**DEFENSE NUCLEAR AGENCY**
ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE
BETHESDA, MARYLAND 20014

NOV 13 1978

Lester Edgar
5040 Jackson St. #13
N. Highlands, CA 95660

Reference: 21361

Dear Mr. Edgar:

Thank you for your response to our request for information on personnel who participated in the Department of Defense (DoD) Atmospheric Nuclear Weapons Tests.

As has been announced in the media, DoD is conducting a major data collection program to identify personnel employed by DoD and involved in these nuclear tests. The telephone and letter responses are valuable supplements to our records search, and they provide up-to-date address information on test participants. If you have additional information in the form of names and accurate addresses, or other group orders, rosters, muster lists, etc., we would appreciate having the data.

The purpose of this program is to obtain individual exposure data, so that detailed research can be conducted by scientific organizations to ascertain if there is any correlation between exposure to low-level external ionizing radiation and subsequent incidence of certain diseases.

To date a firm relationship has not been established between low-level external ionizing radiation and the medical condition described in your call. Any medical management program you are now following should not be altered except under the management of the attending physician. We hope the information gathered through this data collection program will advance medical knowledge in this important area.

In an effort to ensure the information provided is recorded accurately, a form summarizing it is enclosed. Would you please verify and update the information? After completion, please return it in the self-addressed envelope. If there is a change of address or telephone number, we would appreciate your notifying us.

Returned 11-18-78 LE

Once we have developed more specific information, we will contact you again. I cannot give you a firm estimate of how soon this will be, as the number of individuals involved extends into the tens or hundreds of thousands, but I assure you that the program is being carried out as expeditiously as possible.

The information you have provided, and any you may provide in the future, is considered privileged and will be protected under the provisions of the Privacy Act.

Thank you for your cooperation. The information you provided is helpful, and your assistance is greatly appreciated.

Sincerely,

Darrell W. McIndoe, M.D.
Colonel, USAF, MC
Director

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Enclosures

DEFENSE NUCLEAR AGENCY
WASHINGTON, D.C. 20305

Enclosed are a Defense Nuclear Agency Fact Sheet and Veterans Administration Circular 10-83-61. The Fact Sheet outlines the plans and progress of the Nuclear Test Personnel Review Program. If you have any questions about the Fact Sheet, please call the toll free number listed in the Fact Sheet. The Circular outlines the VA medical benefits available to the nuclear test participants. If you have any questions about the Circular, please call your local Veterans Administration facility.

Enclosures
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BOBBY R. ADCOCK
Colonel, USA
Director for Biomedical Effects

Veterans Administration
Department of Medicine and Surgery
Washington, D.C. 20420

CIRCULAR 10-83-61
April 5, 1983

TO: Regional Directors; Directors, VA Medical Center Activities, Domiciliary, Outpatient Clinics, and Regional Offices with Outpatient Clinics

INFO: Directors, Regional Offices; District Counsels

SUBJ: Guidelines for Implementation of Legislation Related to the Provision of Health Services to Veterans Exposed to Ionizing Radiation As a Result of Detonation of Nuclear Devices

1. The "Veterans' Health Care, Training, and Small Business Loan Act of 1981" was signed into law on November 3, 1981. The Act, Public Law 97-72, authorizes the Veterans Administration to provide certain health care services, as described in paragraph 3, to veterans who, while serving on active military duty, were exposed to ionizing radiation from the detonation of nuclear device as a result of participation in either the testing of such a device between 1945 and 1962, or the American occupation of Hiroshima or Nagasaki, Japan, between September 11, 1945, and July 1, 1946. Verification of service at a site during the testing of nuclear devices, or in Hiroshima/Nagasaki during the occupation of Japan, during the times specified will be required. In the absence of affirmative evidence to the contrary, a veteran's contention of exposure at a nuclear device testing site, or in Hiroshima/Nagasaki will be accepted.

2. Health care services may not be provided under this law for the care of conditions which are found to have resulted from a cause other than the specified exposures.

3. Health care services authorized under this provision are limited to hospital and nursing home care in VA facilities and outpatient care in VA facilities on a pre- or post-hospitalization basis or to obviate a need for hospitalization. Such health care services will be provided without regard to the veteran's age, service connected status or the inability of the veteran to defray the expenses of such care. Veterans furnished outpatient care under this authority will be accorded priority ahead of other nonservice-connected veterans and equal to former Prisoners of War who are receiving care for nonservice-connected conditions. Congress made it clear that this law provides for health care only, and that a determination that the veteran is eligible for such care does not constitute a basis for service connection or in any way affect determinations regarding service connection.

4. Each veteran who participated in the testing of a nuclear device or who participated in the occupation of Hiroshima or Nagasaki, Japan, between September 11, 1945, and July 1, 1946, and who requests VA medical care will be provided a physical examination and appropriate diagnostic studies in accordance with DM&S Circular 10-83-12. The examination and studies will be documented in the medical record. If such an examination has been completed within the prior six months, only those procedures which are medically indicated by the current circumstances need be repeated. Where the findings reveal a condition requiring treatment, the responsible staff physician shall make a determination as to whether that condition resulted from a cause other than the veteran's exposure to ionizing radiation.

THIS CIRCULAR EXPIRES ON APRIL 5, 1984

Veterans who meet the criteria of this circular may be treated under this authority. In making this determination, the physician should consider that the following types of conditions are not ordinarily considered to be due to such exposure:

a. Congenital or developmental conditions, e.g., spina bifida; scoliosis.

b. Conditions which are known to have pre-existed military service.

c. Conditions resulting from trauma, e.g., deformity or limitation of motion of an extremity.

d. Conditions having a specific and well established etiology, e.g., tuberculosis; gout.

e. Common conditions having a well recognized clinical course, e.g., inguinal hernia; acute appendicitis.

5. On occasion, the responsible staff physician may find that a veteran requires care for one or more of the conditions listed in paragraph 4, but that the case presents complicating circumstances that make the provision of care under this authority appropriate. In such instances, the physician should seek guidance from the Chief of Staff and the Environmental Physician regarding authorization for treatment. If treatment is so authorized, the reasons will be clearly documented in the medical record. Veterans who are not provided needed medical care under this circular may be furnished care if they are eligible under any other statutory authority.

6. In the event the responsible staff physician finds that a veteran has a condition not ordinarily considered to be due to the specified exposure and there are not complicating circumstances warranting the provision of care under this authority, the decision and its basis will be clearly documented in the medical record.

7. The provisions of this circular will not exclude any veteran who alleges exposure to ionizing radiation as described in paragraph 1 of this circular from being included in a VA Radiation Exposure Registry Program, under development.

8. These guidelines will be effective upon receipt. A copy of the pertinent guidelines should be made available to any veteran seeking care under this authority.

9. This circular rescinds DM&S Circular 10-82-246 dated December 21, 1982.

W. J. JACOBY, JR., M.D.
Deputy Chief Medical Director

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# Fact Sheet

dna

**Defense Nuclear Agency**
Public Affairs Office
Washington, D.C. 20305

10 January 1983

Subject: Nuclear Test Personnel Review (NTPR)

Background of NTPR Program.

Between 1945 and 1962, the Atomic Energy Commission (AEC) carried out some 235 atmospheric nuclear tests, principally in Nevada and the Pacific Ocean. An estimated 220,000 Department of Defense (DoD) personnel, military and civilian, were involved in this testing and many received low-level ionizing radiation exposures in the performance of various activities. Because the exposures generally were well within established radiation exposure limits, there was no reason to expect any increased health risk.

The first indication that former test participants might be experiencing adverse health effects possibly related to radiation exposure at the tests occurred in 1977. The Centers for Disease Control (CDC), as a result of its investigation of a leukemia case involving an individual who had participated in Shot SMOKY at the Nevada Test Site in 1957, became interested in the health status of all personnel who had been present at that shot. By late 1977, a DoD ad hoc committee, working together with CDC, had reconstructed a list of approximately 3,200 DoD personnel who were at or near the Nevada Test Site on the day of the SMOKY test and determined that some eight leukemia cases had occurred among them. CDC calculations indicated the expected incidence of leukemia would be three to four cases. CDC undertook an epidemiological study of these personnel and subsequently identified an additional leukemia case. It should be noted that the cause of the leukemias has not been determined to be related to radiation received at the test. In addition, no increased mortality from other forms of cancer has been observed in this group and the total number of deaths from all causes is essentially what would be normally expected.

Responding to this initial indication of a possible health problem, DoD, in December 1977, began a program of wide-ranging actions on behalf of the atmospheric nuclear test participants. The Defense Nuclear Agency (DNA) was appointed DoD's Executive Agent for this effort. The Nuclear Test Personnel Review (NTPR) program was established by DNA to carry out these responsibilities.

Scope of NTPR Program.

The Nuclear Test Personnel Review Program specific tasks are to:

- Compile a roster of the DoD personnel involved in the atmospheric nuclear tests.
- Develop a history of each atmospheric nuclear event that involved DoD personnel.
- Declassify all possible nuclear test related source documents which formerly bore a security classification.
- Provide estimates of atmospheric test radiation doses -- both as a check on film badge readings and as a substitute for them in those cases where badges were not worn or readings were not recorded or are not retrievable.
- Establish personal contact with as many test participants as possible.
- Identify those individuals who received a higher radiation dose than those doses recommended under current Federal guidelines for radiation workers, notify those individuals of their dose

and offer them free medical examinations at Government hospitals.

- Sponsor, in conjunction with the Department of Energy (DOE), an independent mortality study by the National Academy of Sciences (NAS) of test participants selected by the NAS.

- Carry out a detailed research program, in conjunction with the on-going NTPR Program, to recover all data pertaining to possible radiation exposure of U.S postwar occupation troops at Hiroshima and Nagasaki, Japan. (This item was added to the original NTPR tasks in 1979 when concerns arose that veterans of the postwar occupation of those cities might be experiencing adverse health effects. Thus, since the Autumn of 1979, DNA has carried out a detailed research program to recover from records, historical documents, and interviews all possible data pertaining to the possible radiation exposure of those occupation troops.)

- Provide assistance to the veteran, the Veterans Administration (VA), and other organizations by doing individual research and by providing as complete data as possible on individual participation and radiation doses.

The overall NTPR effort is directed by the Defense Nuclear Agency, Washington, D.C. An NTPR team in each military service conducts detailed research into that service's participation in the atmospheric nuclear test program. A separate team at DNA's Field Command in Albuquerque, New Mexico has responsibility for research of records concerning DoD civilian employees and directs research into test participation by the former Armed Forces Special Weapons Project, a key test entity. In addition, DNA employs several contractors to provide specialized supporting services. The program has now been underway for five years, and about two more years will be required to complete the research. All phases of the NTPR program are being pursued on a high-priority basis, with adequate manpower (about 170 man-years per year) and funding (over $6 million per year). Its completion time is governed by the fact that necessary data are spread among hundreds of repositories and contained in tens or hundreds of thousands of documents.

NTPR Program Accomplishments

- First, the NTPR program has conducted most of the extensive research necessary to retrieve every possible bit of data about personnel participation and radiation exposure from records, archives, repositories, files, and other sources throughout the U.S. in order to piece together a coherent, personnel-oriented history of the atmospheric test program. The historical volumes (organized by series and shot, showing which organizations were there, what these organizations were doing, what radiological safety precautions were taken, what radiation dose levels were present, and other information) will be distributed to over 700 locations (including many public libraries) throughout the U.S. The order of publication of these historical reports is:

| CONUS Operations | Actual/Projected Publication Date | Oceanic Operations | Actual/Projected Publication Date |
|---|---|---|---|
| PLUMBBOB (1957) | Oct 81 | WIGWAM (1955) | Oct 81 |
| TEAPOT (1955) | Mar 82 | CASTLE (1954) | Apr 82 |
| UPSHOT-KNOTHOLE (1953) | Apr 82 | ARGUS (1958) | Dec 82 |
| TUMBLER-SNAPPER (1952) | Apr 82 | REDWING (1956) | Jan 83 |
| RANGER (1951) | Apr 82 | IVY (1952) | Feb 83 |
| BUSTER-JANGLE (1951) | Dec 82 | HARDTACK I (1958) | Apr 83 |
| HARDTACK II (1958) | Jan 83 | DOMINIC I (1962) | May 83 |
| DOMINIC II (1962) | Feb 83 | GREENHOUSE (1951) | Jun 83 |
| TRINITY (1945) | Feb 83 | SANDSTONE (1948) | Sep 83 |
| PLOWSHARE (1962) | Mar 83 | CROSSROADS (1946) | Nov 83 |

Participants who have written or called will be notified when volumes of concern to them have been published and informed of the location of libraries to which distribution has been made. This research/historical report production effort will continue until all atmospheric nuclear weapons tests have been documented and the historical volumes have been distributed.

Of the estimated 220,000 DoD participants in the tests, nearly 95 percent have been identified by name, and preliminary dose information has been recovered for about 134,000. The military services are reconstructing rosters from morning reports and ships' logs, searching medical records and other radiation dosimetry repositories, and identifying units' activities and movements. A product of this research will be listings of participants and their radiation dosimetry information for each series and shot; however, general release of these lists will not be made in order to protect

personal data of individual participants.

- Second, more than 750 formerly classified documents containing information pertinent to the personnel aspects of atmospheric nuclear tests have been declassified. More than 670 of these documents have been catalogued for easy reference by former participants, the VA, and others and placed at the National Technical Information Service (NTIS) for ready public availability. NTIS is an agency of the Department of Commerce and offers these unclassified Department of Defense publications for sale along with other documents. The address and telephone number is: National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161, telephone 703-487-4650. If assistance is desired concerning the acquisition of material, most large public libraries are aware of NTIS and can assist in obtaining documents. The NTIS sales desk telephone number can also be called by any individual. If the exact report desired is not known, an NTIS subject analyst may be able to provide assistance. Moreover, most of the other unclassified documents have been placed at the Department of Energy Nevada Operations Office Coordination and Information Center, Las Vegas, Nevada.

- Third, the NTPR dose reconstruction program has proven to be of great value. It has been used to check the validity of film badge readings (with excellent correlation), to calculate doses for participating groups, and to reconstruct individual doses in specific cases (as in VA claims). As part of this effort, a separate analysis of possible exposures due to inhalation and ingestion of radioactive materials is being done. A later section of this fact sheet discusses dose levels to which participants in the atmospheric nuclear test program were exposed.

- Fourth, the NTPR program operates a toll-free telephone line (800-336-3068)* for test participants to report their involvement in the tests. Information provided by participants has significantly aided in the research and development of a permanent, computerized data base. To date, about 49,000 test participants have called or written DNA.

- Fifth, the individual notification and medical examination program for all individuals who received doses higher than 5 rem** is being carried out in segments, as described below:

  - In March 1979 a notification and medical examination program was initiated for all DoD test participants with cumulative doses from atmospheric testing in excess of 25 rem. The threshold of 25 rem was selected because it is the current recommended national guideline for one-time, planned exposures under emergency conditions. The National Council on Radiation Protection and Measurements evaluates the 25-rem threshold in the following terms in their NCRP Report No. 39 (p. 102):

> Since planned whole-body doses up to 25 rem are reasonably accepted for emergency conditions ..., it follows that accidental doses up to the same magnitude should not cause major concern. At higher levels and especially where the whole-body dose reaches 100 rem, medical observation and subsequent actions based primarily on medical opinion are the important aspects.

The NTPR program has identified a total of 39 DoD personnel in the over-25-rem group, with doses ranging from just over 25 rem to an estimated high of 98 rem. Most of these were exposed as a result of a wind shift at Shot BRAVO during Operation CASTLE at Bikini in 1954. Four of the 39 are known to be dead from causes not associated with radiation (i.e., trauma, heart attacks). Of the remaining 35 who were all notified, 18 desired physicals, 7 did not want examinations, and 10 have not responded. Of the 18 examinations which have been scheduled, we currently have received the results of thirteen. No adverse health effects associated with radiation exposure at the atmospheric nuclear tests were found during these examinations.

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* In Virginia, Hawaii, and Alaska call collect to (202) 274-9161.

** A rem is a unit of radiation dose equivalent and reflects the radiation energy deposited within the body tissue and its capability for causing an effect.)

- In May 1979, the notification and medical examination program was expanded to include the DESERT ROCK Volunteer Observers (Officer Volunteers). These 44 volunteers received gamma doses ranging from a few millirem to about 17 rem; however, they were closer to ground zero than any other participants at the time of detonation. The officer volunteers at shots NANCY, SIMON, BADGER, and APPLE II were also exposed to neutron radiation.

- In June 1979, after careful evaluation to ensure the over-25-rem program was functioning well, the notification and medical examination program was expanded to include all participants identified with annual doses in excess of 5 rem. This threshold was chosen both because 5 rem is the current Federal guideline for allowable annual dose to radiation workers and because it is the best single standard to represent permissible dose levels for most DoD personnel at the time of the tests. Notification of participants is based not only on film badge records but also on dose calculations or dose estimates, if these show a possible over-5-rem dose. It is estimated that about 1,100 DoD personnel will be involved.

- Throughout the course of the NTPR effort, the VA has had a program in effect whereby any eligible veteran test participant is given a free medical examination upon request.

• Sixth, the National Academy of Sciences is well into its third year of work to ascertain whether atmospheric test participants exhibit any adverse health effects which might be attributable to test participation. It is conducting a scientific follow-up study of over 50,000 DoD participants in Operations GREENHOUSE (1951), UPSHOT-KNOTHOLE (1953), CASTLE (1954), REDWING (1956) and PLUMBBOB (1957).

• Seventh, the Defense Nuclear Agency has completed research on the U.S. occupation of Hiroshima and Nagasaki. A detailed fact sheet on this has been produced and is being provided to all occupation personnel who have called or written to DNA. A detailed dose reconstruction--using numerous assumptions which would maximize dose--has also been completed. No areas of concern or significant doubt were identified, and the firm, well-substantiated conclusion is that the radiation doses received by members of the Hiroshima and Nagasaki occupation forces were negligible. DNA's research has disclosed no basis for concern by veterans of the Hiroshima and Nagasaki occupation forces over an increased risk of adverse health effects due to radiation during the occupation. In May 1981, the National Academy of Sciences convened a panel to review the occupation of Hiroshima and Nagasaki and to determine the feasibility and desirability of performing epidemiological studies of veterans who served in the occupation forces in Hiroshima or Nagasaki, Japan, immediately following the wartime bombing of those cities. The National Academy of Sciences panel concluded that:

(1) Scientifically sound studies of morbidity among military personnel who entered Hiroshima or Nagasaki soon after the bombings are impractical.

(2) Studies of mortality among these men, from a strictly scientific point of view, appear to carry inordinate cost in relation to the potential benefit.

(3) No study of the population in question could detect effects that would be predictable from existing knowledge of health hazards associated with radiation exposure.

(4) Even if an excess number of cases of multiple myeloma is present in this population of veterans, this cancer is unlikely to be attributable to ionizing radiation. (The NAS is currently investigating, for purposes of verification of diagnosis, the alleged cases of multiple myeloma).

• Finally, the Service NTPR teams have collected extensive basic information about each series and shot of the atmospheric test program in which that military service had any identified participants. They have also organized and trained their research teams in accessing individual service and medical records. They provide effective claims assistance to individual veterans and to the VA. The VA notifies DNA of all test participant veterans' claims and requests assistance in documenting participation and determining radiation dose, if any. The Service NTPR teams research all claims for the VA which have involvement in the atmospheric nuclear tests as the basis.

Dose Levels in the Atmospheric Test Program

Research to date indicates that most recorded doses to DoD personnel during the tests were quite low--averaging about half a rem. Of course, many participants received no dose at all, and only a

very small percentage exceeded 5 rem per year, the current Federal guideline for allowable annual dose to radiation workers. The most basic source of dose data is the file maintained by the Reynolds Electrical and Engineering Company (REECo), a contractor of DoE (AEC), which is the official master repository of dose records for the atmospheric nuclear weapons tests. These REECo files, which contain the records of both DoD and AEC personnel, show the following:

REECo Film Badge Entries
(1945-1962)

| Dose | Number of Entries | Percent of Entries |
|---|---|---|
| Zero | 96,942 | 42% |
| One rem or less | 204,952 | 88% |
| Three rem or less | 225,765 | 97% |
| Five rem or less | 230,984 | 99% |
| All | 232,303 | 100% |

NTPR Cross-checks on Exposure Levels

To cross-check the accuracy and completeness of the dose data held by REECo, and to ensure that it is representative of DoD participants, the NTPR program conducted numerous separate research efforts on exposures. Examples are:

- Research into historical documentation of numerous individual shots and test series shows dose results similar to the REECo averages. For example: In DESERT ROCK I (Nevada, 1951), none of the participants received over 5 rem; in BUSTER-JANGLE (Nevada, 1951), 0.2 percent received over 5 rem; in TUMBLER-SNAPPER (Nevada, 1952), 1.2 percent received over 4 rem; in TEAPOT (Nevada, 1955), 0.5 percent received over 3.9 rem.

- The Navy NTPR team extracted from REECo files the dose records of former Navy personnel who participated in oceanic testing. Of these individuals, 37 percent received zero exposure and less than one percent received more than 5 rem. In a separate research effort, the Navy conducted a reliability check of radiation dose records obtained from 7,900 individual medical records. Tabulation of the dose showed that less than one percent received more than 5 rem.

- Dose reconstruction was accomplished on Shot SMOKY to check on the accuracy of film badge readings (i.e., to see if test participants might have received larger radiation doses than their film badges recorded). Good correlation between actual film badge readings (0.575 rem average) and the calculated dosage ($0.480 \pm 0.135$ rem) gives considerable confidence in film badge accuracy.

- Dose reconstructions have been done on other shots and series, and all support the data contained in the REECo files.

- Spot checks were made of film badge readings for members of units which maneuvered in proximity to each other and thus should have received comparable exposures. The results were indeed comparable.

- Intensive research and analyses have been carried out regarding possible neutron exposures, since neutrons would not be recorded on film badges. Dose reconstructions indicate that individuals with significant neutron exposure were officer volunteers. All cases where there was a potential for significant neutron exposure has been investigated in detail.

Based on cross-checks such as these, one can be confident that radiation dose levels shown by the REECo master file data (i.e., an average dose of about half a rem for all participants, and less than one percent with doses above the current allowable annual Federal standard) are reasonably representative of all DoD personnel. The identification and quantification of possible exposure due to inhalation and/or ingestion of radioactive materials has been accomplished for a number of events. Thus far, there have been no indications of significant exposure. This effort is continuing.

Health Effects of Ionizing Radiation

Numerous authorities, national and international, have addressed in detail the health risks caused by radiation doses and have recommended standards of acceptable doses for radiation workers. It has been established that adverse health effects can result from exposure to high levels of ionizing radiation (e.g., 100 rem or more). However, it is not known whether or not there are deleterious health effects from exposure to low levels of ionizing radiation (i.e., a few rem). For many years, medical scientists assumed there were no adverse effects from low exposure, i.e., that a "threshold" level of ionizing radiation existed, below which no adverse health effects would be caused. In the 1940's and 1950's, medical scientists gradually shifted to the present hypothesis--that there is no safe threshold, that even low levels carry some slight statistical risk, and that the degree of risk increases linearly with dose. This conclusion, however, is a hypothesis and is based on observations following high levels of exposure. No firm evidence exists to show that exposure to low levels of ionizing radiation would cause adverse health effects. Following are some examples of pertinent statements by medical and scientific authorities:

- The most direct data for the specific issue of atmospheric test participants comes from the Interagency Task Force on the Health Effects of Ionizing Radiation, conducted at White House direction and submitted to the President in August 1979 by the Secretary of Health, Education and Welfare. Its report states:

> For example, in a population of 10,000, one may normally expect 1,600 cases of fatal cancer; exposure of each of the 10,000 persons to one rem of low LET*, low rate, external, whole body radiation may be expected, under current risk estimates, to increase those deaths to roughly 1,601 (June 1979, p. 35).
>
> Thus, at current risk estimates, each individual has an overall likelihood of dying from cancer of about 16 percent, but the risk of dying from radiation-induced cancer is only about .01 percent for each rem of low-level exposure. Stated another way, 1,600 out of 10,000 persons will eventually die of cancer from various causes, but only one out of 10,000 may be expected to die of radiation-induced cancer following radiation exposure of one rem (June 1979, p. 5).
>
> Estimates vary, but the DoD, which is conducting a major research project to identify this test population, believes that about 250,000,** DoD personnel (the great majority of them military) participated in these tests. While the actual exposure levels are under study, the current collective dose estimate is 115,000 person-rems at the Nevada and Pacific test sites. The currently assumed dose-response relationship for cancer would indicate about 12 excess cancer deaths from this estimated radiation dose over the lifetimes of the 250,000 involved (June 1979, p. 63).

- The International Commission on Radiological Protection (ICRP), the most prestigious international group addressing radiation issues, makes the same risk estimate in their 1977 Recommendations of the International Commission on Radiological Protection, ICRP Publication 26, which states:

> For the purposes of radiation protection involving individuals, the Commission concludes that the mortality risk factor for radiation-induced cancers is about $10^{-2}$ $Sv^{-1}$, as an average for both sexes and all ages (January 17, 1977, p. 12). (Note: a sievert (Sv) equals 100 rem, thus the above statement puts the risk at one cancer death per 10,000 persons exposed to one rem.)

ICRP Report No. 26 also states, with regard to these risk estimates, that:

*Linear Energy Transfer (LET) is the conventional expression for the rate of energy deposition measured along the track of an ionizing particle. Gamma rays and X-rays generate low-LET electron tracks. Alpha particles and neutrons generate high-LET tracks.

**Current estimate is about 220,000.

The use of linear extrapolations, from the frequency of effects observed at high doses, may suffice to assess an upper limit of risk.... However, the more cautious such an assumption of linearity is, the more important it becomes to recognize that it may lead to an over estimate of the radiation risks.... Thus, in the choice of alternative practices, radiation risk estimates should be used only with great caution and with explicit recognition of the possibility that the actual risk at low doses may be lower than that implied by a deliberately cautious assumption of proportionality (p. 7).

- The United Nations Scientific Committee on the Effects of Atomic Radiation, in their 1977 UNSCEAR report, states:

The average risk of inducing a fatal malignancy is thus taken as being in the region of $10^{-4}$ $rad^{-1}$... (p. 6) (that is, one fatal cancer for every 10,000 individuals exposed to one rad).

This UNSCEAR report also states:

It must be emphasized again, however, that such a value is derived essentially from mortalities induced at doses in excess of 100 rad. The value appropriate to the much lower dose levels involved in occupational exposure, and even more so in environmental exposures to radiation, may well be substantially less (p. 414).

- In 1980, the Committee on the Biological Effects of Ionizing Radiation (BEIR Committee) of the National Academy of Sciences issued The Effects on Populations of Exposure to Low Levels of Ionizing Radiation which updates their 1972 report. To illustrate risk calculations, the Committee considered two situations: a single exposure to 10 rads and a continuous, lifetime exposure of 1 rad per year. They found that the lifetime risk of cancer mortality ranges from 77 to 226 excess deaths per million per rad for the single exposure, and 67 to 182 excess deaths per million per rad for the continuous exposure. Thus for a single exposure to 10 rads, 770 to 2,260 excess cancer deaths are predicted per million people. The normal expectation of cancer deaths is from 160,000 to 170,000 per million. (pp. 191-192, 265) The 1980 BEIR report predicts a lower risk than their 1972 report. This is because they felt the linear response model used by the 1972 Committee to extrapolate from high exposure levels to low levels did not fit the epidemiological data from high dose exposures as well as the linear-quadratic dose-response model.

- The National Council on Radiation Protection and Measurements, taking cognizance of all available information on health risks, stated in their 1971 NCRP Report No. 39, Basic Radiation Protection Criteria:

The maximum permissible prospective dose equivalent for whole body irradiation from all occupational sources shall be 5 rem in any one year (p. 89).

NCRP Report No. 39 also states:

In the interest of estimating effects in humans conservatively, it is not unreasonable to follow the assumption of a linear relationship between dose and effect in the low dose regions for which direct observational data are not available. It is generally agreed that such an assumption is conservative and would tend to give upper limits for any particular effect (p. 55).

Experience with occupational exposure in the general neighborhood of presently acceptable limits over the last two or three decades has shown no identifiable injury ascribable to radiation (p. 50).

The NCRP reaffirms this 5 rem per year standard in their more recent (1975) Report No. 43. This report also states:

The NCRP continues to hold the view that risk estimates for radiogenic cancers at low doses and low dose rates derived on the basis of linear (proportional) extrapolation from the rising portions of the dose-incidence curves at high doses and high dose rates, as described and discussed in subsequent sections of this report, cannot be expected to provide realistic estimates of the actual risks from low level, low LET radiations, and have such a high probability of over estimating the actual risk as to be of only marginal value, if any, for purposes of realistic risk-benefit evaluation (p. 2).

• The actual U.S. Federal radiation exposure standards were established by the President in 1960, based upon recommendations by the Federal Radiation Council. These standards are somewhat less stringent than the NCRP recommendations, in that they allow 3 rem per quarter, or 12 rem per year, until an accumulated dose equal to 5(N-18) is reached (where N is age in years). For example, a 26-year-old could, within today's Federal standards, receive doses of 12 rem per year for five years, thus accumulating 60 rem at the age of 30. Once the 5(N-18) limit is reached, allowable exposure is limited to 5 rem per year. The actual practice followed today however is to limit annual exposures to 5 rem.

• Nor is 5 rem per year a U.S.-only limit. The ICRP, an international body, also recommends an allowable exposure of 5 rem per year for occupational workers, and even condones 12 rem per year under infrequent conditions.

Summary

Based upon research to date, the average exposure of DoD participants in the atmospheric nuclear tests has been determined to be about one-tenth of the level that is generally agreed as an acceptable annual exposure for radiation workers; authorities widely agree in their assumption that the health risk from an exposure of half a rem is very low (approximately one fatal cancer per 20,000 individuals).

It should be noted that even today, 20-35 years after some 220,000 DoD personnel participated in the atmospheric test program, the only indication that there may be an increased health risk associated with test participation is CDC's identification of leukemia cases (now listed by CDC as nine) among participants whom CDC stated were present at the Nevada Test Site for Shot SMOKY, where the expected normal incidence in this group would be between three and four. (And, as stated earlier, CDC has not to date attributed this leukemia to exposure to ionizing radiation.)

The NTPR program is conducting a careful look into the history of the radiological safety aspects of the atmospheric nuclear weapons testing program and the development of historical documents to record the radiological exposures, if any, and to identify DoD personnel participation. The documents are now becoming available to the public at various libraries throughout the United States.

The careful and extensive study, so far, into the atmospheric nuclear test program indicates that overall the radiological safety precautions and safety measures taken, even in light of today's scientific knowledge of radiation effects, were adequate and there was only a very slight, if any, health risk to test participants.

* **********
* This Fact Sheet Updates Nuclear Test Personnel Review (NTPR) *
* Fact Sheet, 1 March 1982 *
* **********

DEFENSE NUCLEAR AGENCY
WASHINGTON, D.C 20305-1000

June 7, 1985

Dear Veteran:

A major scientific study has just been completed by the National Academy of Sciences (NAS). The report contains important information for the veterans involved in the atmospheric nuclear testing program. A copy of the NAS press release describing the study is enclosed. I urge you to read it carefully.

Additionally, the enclosed summary sheet highlights information which may be of interest. You will find information about medical benefits available to you free of charge from the Veterans Administration (VA); how you can officially comment on proposed rule changes for adjudicating VA compensation claims; information on the 9,029 page history of atmospheric nuclear testing; and an abstract from a Centers for Disease Control study on Test SMOKY veterans.

Finally, I would like to let you know that two organizations, the National Association of Atomic Veterans and the National Association of Radiation Survivors, recently obtained your name and address from our files. A U.S. District Court ruled that the Freedom of Information Act requires us to release your name and address to such groups for their use in conducting studies.

I hope that you will find this information useful.

Sincerely,

RICHARD K. SAXER
Lieutenant General, USAF
Director

Enclosures
as stated

Your Information Package Summary Sheet

FREE MEDICAL CARE - Public Law 97-72 authorizes free medical care at Veterans Administration (VA) facilities for veterans involved in atmospheric nuclear testing, or in the occupation of Hiroshima or Nagasaki. The medical care is for all ailments except those which are clearly not radiogenic. You should consult your local VA hospital for further information.

HISTORY OF NUCLEAR TESTING - The 41 volume, 9,029 page history of atmospheric nuclear testing is now available at over 700 libraries and facilities, or for purchase from the National Technical Information Service (NTIS). If you are interested in learning more about this history or about the thousands of now declassified source documents that were used in preparing the volumes, you should call DNA's toll-free line at 800-336-3068 (or call collect at 202-274-9161 if you live in Virginia, Hawaii, or Alaska).

PROPOSED RULES FOR ADJUDICATING VA CLAIMS - DNA and VA have published draft procedures for adjudicating VA claims for compensation based on a veteran's participation in nuclear testing or the occupation of Hiroshima or Nagasaki. Each agency is asking for comments on its procedures. The VA's proposed rules were published in the April 22, 1985 issue of the Federal Register, volume 50, number 77, page 15,848, a copy of which is available at many libraries. The DNA rules were published in the May 9, 1985 issue of the Federal Register, volume 50, number 90, page 19,538. The proposed DNA procedure, excerpted from the Federal Register, is on the attached page.

STUDIES BY THE NATIONAL ACADEMY OF SCIENCES (NAS) AND THE CENTERS FOR DISEASE CONTROL (CDC). Enclosed is the abstract from the NAS mortality study of nearly one-quarter of all the veterans involved in nuclear testing. A free copy of the complete study can be obtained by writing to either DNA or NAS. In August, 1983 the CDC published its morbidity study of the veterans at Shot SMOKY. The preliminary finding of the CDC study in 1978 initiated the government's efforts on behalf of the nuclear test participants. The abstract from the article of 1983 is provided. The complete article can be found in the August 5, 1983 issue of the Journal of the American Medical Association. A free copy of the article can be obtained by writing to either DNA or CDC.

**DEPARTMENT OF DEFENSE**

**Office of the Secretary**

**32 CFR Part 218**

## Guidance for the Determination and Reporting of Nuclear Radiation Dose for DoD Participants in the Atmospheric Nuclear Test Program (1945–1962)

**AGENCY:** Defense Nuclear Agency.

**ACTION:** Proposed amendment of final rule.

**SUMMARY:** The Defense Nuclear Agency proposes to amend its existing guidelines for reporting nuclear radiation doses. The proposed amendment will establish minimum standards which will be uniformly applicable to all branches of the Military Services, governing the preparation of radiation dose estimates in response to inquiries by the Veterans Administration in connection with claim for compensation, or by any veteran or survivor. The proposed amendment will provide explicit instructions requiring that each radiation dose estimate include available information regarding all material aspects of the radiation environment to which the veteran was exposed, including inhaled, ingested and neutron doses.

**DATE:** Comments must be received on or before: July 8, 1985.

**ADDRESS:** Written comments should be addressed to the Director, Defense Nuclear Agency, Biomedical Effects Directorate, (STBE), Attn: NTPR Program Manager, Washington, D.C. 20305–1000 or may be hand delivered to 6801 Telegraph Road, Alexandria, Virginia 22310–3398, between the hours of 8:00 a.m. and 4:30 p.m., Monday through Friday.

**FOR FURTHER INFORMATION CONTACT:** Mr. Robert L. Brittigan, Telephone No. (202) 325–7681.

**SUPPLEMENTARY INFORMATION:**

### Background

On March 14, 1983, in compliance with a Memorandum Order in the case of *Gott* v. *Nimmo,* Civil Action 80–0906, D.D.C., the Defense Nuclear Agency published a final code rule (48 FR 10645) which set forth policies, procedures, and dose reconstruction methodology to establish standardized scientific principles for dose reconstruction methodology for DoD participants in the atmospheric nuclear test program (1945–1962). On March 22, 1985, the United States Court of Appeals for the District of Columbia Circuit reversed the decision of the District Court (Civ. Nos. 82–1159; 82–1448; 82–1454; 80–0906). On October 24, 1984, H.R. 1961, "Veteran's Dioxin and Radiation Exposure Compensation Standards Act," was enacted as Pub. L. 98–542. The Act requires the Defense Nuclear Agency to publish guidelines specifying minimum standards for the reporting of dose estimates.

### Regulatory Impact Analysis

In accordance with 5 U.S.C. 12291, the Department of Defense has determined that this proposed amendment is not a "major rule" and is not subject to such an analysis.

### Regulatory Flexibility Act

In accordance with 5 U.S.C. 605(b) the Department of Defense has determined that this proposed amendment will not have a significant impact on a substantial number of small entities.

### Paperwork Reduction Act

This proposed amendment does not impose any additional reporting or recordkeeping requiring Office of Management and Budget clearance.

### List of Subjects in 32 CFR Part 218

Radiation dose determination, Dose reconstruction, Dose reconstruction methodology, Radiation environment, Radioactive materials.

Authority: Pub. L. 98–542, 98 Stat 2725.

**Patricia H. Means,**

*OSD Federal Register Liaison Officer, Department of Defense*

May 3, 1985.

## PART 218—[AMENDED]

Accordingly, 32 CFR Part 218 is proposed to be amended as follows:

1. The authority citation for Part 218 is revised to read as follows:

Authority: Pub. L. 98–542, 98 Stat. 2725 (38 U.S.C. 354 note.)

2. The Table of Contents in Part 218 is amended to include a new section number and title: § 218.4 Dose Estimate Reporting Standards.

3. In § 218.1 paragraphs (a), (b) and (c) are redesignated as (b), (c), and (d) and a new paragraph (a) is added to read as follows:

**§ 218.1 Policies.**

(a) Upon request by the Veterans Administration in connection with a claim for compensation, or by a veteran or his or her representative, available information shall be provided by the applicable Military Service which shall include all material aspects of the radiation environment to which the veteran was exposed and shall include inhaled, ingested and neutron doses. The minimum standards for reporting dose estimates are set forth in § 218.4.

* * * * *

4. Section 218.4 is added to read as follows:

**§ 218.4 Dose estimate reporting standards.**

The following minimum standards for reporting dose estimates shall be uniformly applied by the Military Services when preparing information in response to an inquiry by the Veterans Administration, in connection with a claim for compensation, or by a veteran or his or her representative. The information shall include all material aspects of the radiation environment to which the veteran was exposed and shall include inhaled, ingested, and neutron doses, when applicable. To the extent to which the information is available, the responses will address the following questions:

(a) Can it be documented that the veteran was a test participant. If so, what tests did he attend and what were the specifics of these tests (date, time, yield (unless classified) type, location and other relevant details)?

(b) What unit was the man in? What were the mission and activities of the unit at the test?

(c) To the extent to which the available records indicate, what were his duties at the test?

(d) Can you corroborate the specific information relevant to the potential exposure provided by the claimant to the Veterans Administration and forwarded to the Department of Defense? What is the impact of these specific activities on the claimant's reconstructed dose?

(e) Is there any recorded radiation exposure for the individual? Does this recorded exposure cover the full period of test participation?

(f) If recorded dosimetry data is unavailable or incomplete what is the dose reconstruction for the most probable dose, with error limits, if available?

(g) Is there evidence of a neutron or internal exposure? What is the reconstruction?

Upon request, the participant or his or her authorized representative will be informed of the specific methodologies and assumptions employed in estimating his or her dose.

[FR Doc. 85–11133 Filed 5–8–85; 8:45 am]

BILLING CODE 3810–01–M

*news from the* NATIONAL RESEARCH COUNCIL

*The National Research Council was organized by the National Academy of Sciences in 1916 in order to provide for a broader participation by American scientists and engineers in the work of the Academy. The Academy was chartered by the U.S. Congress in 1863 as a private organization with a responsibility for examining questions of science and technology at the request of the Federal Government. The National Academy of Engineering was organized in 1964 under the original NAS charter. The National Research Council now serves as the agent of both Academies in the conduct of studies and investigations in the public interest.*

2101 CONSTITUTION AVENUE, N.W., WASHINGTON, D.C. 20418 AREA CODE 202 EX 3-8100

Date: June 3, 1985
Contact: Gail Porter, (202) 334-2138

# NO CONSISTENT EVIDENCE OF INCREASED CANCER FOUND AMONG ATOMIC VETERANS; EXCESS LEUKEMIA IN ONE GROUP CONFIRMED

FOR RELEASE: AMs, Tuesday, June 4, 1985

WASHINGTON - A National Research Council review* of death certificates for a large sample of "atomic veterans" has found no consistent evidence of increased deaths from cancer or other diseases for the veterans overall. The study did, however, confirm an excess of leukemia among one group of veterans and find a slightly increased number of prostate cancers among another group.

The study included records for more than 46,000 of the 49,000 veterans known to have participated in five test series of atmospheric nuclear explosions carried out between 1951 and 1957. About 5,000 of these men were known to have died by 1982. The test series studied were those code-named "Greenhouse," "Upshot-Knothole," "Castle," "Redwing," and "Plumbbob."

"Mortality from cancer in all groups of participants was, in general, found to be less than the number expected at population death rates and mortality from other diseases was much less than expected, a consequence of selection for good health by the physical screening employed for active duty servicemen," states the study report.

(OVER)

*The study report, Mortality of Nuclear Weapons Test Participants, is available from the Research Council's Medical Follow-up Agency at the letterhead address. Reporters may obtain copies from the Office of Public Affairs, also at the letterhead address.

The finding of excess leukemia incidence among participants at the nuclear test code-named "Smoky" confirms the results of an earlier study by the Centers for Disease Control (CDC). (Smoky was one of 21 tests in the Plumbbob series in 1957.) Based on data recorded by radiation dosimeter badges worn by a sample of participants at the Smoky tests, the study reported that only 0.2 additional cases of leukemia would be expected among the Smoky participants rather than the 6 additional cases identified.

While the number of excess prostate cancers among participants at the Redwing test series was statistically significant, the study noted that prostate cancer "has never been demonstrated to be one especially susceptible to induction by radiation." Moreover, an analysis of the reported radiation doses received by individual participants at Redwing shows no pattern of higher than average radiation exposure among those men who later developed prostate or other genital cancers.

NO CONSISTENT EVIDENCE

"The total body of evidence we have reviewed cannot convincingly either affirm or deny that the higher than statistically expected incidence of leukemia among Smoky participants (or of prostate cancer among Redwing participants) is the result of radiation exposure incident to the tests," the report cautioned. "However, when the data from all the tests are considered, there is no consistent or statistically significant evidence for an increase in leukemia or other malignant disease in nuclear test participants."

The lack of consistent evidence of increased cancer incidence led the study authors to speculate that either the observed incidence of leukemia among Smoky participants is simply a "chance aberration" or that the actual radiation exposure of these men was "several times" the dose recorded at the time.

(MORE)

The Research Council began the study in 1979 at the request of the Defense Nuclear Agency (DNA) shortly after publication of a CDC report that found excess leukemia incidence among Smoky veterans. The study was carried out by Research Council staff members C. Dennis Robinette, Seymour Jablon, and Thomas L. Preston with the oversight of a subcommittee of the Research Council's Committee on Epidemiology and Veterans Follow-up Studies. Funding for the study was provided by DNA and the U.S. Department of Energy.

STUDY DESIGN LIMITS SCOPE

Coauthor Jablon stressed that several details of the study design limit the scope of conclusions that may be drawn. Ideally, he said, a study of this type would compare the cause of death for atomic veterans in the sample with other servicemen who were not test participants. Unfortunately, detailed mortality data for veterans of the same age, who served in the armed forces during the same time as the atomic veterans, do not exist, he added.

Because a direct mortality comparison between atomic veterans and other similarly aged servicemen was not feasible, the study relied instead on a comparison with mortality data for men in the general U.S. population. Since men selected for military service are usually healthier than the general population, such comparisons would tend to underestimate somewhat the number of excess cancers among the atomic veterans.

Jablon also pointed out that studies of the initial survivors of the Hiroshima and Nagasaki atomic bombs show that leukemia is one of the cancers that develops soonest following radiation exposure. Other types of cancers may take 30 years or longer to develop following exposure, and a future reanalysis of mortality rates among these same men might find additional excess cancer cases, he said.

Nevertheless, Jablon said that these points are balanced by the fact that the recorded radiation doses at the various test series are quite low in comparison to those of the Japanese survivors of Hiroshima and Nagasaki and, based on the currently accepted understanding of radiation dose and cancer incidence, would not be expected to produce a statistically significant increase in cancer risk.

(OVER)

The study authors acknowledged that the dosimetry data available was incomplete and may have underestimated somewhat the actual doses received. Even so, they noted that this does not explain why participants at tests other than Smoky, who received similar reported radiation exposures, do not show similarly increased leukemia risks.

BACKGROUND INFORMATION

From 1946 to 1962 the United States conducted 18 atmospheric test series of nuclear weapons. Most of the tests were held at two different sites, one in Nevada and another on a group of islands in the Pacific. Approximately 200,000 people from the various branches of the U.S. armed services participated in the testing program.

Records for participants at five of the test series conducted were included in the study. The test series selected include about an equal number of men from the Nevada and Pacific test sites and were chosen based on the quality of personnel identification and radiation dosimetry data available. The radiation doses received by participants at these particular tests are believed to equal or exceed doses received during test series not included in the study.

Names of participants at these five test series, dates of birth, and information on men who had died by 1982 were supplied by the DNA and the Veterans Administration. Research Council staff members also carried out extensive searches through the military's National Personnel Records Center in St. Louis, Mo., in order to clear up discrepancies or supply missing information.

The Subcommittee on Exposure at Tests of Nuclear Weapons was chaired by James F. Crow, department of genetics, University of Wisconsin, Madison. Other members were: John A. Auxier, applied science laboratory, Oak Ridge, Tenn.; George B. Hutchison, department of epidemiology, Harvard University; Alfred G. Knudson Jr., Institute for Cancer Research, Philadelphia, Penn.; Raymond Seltzer, office of the dean, Graduate School of Public Health, University of Pittsburgh; and H. Eldon Sutton, department of zoology and the Genetics Institute, University of Texas, Austin.

# # #

gp: 1,10

# CDC STUDY OF SMOKY VETERANS

The following is the abstract from "Mortality and Cancer Frequency among Military Nuclear Test (SMOKY) Participants, 1957 Through 1979", as it appeared in the August 5, 1983 article in the Journal of the American Medical Assiciation (JAMA). The study was conducted by Dr. Glyn Caldwell and other researchers from the Centers for Disease Control (CDC). The article's abstract was reprinted with the permission of the authors and JAMA. A free copy of the complete article can be obtained by writing to either the Defense Nuclear Agency or the CDC.


•Follow-up of health status has been completed through 1979 for 3,072 (95.5%) of 3,217 nuclear test participants on military maneuvers during the 1957 nuclear test "Smoky." In these participants, 112 cases of cancer were diagnosed, compared with 117.5 cases expected. During the same follow-up period (1957 through 1979), 64 persons died of cancer compared with an expected 64.3. Statistically significantly increased frequency of occurrence and mortality was found only for leukemia. The amount of cumulative gamma radiation exposure for 1957 ranged from 0 to 10.397 mrem as measured by individual personnel film badges. Although uncertainty remains about the exact amount of radiation exposure, the lack of a significant increase after 22 years in either the incidence of or the mortaility from any other cancer and the apparent lack of a dose effect by unit lead to the consideration that the leukemia findings may be attributable either to chance, to factors other than radiation, or to some combination of risk factors possibly including radiation.

DEPARTMENT OF THE ARMY
US ARMY & JOINT SERVICES ENVIRONMENTAL SUPPORT GROUP
1730 K STREET N.W. ROOM 210
WASHINGTON, DC 20006-3868

June 26, 1986

REPLY TO
ATTENTION OF

DAAG-ESG-N

SGM Lester Edgar, USA (Ret)
5040 Jackson Street, #13
N. Highlands, California 95660

Dear Sergeant Major Edgar:

This is in reference to previous contact regarding your participation in the atmospheric nuclear test program the United States conducted from 1945 to 1962. Since 1978 the Department of Defense (DoD) has undertaken a major research effort to determine the involvement of DoD personnel in these tests.

That effort is now nearing completion and the purpose of this letter is to provide you with the status of the Nuclear Test Personnel Review (NTPR) program, a summary of the test(s) series in which you participated, and a current report on the radiation dose you received.

The overall program is described in the enclosed NTPR fact sheet. You will note that substantial progress has been made in reconstructing participant rosters, documenting the activities of participating personnel, and determining radiation exposures that they received. In addition, a summary of the National Academy of Sciences' recently completed health experience survey is enclosed. This survey, involving a large portion of DoD participants, was conducted to ascertain if there may be increased mortality among the participants due to any specific diseases and if so, whether the diseases may be related to radiation received during the nuclear testing.

An important finding to date is that radiation exposures to the participants were generally quite low. The average dose to an individual was about half a rem. (A rem is a unit of biological dose of radiation which takes into account the effect on body tissue.) Many individuals received recorded doses of zero. Research has indicated that less than a few percent of the nuclear test participants exceeded the current Federal guidelines of 5 rem radiation dose in any calendar year, and those individuals have been, or are being, notified directly. The con-

sensus of the medical and scientific community is that the risk of any adverse health effects from exposures, such as those which were experienced by nearly all test participants, is slight.

The test series in which you participated is summarized in the enclosed series fact sheet(s). To help participants better understand the test(s) series in which they were involved, DNA has prepared in book form, a detailed description of each series, and distributed copies to over 700 libraries and federal offices, including Veterans Administration Regional offices. A listing of the facilities that received these copies of historical volumes is enclosed. Copies of these publications may be purchased through the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161. Consult the enclosed NTIS price list, and be sure to quote the title of the series volume and the reference number when ordering.

The enclosed Army Nuclear Test Personnel Review (ANTPR) summary sheet lists all the tests which documentary evidence indicates you observed while assigned to a participating organization. The "Recorded External Dose" entry on this sheet summarizes all recorded dosimetry badge readings. In cases where no badge readings were available, a calculated dose has been assigned based upon a scientific dose reconstruction of each unit's activities or an analysis of badge readings for each unit. The calculated dose is summarized in the "Reconstructed External Dose" entries on the sheet. Since the totals may cover more than a one year period, they may exceed 5 rem radiation dose and yet not exceed the Federal guidelines.

Should you believe you have a Service-connected medical condition, you may file a claim for benefits or compensation, with the Veterans Administration (VA). Information can be obtained from any VA Regional office. The questions of Service-connected disability cannot be resolved by the U.S. Army. Such a decision is, by law, the exclusive domain of the VA; however, the Army NTPR office will assist you in every way possible.

The "Veterans' Health Care, Training, and Small Business Loan Act of 1981" (PL 97-72) provides for free health care to certain eligible veterans who participated in nuclear tests. For additional information, you should contact your local VA office.

We appreciate the information you previously provided and your participation in the NTPR program. I wish to extend the Army's sincerest appreciation for your dedicated service to our country. If we can be of further assistance, please do not hesitate to contact us.

Sincerely,

for ARTHUR G. SAMILJAN
Major, MSC
Chief, Health Physics Program Office

Enclosures:

DNA NTPR fact sheet
NAS press release re study results
Test Series fact sheet(s)
NTPR library list
NTIS price list
ANTPR summary sheet

# Fact Sheet

dna

**Defense Nuclear Agency**
Public Affairs Office
Washington, D.C. 20305

3 April 1984

Subject: Nuclear Test Personnel Review (NTPR)

Background of NTPR Program.

Between 1945 and 1962, the Atomic Energy Commission (AEC) carried out some 235 atmospheric nuclear tests, principally in Nevada and the Pacific Ocean. An estimated 203,000 Department of Defense (DoD) personnel, military and civilian, were involved in this testing and many received low-level ionizing radiation exposures in the performance of various activities. Almost all the exposures were well within internationally accepted radiation exposure limits.

In 1977, the Centers for Disease Control (CDC), as a result of its investigation of a leukemia case involving an individual who had participated in Shot SMOKY at the Nevada Test Site in 1957, became interested in the health status of all personnel who had been present at that shot. By late 1977, a DoD ad hoc committee, working together with CDC, had reconstructed a list of approximately 3,200 DoD personnel who were at or near the Nevada Test Site on the day of the SMOKY test and determined that some eight leukemia cases had occurred among them. CDC calculations indicated the expected incidence of leukemia would be three to four cases. CDC undertook an epidemiological study of these personnel and subsequently identified an additional leukemia case. However, after continued study, the CDC has recently (1983) attributed the larger than expected number of SMOKY leukemia cases to chance, factors other than radiation, or some combination of risk factors possibly including radiation. In addition, no increased mortality from other forms of cancer has been observed in this group and the total number of deaths from all causes is essentially what would be normally expected.

Responding to this initial indication of a possible health problem, DoD, in December 1977, began a program of wide-ranging actions on behalf of the atmospheric nuclear test participants. The Defense Nuclear Agency (DNA) was appointed DoD's Executive Agent for this effort. The Nuclear Test Personnel Review (NTPR) program was established by DNA to carry out these responsibilities.

Scope of NTPR Program.

The Nuclear Test Personnel Review Program specific tasks are to:

- Compile a roster of the DoD personnel involved in the atmospheric nuclear tests.
- Develop a history of each atmospheric nuclear event that involved DoD personnel.
- Declassify all possible nuclear test related source documents which formerly bore a security classification.
- Provide estimates of atmospheric test radiation doses -- both as a check on film badge readings and as a substitute for them in those cases where badges were not worn or readings were not recorded or are not retrievable.
- Establish personal contact with as many test participants as possible.
- Identify those individuals who received a higher radiation dose than those doses recommended under current Federal guidelines for radiation workers, notify those individuals

of their dose and offer them free medical examinations at Government hospitals.

· Sponsor, in conjunction with the Department of Energy (DOE), an independent mortality study by the National Academy of Sciences (NAS) of test participants selected by the NAS.

· Carry out a detailed research program, in conjunction with the on-going NTPR Program, to recover all data pertaining to possible radiation exposure of U.S postwar occupation troops at Hiroshima and Nagasaki, Japan. (This item was added to the original NTPR tasks in 1979 when concerns arose among veterans of the postwar occupation of those cities that they might be experiencing adverse health effects. Thus, since the Autumn of 1979, DNA has carried out a detailed research program to recover from records, historical documents, and interviews all possible data pertaining to the possible radiation exposure of those occupation troops.)

· Provide assistance to the veteran, the Veterans Administration (VA), and other organizations by doing individual research and by providing as complete data as possible on individual participation and radiation doses.

The overall NTPR effort is directed by the Defense Nuclear Agency, Washington, D.C. An NTPR team in each military service conducts detailed research into that service's participation in the atmospheric nuclear test program. A separate team at DNA's Field Command in Albuquerque, New Mexico has responsibility for research of records concerning DoD civilian employees and directs research into test participation by the former Armed Forces Special Weapons Project, a key test entity. In addition, DNA employs several contractors to provide specialized supporting services. The program has now been underway for five years, and about two more years will be required to complete the research. All phases of the NTPR program are being pursued on a high-priority basis, with adequate manpower (averaging about 150 man-years per year) and funding (over $6 million per year). Its completion time is governed by the fact that necessary data are spread among large numbers of repositories and contained in hundreds of thousands of documents.

NTPR Program Accomplishments

· First, the NTPR program has conducted most of the extensive research necessary to retrieve every possible bit of data about personnel participation and radiation exposure from records, archives, repositories, files, and other sources throughout the U.S. in order to piece together a coherent, personnel-oriented history of the atmospheric test program. The historical volumes (organized by series and shot, showing which organizations were there, what these organizations were doing, what radiological safety precautions were taken, what radiation dose levels were present, and other information) are being distributed to over 700 locations (including many public libraries and all VA regional centers) throughout the U.S and overseas locations. The status of publication of these historical reports is:

| CONUS Operations | Date | Oceanic Operations | Date |
|---|---|---|---|
| TRINITY (1945) | Dec 83 | CROSSROADS (1946) | Jun 84 (Est) |
| RANGER (1951) | Feb 82 | SANDSTONE (1948) | Jan 84 |
| BUSTER-JANGLE (1951) | Jun 82 | GREENHOUSE (1951) | Nov 83 |
| TUMBLER-SNAPPER (1952) | Jun 82 | IVY (1952) | Dec 82 |
| UPSHOT-KNOTHOLE (1953) | Jan 82 | CASTLE (1954) | Apr 82 |
| TEAPOT (1955) | Nov 81 | WIGWAM (1955) | Sep 81 |
| PLUMBBOB (1957) | Sep 81 | REDWING (1956) | Sep 83 |
| HARDTACK II (1958) | Oct 83 | HARDTACK I (1958) | Nov 83 |
| DOMINIC II (1962) | Jan 83 | ARGUS (1958) | Apr 82 |
| PLOWSHARE (1962) | Mar 83 | DOMINIC I (1962) | Nov 83 |

Participants who have written or called will be notified when volumes of concern to them have been published and informed of the location of repositories to which distribution has been made. This research/historical report production effort will continue until all atmospheric nuclear weapons tests have been documented and the historical volumes have been distributed.

Of the estimated 203,000 DoD participants in the tests, nearly 96 percent have been identified by name, and preliminary dose information has been recovered for about 143,000. The military services are reconstructing rosters from morning reports and ships' logs, searching medical records and other radiation dosimetry repositories, and identifying units' activities and movements. A product of this research will be listings of participants and their radiation dosimetry information for each series and shot; however, general release of these lists will not be made in order to protect personal data of individual participants.

- Second, some 850 formerly classified documents containing information pertinent to the personnel aspects of atmospheric nuclear tests have been declassified. More than 750 of these documents have been catalogued for easy reference by former participants, the VA, and others and placed at the National Technical Information Service (NTIS) for ready public availability. NTIS is an agency of the Department of Commerce and offers these unclassified Department of Defense publications for sale along with other documents. The address and telephone number is: National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161, telephone 703-487-4650. If assistance is desired concerning the acquisition of material, most large public libraries are aware of NTIS and can assist in obtaining documents. The NTIS sales desk telephone number can also be called by any individual. If the exact report desired is not known, an NTIS subject analyst may be able to provide assistance. Moreover, most of the unclassified documents have been placed at the Department of Energy Nevada Operations Office Coordination and Information Center, Las Vegas, Nevada.

- Third, the NTPR dose reconstruction program has proven to be of great value. It has been used to check the validity of film badge readings (with excellent correlation), to calculate doses for participating groups, and to reconstruct individual doses in specific cases (for instance, in support of veterans claims). As part of this effort, a separate analysis of possible internal dose due to inhalation and ingestion of radioactive materials is being done. (A later section of this fact sheet discusses dose levels to which participants in the atmospheric nuclear test program were exposed).

The National Academy of Sciences is reviewing the procedures developed for dose reconstruction, dose assignment, and determination of internal dose.

- Fourth, the NTPR program operates a toll-free telephone line (800-336-3068)* for test participants to report their involvement in the tests. Information provided by participants has significantly aided in the research and development of a permanent, computerized data base and development of the test histories and dose reconstructions. To date, about 49,000 test participants have called or written DNA.

- Fifth, the individual notification and medical examination program for all individuals who received doses higher than 5 rem** is being carried out in segments, as described below:

* In Virginia, Hawaii, and Alaska call collect to (202) 274-9161.

** A rem is a unit of radiation dose equivalent and reflects the radiation energy deposited within the body tissue and its capability for causing an effect.

- In March 1979 a notification and medical examination program was initiated for all DoD test participants with cumulative doses from atmospheric testing in excess of 25 rem. The threshold of 25 rem was selected because it is the current recommended national guideline for one-time, planned exposures under emergency conditions. The National Council on Radiation Protection and Measurements evaluates the 25-rem threshold in the following terms in their NCRP Report No. 39 (p. 102):

> Since planned whole-body doses up to 25 rem are reasonably accepted for emergency conditions ..., it follows that accidental doses up to the same magnitude should not cause major concern. At higher levels and especially where the whole-body dose reaches 100 rem, medical observation and subsequent actions based primarily on medical opinion are the important aspects.

The NTPR program has identified a total of 39 DoD personnel in the over-25-rem group, with external doses ranging from just over 25 rem to an estimated high of 98 rem. Most of these were exposed as a result of a wind shift at Shot BRAVO during Operation CASTLE at Bikini in 1954. Four of the 39 are known to be dead from causes not associated with radiation (i.e., trauma, heart attacks). Of the remaining 35 who were all notified, 19 desired physicals, 7 did not want examinations, and 9 have not responded. Of the 13 examinations which have been scheduled, we currently have received the results of eleven. No adverse health effects associated with radiation exposure received at the atmospheric nuclear tests were found during these examinations. However, one of the 13 men has since been diagnosed as suffering from leukemia.

- In May 1979, the notification and medical examination program was expanded to include the DESERT ROCK Volunteer Observers (Officer Volunteers). These 44 volunteers received gamma doses ranging from a few millirem to about 17 rem; however, they were closer to ground zero than any other participants at the time of detonation. The officer volunteers at shots NANCY, SIMON, BADGER, and APPLE II were also exposed to neutron radiation.

- In June 1979, after careful evaluation to ensure the over-25-rem program was functioning well, the notification and medical examination program was expanded to include all participants identified with annual doses in excess of 5 rem. This threshold was chosen both because 5 rem is the current Federal guideline for allowable annual dose to radiation workers and because it is the best single standard to represent permissible dose levels for most DoD personnel at the time of the tests. Notification of participants is based not only on film badge records but also on dose calculations or dose estimates, if these show a possible over-5-rem dose. It is estimated that about 1,200 DoD personnel will be involved. To date, 65% of over-5-rem personnel have been contacted. Of this group, approximately one-quarter have taken physical exams from the Veterans Administration. The results of these physicals report that the incidence of cancer for this group is less than the national average.

- The VA offers free medical treatment to all test participants and Hiroshima/Nagasaki occupation forces. VA Circular 10-83-61 of April 1983 authorizes treatment for any ailment except those which are clearly not radiogenic in origin (e.g. appendicitis, tramatic injury, etc). In June 1983, DNA mailed VA Circular 10-83-61 to all participants for whom it had a current address.

- Throughout the course of the NTPR effort, the VA has had a program in effect whereby any eligible veteran test participant is given a free medical examination upon request.

Sixth, the National Academy of Sciences is well into its fourth year of work to ascertain whether atmospheric test participants exhibit any adverse health effects which might be attributable to test participation. It is conducting a scientific follow-up study of over 50,000 DoD participants in Operations GREENHOUSE (1951), UPSHOT-KNOTHOLE (1953), CASTLE (1954), REDWING (1956) and PLUMBBOB (1957).

· Seventh, the Defense Nuclear Agency has completed research on the U.S. occupation of Hiroshima and Nagasaki. A detailed fact sheet on this has been produced and is being provided to all occupation personnel who have called or written to DNA. A detailed dose reconstruction--using assumptions chosen to give an estimate of the maximum possible dose --has also been completed. No areas of concern or significant doubt were identified, and the firm, well-substantiated conclusion is that the radiation doses received by members of the Hiroshima and Nagasaki occupation forces were negligible. DNA's research has disclosed no basis for concern by veterans of the Hiroshima and Nagasaki occupation forces over an increased risk of adverse health effects due to radiation during the occupation. In May 1981, the National Academy of Sciences convened a panel to review the occupation of Hiroshima and Nagasaki and to determine the feasibility and desirability of performing epidemiological studies of veterans who served in the occupation forces in Hiroshima or Nagasaki, Japan, immediately following the wartime bombing of those cities. The National Academy of Sciences panel concluded that:

(1) It would be impractical to conduct a scientifically sound morbidity (incidence of disease) study of Hiroshima and Nagasaki occupation forces.

(2) A mortality (cause of death) study would be possible, but was judged too costly compared to the scientific benefits.

(3) Based on the known health effects of radiation, the radiological exposures were too low to produce any detectable increase in death or illness.

(4) Even if an excess number of cases of multiple myeloma were present in this population of veterans, it is doubtful that ionizing radiation was the cause.

· Finally, the Service NTPR teams have collected extensive basic information about each series and shot of the atmospheric test program in which that military service had any identified participants. They have also organized and trained their research teams in accessing individual service and medical records. They provide effective claims assistance to individual veterans and to the VA. The VA notifies DNA of all test participant veterans' claims and requests assistance in documenting participation and determining radiation dose, if any. The Service NTPR teams research all claims for the VA which have involvement in the atmospheric nuclear tests as the basis.

Dose Levels in the Atmospheric Test Program

Research to date indicates that most recorded doses to DoD personnel during the tests were quite low--averaging about half a rem. Of course, many participants received no dose at all, and only a very small percentage exceeded 5 rem per year, the current Federal guideline for allowable annual dose to radiation workers. The most basic source of dose data is the file maintained by the Reynolds Electrical and Engineering Company (REECo), a contractor of DoE (AEC), which is the official master repository of dose records for the atmospheric nuclear weapons tests. These REECo files, which contain the records of both DoD and AEC personnel, show the following:

REECo Film Badge Entries
(1945-1962)

| Dose | Number of Entries | Percent of Entries |
|---|---|---|
| 0 | 96,942 | 42% |
| 0-1 | 108,010 | 46% |
| 1.3 | 20,813 | 9% |
| 3-5 | 5,219 | 2% |
| Over 5 | 1,319 | Less than 1% |
| | 232,303 | |

NTPR Cross-checks on Exposure Levels

To cross-check the accuracy and completeness of the dose data held by REECo, and to ensure that it is representative of DoD participants, the NTPR program conducted numerous separate research efforts on exposures. Examples are:

- Research into historical documentation of numerous individual shots and test series shows dose results similar to the REECo averages. For example: In DESERT ROCK I (Nevada, 1951), none of the participants received over 5 rem; in BUSTER-JANGLE (Nevada, 1951), 0.2 percent received over 5 rem; in TUMBLER-SNAPPER (Nevada, 1952), 1.2 percent received over 4 rem; in TEAPOT (Nevada, 1955), 0.5 percent received over 3.9 rem.

- The Navy NTPR team extracted from REECo files the dose records of former Navy personnel who participated in oceanic testing. Of these individuals, 37 percent received zero exposure and less than one percent received more than 5 rem. In a separate research effort, the Navy conducted a reliability check of radiation dose records obtained from 7,900 individual medical records. Tabulation of the dose showed that less than one percent received more than 5 rem.

- Dose reconstruction was accomplished on Shot SMOKY to check on the accuracy of film badge readings (i.e., to see if test participants might have received larger radiation doses than their film badges recorded). Good correlation between actual film badge readings (0.575 rem average) and the calculated dosage (0.480 $\pm$ 0.135 rem) gives considerable confidence in film badge accuracy.

- Dose reconstructions have been done on other shots and series, and all support the data contained in the REECo files.

- Spot checks were made of film badge readings for members of units which maneuvered in proximity to each other and thus should have received comparable exposures. The results were indeed comparable.

- Intensive research and analyses have been carried out regarding possible neutron exposures, since neutrons would not be recorded on film badges. Dose reconstructions indicate that individuals with significant neutron exposure were officer volunteers. All cases where there was a potential for significant neutron exposure have been investigated in detail.

Based on cross-checks such as these, one can be confident that radiation dose levels shown by the REECo master file data (i.e., an average dose of about half a rem for all participants, and less than one percent with doses above the current allowable annual Federal standard) are reasonably representative of all DoD personnel. The identification and quantification of possible exposure due to inhalation and/or ingestion of radioactive materials has been accomplished for a number of events. Thus far, there have been very few incidents of significant exposure. This study of inhalation and/or ingestion of radioactive materials will eventually encompass all of the atmospheric tests.

Health Effects of Ionizing Radiation

Numerous authorities, national and international, have addressed in detail the health risks caused by radiation doses and have recommended standards of acceptable doses for radiation workers. It has been established that adverse health effects can result from exposure to high levels of ionizing radiation (e.g., 100 rem or more). However, it is not known whether or not there are deleterious health effects from exposure to low levels of ionizing radiation (i.e., a few rem). These low level doses are comparable to life time background rates. For many years, medical scientists assumed there were no adverse effects from low exposure, i.e., that a "threshold" level of ionizing radiation existed, below which no adverse health effects would be caused. In the 1940's and 1950's, medical scientists gradually shifted to the present hypothesis--that there is no safe threshold, that even low levels carry some slight statistical risk, and that the degree of risk increases linearly with dose. This conclusion,

however, is a hypothesis and is based on observations following high levels of exposure. No firm evidence exists to show that exposure to low levels of ionizing radiation would cause adverse health effects. Following are some examples of pertinent statements by medical and scientific authorities:

- The most direct data for the specific issue of atmospheric test participants comes from the Interagency Task Force on the Health Effects of Ionizing Radiation, conducted at White House direction and submitted to the President in August 1979 by the Secretary of Health, Education and Welfare. Its report states:

> For example, in a population of 10,000, one may normally expect 1,600 cases of fatal cancer; exposure of each of the 10,000 persons to one rem of low LET*, low rate, external, whole body radiation may be expected, under current risk estimates, to increase those deaths to roughly 1,601 (June 1979, p. 35).
>
> Thus, at current risk estimates, each individual has an overall likelihood of dying from cancer of about 16 percent, but the risk of dying from radiation-induced cancer is only about .01 percent for each rem of low-level exposure. Stated another way, 1,600 out of 10,000 persons will eventually die of cancer from various causes, but only one out of 10,000 may be expected to die of radiation-induced cancer following radiation exposure of one rem (June 1979, p. 5).
>
> Estimates vary, but the DoD, which is conducting a major research project to identify this test population, believes that about 250,000** DoD personnel (the great majority of them military) participated in these tests. While the actual exposure levels are under study, the current collective dose estimate is 115,000 person-rems at the Nevada and Pacific test sites. The currently assumed dose-response relationship for cancer would indicate about 12 excess cancer deaths from this estimated radiation dose over the lifetimes of the 250,000 involved (June 1979, p. 63).

- The International Commission on Radiological Protection (ICRP), the most prestigious international group addressing radiation issues, makes the same risk estimate in their 1977 - Recommendations of the International Commission on Radiological Protection, ICRP Publication 26, which states:

> For the purposes of radiation protection involving individuals, the Commission concludes that the mortality risk factor for radiation-induced cancers is about $10^{-2}$ $Sv^{-1}$, as an average for both sexes and all ages (January 17, 1977, p. 12). (Note: a sievert (Sv) equals 100 rem, thus the above statement puts the risk at one cancer death per 10,000 persons exposed to one rem.)

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*Linear Energy Transfer (LET) is the conventional expression for the rate of energy deposition measured along the track of an ionizing particle. Gamma rays and X-rays generate low-LET electron tracks. Alpha particles and neutrons generate high-LET tracks.
**Current estimate is about 203,000. The original figure included personnel who were involved in logistics, planning, or laboratory research, and were not actually at the tests. Also, personnel who attended several test series are now counted only once in the total estimate.

ICRP Report No. 26 also states, with regard to these risk estimates, that:

> The use of linear extrapolations, from the frequency of effects observed at high doses, may suffice to assess an upper limit of risk.... However, the more cautious such an assumption of linearity is, the more important it becomes to recognize that it may lead to an over estimate of the radiation risks.... Thus, in the choice of alternative practices, radiation risk estimates should be used only with great caution and with explicit recognition of the possibility that the actual risk at low doses may be lower than that implied by a deliberately cautious assumption of proportionality (p. 7).

· The United Nations Scientific Committee on the Effects of Atomic Radiation, in their 1977 UNSCEAR report, states:

> The average risk of inducing a fatal malignancy is thus taken as being in the region of $10^{-4}$ $rad^{-1}$ ... (p. 6) (that is, one fatal cancer for every 10,000 individuals exposed to one rad).

This UNSCEAR report also states:

> It must be emphasized again, however, that such a value is derived essentially from mortalities induced at doses in excess of 100 rad. The value appropriate to the much lower dose levels involved in occupational exposure, and even more so in environmental exposures to radiation, may well be substantially less (p. 414).

· In 1980, the Committee on the Biological Effects of Ionizing Radiation (BEIR Committee) of the National Academy of Sciences issued The Effects on Populations of Exposure to Low Levels of Ionizing Radiation which updates their 1972 report. To illustrate risk calculations, the Committee considered two situations: a single exposure to 10 rads and a continuous, lifetime exposure of 1 rad per year. They found that the lifetime risk of cancer mortality ranges from 77 to 226 excess deaths per million per rad for the single exposure, and 67 to 182 excess deaths per million per rad for the continuous exposure. Thus for a single exposure to 10 rads, 770 to 2,260 excess cancer deaths are predicted per million people. The normal expectation of cancer deaths is from 160,000 to 170,000 per million. (pp. 191-192, 265) The 1980 BEIR report predicts a lower risk than their 1972 report. This is because they felt the linear response model used by the 1972 Committee to extrapolate from high exposure levels to low levels did not fit the epidemiological data from high dose exposures as well as the linear-quadratic dose-response model.

· The National Council on Radiation Protection and Measurements, taking cognizance of all available information on health risks, stated in their 1971 NCRP Report No. 39, Basic Radiation Protection Criteria:

> The maximum permissible prospective dose equivalent for whole body irradiation from all occupational sources shall be 5 rem in any one year (p. 89).

NCRP Report No. 39 also states:

> In the interest of estimating effects in humans conservatively, it is not unreasonable to follow the assumption of a linear relationship between dose and effect in the low dose regions for which direct observational data are not available. It is generally agreed that such an assumption is conservative and would tend to give upper limits for any particular effect (p. 55).
>
> Experience with occupational exposure in the general neighborhood of presently acceptable limits over the last two or three decades has shown no identifiable injury ascribable to radiation (p. 50).

The NCRP reaffirms this 5 rem per year standard in their more recent (1975) Report No. 43. This report also states:

> The NCRP continues to hold the view that risk estimates for radiogenic cancers at low doses and low dose rates derived on the basis of linear (proportional) extrapolation from the rising portions of the dose-incidence curves at high doses and high dose rates, as described and discussed in subsequent sections of this report, cannot be expected to provide realistic estimates of the actual risks from low level, low LET radiations, and have such a high probability of over estimating the actual risk as to be of only marginal value, if any, for purposes of realistic risk-benefit evaluation (p. 2).

· The actual U.S. Federal radiation exposure standards were established by the President in 1960, based upon recommendations by the Federal Radiation Council. These standards are somewhat less stringent than the NCRP recommendations, in that they allow 3 rem per quarter, or 12 rem per year, until an accumulated dose equal to 5(N-18) is reached (where N is age in years). For example, a 26-year-old could, within today's Federal standards, receive doses of 12 rem per year for five years, thus accumulating 60 rem at the age of 30. Once the 5(N-18) limit is reached, allowable exposure is limited to 5 rem per year. The actual practice followed today however is to limit annual exposures to 5 rem.

· Nor is 5 rem per year a U.S. only limit. The ICRP, an international body, also recommends an allowable exposure of 5 rem per year for occupational workers, and even condones 12 rem per year under infrequent conditions.

MEDICAL FOLLOW-UP STUDIES OF PARTICIPANTS

· As a result of May 1981 panel convened by the National Academy of Sciences (NAS) to review the occupation of Hiroshima and Nagasaki, DNA asked NAS to investigate the incidence of multiple myeloma among the occupation forces. DNA and veterans groups supplied the Academy with the names of all known participants who reportedly had multiple myeloma. NAS confirmed the veterans diagnosis and participation. In June 1983, the Academy's report concluded that "the reported incidence of nine verified cases of multiple myeloma among U.S. veterans of the occupation forces stationed in or near Hiroshima and Nagasaki constitute an incidence no greater than that in the general U.S. population." Normally, the expected incidence in this population would be 18. After announcing its report, NAS identified and investigated four new cases. However, these new cases have not changed the basic conclusion of the NAS report.

· Recently, the Centers for Disease Control (CDC) updated the results of their study of SMOKY participants. It was the initial findings of the CDC which prompted the NTPR effort. The results of the CDC study were published in the Journal of American Medical Association (5 August 1983). The conclusions were that participant deaths due to cancer as well as total numbers of cases of cancer were slightly less than the statistical norm. The only abnormal finding was the larger number than expected of leukemia cases. This was attributed "to chance, factors other than radiation, or some combination of risk factors possibly including radiation."

· Preliminary National Academy of Sciences data from the first test series analyzed (PLUMBBOB) indicate that, as previously reported by the Centers for Disease Control, leukemia occurred excessively among participants at the particular Shot SMOKY. However, there is no excess of mortality from leukemia or from any other form of cancer among the 12,000 participants who witnessed the 23 other PLUMBBOB tests.

Summary

Based upon research to date, the average exposure of DoD participants in the atmospheric nuclear tests has been determined to be about one-tenth of the level that is generally agreed as an acceptable annual exposure for radiation workers; authorities widely agree in their assumption that the health risk from an exposure of half a rem is very low (approximately one fatal cancer per 20,000 individuals).

It should be noted that even today, 20-35 years after some DoD personnel participated in the atmospheric test program, the only scientific indication that there may be an increased health risk associated with test participation is CDC's identification of leukemia cases (now listed by CDC as ten) among participants whom CDC stated were present at the Nevada Test Site for Shot SMOKY, where the expected normal incidence in this group would be between three and four. (And, as stated earlier, CDC did not attribute this leukemia to be solely the result of exposure to ionizing radiation.)

The NTPR program is conducting a careful look into the history of the radiological safety aspects of the atmospheric nuclear weapons testing program, the development of historical documents to record the radiological exposures, and the identification of DoD personnel participation. These documents are now available to the public at various libraries throughout the United States or through NTIS.

So far, the careful and extensive study into the atmospheric nuclear test program indicates that overall the radiological safety precautions and safety measures taken, even in light of today's scientific knowledge of radiation effects, were adequate and there was only a very slight, if any, health risk to test participants.

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* ********************************************************************
*     This Fact Sheet Updates Nuclear Test Personnel Review (NTPR)  *
*     Fact Sheet, 10 January 1983                                   *
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*news from the* NATIONAL RESEARCH COUNCIL

*The National Research Council was organized by the National Academy of Sciences in 1916 in order to provide for a broader participation by American scientists and engineers in the work of the Academy. The Academy was chartered by the U.S. Congress in 1863 as a private organization with a responsibility for examining questions of science and technology at the request of the Federal Government. The National Academy of Engineering was organized in 1964 under the original NAS charter. The National Research Council now serves as the agent of both Academies in the conduct of studies and investigations in the public interest.*

2101 CONSTITUTION AVENUE, N.W., WASHINGTON, D.C. 20418 AREA CODE 202 EX 3-8100

Date: June 3, 1985
Contact: Gail Porter, (202) 334-2138

# NO CONSISTENT EVIDENCE OF INCREASED CANCER FOUND AMONG ATOMIC VETERANS; EXCESS LEUKEMIA IN ONE GROUP CONFIRMED

FOR RELEASE: AMs, Tuesday, June 4, 1985

WASHINGTON - A National Research Council review* of death certificates for a large sample of "atomic veterans" has found no consistent evidence of increased deaths from cancer or other diseases for the veterans overall. The study did, however, confirm an excess of leukemia among one group of veterans and find a slightly increased number of prostate cancers among another group.

The study included records for more than 46,000 of the 49,000 veterans known to have participated in five test series of atmospheric nuclear explosions carried out between 1951 and 1957. About 5,000 of these men were known to have died by 1982. The test series studied were those code-named "Greenhouse," "Upshot-Knothole," "Castle," "Redwing," and "Plumbbob."

"Mortality from cancer in all groups of participants was, in general, found to be less than the number expected at population death rates and mortality from other diseases was much less than expected, a consequence of selection for good health by the physical screening employed for active duty servicemen," states the study report.

(OVER)

*The study report, Mortality of Nuclear Weapons Test Participants, is available from the Research Council's Medical Follow-up Agency at the letterhead address. Reporters may obtain copies from the Office of Public Affairs, also at the letterhead address.

The finding of excess leukemia incidence among participants at the nuclear test code-named "Smoky" confirms the results of an earlier study by the Centers for Disease Control (CDC). (Smoky was one of 21 tests in the Plumbbob series in 1957.) Based on data recorded by radiation dosimeter badges worn by a sample of participants at the Smoky tests, the study reported that only 0.2 additional cases of leukemia would be expected among the Smoky participants rather than the 6 additional cases identified.

While the number of excess prostate cancers among participants at the Redwing test series was statistically significant, the study noted that prostate cancer "has never been demonstrated to be one especially susceptible to induction by radiation." Moreover, an analysis of the reported radiation doses received by individual participants at Redwing shows no pattern of higher than average radiation exposure among those men who later developed prostate or other genital cancers.

NO CONSISTENT EVIDENCE

"The total body of evidence we have reviewed cannot convincingly either affirm or deny that the higher than statistically expected incidence of leukemia among Smoky participants (or of prostate cancer among Redwing participants) is the result of radiation exposure incident to the tests," the report cautioned. "However, when the data from all the tests are considered, there is no consistent or statistically significant evidence for an increase in leukemia or other malignant disease in nuclear test participants."

The lack of consistent evidence of increased cancer incidence led the study authors to speculate that either the observed incidence of leukemia among Smoky participants is simply a "chance aberration" or that the actual radiation exposure of these men was "several times" the dose recorded at the time.

(MORE)

The Research Council began the study in 1979 at the request of the Defense Nuclear Agency (DNA) shortly after publication of a CDC report that found excess leukemia incidence among Smoky veterans. The study was carried out by Research Council staff members C. Dennis Robinette, Seymour Jablon, and Thomas L. Preston with the oversight of a subcommittee of the Research Council's Committee on Epidemiology and Veterans Follow-up Studies. Funding for the study was provided by DNA and the U.S. Department of Energy.

STUDY DESIGN LIMITS SCOPE

Coauthor Jablon stressed that several details of the study design limit the scope of conclusions that may be drawn. Ideally, he said, a study of this type would compare the cause of death for atomic veterans in the sample with other servicemen who were not test participants. Unfortunately, detailed mortality data for veterans of the same age, who served in the armed forces during the same time as the atomic veterans, do not exist, he added.

Because a direct mortality comparison between atomic veterans and other similarly aged servicemen was not feasible, the study relied instead on a comparison with mortality data for men in the general U.S. population. Since men selected for military service are usually healthier than the general population, such comparisons would tend to underestimate somewhat the number of excess cancers among the atomic veterans.

Jablon also pointed out that studies of the initial survivors of the Hiroshima and Nagasaki atomic bombs show that leukemia is one of the cancers that develops soonest following radiation exposure. Other types of cancers may take 30 years or longer to develop following exposure, and a future reanalysis of mortality rates among these same men might find additional excess cancer cases, he said.

Nevertheless, Jablon said that these points are balanced by the fact that the recorded radiation doses at the various test series are quite low in comparison to those of the Japanese survivors of Hiroshima and Nagasaki and, based on the currently accepted understanding of radiation dose and cancer incidence, would not be expected to produce a statistically significant increase in cancer risk.

(OVER)

The study authors acknowledged that the dosimetry data available was incomplete and may have underestimated somewhat the actual doses received. Even so, they noted that this does not explain why participants at tests other than Smoky, who received similar reported radiation exposures, do not show similarly increased leukemia risks.

BACKGROUND INFORMATION

From 1946 to 1962 the United States conducted 18 atmospheric test series of nuclear weapons. Most of the tests were held at two different sites, one in Nevada and another on a group of islands in the Pacific. Approximately 200,000 people from the various branches of the U.S. armed services participated in the testing program.

Records for participants at five of the test series conducted were included in the study. The test series selected include about an equal number of men from the Nevada and Pacific test sites and were chosen based on the quality of personnel identification and radiation dosimetry data available. The radiation doses received by participants at these particular tests are believed to equal or exceed doses received during test series not included in the study.

Names of participants at these five test series, dates of birth, and information on men who had died by 1982 were supplied by the DNA and the Veterans Administration. Research Council staff members also carried out extensive searches through the military's National Personnel Records Center in St. Louis, Mo., in order to clear up discrepancies or supply missing information.

The Subcommittee on Exposure at Tests of Nuclear Weapons was chaired by James F. Crow, department of genetics, University of Wisconsin, Madison. Other members were: John A. Auxier, applied science laboratory, Oak Ridge, Tenn.; George B. Hutchison, department of epidemiology, Harvard University; Alfred G. Knudson Jr., Institute for Cancer Research, Philadelphia, Penn.; Raymond Seltzer, office of the dean, Graduate School of Public Health, University of Pittsburgh; and H. Eldon Sutton, department of zoology and the Genetics Institute, University of Texas, Austin.

# # #

gp: 1,10

# CDC STUDY OF SMOKY VETERANS

The following is the abstract from "Mortality and Cancer Frequency among Military Nuclear Test (SMOKY) Participants, 1957 Through 1979", as it appeared in the August 5, 1983 article in the Journal of the American Medical Assiciation (JAMA). The study was conducted by Dr. Glyn Caldwell and other researchers from the Centers for Disease Control (CDC). The article's abstract was reprinted with the permission of the authors and JAMA. A free copy of the complete article can be obtained by writing to either the Defense Nuclear Agency or the CDC.


·Follow-up of health status has been completed through 1979 for 3,072 (95.5%) of 3,217 nuclear test participants on military maneuvers during the 1957 nuclear test "Smoky." In these participants, 112 cases of cancer were diagnosed, compared with 117.5 cases expected. During the same follow-up period (1957 through 1979), 64 persons died of cancer compared with an expected 64.3. Statistically significantly increased frequency of occurrence and mortality was found only for leukemia. The amount of cumulative gamma radiation exposure for 1957 ranged from 0 to 10.397 mrem as measured by individual personnel film badges. Although uncertainty remains about the exact amount of radiation exposure, the lack of a significant increase after 22 years in either the incidence of or the mortaility from any other cancer and the apparent lack of a dose effect by unit lead to the consideration that the leukemia findings may be attributable either to chance, to factors other than radiation, or to some combination of risk factors possibly including radiation.

# Fact Sheet

**Defense Nuclear Agency**
Public Affairs Office
Washington, D.C. 20305

Subject: SANDSTONE Fact Sheet

SANDSTONE was a three-detonation nuclear weapon test series held at Enewetak Atoll, the Atomic Energy Commission's (AEC) Pacific Proving Ground (PPG), in the spring of 1948. Located in the Central Pacific Ocean, the PPG consisted principally of Enewetak* and Bikini atolls in the northwestern Marshall Islands.

| Assigned Name | Local Date | Location | Yield (KT)[a] |
|---|---|---|---|
| X-RAY | 15 April | 200-foot (61-meter) tower on Enjebi Island | 37 |
| YOKE | 1 May | 200-foot (61-meter) tower on Aomon Island | 49 |
| ZEBRA | 15 May | 200-foot (61-meter) tower on Runit Island | 18 |

Note:
[a]One kiloton equals the approximate energy release of a one-thousand-ton TNT explosion.

HISTORICAL BACKGROUND

Operation SANDSTONE was the second test series to be held in the Marshall Islands, but it differed from the first series (CROSSROADS in 1946) in that it was primarily an AEC scientific test series with the armed forces serving in a supporting role. Its purpose was to proof-test improved-design atomic weapons, whereas the purpose of CROSSROADS was to test nuclear weapons effects on ships.

The weapons were tested at Enewetak by a joint military and civilian organization designated Joint Task Force 7 (JTF 7). This was a military organization in form, but contained military, civil service, and contractor personnel of the Department of Defense (DOD) and the AEC. The commander of this force was the appointed representative of the AEC and reported to both the Joint Chiefs of Staff and the Commander in Chief, Pacific.

Peak DOD numerical strength at SANDSTONE was approximately as follows:

| | |
|---|---|
| Uniformed military | 9,890 |
| DOD civilians | 350 |
| DOD contractors | 126 |
| | 10,366 |

* Formerly Eniwetok. A better understanding of the Marshall Islands language has permitted a more accurate transliteration of Marshall Island names into English language spelling.

Numerous technical experiments were carried out in conjunction with each of the three detonations. These experiments measured the yield and efficiency of the devices and attempted to gauge military effects of the explosions. DoD personnel participated in this test operation as individuals involved in AEC weapon design and development, as units performing separate experiments, and as units performing various support roles.

An extensive radiological safety (radsafe) program with the following objectives was instituted:

1. Keeping personnel radiation exposure at the lowest possible level consistent with medical knowledge of radiation effects and the importance of the test series

2. Avoiding inadvertent contamination of populated islands and transient shipping.

This program established an organization to provide radsafe expertise and services to commanders of the separate components of the task force, who were responsible for personnel safety within their commands. Personnel were trained in radiological safety. Standards governing permissible exposure were established. The standards were 0.1 roentgen (R) per 24-hour period and a maximum exposure of 3R for specifically approved missions. Film badges were issued to persons likely to be exposed to radiation, as well as a representative group of the task force. An extensive weather forecasting group was established to predict wind directions and areas of potential fallout. Personnel were evacuated from danger areas before each detonation. Reentry to radioactive areas was restricted to personnel required to retrieve important data, and their radiation exposures were monitored.

TEST OPERATIONS AND EXPOSURES

Each of the SANDSTONE tower shots produced fallout; however, none of the inhabited islands in the area received appreciable fallout. Kwajalein received measureable fallout on 3 May, two days after the YOKE shot. The estimated dose from fallout for persons who were on Kwajalein for the entire test series was calculated to be 0.075 R.

Most task force personnel were on Kwajalein or aboard ships. The remainder were on Enewetak and stayed there for the three shots. The temporary camps on the northern and eastern islands of the atoll near the detonation sites were abandoned and dismantled before the shots. Task force ships evacuated the lagoon, except for USS Albemarle (AV-5), USS Mount McKinley (AGC-7), USS Curtiss (AV-4), and USS Bairoko (CVE-115), which remained in the lagoon near the base islands on the southern side of the atoll.

Highest DoD exposures for both the Army (6.050 R) and the Navy (5.140 R) were accrued by radiation monitors from the Joint Radiological Safety Group. Only eleven personnel (0.6 percent of those badged) received exposures in excess of the imposed standards of 3 R. In fact, radiation exposure for badged JTF 7 personnel at SANDSTONE averaged less than 0.25 R, and approximately 65 percent had zero exposures. The unbadged men were not expected to be exposed to radioactivity. Recorded SANDSTONE exposures are summarized in the table on the following page.

SANDSTONE Joint Task Force 7 Personnel Exposures

| | Number Badges | Exposure Ranges (roentgens) 0 | 0.001-1 | 1-2 | Over 2 | High (R) |
|---|---|---|---|---|---|---|
| Army | 327 | 168 | 141 | 10 | 8 | 6.050 |
| % of Total | | 51 | 43 | 3 | 3 | |
| Navy | 973 | 730 | 233 | 8 | 2 | 5.140 |
| % of Total | | 75 | 24 | 1 | 1 | |
| Air Force | 350 | 195 | 144 | 8 | 3 | 3.060 |
| % of Total | | 56 | 41 | 2 | 1 | |
| Marines | 112 | 102 | 9 | 1 | 0 | 1.040 |
| % of Total | | 91 | 8 | 1 | 0 | |
| Non-DoD Participants | 119 | 18 | 83 | 6 | 12 | 17.0 |
| % of Total | | 15 | 70 | 5 | 10 | |
| Totals | 1,881 | 1,213 | 610 | 33 | 25 | 17.0 |
| % of Total | | 65 | 32 | 2 | 1 | |

# Facilities Receiving Nuclear Test Personnel Review Historical Volumes

**1 March 1984**

### Alabama

Veterans Administration–RO
ATTN: Director
474 S Court Street
Montgomery, AL 36104

Alabama, University of
ATTN: Director of Libraries (Regional)
P O Box 1465
University, AL 35486

Alexander City State Jr College
Thomas D Russell Library
P O Box 699
Alexander City, AL 35010

Auburn Univ at Montgomery Lib (Regional)
Montgomery, AL 36104

Drake Memorial Learning Resource Ctr
Alabama Agricultural Mechanical College
Normal, AL 35762

Gadsden Public Library
254 College St
Gadsden, AL 35901

Ralph Brown Draughon Lib
ATTN: Microforms & Documents Dept
Auburn University
Auburn, AL 36830

Samford University
Harwell G Davis Library
800 Lakeshore Drive
Birmingham, AL 35229

Southern Alabama, University of
Mobile, AL 36688

Mobile Public Library
ATTN: GOVTMNTL Info Division
546 Davis Ave
Mobile, AL 36603

### Alaska

Veterans Administration–RO
ATTN: Director
605 W 4th Avenue
Anchorage, AK 99501

Alaska, University
Rasmuson Library
Fairbanks, AK 99701

Alaska, University of
Anchorage Library
3211 Providence Avenue
Anchorage, AK 99504

### Arizona

Veterans Administration–RO
ATTN: Director
3225 N Central Avenue
Pheonix, AZ 85012

Arizona State University Library
Tempe, AZ 85281

Arizona, University of
ATTN: Director of Libraries (Regional)
Tucson, AZ 85721

Dept of Lib & Archives (Regional)
Phoenix, AZ 85012

Grand Forks Public City–County Library
2110 Library System
11 W Cherry St.
Flagstaff, AZ 86001

Northern Arizona University Lib
ATTN: Government Documents Dept
P O Box 6022
Flagstaff, AZ 86011

Phoenix Public Library
12 East McDowell Road
Phoenix, AZ 85004

### Arkansas

Veterans Administration-RO
ATTN: Director
1200 W 3rd Street
Little Rock, AR 72201

Arkansas College Library
Mabee Learning Resources Center
Batesville, AR 72501

Arkansas Library Comm
Library Archives & Computer
Complex State Capitol Mall
Little Rock, AR 72201

Arkansas State University
Dean B Ellis Library
State University, AR 72467

Arkansas, University of
ATTN: Government Documents Div
University Libraries
Fayetteville, AR 72701

Little Rock Public Library
700 Louisiana Street
Little Rock, AR 72201

Ouachita Baptist University
Riley Library
Arkadelphia, AR 71923

### California

Veterans Administration-RO
ATTN: Director
Federal Building
1100 Wilshire Blvd.
West Los Angeles
Los Angeles, CA 90024

Veterans Administration–RO
ATTN: Director
211 Main Street
San Francisco, CA 94105

Veterans Administration–RO
ATTN: Director
2022 Camino Del Rio North
San Diego, CA 92108

Adams State College
Learning Resources Center
Alamosa, CA 81101

Anaheim Public Library
500 W. Broadway
Anaheim, CA 92805

Angelo Iacovoni Pub Lib
5020 Clark Avenue
Lakewood, CA 90712

California at Fresno State Univ Lib
Fresno, CA 93740

California at Los Angeles Univ Lib
ATTN: Pub Affairs Serv US Docs
Public Affairs Service
405 Hilgard Avenue
Los Angeles, CA 90024

California at San Diego University
ATTN: Documents Department
University Library C 075
La Jolla, CA 92093

California at Stanislavs St Clg Lib
800 Monte Vista Avenue
Turlock, CA 95380

California St Polytechnic University
University Library
San Luis Obispo, CA 93401

California St Univ at Northridge
ATTN: Gov Doc
Oviatt Library
1811 Nordhoff Street
Northridge, CA 91324

California State Library (Regional)
P O Box 2037
Sacramento, CA 95809

California State Univ at Long Beach Lib
6101 E 7th Street
Long Beach, CA 90801

California State University
Chico Library
Chico, CA 95929

California State University
Dominguez Hills Educ Res Ctr
800 East Victoria St
Carson, CA 90747

California Univ Library
ATTN: Govt Publications Dept
P O Box 5900
Riverside, CA 92507

California Univ Library
Santa Barbara, CA 93106

California University Library
ATTN: Govt Documents Dept
Davis, CA 95616

California University Library
ATTN: Documents Sec
Santa Cruz, CA 95064

California, University
ATTN: Government Documents Dept
General Library
Berkely, CA 94720

Carson Regional Library
ATTN: Gov Publications Unit
151 E Carson St
Carson, CA 90745

Claremont Colleges Libs
ATTN: Doc Collection Honnold Lib
222 E 9th st
Claremont, CA 91711

Compton Library
240 West Compton Blvd
Compton, CA 90220

Culver City Library
4975 Overland Ave
Culver City, CA 90230

Fresno County Free Library
2420 Mariposa Street
Fresno, CA 93721

Garden Public Library
1731 W Gardena Blvd
Gardena, CA 90247

Gleeson Library
University of San Franciso
San Franciso, CA 94117

Humboldt State College Library
ATTN: Documents Department
Arcata, CA 95521

Huntington Park Library
San Antonio Region
6518 Miles Avenue
Huntington Park, CA 90255

Lancaster Regional Library
1150 W Avenue J
Lancaster, CA 93534

Long Beach Pub Library
Ocean & Pacific Aves
Long Beach, CA 90802

Los Angeles Public Library
ATTN: Serials Div U S Documents
361 S Anderson Street
Los Angeles, CA 90033

Michel Orradre Library
ATTN: Documents Div
University of Santa Clara
Santa Clara, CA 95053

Montebello Library
1550 Beverly Blvd
Montebello, CA 90640

Norwalk Public Library
12350 Imperial Highway
Norwalk, CA 90650

Oakland Public Library
125 14th st
Oakland, CA 94612

Riverside Public Library
P O Box 468
Riverside, CA 92502

San Diego County Library
ATTN: C. Jones, Acquisitions
5555 Overland Ave Bldg 15
San Diego, CA 92123

San Diego Public Library
820 E St
San Diego, CA 92101

San Diego State Univ Lib
ATTN: Govt Pubs Dept
San Diego, CA 92182

San Francisco Public Library
ATTN: Govt Documents Dept
Civic Center
San Francisco, CA 94102

San Francisco State College
ATTN: Govt Publications Collection
1630 Holloway Avenue
San Francisco, CA 94132

San Jose State College Library
ATTN: Documents Dept
San Jose, CA 95192

San Luis Obispo City-County Library
P O Box X
San Luis Obispo, CA 93406

Southern California Univ Library
ATTN: Documents Department
P O Box 77983
Los Angeles, CA 90007

Southwestern University
School of Law Library
675 South Westmoreland Ave
Los Angeles, CA 90005

Stanford University Library
ATTN: Govt Documents Dept
Stanford, CA 94305

Stockton & San Joaquin Public Lib
605 N El Dorado Street
Stockton, CA 95202

Torrance Civic Center Library
3301 Torrance Blvd
Torrance, CA 90503

UCLA Research Library
ATTN: Public Affairs Service/US Docs
405 Hilgard Avenue
Los Angeles, CA 90024

Valencia Library
23743 Valencia Blvd
Valencia, CA 91355

West Covina Library
1601 West Covina Parkway
West Covina, CA 91790

West Hills Community Col Library
300 Cherry Lane
Ocalinga, CA 93210

## Colorado

Veterans Administration--RO
ATTN: Director
Denver Federal Center
Building 20
Denver, CO 80225

Colorado State Univ Libs
Fort Collins, CO 80523

Colorado, University Libraries
ATTN: Director of Libraries
Government Publication
Boulder, CO 80309

Denver Public Library (Regional)
ATTN: Documents Div
1357 Broadway
Denver, CO 80203

Jefferson County Public Lib
Lakewood Regional Library
10200 West 20th Street
Lakewood, CO 80215

Mesa County Public Library
530 Grand Avenue
Grand Junction, CO 81501

Penrose Library
University of Denver
University Park Campus
Denver, CO 80208

## Connecticut

Veterans Administration—RO
ATTN: Director
450 Main Street
Hartford, CT 06103

Connecticut State Library (Regional)
231 Capital Ave
Hartford, CT 06103

Connecticut University of
ATTN: Govt of Connecticut
Wilbur Cross Library
Storrs, CT 06268

Connecticut, University
ATTN: Director of Libraries
Storrs, CT 06520

Hartford Public Library
500 Main St
Hartford, CT 06103

Quinebaug Valley Community Col
P O Box 59
Danielson, CT 06239

Silas Bronson Public Library
267 Grand St
Waterbury, CT 06702

Southern Connecticut State College
ATTN: Library
501 Crescent St
New Haven, CT 06515

Trinity College Library
300 Summit Street
Hartford, CT 06106

Wesleyan University
ATTN: Documents Librarian
Olin Library
Middletown, CT 06457

Willimantic Public Library
905 Main St
Willimantic, CT 06226

Yale University
ATTN: Director of Libraries
New Haven, CT 06520

## Delaware

Veterans Administration—RO
ATTN: Director
1601 Kirkwood Hwy
Wilmington, DE 19805

Delaware, University of
Norris Library
Newark, DE 19711

Newark Free Library
750 E Delaware Avenue
Newark, DE 19711

## District of Columbia

Veterans Administration—RO
ATTN: Director
941 N Capital Street, NE
Washington, DC 20421

Georgetown Univ Library
ATTN: Govt Docs Room
37th & O Streets, NW
Washington, DC 20007

## Florida

Veterans Administration—RO
ATTN: Director
144 1st Avenue S
St Petersburg, FL 33701

Central Florida, Univ of
ATTN: Library Docs Dept
P O Box 25000
Orlando, FL 32816

Florida A & M Univ
Coleman Memorial Library
Tallahassee, FL 32307

Florida Atlantic Univ Lib
ATTN: Div of Public Documents
Boca Raton, FL 33431

Florida Inst of Tech
ATTN: Library
P O Box 1150
Melbourne, FL 32901

Florida Intl Univ Library
ATTN: DLCS Section
Tamiami Trail
Miami, FL 33144

Florida State University
R M Strozier Library
Tallahassee, FL 32306

Florida, University of
ATTN: Director of Libraries (Regional)
P O Box 14333, University Station
1630 NW 1st Avenue
Gainesville, FL 32604

Haydon Burns Library
122 N Ocean St
Jacksonville, FL 32202

Lake Sumter Comm Col Lib
Leesburg, FL 32748

Lakeland Public Library
100 Lake Morton Dr
Lakeland, FL 33801

Miami Library, University of
ATTN: Government Publications
P O Box 248214
Miami, FL 33124

Miami Public Library
ATTN: Documents Division
1 Biscayne Blvd
Miami, FL 33132

Selby Public Library
1001 Boulevard of the Arts
Sarasota, FL 33577

South Florida University Library
4202 Fowler Avenue
Tampa, FL 33620

Stetson Univ
DuPont Ball Library
De Land, FL 32720

Tampa, Hillsborough County Public Lib
900 N Ashley Street
Tampa, FL 33602

Volusia County Public Libraries
City Island
Daytona Beach, FL 32014

West Florida, University of
John C Pace Library
Pensacola, FL 32504

Broward County Library Sys
Building D
1301 W Copans Road
Pompano Beach, FL 33064

## Georgia

Veterans Administration—RO
ATTN: Director
730 Peachtree Street, NE
Atlanta, GA 30308

Atlanta Public Library
ATTN: Ivan Allen Dept
1 Margaret Mitchell Square at
Carnegie & Forsyth Street
Atlanta, GA 30303

Atlanta University
Trevor Arneti Library
273 Chestnut Street, SW
Atlanta, GA 30314

Dalton Jr College Library
Dalton, GA 30720

DeKalb Comm Col So Cpus
Learning Resources Ctr
3251 Panthersville Rd
Decatur, GA 30034

Emory University
Robert W. Woodruff Lib
Atlanta, GA 30322

Georgia Inst of Tech
Price Gilbert Memorial Lib
225 North Ave NW
Atlanta, GA 30332

Georgia Southern College
Rosenwald Library
Statesboro, GA 30460

Georgia Southwestern College
ATTN: Director of Libraries
James Earl Carter Library
Americus, GA 31709

Georgia State Univ Lib
104 Decatur St SE
Atlanta, GA 30303

Georgia, University of
ATTN: Director of Libraries (Regional)
Athens, GA 30602

Mercer University
Stetson Memorial Library
1330 Edgemont Ave
Macon, GA 31207

North Georgia College
Stewart Library
Dahlonega, GA 30533

Reese Library
Augusta College
2500 Walton Way
Augusta, GA 30904

Savannah Pub & Effingham Libty Reg Lib
2002 Bull Street
Savannah, GA 31401

Simon Schwob Mem Lib
Columbus College
Columbus, GA 31907

West Georgia College
Irvine Sullivan Ingram Lib
Carrollton, GA 30118

## Guam

Guam RFK Memorial University Lib
ATTN: Fed Depository Collection
UOG Station
Mangilao, Guam 96913

Guam, University of
Robert F Kennedy Memorial Lib
Box DK
Agana, Guam 96910

Nieves M Flores Memorial Lib
P O Box 652
Agana, Guam 96910

## Hawaii

Veterans Administration—RO
ATTN: Director
PJKK Federal Building
300 Ala Moana Blvd
Honolulu, HI 96850

Brigham Young University
Joseph F Smith Library
Hawaii Campus
Laie, HI 96762

Hawaii Library Univ of
ATTN: Government Docs Collection
2550 The Mall
Honolulu, HI 96822

Hawaii State Library
ATTN: Federal Documents Unit
478 S King St
Honolulu, HI 96813

Hawaii, University at Monoa
ATTN: Director of Libraries (Regional)
Honolulu, HI 96822

Hawaii, University of
Hilo Campus Library
P O Box 1357
Hilo, HI 96720

Maui Public Library
Kahului Branch
Kamehameha & School Street
Kahului, HI 96732

## Idaho

Veterans Administration—RO
ATTN: Director
Federal Bldg & U S Courthouse
550 W Fort Street
Boise, ID 83724

Idaho Public Lib & Info Center
715 Capital Blvd
Boise, ID 83706

Idaho State Library
325 W State St
Boise, ID 83702

Idaho State University Library
ATTN: Documents Department
Pocatello, ID 83209

Idaho, University of
ATTN: Director of Libraries (Regional)
Moscow, ID 83843

Terteling Library
College of Idaho
Caldwell, ID 83605

## Illinois

Veterans Administration—RO
ATTN: Director
P O Box 8136
Chicago, IL 60680

Bradley University
Director of Library
Peoria, IL 61625

Chicago Public Library
ATTN: Government Publications Dept
425 N Michigan Ave
Chicago, IL 60611

Chicago State, University of
95th St at King Dr
Chicago, IL 60628

Chicago University Library
ATTN: Director of Libraries
1100 E 57th Street
Chicago, IL 60637

Decatur Public Library
247 East North Street
Decatur, IL 62523

Eastern Illinois University
Booth Library
Charleston, IL 61920

Freeport Public Library
314-318 W Stephenson St
Freeport, IL 61032

Illinois Library, University of
ATTN: Documents Section
Chicago Circle Box 8198
Chicago, IL 60680

Illinois State Library (Regional)
ATTN: Government Documents Branch
Centennial Building
Springfield, IL 62706

Illinois Univ At Urbana Champaign
ATTN: P Watson Documents Library
1408 W Gregor Drive
Room 200D Library
Urbana, IL 61801

Illinois Valley Comm Col
ATTN: Library
R R 1
Oglesby, IL 61348

Illinois State University
Milner Library
Normal, IL 61761

Lake Forest College
Donnelley Library
Lake Forest, IL 60045

Marshall Brooks Library
Principia College
Elsah, IL 62028

Mt Prospect Public Lib
Government Information Ctr
10 South Emerson Street
Mt Prospect, IL 60056

Northern Illinois University
Founder Memorial Library
De Kalb, IL 60115

Northwestern University Lib
ATTN: Govt Publications Dept
Evanston, IL 60201

Northeastern Illinois University
ATTN: Library
Bryn Mawr at St Louis Ave
Chicago, IL 60625

Peoria Public Library
ATTN: Business, Science & Tech Dept
107 NE Monroe
Peoria, IL 61620

Popular Creek Public Lib District
1405 South Park Blvd
Streamwood, IL 60103

Shawnee Library System
RR 2 Box 136A
Carterville, IL 62918

Southern Illinois University
Lovejoy Mem Library
Edwardsville, IL 62025

Southern Illinois University
ATTN: Documents Ctr
Morris Library
Carbondale, IL 62901

Western Illinois University Lib
Macomb, IL 61455

## Indiana

Veterans Administration—RO
ATTN: Director
575 N Pennsylvania Street
Indianpolis, IN 46204

Allen County Public Library
900 Webster Street
Fort Wayne, IN 46802

DePauw University
Roy O West Library
Greencastle, IN 46135

Evansville & Vanderburgh County Pub Lib
22 SE 5th St
Evansville, IN 47708

Gary Public Library
220 West Fifth Avenue
Gary, IN 46402

Indiana State Library (Regional)
ATTN: Serial Section
140 North Senate Avenue
Indinapolis, IN 46204

Indiana State University
ATTN: Documents Libraries
Cunningham Mem Library
Terre Haute, IN 47809

Indiana University Library
ATTN: Documents Department
Bloomington, IN 47405

Indianapolis Marion Cyt Pub Library
ATTN: Social Science Div
40 E St Clair St
Indianapolis, IN 46204

Irwin Library
Butler University
4600 Sunset Ave
Indianpolis, IN 46208

Lilly Library
Earlham College
Richmond, IN 47374

Notre Dame, University of
ATTN: Document Center
Memorial Library
Notre Dame, IN 46556

Purdue University Library
Lafayette, IN 47907

## Iowa

Veterans Administration—RO
ATTN: Director
210 Walnut Street
Des Moines, IA 50309

Burlington Library
501 N 4th Street
Burlington, IA 52601

Drake University
ATTN: Cowles Library
28th St & Univ Ave
Des Moines, IA 50311

Free Public Library
Willow Ave & Pearl Street
Council Bluff, IA 51501

Graceland College
Frederick Madison Smith Lib
Lamoni, IA 50140

Iowa State University Library
ATTN: Govt Documents Dept
Ames, IA 50010

Iowa University Library
ATTN: Government Documents Dept
Iowa City, IA 52242

Sioux City Public Library
705 6th Street
Sioux City, IA 51105

University of Northern Iowa
ATTN: Library
Documents Collection
Cedar Falls, IA 50613

Upper Iowa College
ATTN: Documents collection
Henderson Wilder Library
Fayette, IA 52142

Davenport Public Library
321 Maine Street
Davenport, IA 52801

## Kansas

Veterans Administration—RO
ATTN: Director
5500 E Kellogg
Wichita, KS 67218

Fort Hays State University
Ft Hays Kansas State College
Forsyth Library
Hays, KS 67601

Hutchinson Public Library
901 N Main St
Hutchinson, KS 67501

Kansas State Library
343 N Capital St., Third Floor
Topeka, KS 66612

Kansas State Univ Library
ATTN: Documents Dept
Manhattan, KS 66506

Kansas, University of
ATTN: Director of Libraries (Regional)
Lawrence, KS 66040

Wichita State Univ Library
Wichita, KS 67208

William Allen White Lib
ATTN: Govt Documents Div
Emporia Kansas State College
Emporia, KS 66801

## Kentucky

Veterans Administration—RO
ATTN: Director
600 Federal Place
Louisville, KY 40202

Eastern Kentucky University
John Grant Crabbe Lib
Richmond, KY 40475

Hopkinsville Comm Col
North Drive
Hopkinsville, KY 42240

Kentucky Dept of Library & Archives
ATTN: Documents Section
State Library Services Div
P O Box 537
Frankfort, KY 40602

Kentucky, University of
ATTN: Director of Libraries (Regional)
Lexington, KY 40506

Louisville Free Pub Lib
4th & York Sts
Louisville, KY 40203

Louisville Univ Library
Belknap Campus
Louisville, KY 40208

Murray State Univ Lib
ATTN: Library
15th & Olive Sts
Murray, KY 42071

## Louisiana

Veterans Administration—RO
ATTN: Director
701 Loyola Avenue
New Orleans, LA 70113

Isaac Delgado College
Moss Memorial Library
615 City Park Ave
New Orleans, LA 70119

Louisiana State University
ATTN: Director of Libraries (Regional)
Baton Rouge, LA 70803

McNeese State Univ
Frazer Memorial Library
Lake Charles, LA 70609

New Orleans Library University
ATTN: Govt Documents Div
Lake Front
New Orleans, LA 70122

New Orleans Public Lib
219 Loyola Ave
New Orleans, LA 70140

Nicholls State Univ Library
ATTN: Docs Div
Thibodaux, LA 70301

Northwestern State Univ
Watson Memorial Library
Natchitoches, LA 71457

Prescott Memorial Lib
Louisiana Tech Univ
Ruston, LA 71272

Richard W Norton Mem Lib
Louisiana College
Pineville, LA 71360

Shreve Memorial Library
P O Box 21523
Shreveport, LA 71120

Southern Univ In New Orleans Library
6400 Press Dr
New Orleans, LA 70126

Southwestern Lousiana Univ of
Louisiana Libraries
USL Box 4 0199
Lafayette, LA 70504

Howard Tilton Mem Libr
ATTN: Documents Dept.
Tulane Univ
New Orleans, LA 70118

## Maine

Veterans Administration—RO
ATTN: Director
Togus, ME 04330

Bangor Public Library
145 Harlow Street
Bangor, ME 04401

Bates College Library
Lewiston, ME 04240

Bowdoin College
Hawthorne Longfellow Lib
Brunswick, ME 04011

Maine Maritime Academy
Nutting Memorial Library
Castine, ME 04421

Maine, University of
Raymond H. Fogler Library
Orono, ME 04473

Mantor Library
ATTN: Director of Libraries
Univ of Maine at Farmington
41 High Street
Farmington, ME 04938

Portland Public Library
5 Monument Square
Portland, ME 04101

University of Maine at Orono
Bangor Community College Library
Bangor, Maine 04401

## Maryland

Veterans Administration—RO
ATTN: Director
31 Hopkins Plaza
Federal Bldg
Baltimore, MD 21201

Enoch Pratt Free Library
ATTN: Documents Office
400 Cathedral Street
Baltimore, MD 21201

John Hopkins University
ATTN: Documents Library
Milton S Eisenhower Library
Baltimore, MD 21218

Maryland, University of
ATTN: McKeldin Lib Docs Div
College Park, MD 20740

Maryland, University of
Baltimore Co Library
5401 Wilkens Ave
Baltimore, MD 21228

## Massachusetts

Veterans Administration—RO
ATTN: Director
J F K Federal Bldg
Government Center
Boston, MA 02203

Boston Public Library (Regional Dep)
ATTN: Documents Department
Boston, MA 02117

Brandeis University Lib
ATTN: Documents Section
415 South St
Boston, MA 02154

Curry College Library
1071 Blue Hill Ave
Milton, MA 02186

Harvard College Library
ATTN: Director of Libraries
Cambridge, MA 02138

Massachusetts, Univ of
ATTN: Government Docs College
Goddell Library
Amherst, MA 01002

MIT Libraries
Serials & Journals 14E 210
Boston, MA 02139

Northeastern University
ATTN: Dodge Library
360 Huntington Ave
Boston, MA 02115

Southeastern Massachusetts Univ Lib
ATTN: Documents Sec
P O Box 6
New Bedford, MA 02747

Springfield City Library
ATTN: Documents Section
220 State Street
Springfield, MA 01103

State Lib of Mass
State House
Boston, MA 02133

Tufts University Library
ATTN: Documents Dept
Medford, MA 02155

William College Library
Williamstown, MA 01267

Worcester Public Library
Salem Square
Worcester, MA 01608

## Michigan

Veterans Administration—RO
ATTN: Director
Patrick V. McNamara Federal Bldg
477 Michigan Avenue
Detroit, MI 48226

Calvin College Library
3207 Burton St SE
Grand Rapids, MI 49506

Central Michigan University
ATTN: Library Documents Section
Mt Pleasant, MI 48859

Delta College Library
Mackinaw and Kuch Rds
University Center, MI 48710

Detroit Public Library
5201 Woodward Ave
Detroit, MI 48202

Eastern Michigan University Lib
Ypsilanti, MI 48197

Grand Rapids Public Library
ATTN: Director of Libraries
60 Library Plaza NE
Grand Rapids, MI 49503

Hoyt Public Library
505 Janes Street
Saginaw, MI 48605

Kalamazoo Public Library
315 South Rose Street
Kalamazoo, MI 49007

Michigan State Library
Govt Ctr Lib Law Bldg
P O Box 30007
733 E Mich Ave
Lansing, MI 48909

Michigan State University Library
E Lansing, MI 48824

Michigan Tech University
ATTN: Library Documents Dept
Houghton, MI 49931

Michigan, University of
ATTN: Acq Sec Documents Unit
Harlan Hatcher Library
Ann Arbor, MI 48109

Northern Michigan Univ
ATTN: Documents
Olson Library
Marquette, MI 49855

Northwestern Michigan College
Mark Ostertin Library
1701 East Front Street
Traverse City, MI 49684

Oakland Comm College
Martin L King Lrng Res
27055 Orchard Lake Rd
Farmington, MI 48024

Olivet College Library
Olivet, MI 49076

State Historical Soc Lib
ATTN: Docs Serials Section
816 State St
Madison, MI 53706

Traverse City Public Library
322 Sixth St
Traverse City, MI 49684

Wayne State Univ Library
G Flint Purdy Library
5244 Gullen Mall
Detroit, MI 48202

Wayne State University Law Library
ATTN: Documents Dept
468 W Ferry St
Detroit, MI 48202

## Minnesota

Veterans Administration—RO
ATTN: Director
Fort Snelling Federal Bldg
P O Box 1820
St Paul, MN 55111

Anoka County Library
1100 90th Ave NE
Blaine, MN 55434

Bemidji State College
ATTN: Library
Bemidji, MN 56601

Carleton College Library
Northfield, MN 55057

Duluth Public Library
ATTN: Documents Section
520 W Superior Street
Duluth, MN 55802

Gustavus Adolphus College
ATTN: Library
Saint Peter, MN 56082

Hennepin County Libraries
ATTN: Government Documents
70th at York Avenue South
Minneapolis, MN 55435

Mankato State College
ATTN: Govt Publications
Mankato, MN 56001

Minneapolis Public Lib
300 Nicollet Mall
Minneapolis, MN 55401

Minnesota, University of
ATTN: Director of Libraries (Regional)
2030 University Avenue SE
Minneapolis, MN 55414

Moorhead State College
ATTN: Library
DS 306
Moorhead, MN 56560

St Paul Public Library
Saint Paul, MN 55102

## Mississippi

Veterans Administration—RO
ATTN: Director
1500 E Woodrow Wilson Avenue
Jackson, MS 39216

Delta State University
W B Roberts Library
Cleveland, MS 38732

Mississippi State University
Mitchell Memorial Library
Acquisition Dept
State College, MS 39762

Mississippi, University of
ATTN: Director of Libraries
P O Box 162
University, MS 38677

Southern Mississippi, Univ of
ATTN: Library
Southern Station Box 5053
Hattiesburg, MS 39401

### Missouri

Veterans Administration—RO
ATTN: Director
Federal Building
1520 Market Street, Rm 4600
St Louis, MO 63103

Kansas City Public Library
ATTN: Documents Div
311 E 12th Street
Kansas City, MO 64106

Missouri, University of
ATTN: Government Documents Library
Columbia, MO 65201

Missouri Univ at Kansas City Gen
5100 Rockhill Rd
Kansas City, MO 64110

Northeast Missouri State University
Pickler Memorial Library
Kirksville, MO 63501

Southeast Missouri State University
Kent Library
Cape Girardeau, MO 63701

Southwest Missouri State College
ATTN: Library
901 South National
Springfield, MO 65802

St Joseph Public Library
10th & Felix Sts
Saint Joseph, MO 64501

St Louis Public Library
1301 Olive Street
Saint Louis, MO 63103

Washington, University of
ATTN: Documents Div
John M Olin Library
660 Millbrook Blvd
Saint Louis, MO 63130

Central Missouri State College
ATTN: Government Documents
Ward Edwards Library
Warrensburg, MO 64093

### Montana

Veterans Administration—RO
ATTN: Director
Fort Harrison, MT 59636

Eastern Montana College Library
ATTN: Documents Department
1500 North 30th Street
Billings, MT 59101

Montana State Library
East Lyndale Avenue
Helena, MT 59601

Montana State University Lib
Bozeman, MT 59717

Montana, University of
ATTN: Director of Libraries (Regional)
Missoula, MT 59812

Northern Montana College Library
Havre, MT 59501

### Nebraska

Veterans Administration—RO
ATTN: Director
Federal Building
100 Centennial Mall North
Lincoln, NE 68505

Calvin T Ryan Library
ATTN: Government Documents Dept
Kearney State College
Kearney, NE 68847

Nebraska Library Comm
Nebraska Pub Clearinghouse
1420 P St
Lincoln, NE 68508

Nebraska Western College Library
1601 E 27th NE
Scottsbluff, Nebraska 69361

Nebraska, University of
ATTN: Director of Libraries (Regional)
Lincoln, NE 68588

Omaha Pub Lib Clark Branch
Business Scientific Tech Dept
215 South 15th St
Omaha, NE 68102

Omah, Univ oScottsbluff Public Library
1809 Third Avenue
Scottsbluff, NE 69361

### Nevada

Veterans Administration—RO
ATTN: Director
245 E Liberty Street
Reno, NV 89520

Nevada Library, Univ of
ATTN: Government Publ Dept
Reno, NV 89557

Nevada, University at Las Vegas
ATTN: Director of Libraries
James R. Dickinson Library
4505 Maryland Parkway
Las Vegas, NV 89154

Elko County Library
720 Court Street
Elko, NV 89801

### New Hampshire

Veterans Administration—RO
ATTN: Director
Federal Building
275 Chestnut Street
Manchester, NH 03103

Dartmouth College
Baker Library
Hanover, NH 03755

Manchester City Library
405 Pine Street
Manchester, NH 03104

New Hampshire University Lib
Durham, NH 03824

### New Jersey

Veterans Administration—RO
ATTN: Director
20 Washington Place
Newark, NJ 07102

Drew University
Rose Memorial Library
36 Madison Ave
Madison, NJ 07940

East Orange Public Lib
U S Government Depository
21 South Arlington Ave
East Orange, NJ 07018

Eastern Branch
Monmouth County Library
NJ Highway 35
Red Bank, NJ 07701

Fairleigh Dickinson Univ
ATTN: Depository Dept
Messler Library
Rutherford, NJ 07070

Free Pub Lib of Elizabeth
11 S Broad Street
Elizabeth, NJ 07202

Glassboro State College
Savitz Learning Res Ctr
Glassboro, NJ 08028

Jersey City State College
F A Irwin Lib Perdcls Doc Sec
2039 Kennedy Blvd
Jersey City, NJ 07305

Johnson Free Public Lib
275 Moore Street
Hackensack, NJ 07601

Newark Public Library
5 Washington St
Newark, NJ 07101

Ocean County College
Learning Resources Ctr
College Dr
Toms River, NJ 08073

Passaic Public Library
195 Gregory Ave
Passaic, NJ 07055

Phillipsburg Free Public Library
200 Frost Avenue
Phillipsburg, NJ 08865

Plainfield Public Library
Eight Street, Park Ave
Plainfield, NJ 07060

Princeton University Library
ATTN: Documents Division
Princeton, NJ 08544

Rutgers Camden Library Univ
300 North 4th Street
Camden, NJ 08102

Rutgers, The State University
John Cotton Dana
185 University Ave
Newark, NJ 07102

Stockton State College Library
Pomona, NJ 08240

Trenton Free Public Library
120 Academy Street
Trenton, NJ 08608

## New Mexico

Veterans Administration—RO
ATTN: Director
Dennis Chavez Federal Bldg
U S. Courthouse
500 Gold Avenue SW
Albuquerque, NM 87102

Eastern New Mexico Univ
Golden Library
Portales, NM 88130

Los Alamos National Scientific Lab
ATTN: Library
Mail Station 5000
P O Box 1663
Los Alamos, NM 87545

New Mexico State Library
P O Box 1629
Santa Fe, NM 87501

New Mexico State University
ATTN: Lib Documents Div
Box 3475
Las Cruces, NM 88003

New Mexico, University of
ATTN: Director of Libraries (Regional)
Zimmerman Library
Albuquerque, NM 87131

## New York

Veterans Administration—RO
ATTN: Director
Federal Building
111 W Huron
Buffalo, NY 14202

Veterans Administration—RO
ATTN: Director
252 Seventh Avenue
New York, NY 10001

Albany Public Library
161 Washington Avenue
Albany, New York 12210

B Davis Schwartz Mem Lib
C W Post Ctr, Long Island Univ
Greenvale, NY 11548

Benjamin F Feinberg Library
ATTN: Government Documents
State University College
Plattsburgh, NY 12901

Brooklyn College
ATTN: Documents Division
Bedford Ave & Ave H
Brooklyn, NY 11210

Buffalo & Erie Co Pub Lib
Subscription Div
Lafayette Square
Buffalo, NY 14203

Colgate Univ Library
ATTN: Reference Library
Hamilton, NY 13346

Columbia University Library
ATTN: Documents Service Center
420 W 118th St, Rm 327
New York, NY 10027

Cornell University Lib
Serial Dept
Ithaca, NY 14853

East Islip Public Library
381 East Main Street
East Islip, NY 11730

Elmira College
Gannett Tripp Learning Ctr
Elmira, NY 14901

Herbert H Lehman College
ATTN: Library Documents Division
Bedford Park Blvd W
Bronx, NY 10468

Hofstra Univ Library
ATTN: Documents Dept
Hempstead, NY 11550

Horrmann Library
Wagner College
Grymes Hill
Staten Island, NY 10301

Nassau Library System
900 Jerusalem Avenue
Uniondale, NY 11553

New York Public Library
Lenox Branch
476 5th Ave
New York, NY 10018

New York State Library
ATTN: Doc Control Cultural Ed Ctr
6th Floor
Cultural Education Center
Empire State Plaza
Albany, NY 12230

New York State, University of
ATTN: Docs Librarian
Milne Library
Geneseo, NY 14454

New York at Stony Brook, Univ of
ATTN: Main Lib Documents Section
Stony Brook, NY 11790

New York Col at Cortland, State Univ of
Memorial Library
Cortland, NY 13045

New York State, Univ of
ATTN: Library Documents Sec
Vestal Parkway East
Binghamton , NY 13901

New York State, Univ of
College at Purchase
Purchase, NY 10577

New York, State University of
ATTN: Documents Center
Penfield Library
Oswego, NY 13126

New York, State University of
ATTN: Documents Dept
Lockwood Memorial Library
Buffalo, NY 14260

New York, State University of
Drake Memorial Library
Brockport, NY 14420

New York University Library
ATTN: Documents Dept
7th Floor
70 Washington Sq So
New York, NY 10012

Niagara Falls Pub Lib
1425 Main St
Niagara Falls, NY 14305

Onondaga County Public Library
ATTN: Government Documents Section
335 Montgomery Street
Syracuse, NY 13202

Pratt Institute Library
Brooklyn, NY 11205

Rochester Library, University of
ATTN: Documents Section
River Campus Station
Rochester, NY 14617

Skidmore College
Saratoga Springs, NY 12866

St Bonaventure University
Friedsam Mem Library
St Bonaventure, NY 14778

St Lawrence University
Owen D Young Library
Canton, NY 13617

Syracuse University Library
ATTN: Documents Div
Ernest S Bird Library
222 Waverly Ave
Syracuse, NY 13210

University Libraries
ATTN: Director of Libraries
Suny/Buffalo
432 Capen Hall
Buffalo, NY 14620

Yeshiva University
Pollack Library
500 West 185th Street
New York, NY 10033

## North Carolina

Veterans Administration—RO
ATTN: Director
Federal Building
251 N Main Street
Winston Salem, NC 27102

Appalachian State University
ATTN: Library Documents
Boone, NC 28607

Charlotte & Mechlenburg Count Pub Lib
ATTN: E Correll
310 North Tyron Street
Charlotte, NC 28202

Davidson College
Hugh A & J Grey Mem Library
Davidson, NC 28036

Duke University
ATTN: Public Docs Dept
Wm R Perkins Library
Durham, NC 27706

East Carolina University
ATTN: Library Docs Dept
Greenville, NC 27834

Elon College Library
Box 187
Elon College, NC 27244

Gardner-Webb College
ATTN: Documents Librarian
POB 836
Boiling Springs, NC 28017

New Hanover County Public Library
409 Market St
Wilmington, NC 28401

North Carolina Agri & Tech State Univ
F D Bluford Library
Greensboro, NC 27411

North Carolina at Charlotte, Univ of
ATTN: Atkins Library Documents Dept
UNCC Station
Charlotte, NC 28223

North Carolina at Greensboro Library, Univ of
Walter Clinton Jackson
Greensboro, NC 27412

North Carolina at Wilmington, Univ of
William M Randall Lib
P O Box 3725
Wilmington, NC 28421

North Carolina Central University
James E Shepard Mem Library
Durham, NC 27727

North Carolina State University
D H Hill Library
P O Box 5007
Raleigh, NC 27607

North Carolina at Chapel Hill, University of
ATTN: BA SS Division Documents
Chapel Hill, NC 27514

Western Carolina University
Hunter Library
Cullowhee, NC 28723

## North Dakota

Veterans Administration—RO
ATTN: Director
21st Avenue & Elm Street
Fargo, ND 58102

Dickinson State College
Stoxen Library
Dickinson, ND 58601

Minot State College
Memorial Library
Minot, ND 58701

North Dakota State University
ATTN: Docs Librarian
Fed Documents Office
Fargo, ND 58105

North Dakota, University of
Chester Fritz Library
Grand Forks, ND 58201

## Ohio

Veterans Administration—RO
ATTN: Director
Anthony J Celebrezze Federal Bldg
1240 E 9th Street
Cleveland, OH 44199

Akron Public Library
55 South Main St
Akron, OH 44326

Akron University
ATTN: Government Documents
Bierce Library
Akron, OH 44325

Bowling Green State Univ
ATTN: Lib Govt Docs Services
Library Bldg
Bowling Green, OH 43402

Case Western Reserve University
Freiberger Library
11161 East Blvd
Cleveland, OH 44106

Cincinnati University Library
Cincinnati, OH 45221

Cleveland Public Library
ATTN: Documents Collection
325 Superior Avenue
Cleveland, OH 44114

Cleveland State Univ Lib
1860 E 22nd Street
Cleveland, OH 44115

Columbus & Franklin Cty Public Lib
96 South Grant Avenue
Columbus, OH 43215

Dayton & Montgomery City Pub Lib
215 E 3rd St
Dayton, OH 45402

Dayton, University of
300 College Park Ave
Dayton, OH 45469

Denison Univ Library
Granville, OH 43023

Kent State University Library
Kent, OH 44242

Kenyon College Library
Gambier, OH 43022

Miami Univ Library
Oxford, OH 45056

Oberlin College Library
Oberlin, OH 44074

Ohio State Library
State Office Bloc
65S Front St
Columbus, OH 43215

Ohio State University
ATTN: Libraries Documents Division
1858 Neil Ave
Columbus, OH 43210

Ohio University Library
Athens, OH 45701

Public Lib Cincinnati & Hamilton County
800 Vine Street
Cincinnati, OH 45202

Steubenville, University of
Starvaggi Memorial Library
Steubenville, OH 43952

Toledo Library, University of
2801 W Bancroft St
Toledo, OH 43606

Toledo Public Library
ATTN: Social Science Dept
325 Michigan St
Toledo, OH 43624

Wooster, College of
ATTN: Government Documents
Andrews Library
Wooster, OH 44691

Wright State Univ Library
Dayton, OH 45435

## Oklahoma

Veterans Administration—RO
ATTN: Director
Federal Building
125 S Main Street
Muskogee, OK 74401

Central State University
ATTN: Library Documents Dept
Edmond, OK 73034

East Central University
Linscheid Library
Ada, OK 74802

Northeastern Oklahoma State Univ
John Vaughan Library
Tahlequah, OK 74464

Northwestern State Univ Library
Alva, OK 73717

Oklahoma City Univ Library
2501 North Blackwelder
Oklahoma City, OK 73106

Oklahoma City Univ Library
Stillwater, OK 74074

Oklahoma Dept of Libs
ATTN: U S Govt Documents
200 NE 18th St
Oklahoma City, OK 73105

Oklahoma, University of
ATTN: Documents Div
P O Box 2758
Boulevard Station
Norman, OK 73069

Tulsa, University of
McFarlin Library
600 S College
Tulsa, OK 74104

## Oregon

Veterans Administration—RO
ATTN: Director
Federal Building
1220 SW 3rd Avenue
Portland, OR 97204

Eastern Oregon College Library
La Grande, OR 97850

Oregon State Library
State Library Bldg
Salem, OR 97310

Oregon, University of
ATTN: Documents Section
University Library
Eugene, OR 97403

Portland Library, Assoc of
Social Sci & Sci Dept
801 SW 10th Ave
Portland, OR 97205

Portland State Univ Lib
P O Box 1151
Portland, OR 97207

Reed College Library
3203 SE Woodstock
Portland, OR 97202

Southern Oregon College
ATTN: Library
1250 Sisiyou Blvd
Ashland, OR 97520

## Pennsylvania

Veterans Administration-RO
ATTN: Director
1000 Liberty Avenue
Pittsburgh, PA 15222

Veterans Administration—RO
ATTN: Director
5000 Wissahickom Avenue
Philadelphia, PA 19144

Allegheny College
Pelletier Library
North Main Street
Meadville, PA 16335

Altoona Area Public Library
1600 Fifth Ave
Altoona, PA 16602

Bucknell University
Ellen Clarke Bertrand Lib
Lewisburg, PA 17837

Carnegie Library of Pittsburgh
4400 Forbes Avenue
Pittsburgh, PA 15213

Carnegie Mellon University
ATTN: Director of Libraries
Pittsburgh, PA 15213

John J Wright Library
La Roche College
9000 Babcock Blvd
Pittsburgh, PA 15237

Millersville State College
Ganser Library
Millersville, PA 17551

Pennsylvania State Library
ATTN: Government Publications Section
P O Box 1601
Harrisburg, PA 17105

Pennsylvania State University
ATTN: Library Document Sec
University Park, PA 16802

Pennsylvania, University of
ATTN: Director of Libraries
3420 Walnut Street
Philadelphia, PA 19104

Philadelphia, Free Lib of
ATTN: Govt Publications Dept
Logan Square
Philadelphia, PA 19103

Pittsburg, University of
ATTN: Documents Office G8
Hillman Library
Pittsburgh, PA 15260

Reading Public Library
5th & Franklin Sts
Reading, PA 19602

Scranton Public Library
N Washington & Vine Streets
Scranton, PA 18503

Slippery Rock State College Library
Slippery Rock, PA 16057

Swarthmore College Lib
ATTN: Reference Dept
Swarthmore, PA 19081

Temple University
Paley Library Docs Rm
Philadelphia, PA 19122

West Chester State Coll
ATTN: Documents Dept
Francis Harvey Green Library
West Chester, PA 19380

Westmoreland Cty Comm College
ATTN: Learning Resource Ctr
Armbrust Rd
Youngwood, PA 15697

### Philippines

Veterans Administration—RO
ATTN: Director
1131 Roxas Blvd
Manila, Phillippines
APO San Francisco 96528

### Puerto Rico

Veterans Administration—RO
ATTN: Director
U S Courthouse & Federal Bldg
Carlos E Chardon Street
Hato Rey
San Juan, PR 00918

Puerto Rico, University of
ATTN: Doc & Maps Room
General Library
San Juan, PR 00931

### Rhode Island

Veterans Administration—RO
ATTN: Director
321 S Main Street
Providence, RI 02903

Brown University
John D Rockefeller Jr Library
Prospect Street
Providence, RI 02912

Providence College
Phillips Mem Library
River Ave at Eaton St
Providence, RI 02918

Providence Public Library
150 Empire St
Providence, RI 02903

Westerly Public Library
Memorial Library Association of Westerly
Broad St, Box 356
Westerly, RI 02891

Rhode Island Library, University of
ATTN: Govt Publications Office
Wakefield, RI 02881

Rhode Island, University of
ATTN: Director of Libraries
Kingston, RI 02908

### South Carolina

Veterans Administration—RO
ATTN: Director
1801 Assembly Street
Columbia, SC 29201

Charleston County Library
404 King St.
Charleston, South Carolina 29403

Clemson University
ATTN: Director of Libraries
Clemson, SC 29631

Greenville County Library
300 College St
Greenville, SC 29601

Richland County Pub Lib
1407 Sumter Street
Columbia, SC 29201

South Carolina State Library
1500 Senate Street
Columbia, SC 29201

South Carolina, University of
ATTN: Government Documents
Thomas Cooper Library
Columbia, SC 29208

Winthrop College
ATTN: Documents Dept
Dacus Library
Rock Hill, SC 29733

### South Dakota

Veterans Administration—RO
ATTN: Director
Courthouse Plaza Bldg
300 North Dakota Avenue
Sioux Falls, SD 57101

H M Briggs Library
South Dakota University
University Station
Brookings, SD 57006

Rapid City Public Library
P O Box 3090
Rapid City, SD 57709

South Dakota Sch of Mines & Tech Library
Rapid City, SD 57701

South Dakota State Library
ATTN: Federal Documents Department
State Library Bldg
Pierre, SD 57501

South Dakota, University of
ATTN: Documents Librarian
I D Weeks Library
Vermillion, SD 57069

### Tennessee

Veterans Administration—RO
ATTN: Director
110 9th Avenue S
Nashville, TN 37203

Chattanooga Hamilton Co
Bicentennial Library
1001 Broad Street
Chattanooga, TN 37402

East Tennessee State Univ
ATTN: Documents Dept
Sherrod Lib
University Station
Johnson City, TN 37614

Memphis & Shelby Co
Pub Lib & Info Ctr
1850 Peabody Ave
Memphis, TN 38104

Memphis State University
John W Brister Library
Memphis, TN 38152

Public Library of Nashville
and Davidson County
8th Ave North at Union
Nashville, TN 37203

Tennessee Technological University
Jere Whitson Mem Library
Cookeville, TN 38501

Tennessee, University of
ATTN: Director of Libraries
Knoxville, TN 37916

Vanderbilt University Library
ATTN: Govt Documents Section
Central Documents Unit
Nashville, TN 37203

### Texas

Veterans Administration-RO
ATTN: Director
2515 Murworth Drive
Houston, TX 77054

Veterans Administration—RO
ATTN: Director
1400 N Valley Mills Drive
Waco, TX 76710

Angelo State University Library
2601 West Avenue North
San Angelo, TX 76901

Arthur Hopkins Library
Austin College
Sherman, TX 75090

Baylor University Library
ATTN: Docs Dept
Box 6307, B U Station
Waco, TX 76706

Corpus Christi State University Lib
6300 Ocean Drive
Corpus Christi, TX 78412

Dallas County Public Library
414 South R L Thornton Freeway
Dallas, TX 75203

Dallas Public Library
Commerce Street
Dallas, TX 75201

East Texas State University
ATTN: Library
East Texas Station
Commerce, TX 75428

El Paso Public Library
ATTN: Documents & Geneology Dept
501 North Oregon Street
El Paso, TX 79901

Fort Worth Public Library
300 Taylor Street
Fort Worth, TX 76102

Hardin-Simmons University Library
Abilene, TX 79601

Houston Library, University of
ATTN Documents Div
3801 Cullen Blvd
Houston, TX 77004

Houston Public Library
Julia Ideson Bldg
500 McKinney
Houston, TX 77002

Midwestern University
Moffett Library
3410 Taft St
Wichita Falls, TX 76308

North Texas State Univ Library
North Texas, TX 76203

Pan American University Library
Edinburg, TX 78539

Rice University
ATTN: Director of Libraries
P O Box 1892
Houston, TX 77001

San Antonio Public Library
ATTN: Bus Science & Tech Dept
203 S St Marys St
San Antonio, TX 78205

Southern Methodist University
Fondren Library
Dallas, TX 75275

Texas A & M University Library
College Station, TX 77843

Texas at Arlington, University of
ATTN: Library Documents
Arlington, TX 76019

Texas at Austin, University of
Lyndon B Johnson Sch of Public Affairs
Austin, TX 78712

Texas at Austin, University of
ATTN: Documents Coll
Perry Castaneda Lib Pcl 2402D
Austin, TX 78712

Texas at San Antonio, University of
ATTN: Library
San Antonio, TX 78285

Texas Christian University
Mary Couts Burnett Lib
Fort Worth, TX 76129

Texas State Library
ATTN: U S Documents Section
P O Box 12927
Austin, TX 78711

Texas Tech University Library
ATTN: Government Documents Dept
Lubbock, TX 79409

Trinity University Library
ATTN: Documents Collection
715 Stadium Dr
San Antonio, TX 78284

West Texas State University
ATTN: Library
West Texas Station
Canyon, TX 79015

## Utah

Veterans Administration—RO
ATTN: Director
Federal Building
125 S State Street
Salt Lake City, UT 84138

Brigham Young University
ATTN: Documents Collection
Law Library
Provo, UT 84602

Brigham Young University
ATTN: Documents & Map Section
Lee Library
Provo, UT 84602

Southern Utah State College Library
ATTN: Documents Department
Cedar City, UT 84720

Utah State University
Merrill Library LRC
UMC 30
Logan, UT 84322

Utah, University of
ATTN: Special Collections
Marriott Library
Reference Librarian
Salt Lake City, UT 84112

Utah, University of
ATTN: Director of Libraries
Spencer S Eccles Health Sciences Lib
Building 89
Salt Lake City, UT 84112

Weber State College Library
3750 Harrison Blvd
Ogden, UT 84408

## Vermont

Veterans Administration—RO
ATTN: Director
White River Junction, VT 05001

Middlebury College Library
Middlebury, VT 05753

Vermont, University of
ATTN: Director of Libraries
Burlington, VT 05405

## Virginia

Veterans Administration—RO
ATTN: Director
210 Franklin Road, SW
Roanoke, VA 24011

Chesapeake Pub Lib System
Civic Ctr
300 Cedar Rd
Chesapeake, VA 23320

Hollins College
Fishburn Library
Hollins College, VA 24020

James Madison University
Madison Memorial Library
Harrisonburg, VA 22807

Old Dominion University
ATTN: Doc Dept Univ Library
Hampton Blvd
Norfolk, VA 23508

Virginia Commonwealth Univ
James B Cabell Library
901 Pake Ave
Richmond, VA 23220

Virginia Military Institute
Preston Library
Lexington, VA 24450

Virginia Polytechnic Inst Lib
ATTN: Docs Dept
Blacksburg, VA 24061

Virginia State Library
ATTN: Serials Section
Richmond, VA 23219

Virginia, University of
ATTN: Public Documents
Charlottesville, VA 22903

William & Mary College
ATTN: Docs Dept
Swen Library
Williamsburg, VA 23185

## Washington

Veterans Administration–RO
ATTN: Director
Federal Office Building
915 2nd Avenue
Seattle, WA 98174

Central Washington University
ATTN: Library Docs Section
Ellensburg, WA 98926

Eastern Washington Univ
The Library
Cheney, WA 99004

Everett Public Library
2700 Hoyt Ave
Everett, WA 98201

Seattle Public Library
ATTN: Ref Documents Asst
4th and Madison
Seattle, WA 98104

Spokane Public Library
ATTN: Reference Dept
West 906 Main Ave
Spokane, WA 99201

Tacoma Public Library
1102 S Tacoma Ave
Tacoma, WA 98402

Washington State Library
ATTN: Documents Section
Olympia, WA 98501

Washington State University
ATTN: Lib Documents Section
Pullman, WA 99164

Washington University Libraries FM-25
ATTN: Director of Libraries
Seattle, WA 98195

Western Washington Univ
Wilson Library
516 High St
Bellingham, WA 98225

Whitman College
Penrose Memorial Library
Walla Walla, WA 99362

## West Virginia

Veterans Administration–RO
ATTN: Director
640 4th Avenue
Huntington, WV 24701

Salem College Library
Salem, WV 26426

West Virginia College of Grad Studies Lib
Institute, WV 25112

West Virginia, University of
ATTN: Director of Libraries (Regional)
Morgantown, WV 26506

## Wisconsin

Veterans Administration-RO
ATTN: Director
342 N Water Street
Milwaukee, WI 53202

Beloit College Libraries
ATTN: Serials Documents Department
Beloit, WI 53511

Fond du Lac Public Lib
32 Sheboygan St
Fond du Lac, WI 54935

Lawrence University
ATTN: Documents Dept
Seeley G Mudd Library
Appleton, WI 54912

Marathon County Public Library
400 First Street
Wausau, WI 54401

Milwaukee Pub Lib
814 W Wisconsin Ave
Milwaukee, WI 53233

Superior Public Library
1204 Hammond Ave
Superior, WI 54880

Wisconsin at Whitewater, University of
ATTN: Government Documents Library
Harold Andersen Library
Whitewater, WI 53190

Wisconsin Milwaukee University
Library Docs
Milwaukee, WI 53201

Wisconsin Oshkosh University
Forrest R Polk Library
800 Algoma Blvd
Oshkosh, WI 54901

Wisconsin Platteville University
Doc Unit Library
725 W Main St
Platteville, WI 53818

Wisconsin Univ at Stevens Point
ATTN: Docs Section
Learning Resources Ctr
Stevens Point, WI 54481

Wisconsin, University of
ATTN: Govt Pubs Dept
Green Bay Library
Green Bay, WI 54302

Wisconsin, University of
ATTN: Acquisitions Department
Memorial Library
128 State Street
Madison, WI 53706

## Wyoming

Veterans Administration–RO
ATTN: Director
2360 E Pershing Blvd
Cheyenne, WY 82001

Central Wyoming College Library
P O Box 80
Riverton, WY 82501

Coe Library
ATTN: Documents Division
P O Box 3334
University Station
Laramie, WY 82701

Natrona County Public Library
307 East Second Street
Casper, WY 82601

Western Wyoming Community College Lib
2500 College Drive
Rock Springs, WY 82901

Wyoming State Library
Supreme Court & Library Bldg
Cheyenne, WY 82001

# CURRENT NTIS PRICE LIST FOR HISTORICAL VOLUMES

The following is a price list of currently available atmospheric nuclear test series historical volumes which are discussed in the DNA Fact Sheet. Copies of these publications may be purchased through the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161. It is essential that you reference the publication number and title when ordering publications. Microfiche copies, which require special reading machines, are also available for about $4.00 per microfiche. Most documents will consist of only one microfiche.

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|---|---|---|---|---|
| DNA 6000F | Operation WIGWAM/1955 | 252 | ADA105685 | $22.95 |
| DNA 6001F | Operation PLUMBBOB/Shot GALILEO | 85 | ADA103829 | 11.95 |
| DNA 6002F | Operation PLUMBBOB/Shot HOOD | 110 | ADA138287 | 16.95 |
| DNA 6003F | Operation PLUMBBOB/Shot PRISCILLA | 104 | ADA105674 | 16.95 |
| DNA 6004F | Operation PLUMBBOB/Shot SMOKY | 155 | ADA103828 | 16.95 |
| DNA 6005F | Operation PLUMBBOB/1957 | 311 | ADA107317 | 28.95 |
| DNA 6006F | Operation PLUMBBOB/Shots DIABLO to FRANKLIN PRIME | 202 | ADA118683 | 22.95 |
| DNA 6007F | Operation PLUMBBOB Shots WHEELER to MORGAN | 146 | ADA118680 | 16.95 |
| DNA 6008F | Operation PLUMBBOB Shots BOLTZMANN to WILSON | 144 | ADA118681 | 16.95 |
| DNA 6009F | Operation TEAPOT/1955 | 275 | ADA113537 | 22.95 |
| DNA 6010F | Operation TEAPOT Shots WASP to HORNET | 188 | ADA114080 | 16.95 |
| DNA 6011F | Operation TEAPOT/Shot Bee | 87 | ADA113539 | 11.95 |
| DNA 6012F | Operation TEAPOT/Shot Apple 2 | 105 | ADA113538 | 16.95 |
| DNA 6013F | Operation TEAPOT Shots ESS-MET/Shot ZUCCHINI | 260 | ADA114082 | 22.95 |
| DNA 6014F | Operation UPSHOT-KNOTHOLE/1953 | 266 | ADA121624 | 22.95 |
| DNA 6015F | Operation UPSHOT-KNOTHOLE Shot BADGER | 100 | ADA121671 | 11.95 |
| DNA 6016F | Operation UPSHOT-KNOTHOLE Shot SIMON | 94 | ADA121667 | 11.95 |
| DNA 6017F | Operation UPSHOT-KNOTHOLE Shots ANNIE to RAY | 208 | ADA121635 | 22.95 |
| DNA 6018F | Operation UPSHOT-KNOTHOLE Shots ENCORE to CLIMAX | 232 | ADA121634 | 22.95 |
| DNA 6019F | Operation TUMBLER-SNAPPER | 220 | ADA122242 | 22.95 |
| DNA 6020F | Operation TUMBLER-SNAPPER Shots ABLE, BAKER, CHARLIE, and DOG | 234 | ADA122241 | 22.95 |
| DNA 6021F | Operation TUMBLER-SNAPPER Shots EASY, FOX, GEORGE, and HOW | 180 | ADA122240 | 16.95 |
| DNA 6022F | Operation RANGER Shots ABLE, BAKER, EASY, BAKER-2, FOX | 182 | ADA118684 | 16.95 |
| DNA 6023F | Operation BUSTER-JANGLE/1951 | 191 | ADA123441 | 16.95 |
| DNA 6024F | Operation BUSTER-JANGLE Shots ABLE to EASY | 141 | ADA122358 | 16.95 |
| DNA 6025F | Operation BUSTER-JANGLE Shots SUGAR and UNCLE | 133 | ADA122243 | 16.95 |
| DNA 6026F | Operation HARDTACK II | 242 | ADA130929 | 22.95 |
| DNA 6027F | Operation DOMINIC II Shots LITTLE FELLER II, JOHNIE BOY, SMALL BOY, LITTLE FELLER I | 218 | ADA128367 | 22.95 |
| DNA 6028F | Project TRINITY/1945-1946 | 76 | ADA128035 | 11.95 |
| DNA 6029F | PLOWSHARE | 132 | ADA130165 | 16.95 |
| DNA 6030F | Safety Experiments Nov 1955-Mar 1958 | 80 | ADA123423 | 11.95 |
| DNA 6031F | Reference Manual | 224 | ADA136818 | 22.95 |
| DNA 6032F | Operation CROSSROADS | 568 | ADA146562 | 40.95 |
| DNA 6033F | Operation SANDSTONE | 222 | ADA139151 | 22.95 |
| DNA 6034F | Operation GREENHOUSE | 334 | ADA134735 | 28.95 |
| DNA 6035F | Operation CASTLE/1954 | 530 | ADA117574 | 40.95 |
| DNA 6036F | Operation IVY/1952 | 364 | ADA128082 | 28.95 |
| DNA 6037F | Operation REDWING | 442 | ADA134795 | 34.95 |
| DNA 6038F | Operation HARDTACK I | 474 | ADA136819 | 34.95 |
| DNA 6039F | Operation ARGUS | 135 | ADA122341 | 16.95 |
| DNA 6040F | Operation DOMINIC I | 436 | ADA136820 | 34.95 |

# ANTPR PARTICIPANT SUMMARY

EDGAR , LESTER , 5040 JACKSON ST #13

RA 38506482 N HIGHLANDS , CA 95660

431-34-3646

## SANDSTONE

RECONSTRUCTED EXTERNAL DOSE (IN REM)

| EXPOSURE PERIOD (YY/MM/DD YY/MM/DD) | GAMMA |
|---|---|
| 48/04/01 48/05/31 | 0.060 |

TOTAL OPERATION DOSE 0.060

**Defense Nuclear Agency**
6801 Telegraph Road
Alexandria, Virginia 22310-3398

AUG 7 1989

Dear Veteran:

In light of the significant changes in the Nuclear Test Personnel Review Program, I felt it important to bring you up-to-date on the latest findings and recent developments.

I have attached a series of four fact sheets which should be of interest to you. They provide an overview of our collective efforts to assist veterans in obtaining information about their participation and radiation exposure history during nuclear testing. This information is often requested to assist in the preparation of claims that are submitted to the Department of Veterans Affairs (VA), formerly the Veterans Administration.

As you may already know, last year Congress passed Public Law 100-321, "Radiation-Exposed Veterans Compensation Act of 1988." This provides presumptive compensation for some veterans who have one of 13 radiogenic diseases. I have attached a copy of the Public Law which lists these diseases, and an excerpt from the Federal Register of June 21, 1989 which explains this law. In general, one may qualify for service connected compensation by having one of the 13 radiogenic diseases and by satisfying one of the following criteria: received exposure to radiation from the detonation of a nuclear device at the United States atmospheric or underwater weapons tests; participated as part of the occupation forces who performed official military duties within a 10-mile radius of Hiroshima and Nagasaki; or received exposure to radiation while interned as a prisoner of war in the vicinity of Hiroshima and Nagasaki. You may have to submit a new claim to the VA, in addition to any past claim you may have filed, in order to be considered under this new law. If you have questions about your participation, you may wish to call our toll-free telephone line (800-462-3683) or call collect (703-285-5610). Of course, any actions or decisions pertaining to your claim would have to be addressed by the VA.

I wish to express my personal appreciation for your participation in the Nuclear Test Personnel Review Program and for your continuing support by sharing your experiences with us. If you know other veterans who may be eligible, please encourage them to contact us.

Sincerely,

J. T. PARKER
Vice Admiral, USN
Director

Enclosures:
as stated

Public Law 100-321
100th Congress

# An Act

To amend title 38, United States Code, to provide a presumption of service connection to veterans (and survivors of such veterans) who participated in atmospheric or underwater nuclear tests as part of the United States nuclear weapons testing program or in the American occupation of Hiroshima or Nagasaki, Japan, and who suffer from certain diseases that may be attributable to exposure to ionizing radiation, and other purposes.

May 20, 1988
[H.R. 1811]

SECTION 1. SHORT TITLE.

Radiation-Exposed Veterans Compensation Act of 1988.
38 USC 101 note.

This Act may be cited as the "Radiation-Exposed Veterans Compensation Act of 1988".

SEC. 2. PRESUMPTION OF SERVICE CONNECTION FOR CERTAIN RADIATION-EXPOSED VETERANS.

(a) PRESUMPTION.—Section 312 of title 38, United States Code, is amended by adding at the end the following new subsection:

"(c)(1) For the purposes of section 310 of this title, and subject to the provisions of section 313 of this title, a disease specified in paragraph (2) of this subsection becoming manifest in a radiation-exposed veteran to a degree of 10 percent or more within the presumption period (as specified in paragraph (3) of this subsection) shall be considered to have been incurred in or aggravated during the veteran's service on active duty, notwithstanding that there is no record of evidence of such disease during the period of such service.

"(2) The diseases referred to in paragraph (1) of this subsection are the following:

"(A) Leukemia (other than chronic lymphocytic leukemia).
"(B) Cancer of the thyroid.
"(C) Cancer of the breast.
"(D) Cancer of the pharynx.
"(E) Cancer of the esophagus.
"(F) Cancer of the stomach.
"(G) Cancer of the small intestine.
"(H) Cancer of the pancreas.
"(I) Multiple myeloma.
"(J) Lymphomas (except Hodgkin's disease).
"(K) Cancer of the bile ducts.
"(L) Cancer of the gall bladder.
"(M) Primary liver cancer (except if cirrhosis or hepatitis B is indicated).

"(3) The presumption period for purposes of paragraph (1) of this subsection is the 40-year period beginning on the last date on which the veteran participated in a radiation-risk activity, except that such period shall be the 30-year period beginning on that date in the case of leukemia (other than chronic lymphocytic leukemia).

"(4) For the purposes of this subsection:

19-139 O - 88 (321)

"(A) The term 'radiation-exposed veteran' means a veteran who, while serving on active duty, participated in a radiation-risk activity.

"(B) The term 'radiation-risk activity' means any of the following:

"(i) Onsite participation in a test involving the atmospheric detonation of a nuclear device.

"(ii) The occupation of Hiroshima or Nagasaki, Japan, by United States forces during the period beginning on August 6, 1945, and ending on July 1, 1946.

"(iii) Internment as prisoner of war in Japan (or service on active duty in Japan immediately following such internment) during World War II which (as determined by the Administrator) resulted in an opportunity for exposure to ionizing radiation comparable to that of veterans described in clause (ii) of this subparagraph.".

38 USC 312 note.

(b) EFFECTIVE DATE.—Subsection (c) of section 312 of title 38, United States Code, as added by subsection (a), shall take effect on May 1, 1988.

(c) REQUIREMENTS REGARDING VETERANS' ENVIRONMENTAL HAZARDS ADVISORY COMMITTEE SCIENTIFIC COUNCIL REPORTS.—Section 6(d)(3) of the Veterans' Dioxin and Radiation Exposure Compensation Standards Act (Public Law 98-542) is amended by striking out "the Committee and the Administrator" and inserting in lieu thereof "the Committee, the Administrator, and the Committees on Veterans' Affairs of the Senate and House of Representatives"

38 USC 354 note.

Approved May 20, 1988.

LEGISLATIVE HISTORY—H.R. 1811:

HOUSE REPORTS: No. 100-235 (Comm. on Veterans' Affairs).
CONGRESSIONAL RECORD:
Vol. 133 (1987): July 28, considered and passed House.
Vol. 134 (1988): Apr. 25, considered and passed Senate, amended.
May 2, House concurred in Senate amendments.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS, Vol. 24 (1988):
May 20, Presidential statement.

38 CFR Part 3

RIN 2900-AD53

## Diseases Subject to Presumptive Service Connection, and Payment of the Special Allowance Under Section 156 of Pub. L. 97-377

**AGENCY:** Department of Veterans Affairs.

**ACTION:** Final regulations.

**SUMMARY:** The Department of Veterans Affairs (VA) has amended two regulations to implement recently enacted legislation. The chronic diseases subject to presumption of service connection and the diseases subject to presumption of service connection for certain prisoners of war (POWs) are expanded. Presumptions of service connection are established for certain cancers for radiation-exposed veterans. The prohibition against payments under the Restored Entitlement Program for Survivors (REPS) for one group of claimants has been removed. The intended effect of these changes is to expand eligibility for certain claimants in accordance with the law.

**EFFECTIVE DATE:** These changes are effective May 20, 1988, the date of enactment of Pub. L. 100-322, except for § 3.309(d) which is effective May 1, 1988, in accordance with Pub. L. 100-321.

(d) *Diseases specific to radiation-exposed veterans.* (1) The diseases listed in paragraph (d)(2) of this section shall be service-connected if they become manifest in a radiation-exposed veteran as defined in paragraph (d)(4) of this section to a degree of 10 percent or more within the presumptive period specified in paragraph (d)(3) of this section, provided the rebuttable presumption provisions of §3.307 of this part are also satisfied.

(2) The diseases referred to in paragraph (d)(1) of this section are the following:

(i) Leukemia (other than chronic lymphocytic leukemia).
(ii) Cancer of the thyroid.
(iii) Cancer of the breast.
(iv) Cancer of the pharynx.
(v) Cancer of the esophagus.
(vi) Cancer of the stomach.
(vii) Cancer of the small intestine.
(viii) Cancer of the pancreas.
(ix) Multiple myeloma.
(x) Lymphomas (except Hodgkin's disease).
(xi) Cancer of the bile ducts.
(xii) Cancer of the gall bladder.
(xiii) Primary liver cancer (except if cirrhosis or hepatitis B is indicated).

(3) The presumptive period referred to in paragraph (d)(1) of this section is:

(i) In the case of leukemia (other than chronic lymphocytic leukemia), the 30-year period beginning on the last date on which the veteran participated in a radiation-risk activity.

(ii) In the case of other disease listed in paragraph (d)(2) of this section, the 40-year period beginning on the last date on which the veteran participated in a radiation-risk activity.

(4) For purposes of this section:

(i) The term "radiation-exposed veteran" means a veteran who, while serving on active duty, participated in a radiation-risk activity.

(ii) The term "radiation-risk activity" means:

(A) Onsite participation in a test involving the atmospheric detonation of a nuclear device by the United States.

(B) The occupation of Hiroshima or Nagasaki, Japan, by United States forces during the period beginning on August 6, 1945, and ending on July 1, 1946.

(C) Internment as a prisoner of war in Japan (or service on active duty in Japan immediately following such internment) during World War II which resulted in an opportunity for exposure to ionizing radiation comparable to that of the United States occupation forces in Hiroshima or Nagasaki, Japan, during the period beginning on August 6, 1945, and ending on July 1, 1946.

(iii) The term "atmospheric detonation" includes underwater nuclear detonations.

(iv) The term "onsite participation" means:

(A) During the official operational period of an atmospheric nuclear test, presence at the test site, or performance of official military duties in connection with ships, aircraft or other equipment used in direct support of the nuclear test.

(B) During the six month period following the official operational period of an atmospheric nuclear test, presence at the test site or other test staging area to perform official military duties in connection with completion of projects related to the nuclear test including decontamination of equipment used during the nuclear test.

(C) Service as a member of the garrison or maintenance forces on Eniwetok during the periods June 21, 1951 through July 1, 1952, August 7, 1956 through August 7, 1957 or November 1, 1958 through April 30, 1959.

(D) Assignment to official military duties at Naval Shipyards involving the decontamination of ships that participated in Operation Crossroads.

(v) The term "operational period" means:

(A) For Operation *TRINITY* the period July 16, 1945 through August 6, 1945.

(B) For Operation *CROSSROADS* the period July 1, 1946 through August 31, 1946.

(C) For Operation *SANDSTONE* the period April 15, 1948 through May 20, 1948.

(D) For Operation *RANGER* the period January 27, 1951 through February 6, 1951.

(E) For Operation *GREENHOUSE* the period April 8, 1951 through June 20, 1951.

(F) For Operation *BUSTER-JANGLE* the period October 22, 1951 through December 20, 1951.

(G) For Operation *TUMBLER-SNAPPER* the period April 1, 1952 through June 20, 1952.

(H) For Operation *IVY* the period November 1, 1952 through December 31, 1952.

(I) For Operation *UPSHOT-KNOTHOLE* the period March 17, 1953 through June 20, 1953.

(J) For Operation *CASTLE* the period March 1, 1954 through May 31, 1954.

(K) For Operation *TEAPOT* the period February 18, 1955 through June 10, 1955.

(L) For Operation *WIGWAM* the period May 14, 1955 through May 15, 1955.

(M) For Operation *REDWING* the period May 5, 1956 through August 6, 1956.

(N) For Operation *PLUMBBOB* the period May 28, 1957 through October 22, 1957.

(O) For Operation *HARDTACK I* the period April 28, 1958 through October 31, 1958.

(P) For Operation *ARGUS* the period August 27, 1958 through September 10, 1958.

(Q) For Operation *HARDTACK II* the period September 19, 1958 through October 31, 1958.

(R) For Operation *DOMINIC I* the period April 25, 1962 through December 31, 1962.

(S) For Operation *DOMINIC II/ PLOWSHARE* the period July 6, 1962 through August 15, 1962.

(vi) The term "occupation of Hiroshima or Nagasaki, Japan, by United States forces" means official military duties within 10 miles of the city limits of either Hiroshima or Nagasaki, Japan, which were required to perform or support military occupation functions such as occupation of territory, control of the population, stabilization of the government, demilitarization of the Japanese military, rehabilitation of the infrastructure or deactivation and conversion of war plants or materials.

(vii) Former prisoners of war who had an opportunity for exposure to ionizing radiation comparable to that of veterans who participated in the occupation of Hiroshima or Nagasaki, Japan, by United States forces shall include those who, at any time during the period August 6, 1945, through July 1, 1946:

(A) Were interned within 75 miles of the city limits of Hiroshima or within 150 miles of the city limits of Nagasaki, or

(B) Can affirmatively show they worked within the areas set forth in paragraph (d)(4)(vii)(A) of this section although not interned within those areas, or

(C) Served immediately following internment in a capacity which satisfies the definition in paragraph (d)(4)(vi) of this section, or

(D) Were repatriated through the port of Nagasaki.

(Authority: 38 U.S.C. 312)

# Fact Sheet

dna

**Defense Nuclear Agency**
Public Affairs Office
Washington, D.C. 20305

January 1989

Subject: Nuclear Test Personnel Review (NTPR)

Since 1978, the Defense Nuclear Agency (DNA) has been conducting a major program to identify the approximately 200,000 Department of Defense (DoD) military and civilian personnel who participated in some 235 nuclear tests that were conducted during the atmospheric test series, primarily in Nevada and the Pacific Ocean. This NTPR program has involved intensive, high priority research of the broadest scope. Managed by a special office at DNA that is dedicated to identifying all such veterans and providing them with the best available estimates of radiation exposure for each, program personnel have compiled a roster of DoD personnel involved in the atmospheric nuclear tests. In addition, program personnel have developed a history of each atmospheric nuclear event that involved DoD participants, collected and analyzed all recorded dosimetry, and provided calculated doses in cases where recorded doses are unavailable or are incomplete. The program has also supported studies to ascertain whether adverse health effects are being experienced by test veterans that could be attributed to the tests.

An extensive public outreach program has been conducted to insure maximum interface with the thousands of test participants, to share with them the vast amount of data that has been collected on their behalf, and to advise them of the specifics of their individual involvement and radiation exposure history insofar as can be estimated from available records. Over 100 archives nationwide have been researched for relevant information; a well organized and easily accessed Coordination and Information Center has been established in Las Vegas, Nevada; over 40 historical volumes and more than 25 analytical reports have been developed to provide details of each test and operation; and a reading room has been established at DNA Headquarters to assist in making these data available to the public. All NTPR reports also have been placed in libraries throughout the country as well as at Veterans Administration (VA) offices to allow ready access to these important documents. To date, over 60,000 participants or their representatives have made personal contact with the program and have received a letter containing all the information that the NTPR has located on their participation. These contacts also have been followed up with personal letters, which provide the latest information and current important developments.

A major objective of the program is to assist veterans in obtaining information for their VA claims regarding their exposure to ionizing radiation at atmospheric nuclear tests. DNA has supported and continues to sponsor several important studies conducted by the National Academy of Sciences (NAS) to determine whether there is an unusually high incidence of mortality among nuclear test participants.

Under the mandates of Public Laws 98-542 and 100-321, DNA continues to identify nuclear test participants, their radiation risk activities, and the resultant radiation doses, thereby facilitating the health care and/or compensation of veterans as authorized by these laws. The VA advises that free medical examinations are available at VA facilities to any former military test participant, as well as medical care for conditions that the VA considers to be related to exposure to ionizing radiation. For the relatively few individuals who received doses in excess of today's Federal guidance (less than one percent of all participants), DNA has established personal contact with each for which an address could be found and encouraged them to undergo this examination. No adverse health effects attributable to radiation exposure have been detected among this unique higher-dose group of veterans.

Specific Accomplishments/Findings

DNA continues to expand upon its work to research the many important issues surrounding the nation's atmospheric nuclear test program. To date:

- Over 200,000 test participants have been identified and researched as to their specific involvement and their recorded radiation exposure.

- Extensive dose reconstruction methodologies, developed to provide a comprehensive analysis of both external dose and internal dose commitment, have been published in the *Federal Register* and reviewed by many of the country's leading experts. These methodologies have been applied to most participating units as well as to individual circumstances of exposure, to determine total doses to participating veterans.

- Research indicates that doses to most DoD personnel were quite low, averaging about 0.625 rem. This is one-eighth the current Federal Guideline for allowable dose to radiation workers, which permits up to 5 rem per year. Even at the currently allowable dose, there is a very low risk of causing any type of radiogenic disease above that normally expected in the general population exposed to background levels of radiation.

- Hundreds of thousands of pages of data have been recovered and researched, including over a thousand basic test reports, many of which had to be declassified, reprinted, and indexed for public use.

- Original dosimetry source documents have been and are still being re-examined for accuracy and completeness. Individual involvement at the tests is continually researched to insure that all dose potential has been documented and considered.

- At DNA's request, the National Academy of Sciences (NAS) conducted an extensive study of mortality of more than 46,000 nuclear test participants. The study, entitled "Mortality of Nuclear Weapons Test Participants," found " ...no consistent evidence of increased deaths from cancer or any other diseases overall." An additional NAS study on mortality of the 42,000 participants at CROSSROADS is now being conducted and will provide, in about four years, scientific information on deaths due to radiogenic disease in this large population. To ensure the most accurate interpretation of recorded doses as it may relate to health effects, the NAS

also is studying the accuracy of film badge dosimetry. This evaluation of personnel film badges will be finished in about one year.

DNA is dedicated to provide all nuclear test veterans with a responsive, helpful program of historical research, dose determination, and individual support to ensure that each veteran fully understands his or her involvement in atmospheric nuclear tests. Individual dose reconstructions, as noted above, are based on evaluations of available records. Any test participant who can provide copies of personal records is invited to send them to DNA if it appears that his or her dose reconstruction is based on incomplete records. Further inquiries can be addressed to Defense Nuclear Agency (ATTN: RARP/NTPR), 6801 Telegraph Road, Alexandria, Virginia 22310-3398, or one may call 1-800-462-3683. In Virginia, call (collect) 703-285-5610.

# Fact Sheet

dna

**Defense Nuclear Agency**
Public Affairs Office
Washington, D.C. 20305

January 1989

Subject: Radiation Exposure and the Nuclear Test Personnel Review Program

During the atmospheric test series from 1945 to 1962, the Atomic Energy Commission (AEC) conducted some 235 nuclear tests, principally in Nevada and the Pacific Ocean. Approximately 200,000 Department of Defense (DoD) personnel, military and civilian, were involved in this testing. Many were exposed to low levels of ionizing radiation in the performance of various activities. The doses generally were within established limits and averaged about 0.6 rem. Approximately 1700 personnel exceeded the current Federal occupational radiation exposure guideline of 5.0 rem per year.

The Nuclear Test Personnel Review (NTPR) Program, established by DoD and administered by the Defense Nuclear Agency (DNA), is committed to provide each test participant the recorded radiation exposure or to assess the most probable exposure. This fact sheet describes the methods used to assess radiation exposure for individual test participants as well as the major findings of the Program to date.

The basic means to measure dose from ionizing radiation is the film badge. Of the some 200,000 DoD participants in atmospheric nuclear tests, about 95,000 have film badge data available. The official repository for these records is maintained by the Reynolds Electrical & Engineering Company (REECo), a contractor of the Department of Energy, formerly the Atomic Energy Commission. Individual dose information is available from DNA. Requests for such information may be from the individual, an authorized representative, the Veterans Administration (VA), or others as authorized by the Privacy Act.

Until 1955, DoD and AEC policy resulted in the issue of film badges to only a portion of the personnel in a homogeneous unit, such as a platoon, ship, or aircraft. If everyone in the unit was expected to receive similar exposures, only a few representatives of the unit might be badged. If some personnel would be performing functions not typical of the unit as a whole, then those personnel would be individually badged. After 1955, the policy was to badge all participants. However, some badges were unreadable and some records were lost or destroyed, as in the fire at the Federal Records Center in St. Louis. Thus, a significant portion of the NTPR effort has focused on assessing the exposure of those personnel who were not issued film badges and those whose records are missing or are incomplete.

In performing exposure assessments, DNA considers all of the relevant circumstances leading to potential radiation dose. All assessments begin with the determination of individual or unit activities and the relationship of such

activities to the radiological environment. If it is obvious from records of where people were that they were not exposed to a radiological environment, their dose is judged to be zero. If some members of a unit had film badges with valid readings while others did not, and if all members had a common relationship to the radiological environment, the doses for unbadged personnel can be inferred from the doses of badged personnel. Where there are insufficient badges, or where a common relationship to the radiological environment does not exist, dose calculations are performed.

Determination of No Dose Potential. DNA researches activities of an individual or his unit for the period of participation in an atmospheric nuclear test. Unit locations and movements are related to areas of radioactivity. If personnel were beyond the range of initial radiation (several miles) from nuclear detonations, did not experience fallout or enter a contaminated area, and did not come in contact with radioactive materials, they are judged to have received no radiation dose.

Dose Based on Film Badges of Others. DNA uses film badge data from badged personnel to derive individual doses for unbadged personnel. A group of participants is identified who had a common activity and thus a similar potential for exposure to radiation. Identification of these homogeneous groups is based upon research of historical records, technical reports, or correspondence. Using standard statistical methods, the film badge data are examined to determine proper representation of the entire group and thus their validity for use in statistical calculations. Often, the dose or time distribution of badge readings indicates that the group should be subdivided into more similar groups before proceeding further with the analysis. For each homogeneous group, the mean dose, variance, and confidence limits are determined, and the 95th percentile dose is then assigned to unbadged personnel. This ensures that personnel are assigned doses that are much higher than the average for the group. If individuals cannot be associated with a specific homogeneous group, statistical derivation of dose is not used.

Dose Calculation. DNA performs rigorous dose calculations when film badge data are unavailable for any part (or all) of the exposure period. DNA also performs calculations if film badge data are available but cannot be used statistically, if unique activities are ascribed to specific individuals, or if neutron or internal radiation exposures are indicated. These calculations involve correlating the activities of an individual or unit with a fully characterized radiological environment.

The calculation of dose is a standard scientific practice used by health physicists when the entire circumstances of radiation exposure require assessment. First, the conditions of exposure are reconstructed to include all known activities based on input from the individual as well as information from official reports and historical documents. The radiation environment is then characterized in time and space, and collated with the activities and locations of the unit or the individual. In addition to the gamma radiation that would have been measured by a film badge, the radiation environment includes neutron radiation for close-in personnel and beta and alpha radiation for personnel whose activities indicate the possibility of inhalation or ingestion of radioactive materials. Finally, the intensity of the radiation is determined for the entire period of exposure, from which the total integrated dose is calculated. An uncertainty analysis, which considers the values of all

parameters used, provides a measure of the confidence of the calculations. Existing dosimetry is then analyzed and compared with the calculated dose to further enhance the confidence of the calculations. Where the potential existed for inhalation or ingestion of radionuclides, internal dose commitments are derived and provided to the VA and/or to the individual. These are doses accrued over a 50-year period after exposure which, when added to the film badge or calculated whole body dose, represent the total dose to the organ specified.

The above dose determination procedures have been reviewed by some of the country's leading scientists and were initially described in the *Federal Register* on May 20, 1982, and later amplified in the *Federal Register* on October 21, 1985. Subsequently, the National Academy of Sciences (NAS) completed a "Review of the Methods Used to Assign Radiation Doses to Service Personnel at Nuclear Weapons Tests." The NAS Committee on Dose Assignment and Reconstruction for Service Personnel at Nuclear Weapons Tests found that:

> "...the procedures used to estimate external radiation doses were reasonably sound. The NTPR has developed procedures that permit satisfactory estimates to be made of the external doses received by these participants. There are uncertainties in the dose estimates, but it appears that 99 percent of the personnel received doses of less than 5 rem, which is approximately the average dose received by the general population during the last 30 years from exposure to natural radiation and the use of ionizing radiation during medical procedures. [The committee] found no evidence that the NTPR teams had been remiss in carrying out their mandate. If any bias exists in the estimates, it is probably a tendency to overestimate the most likely dose, expecially for internal emitters or when the statistical procedure for assigning dose is used."

DNA has developed the NTPR Program to provide every interested veteran with the available information relevant to his or her radiation exposure. Dose reconstruction, as noted above, is based on evaluation of available records. Any test participant who can provide copies of personal records is invited to send them to DNA if it appears that his or her dose reconstruction is based on incomplete records. Further inquiries can be addressed to Defense Nuclear Agency (ATTN: RARP/NTPR), 6801 Telegraph Road, Alexandria, Virginia 22310-3398, or one may call 1-800-462-3683. In Virginia, call (collect) 703-285-5610.

# Fact Sheet

dna

**Defense Nuclear Agency**
Public Affairs Office
Washington, D.C. 20305

January 1989

Subject: Epidemiology and the Nuclear Test Personnel Review Program

A major aspect of the Nuclear Test Personnel Review (NTPR) Program has been devoted to ascertaining the health status of Department of Defense (DoD) participants in atmospheric nuclear testing. This involves the epidemiological investigation of selected participant groups. The studies were designed to identify any unusual incidence of disease. If unusual incidence of disease is found among test participants, radiation exposure from the tests would warrant investigation as a possible cause. In that event, follow-up studies would attempt to isolate the cause(s) of any anomalies. Research to date indicates that radiation doses to most DoD personnel were quite low, averaging about 0.625 rem. This is one-eighth the current Federal guidance for allowable dose to radiation workers, which permits up to 5 rem per year. Even at the currently allowable dose, there is a very low risk of induction of any type of radiogenic disease above that normally expected in the unexposed, general population.

An unusual incidence of leukemia originally prompted the NTPR Program. By 1978, eight leukemia cases had emerged (where only three or four were expected) among the approximately 3200 DoD personnel who, in 1957, were at or near the Nevada Test Site on the day of Shot SMOKY, Operation PLUMBBOB. The Centers for Disease Control (CDC) published the results of an epidemiological study of this group in the *Journal of the American Medical Association* on August 5, 1983. The conclusions were that participant deaths due to cancer, as well as total number of cases of cancer, were slightly less than the statistical norm, except for the larger-than-expected number of leukemia cases. CDC attributed this increase to chance, to factors other than radiation, or to some combination of risk factors, possibly including radiation. An additional finding was that the total number of deaths from all causes was essentially as expected from natural causes.

Concurrently, the Defense Nuclear Agency (DNA) engaged the National Academy of Sciences (NAS) to study the health status of more than 46,000 test personnel. The NAS selected participants at PLUMBBOB and four other test operations: REDWING (1956), CASTLE (1954), UPSHOT-KNOTHOLE (1953), and GREENHOUSE (1951). The Academy, an independent, Congressionally chartered organization, utilizes leading national experts in their respective fields to conduct such reviews. Jointly funded by DNA and the Department of Energy (DOE), this study, entitled "Mortality of Nuclear Weapons Test Participants," encompassed nearly one-fourth of all veterans involved in atmospheric nuclear tests. The NAS review of death certificates for this large sample of "atomic veterans" provided no consistent evidence of increased deaths from cancer or other diseases for the veterans overall. The study confirmed the excess leukemia among the SMOKY participants and found a slightly increased number of prostate cancers among personnel who participated in Operation REDWING in 1956. The NAS also found that the entire group had a lower death rate than the national average for their age group.

Moreover, the incidence of death due to disease was less than expected whereas traumatic deaths (e.g., accident, war, crime) were greater. The NAS found no evidence of excess deaths attributable to radiation exposure.

The National Academy of Sciences also convened a panel in May 1981 to investigate the incidence of multiple myeloma among the occupation forces of Hiroshima and Nagasaki. DNA and veterans groups provided the Academy with the names of all known participants who reportedly had multiple myeloma. NAS concluded that the reported incidence of nine verified cases of multiple myeloma among U.S. veterans of the occupation forces stationed at or near Hiroshima and Nagasaki is less than the incidence in the general population. The expected incidence in a group of this size would be 18.

DNA and the VA are supporting an additional NAS study, initiated in 1988. The study is examining the mortality of the some 42,000 participants at Operation CROSSROADS, as well as that of a control group of a like number of unexposed personnel serving at the same time and in similar duties. The use of a control group will ensure that the mortality of CROSSROADS participants is compared to that of personnel whose basic activities and initial level of health were similar. The study should be completed in about four years.

The VA has made it possible for personnel who served on active duty and have doses in excess of 5 rem to be provided a complete medical examination to assess their health status. About 1700 DoD personnel (less than one percent) have such doses, both recorded and calculated, and virtually all have been contacted by DNA and offered this service. Only those who could not be located after extensive efforts have not been so notified. About one-third of the participants have been given physical examinations at VA facilities. The incidence of cancer in this group has been found to be less than the national average. In addition, the VA provides medical examinations, hospital and nursing home care, and limited outpatient services for veterans with radiogenic conditions, in accordance with Public Law 97-72.

In the aggregate, the findings of health studies are consistent with what would be expected for unexposed populations. This is not surprising because of the generally low radiation doses received by test participants. National and international authorities have addressed in detail the health risks caused by radiation and have recommended dose limits for radiation workers. It has been established that adverse health effects can result from <u>high doses</u> of ionizing radiation (e.g., 100 rem or more), but it is not known whether there are deleterious health effects from <u>low doses</u> of such radiation (e.g., 5 rem). All of the studies have concluded that the doses received by most nuclear test participants are considerably less than these doses and considerably less than lifetime total doses from natural environmental radiation.

According to the National Cancer Institute, in a population of 10,000 individuals who received no known nuclear test or occupational radiation exposure, 1600 are normally expected to die of cancer. According to the National Academy of Sciences Committee on the Biological Effects of Ionizing Radiation (BEIR), if cancer mortality from high-dose cases can be extrapolated to low levels of radiation, then a dose of about one rem of whole body gamma radiation to the same 10,000 individuals would add only <u>one</u> additional cancer death. This is considered to be acceptable by current Federal occupational radiation exposure guidelines, and is less than many other occupational risks in

our society today. The average dose of about 0.6 rem to nuclear test veterans is well less than one rem.

Despite these reassuring medical and health findings, DNA continues to pursue every reasonable avenue available in the extensive effort to assess the incidence of radiogenic diseases among nuclear test participants. The Agency encourages all veterans to provide as much information and documentation as possible about themselves and their involvement in nuclear tests. This facilitates further research on their behalf and adds to the scientific knowledge about possible health effects from exposure to low-level ionizing radiation. Such information can be forwarded to Defense Nuclear Agency (ATTN: RARP/NTPR), 6801 Telegraph Road, Alexandria, Virginia 22310-3398, or one may call 1-800-462-3683. In Virginia, call (collect) 703-285-5610.

# Fact Sheet

dna

**Defense Nuclear Agency**
Public Affairs Office
Washington, D.C. 20305

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Subject: Veterans' Services and the Nuclear Test Personnel Review Program

The Nuclear Test Personnel Review (NTPR) Program, established by the Department of Defense in 1978, has developed an extensive support system to assist the veterans of atmospheric nuclear tests in assessing the significance of their participation and radiation exposure. Through the NTPR Program, veterans may learn the details of their individual participation and their radiation doses, obtain documentation about the tests and their unit's role, and be informed of the availability of health care and other assistance by the Veterans Administration (VA).

The NTPR Program is conducted on a high-priority basis, with the Defense Nuclear Agency (DNA) directing its progress and effectiveness. Dedicated and knowledgeable uniformed and civilian personnel from the Army, Navy, Marine Corps, and Air Force initially researched the extensive archival records to provide the data about the thousands of units that participated in nuclear tests conducted from 1945 until the treaty banning atmospheric nuclear testing took effect in 1962. More recently, the resources committed to assist in this important effort have been consolidated at DNA to facilitate greater efficiency. To make all these items of information personally available to the veterans and other interested persons, DNA has established a reading room at 6919 Telegraph Road, Alexandria, Virginia, which is open to the public. Participants or their representatives are encouraged to visit this facility. If a visit is not possible, one may contact the Defense Nuclear Agency, ATTN: RARP-NTPR, 6801 Telegraph Road, Alexandria, Virginia 22310-3398, or call 1-800-462-3683. In Virginia, one may call (collect) 703-285-5610. Information is provided verbally or by mail, as requested.

These services will be much more effective if more veterans are aware of them and utilize them. Through extensive public outreach programs in the press and on television and radio, as well as with the many veterans groups, DNA has encouraged "atomic veterans" to come forth and examine the available information about their participation. Such contact enables each veteran to draw on DNA's wealth of information to apply to his individual case; it also allows the veteran to contribute any information about his participation that may be of help to others in his unit by augmenting the records that DNA has.

Public Law 97-72, the "Veterans' Health Care and Small Business Loan Act of 1981," authorized the VA to provide "hospital and nursing home care and limited outpatient services to veterans who were exposed while serving on active duty to ionizing radiation from the detonation of a nuclear device in connection with such veteran's participation in the test of such a device, or with the American occupation of Hiroshima and Nagasaki during the period beginning September 11,

1945 and ending July 1, 1946." This law provides for medical care related to radiogenic diseases, but does not authorize care for conditions that are found by the VA to have resulted from other than exposure to ionizing radiation. DNA assists the VA by verifying individual participation.

Public Laws 98-542 and 100-321 provide for VA determination of service connection and benefits for specified cancers. More specifically, PL 98-542, "Veteran's Dioxin and Radiation Exposure Compensation Standards Act," enacted October 24, 1984, defines rules for adjudicating VA claims and establishes a panel of experts for addressing scientific issues. PL 100-321, "Radiation Exposed Veterans Compensation Act of 1988," enacted May 20, 1988, provides a presumption of service connection for veterans (and survivors of such veterans) who participated in atmospheric or underwater nuclear tests as part of the United States nuclear weapons testing program or in the American occupation of Hiroshima and Nagasaki, Japan, and who suffer from certain diseases (i.e., thirteen types of cancer) that may be attributable to exposure to ionizing radiation. DNA assists the VA by providing participation and any associated radiation exposure information. Additional information about these benefits is available at local VA facilities. Veterans can receive free assistance in submitting claims by contacting one of the veterans' service organizations.

A history of atmospheric nuclear testing operations has been developed by DNA in an easily understandable series of more than 40 volumes containing over 9000 pages of detailed aspects of every test in each nuclear test operation. These historical reports are available at more than 700 libraries and facilities nationwide. In addition, over 25 volumes of radiation exposure assessments for major participant groups in the various test operations also have been widely disseminated. All reports are available in the NTPR reading room at DNA and may be purchased from the National Technical Information Service (NTIS), an agency of the Department of Commerce that provides unclassified DoD reports and other documents. The NTIS may be contacted at 5285 Port Royal Road, Springfield, Virginia 22161 (phone 703-487-4650). Any person who is interested in learning more about the histories, the radiation exposure assessments, or the thousands of now-declassified source documents that were used in the preparation of the historical and analytical reports is encouraged to visit the NTPR Reading Room or contact the NTPR Program.

A repository of over 125,000 documents related to nuclear weapons testing also has been established for public use at the Coordination and Information Center (CIC) in Nevada. The center, partially funded by DNA, is administered by the Department of Energy and operated by the Reynolds Electrical & Engineering Company at 3084 South Highland Avenue in Las Vegas, Nevada. The purpose of the CIC is to make available, at a facility accessible to the general public, unclassified and declassified historical documents that have been collected, consolidated, indexed, and stored for long term preservation and rapid retrieval. The facility also provides a staff to assist in the identification and retrieval of specific documents that relate to participation in atmospheric nuclear tests. Correspondence regarding the CIC should be directed to the U. S. Department of Energy, P. O. Box 14100, Las Vegas, Nevada 89114, or one may call the facility at 702-295-0731. Nominal charges to cover costs are made for duplicating documents and for information searches through the extensive data base. A fee schedule is available on request. The reading room at DNA has a computer terminal through which the index of this repository is accessible to interested veterans or their representatives.