelines concerning informed consent and the use of institutional review boards in any experiments involving human subjects. However, the Department of Health and Human Service has

also promulgated guidelines concerning certain segments of our population who should have additional protections. These include pregnant mothers and their fetuses, children, and prisoners. While HHS has adopted these guidelines, most other agencies have not. Today we will ask "why no?"

In addition, as I understand it, a rule regarding the use of human subjects who are institutionalized and mentally impaired has not yet made it our of HHS. Again we will ask why this is the case.

I've covered a broad set of questions for the Committee to review, so let me repeat the three areas I outlined at the beginning of the statement.

With respect to the radiation experiments,

1) What happened in the past? What is being done to address this?

2) What types of radiation experiments are going on now?? Are they being conducted properly?

And

3) What other types of human experimentation are being conducted by the government now? Are these experiments being

conducted appropriately? How do we know?

I'd like to welcome our witnesses this morning. Before we hear from Secretary O'Leary, I'd like to recognize Senator...

SELECTED CHRONOLOGY OF SENATOR GLENN'S
LEGISLATIVE AND OVERSIGHT EFFORTS ON RADIATION WITH
THE SENATE COMMITTEE ON GOVERNMENTAL AFFAIRS

Hearings

March 6-7, 1979, Subcommittee on Energy, Nuclear Proliferation and Federal Services, Sen. Glenn, chair - - "Radiation Protection - Interagency Task Force Reports"

Hearings examined fragmented and overlapping Federal agency regulation of radiation protection specifically reports by Federal Interagency Task Force on Ionizing Radiation. Hearing also examined several health effects studies - involving radiation exposure, including those involving atomic veterans-downwinders, nuclear workers, and children exposed to X-rays in utero.

May 3, 9, and 10, 1979, Subcommittee on Energy, Nuclear Proliferation and Federal Services, Sen. Glenn chair -'Radiation Protection - - Institutional Issues"

Hearing addressed research and regulatory options being considered by HEW task force on radiation; institutional issues in radiation research; health effects estimates and emergency planning issues related to the Three Mile Island accident, and the implications of the Biological Effect of Ionizing Radiation (BEIR) Report of the National Academy of Sciences.

December 4, 1979, and March 20, 1980, subcommittee on Energy, Nuclear Proliferation and Federal Services, Sen. Glenn, chair -- "Federal Radiation Protection Management Act of 1979"

Examined S.1933 and heard testimony from GAO on report, "Radiation Control Programs Provide Limited Protection."

July 21, 1980, subcommittee on Energy, Nuclear Proliferation and Federal Services, Sen. Glenn, chair - - "DOE's safety and Health Program for Enrichment Plant Workers"

GAO testified on report which concluded that DOE was not adequately monitoring and enforcing its health and safety standards for workers at Uranium enrichment plants. DOE. Dept of Labor, NIOSH and OSHA witnesses also testified.

April 29, 1982, Subcommittee on Energy Nuclear proliferation and Federal, Services, Sen Glenn, chair -- "Federal-Radiation Protection Management Act of 1982, S.2284)

Hearing examined issues pertaining to Sen. Glenn's legislation, S.2284.

June 16, 17, 1987, Governmental Affairs Committee, Sen. Glenn, chair - - "Nuclear Protections and Safety Act of 1987"

August 2. 1989, Governmental Affairs Committee, Sen. Glenn, chair, - - "DOE's Radiation Health Effects Research Program and Working Coalitions at DOE Sites"

Hearing examined safety and health aspects of Sen. Glenn's bill S. 1304, including the Titles establishing a Radiation research Advisory Committee and transfer to OSHA and NIOSH of certain worker oversight responsibilities. Admiral Watkins testified.

May 6, 1993, Governmental Affairs Committee, Sen. Glenn, chair-- "Federal Regulation of Medical Radiation"

Hearing examined issues raised by Cleveland Plain Dealer series on medical radiation incidents. Among other issues, hearing focused on patient notification and administration problems of the NRC. Gaps in federal regulation between FDA and NRC were also discussed. Hearing resulted in Memorandum of Understanding between two agencies on this issue.

Legislation

"Federal Radiation Protection Management Act of 1980," (S.1938, Report No. 96-925, introduced October 24, 1979)

The purpose of the bill was to provide for greater coordination among the various federal agencies involved In the regulatory and research aspects of Federal radiation protection activities. The bill also aimed to ensure the highest practicable protection against harmful radiation exposure. The bill created two interagency groups - - the Federal Council 0:1 Radiation Protection and the Federal Conference on Radiation into the Biological Effects of Ionizing Radiation. The first would be chaired by EPA and would endeavor to coordinate federal regulation of radiation. The second would be chaired by NIH and would have the responsibility-of overseeing Federal involvement in ionizing radiation research. Legislation was introduced October 24, 1979, reported from the Subcommittee June 2, 1980 (with amendments, and reported from full Committee June 17, 1980 (with amendments).

"Federal Radiation Protection Management Act of 1982, (S. 2284)

A bill to ensure adequate protection of workers, the general public, and the environment from harmful radiation exposure, to establish mechanisms for the effective coordination of the various

federal agencies involved in radiation protection activities, and to develop a coordinated radiation research --program. Subcommittee hearing held April 29, 1982.

"Radiation Research Reorganization Act of 1985," (S. 525, introduced February 27, 1985)

Bill would transfer to tile Secretary of HHS the authority of the Secretary of Energy to conduct epidemiological studies of the effects of radiation.

"Nuclear Protection and Safety Act of 1987" (5.1085, introduced April 23, 19.87)

Bill proposed creation of independent nuclear safety board, - applies OSHA and NIOSH provisions to DOE Nuclear facilities, and creates a Radiation Study Advisory Board to Oversee DOE"s -research program on the health effects of ionizing radiation.

"DOE Nuclear Safety and Environment Act." (5.1304. introduced July 12, 1989)

The bill contained 8 titles. Among other things the bill:: 1) would require OSHA and NIOSH to regulate and oversee worker safety and health at DOE facilities; 2) established a radiation research advisory board controlled by HHS to oversee and review the conduct of DOE"s radiation health effects research; 3) codified DOE's Office of Environment Safety and Health. Senator Glenn testified on this bill before Energy and Natural Resources Committee on October 5, 1989.

Reports (partial listing)

"Early Health Problems of the U.S. Nuclear Weapons -Industry and their applications for Today," December 1989, Majority Staff Report

Report documents several and little known public health problems encountered during the early years of the U.S. nuclear weapons program (planned and unplanned radiation releases). The report recommends funding needed health studies and to make available all DOE material (including archival files) to examine potential health hazards over the past several decades.

"Bibliography of Epidemiological Papers and Reports Provided by DOE to the Senate Governmental Affairs Committee" Majority Staff research, released summer 1989.

"Nuclear Health and Safety: Examples of Post World War II Radiation Releases at U.S. Nuclear Sites," GAO, November 1993, RCED-94-51FS.

This report done at your request documents 12 previously undisclosed planned releases of radiation by the AEC and DOD to various experiments in the early days of the weapons program. GAO is conducting followup work for you on this issue.

SUMMARY STATEMENT OF REPRESENTATIVE EDWARD J. MARKEY
BEFORE THE PRESIDENTIAL ADVISORY COMMITTEE
ON HUMAN RADIATION EXPERIMENTS
April 21, 1994

Chairperson Faden and members of the Committee, thank you for the opportunity to appear today. I am pleased and honored to be involved with your first meeting, which reflects the leadership of the Clinton administration in addressing issues related to human radiation experiments. I will Summarize my statement and ask that my full testimony be included in the record, along with a staff report on the plutonium experiments.

The recent acknowledgement by federal officials that the government conducted radiation experiments with human guinea pigs grabbed the attention of U.S. citizens, because most people assumed that our country would not engage in this kind of activity. To close the door on this regrettable legacy, we -should focus on proper remedies to respond to past wrongs, ensure these things can never happen again, and doe the right thing today for those who suffered injury.

Accordingly, today I am introducing legislation with the goals of full disclosure, medical follow-up of subjects, and appropriate compensation for subjects or families for damages.
It is my hope that the administration will accomplish these goals before legislation is enacted, but I desire the force of legislation if the executive branch should falter in meeting these goals.

My experience with these issues stems from a report I released in October 1986, "American Nuclear Guinea Pigs: Three Decades of Radiation Experiments on U.S. Citizens." This report revealed the frequent and systematic use of human subjects as

 guinea pigs in experiments with ionizing radiation which provided little or no medical benefit to the subjects. These experiments can be characterized as repugnant or bizarre in many cases, and were marred by a lack of informed consent in some cases.

This report was essentially ignored by the Reagan administration, and it languished on a shelf at the Department of Energy. When Secretary Hazel, 0'Leary learned of these experiments and my 1986 staff report, she decided to disclose all information on human experimentation. I commend and support her efforts to lift the shroud of secrecy on her Department.

It is not my desire to blame present leaders of institutions for past mistakes. My concern is that institutions work with Congress today to address past abuses. I therefore welcome the leadership by the Clinton Administration, and I look forward to working with the Administration, this Committee, and the scientific community in formulating proper responses today.

I also wish to submit for the record a staff analysis of documents released this March by Secretary O'Leary, related to the plutonium injection experiments. These plutonium papers raise several issues which have not yet been resolved, and which are relevant to the efforts of the Interagency Working Group. One issue goes to the question of what standards were in effect at the time of the experiments. The plutonium papers suggest "that for a brief period of time in 1947, the Atomic Energy Commission required that human radiation experiments should be conducted only if the subject received medical benefits a standard similar to those by which we judge these experiments today. I hope that the Working Group, or the Advisory Committee,

as it sees fit, will determine precisely what standards were in effect in 1947, and whether they deteriorated over time.

In addition, I want to emphasize to this Committee the need to maintain the integrity of government records during the search for documents on radiation experiments with human subjects. I recommend that steps be taken to avoid review of files by individuals who may have direct conflicts of interest.

I understand the charge to the Advisory Committee, but I hope that if the Committee finds it appropriate to go beyond its charge in two areas of substance, it will not hesitate to do so. The first area is compensation for damages, where the breadth and depth of this Committee would allow it to make valuable contributions if it chose to recommend standards for compensation.

The second area lies with the knowledge that the sad history of the U.S. government's use of its own citizens as guinea pigs is not limited to ionizing radiation. If the Committee considers it warranted to recommend that the federal investigation be expanded to include experiments with chemical or biological agents, I hope it will not hesitate to do so.

In summary, what has been revealed is no less than the frequent a systematic use of U.S. citizens as guinea pigs during experiments with a variety of dangerous radiation, chemical, and

biological agents. These experiments shock the conscience and demand a response. I look forward to working with the Administration and the Advisory Committee to gain full disclosure of this shameful past, and to provide restitution to those citizens who have suffered injury.

[Letterhead: Congress of the United States, House of Representatives, Washington, DC 20515-2107, Edward J. Markey, 7th District, Massachusetts Committees, [word deleted] and Commerce, Chairman Subcommittee on Telecommunications and Finance, Natural Resources, Commission on Security and Cooperation in Europe]

STATEMENT OF REPRESENTATIVE EDWARD J. MARKEY
BEFORE THE PRESIDENTIAL ADVISORY COMMITTEE
ON HUMAN RADIATION EXPERIMENTS
April 21, 1994

Chairperson Faden and members of the Advisory Committee, thank you for the opportunity to appear before you today. I am pleased and honored to, be involved with your first meeting. The establishment of this Committee to provide advice and recommendations to the Human Radiation Interagency Working Group, and the occasion of this meeting, represent tangible results of the leadership of the Clinton administration in addressing issues related to human experimentation with ionizing radiation. These events clearly indicate that the administration is moving forward in its response to past wrongs which the U.S. government committed against its own citizens.

The recent acknowledgement by federal officials that the government conducted radiation experiments with human guinea pigs grabbed the attention of all U.S. citizens, and the reason is that most people assumed that our country would not engage in this kind of activity. I think the fact that the federal government -- our government -- funded or engaged in this kind of activity is the most disturbing aspect of this whole story. Most Americans thought that our country would not take that kind of action. To close the door on this regrettable legacy, we should focus on the proper remedies to respond to past wrongs, make -certain these things can never happen again, and do the right thing today by compensating those who suffered injury.

Accordingly, today I am introducing legislation to address - past wrongs. My focus is on the Department of Energy, because that is the agency with which I have the most experience. My legislation has three goals. It is my hope that the administration will accomplish these goals before legislation is enacted, but I desire to have the force of legislation if the executive branch

should falter in meeting these goals:

Require full disclosure from the Department of Energy, while protecting the privacy of subjects and their families, on experiments with ionizing radiation that provided little or no benefit to the subjects and were funded by the Department or its predecessor agencies;

Require the Department of Energy to formulate a plan to conduct proper medical follow-up of subjects where it seems

feasible and indicated; and to provide free medical care for injuries related to experiments;

Require the Secretary of Energy, after consultation with other appropriate federal officials, to recommend appropriate compensation for those subjects or their families who have suffered damages, and make any other recommendation for appropriate compensation for those who have been wronged.

The legislation I am introducing does not impose a particular compensation plan, but rather directs the Secretary of Energy to report to Congress in six months on what should be the appropriate scheme. I recognize that there is some debate on the effectiveness of existing legislation for exposed atomic veterans and for "downwinders" from atomic tests. In light of that debate, I think it is appropriate for the Administration to review these and other compensation systems and then develop an appropriate system for the victims identified here today. The best system would merge science with compassion in determining standards for compassion. Provision should also be made for -appropriate remedies other than monetary compensation to unwitting subjects who suffered "dignity injury."

With the Advisory Committee's indulgence, I would like to briefly describe my involvement with these issues. In October 1986, I released "American Nuclear Guinea Pigs: Three Decades of Radiation Experiments on U.S. Citizens," a staff report of the House Subcommittee on Energy Conservation and Power. This report revealed the frequent and systematic use of human subjects as guinea pigs, describing 31 experiments in which nearly 700 persons were exposed to ionizing radiation that provided little or no medical benefit to the subjects.

The 1986 report also discussed some of the more repugnant or bizarre experiments. At the top of this list were the plutonium injection experiments, in which patients designated terminal within

10 years were given plutonium to determine how the body handled this radioactive material. This experiment provided no medical benefits to the subjects, and is marred by a lack of informed consent, since even the word "plutonium" was classified during the 1940s. Moreover, as my staff report documents, when the Atomic Energy Commission conducted a follow-up study in 1973 to determine the amounts of plutonium remaining in subjects' bodies, informed consent was not obtained from patients who were still alive, nor from families who were asked for permission to exhume the bodies of deceased subjects. Sadly, thirty years later, the word "plutonium" was still too explosive for the federal government to tell the victims.

The response of the Reagan administration to my 1986 staff report can be described as, "Thanks for the information, we're not going to do anything," and the report languished on a shelf

at the Department of Energy until recently. Then in November 1993, a series of articles by Eileen Welsome, a reporter at the Albuquerque Tribune, identified some victims of the plutonium - injection experiments and their families, and put a human face on the issue. Last week, Eileen Welsome was awarded the Pulitzer Prize for these articles. When Secretary of Energy Hazel O'Leary learned of these experiments and my 1986 staff report, she decided that the appropriate course of action was full disclosure of all information on experiments with human subjects. As the members of this Committee well known--in January 1994, President Clinton formed the Human Radiation Interagency Working Group, and announced that he would establish this Advisory Committee. I commend the President for his leadership, and I commend Secretary o'Leary for her efforts to lift the shroud of secrecy on her Department, and bring the questionable past of the Department and its predecessor agencies into the sunshine of public scrutiny.

In another set of experiments which came to light in late 1993, at the Fernald School in Massachusetts during the 1940s and 50s, schoolboys classified as mentally retarded were fed radioactive calcium and iron with their breakfast meals. Yet parents of these children were deceived about the nature of the experiments when they gave their consent. With at least one experiment, the letter from the School requesting consent never mentioned that radioactive material would be fed, noted that experimental subjects were selected from a "group of our brighter patients," and implied that the experiment might result in "gains in weight and other improvements."

These experiments were funded by the Atomic Energy Commission, the National Institutes of Health, and the Quaker Oats Company, and research was conducted by faculty at MIT and Harvard. These experiments clearly fit within the scope of the documents that I requested from the Department of Energy in the mid-1980s, yet they were not reported then. With the revelation of the Fernald School experiments, I began to question whether we know the full scope of human experimentation; whether the 1986 staff report provided a reasonably accurate picture or whether the extent of testing was larger.

This question has been reinforced by findings of the Massachusetts Department of Mental Retardation (DMR), which after the revelation of the Fernald School experiments launched its own investigation for full disclosure. With the assistance of Harvard University, the DMR identified additional experiments during the 1960s at the Wrentham School, where tiny children as young as two years old were administered radioactive iodine to test potential "countermeasures" to atomic fallout, in work funded by the U.S. Public Health Service, Division of Radiological Health.

Statement of Representative Markey, April 21, 1994, p. 4

One reason why I find these experiments so repugnant is because of the vulnerable nature off the subjects used. It was no accident that students at the Fernald and Wrentham Schools were fed radioactive material, and not university students. It is no accident that the terminally ill were experimental subjects, including some who were comatose. It is no accident that the elderly, soldiers, and prisoners were used for testing with radioactive material. Such members of society are not fully enfranchised and lack control over their lives. They deserve protection, not exploitation as human guinea pigs. Certainly, experimental drugs or treatments intended to make the patient better may be used. But that was not the case with these experiments. We must again look at our ethical guidelines to make certain they protect the vulnerable.

When I released my staff report in 1986, I had assumed that experiments of such nature were the product of the arrogance of the early Atomic Age, and the paranoia of the Cold War. But as these experiments have gained new attention, I have been shocked and dismayed to find that individual scientists feel compelled even today to defend these experiments of years ago. Some have stepped forward to claim that such experiments should not be judged according to today's standards, and besides, the doses given were low. To these attitudes, I have two responses:
First, contrary to such opinions, the 1940s and 1950s were not

devoid of patient knowledge or ethical standards. Radiation and its health effects were widely discussed in the era of bomb shelters and air raid drills. Moreover, the Nuremberg Code was in effect, written by the United States and the Allies in the aftermath of World War II, and it established guidelines on obtaining informed consent for experiments. Clearly, the Fernald School experiments violate this basic human rights standard.

In this regard, I commend the recent statement of Charles Vest, president of MIT, who acknowledged that while doses at the - Fernald school may have been relatively low, he was "sorry" for the experiments, because of the children selected and the lack of informed consent. MIT explained that President Vest issued his statement because "it seemed the decent thing to do," and I applaud his decency.

I wish to make clear that I consider such ethically questionable experiments to be aberrations, and I do not desire to cast doubt upon the overwhelming majority of biomedical research, representing - laboratory experiments, legitimate nuclear medicine for, and ethical clinical trials. I have long been a strong advocate of public funding for basic research, and I commend those investigators who work daily to understand, prevent, and treat disease.

Nor is it my desire to blame present leaders of organizations and institutions for past mistakes. My concern is

that institutions work with Congress today to do the right thing to address past abuses. I therefore welcome the leadership by the Clinton Administration, and I look forward to working with the Administration, this Committee, and the scientific community in formulating proper responses today.

In March 1994, as part of the Administration's commitment to full disclosure, Secretary of Energy O'Leary released two boxes of documents related to the plutonium injection experiments. I reiterate my commendation of Secretary O'Leary, and note that her efforts haven already produced results not seen previously from the Department of Energy. Nonetheless, the documents released raise some issues which have not yet been resolved. I enclose as an attachment a staff report on these plutonium papers. Matters identified, and their relevance to the ongoing work of the Interagency Working Group, or of the Advisory Committee, as it sees fit, are as follow:

The precise number of persons exposed to plutonium in experiments remains an open question. On this matter, the Working Group is already committed to full disclosure on all experiments.

The plutonium papers indicate, more clearly than material provided to my Subcommittee in the 1980s, the coordinated nature of the plutonium injection experiments, and their connection to other experiments with human subjects, specifically injections of polonium and uranium. It seems appropriate for the Working Group to determine to what extent experiments represent a coordinated federal effort rather than a collection of isolated studies.

The plutonium papers suggest that for a brief period of time in the late 1940s, the Atomic Energy Commission required that experiments with ionizing radiation and human subjects should be conducted only if the subjects received medical benefits -- a standard similar to those by which such experiments are being judged today. If this in fact was AEC policy, it must have been overturned or violated by many later experiments. It seems appropriate for the Working Group to determine what standards were in place in the late 1940s, and whether they deteriorated over time.

In February 1987, the Department of Energy notified me that they would not conduct further follow-up of experimental subjects. However, at the same time, the Department was desperately trying to conduct follow-up with the family of a deceased patient, an Australian national injected with plutonium before his fifth birthday. It seems appropriate for the Working Group to determine the full extent of any follow-up conducted in the 1980s, and evaluate whether the efforts then might facilitate follow-up of subjects now.

Statement of Representative Markey, April 21, 1994, p. 6

In addition, I want to emphasize to this Committee the need to maintain the integrity of government records during the search for documents on radiation experiments with human subjects. I recommend that steps be taken to avoid review of files by individuals who may have direct conflicts of interest.

I understand the charge to the Advisory Committee, but I hope that if the Committee finds it appropriate to go beyond its charge in two-areas of substance, it will not hesitate to do so. The first area is compensation for damages, where the breadth and depth of this Committee would allow it to make valuable contributions if it chose to recommend standards for compensation. The second area lies with the knowledge that the sad history of the U.S.

government's use of its own citizens as guinea pigs is not limited to ionizing radiation. If the Committee considers it warranted to recommend that the federal investigation be expanded to include experiments with chemical or biological agents, I hope it will not hesitate to do so.

As an example of chemical experiments, a 1993 report from a scientific panel convened by the Institute of Medicine, Veterans at Risk, examined the long-secret exposure of soldiers as - experimental subjects to chemical warfare agents. This report noted that over 60,000 military personnel were used as subjects, including 4,000 soldiers exposed to mustard gas and Lewisite, a related chemical. The panel concluded that although experimental subjects were designated "volunteers," it was clear from official reports that recruitment of subjects "was accomplished through lies and half-truths," during World War II and later experiments as well. The panel found it "most appalling" that no long term - medical follow-up was conducted on the subjects, despite knowledge available by 1933 that mustard gas and Lewisite could produce long term detrimental health effects.

In summary, what has been revealed is no less than the - frequent and systematic use of U.S. citizens as guinea pigs during experiments with a variety of dangerous radiation, chemical, and biological agents. These experiments shock the --conscience and demand a response. I look forward to working with the Administration and the Advisory Committee to gain full disclosure of this shameful past, to provide the medical follow-up and treatment that experimental subjects deserve, and to take -- other measures as necessary for restitution to those citizens who have suffered injury.

[Letterhead: Congress of the United States, House of Representatives, Washington, DC 20515-2107, Edward J. Markey, 7th District, Massachusetts Committees, [word deleted] and Commerce, Chairman Subcommittee on Telecommunications and Finance, Natural Resources, Commission on Security and Cooperation in Europe]
MEMORANDUM

To: Congressman Edward J. Markey
From: Staff
Subject: The Plutonium Papers
Date: 4/20/94

Summary and Conclusions

You requested from staff review and analysis of documents from the

Department of Energy related to the plutonium injection experiments. This memo provides the staff analysis and discussion of issues relevant to the ongoing efforts of the Human Radiation Interagency Working Group.

On March 3, 1994, Secretary of Energy Hazel O'Leary released to her Department's Public Reading Room two boxes of documents related to plutonium injection experiments in the 1940s. These injections were one set of experiments described in "American Nuclear Guinea Pigs," the 1986 report you released as Chairman of the House Subcommittee on Energy Conservation and Power. During 1945 to 1947, as part of the Manhattan Project, 18 patients diagnosed as -terminal within 10 years were injected with -plutonium. Despite the original diagnoses, seven patients lived longer, including one who lived until 1991, 44 years after his injection. Internal investigations by the Atomic Energy Commission found that even the word "plutonium" was classified during World War II, informed consent was not granted in the initial experiments, and living patients were not informed that they had been injected with plutonium until 1974.

The plutonium injection experiments returned to public attention in November 1993 when a series of articles by Eileen Welsome in the Albuquerque Tribune identified five of the experimental subjects and interviewed family members. These articles came to the attention of Secretary O'Leary, along with your 1986 report, and eventually a federal Human Radiation Interagency Working Group was established to provide full disclosure of records regarding questionable exposures of populations to ionizing radiation. Secretary O'Leary's release of the plutonium papers in March 1994 is in keeping with that goal.

You have frequently commended Secretary O'Leary for her leadership, and have noted that her efforts have already produced results not previously seen from the Department of Energy. Nonetheless, the documents released point to some issues that have not yet been resolved. These issues, and their relevance

to the continuing efforts of the Interagency Working Group, are summarized below:

I. The plutonium papers report additional related exposures of human subjects, beyond the 18 patients which the Department of Energy reported to your Subcommittee in the 1980s. You have written two letters to Secretary O'Leary on this matter during March and April 1994. One individual was injected with americium,

a related element, during 1947; six additional human subjects drank plutonium in 1946; and there are cryptic references to two more subjects injected with plutonium in 1944. The precise number of persons exposed thus remains an open question. In this regard, the Interagency Working Group is already committed on a generic basis to full disclosure on all experiments.

2. The plutonium papers indicate, more clearly than material provided to your Subcommittee in the 1980s, the coordinated nature of the plutonium injection experiments, and their connection to other experiments with ionizing radiation and human subjects, specifically injections of uranium and polonium. It would appear appropriate for the Interagency Working Group, as it reviews experiments, to determine to what extent they represent a coordinated federal effort rather than a collection of isolated studies.

3. The plutonium papers refer to directives from the Atomic Energy Commission in the late 1940s, which prohibited the administration of radioactive material to humans for purposes other than medical treatment or diagnosis. This same standard has been applied more recently: Your 1986 report did not challenge experiments conducted for medical treatment and diagnosis, and the Executive Order establishing the Interagency Working Group exempted established treatment and diagnosis methods. The suggestion is that for a brief period of time in the late 1940s, the Atomic Energy Commission got things right in setting standards for human experimentation. But those standards were overturned or violated by experiments later and up to the mid 1970s, when tighter federal regulations went into place, and questionable experiments with ionizing radiation apparently stopped. It would be appropriate for the Interagency Working Group to analyze how and why the directives of the late 1940s were replaced by looser standards for over 20 years.

4. In February 1987, Secretary of Energy John Herrington replied to your October 1986 report by noting that his Department would not conduct further follow-up on subjects of the experiments. However, the plutonium papers reveal that after your 1986 report was released, the Department did pursue follow-up on one living and one deceased subject of the plutonium injection experiments. Efforts by staff to obtain further information from the Department of Energy on the full extent of the follow-up after your report have not been successful. Because the Interagency Working Group may ultimately be involved with notification or medical follow-up of subjects, it would seem appropriate to

evaluate the follow-up conducted in the late 1980s and determine whether the efforts then would facilitate further follow-up at the present time of subjects.

The following sections provide a brief background on your 1986 report and the plutonium injection experiments, and then discuss each of the four points above. Where reference is made to the plutonium papers released by the Department of Energy (DOE) in March 1994, material is designated by DOE's assigned document numbers or (Bates) page numbers.

Background

In October 1986, as Chairman of the House Subcommittee on Energy Conservation and Power, you released the staff report "American Nuclear Guinea Pigs: Three Decades of Radiation Experiments on U.S. Citizens." The report described 31 experiments, during which nearly 700 human subjects were exposed to ionizing radiation that provided little or no medical benefit to those exposed. The earliest experiments began in the 1940s, and the latest extended to the early 1970s. In some cases, the experiments were designed to cause harm or otherwise measure the effects of radiation on the human body. In some cases, the experiments were conducted on vulnerable populations where informed consent for experiments would have been problematic: the elderly, hospital patients suffering from terminal diseases or who might not have retained their full faculties, or prisoners. Most of the experiments were conducted to measure the metabolism and distribution of radioactive substances as they passed through the human body; such information was useful in setting standards for occupational exposure to radioactive substances. It should be noted that such human experimentation with potentially hazardous substances is not common today. Typically, standards for workers or the general public for toxic substances are set on the basis of the most reliable and most stringent animal data for a given substance. An Appendix to your 1986 report described the current federal regulations for experiments with human subjects.

Your 1986 report also described some of the "more repugnant or bizarre" of the experiments, and the plutonium injection experiments were placed at the top of this list. During 1945 to 1947, as part of the Manhattan Project, 18 patients diagnosed as terminal within 10 years were injected with plutonium, to measure metabolism and distribution of this substance. These experiments were carried out at Strong Memorial Hospital in Rochester; the Manhattan District Hospital at Oak Ridge, Tennessee; the University of Chicago; and the University of California, San Francisco.

Despite the original diagnoses, seven of these patients lived longer than 10 years, including five who lived longer than 20 years. Internal investigations by the Atomic Energy Commission during the 1970s found that even the word "plutonium" was classified during World War II, informed consent was not granted in the initial experiments, families were not properly informed of plutonium injections when the Atomic Energy

Commission requested permisssion for exhumations in the 1970's, and living patients were not informed that they had been injected with plutonium until 1974.

The Reagan administration Department of Energy declined to take any action on your 1986 report, and the report gained little further attention at the time. The plutonium injection experiments returned to public attention in November 1993, when a series of articles by Eileen Welsome in the Albuquerque Tribune identified five of the experimental subjects and described the shock and outrage of family members; these articles have since won a Pulitzer Prize. In her lead article, Ms. Welsome acknowledged that " the key " to starting her investigation was a set of documents, related to your 1986 report, that she obtained through your staff. When the Tribune articles, along with your 1986 report, came to the attention of Secretary of Energy Hazel O'Leary, she stated she was "appalled" to learn of such "repugnant" experiments.

Also in late 1993, information was revealed on experiments at the Fernald School in Waltham, Massachusetts (presently located in your congressional district), where teenage boys designated as mentally retarded were fed radioactive iron or calcium in one experiment, during the 1940's and 1950's. The parents of these children were deceived in granting consent for participation: With at least one experiment, the letter requesting consent never mentioned that radioactive material would be fed, noted that experimental subjects were selected from a " group of our brighter patients," and implied that the experiment might result in "gains in weight and other improvements."

These experiments were funded in part by the Atomic Energy Commission. These experiments were not revealed to the House Subcommittee on Energy Conservation and Power in the late 1980's, although they clearly fall within the scope of Subcommittee requests for documents on all experiments with human subjects and ionizing radiation, funded by the Department of Energy or its predecessors. This circumstance has led you to question whether the full scope of human experimentation has been identified: Did your

1986 report identify the "iceberg" of human radiation experiments, or did it merely describe the "tip of the iceberg?"

Secretary O'Leary accepted the findings of your 1986 report, and in January 1994 a Human Radiation Interagency Working Group was established to provide full disclosure of records regarding questionable exposures of human populations to ionizing radiation. As part of this commitment to full disclosure, Secretary O'Leary in March released to the Department's Public Reading Room two copier-sized boxes of files related to the plutonium injection experiments. One box includes medical files on the experimental subject's, with subject names redacted. A second box includes background information, including documents related to the original experiments and to the Atomic Energy Commission investigations in the 1970s on the original

experiments. Matters raised by these recently-released documents are described below:

How Many Human Subjects?

The transmittal letter from the Department of Energy on the released documents in March 1994 referred to 18 subjects injected with plutonium, as aid the summary factsheet which the Department provided to the House Subcommittee on Energy Conservation and Power in the mid-1980s. However, an initial review of the plutonium papers revealed a table including a 19th patient, designated "Cal-A," who was injected with 0.25 microcuries of americium-241, a radioactive substance similar to plutonium (Plutonium Document 700042). He was injected on June 10, 1947, about a month before the last plutonium injection, which occurred on July 18, 1947. Material released by the Department also includes a very thin file on Cal-A, consisting of some hand-written-notes and a death certificate (Document 700300). Cal-A was an Asian-American teenager, suffering from bone cancer, and he died less than a year after the injection.

As indicated above, the documents released in March 1994 include the redacted medical files of the 18 plutonium injectees, and these appear to originate from 40-series files maintained at the Department of Energy's Argonne National Laboratory, Center for Human Radiobiology. It appears that Cal-A is designated as Case 30-082 at the same facility.

In a letter of March 15, 1994 to Secretary O'Leary, you noted the description of Cal-A, and expressed your hope that this additional

human subject will not become the "forgotten victim" of the transuranium injection experiments. You recommended that if additional medical files are available on this patient, the Department should redact and release those files, after following the same procedures to protect the privacy of subjects and their relatives that were followed with the files of those injected with plutonium. You also recommended that as the Department considers recognition or other appropriate action for the victims of plutonium injections, it give the same consideration to the case of Cal-A.

A more detailed review of the plutonium papers indicated that additional human subjects drank plutonium, and additional subjects may have been injected, in the 1940s. In a letter to Secretary O'Leary of April 11, 1994, you described these -additional experiments, and noted that the precise number of persons exposed to plutonium in experiments remains an open question.

Plutonium Document 700029 describes a telephone conversation between Sidney Marks, who in 1974 led an Atomic Energy Commission (AEC) investigation into the plutonium injection experiments, and Louis Hempelmann, who had been involved in planning the injections in the 1940s. The document notes that in Rochester, "In the unclassified files [Hempelmann] discovered a reference to

injection of plutonium in 1944 into two patients who were fatally ill. These are in addition to the 18." Document 700032 records another telephone conversation, noting that, "We have the information on the original 18 plus the 19th. We have records on 19 plus a bit of information on 6 more which are entirely new. The six new ones are plutonium." Document 700055 appears to be an outline for the AEC investigation; at the top of the first page are listed cities and dates that correspond to times of injections, with the note for Rochester, "Possibly 2 others in 1944."

It should be noted that in subsequent material presented to the AEC Commissioners in 1974 (Document 700014) and in later accounts, a total of 18 patients were described for the plutonium injections, and the earliest reported injection dates were in 1945. It appears that the plutonium documents provided by the Department do not make clear what conclusions were reached on the possible two additional injections: whether these additional injections were definitively ruled out, or whether data were insufficient to confirm their occurrence.

One of the plutonium papers, however, clearly indicates that additional experimental subjects drank plutonium (Document 700130). This document is a memorandum of June 20, 1946 from E.R. Russell to J.J. Nickson, two University of Chicago scientists involved in the plutonium injections. Part of this document contains urinary plutonium excretion data on MX-200, an experimental subject who in later accounts was designated Chi-3 and is recognized as a patient injected with plutonium at the University of Chicago. The first few paragraphs of this document describe the detection of plutonium in the feces of individuals working "with or in areas contaminated with" plutonium. Document 700130 also contains the following comments:

"In order that one might gain some idea as to the rate of intestinal elimination, it was thought advisable to conduct - experiments with humans whereby approximately 400 (proportional)c/m (counts per minute of alpha radiation] were injected and the elimination rate followed.... The details of the test are given in the following section." (p. 1)

"On May 13, 1946, six individuals drank a solution prepared as follows: 10 ml of a 0.01 M hydrochloric acid solution containing 39 (proportional)c/m of plutonium per ml was added to 100 ml of drinking water - and without mixing the individual drank the solution."

"During the first 24 hours after the ingestion, each individual collected the urine eliminated and this assayed for plutonium.... Each fecal specimen was collected during the following six days and the plutonium content determined. ... The results are shown in Figures 1 through 6.... These tests will be repeated where a cathartic is given immediately after the ingestion of the plutonium." (p. 2)

It should be recognized that there may be significant differences between the subjects who drank plutonium and the victims of the plutonium injections: The plutonium injected represented up to millions of counts per minute of radioactive material, while the drinking solutions represented a few hundred counts per minute. The subjects for drinking plutonium may have been volunteers, and informed consent may not be an issue. Nonetheless, these do represent additional human experimental exposures to plutonium, and they should have been reported to the House Subcommittee on Energy Conservation and Power in the 1980s. In addition, the documents recently released do not appear to provide more detailed information on this experiment than the material quoted above.

Accordingly, in your April 11 letter to Secretary O'Leary, you asked if additional information was available on the plutonium drinking and injection experiments. In making this request, you recognized that some of the documents already released are nearly 50 years old, that even the AEC investigation was concluded -nearly 20 years ago, and that there may be no one alive who can answer some questions on these experiments. Nonetheless, you requested that the Department make reasonable efforts to provide answers, because of the intense public interest in the plutonium experiments, and because loose threads remain dangling on their full history. The plutonium drinking experiments reveal another part of the "iceberg" of human experiments with this deadly substance, and your concern remains over how much more of the iceberg is still hidden from view.

Connections With Other Experiments

Documents provided to your House Subcommittee in the 1980s by the Department of Energy included descriptions of many individual experiments, but connections between experiments were not readily apparent. Material in the plutonium documents released in March makes clearer the connections between this and other experiments.

SECY-75-130, an August 1974 memo provided to the Commissioners of

the Atomic Energy Commission, summarized disclosure to subjects of the plutonium injection experiments (Document 700013). The summary notes on p. I the laboratories conducting the experiments at the Universities of California, Chicago, and Rochester, and indicates on p. 2 that, "The study was loosely coordinated between the laboratories." During April and May of 1945, one patient each was injected at Oak Ridge, Chicago, and San -Francisco. Ultimately, a total of 11 patients were injected at Rochester, one at Oak Ridge, three at Chicago, and four (including Cal-A) at San Francisco.

Document 700001 contains notes from an interview in 1974 with Louis Hempelmann, who was involved in the planning of the original experiments. He noted that Stafford Warren, medical director of the Manhattan Project, initiated the program at Rochester under contract with Dr. (Samuel) Bassett, who was in charge of the Metabolic ward. Other documents report additional

experiments at the Metabolic Ward with other radioactive elements.

Document 700021 is a March 1974 memo from "Sid" to "Jim," which

includes the comment, "Louie Hempelmann has come up with two additional fatally ill patients who were injected at Rochester in 1944. There are also uranium and polonium injection cases. At the meeting, may we raise the question of including everything we discover?" The two principals of this memo are not specified, but a handwritten entry at the top is "Notes to Liverman." Document 700073 is a later memo of April l, 1974, from James Liverman, Director of the AEC's Division of Biomedical and Environmental Research (DBER), to Sidney Marks, DBER, designating Marks as the individual responsible for carrying out an investigation, into the original plutonium injection experiments. This memo was silent on the matter of other experiments.

However, the plutonium papers released by the Department of Energy in March 1994 include one folder titled "Polonium Injections," and a second titled "Uranium Injections." The experiments in question were previously identified to your Subcommittee, and are described in your 1986 report. The polonium experiments, conducted during 1943 to 1947 on six leukemia patients, were described as Category 1.003, Number 12. The uranium injections, conducted during 1946 and 1947 on six hospital patients, were described as Category 1.003, Number 119 (the Category and Number designation were those provided by the Department of Energy). Both sets of experiments were conducted through the University of Rochester, and were connected with the Metabolic Ward at strong Memorial Hospital.

The plutonium injection experiments were summarized in a Los - Alamos laboratory report of 1951, designated LA-1151, which gives the names of scientists involved in writing the report and in doing the work. (This report is found several different times among the DOE plutonium papers; Document 700129 is one such copy.) Samuel H. Bassett, who was in charge of the Metabolic Ward at the University of Rochester, was listed as both an author and a person performing the work.

Document 700140 reports that polonium, a radioactive substance that emits alpha particles (as does plutonium), was produced in large quantities during World War II for production of neutron generators. As your 1986 report-described, the polonium - experiments were reported in a scientific publication, which was Chapter 3 of Biological studies with Polonium, Radium, and Plutonium, National Nuclear Energy Series, Volume VI-3, McGraw-- Hill, New York, 1950. Four leukemia patients received injections, one ingested polonium, and polonium was placed on the finger of one. The book editor was Robert M. Fink, formerly of the University of Rochester, and authors of this chapter were H.E. Silberstein, W.N. Valentine, W.L. Minto, J.S. Lawrence, R.M. Fink, and A.T. Gorham. It should be noted that report LA-1151, on the

plutonium experiments, lists Robert Fink and Hannah Silberstein as persons performing the work. In addition,

Document 700141 is a letter from Henry A. Blair, director of Strong Memorial Hospital, to Shields Warren of the Atomic Energy Commission, describing the polonium experiments.

As your 1986 report described, the uranium injection experiments at the University of Rochester were summarized in a scientific report, "The Excretion of Hexavalent Uranium Following Intravenous Administration: II. Studies on Human Subjects," designated UR-37 and submitted to Henry A. Blair in June 1948. With this experiment, six hospital patients with good kidney function were injected successively with increasing doses of uranium nitrate, until doses were high enough to cause kidney disfunction; excretion of uranium was also monitored. UR-37 described one patient as "hallucinatory," a second as suffering from "emotional maladjustment," and gave the following comment on the patient receiving the largest dose:' "As he had no home, he agreed willingly to enter the metabolic unit for special studies." Authors of the report were Samuel Bassett, head of the Metabolism Section, along with Albert Frankel, Nathan Cedars, Helen Van Alstine, Christine Waterhouse, and Katherine Cusson. Along with Bassett, Van Alstine and Waterhouse were also designated as persons performing the work for plutonium injection experiments described in LA-115l. Among the DOE plutonium papers, Documents 700152, 700153, and 700158 appear to represent drafts of the title page, abstract, and text, respectively, for what eventually became, report UR-37.

The overall conclusion from the folders for polonium and uranium injections among the DOE plutonium papers is that these additional experiments were carried out at the University of Rochester by some of the same investigators involved with the plutonium injection experiments. Although staff of the Atomic Energy Commission clearly knew of these additional experiments in 1974, the Commission investigation was truncated with the plutonium injection experiments.

What Standards Were Established?

Document 700017 of the plutonium papers contains a chronology of documents related to the experiments up to the 1970s, with a brief description of each document. This chronology suggests that as the plutonium injection experiments were ending, officials of the Atomic Energy Commission decided to restrict additional experiments with human subjects. Not all pages of Document 700017 were

numbered in the original, but each page now contains a Bates page number, which is the DOE designation for consecutive page numbers in the plutonium papers released in
March.
Page 3 of Document 700017 (Bates page 0000084) notes a memo of 4/17/47, from Colonel O.G. Haywood to Dr. Fiedler [sic]. It does not appear that this particular document was included as part of the plutonium papers, but it has previously been released, and your staff obtained a copy from the Federation of American Scientists. Colonel Haywood was with the Corps of Engineers, and

the letter was sent on Atomic Energy Commission stationery, to Dr. Fidler with the AEC at Oak Ridge. The letter notes that documents related to medical experiments on humans are to be classified "Secret," because they could have adverse effects on public opinion or result in legal suits. This letter also notes that, "Further work in this field in the future has been prohibited by the General Manager." However, the letter goes on to say that, "These instructions do not pertain to documents regarding clinical or therapeutic uses of radioisotopes and similar materials beneficial to human disorders and diseases."

The chronology also describes (Bates page 0000097) a memo of 4/30/47 from Carroll Wilson, General Manager of the Atomic Energy Commission, to Stafford Warren, past medical director of the Manhattan Project. The chronology contains the following summary of this memo:

"Opinions of Commission re approved clinical testing
a. treatment to be given only when there is expectation that it will benefit patient
b. decision of advisability to be made by attending physician."

The summary also describes provisions for informed consent. It appears that this specific document was not included in the plutonium papers released in March. Your staff has requested a copy of this document through the Department of Energy's office of congressional affairs, but has not yet obtained it. However, this summary, along with the contents of the letter from Haywood to Fidler described above, seem to indicate that at one point in 1947, the Atomic Energy Commission required not only informed consent for experiments, but also the expectation that radioactive material would be administered on for the benefit of a patient. Yet your 1986 report described experiments in the 5Os, 60s, and into the 70s, where subjects received ionizing radiation that provided little or no benefit to the subject. The fact that the later

experiments occurred indicates that the 1947 guidance was either violated or overturned in the interim.

An additional entry in Document 700017 underscores the indication that new standards were put in place. Bates page 000090 refers to a memo of 1/6/48 from Dr. Blair (director of Strong Memorial Hospital) to Bale (division director over the Metabolic Ward), with the summary: "Human metabolism work under Bassett to be discontinued on order from Shields Warren (AEC medical director]. Bassett to write history for files."

It appears that the plutonium papers released in March do not contain any of the individual memos described above. Nonetheless, the implication from the summary of these memos is that for a brief period in 1947, the Atomic Energy Commission set standards for human radiation experiments similar to those used today to judge past experiments. Your 1986 report challenged experiments that provided little or no medical benefit to those exposed. The Human Radiation Interagency Working Group was given the charge from the White House to review "human radiation"

experiments," defined in part as, "experiments on individuals involving intentional exposure to ionizing radiation. This category does not include common and routine clinical practices, such as established diagnosis and treatment methods, involving incidental exposure to ionizing radiation." (Executive Order, President Clinton, 1/18/94).

It therefore seems appropriate that as the Interagency Working Group moves forward, some effort should be devoted to determining precisely what standards were in effect in April 1947, and how they deteriorated over time. The matter of what standards were in effect after 1947 and whether they might have been violated is also related to the question of what compensation would be appropriate for experimental subjects.

What Follow-up Was Performed in 1987?

In a letter to you of February 10, 1987, Secretary of Energy John Herrington responded to the October 1986 report by stating, "(T)here is no scientific reason to expect that any of the subjects who are not already being monitored will incur any harmful effects. Therefore, there is neither any reason for attempting any further follow-up studies on these subjects nor to propose new legislation to compensate them." [An attachment to the Secretary's letter described patients who received radiation therapy and other cases

where follow-up was already in progress.]

However, contrary to Secretary Herrington's letter, the plutonium papers indicate that in response to your report, the Department did attempt follow-up on one of the deceased plutonium injection patients, and contacted the remaining living patient. The living patient was Cal-3, who has since died, and who has been identified as Elmer Allen by Eileen Welsome of the Albuquerque Tribune and by Elmerine Allen Whitfield, the patient's daughter, both of whom testified before the House subcommittee on Energy and Power on January 18, 1994. The medical file for Cal-3 contains correspondence with and about this patient in the 1980s. Document 700547 is a letter of October 29, 1986, five days after release of "American Nuclear Guinea Pigs," from Dr. James Stebbings, at the Department of Energy's Argonne National Laboratory, to Cal-3 requesting permission to identify the patient to a congressional subcommittee. Document 700613 is the consent form, with names deleted, authorizing identification of the patient and his wife to the House subcommittee on Energy Conservation and Power. Document 700546 is a letter from Dr. Stebbings to Dr. James Robertson at the Department of Energy in Washington, D.C., enclosing a copy of the signed consent form on November 13, 1986. The letter also suggests that the surviving patient be awarded a medal, with the comment that, "Congressman Markey would surely approve." It appears, however, that no award was ever given to this patient.

The medical file for Cal-2 also contains correspondence seeking follow-up from Argonne National Laboratory in the 1980s. Cal-2 was an Australian boy, not quite five years old, who was flown to

the U.S. in 1946 for treatment of bone cancer. During his hospitalization in San Francisco, he was chosen as a subject for plutonium injection. He returned to Australia, where he died less than one year later. Document 700474 is a letter from Dr. Stebbings to an official at the Institute of Public Health in Sydney, Australia, in an attempt to reach the family of Cal-2. This letter reports that the child was "injected with a long-lived alpha-emitting radionuclide." Document 700471 is a letter from Dr. Stebbings to New South Wales, Australia (names and town deleted), inquiring about recollections of the boy's hospitalization in 1946. The letter notes that, "those events have become rather important in some official circles here," but provides few details to the family. A hand-written note on the letter reports no response through October 8, 1987.

Considering the history on the lack of informed consent with these experiments, it is surprising that the letters to Australia failed to mention the word "plutonium." The Australian news media has since identified Cal-2 as Simeon Shaw, the son of a wool buyer in New South Wales, and information on the injection created an international incident.

The information in the medical file does indicate that at a time when Secretary Herrington told you that no follow-up would be conducted on living subjects, the Department of Energy was desperately interested in conducting follow-up on a deceased Australian patient. In an effort to determine the full extent of follow-up by the Department after 1986, your staff has requested, through the Department's office of congressional affairs, the opportunity to speak with Dr. Stebbings, Dr. Robertson, and any other officials who may have been involved in the follow-up. So far, that request has been unsuccessful. It remains an open question as to what was the full extent of follow-up performed in the 1980s, and whether the efforts then would facilitate any further follow-up on subjects now. It seems appropriate for the Interagency Working Group to address these questions as its efforts continue.

Staff Memo on Plutonium Papers, p. 13.

DOE Plutonium Documents cited. Descriptions are as provided by the Department of Energy. The documents collectively represent over a hundred pages and have already been released to the DOE Public Reading Room. Copies therefore are not attached; Mr. Markey's staff would be willing to provide interested parties copies of individual documents if difficulty is encountered in obtaining copies through DOE:

700001. Comments on-meeting with L. Hempelmann on 4/17/74.
700013. SECY-75-130, Disclosure to patients injected with plutonium, 8/13/74.
700014. For Commission meeting on plutonium injectees, 5/28/74.
700O17. Log of documents, 2/18/44-5/4/74.
700021. Memo from Sid to Jim, 3/29/74.
700029. Telephone conversation, S. Marks and L. Hempelmann, 3/28/74.
700032. Telephone call from F. Brooks to S. Marks, 4/8/74.
700042. Table 1. Basic data on transuranic injection cases, 11/8/73.
700055. Information regarding sources of information and knowledge regarding the plutonium injections, "circa 1970s."
700073. Memo from J.L. Liverman to S. Marks, 4/1/74.

700129. LA-1151, Langham et al., September 1950.
700130. Memo from E.R. Russell to J.J. Nickson, 6/20/46.
700140. Notes, human experiments with polonium, no date.
700141. Letter from H.A. Blair to S. Warren- 4/4/49.
700152. Title page, Bassett et al., the excretion of uranyl nitrate given intravenously to human subjects (draft)
700153. Abstract, the excretion of uranyl nitrate given intravenously to human subjects (draft).
700158. Clinical methods, the excretion of uranyl nitrate given intravenously to man (draft).
700300. Death certificate, file of Cal-A.
700471. Letter from J.H. Stebbings to family of Cal-2, 2/25/87.
700474. Letter from J.H. Stebbings to G. Richards, 12/19/86.
700546. Letter from J.H. Stebbings to J. Robertson, 11/13/86.
700547. Letter from J.H. Stebbings to Cal-3, 10129/86.
700613. Letter from Cal-3, 11/11/86.
[Letterhead: Congress of the United States, House of Representatives, Washington, DC 20515-2107, Edward J. Markey, 7th District, Massachusetts Committees, [word deleted] and Commerce, Chairman Subcommittee on Telecommunications and Finance, Natural Resources, Commission on Security and Cooperation in Europe]

STATEMENT OF REPRESENTATIVE EDWARD J. MARKEY
BEFORE THE HOUSE JUDICIARY COMMITTEE
SUBCOMMITTEE ON ADMINISTRATIVE LAW AND GOVERNMENTAL RELATIONS
February 2, 1994

Chairman Bryant and members of the Subcommittee, thank you for the opportunity to appear before you today. I wish to commend the Chairman and the Subcommittee for convening these hearings as the Congress begins to consider the remedies necessary to correct past wrongs which the U.S. government has committed against its own citizens.

The recent acknowledgement by federal officials that the government conducted radiation experiments with human guinea pigs has grabbed the attention of all U.S. citizens, and the reason is that most people assumed that our country would not engage in this kind of activity. I think the fact that the federal government -- our government - funded or engaged in this kind of activity is the most disturbing Act of this whole story. Most Americans thought that our country would not take that kind of action. To close the door on this regrettable legacy, we should focus on the proper remedies to respond to past wrongs, make certain these things can never happen again, and do the right thing today by compensating those who suffered injury.

With the Subcommittee's indulgence, I would like to briefly describe my involvement with these issues. In October 1986, I released "American Nuclear Guinea Pigs: Three Decades of Radiation Experiments on U.S. Citizens," a staff report of the House Subcommittee on Energy Conservation and Power. This report revealed the frequent and systematic use of human subjects as guinea pigs in experiments with ionizing radiation which provided little or no medical benefit to the subjects. With the permission of the Chairman and this Subcommittee, I wish to provide a copy of the 1986 report for the record.

The 1986 report also discussed some of the more repugnant or bizarre experiments. At the top of this list were the plutonium injection experiments, in which patients designated terminal within 10 years were given plutonium to determine how the body handled this radioactive material. This experiment provided no medical benefits to the subjects, and is marred by a lack of informed consent, since even the word "plutonium" was classified during the 1940s. Moreover, as my staff report documents, when the Atomic Energy Commission conducted a follow up study in 1973 to determine the amounts of plutonium remaining subjects' bodies, informed consent was not obtained from patients who were still alive, nor from families who were asked for permission to exhume the bodies of deceased subjects. Sadly, thirty years later, the word "plutonium" was still too explosive for the federal government to tell the victims.

Statement of Mr. Markey, 2/2/94, p. 2

In another set of experiments which have only recently come to light, at the Fernald School in Massachusetts during the 1940s and 50s, schoolboys classified as mentally retarded were fed radioactive calcium and iron with their breakfast meals. Parents of these children were deceived about the nature of the experiments when they gave their consent. With at least one experiment, the letter from the School requesting consent never mentioned that radioactive material would be fed, noted that experimental subjects were selected from a "group of our brighter patients," and implied that the experiment might result in "gains in weight and other improvements."

These experiments were funded by the Atomic Energy Commission, the National institutes of Health, and the Quaker Oats Company, and research was conducted by faculty at MIT and Harvard. These experiments clearly fit within the scope of the documents that I requested from the Department of Energy in the mid-198Os, yet they were not revealed then. One question that I have today is whether

we know the full scope of human experimentation; whether the 1986 staff report provides a reasonably accurate picture or whether the extent of testing is larger.

One reason why I find these experiments so repugnant is because of the vulnerable nature of the subjects used. It was no accident that the students at the Fernald School were fed radioactive iron, and not the students at MIT. It is no accident that the terminally ill were experimental subjects, including some who were comatose. It is no accident that prisoners, soldiers, and the elderly were used for testing with radioactive material. Such members of society are not fully enfranchised and lack control over their lives. They deserve protection, not exploitation as human guinea pigs. Certainly, experimental drugs or treatments. intended to make the patient better may be used. But that was not the case with these experiments. We must again look at our ethical guidelines to make certain they protect the vulnerable.

The response of the Reagan administration to my 1986 staff report can he described as, "Thanks for the information, we're not going to do anything," and the report languished on a shelf at the Department of Energy until recently. Then in November 1993, a series of articles by Eileen Welsome, a reporter at the Albuquerque Tribune identified some victims of the plutonium injection experiments and their families, and put a human face on the issue. When Secretary of Energy Hazel O'Leary learned of these experiments and my 1986 staff report, she decided that the appropriate course of action was full disclosure of all information on experiments with human subjects. I commend Secretary O'Leary and support her efforts to lift the shroud of secrecy on her Department, and bring the questionable past of the Department and its predecessor agencies into the sunshine of public scrutiny.

When I released my staff report in 1986, I had assumed that experiments of such nature were the product of the arrogance of the early Atomic Age, and the paranoia of the Cold War. But as these experiments have gained new attention, I have been shocked and dismayed to find that individual scientists feel compelled even today to defend these experiments of years ago. Some have stepped forward to claim that such experiments should

not be judged according to today's standards, and besides, the doses given were low. To these attitudes, I have two responses: First, contrary to such opinions, the 1940s and 1950s were not devoid of patient knowledge or ethical standards. Radiation and its health effects were widely discussed in the era of bomb shelters

and air raid drills. Moreover, the Nuremberg Code was in effect, written by the United States and the Allies in the aftermath of World War II, and it established guidelines on obtaining informed consent for experiments. Clearly, the Fernald School experiments violate this basic human rights standard.

In this regard, I commend the recent statement of Charles Vest, president of MIT, who acknowledged that while doses at the Fernald School may have been relatively low, he was "sorry" for the experiments, because of the children selected and the lack of informed consent. MIT explained that President Vest issued his statement because "it seemed the decent thing to do," and I applaud his decency.

It is not my desire to blame present leaders of organizations and institutions for past mistakes. My concern is that institutions work with Congress today to do the right thing to address Past abuses. I therefore welcome the leadership by the Clinton Administration, and I look forward to working with the Administration, this Subcommittee, and the scientific community in formulating proper responses today. Clearly, this Subcommittee has much experience in crafting compensation plans.

I have already circulated to our colleagues a letter inviting them to cosponsor legislation with me that would accomplish three goals:

Require full disclosure from the Department of Energy, while protecting the privacy of subjects and their families, on experiments with ionizing radiation that provided little or no benefit to the subjects and were funded by the Department or its predecessor agencies;

Require the Department of Energy to formulate a plan to conduct proper medical follow-up of subjects where it seems feasible and indicated; and to provide free medical care for injuries related to experiments;

Require the Secretary of Energy, after consultation with other appropriate federal officials, to recommend appropriate compensation for those subjects or their families who have suffered damages, and make any other recommendation for appropriate compensation for those who have been wronged.

The legislation I will propose does not impose a particular compensation plan, but rather directs the Secretary of Energy to report to Congress in six months on what should be the appropriate scheme. I recognize that there is some debate on the effectiveness

of the Downwinder legislation and the Radiation Exposed Veterans Compensation Act of 1988 two subjects that this Subcommittee knows well. In light of that debate, I think it is

appropriate for the Administration and this Subcommittee to review these and other compensation systems and then develop an appropriate system for the victims identified here today. The best system would merge science with compassion in determining standards for compassion. Provision should also be made for appropriate remedies other than monetary compensation to unwitting subjects who suffered "dignity injury."

The legislation that will introduce will focus on the Department of Energy and the information it possesses because of my previous involvement with that Department. However, I note that other witnesses before this Subcommittee will discuss experiments conducted by the federal government using chemical or biological agents. Unfortunately, the sad history of the government's use of its own citizens is not limited to ionizing radiation. I think it is important for this Subcommittee to explore other areas where American may have been used as experimental subjects and exposed to danger.

For example, a recent report from a scientific panel convened by the Institute of Medicine, Veterans at Risk, investigated the long-secret exposure of soldiers as experimental subjects to chemical warfare agents. This report noted that over 60,000 military personnel were used as subjects, including 4,000 soldiers exposed to mustard gas and Lewisite, a related chemical. The panel concluded that although experimental subjects were designated "volunteers," it was clear from official reports that recruitment of subjects "was accomplished through lies and half-truths," during World War U and later experiments as well. The panel found it "most appalling" that no long term medical follow-up was conducted on the subjects, despite knowledge available by 1933 that mustard gas and Lewisite could produce long term detrimental health effects.

Mr. Chairman and members of this Subcommittee, what this Congress has encountered is no less than the frequent and systematic use of U.S. citizens as guinea pigs during experiments with a variety of dangerous radiation, chemical, and biological agents. These experiments shock the conscience and demand a response. I look forward to working with you and our colleagues to gain full disclosure of this shameful past, to provide the medical follow-up and treatment that experimental subjects deserve, and to provide restitution to those citizens who have suffered injury.

February 10, 1994

The Honorable Donna E. Shalala Secretary
U.S. Department of Health and Human Services
200 Independence Avenue, S.W.
Washington, D.C. 20201

Dear Secretary Shalala:

I commend and support the efforts of the Clinton Administration, through the Human Radiation Interagency Working Group, to disclose all records regarding questionable exposures of human populations to ionizing radiation. I recognize that your department, as part of the Interagency Working Group, is involved in an intensive search of archival files to determine the full extent of radiation experiment with human subjects

Recent revelations about past experiments on children with mental retardation at two Massachusetts institutions, the Fernald school and the Wrentham School, take it necessary that I request heightened attention to experiments on the developmentally challenged. The scientific report of the Wrentham school experiments noted that the test subjects were chosen "because it was desirable to secure children living under constant conditions of environment, diet, and iodide uptake. It appears that similar considerations contributed to selection of schoolboys at the Fernald school for experiments where radioactive material was placed in their breakfast meals. These revelations cause concern about whether the populations at such institutions presented too great a temptation for experimental investigators across the country. I am therefore compelled to request that your department and the Interagency Working Group give special attention to experiments on such subjects as you review your files. The experiments at the Fernald school were partially funded by the National Institutes of Health. The experiments at the Wrentham school were designed to measure effects related to radioactive fallout, and were funded by the U.S. Public Health Service, Division of Radiological Health. I also request that you give special attention to the files of that office, to determine if other questionable experiments were conducted in the name of understanding exposures from atomic bombs.
The Honorable Donna E. shalala

The experiments at the Wrentham School were uncovered through efforts of the Massachusetts Department of Mental Retardation, which initiated an intense review of its own files after the revelation near the end of 1993 of earlier experiments at the Fernald School. Data on the Wrentham School experiments, including the rationale for selecting subjects, were published in a scientific article (Saxena, Chapman, and Pryles, Science, 19 October 1962, pq. 430, 431). The investigators were faculty at the Harvard Medical School, Massachusetts General Hospital, and Boston university School of Medicine. The experiments were designed to test the ability of non.radioactive iodide in the diet to suppress the body's uptake of radioactive iodine-131, which is a principal contaminant in fallout from atmospheric nuclear explosions. The experiments were meant to test this method as a possible "countermeasure" to reduce the hazards to the general population from fallout, and the experimental results identified a minimal effective dose of non-radioactive iodide to suppress completely the uptake of radioactive iodine by the normal human thyroid. The experimental subjects were approximately 60 children from I to Il years old.

It is absolutely shocking that the arrogance of the early atomic Age and the paranoia of the Cold War combined to designate tiny children at the Wrentham School as "desirable" subjects for jtests related to radioactive fallout. Even given the tenor of those times one must basic why it was necessary to select children as experimental subjects. Why could these experiments not have been conducted on laboratory rats, if a population with a controlled diet was needed? If it was deemed fully necessary to use human subjects, why could the subjects not have been consenting healthy adults?

As you know, in October 1986, I released a staff report of the House Subcommittee on Energy Conservation and Powers which described experiments with human subjects and ionizing radiation that provided little or no medical benefit to those exposed. An appendix to that report described current federal regulations on human experimentation, including four general principles:

Risks to subjects should be minimized;

Rises to subjects should be reasonable in relation to anticipated benefits, and the importance of the knowledge that may reasonably be expected to result;

Subjects should be selected in an equitable manner;

Informed consent shall be sought from each prospective subject or authorized representative. Informed consent includes a clear description of the risks and benefits of the experimental procedure. additional restrictions are in effect for experiments with children, and such experiments generally require a benefit for the subject or a benefit for the health of children generally.
The Honorable Donna Z. Shalala

At the moment, the extent of informed consent at the Wrentham School is not known. But these experiments, by designating "mentally defective" children as a test population, clearly would not meet present requirements for equitable selection of subjects. The children at the Wrentham School were members of society who deserved protection, not exploitation as experimental subjects. The investigators satisfied themselves that "tracer" doses of one microcurie (representing 37,000 radioactive disintegrations per second) of iodine-131 were fed, and that the doses of nonradioactive iodide were below those know to be toxic to children. Nonetheless, these exposures to children should have been completely avoidable, and it does not seem a prudent public health measure to adulterate the diets of children with sodium-iodide and radioactive iodine.

The Massachusetts Department of Mental Retardation initiated the search of its own files after information was revealed on experiments with children designated as mentally retarded at the Fernald School in Waltham, Massachusetts. During the late 1940s, 17 male teenage students were fed breakfasts containing radioactive iron. During the early 1950s, several experiments were conducted with radioactive calcium: In the first case, male teenage students were fed breakfasts containing radioactive material; in a followup study, 17 male teenage students were fed breakfasts containing radioactive material. In another experiment, radioactive calcium was injected into nine male students, aged 11 to 15, and one adult. It is not clear at this time whether there was some overlap in the subjects chosen for the various exposures. These experiments were conducted to gain information on human metabolism of dietary components. The experiments were performed by investigators at the Massachusetts Institute of Technology and Harvard university. Funding was provided by the Quaker Oats Company, by at least two separate Atomic Energy Commission contracts, and by the National Institutes of Health.

In addition to the selection of subjects, experiments at the

Fernald School were. further marred by the fact that parents were deceived when they gave their consent for participation. With at least one experiment, the letter from the School requesting consent never mentioned that radioactive material would be fed, noted that subjects would be selected from a "group of our brighter patients," and implied that the experiment might result in "gains in weight and other improvements, particularly in the blood."

I note that Dr. Charles Vest, president of MIT, recently acknowledged that while doses at the Fernald School may have been relatively low, he was "sorry" for the experiments, because of the children selected and the lack of informed consent. MIT explained that President Vest issued his statement because "it seemed the decent thing to do" and I applaud his decency.
The Honorable Donna Z. Shalala

The experiments at the Fernald School resulted in several scientific publications, and one in my possession noted that the experimental subjects "were institutionalized in a state school under uniform nutritional and environmental conditions" (Bronner et al, 1954, Journal of Nutrition 54, 523-542). Thus far, questionable experiments have been identified at two schools for the developmentally challenged in Massachusetts. However this description at the Fernald School, and the designation of students at the Wrentham school as "desirable" subjects, leads one to question whether the controlled environments of such institutions might have presented a temptation that medical investigators across the country found too difficult to resist. I therefore consider it necessary to request that special attention be given to experiments with developmentally challenged subjects, as your department and other members of the interagency Working croup seek full disclosure of radiation experiments with human subjects.

In the mid-1980s, the House subcommittee on Energy conservation and Power requested from the Department of Energy information on experiments with ionizing radiation and human subjects, funded by that department or its predecessor agencies. The Fernald school experiments were partially funded by the Atomic Energy Commission, but they were not disclosed to my Subcommittee in the 1980s. I have been concerned over whether my staff report in 1986 identified the full range of human radiation experiments, or whether the actual extent was much greater. It appears that the experiments at the Wrentham school were not funded at all by the Atomic Energy Commission; they were supported, however, by the U.S.

public Health Service, Division of Radiological Health, Research Branch. Since this division funded these experiments as part of a concern over reducing the hazard of fallout to the general population, I must wonder what other experiments might have been sponsored on the same topic.therefore also request that as you review archival files, special attention be given to the activities of this Division.

I wish to make it clear that I do not desire to blame present leaders for past mistakes of their institutions. I do wish to support and encourage present leaders in their efforts to do the right thing today to identify and correct past mistakes. In that regard, I commend the leadership of the Clinton administration and its cabinet members, and the leadership of President Vest and other members of the scientific community, in seeking full disclosure of the troubled history of radiation experimentation with human subjects.

I appreciate your cooperation on this matter. I request that you keep me informed of your efforts and those of the Interagency Working Group as you investigate improper experiments with ionizing radiation.

Sincerely,

Edward J. Markey
Member of Congress

cc Human Radiation Interagency Working Group
c/o Christine Varney
Secretary to the Cabinet
The White House

Elizabeth Stengel
Vice President of External Affairs
Boston University Medical Center

Jane Corlette

Acting Vice President of Government Community, and
Public Affairs
Harvard University

Allen Peckham
Vice President for Development and Public Affairs
Massachusetts General Hospital

[Letter head]
The Honorable Edward J. Markey
House of Representatives
Washington, D.C. 20515

Dear Ed.:

I thank you for your letter drawing attention to past experiments conducted at the Wrentham School and the Fernald School during which children were exposed to ionizing radiation. Be assured that the concerns you express are shared by myself and the administration both with respect to the nature of the experiments themselves as well as the use of institutionalized children.

As you know, the President has requested all Departments, as a matter of priority, to obtain full information about all human experiments which involve ionizing radiation and to make this information publicly available. The Department is cooperating fully in that activity and will work closely with the special Advisory Committee which is soon to be appointed. The Administration effort is designed to be comprehensive, and will include, as you suggest, experiments involving developmentally challenged subjects.

Your own efforts in calling attention to this problem are to be applauded. I look forward to keeping you apprised of progress.

Sincerely,

Donna E. Shalala