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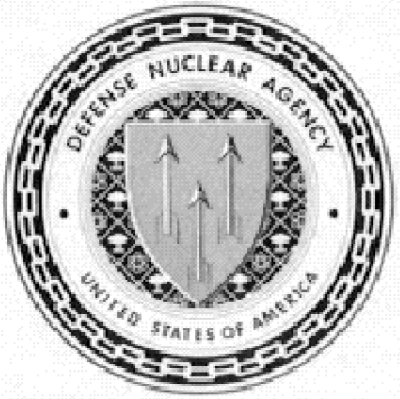

United States Atmospheric Nuclear Weapons Tests
Nuclear Test Personnel Review

Prepared by the Defense Nuclear Agency as Executive Agency
for the Department of Defense

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This report provides supplementary information to the series and shot volumes. The information includes a glossary; list of acronyms; explanations of radiation health concepts, radiation measurement, radiation detection, radiation protection, and radiation standards; and a list of data and document sources.

PREFACE

From 1945 to 1962, the United States Government, through the Manhattan Engineer District and its successor agency, the Atomic Energy Commission (AEC), conducted 235 atmospheric nuclear weapons tests at sites in the United States and in the Pacific and Atlantic Oceans. In all, an estimated 220,000 Department of Defense (DOD) participants, both military and civilian, were present at the tests.

In 1977, 15 years after the last above-ground nuclear weapons test, the Centers for Disease Control* noted a possible leukemia cluster among a small group of soldiers present at Shot SMOKY, a test of Operation PLUMBBOB, the series of atmospheric nuclear weapons tests conducted in 1957. Since that initial report by the Centers for Disease Control, the Veterans Administration has received a number of claims for medical benefits from former military personnel who believe their health may have been affected by their participation in the weapons testing program.

In late 1977, the DOD began a study to provide data to both the Centers for Disease Control and the Veterans Administration on potential exposures to ionizing radiation among the military and civilian participants in the atmospheric nuclear tests. The DOD organized an effort to:

- Identify DOD participants in the atmospheric nuclear weapons tests and other nuclear tests
- Determine the extent of the participants' exposure to ionizing radiation

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*The Centers for Disease Control are part of the U.S. Department of Health and Human Services (formerly the U.S. Department of Health, Education, and Welfare).

- Provide public disclosure of information concerning participation by DOD personnel in the atmospheric nuclear weapons tests and other nuclear tests.

Two sets of volumes have been published to present information on the atmospheric nuclear tests. One set of volumes documents participation in the testing in the southwestern United States, and the other set documents participation in the oceanic testing. Each set of volumes is organized by operation and by shot to identify and describe the activities of DOD participants, radiological safety procedures used, and radiation exposures of individuals.

Certain terms and concepts are used repeatedly in the volumes. These include scientific and technical terms and basic concepts of radiation physics, dosimetry, and protection. The purpose of this manual is to provide the reader with a reference for understanding these terms and concepts as they are used in the reports on the continental testing program. This volume contains a list of document and data sources and a list of acronyms commonly used. In addition, it includes four appendices: Appendix A, a glossary of technical terms; Appendix B, a list of announced U.S. nuclear tests; Appendix C, a radiological standards matrix for the U.S. nuclear test series; and Appendix D, a list of the nuclear detonations conducted by other nuclear powers through 31 December 1981.

The Defense Nuclear Agency Action Officer, Lt Col H. L. Reese, USAF, under whom this work was done, wishes to acknowledge the research and editing contribution of numerous reviewers in the military services and other organizations in addition to those writers listed in block 7 of DD Form 1473.

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DOCUMENT AND DATA SOURCES

The following libraries and document repositories were researched to acquire the references used to produce the CONUS series and shot volumes.

Air Force Special Weapons Center - Air Force Weapons Laboratory
Technical Library
Kirtland Air Force Base
Albuquerque, New Mexico

Army War College
Carlisle, Pennsylvania

Defense Atomic Support Information Analysis Center
General Electric Tempo
Santa Barbara, California

Defense Nuclear Agency Technical Library
Alexandria, Virginia

Defense Technical Information Center
Cameron Station
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Department of Energy
Historical Archives
Germantown, Maryland

Federal Archives and Records Center
San Bruno, California

Lexington-Bluegrass Army Depot Activity
Technical Library
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Library of Congress
Washington, D.C.

Marine Corps Archives Historical Center
Navy Yard
Washington, D.C.

Marine Staff College Library
Quantico, Virginia

Modern Military Branch
National Archives and Records Service
Washington, D.C.

National Atomic Museum
Kirtland Air Force Base
Albuquerque, New Mexico

National Personnel Records Center
St. Louis, Missouri

National Technical Information Service
Springfield, Virginia

Nevada Operations Office Archives
Department of Energy
Las Vegas, Nevada

Nuclear Regulatory Commission Library
Bethesda, Maryland

Office of Air Force History
Bolling Air Force Base
Washington, D.C.

Simpson Historical Research Center Library
Maxwell Air Force Base
Montgomery, Alabama

Sixth Army Headquarters
Presidio
San Francisco, California

Washington Records Center
Suitland, Maryland

LIST OF ACRONYMS AND ABBREVIATIONS

This section provides a list of acronyms and abbreviations used frequently in the reports on the U.S. nuclear test series. These acronyms are used in both the reports and the bibliographies included with each published volume.

AEC	Atomic Energy Commission (its functions are now performed by the Department of Energy and the Nuclear Regulatory Commission)
AEDS	Atomic Energy Detection System
AFB	Air Force Base
AFSWC	Air Force Special Weapons Center
AFSWP	Armed Forces Special Weapons Project (now Defense Nuclear Agency)
AFTAC	Air Force Technical Applications Center
AWS	Air Weather Service
BCT	Battalion Combat Team
BJY	BUSTER-JANGLE Y (intersection of BUSTER and JANGLE roads with Mercury Highway)
CBR	Chemical, biological, and radiological
CDR	Camp Desert Rock
CETG	Civil Effects Test Group
CONUS	Continental United States
CTO	Continental Test Organization
DASA	Defense Atomic Support Agency (now Defense Nuclear Agency, Department of Defense)
DMA	Division of Military Application (part of the AEC)
DNA	Defense Nuclear Agency
DOD	Department of Defense
DOE	Department of Energy

DWET	Directorate Weapons Effects Tests
EDR	Exercise Desert Rock
EG&G	Edgerton, Germeshausen, and Grier, Incorporated
FCDA	Federal Civil Defense Administration
FCSU	Field Command Support Unit
FCWT	Field Command Weapons Test
GZ	Ground zero
HE	High explosives
HumRRO	Human Resources Research Office
IBDA	Indirect Bomb Damage Assessment
JTO	Joint Test Organization (renamed NTO in 1957)
kt	Kiloton
LASL	Los Alamos Scientific Laboratory
LRL	Lawrence Radiation Laboratory
LVT	Landing vehicle tracked
MAUD	[Committee for the] Military Application of Uranium Detonation
MED	Manhattan Engineer District
MLC	Military Liaison Committee
NASWF	Naval Air Special Weapons Facility
NBS	National Bureau of Standards
NML	Naval Material Laboratory
NPG	Nevada Proving Ground (renamed Nevada Test Site in 1955)
NRDL	Naval Radiological Defense Laboratory
NTO	Nevada Test Organization
NTS	Nevada Test Site
NTSO	Nevada Test Site Organization

OCAFF	Office, Chief of Army Field Forces
OCDM	Office of Civil and Defense Mobilization
ORO	Operations Research Office
PDT	Pacific Daylight Time
PST	Pacific Standard Time
rad	Radiation absorbed dose
Radex	Radiological exclusion
REECo	Reynolds Electrical and Engineering Company
rem	Roentgen equivalent man
R/h	Roentgen per hour
SAC	Strategic Air Command
SFOO	Santa Fe Operations Office, Department of Energy
SWC	Special Weapons Command
TAC	Tactical Air Command
UCRL	University of California Radiation Laboratory (now Lawrence Livermore National Laboratory)
USAF	United States Air Force
USPHS	United States Public Health Service
UTM	Universal Transverse Mercator
VLR	Very long range
WETG	Weapons Effects Test Group

CHAPTER 1

GENERAL CHARACTERISTICS OF A NUCLEAR DETONATION

This chapter provides a basis for understanding how a nuclear detonation works and how the forces released by a nuclear detonation can cause destruction. The different forms of energy released are described, along with an explanation of how this energy is produced during the detonation.

In general, a nuclear detonation, as well as a non-nuclear explosion, results from the very rapid release of a large amount of energy within a limited space. A nuclear detonation is characterized by an almost instant release of energy that causes a tremendous increase in temperature and pressure. Expansion of this area of high temperature and pressure produces a shock or blast wave that moves outward from the center of the detonation. The energy of the shock or blast wave dissipates with increased distance from the point of detonation. The shock wave in the air is referred to as the "blast wave." In water or in the ground, the term "shock wave" is used because the effect is like that of a sudden impact or shock.

Nuclear devices are similar to conventional explosives in that their destructive action is due mainly to the blast and shock waves. However, there are several basic differences between nuclear and regular high-explosive devices. Nuclear devices can release thousands or millions of times more energy than do normal conventional explosives. Temperatures produced by a nuclear detonation are much higher than temperatures created by conventional explosions. A fairly large proportion of the energy released is thermal radiation: primarily ultraviolet, visible light, and infrared radiation. This intense thermal radiation

can cause skin burns and flash blindness and start fires at considerable distances from the point of detonation. Two other differences are that a nuclear detonation releases highly penetrating and potentially harmful ionizing radiation and that the residues of some nuclear detonations are radioactive for long periods of time and can be deposited over a large area.

1.1 ATOMIC STRUCTURE

All substances are composed of one or more of 92 naturally occurring elements or possibly a number of man-made elements. The smallest part of an element that can exist and still retain the characteristics of that element is an atom. Each atom consists of a central nucleus surrounded by a number of electrons. The nucleus is composed of particles called protons and neutrons. These particles have approximately equal masses, but protons are positively charged, while neutrons are neutral. Therefore, the nucleus has a net positive charge. An atom is neutral, however, because the positive charge of its protons is exactly balanced by the negative charge of electrons that surround the nucleus.

The number of positive protons balanced by an equal number of negative electrons remains constant in all atoms of the same element. However, the number of neutrons may vary. The atomic number of an element indicates the number of protons in the nucleus, and the mass number refers to the sum of the number of protons and neutrons. The atomic number of a particular element is constant, but its mass number may vary. Atoms of an element that have the same atomic number but have different mass numbers are called "isotopes" of that element. For example, normal hydrogen has the atomic number 1 with a mass number of 1; its nucleus contains a single proton and no neutrons (1 + 0 = 1), and its positive charge is balanced by a single negatively charged electron. Deuterium is an isotope of hydrogen with one proton

and one neutron in its nucleus, giving it a mass number of 2 (1 + 1 = 2). Tritium is another isotope of hydrogen; it has one proton and two neutrons. Therefore, its atomic number remains as 1, while its mass number increases to 3 (1 + 2 = 3).

In a conventional explosion, the energy released is produced by the rearrangements of atoms in a chemical reaction. In a nuclear explosion, however, the energy released is caused by reactions occurring within the nucleus itself. The force between the components of the nucleus (protons and neutrons) is many times greater than the force between atoms. This accounts for the tremendous amount of energy released by a nuclear detonation. There are two types of nuclear reactions that lead to these large releases of energy: "fission," the splitting of the nucleus of a heavy atom (for example, uranium) into two or more lighter nuclei, and "fusion," the joining of two very light nuclei, such as hydrogen nuclei, to form a heavier nucleus, such as the helium nucleus.

1.2 FISSION AND FUSION REACTIONS

The elements normally used to produce nuclear detonations from fission reactions are certain isotopes of uranium and plutonium, such as uranium-235 and plutonium-239. The fission process is usually initiated when a free neutron penetrates the nucleus of the atom (uranium or plutonium), causing the nucleus to become unstable and to split into two or more smaller parts. Energy, two or more additional neutrons, and two or more gamma rays are normally released when the nucleus splits. The smaller, lighter nuclei that result from this process are called "fission fragments" or products. These fission fragments are usually radioactive and contribute to the radiation emitted from a nuclear detonation. The fission of 2.5 pounds of uranium could release as much energy as 20 kilotons of TNT. The uranium required for a 20-kiloton detonation must be greater than 2.5

pounds, however, because the fission reaction is not 100 percent efficient and only part of the uranium is fissioned.

Although two or three neutrons may be produced for every nucleus that undergoes fission, not all of these neutrons will cause additional fissions. Some of the neutrons escape from the material, while others are absorbed by atoms of non-fissionable materials. A "chain reaction" of fissions must occur in order to sustain the fission process. This requires that at least one neutron from each nucleus that is split be available to cause further fissioning. If the neutrons are lost at a faster rate than they are formed by fission, the chain reaction is not self-sustaining; that is, sufficient energy will not be released for a nuclear detonation to occur. Therefore, it is necessary to minimize the escape of neutrons and maximize the interaction of neutrons with the nuclei of the fissionable material.

There are several ways to minimize the escape of neutrons and maximize their interaction. One way is to increase the mass of the fissionable material at constant density so that the ratio of surface area to mass is decreased. The same result can be achieved by compressing a constant mass into a smaller volume so that the surface area is decreased. If the ratio of the surface area to mass is large, too many neutrons will escape, preventing a sustaining chain reaction. Such a configuration of fissionable material is called "subcritical." However, as the mass of the material is increased or its volume is decreased by compression, the relative loss of neutrons can be decreased to the point that a self-sustaining reaction is possible. This configuration is known as a "critical mass."

For nuclear weapons, a merely critical mass is insufficient to achieve detonation. Rather, a supercritical mass is necessary so that the reactions will multiply rapidly. This can be achieved by two different methods. First, a supercritical mass

can be attained by bringing together two barely subcritical masses. This method, called gun assembly, usually employs a cylinder in which an explosive propellant is used to propel one subcritical piece of fissionable material into the other. Figure 1-1a illustrates the principle of the gun-assembly nuclear device. The second method, called implosion, is based on the principle that strong compression of a subcritical mass of fissionable material increases its density, thereby causing it to attain criticality or supercriticality. This is achieved by completely surrounding a subcritical mass of uranium or plutonium with high explosives, as shown in Figure 1-1b. Detonation of the high explosives results in a strong implosive compression of the fissionable materials and the consequent attainment of supercriticality.

A fusion reaction occurs when a pair of nuclei, usually isotopes of hydrogen, unite to form the nucleus of a heavier atom. This union is accompanied by a release of energy. Two isotopic forms of hydrogen are commonly used in fusion reactions: deuterium, with one proton and one neutron, and tritium, with one proton and two neutrons. These isotopes must be sufficiently concentrated at a high temperature and pressure to achieve a self-sustaining fusion reaction. A great deal of energy must be supplied to initiate fusion between nuclei. Raising the fusion materials to very high temperatures can begin and sustain fusion reactions, which are therefore called "thermonuclear" reactions or processes.

Temperatures reaching tens of millions of degrees are needed to initiate fusion reactions. Fission explosions can provide the energy and heat required to initiate the fusion process in a thermonuclear device.

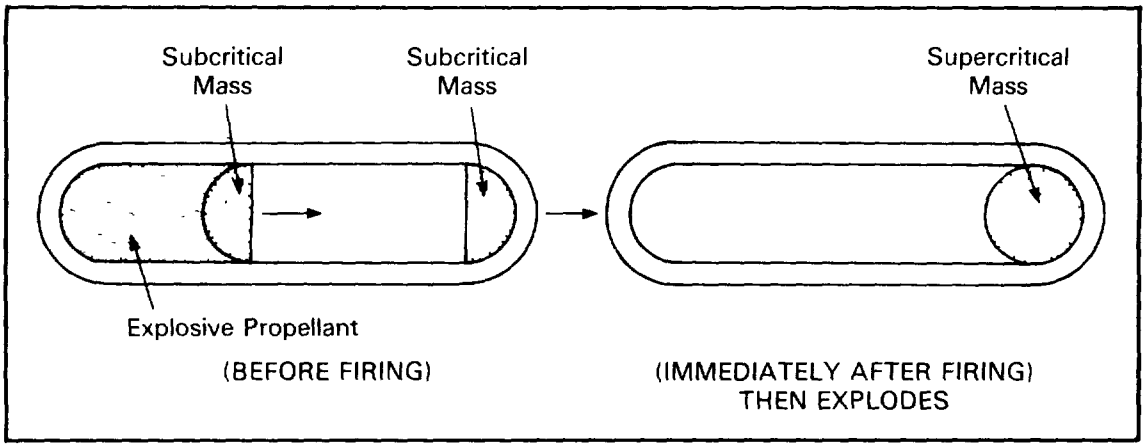

Figure 1-1a: PRINCIPLE OF GUN-ASSEMBLY NUCLEAR DEVICE (GLASSTONE AND DOLAN)

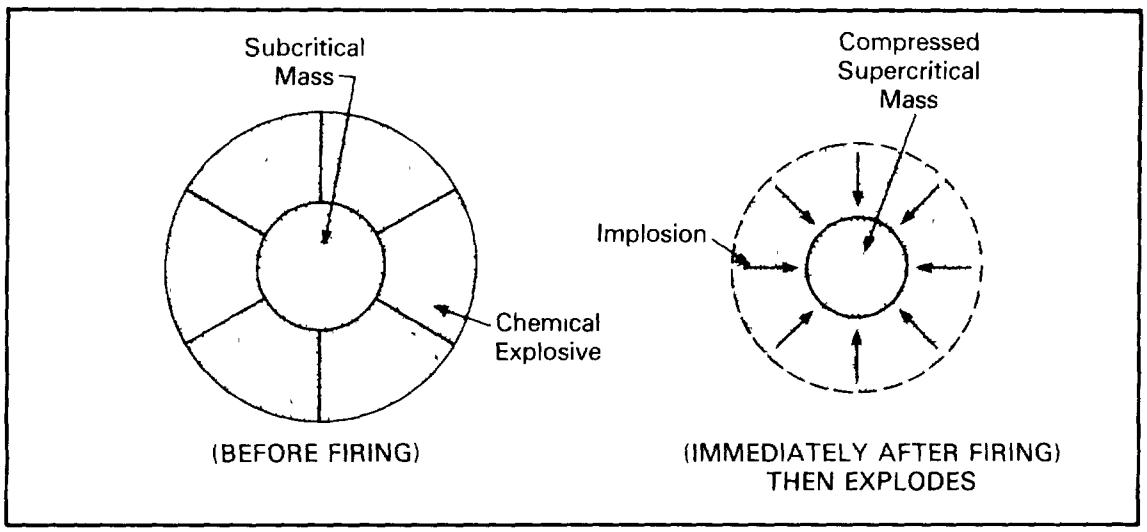

Figure 1-1b: PRINCIPLE OF IMPLOSION-TYPE NUCLEAR DEVICE (GLASSTONE AND DOLAN)

1.3 DESCRIPTION OF A NUCLEAR DETONATION

Certain phenomena are characteristic of a nuclear detonation. These phenomena will vary depending on the design of the nuclear device, the meteorological conditions, the terrain where the detonation occurs, and the location of the detonation relative to the earth's surface. Detonations that occur high enough above the ground to prevent the resulting fireball from touching the surface are called "air bursts." Detonations at altitudes greater than 100,000 feet are termed "high-altitude" bursts. A "surface burst" takes place on the ground surface or at an altitude low enough to allow the fireball to touch the earth's surface. Underground and underwater bursts occur beneath the surface of the earth or water, respectively. The point of detonation of a surface burst is called "ground zero." The area on the ground immediately above or below the point of detonation of a high altitude burst, an air burst, or an underground or underwater detonation is called "surface zero," "ground zero," or "surface ground zero."

The following sections describe in general terms the phenomena that result from a nuclear detonation.

1.3.1 Fireball Formation

A nuclear detonation causes a tremendous and extremely rapid increase in temperature and pressure at the point of detonation. Temperatures tens of millions of degrees and pressures millions of times that of ambient atmospheric pressure are generated almost instantly. Because of the great heat, all the materials of the nuclear device are vaporized. The surrounding air is heated to extremely high temperatures, which leads to the formation of a hot and highly incandescent mass of air referred to as the "fireball." The fireball then radiates thermal energy in the form of ultraviolet, visible light and infrared radiation.

High levels of neutron and gamma radiation are also emitted as a result of nuclear reactions in the weapon and its debris.

The effects of the thermal radiation emitted from the early fireball depend on the energy yield of the detonation, the type of combustible material, the meteorological conditions, and the distance from the point of detonation. At a distance of two kilometers, for example, thermal radiation from a 20-kiloton detonation can ignite paper and dry wood and cause severe skin burns.

A large pulse of electromagnetic radiation is also emitted from the fireball within a microsecond of the detonation. This electromagnetic pulse can interfere with communications and even damage electronic equipment far from the detonation.

The fireball continues to expand. Within two milliseconds after the detonation, all parts of the fireball reach approximately the same temperature. The fireball is then called an "isothermal sphere."

After the detonation, a blast wave is formed and is driven outwards by the force of the explosion. The tremendous pressure and temperature caused by passage of this blast front make the air opaque. Consequently, the fireball is obscured by a layer of luminous opaque air. Within milliseconds, however, this blast-heated air is cool enough so that the highly incandescent fireball is visible through the blast-front.

The fireball reaches its maximum size about one second after the detonation. As the fireball expands, it continually rises and draws in more air. This growth is accompanied by a decrease in temperature. The peripheral layers of the fireball cool first, imposing a drag or slowing effect on the exterior surface of the ascending fireball. This brings about a characteristic

change in shape. The spherical mass tends to develop into a toroid-shaped (or doughnut-shaped) configuration. As it ascends, the toroid undergoes violent internal circulatory motions that draw in air from beneath the toroid and thoroughly circulate the hot gases, air, and debris. Figure 1-2 shows the toroidal circulation within the radioactive cloud. The toroid-shaped fireball cools as it rises until its energy has dissipated at higher altitudes. By this point, the vaporized nuclear materials have been throughly mixed with water droplets, dust, and debris that may have been sucked into the expanding fireball.

Huge amounts of dirt and debris can be incorporated into the fireball when a nuclear detonation occurs on or near the earth's surface. The radioactive cloud formed within and around the cooling fireball continues to rise until it stabilizes at an altitude that is dependent on yield and atmospheric conditions. The radioactive cloud from very high-yield detonations may penetrate the tropopause and enter the stratosphere.

1.3.2 Blast Wave Formation in Air

The blast wave is responsible for much of the damage to structures and materials that results from a nuclear detonation. The expansion of the intensely hot gases at extremely high pressures in the fireball causes a blast wave to form, which moves outward at high velocity. The main characteristic of this wave is its sharply increased pressure. Peak overpressure (pressure exceeding the ambient air pressure of 14.7 pounds per square inch at sea level) can be many times greater than the ambient pressure. The passage of the blast wave causes high winds to follow, and the forces exerted by these winds are referred to as "dynamic pressure." The overpressure, combined with dynamic pressure, can cause much damage. Table 1-1 indicates the dynamic pressures and wind velocities associated with various peak overpressures.

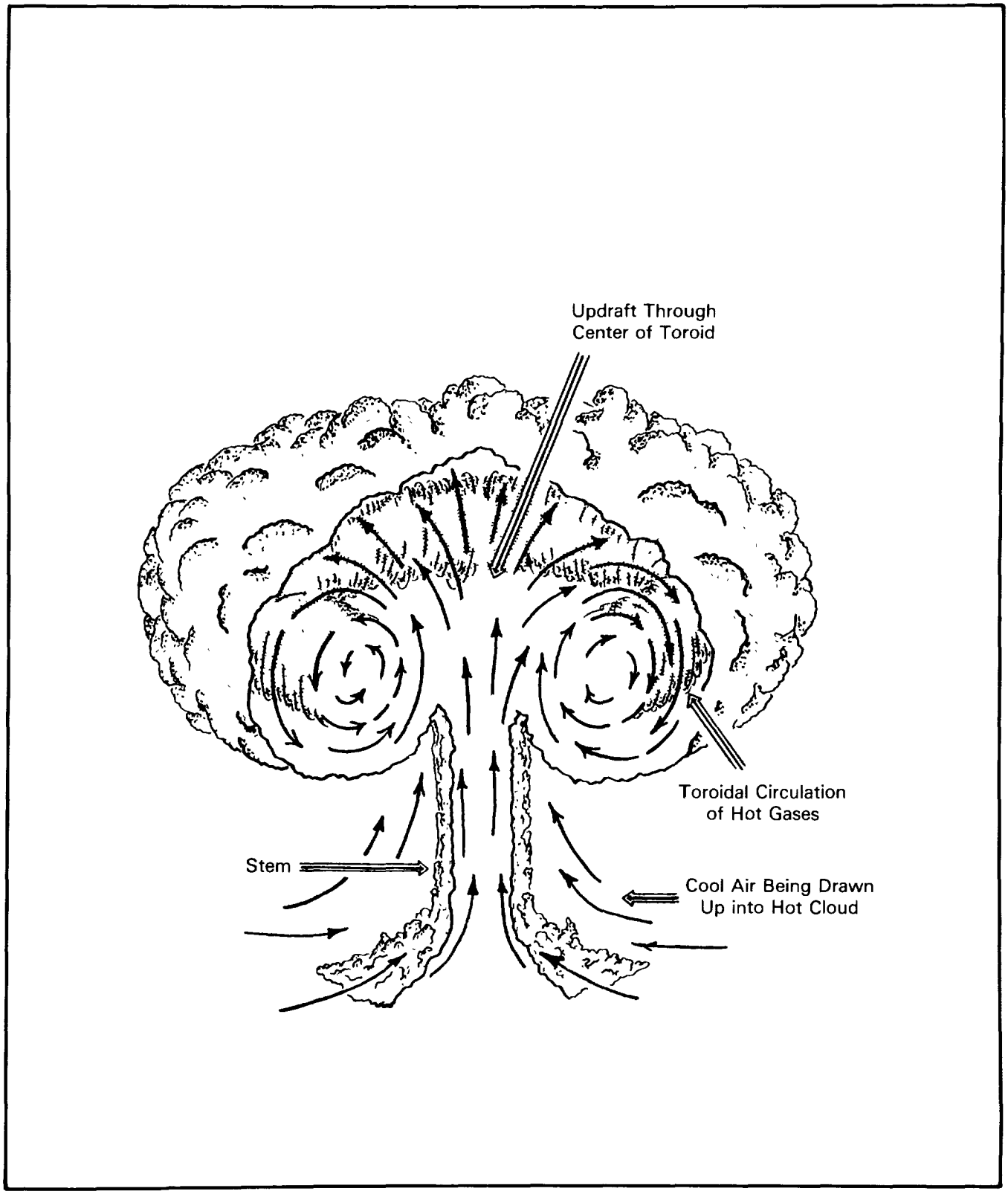

Figure 1-2: SCHEMATIC REPRESENTATION OF TOROIDAL CIRCULATION WITHIN THE RADIOACTIVE CLOUD FROM A NUCLEAR DETONATION (GLASSTONE AND DOLAN)

Table 1-1: PEAK OVERPRESSURE, DYNAMIC PRESSURE AND MAXIMUM WIND VELOCITY IN AIR CALCULATED FOR AN IDEAL BLAST FRONT (GLASSTONE AND DOLAN)

Peak Overpressure (Pounds Per Square Inch)	Peak Dynamic Pressure (Pounds Per Square Inch)	Maximum Wind Velocity (Miles Per Hour)
200	330	2,078
150	222	1,777
100	123	1,415
72	74	1,168
50	41	934
30	17	669
20	8.1	502
10	2.2	294
5	0.6	163
2	0.1	70

As the dynamic pressure diminishes, the overpressure also decreases until it actually becomes negative, or less than ambient air pressure. A partial vacuum is then produced, and the air is sucked back toward the point of detonation. This "negative phase" of the blast wave lasts for a longer period of time than the "positive phase" of overpressure.

For a given fixed location near the point of detonation, a series of pressure changes are evident over a period of time. For a short interval after the detonation, there is no change in the ambient air pressure since it takes some time for the blast wave to travel from the point of detonation to the given location. This arrival time depends on the energy yield of the nuclear device and the distance from the detonation. For example, at a distance of 1.6 kilometers from a detonation of

20 kilotons, the arrival time is about three seconds, while for a one-megaton detonation, the time is only 1.4 seconds.

When the incident blast wave from an air burst strikes the earth's surface, it is reflected. For a given location on the surface, the incident and reflected blast waves will occur at the same time. At locations above the reflecting surface, however, two separate blast waves are evident, the first being the incident blast wave and the second the reflected wave. Initially, the two waves travel at the same speed. However, as the reflected wave travels through air previously heated and compressed by the incident wave, it travels at a greater speed and eventually overtakes and merges with the incident wave. This process of wave interaction is called "Mach reflection," and the region where the two waves merge into one front is termed the "Mach region."

Figure 1-3a indicates the merging of the incident and reflected waves. The incident wave moves outwards and downwards, while the reflected wave moves outwards and upwards. The single wave front formed from the merging of these two waves is called the "Mach stem." The overpressure at the Mach stem is greater than that of either the incident or reflected shock wave. The point at which the incident wave, reflected wave, and Mach stem meet is the "triple point." As the reflected wave continues to overtake the incident wave, the triple point rises and the height of the Mach stem increases, as shown in Figure 1-3b. The behavior and destructive capabilities of this merged wave are identical to those described previously for blast waves in general.

The distance from the detonation at which the Mach stem forms depends on the yield of the detonation and the height of the burst above the ground. In general, the Mach stem forms at increasing distances from ground zero as the yield is decreased

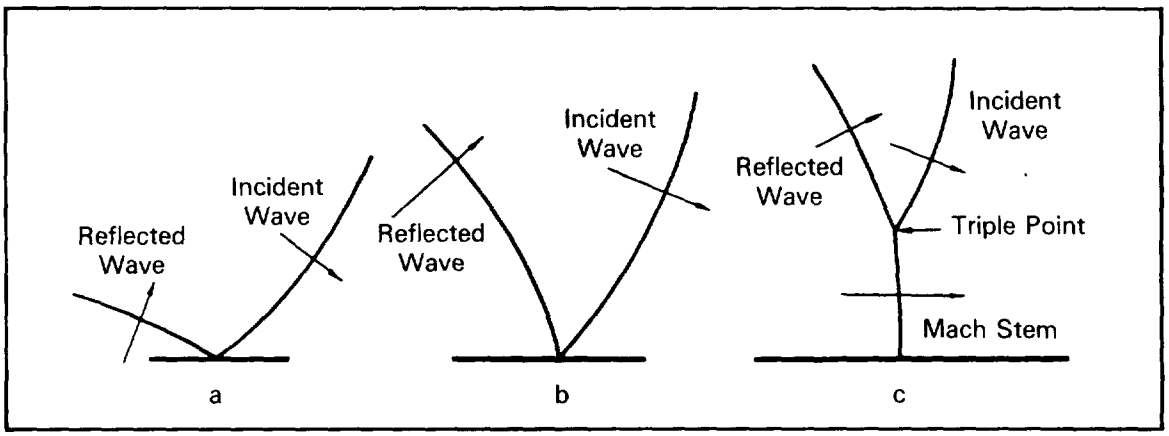

Figure 1-3a: MERGING OF INCIDENT AND REFLECTED WAVES AND FORMATION OF MACH Y CONFIGURATION OF BLAST FRONTS (GLASSTONE AND DOLAN)

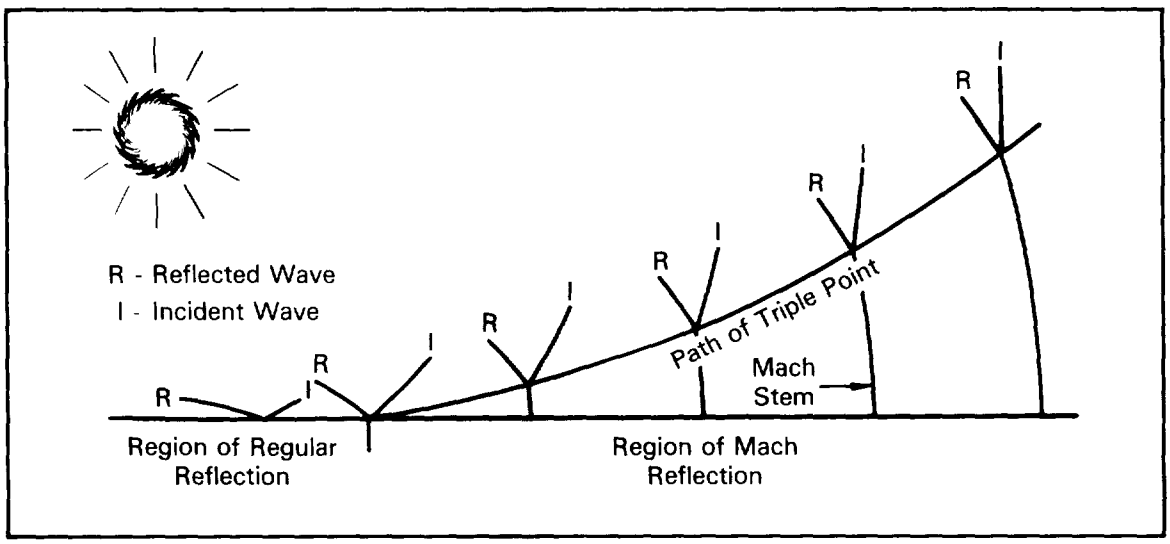

Figure 1-3b: OUTWARD MOTION OF THE BLAST WAVE NEAR THE SURFACE IN THE MACH REGION (GLASSTONE AND DOLAN)

or as the height is increased. For a surface detonation, however, the Mach stem forms immediately, since the incident and reflected blast waves merge instantly. The combined blast waves then move outwards from the explosion in a direction horizontal to the earth's surface. The behavior and effect of the blast wave from any type of nuclear detonation are influenced by the meteorological conditions, altitude of the detonation, terrain, and the ability of the surface to reflect the blast wave.

A nuclear detonation beneath or on the surface produces a ground shock that sets the surrounding earth in motion. This shock wave is produced primarily by direct interaction of the explosive energy with the ground. As with the air blast wave, the ground shock wave travels outward and steadily decreases in energy and effect with increasing distance from the point of detonation.

The ground shock wave can damage structures buried in the ground or in contact with the ground. The extent of damage depends on the size, shape, and flexibility of the structure and equipment, the yield and location of the detonation, and the structure's distance from the point of detonation. In general, structures must be relatively close to the detonation to experience significant ground shock effects.

When a nuclear device is detonated over a flat, relatively dry surface that reflects thermal energy, a hot layer of air is produced near the surface. This thermal layer, referred to as the "preshock thermal layer," can cause the formation of an auxiliary blast wave, called a "precursor." The precursor moves in advance of the main blast wave and remains close to the surface as it moves outwards from ground zero.

The formation of a precursor may alter typical blast wave characteristics considerably. The peak overpressure at the blast

front may be reduced and be less sharply delineated than under ideal conditions. Oscillations of the dynamic pressure and overpressure may also occur. These alterations caused by the precursor may or may not be apparent in a particular nuclear detonation, and the effects cannot be generalized.

CHAPTER 2

BASIC RADIATION PHYSICS

Nuclear detonations produce ionizing radiation, in addition to blast effects and heat. This chapter defines ionizing radiation and describes the various types of radiation associated with a nuclear detonation. In addition, this chapter discusses the major phases of radiation emissions from a nuclear detonation, the types of radiation that characterize each phase, and the interaction of these radiations with the surrounding medium.

2.1 TYPES OF IONIZING RADIATION

Nuclear radiations resulting from a nuclear detonation consist of alpha and beta particles, neutrons, and gamma rays. These radiations have sufficient energy to strip an electron from an atom, either directly or indirectly, leaving a positively charged particle and a negatively charged free electron. The process of stripping an electron from an atom is called "ionization," and the resulting positively charged particle and negatively charged electron are called an "ion pair." Because ions are highly reactive, they can disrupt chemical processes and cause biological damage.

2.1.1 Alpha Radiation

Alpha particles are composed of two protons and two neutrons and thus have a double positive charge. Alpha particles are identical to the nucleus of a helium atom. Because of their relatively large mass and charge, they readily interact with nearby atoms. In their passage through matter, alpha particles lose their energy rapidly and produce a great deal of ionization

in a short distance. They have a range of only a few centimeters in air and are incapable of penetrating clothing or even the outer layer of unbroken skin. Therefore, alpha radiation poses no external exposure hazard. However, alpha-emitting materials can enter the body by ingestion, inhalation, or through broken skin and may possibly constitute a hazard.

2.1.2 Neutron Radiation

Neutrons are uncharged nuclear particles. They can travel hundreds of meters in air and readily penetrate tissue or other matter. Because neutrons are electrically neutral, ionization produced by their interaction with matter is almost totally indirect. For example, when a neutron collides with a hydrogen atom, the neutron transfers some or all of its energy to the nucleus. If enough of the kinetic energy of the neutron is transferred, the nucleus can be knocked free from its bond with other atoms. This positively charged nucleus then causes ionization as it travels through matter. As neutrons collide with nuclei in their path, they lose energy and are eventually absorbed (captured) by the nuclei. When these neutrons are absorbed, the absorbing nucleus may emit ionizing radiation, such as a gamma ray.

2.1.3 Beta Radiation

Beta particles are ejected from excited, unstable nuclei and are physically identical to electrons moving at high speed. Beta particles may, however, be either negatively or positively charged. Unlike alpha particles, which are emitted at well-defined energy levels from a given radionuclide, beta particles are emitted with a range of energies up to some maximum value. The mass of a beta particle at rest is the same as the mass of an electron, about 1/1,800 that of a proton. Beta particles produce ionization in matter, but because of their exceedingly small mass

and great velocity, they do not produce nearly as much ionization per unit of distance as do alpha particles. Beta particles may travel several meters in the air before being absorbed. In more dense material, such as body tissue, high-energy beta particles may travel up to a centimeter. Clothing normally provides adequate protection from beta radiation. Therefore, beta radiation is a hazard only when beta-emitting materials are either in direct contact with the skin or are inhaled or ingested.

2.1.4 Gamma Radiation

Gamma radiation is a form of electromagnetic energy. Gamma rays are parcels of energy called photons with no electrical charge and no rest mass. Other types of electromagnetic energy include visible light, radio waves, microwaves, and X-rays.

Gamma rays are emitted from the nucleus as excess energy as a result of some nuclear de-excitation. They are emitted with well-defined energies for a given radionuclide. Gamma rays of several different energies can be ejected simultaneously. In general, gamma rays have ranges of hundreds of meters in air, and they can readily penetrate matter. Because they are highly penetrating, gamma rays pose a significant external exposure hazard. Dense materials, such as lead and steel, are often used as shields against gamma radiation.

2.2 RADIATION RESULTING FROM A NUCLEAR DETONATION

The radiation resulting from a nuclear detonation has been categorized as "initial" and "residual." Initial radiation is defined as the radiation emitted from the fireball and radioactive cloud within the first minute after the detonation. Initial radiation includes "prompt" radiation, which is emitted

almost simultaneously with the detonation. Residual radiation is the radiation emitted from radioactive fission products, unused nuclear material, and neutron-induced radioactive materials more than one minute after the detonation.

2.2.1 Initial Radiation

Initial radiation includes gamma rays, neutrons, and alpha and beta particles; however, because of the extremely short ranges of alpha and beta particles, they are of little consequence as a potential hazard.

Gamma rays emitted as initial radiation originate in a number of ways. First, gamma rays result from the fission process itself. Second, the neutrons that escape without producing further fissioning may interact with or be captured by nonfissionable material, such as the weapon case or nitrogen in the air. These interactions may produce excited, unstable nuclei that release the excess energy as gamma rays. Finally, gamma rays are also emitted by the radioactive fission products that are produced in the detonation.

Neutrons are also part of the initial radiation emitted during a nuclear detonation. Essentially all of the neutrons are released either in the fission or fusion process. All fusion neutrons and more than 99 percent of the fission neutrons are emitted almost immediately. These are referred to as "prompt" neutrons. The remaining fission neutrons, called "delayed" neutrons, are released within the first minute and also constitute part of the initial radiation.

2.2.2 Residual Radiation

By definition, residual radiation is that radiation emitted more than one minute after the detonation. The source, extent, and significance of this radiation are influenced by factors such

as the design and yield of the nuclear device, the location of the detonation with respect to the earth's surface, and meteorological conditions.

The residual radiation from a weapon detonated high in the air emanates primarily from the radioactive fission products, unfissioned nuclear material (plutonium, uranium, or both), and weapon debris made radioactive by neutron-activation. These sources of radiation vary with the yield and design of the nuclear device. For example, a thermonuclear (fission-fusion) device would produce fewer radioactive fission products than a pure fission device of the same yield. The weapon design, which encompasses factors such as size and materials, also influences the quantity and type of neutron-induced activity produced.

These radiation sources are of little consequence as long as they remain in the air; however, eventually they settle to the ground as "fallout." The time until fallout is a function of the height and yield of a detonation; that is, the greater the yield, the higher the radioactive debris will be lifted and the longer it will take to fall to the ground.

In surface or low-altitude detonations, elements and minerals in the soil can be made radioactive by interaction with neutrons. For example, neutrons released by such nuclear detonations can transform the stable isotope of sodium, an abundant element in most soils, into radioactive sodium-24. Other common soil constituents that can be neutron-activated include manganese, iron, silicon, and aluminum. Neutron activation can also make many of the metals used in building materials radioactive. These materials then contribute to residual radiation.

2.3 Fallout from Nuclear Detonations

Generally, fallout represents an acute hazard only when the nuclear detonation occurs on or near the surface of the earth. In surface or low air detonations, the fireball actually touches the ground and vaporizes some of the rock, soil, and other materials that are in the area. These materials, along with the fission products and unfissioned nuclear material, are then in a gaseous form within the fireball and are carried aloft as the fireball ascends. Dust and other particles that have been carried aloft by the fireball become contaminated as they are thoroughly mixed with the vaporized nuclear debris.

Eventually these radioactive particles cool, condense, and either fall back to the earth or remain suspended in the atmosphere for indefinite periods of time. Early fallout is defined as that which reaches the ground during the first 24 hours following a nuclear detonation. The early fallout contains the larger, heavier particles and can produce fairly high levels of radioactive contamination over large areas. Delayed fallout, which reaches the ground more than 24 hours after the detonation, consists of very fine particles that settle in low concentrations over a considerable portion of the earth's surface. The radioactivity level of delayed fallout is greatly reduced as a result of radioactive decay during the relatively long time the particles remain in the upper atmosphere. The radionuclides with short half-lives contribute more prominently to early fallout, while those with longer half-lives become prominent in delayed fallout. This occurs because the short-lived nuclides have usually decayed by the time the delayed fallout settles to the earth's surface.

The immediate concern related to fallout is the external exposure hazard from beta and gamma radiation produced by the fission products. Many different fission products are included in the fallout. Fission products are a complex mixture of over 300 different nuclides of 35 or more elements, and practically

all of these nuclides are radioactive. In general, the gamma radiation from fission products taken as a whole decreases with time according to the following approximation: for every seven-fold increase in time, the gamma intensity decreases by a factor of ten. For example, the gamma intensity seven days after the explosion is about one-tenth of that occurring one day after the explosion. This rule is applicable for up to six months following the detonation. After six months, the gamma intensity decreases even more rapidly.

The uranium or plutonium components of the weapon that do not fission are also a part of the nuclear fallout. These elements have extremely long half-lives of thousands of years. Because they emit primarily alpha particles, fallout particles containing uranium and plutonium do not constitute an external exposure problem but can be hazardous if inhaled or ingested.

CHAPTER 3

RADIATION MEASUREMENT, INSTRUMENTATION, AND PROTECTION

This chapter explains basic units of radiation measurement and briefly describes instruments used to detect and to measure radiation. The chapter also outlines the basic principles of radiation protection.

3.1 UNITS OF RADIATION

The roentgen, abbreviated R, is the unit that expresses the amount of ionization that gamma or X-radiation produces in air. One roentgen of gamma radiation forms 2.08×10^9 ion pairs per cubic centimeter of air. When converted to units of energy, this is equivalent to the deposition of 88 ergs per gram of air at standard temperature and pressure. It is important to note that the roentgen is a measure of the gamma or X-radiation intensity or exposure in air, not a measure of radiation dose.

The rad (radiation absorbed dose) is the unit currently used to express the dose absorbed from any ionizing radiation in any material. A rad is defined as the absorption of 100 ergs of energy per gram of material, regardless of the type of radiation involved. Exposure to 1 roentgen of X or gamma radiation results in an absorbed dose of approximately 1 rad.

The rem (roentgen equivalent man) is the unit of biological dose equivalent. Dose equivalent is defined as the product of the absorbed dose (in rads) and other necessary modifying factors such as the quality factor (QF), which takes into account the effectiveness of a particular type of radiation in producing

biological damage. This makes it possible to express the radiation dose in terms of a common unit for all ionizing radiation. For internal organ dose calculations, a distribution factor (DF) is also used. This factor adjusts the dose equivalent to allow for nonuniform distribution of the radioactive material within the organ.

3.2 RADIATION DETECTION, EXTERNAL EXPOSURE

Since the human senses are incapable of perceiving ionizing radiation, special instruments are necessary to detect radiation. This section describes various methods used to detect and measure radiation.

3.2.1 Radiation Survey Instrumentation

Several different types of portable survey instruments can detect and measure the intensity of ionizing radiation. All of these instruments measure radiation indirectly by detecting and evaluating an event (primarily ionization) caused by the radiation in some medium. The types of instruments differ primarily in the medium in which the event takes place and in the method by which this event is detected and measured. Most portable survey instruments fall into two general categories: gas ionization detectors and scintillation detectors. The gas ionization detector takes advantage of the ionization produced when radiation passes through a gas; the scintillation detectors depend on the property of certain materials to emit light (scintillate) when struck by ionizing radiation.

Gas Ionization Detectors

As the name implies, this category of detectors uses a gas as the detection medium. The typical detector consists of a cylindrical or rectangular chamber with a wire strung through the

center. This central wire is insulated from the chamber walls and has a positive charge. The chamber is filled with air or a gas such as argon, and this gas-filled space serves as the sensitive volume. Radiation that enters the sensitive volume ionizes the gas. This produces free electrons, which, because they are negatively charged, are attracted to the positively charged central wire, also known as the anode. As these electrons are collected on the anode, they neutralize and reduce the charge. This reduction in charge can be measured and used as an indication of the amount of radiation present.

The three basic types of gas ionization detectors are the ionization chamber, the proportional counter, and the Geiger-Mueller detector. The primary difference between these detector types is the amount of voltage differential applied between the central anode and the chamber wall.

The ionization chamber instrument operates at a voltage potential just great enough to collect all of the free electrons produced by the ionizations taking place in the chamber. By increasing this voltage, the free electrons produced by the original ionizing event can be accelerated to the point that they cause additional ionization as they are attracted toward the central anode. These secondary ionizations also produce electrons that are attracted to the anode adding to the neutralization of the charge. If the voltage differential is greatly increased, ionization can be amplified to the point that nearly all of the gas in the chamber is ionized whenever a single ionizing event takes place. This greatly increases the sensitivity of the detector. Geiger-Mueller detectors operate at such a voltage and are thus best suited for monitoring low-level radiation where high sensitivity is needed. Ionization chamber instruments are the least sensitive of the gas ionization detectors; therefore, they are generally used as high-range instruments. Proportional counters, which operate at an intermediate voltage, are not commonly used for field surveys.

Gas ionization instruments can be used to detect all forms of ionizing radiation. Since the radiation must penetrate the chamber before it can be detected, the type of radiation to be measured must be considered in the chamber design. For example, the chamber walls of an alpha radiation detector must be constructed of an ultra-thin material that will allow entry of the alpha particle. On the other hand, the chamber walls of a gamma detector can be fairly substantial because gamma rays are highly penetrating. The chamber walls of beta-gamma detectors normally have a thin window of mica or other light material that can be opened or closed depending on whether or not beta particles are to be detected.

Scintillation Detectors

Another kind of portable survey meter is the scintillation detector. This detector consists of a phosphorescent material that emits light, or scintillates, when irradiated and a system to convert the light into electrical energy, amplify it, and measure the electrical output. Scintillation detectors can detect alpha and beta particles, and they are especially efficient in measuring gamma radiation.

3.2.2 Personnel Dosimetry

Film badges and pocket dosimeters are generally used to determine the wearer's cumulative external exposure to X-radiation or gamma radiation. These devices are worn by personnel working in a radiation environment.

Film Badges

Photographic film is sensitive to ionizing radiation in much the same manner that it is to light. Processed or developed film that has been exposed to radiation will exhibit a darkening or increased optical density that can be related to the degree of

exposure. This optical density can be measured with a densitometer and compared with a calibrated standard to estimate the exposure. Using this technique, photographic film worn in the form of a badge can measure an individual's cumulative gamma radiation exposure.

Typically, the film is wrapped in a light-tight paper packet lined with a very thin layer of lead. This thin layer of lead has two purposes. First, it filters out very low energy gamma rays, which are of little biological significance but cause a disproportionate change in the optical density of the film. Second, the lead layer helps to intensify the interaction of high energy gamma radiation with the film. The film packet is placed inside a plastic holder clipped to the outer clothing. The badge is usually worn on the chest. Figure 3-1 presents a drawing of a typical film badge holder.

Photographic film will respond to the ionizing effects of any radiation that reaches it. The lead-lined paper wrapper will filter out alpha radiation and will also attenuate very low energy beta radiation. The plastic film holder will absorb most of the other beta radiation. Therefore, to detect beta radiation exposure, a "window" is commonly provided in the film holder. Gamma radiation will easily penetrate the plastic holder. Thus, by comparing the exposure due to gamma recorded by the "closed" portion of the film with the exposure due to beta and gamma recorded by the "open" portion, the part attributable mainly to beta can be evaluated.

Although neutron radiation is not directly ionizing, film can be used to record neutron exposures. Unfortunately, neutron film dosimetry was in its infancy at the time of the nuclear tests and was not used other than experimentally.

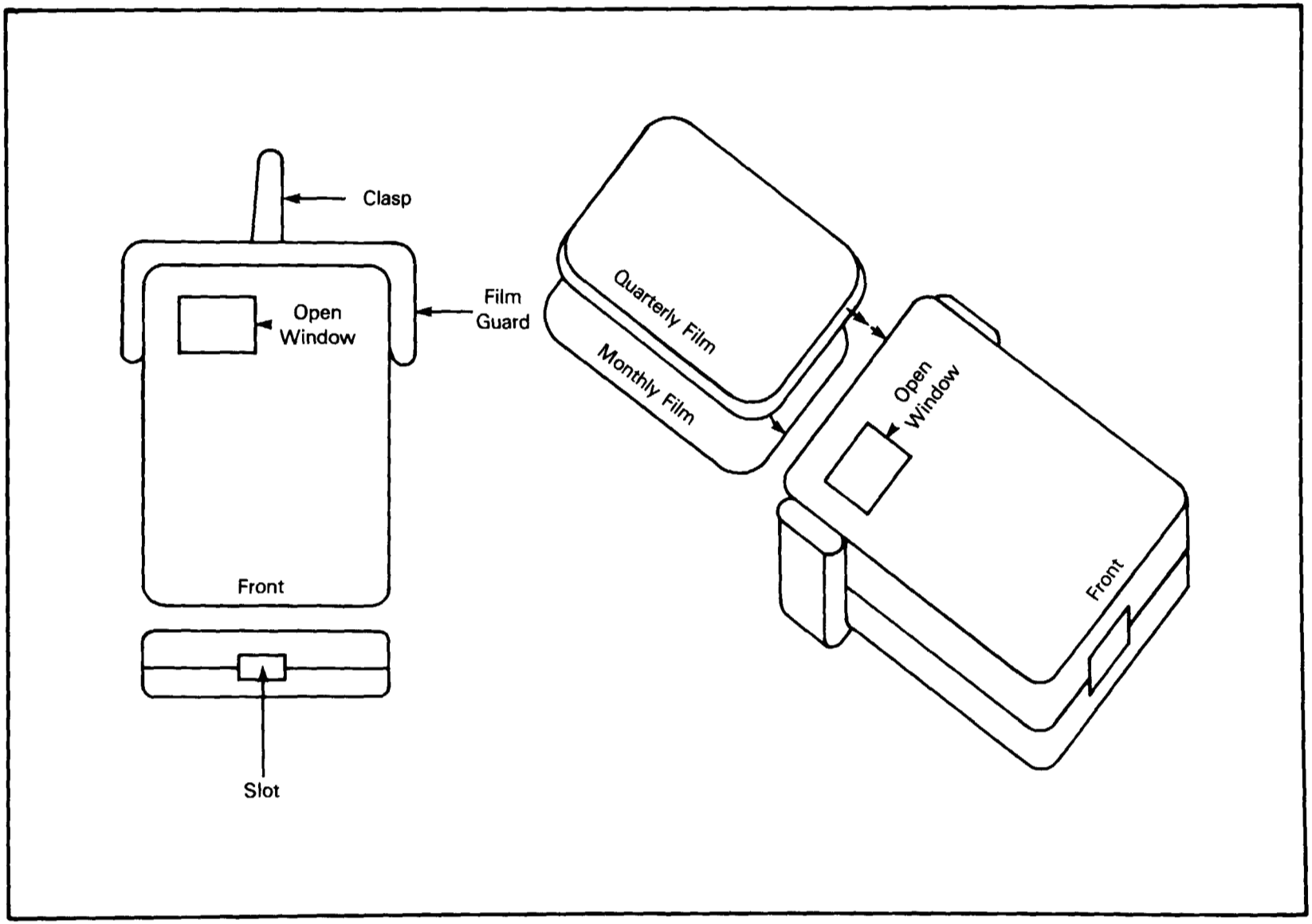

Figure 3-1: FILM BADGE HOLDER (SMITH)

Direct-reading Dosimeters

Film badges must be processed before they can furnish information on radiation exposure. Direct-reading pocket dosimeters, on the other hand, provide instantaneous information on cumulative exposure. These dosimeters are used primarily to measure X-radiation or gamma radiation.

Pocket dosimeters are typically about the size and shape of a writing pen, as indicated in figure 3-2. The dosimeter consists of a small ionization chamber coupled to a miniature electrostatic meter and an optical reading system. A charge is applied to the chamber so that the electrostatic meter reads zero. As radiation ionizes the air in the chamber, the applied charge is dissipated. The loss of charge is directly proportional to the radiation exposure. The accumulated exposure can be determined at any time by aiming the instrument at a light source and reading a scale. The dosimeter can be used again after it has been recharged. The operating range of pocket dosimeters varies considerably; typical ranges are 0 to 200 mR and 0 to 10 R.

If a pocket dosimeter is dropped or jarred, it can discharge and indicate an exposure when none has actually occurred. Dosimeters may also leak their charge in conditions of high humidity. For these reasons, two dosimeters are usually worn close together, and the lowest reading is taken as the exposure estimate.

3.3 RADIATION MEASUREMENT, INTERNAL EXPOSURE

Radioactive material may enter the body by ingestion, inhalation, or, in certain cases, by direct penetration of the skin (absorption or through an open wound). Once inside the body, the material continues to be a source of radiation exposure until it is eliminated through biological processes, radioactive decay, or a combination of both.

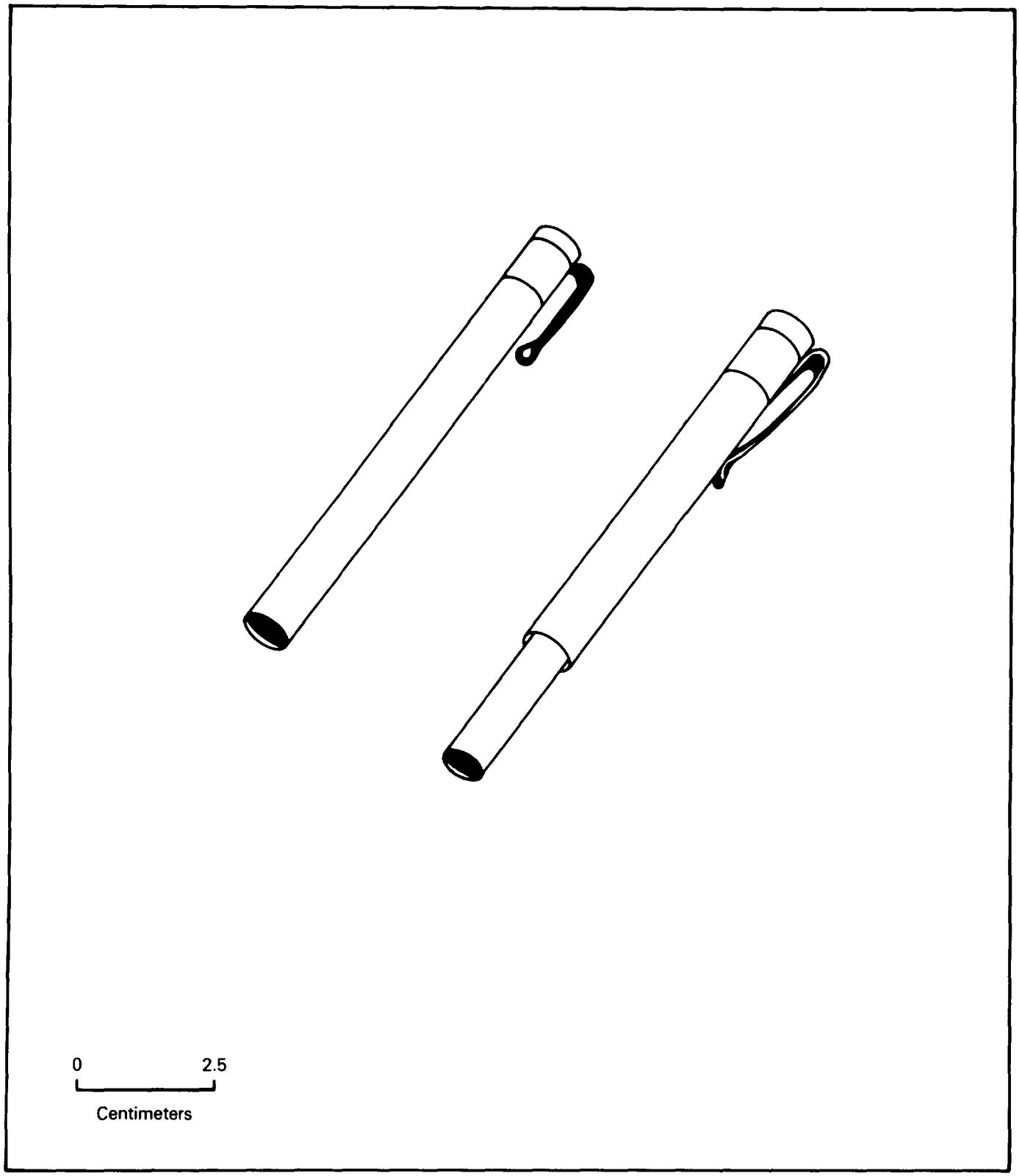

Figure 3-2: POCKET DOSIMETERS (SMITH)

To calculate the dose resulting from internal deposition, it is first necessary to estimate the quantity of radioactive material that has entered the body. Once this has been estimated, calculations based on many factors, such as the chemical, physical, and radiological properties of the material as well as its biological fate, are used to figure the dose received by the individual.

The following paragraphs briefly summarize methods used to determine the quantity of radioactive material that may have entered the body.

3.3.1 Air Sampling

Samples of airborne radioactive material are customarily collected by drawing a known volume of air through a filter and analyzing the filter in a laboratory. The physical state of the airborne material dictates the type of filter required. For example, a paper filter of good quality can be used to sample most airborne particulate matter. For gaseous material, such as certain iodine compounds, an activated charcoal filter must be used to collect the material by adsorption on the filter media. Air also can be sampled by simply collecting a known volume in a special container, such as an evacuated bottle. The air is then transported to the laboratory for analysis using appropriate instrumentation. The amount of radioactive material inhaled can be calculated by multiplying the airborne concentration (quantity per unit volume) by a standard breathing rate and volume and the duration of exposure. Since the retention of radioactive particles in the lung depends on the size of the particles, the calculation may also consider the particle sizes.

Swabbing the nasal passages with moistened cotton swabs and analyzing the swabs for radioactivity is often used as an indicator of possible inhalation exposure. However, this technique cannot quantify the exposure.

3.3.2 Water and Food Sampling

Samples of water or food can also be submitted to special laboratories for analysis. Again the amount of intake is calculated by multiplying the concentration of radioactive material in the water or food by the quantity of water or food ingested.

3.3.3 Bioassays/Biological Sampling

In certain cases, samples of body tissue, exhaled breath, or excreta (urine and feces) can be analyzed in a laboratory to determine the quantity of radioactive material within the body. Such determinations require knowledge of the biological characteristics of particular radionuclides in order to calculate the amount of intake.

3.3.4 Whole-body Counting

A whole-body counter is useful when the internal source is a gamma radiation emitter. This device employs a heavily shielded enclosure large enough to hold the person being monitored in an environment with low background radiation. This allows measurement of extremely low levels of radiation emitted from sources within the body.

The previous sections have presented the general methodology used to determine an individual's exposure to external and internal ionizing radiation. The following section discusses the methods for reducing exposure to external and internal radiation.

3.4 RADIATION PROTECTION

The basic principle of radiation protection is to minimize an individual's exposure to ionizing radiation. External radiation exposure is reduced by lessening or eliminating the amount

of radiation that impinges upon the body. Among the most effective means of reducing external exposure are using shielding material, increasing the distance from the source of radiation, and reducing exposure time. A method for reducing internal exposure is to prevent internal deposition through the use of protective equipment, such as respirators.

3.4.1 Protection against External Radiation Exposures

The intensity of radiation decreases in inverse proportion to the square of the distance from a point source. In general terms, this means that for every doubling of distance away from the radiation source, the radiation intensity decreases by a factor of four. Therefore, individuals can be protected from exposure simply by keeping them away from the source of radiation. For example, a person located 100 meters from a gamma radiation point source would be exposed to one-quarter of the radiation to which a person located 50 meters from the source would be exposed. This example pertains only to an individual exposed to a point source of radiation, not from a source distributed over a large area (such as fallout distributed over a large surface area).

Another method of reducing radiation exposure is to insert shielding material between the radiation source and the personnel. Normal clothing provides adequate protection against alpha and low-energy beta particles. Special shielding is required for gamma and neutron radiations, however, since they can readily penetrate many materials. High-density materials, such as lead and iron, are commonly used in gamma ray shields; however, these materials alone are not as effective against neutrons. To shield effectively against neutrons, the material(s) must first slow the neutron and then absorb it. Materials such as iron or barium are commonly used to decelerate very high-speed neutrons to an intermediate speed. These

intermediate-speed neutrons are then slowed further by the use of materials containing elements of low atomic weight (for example, water or paraffin) until the neutrons reach a point where they can be absorbed by materials such as boron or hydrogen.

The third method of controlling radiation exposure is to keep exposure to a minimum by limiting the amount of time individuals spend in radiation areas. Gamma radiation intensities can be monitored by survey meters. These data on exposure rates can then be used to determine the length of time individuals can stay in an area before reaching a predetermined exposure level.

Radiation exposure can be further minimized by allowing the radioactivity in an area to decay to safe levels before permitting entry of personnel. Radiation emitted from a radioactive source steadily decreases with time, according to the half-life of the radioactive material.

3.4.2 Other Protective Measures

To protect personnel from internal exposure, it is necessary to prevent them from inhaling or ingesting radioactive material and also to prevent radioactive materials from entering the body through a wound. Anticontamination clothing and respiratory equipment can be used to protect individuals from internal exposure.

Anticontamination Clothing

Anticontamination clothing consists generally of coveralls, shoe covers, gloves, and caps. The specific type of clothing worn is dictated by weather conditions, work to be performed, and anticipated contamination levels. The proper wear of anticontamination clothing, used either in place of or over regular apparel, includes overlapping coverall cuffs on gloves and boots and securing the cuffs with tape. In addition, the coveralls are

buttoned and taped at the neck. Removal of this clothing upon leaving a contaminated area helps to control the spread of radioactive material into uncontrolled areas.

Respiratory Protective Equipment

Respiratory protective devices are designed to prevent individuals from inhaling radioactive materials. Some respirators remove the contamination from the inhaled air, while others supply clean air from an uncontaminated source.

An air-purifying respirator consists of a cartridge or canister through which the air is inhaled. Contaminants are removed by filtration, absorption, or adsorption. Particulate matter is effectively removed by filtration, but gases and vapors must be absorbed or adsorbed by special chemicals or activated charcoal. The filtration system is contained in cartridges that attach to the respirators.

An air-supplying respirator receives air from either an air line or a portable air supply tank. Air-supplying respirators give the most complete respiratory protection against airborne radioactivity.

The efficiency of any respirator, whether air-purifying or air-supplying, depends upon its fit. If the respirator does not fit properly, it may leak and not protect adequately. The mask should always be checked for proper fit before use.

CHAPTER 4

DEVELOPMENT OF RADIATION PROTECTION STANDARDS

This chapter addresses the evolution of protection guidelines for external exposure to radiation as developed by national and international authorities. The chapter discusses changes in the terminology used in radiation protection before concluding with a chronology of radiation protection milestones.

4.1 DEVELOPMENT OF THE STANDARDS

Scientific recognition and identification of ionizing radiations occurred in the late 19th century. In 1895, Wilhelm Roentgen observed that photographic film darkened when placed near an operating cathode tube. He demonstrated that invisible rays emanating from the cathode tube were responsible for darkening the film. He called these invisible rays "X-rays." In 1896, Henri Becquerel discovered that uranium emitted similar kinds of rays. These rays, along with X-rays, were shown to produce electrical charges in air, and for this reason were referred to as "ionizing radiations."

While continuing his work on X-rays, Roentgen discovered that most materials, including human tissue, were transparent to X-rays. This discovery led directly to medical and scientific uses of X-rays and launched the modern field of radiology.

Early radiographic equipment consisted of a simple X-ray tube that was completely unshielded: no attempts were made to control the X-ray exposure of either the patient or the operator. By the end of 1896, many operators of X-ray devices were complaining of skin and eye irritations. These health effects were not considered serious, however, and no effort was made to

reduce or eliminate these symptoms until 1903, when an English radiologist expressed concern over the extensive exposure received by X-ray machine operators. Because of this concern, many radiologists began wearing protective clothing to reduce exposure to X-rays. This clothing included gloves and aprons lined with lead, eye goggles, and face shields. Such individual protective measures were later abandoned in favor of protective shielding built into the X-ray apparatus itself.

By the early 1920s, it was known that continued exposure to X-rays produced a reddening or erythema of the skin. The amount of X-radiation needed to produce this reddening was called the "erythema dose." The determination of this amount was a crude and subjective estimate of the dose since the extent of biological effect varied widely depending on the exposure, time of exposure, and individual tolerance. However, the erythema dose was the first attempt at quantifying radiation exposure.

It was soon realized that a more precise measure was required to quantify exposure to ionizing radiation. A standardized set of exposure criteria was needed to properly describe human exposure to radiation. In 1925, an international committee, called the International Commission on Radiological Units and Measurements (ICRU), was established to evaluate the problem of human exposure to radiation and to recommend standardized units and measurements that could be used to quantify radiation exposure. In 1928, this committee recommended adopting the roentgen as the standard unit of X-radiation exposure. Although the roentgen became a common unit for measuring radiation, it is a physical unit of exposure in air rather than a biological measure of absorbed dose.

Actual protection standards were not addressed until 1928, when the International X-ray and Radium Protection Commission was formed. This group is now the International Commission on Radio-

logical Protection (ICRP). In 1929, a similar organization, the American Advisory Committee on X-ray and Radium Protection, was founded in the United States. In 1934, the ICRP made its first recommendation of a tolerance level of exposure: 0.2 roentgens per day. Largely because of World War II, the ICRP did not meet between 1937 and 1950, and this recommended limit remained in effect until 1950.

Like the ICRP and the ICRU, the American Advisory Committee on X-ray and Radium Protection discontinued most of its work during World War II. In the United States during the early 1940s, the major efforts in the radiation field were directed toward the development of nuclear weapons. The weapons program led to a vastly expanded radiation industry that called for an increased understanding of radiological control and safety measures. This awareness was reflected by the American Advisory Committee's recommendation that occupational exposure to radiation should be limited to 0.1 roentgen per day. This recommended limit was used for radiation workers on the Manhattan Project.

After World War II, the American Advisory Committee reorganized as the National Council on Radiation Protection and Measurements (NCRP). In 1949, the NCRP made a number of basic decisions regarding radiation exposure, including the recommendation to lower the permissible dose to 0.3 roentgens per week. In addition, it recommended the adoption of Relative Biological Effectiveness (RBE) as a means for calculating absorbed dose from different types of radiation.

The NCRP introduced the term "permissible dose" in 1949 to describe the maximum radiation dose that could be safely received by an individual. The NCRP adopted this new term because data from biological studies showed that it could not be assumed that all effects have a threshold dose, below which no effects would

result. In the case of genetic damage, effects might be expected at very low doses. The term "tolerance dose," which had been used up to that time, seemed to suggest a dose below which no effects would occur.

The change in terminology did not entirely eliminate the ambiguities associated with interpretation of radiation protection terms. "Permissible dose" does not explain who or what gives "permission" to receive a particular dose of radiation, especially since the NCRP is not a regulatory agency and only makes recommendations about radiation protection measures. Terms that have been used synonymously with permissible dose have been "tolerable," "acceptable," and "allowable" dose. The specific application of these terms has been much debated, but for practical purposes, they can all be used when referring to a standardized maximum limit on the dose of radiation received by an individual. The NCRP, however, has continued to use "permissible dose" when describing recommended radiation dose limits.

In 1950, the ICRP made new recommendations based on the data collected by the NCRP. The ICRP recommended at that time that the weekly exposure limit be lowered to 0.3 roentgens to agree with the NCRP recommended limit.

At a joint meeting in 1953, the ICRP and the ICRU recommended a new radiation unit, the rad. The rad, in contrast to the roentgen, is a unit of absorbed dose, not a unit of exposure. The ICRP and the ICRU also identified another new term, the rem, as the absorbed dose of any ionizing radiation that had the same biological effectiveness as one rad of X-radiation. The dose in rem was equal to the dose in rads multiplied by the appropriate RBE.

In 1956, because of concern over long-term exposures at low dose rates and possible genetic effects, both the NCRP and the

ICRP independently recommended reducing the permissible exposure level for radiation workers to 5 rem per year. They also recommended that the total accumulated dose over the lifetime of an individual be restricted according to the age-proration formula D=5(N-18), where D is the total accumulated dose and N is the individual's age in years. Therefore, a radiation worker 28 years of age should not have an accumulated lifetime dose greater than 50 rem [5(28-18)=50]. The NCRP and the ICRP adopted the age-prorated limit for whole body exposure in 1957.

Because of the increasing use of radiation and the potential exposure of the general population to radiation, several studies were commissioned and new organizations and agencies were established in the 1950s to study problems related to radiation exposure. The National Academy of Science commissioned the Biological Effects of Atomic Radiation (BEAR) study in 1955, which was continued as the Biological Effects of Ionizing Radiation (BEIR) study in 1972. The United Nations established its own scientific committee on the Effects of Atomic Radiation (UNSCEAR) in 1955. Based on the findings of these studies, the ICRP and NCRP suggested an exposure limit for the general population of 0.5 rem per year.

The U.S. Federal Radiation Council (FRC) was formed by Executive Order in 1959 to guide Federal agencies in setting standards and criteria for radiation exposure. Before 1959, the Federal government had been using standards based on recommendations of the NCRP, ICRP, and the National Academy of Science. In 1960, the FRC adopted a basic set of standards essentially the same as that developed by the NCRP in 1957. In 1970, the FRC was decommissioned and incorporated into the newly formed Environmental Protection Agency (EPA). The EPA had the responsibility of recommending radiation standards and limits pertaining to the environment in general.

For the most part, the guidelines for exposure to ionizing radiation set in 1957 by the NCRP and the ICRP have remained unchanged to the present time. In 1963, however, the NCRP and the ICRP recommended that the RBE be replaced by the Quality Factor (QF). Before 1963, the RBE was used to convert the dose in rads to the dose equivalent in rem. The RBE was an experimentally determined value that related the biological damage caused by one type and energy of radiation to the damage caused by any other radiation. The QF is used as the multiplier to convert the absorbed dose (rads) to units of human dose equivalency (rem). Each type and in some cases each energy of radiation is assigned a specific QF based on its ability to produce ionization and its linear energy transfer value. In 1971, after completing a ten-year study and review of basic radiation protection criteria, the NCRP determined that no major changes should be made in the 1957 recommendations. Its statements of 1971 are currently used for radiation protection work.

This section has summarized significant developments in radiation protection standards. Since the first basic standards for radiation protection were established in 1934, they have been reduced twice. The first change, from 0.1 roentgen per day to 0.3 roentgens per week, occurred in 1949. The second change, from 0.3 rem per week to 5 rem per year, a threefold reduction, occurred in 1956. The reduction of the permissible standards has been based on theoretical concepts concerning genetic risks and on observed biological effects in animals, not on observed effects in humans. The radiation exposure standards currently used for human protection are as follows:

Occupational Exposure	Period	Dose Limit (rem)
Whole body, head and trunk, blood-forming organs, lens of the eye, gonads	Calendar Quarter	1.25*
Skin	Calendar Quarter	7.5
Hands, forearms, feet, and ankles	Calendar Quarter	18.75

*Can be raised to 3 if when added to the accumulated occupational dose to the whole body, the total does not exceed 5(N-18) rem where N equals the individual's age in years at his last birthday.

4.2 CHRONOLOGY OF RADIATION PROTECTION STANDARDS

This section summarizes events in the development of the radiation protection standards discussed in the preceding section.

1910-1920s: The "erythema dose" was identified and commonly used as an indicator of excessive exposure to X-radiation.

1928: The international commission that became the ICRU was formed. This commission adopted the "roentgen" as the international unit of radiation measurement. Although not a radiation protection unit, all subsequent radiation measurements and units were directly or indirectly based on the roentgen.

1934: The American Advisory Committee on X-ray and Radium Protection (now the NCRP) recommended a "tolerance dose" of 0.1 roentgen per day for radiation workers. The ICRP recommended a tolerance dose of 0.2 roentgens per day for radiation workers.

1949: The NCRP recommended a "permissible dose" of 0.3 roentgens per week. The NCRP recommended adoption of the terms "RBE" and "permissible dose."

1950: The ICRP adopted the NCRP 1949 recommendation of 0.3 roentgens per week permissible dose for radiation workers.

1953: The ICRP and ICRU introduced the units "rad" and "rem" to express radiation absorbed dose.

1956: Both the NCRP and ICRP independently recommended lowering the permissible dose for radiation workers to 5 rem per year. In addition, they proposed a limit of 0.5 rem per year for the general population.

1957: The NCRP and the ICRP adopted the "age-proration principle" of lifetime dose. According to this principle, the total accumulated dose an individual can receive over his lifetime is equal to 5(N-18) rem, where N is the individual's age in years.

1959: The FRC was established by Executive Order to provide guidance to all Federal agencies proposing radiation standards and guidelines.

1960: The FRC developed its first set of standards, which were essentially the same as the 1957 standards of the NCRP and ICRP, and proposed a permissible dose of 5 rem per year.

1963: The ICRP recommended adoption of the QF, instead of the RBE, to determine dose equivalency in humans. The commission also recommended that the RBE

continue to be used in experimental work but not in radiation protection.

1970: The authority of the FRC was transferred to the EPA.

1971: The NCRP completed a ten-year study and review of radiation protection criteria. Basically, the council did not change the 1957 recommendations.

Appendix C presents data on radiation exposure standards specific to the U.S. nuclear test series.

CHAPTER 5

BIOLOGICAL EFFECTS OF IONIZING RADIATION

Exposure to radiation that produces ionization can damage biological systems, as has been known for some time. The first documented case of human injury occurred only a few months after Wilhelm Roentgen announced the discovery of X-rays in 1895. Since that time, much has been learned about exposure to ionizing radiation. However, many unknowns remain.

This chapter briefly summarizes some of the pertinent knowledge on biological effects. This general discussion is not intended as a full exposition of the biological effects of radiation. Rather, it presents key material drawn from basic sources such as The Medical Effects of Nuclear Weapons by the Armed Forces Radiobiology Research Institute, "Health Aspects of Nuclear Weapons Testing" by the Atomic Energy Commission, the BEIR III Report prepared by the Committee on the Biological Effects of Ionizing Radiations, Glasstone and Dolan's The Effects of Nuclear Weapons, The Health Physics Technician Training Manual edited by Stroscheir and Maeser, and Sources and Effects of Ionizing Radiation by the United Nations Scientific Committee on the Effects of Atomic Radiation. (See the reference list for bibliographic information concerning these reports.) The reader should consult these and other volumes for a comprehensive presentation of this complex and controversial topic.

5.1 EXPOSURE

Individuals can be exposed to radiation from a nuclear detonation in several different ways. Persons located close to the detonation can be exposed to high levels of initial neutron and gamma radiation, even if they are adequately protected from the thermal and blast effects. Persons can be exposed to the

residual radiation from neutron-induced radioactivity in the soil and from radioactive fallout that settles to the ground. In the former case, the exposure is considered "external" (that is, the radiation source is located outside the body). In the latter case, the exposure can be external or "internal" if the radioactive material is taken into the body by inhalation, ingestion, or directly through the skin (through an open wound or in some cases by absorption). Radiation exposures that occur within a relatively short period of time, arbitrarily taken as 24 hours, are termed "acute exposures." Exposures that occur over a longer period of time are defined as "chronic exposures."

5.2 CHRONOLOGY OF BIOLOGICAL EFFECTS

The observable biological effects of acute exposures normally follow a sequential pattern. For chronic exposures, this pattern may not be recognizable since these effects overlap one another. Generally, however, the chronology follows the pattern described below.

A time lag, called the latent period, occurs between the initial radiation exposure and the first detectable biological effect. This period can vary greatly. The larger the radiation exposure, the shorter the latency period. The effects that appear within minutes, days, or weeks are arbitrarily termed "acute" effects. Those appearing years, decades, or even generations later are called "long-term" effects. Following the latent period is a stage of demonstrable effects, such as loss of hair, and possibly a period of recovery, since some biological effects are subject to recovery. For example, hair lost as a result of radiation exposure will return if the individual survives the initial exposure. There may, however, be residual damage from which there is no recovery. Such residual damage is the basis for long-term effects.

5.3 FACTORS THAT INFLUENCE BIOLOGICAL EFFECTS

Several factors determine the extent of biological damage caused by radiation. These factors include the type of radiation absorbed by the body, the total amount of radiation absorbed by the body, the rate of exposure, the portion of the body exposed, the relative sensitivity of certain body tissues to radiation, and individual variability in response to equivalent radiation dose.

5.3.1 Type of Radiation

The amount of radiation absorbed in a tissue is a function of the type and energy of the incident radiation. In most cases, alpha and beta radiation will be completely absorbed by body tissue, while gamma rays and neutrons may be only partially absorbed. For a given type of radiation, the greater its energy, the greater its penetration ability. However, the penetration ability of different types of radiation of equal energy varies widely. For instance, a high-energy alpha particle will not penetrate the outer layer of skin, whereas a fairly low-energy gamma ray will easily penetrate well into or even through the entire body. To consider another factor relative to the different types of radiation, living cells demonstrate a greater biological response to highly ionizing particles (such as alpha particles) that rapidly transfer their energy during transit than to radiations (such as beta particles and gamma rays) that do not transfer as much energy per unit of path length through tissue. In other words, some types of radiation are more effective than others in producing damage.

5.3.2 Total Amount of Radiation Absorbed

The amount of radiation absorbed is commonly termed "dose." As with most hazardous or toxic agents, there is a quantitative relationship between the extent of damage, or effect, and the

dose received. The latency period for an observed effect, as stated earlier, usually decreases with increases in dose.

In considering almost all acute effects, there is a threshold dose below which the effect does not appear. For example, if a person were to expose groups of experimental animals to increasing levels of gamma radiation and look for an effect, such as vomiting, within one week after the exposure, he or she would observe a threshold dose below which none of the animals vomited. Once this threshold dose was exceeded, the percentage of animals vomiting would increase rapidly until the effect was observed in all exposed animals.

Today, many experts do not believe there is a threshold dose for most of the long-term biological effects. It is reasonably well established that the genetic effects of radiation follow a linear or a "non-threshold" dose-effect relationship. Considerable evidence from animal experiments indicates that life span shortening and possibly carcinogenic effects also follow this relationship. More sensitive means of measuring these effects are, however, needed to confirm this relationship.

5.3.3 Rate of Radiation Absorption

The rate at which the radiation dose is received is a critical factor for most acute radiation effects. For example, in most cases, a given dose will produce much less of an effect if delivered over a period of several days rather than in a single exposure. This fact supports the theory that some recovery occurs between exposures. On the other hand, if permanent radiation damage results in some of the long-term effects, rate of radiation absorption is probably not a factor.

5.3.4 Area or Portion of the Body Exposed

Large doses of radiation that would be lethal if applied to the whole body can be administered to portions of the body without apparent danger. Therapeutic radiation doses are a prime example.

5.3.5 Relative Sensitivity of Certain Body Cells and Tissues

All cells and tissues are not equally sensitive to radiation. Several factors influence their degree of sensitivity. In general, cells and tissues that are rapidly growing or are being continually renewed or replaced are the most sensitive to radiation damage. Other factors include the degree of cell or tissue specialization and structure. The most radiosensitive tissues and cells include the lymphoid tissue (particularly lymphocytes), reproductive tissue, spleen, immature blood cells found in bone marrow, and the cells lining the gastrointestinal tract. The least sensitive tissues are bone, muscle, and nerve. Since the blood-forming organs, such as the spleen and bone marrow, are extremely radiosensitive, any shielding of these areas would materially lessen the effect of a whole body exposure.

5.3.6 Species and Individual Variability

Responses to equal radiation doses vary considerably among animal species and even within species. For example, a whole body exposure to 250 roentgens would be lethal to approximately 50 percent of exposed guinea pigs. Approximately 875 roentgens would be required to produce the same effect in rabbits.

5.4 CLINICAL EFFECTS

The clinical effects of exposure to ionizing radiation can range from a minor reddening of the skin (erythema) to death. The time interval between the exposure and the onset of these

effects generally depends on the amount of radiation absorbed in the critical body organs.

5.4.1 Acute Effects

"Radiation sickness" is the term commonly used to describe the acute effects of radiation exposure. These effects or symptoms are collectively referred to as "acute radiation syndrome." The following information summarizes the acute effects expected from increasing levels of radiation exposure of humans.

Doses of 25 to 100 rem

The individual receiving a radiation dose of 25 to 100 rem may show no sign of illness and should be able to continue with normal activities. This dose may produce slight changes in the blood, primarily a decrease in the number and in the composition of white blood cells. Doses of less than 25 rem normally cause no observable effects in the exposed individual.

Doses of 100 to 200 rem

A radiation dose ranging from 100 to 200 rem will result in illness but the effects should not be fatal. The initial phase, which persists for two or three days after exposure, will be characterized by slight fatigue, nausea, or vomiting. The latent period that follows may last up to two weeks. Complete recovery occurs in the final phase, unless complications occur due to infections or other injuries. Although the number of white blood cells decreases significantly, this decrease is usually not serious, and the white cell count customarily returns to normal by the final phase of the illness.

Doses of 200 to 1,000 rem

The probability of survival is good at the lower end of this range but poor at the upper end. The initial phase, which continues for two or three days, has the characteristic symptoms

associated with doses of 100 to 200 rem. The symptoms then discontinue, and the latent phase occurs for about two weeks. In this stage, the individual may feel relatively good and may even resume normal activities. The final phase occurs when earlier symptoms return, accompanied by diarrhea, fever, and loss of hair. Internal hemorrhaging also occurs at this time, and spontaneous bleeding from mucous membranes is common. Damage to the blood-forming organs (bone marrow) causes a severe depletion of the white blood cells. This leads to increased susceptibility to infection, which can be a serious complicating factor. If the resultant infection is not controlled, it can spread to vital organs and cause death. In general, for doses less than 600 rem, recovery is possible if infections or other complications do not occur. For doses exceeding 600 rem, however, the chances for survival are minimal even if no complications arise. Death usually occurs within two to eight weeks following exposure.

Doses over 1,000 rem

Doses ranging from about 1,000 to 5,000 rem cause irreparable damage to the gastrointestinal and central nervous systems. Radiation damage to the gastrointestinal tract leads to infection, which causes severe diarrhea, vomiting, loss of appetite, and high fever. Damage to the central nervous system, usually from doses greater than 2,000 rem, causes complete loss of neuromuscular activity, intermittent stupor, and respiratory paralysis. For all doses exceeding 1,000 rem, death usually occurs within a few days of exposure.

Beta Burns

Beta radiation, generally considered an internal hazard, may be an external exposure hazard if particles emitting beta radiation are deposited on bare human skin. This exposure can cause a characteristic type of radiation skin burn called "beta burn."

Information concerning the development and healing of beta burns has been obtained from observations of Marshall Islanders inadvertently exposed to fallout during a nuclear test at the Pacific Testing Ground. Particles from the early fallout settled on the bare skin of individuals. Within 48 hours, the contaminated individuals experienced an itching and burning sensation of the skin. These symptoms abated after one or two days but recurred about two or three weeks later. They were accompanied by loss of hair and burn lesions on the skin. The burns were usually limited to the outer layer of skin. After formation of a dry scab, the lesions healed rapidly, leaving an area of abnormal pigmentation. Normal pigmentation was usually restored after several months. Beta burns occurred only on parts of the body not protected by clothing or other materials, such as the scalp, neck, and forearms.

5.4.2 Long-term Effects of Radiation Exposure

Some consequences of ionizing radiation may not become apparent until years after the time of exposure. Although these effects may occur later in life, they are most likely the result of changes induced in the cells and tissues at the time of radiation exposure. These effects may also become manifest following chronic, or long-term, exposure to levels of radiation that may not cause observable acute radiation sickness. The exact causes of these health effects and the reasons why a long latency period is required before they become apparent are not completely known.

Late-developing health effects include cataracts, leukemia and other types of cancer, retarded development of children exposed in utero, and genetic or hereditary effects. Since all of these effects also occur naturally, it is extremely difficult to identify specifically a radiation-induced long-term effect.

Cataracts, which are an opaqueness of the eye lens, occur commonly in elderly persons but are rare in individuals less than

40 years of age. Cataracts were found in a number of Hiroshima and Nagasaki survivors considered too young to have developed natural cataracts. Numerous animal experiments have shown that neutron and, to a lesser extent, gamma radiation can cause cataracts. The available data strongly suggest that cataract formation is a threshold phenomenon. It has been estimated that acute neutron or gamma doses greater than 200 rem are necessary to cause cataracts in humans. The threshold for doses spread over a period of months is much higher. It usually takes a latency period of several months to years after exposure before cataracts become apparent in an individual.

Ninety percent of the Hiroshima and Nagasaki survivors who contracted leukemia received radiation doses greater than 200 rem (based on the best dose estimates currently available), but not all who received such a high dose developed the disease. This demonstrates the variance in susceptibility, mentioned earlier, within species. The data from the Hiroshima and Nagasaki survivors and other sources indicate that there is no threshold dose for leukemia and that the probability of causing leukemia is roughly proportional to the whole body dose. According to the 1977 report of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), an additional 15 to 25 cases of leukemia can be expected per million man-rads of dose of radiation such as X-rays or gamma rays. In other words, 98 cases of leukemia can be expected to occur naturally in a population of 1,000,000 persons. If each of these persons was to receive a radiation dose of 1 rad, an additional 15 to 25 cases would be expected.

Similar statistics have been developed for other types of cancer. While the scope of this manual does not permit a detailed review of the literature, the following example using data from the 1977 UNSCEAR report does provide good summary information. In a typical group of 10,000 Americans, national cancer statistics indicate that about 1,600 will eventually die

of cancer. These are "natural" cancer deaths, not caused by exposure to excess man-made ionizing radiation. This estimate is so approximate that a variation of 50 to 100 such deaths would not be regarded as abnormal. Now, if each of these 10,000 individuals was exposed to 1 rem of ionizing radiation, cancer statistics show that there will be only one additional cancer death over the lifetimes of the 10,000 individuals. Thus, if the variation in natural cancer deaths ranges from 1,500 to 1,700 out of 10,000 individuals, and if a dose of 1 rem to each of these 10,000 individuals causes a statistical increase of only one more death, it is understandable that medical science has difficulty in identifying this effect with precision.

Information about abnormal prenatal and postnatal development of children following exposure to radiation comes from the Hiroshima and Nagasaki survivors. Pregnant women who received gamma and neutron doses greater than 200 to 250 rem (estimated) experienced an increased rate of stillbirths and of infant mortality within a year of birth. The increases in infant mortalities were significant only, however, when the mothers had been exposed during the last three months of pregnancy. Mothers who received doses greater than about 200 rem during the first three months of pregnancy delivered live infants, but a slight increase in the prevalence of mental retardation was noted. Some of the infants also experienced malformations of the teeth caused by radiation damage to the pulp and roots of the teeth.

The genetic or hereditary effects of nuclear radiation have not been documented in humans. Information about this subject comes exclusively from laboratory studies on experimental animals with relatively short generation times. Unfortunately, these data cannot be extrapolated to humans with any degree of certainty. It is possible, however, that excessive radiation exposure to the reproductive organs could cause changes in the genetic material of the chromosomes.

It has been known for some time that ionizing radiation is carcinogenic, that is, that it causes cancer. The mechanism for cancer production is not yet understood. The first recorded cases were skin cancers on the hands of early X-ray workers. Since then, the relationship between cancer in humans and radiation exposures has been documented in several cases. Notable examples include the:

- Occurrence of bone cancers among the first workers who applied a radium compound to watch dials
- Increased incidence of leukemia among early radiologists and the survivors of the atomic bombings at Hiroshima and Nagasaki
- Increased incidence of thyroid cancers in certain patients treated by X-ray therapy.

The first evidence of increased incidence of leukemia among the Hiroshima and Nagasaki survivors appeared in 1947; the disease reached its peak in 1951 to 1952, five to seven years after the bombing.

5.5 HEALTH EFFECTS OF INTERNAL RADIATION EXPOSURE

Radioactive material can enter the body through an open wound, by inhalation, or by ingestion. Radiation exposure from these internal sources continues until the radioactivity completely decays or the source is eliminated from the body. Radioactive materials, upon entering the body, can be concentrated in certain organs or tissues, causing significant radiation exposure to these tissues. Internal deposition of the radioactive materials depends largely upon their chemical composition. For example, radioisotopes of iodine will follow the same metabolic pathways as normal iodine and become localized in the thyroid gland. Radioisotopes of cerium and strontium, chemically similar to calcium, are "bone-seekers" and become incorporated into the bone tissues.

The size of the particle affects its entry and deposition into the body by inhalation. Larger particles are usually filtered out by the nose and upper air passages and are prevented from entering the lungs. Smaller particles not filtered out can reach the inner passages of the lungs. If the particles are soluble in body fluids, they will be dissolved and will enter the bloodstream, where they will be transported to other body tissues or be eliminated from the body. If the particles are insoluble, they can remain in the lungs for long periods of time, until removed by normal body processes. The extent of damage to the lungs caused by these inhaled particles apparently depends on the size of the particles, the type of radiation omitted, and the length of time in the lungs. Internal exposure of the lungs may lead to lung cancer, pneumonitis, or fibrosis.

Radioactive material can also enter the body through ingestion. Soluble particles are digested and enter the bloodstream, where they can be carried to other tissues or be eliminated from the body through the kidneys. Insoluble particles are carried through the gastrointestinal system and are eventually eliminated in the fecal matter.

The length of time a particular radioactive substance remains in the body depends on its "biological half-life." The biological half-life refers to the time required for the body to eliminate, through natural processes, half of the initial concentration of the radioactive substance. The combination of radiological and biological half-lives leads to the "effective half-life," which is a measure of the net rate of loss of a radioactive substance from the body by both decay and biological elimination. The total radiation dose delivered to the body or to a particular organ or tissue depends on the substance's effective half-life, the total quantity of the material in the organ or tissue, and the nature and energy of the radiation emitted from the material.

In general, alpha- and beta-emitting substances taken internally can cause much more localized tissue damage than gamma-emitting substances. This occurs because alpha and beta radiations deposit essentially all of their energy within a small volume of tissue. It must be understood that this is a general description of the relative internal hazards associated with the different types of radiation. Very few radioactive substances emit only one type of radiation. Practically all beta emitters also emit gamma radiation, as do most alpha emitters. Therefore, deposition of radioactive substances in the body usually results in internal exposure to a variety of different types and energies of radiation.

A number of potentially harmful radionuclides are produced in a nuclear detonation. The number of radionuclides is too large to permit discussion of all of them here, but several of the more important radionuclides that occur as part of the fallout are discussed below.

Several different radioisotopes of iodine are in the fallout, and all of them are capable of entering the body and becoming deposited in the thyroid gland. This may lead to cancer of the thyroid or some other metabolic change that disrupts the normal functioning of the gland. Other fission products include strontium-89, strontium-90, and barium-140. Strontium-89 and barium-140 have relatively short half-lives of a few weeks and represent a short-term radiation hazard. Strontium-90, however, has a half-life of 29 years and constitutes a long-term radiation hazard. All three of these radionuclides are biochemically similar to calcium and, upon entry into the body, are rapidly deposited into bone tissue. Strontium-90 is a special hazard because it is a major component of delayed fallout that occurs months or years after a nuclear detonation. It makes its way into the body primarily through plant food. Strontium-90 is a beta emitter and can cause serious localized damage to bone tissue. Experiments in animals indicate that large concentrations of strontium-90 can produce bone necrosis, bone tumors or

cancers, and leukemia. These health effects have also been observed in some humans.

Cesium-137 is another long-lived component of delayed fallout. It has a half-life of 30 years and decays by beta particle and gamma ray emission. Because delayed fallout continues to be deposited on the earth's surface for years, the amount of cesium-137 and strontium-90 in plants and animals has accumulated over the years. If contaminated plants and animals are consumed by humans, the concentration of cesium-137 can build up within the body. Upon entry into the body, cesium-137 is usually dissolved and distributed uniformly throughout the body tissues. Because of this uniform distribution, the entire body can be irradiated by both beta and gamma radiation as the cesium-137 decays.

In addition to fission products, radioactive fallout may also contain some unfissioned plutonium, uranium, or both. These radionuclides emit alpha particles and are therefore hazardous if taken internally. In addition to being internal radiation hazards, they are chemically toxic. If taken into the body, they become localized primarily in the liver and bones. They have a long effective half-life and are capable of damaging these tissues. These radionuclides have been shown to produce malignancies in both liver and bone tissues of experimental animals.

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APPENDIX A

GLOSSARY

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GLOSSARY

The following scientific and technical terms are used throughout the series and shot volumes on continental atmospheric nuclear weapons testing.

ABSORBED DOSE	The amount of energy absorbed per unit mass of irradiated material. Absorbed dose is measured in rads.
ACTIVITY	The rate of decay of radioactive material expressed as the number of radionuclide disintegrations per unit time. The unit of activity is the curie.
ACUTE RADIATION EXPOSURE	Short-term exposure to radiation, generally defined to be the total exposure received within a period of 24 hours.
ACUTE RADIATION SICKNESS	The complex of symptoms characterizing the sickness caused by excessive exposure to ionizing radiation. The severity of the sickness depends on the dose of radiation received by the individual.
AFTERWINDS	Wind currents set up in the vicinity of a nuclear explosion directed toward the burst center, resulting from the updraft which accompanies the rise of the fireball.
AIR BURST	The explosion of a nuclear weapon at such a height that the expanding fireball does not touch the earth's surface.
AIR SAMPLING for RADIOACTIVITY	The process of collecting certain volumes of air to determine the level of radioactivity in the air.
ALPHA PARTICLES	A form of particulate radiation emitted from the nuclei of certain radioactive elements. An alpha particle is composed of two neutrons and two protons and is identical to the nucleus of a helium atom, having a double positive charge. An alpha particle cannot penetrate clothing or the outer layer of skin, so

	it is not an external exposure hazard. Such a particle is extremely hazardous, however, if exposure occurs internally.
AMBIENT PRESSURE	The standard atmospheric pressure at a specific location and time.
ATOM	The smallest particle of an element that still retains the characteristics of that element. Every atom consists of a positively charged central nucleus, which carries nearly all the mass of the atom. The nucleus is generally composed of uncharged neutrons and positively charged protons. It is surrounded by electrons that carry a negative charge.
ATOMIC ENERGY	Energy released by various nuclear reactions, such as fission, fusion, or radioactive decay. Great amounts of energy are released during fission and fusion processes. It is this energy that makes nuclear weapons far more powerful than conventional explosives. Nuclear energy is another and a more appropriate label for this energy.
ATTENUATION OR ABSORPTION	The process by which radiation intensity is decreased when it passes through matter. The decrease in intensity is due to absorption and scattering of the radiation energy by the atoms of the attenuating material.
AZIMUTH	Horizontal direction expressed as the angular distance between the direction north and the observer's heading. The azimuth is usually measured from true north as the reference direction clockwise through 360 degrees.
BACKGROUND RADIATION (NATURAL)	Naturally occurring radioactivity in the environment or within the body. The primary sources of this energy are cosmic rays and certain minerals present in the earth and in tissues of the body.
BETA BURNS	Skin lesions caused by deposition of beta-emitting fallout particles onto bare human skin.

BETA PARTICLE	A charged particle of very small mass emitted spontaneously from the nuclei of certain radioactive elements. Physically, the beta particle is identical to an electron moving at high speed.
BHANGMETER	An optical device for determining the yield of a nuclear detonation.
BIOASSAY	The determination of the concentration of materials, including radioactive materials, within the body by sampling and analyzing tissue or body fluids.
BIOLOGICAL HALF-LIFE	The time required for the amount of a specified element which has entered the body to decrease to half of its initial concentration as a result of natural, biological processes.
BLAST	The force released as a shock wave traveling through the air from the detonation of an explosive device.
BLAST WAVE	A pulse of air, propagated by an explosion, in which the pressure increases sharply at the front. The blast wave is accompanied by strong winds.
BREAKAWAY	The onset of a condition in which the shock front in the air moves away from the exterior of the expanding fireball produced by a nuclear detonation.
BURST	An explosion or detonation.
CALIBRATION	The determination of the variation of a measuring instrument from a set standard to ascertain necessary adjustment or correction factors.
CAPTURE, NEUTRON	The process by which a nucleus acquires an additional neutron.
CHAIN REACTION	A reaction that stimulates its own repetition, usually referring to fission or fusion reactions.

CHECKPOINTS OR CHECK STATIONS	Locations established to control entry into restricted areas.
CHRONIC RADIATION EXPOSURE	Long-term exposure to radiation, generally defined as the total exposure received over a period greater than 24 hours.
CLOUD SAMPLING	The process of collecting samples of the cloud resulting from a nuclear detonation to determine the amount of airborne radioactivity, both particulate and gaseous, contained in the cloud. This was usually conducted by specially equipped aircraft.
CLOUD STEM	The visible column of debris (and possibly dust and water droplets) extending upward from the point of burst of a nuclear device.
CLOUD TRACKING	The process of using either radar or aircraft to monitor the drift of a cloud resulting from a nuclear detonation.
COMMAND POST EXERCISE	A military exercise usually conducted only by the Headquarters Staff; a dry run of the exercise without field units.
CONTAINED UNDERGROUND BURST	An underground detonation at such a depth that none of the radioactive debris escapes into the atmosphere.
CONTAMINATION, RADIOACTIVE	The presence of unwanted radioactive material on or within areas, objects, or persons.
CONTROLLED AREA	An area to which personnel access is controlled for administrative, security, or safety purposes.
COORDINATES	A set of numbers and/or letters used to specify a location on a map.
CRITICAL MASS	The quantity or mass of fissionable material that will support a chain reaction.
CUMULATIVE DOSE	The total dose resulting from repeated exposure to radiation.

CURIE (Ci)	A measure of radioactive quantity, the amount of radioactive material that decays at a rate of 3.7×10^{10} nuclear disintegrations per second. A millicurie is one-thousandth of a curie (3.7×10^{7} disintegrations per second) and a microcurie is one-millionth of a curie (3.7×10^{4} disintegrations per second).
DAUGHTER PRODUCT	Nuclides, either stable or radioactive, resulting from the radioactive decay of other nuclides.
DEBRIS, NUCLEAR	The radioactive material remaining after a nuclear detonation. It consists of fission products, products of neutron capture, and uranium and plutonium that did not fission.
DECAY, RADIOACTIVE	The spontaneous emission of radiation, generally alpha or beta particles, often accompanied by gamma rays. The radiation is emitted by an unstable isotope. As a result of the emission, the radioactive isotope is converted into a different element which may or may not be radioactive.
DECONTAMINATION	The reduction in the effect of contaminating radioactive material or the removal of contaminating radioactive material from a structure, area, object, or person.
DENSITOMETER	An instrument for measuring the degree of darkening of developed photographic film in a film badge.
DEVICE, NUCLEAR	A nuclear explosive device, commonly referred to as an atomic or nuclear weapon, engineered to produce a detonation with some predetermined characteristics.
DISINTEGRATION, NUCLEAR	The decay of an unstable nucleus by the emission of particles and/or photons. See PHOTON.
DOSE	See ABSORBED DOSE or DOSE EQUIVALENT.

DOSE EQUIVALENT	The absorbed dose expressed in terms of its biological effect. It is the product of the absorbed dose in rads multiplied by a quality factor and any modifying factors. The dose equivalent is expressed in rem.
DOSE RATE	The dose of ionizing radiation received per unit of time, usually expressed in rads (or rem) per hour or in multiples or submultiples of these units.
DOSIMETER	An instrument for measuring and recording the total accumulated dose of (or exposure to) ionizing radiation. Instruments worn or carried by individuals are called personnel dosimeters.
DOSIMETRY	The theories about and applications of the techniques involved in measuring and recording radiation doses and dose rates. Its practical application includes the use of various types of radiation detection instruments to measure radiation.
DYNAMIC PRESSURE	The air pressure resulting from the mass air flow (or wind) behind the shock front of a blast wave.
EFFECTIVE HALF-LIFE	The time required for a radioactive element contained in an animal body to diminish by 50 percent as a result of the combined action of radioactive decay and biological elimination.
ELECTROMAGNETIC PULSE	The sharp pulse of electromagnetic energy produced when a nuclear detonation occurs at the earth's surface or at high altitudes. The intense energy can damage sensitive electronic equipment.
ELECTROMAGNETIC RADIATION OR ENERGY	The propagation of varying electric and magnetic fields through space at the speed of light in a wave motion. Familiar electromagnetic radiations include visible light, ultraviolet light, microwaves, and gamma radiation.

ELECTRON	A particle of very small mass, carrying a unit negative charge. Electrons orbiting the nucleus are present in all atoms. Their number equals the number of positive charges (or protons) in the nucleus of an electrically neutral atom.
EXPOSURE, RADIANT	The total amount of thermal radiation energy received per unit area of exposed surface. It is usually expressed in calories per square centimeter.
EXPOSURE, X or GAMMA RADIATION	A measure of the ionization produced by gamma (or X) rays in air. The exposure rate, exposure per unit of time, is commonly used to indicate the gamma radiation intensity of a source. The unit of exposure is the roentgen (R).
FALLOUT	The descent to the earth's surface of particles contaminated with radioactive material as a result of a nuclear detonation. The term also applies to the contaminated particulate matter itself.
FILM BADGE	A personnel dosimeter utilizing photographic film to measure the radiation dose received by the wearer. The badge is usually clipped to an outer garment above waist level. The dose is calculated from the degree of film darkening that results from exposure to radiation.
FIREBALL	The luminous sphere of hot gases that forms a few thousandths of a second after a nuclear detonation.
FISSION	The splitting of a heavy nucleus into two or more radioactive nuclei, accompanied by the release of a large amount of energy and generally one or more neutrons and one or more gammas. Fission is usually initiated by neutrons, but it can also occur spontaneously.
FISSION FRAGMENTS	The nuclei formed as a result of the fissioning of a nucleus.

FISSION PRODUCTS	The nuclei (fission fragments) formed by fission, plus the nuclides formed by the radioactive decay of the fission fragments. Fission products are a complex mixture of over 300 isotopes of 35 or more elements. Practically all of these isotopes are radioactive.
FLASH BURN	A skin burn caused by exposure to the thermal radiation produced by a nuclear detonation.
FLUX OR FLUX DENSITY	The number of gamma-ray photons, neutrons, particles, or the amount of energy crossing a unit surface area per unit of time.
FORWARD AREA	The operational area of the Nevada Test Site north of Camp Mercury and Camp Desert Rock. More specifically, the area includes Frenchman Flat, Yucca Pass, and Yucca Flat.
FUSION	The formation of a heavier nucleus from two lighter nuclei, accompanied by the release of a large amount of energy.
GAMMA RAYS	A form of electromagnetic radiation emitted spontaneously from the nuclei of certain radioactive elements, often in conjunction with the emission of alpha or beta particles. Gamma rays also result from other nuclear reactions, such as fission and neutron capture. Gamma rays are identical to X-rays, except that they originate within the nucleus. Gamma rays travel great distances in the air and can easily penetrate most substances.
GEIGER-MUELLER DETECTOR	A type of instrument that detects and measures ionizing radiation. It is the most widely used instrument for routine surveys of contaminated areas.
GENETIC EFFECTS	Hereditary changes or effects passed from an individual to his or her offspring.
GROUND WAVE	A shock wave formed in the ground by the blast from an explosion.

GROUND ZERO (GZ) OR SURFACE ZERO (SZ)	The point on the ground vertically below or above the center of a nuclear burst; frequently abbreviated GZ. This is also referred to as surface zero, especially for underwater bursts.
HALF-LIFE, RADIOLOGICAL	The time required for a radioactive substance to lose half of its activity by radioactive decay.
HEALTH PHYSICS	The branch of radiological science dealing with the protection of personnel from exposure to ionizing radiation.
HEIGHT OF BURST	The height above the earth's surface at which a device is detonated.
HIGH ALTITUDE BURST	A detonation at an altitude over 100,000 feet.
HOT PARK	An area of the Nevada Test Site specially designated for isolating contaminated equipment and vehicles registering over 0.007 roentgens per hour after decontamination. Contaminated items remained in the hot park until normal decay reduced radiation intensities to acceptable levels.
INDUCED RADIOACTIVITY	Radioactivity produced in certain materials as a result of the capture of neutrons. In a nuclear detonation, neutrons induce radioactivity in the weapon debris as well as in the surroundings.
INITIAL NUCLEAR RADIATION	Nuclear radiation (essentially neutrons and gamma rays) emitted from the fireball and the cloud during the first minute after a nuclear explosion. One minute is the time required for the source of part of the radiations (such as fission products in the cloud) to attain such a height that only insignificant amounts of radiation from the cloud reach the earth's surface.
INTENSITY, NUCLEAR RADIATION	The amount of energy of any radiation incident on an area. This term, usually applied to gamma radiation, expresses the exposure rate (in R/hour) at a given location.

INTERNAL EMITTERS	Radioactive material deposited in the body. Internal deposition is the result of inhalation, ingestion, or entrance through an open cut.
ION	See IONIZATION.
IONIZATION	The removal of an electron from an atom, leaving a positively charged ion. The detached electron and the remaining ion are referred to as an ion pair.
IONIZATION CHAMBER DETECTOR	A type of instrument that detects and measures ionizing radiation.
IONIZING RADIATION	Electromagnetic radiation (gamma rays or X-rays) or particulate radiation (alpha particles, beta particles, or neutrons) capable of producing ions in its passage through matter.
ISOINTENSITY CONTOUR MAPS	Maps on which lines represent areas of equal radiation intensity or exposure rates. These are often improperly referred to as isodose contour maps.
ISOTOPES	Atoms of the same element with identical numbers of protons but different numbers of neutrons. They have the same atomic number but a different mass number.
KILO-	A prefix denoting 1,000. For example, one kiloton means 1,000 tons.
LD-50 DOSE	The dose of an agent required to kill, within a specified period, 50 percent of the individuals in a large group of animals or organisms. For example, LD-50/30 is a lethal dose to 50 percent of the organisms in 30 days.
LIMITED RADIOLOGICAL EXCLUSION AREA	An area of contamination with radiation levels between 0.01 and 0.1 roentgen of gamma radiation per hour or between 1,000 and 10,000 counts of alpha radiation per 55 square centimeters. Only necessary personnel with film badges were permitted to enter these controlled areas.

LINEAR ENERGY TRANSFER (LET)	The unit used to express the amount of energy transferred as ionizing radiation that passes through and interacts with a material.
MACH STEM	The shock or blast wave formed by the merging of the incident and reflected blast waves from a nuclear detonation. The Mach stem is the leading edge of the blast wave as it moves outward from the point of detonation. The location on the ground where the Mach stem forms is called the Mach region.
MEGA-	A prefix denoting 1,000,000. For example, one megaton means 1,000,000 tons.
MICROBAROGRAPH	An instrument that measures and records small changes in atmospheric pressure.
MONITORING	The procedure or operation of locating and measuring radioactive contamination by means of survey instruments. Persons engaged in this activity are referred to as radiological monitors.
NEUTRON	The constituent particles, along with protons, of the nucleus of an atom. Neutrons are uncharged and have a mass number of one. They are used to initiate the fission process, and large numbers of them are produced in fission and fusion processes. They constitute a significant portion of the prompt radiation from both fission and fusion detonations. Neutrons travel great distances in the air and can readily penetrate most substances.
NEVADA TEST SITE (NTS)	The region in southeast Nevada set aside for the continental atmospheric nuclear weapons testing program. Prior to 1955, this area was called the Nevada Proving Ground.
NUCLEAR DETONATION	A general name given to any explosion in which the energy released results from reactions involving atomic nuclei, either fission or fusion or both.

NUCLEAR RADIATION	Radiation emitted from unstable nuclei. Important nuclear radiations are alpha and beta particles, gamma rays, and neutrons. All nuclear radiations are ionizing radiations, but the reverse is not true. X-rays, for instance, are included among ionizing radiations, but they are not nuclear radiations since they do not originate from atomic nuclei.
NUCLEUS	The small, central, positively charged region of an atom which carries essentially all the mass. Except for the nucleus of hydrogen-1, which is a single proton, all atomic nuclei contain both protons and neutrons. The number of protons determines the total positive charge, or atomic number. The total number of neutrons and protons, called the mass number, relates to the mass of the atom. The nuclei of isotopes of a given element contain the same number of protons but different numbers of neutrons. Thus, they have the same atomic number, and so are the same element, but they have different mass numbers and masses. The nuclear properties of an isotope of a given element are determined by both the number of neutrons and the number of protons.
NUCLIDE	An atomic species distinguished by the composition of its nucleus, that is, by the number of protons and the number of neutrons.
OFFSITE	The area outside the boundaries of the Nevada Test Site.
ONSITE	The total area encompassed by the Nevada Test Site, including Camp Mercury, Frenchman Flat, Yucca Pass, and Yucca Flat.
ORDNANCE EQUIPMENT	Weapons, ammunition, and related equipment used by military personnel.

OVERPRESSURE	The transient pressure, exceeding the ambient atmospheric pressure, that is produced at the leading edge of the blast wave from a nuclear detonation. Overpressure is expressed in pounds per square centimeter.
PHANTOM	Material that approximates the characteristics of human tissue. Absorbed dose in humans can be simulated by exposing a phantom to radiation and measuring the dose received.
PHOTOMULTIPLIER TUBE	An electronic device that converts light impulses into an amplified electrical signal. These tubes are used in scintillation detectors.
PHOTON	A unit of electromagnetic radiation having a discrete amount of energy but no rest mass or electrical charge.
PHOTORECONNAISSANCE AIRCRAFT	Specially equipped aircraft used to take aerial photographs of a specific target.
PIBAL	A system measuring low-altitude wind direction and velocity.
PRECURSOR	An air pressure wave that moves ahead of the main blast wave from a surface or low-air nuclear detonation.
PROMPT RADIATION	Radiation emitted from a nuclear detonation within a microsecond of detonation. It consists mainly of neutron and gamma radiation.
PROTON	An atomic particle with a single positive charge and with a mass close to that of a neutron. Protons are constituents of all nuclei. The number of protons in the nucleus of an atom determines its atomic number.
QUALITY FACTOR	The factor used to convert the absorbed dose, in rads, to the dose equivalent, in rem. The quality factor has an assigned value for each type of ionizing radiation, based on the linear energy transfer (LET) of the radiation.

RAD	The unit of absorbed radiation dose that represents the absorption of 100 ergs of ionizing radiation per gram of absorbing material, such as body tissue.
RADIAC	A generic term designating radiological measuring instruments and equipment. The term is derived from the words Radioactivity Detection, Indication, and Computation.
RADIATION	The emission and propagation of energy through matter or space. The term includes the propagation of alpha and beta particles, neutrons, photons, and thermal energy.
RADIOACTIVITY	The spontaneous emission of alpha or beta particles, neutrons, or gamma rays from the nuclei of unstable isotopes. As a result of this emission, the radioactive isotope decays into another isotope that may or may not also be radioactive. Ultimately, as a result of one or more stages of radioactive decay, a stable (nonradioactive) end product is formed.
RADIOLOGICAL EXCLUSION AREA	An area within the Nevada Test Site with radiation levels exceeding either 0.1 roentgen of gamma radiation per hour or 10,000 counts of alpha radiation per minute per 55 square centimeters. Entry of personnel into such an area was restricted.
RADIOLOGICAL MONITOR	An individual trained in the use of radiation detection instruments and in the assessment of radiological hazards.
RADIOLOGICAL SURVEY	An effort to determine the distribution of radiological contamination and exposure rates in an area.
RADIONUCLIDE	A radioactive atomic species.
RAWINSONDE	A device that measures high-altitude wind direction and velocity.

RELATIVE BIOLOGICAL EFFECTIVENESS (RBE)	A factor used to compare the biological effectiveness of different types of ionizing radiation. It is the ratio of the amount of absorbed radiation required to produce a given effect, to a standard radiation (gamma rays or X-rays of a specific energy) required to produce the same effect. The term is normally used in the field of experimental radiobiology and not for human radiation protection.
REM	The unit of dose equivalent, which is the amount of any ionizing radiation that produces the same biological effect as one rad of gamma or X-radiation. The rem is the product of the absorbed dose (rads) times the quality factor and any other modifying factor.
REP	An obsolete unit of absorbed dose measurement. The rep measured energy transferred to soft tissue by radiation. The current unit of absorbed dose is the rad.
RESIDUAL NUCLEAR RADIATION	Nuclear radiation, chiefly beta particles and gamma rays, that persists after the first minute following a nuclear detonation. The radiation is emitted mainly by fission products and materials in which radioactivity has been induced by the capture of neutrons.
RESPIRATOR	A device worn over the mouth and nose to prevent the inhalation of hazardous material.
RESUSPENSION	The process of returning to the air material that was once airborne and had settled to the ground surface. Resuspension can result from natural occurrences, such as wind, or from such activities as personnel movement and vehicular traffic.
ROENTGEN	A unit of exposure to gamma radiation or X-radiation. It is the quantity of gamma rays or X-rays that produces 2.08×10^9 ion pairs in a cubic centimeter of air at standard temperature and pressure. An exposure of one roentgen is approximately equal to an absorbed dose of one rad in soft tissue.

SCATTERED RADIATION	Radiation deflected from its original path as a result of collisions with particles, atoms, or molecules in its passage through air or matter.
SHIELDING	Any material or obstruction that absorbs radiation and thus tends to protect personnel from exposure. A moderately thick layer of any opaque material will provide satisfactory shielding from thermal radiation, but a considerable thickness of material of high density may be needed to provide shielding from gamma rays.
SHOCK (BLAST) FRONT	The front of a shock wave and the relatively sharp boundary between the pressure created by an explosion and the ambient pressure. It is referred to as a shock front when in ground or water and as a blast wave when in air.
SHOCK WAVE	A continuously propagated pressure pulse or wave initiated by the expansion of the hot gases produced in an explosion. A shock wave in air is generally referred to as a blast wave.
SLANT RANGE	The distance measured to a point on the ground from the point of detonation in the air.
SOMATIC EFFECTS	The nongenetic health effects observed in an individual exposed to a harmful substance, such as nuclear radiation. The changes in blood cells that occur following a radiation dose of 50 to 100 rem is a somatic effect.
SPECTROMETER	An electronic device used to measure intensities and energies of radiations.
SPECTRUM	A range of values of a certain quantity: for example, an energy spectrum.
SURFACE BURST	The explosion of a nuclear device at a height above the surface less than the radius of the fireball. An explosion in which the device is detonated on the surface is called a contact surface burst or a true surface burst.

THERMONUCLEAR	An adjective referring to the process in which very high temperatures are used to bring about the fusion of hydrogen nuclei with the accompanying liberation of energy. A thermonuclear device is one in which part of the explosive energy results from thermonuclear fusion reactions. The high temperatures required are obtained by means of a fission explosion.
THRESHOLD DOSE	The radiation dose level below which no health effects may occur. There seem to be different threshold doses for different types of radiation and health effects. There may not even be a threshold for certain effects, such as genetic and carcinogenic ones.
TNT EQUIVALENT	A measure of the energy released in the detonation of a nuclear device expressed in terms of the quantity of TNT that would release the same amount of energy when exploded. The basis of the TNT equivalence is that the explosion of one ton of TNT releases one billion calories of energy.
VENTING	The release of radioactive materials to the atmosphere from a deep underground detonation. Normally, the detonation would be deep enough to contain the detonation completely.
WASHOUT	The removal of radioactive particles from a nuclear cloud by precipitation when the particles are below a rain or snow cloud. When the nuclear cloud is within a rain or snow cloud, the removal of radioactive particles from the nuclear cloud is known as rainout or snowout.
WHOLE-BODY EXPOSURE	The uniform exposure of the entire body to radiation, in contrast to the irradiation of only a part of the body.
X-RAYS	Penetrating electromagnetic radiation similar to gamma rays but of non-nuclear origin and of lower energy.

YIELD	The total effective energy released in a nuclear detonation. It is usually expressed in terms of the TNT equivalent required to produce the same energy release in an explosion. Nuclear detonation yields are commonly expressed in kilotons or megatons (thousands or millions of tons) of TNT equivalent.

Many of the definitions cited above have been adapted from Glasstone and Dolan; Atomic Energy Commission, Nuclear Terms; and Bureau of Radiological Health Publ No. 2016.

APPENDIX B

ANNOUNCED UNITED STATES NUCLEAR TESTS JULY 1945 THROUGH DECEMBER 1982*

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APPENDIX B

ANNOUNCED UNITED STATES NUCLEAR TESTS JULY 1945 THROUGH DECEMBER 1982

This document lists chronologically and alphabetically by event name all nuclear tests conducted and announced by the United States from July 1945 through December 1982, with the exception of the GMX experiments. The 22 GMX experiments, conducted at the Nevada Test Site (NTS) between December 1954 and February 1956, were "equation-of-state" physics studies that used small chemical explosives and small quantities of plutonium. Several tests conducted during Operation Dominic involved missile launches from Johnston Atoll. Several of these missile launches were aborted, resulting in the destruction of the missile and nuclear device either on the pad or in the air.

On August 5, 1963, the United States and the Soviet Union signed the Limited Test Ban Treaty which effectively banned testing of nuclear weapons in the atmosphere. All U.S. nuclear tests conducted prior to that date have been announced and are listed in this document. Some tests conducted underground since the signing of the Treaty and designed to be contained completely have not been announced. Information concerning these events is classified. Occasionally, the code name and detonation date of an unannounced test is declassified which permits its listing in subsequent revisions to this document.

Data on United States tests were obtained from and verified by the Department of Energy's three weapons laboratories--Los Alamos National Laboratory, Los Alamos, New Mexico; Lawrence Livermore National Laboratory, Livermore, California; and Sandia National Laboratories, Albuquerque, New Mexico. Additionally, data were obtained from public announcements issued by the Atomic Energy Commission and its successors, the Energy Research and Development Administration and the Department of Energy, respectively.

Test Dates

Time and date for all events listed in this document were converted from local time to Greenwich Civil Time (GCT). The event date listed is the GCT date for the event.

Test Series

U.S. nuclear tests were conducted on an intermittent basis from 1946 to October 1958. Each series of tests during that period was given a name, such as Operation Crossroads, 1946; Operation Sandstone, 1948; and Operations Ranger, Greenhouse, Buster, and Jangle in 1951.

On November 1, 1958, the United States entered into a unilateral testing moratorium announced by President Eisenhower with the understanding that the U.S.S.R. would also refrain from conducting tests. The Soviet Union broke that moratorium in September 1961 with a series of large tests.

On September 15, 1961, the U.S. resumed testing on a year-round basis. The tests are listed by fiscal year. For example, FY 1963 tests--which began July 1, 1962, and extended through June 30, 1963--were in the Operation Storax series.

Also after the resumption of testing, the U.S. conducted Operation Dominic I in the Pacific between April and November of 1962 and Operation Dominic II at the Nevada Test Site in July of 1962.

In 1976, the Federal Government changed the fiscal year to begin on October 1 and end on September 30. Accordingly, the FY 1976 series, Operation Anvil, did not end on June 30 but was extended through September 30, 1976, a period of 15 months.

Test Yields

The nomenclature for test yields varied according to information policy governing specific years. In some cases, no yield information has been released; in a few cases, the terms "very slight" and "slight" were used without amplification. Except for tests where specific yields or relative specific yields such as "about 2 kt," "several Mt," "less than 0.1 kt," etc., were announced, test yields are given in these terms:

1945 through 1963:

Low (less than 20 kt)
Intermediate (20 to 200 kt)-all tests except Operation Dominic I
Intermediate (20 to 1,000 kt)-Operation Dominic I
Submegaton (less than one Mt, but more than 200 kt)
Megaton Range
Low Megaton (from one to several Mt)

1964 through February 1976:

Less than 20 kt
20 to 200 kt
200 to 1,000 kt

March 1976:

During a series of high-yield tests conducted during this month, two ranges were added, and the 200 to 1,000 kt range was dropped.

200 to 500 kt
500 to 1,000 kt

Since March 1976:

On March 31, 1976, the Soviet Union and the United States agreed to limit the maximum yield of underground tests to 150 kt. The yield ranges now reported are:

Less than 20 kt
20 to 150 kt

Test Locations

The first test of a nuclear weapon was in the atmosphere on July 16, 1945, at Alamogordo, New Mexico. At various times between June 1946 and November 1962, atmospheric and underground tests were conducted by the United States in the Marshall Islands, Christmas Island, and Johnston Atoll in the Pacific Ocean; and over the South Atlantic Ocean. Between January 1951 and July 1962, atmospheric and underground nuclear tests were conducted at the Nevada Test Site.

Since July 1962, all nuclear tests conducted in the United States have been underground and most of them have been at the NTS. Some tests were conducted on the Nellis Air Force Base Bombing Range; in central and northwestern Nevada; in Colorado, New Mexico, and Mississippi; and on Amchitka, one of the Aleutian Islands off the coast of Alaska.

Test Types and Purpose

The definition of terms used in this document appears in the Glossary of Terms. "Type" refers to the method of deployment of the nuclear device at time of detonation such as "tower," "tunnel," "airdrop," etc. "Purpose" indicates whether the test was part of the weapons development program, a DOD effects test, a joint U.S./U.K. test, or was part of some special program that involved the use of nuclear devices. In the Summary preceding the chronological listing of nuclear tests, the sum of all tests conducted underground (tunnel, shaft, and crater events) appears as "Total Underground." With the exception of five underwater tests, the remaining events appear as "Total Atmospheric."

Categorization of a test as "atmospheric" or "underground" should not be used in all cases as an indicator that radioactivity from the test was or was not detected. Unless otherwise noted, all nuclear tests that took place at NTS or the Bombing Range prior to September 15, 1961, produced radioactivity detected off site.* On the other hand, unless otherwise noted, no test taking place at NTS or the Bombing Range on or after September 15, 1961, produced an uncontrolled release of radioactivity.

Test Totals for Nevada Test Site

DOE's Nevada Operations Office, when discussing off-site detection of radiation from tests, sometimes has used the term "atmospheric" to describe any test where the release of radioactivity to the atmosphere was anticipated and was a factor in test planning. Nineteen tests (nine crater and ten shaft) listed in this document as "underground" have been categorized elsewhere as atmospheric since they were not "designed to be contained." See the following table for a comparison of test totals listed by the placement criterion used in this document with those listed by the "designed to be contained" criterion.

*See Glossary of Terms for definition of "off site."

APPENDIX B (continued)

CATEGORIZATION OF NTS NUCLEAR TESTS

Placement Criterion (This Document)		Containment Design Criterion (Sometimes Used in Public Discussion)	
A. Atmospheric		A. Not Designed to be Contained (Atmospheric)	
Aboveground--NTS	100(1)	Aboveground	105
Aboveground--Bombing Range	5(2)		
		Unstemmed Hole	9
		Crater	10
Subtotal (Atmospheric)	105	Subtotal	124
B. Underground		B. Designed to be Contained	
Shaft--Unstemmed Hole	9(3)		
Crater	9		
Shaft--Stemmed	1(4)		
	433	Shaft	433
Tunnel	49	Tunnel	49
Subtotal (Underground)	501	Subtotal	482
TOTAL	606	TOTAL	606

(1) Consists of 84 weapons or weapons effects tests and 16 safety tests, all of which were conducted "in the air" at the NTS.

(2) Consists of four storage-transportation tests and one safety test "in the air" on the Bombing Range.

(3) Nine events were conducted underground in unstemmed holes to minimize but not eliminate the release of radioactivity to the atmosphere. Because incandescent gases were released, these tests are sometimes referred to as "Roman candles."

(4) Ten tests were designed to be cratering tests, hence not designed to be contained. Sulky on December 18, 1964, failed to produce the expected crater, but because placement was in a shaft, albeit shallow, it is listed in this document as a shaft test.

GLOSSARY OF TERMS

Airburst	The explosion of a nuclear weapon at such a height that the expanding fireball does not touch the earth's surface prior to the time the fireball reaches its maximum luminosity. The airburst reported in this document resulted from the detonation of a device fired from a 280-mm cannon.
Airdrop	A nuclear device dropped from an aircraft and exploded in the atmosphere.
Atmospheric	A test conducted aboveground or above water, i.e., in the open air.
Balloon	A nuclear device suspended from a balloon and exploded in the atmosphere.
Barge	A nuclear device exploded from a barge moored in the lagoon at Enewetak or Bikini.
Crater	A nuclear device placed shallow enough underground to produce a throw-out of earth when exploded.
Joint U.S.-U.K.	A nuclear test conducted jointly by the United States and the United Kingdom under a cooperative agreement in effect between the two countries since August 4, 1958.
KT	A kiloton. The energy of a nuclear explosion that is equivalent to an explosion of 1,000 tons of TNT.
MT	A megaton. The energy of a nuclear explosion that is equivalent to an explosion of one million tons of TNT.
NTS	The Nevada Test Site, a 1,350-square-mile area in southern Nevada in Nye County and about 65 miles northwest of Las Vegas.
Off Site	The detection of radioactivity off site is defined as detected outside the Test Range Complex, an area that includes both the Nevada Test Site and the adjacent government-controlled Nellis Air Force Range.

On Site	A notation that radioactivity was detected on site only is made for tests from which there was an unplanned release of radioactivity into the atmosphere that was not detectable beyond the boundaries of the Test Range Complex.
Plowshare	Application of nuclear explosives to develop peaceful uses for atomic energy. The program is no longer active.
Rocket	A nuclear device launched by rocket and exploded in the atmosphere.
Safety Experiment	Experiment designed to confirm a nuclear explosion will not occur in case of an accidental detonation of the explosive associated with the device.
Seismic Calibration	A nuclear test to evaluate seismic effects of an underground explosion.
Shaft	A nuclear device exploded at the bottom of a drilled or mined vertical hole. Some safety tests were set off at the bottom of unstemmed drilled holes, producing a "Roman candle" effect.
Storage-Transportation	Detonations of combinations of high explosives and nuclear materials designed to study distribution of nuclear materials during accidents in several transportation and storage configurations.
Surface	A nuclear device placed on or close to the earth's surface.
T	A ton. Equivalent to a ton of TNT.
Thermonuclear Device	A "hydrogen bomb."
Tower	A nuclear device mounted at the top of a steel or wooden tower and exploded in the atmosphere.
Tunnel	A nuclear device exploded at the end of a long horizontal drift mined into a mountain or mesa in a way that places the burst point deep within the earth.

UG	Underground nuclear test conducted in a tunnel or at the bottom of a drilled hole or shaft. Some underground nuclear tests were not designed to contain all radioactivity, e.g., cratering tests or safety experiments.
UW	A nuclear test conducted underwater.
Vela Uniform	Department of Defense (DOD) program designed to improve the capability to detect, identify, and locate underground nuclear explosions.
Weapons Effects	A nuclear test to evaluate the civil or military effects of a nuclear detonation on various targets, such as military hardware.
Weapons Related	A nuclear detonation conducted for the purpose of testing a nuclear device intended for a specific type of weapon system.
Yield	The total effective energy released in a nuclear explosion. It is usually expressed in terms of equivalent tonnage of TNT required to produce the same energy release in an explosion.

ANNOUNCED UNITED STATES NUCLEAR TESTS -

TOTALS BY YEAR

	U.S.	US/UK
PRE-TREATY		
CY 1945	3	
CY 1946	2	
CY 1947		
CY 1948	3	
CY 1949		
CY 1950		
CY 1951	16	
CY 1952	10	
CY 1953	11	
CY 1954	6	
CY 1955	18	
CY 1956	18	
CY 1957	32	
CY 1958	77	
CY 1959		
CY 1960		
CY 1961	10	
CY 1962	96	2
CY 1963	29	
PRE-TREATY	331	2
POST-TREATY		
CY 1963	14	
CY 1964	29	1
CY 1965	28	1
CY 1966	40	
CY 1967	28	
CY 1968	33	
CY 1969	29	
CY 1970	30	
CY 1971	12	
CY 1972	8	
CY 1973	9	
CY 1974	7	1
CY 1975	16	
CY 1976	15	1
CY 1977	12	
CY 1978	12	2
CY 1979	14	1
CY 1980	14	3
CY 1981	16	1
CY 1982	18	1
CY 1983		
POST-TREATY	394	12
TOTAL	715	14

TOTALS BY TYPE

	U.S.	US/UK
TUNNEL	51	
SHAFT	438	14
CRATER	9	
TOTAL UG	498	14
AIRBURST	1	
BALLOON	25	
TOWER	56	
AIRDROP	54	
ROCKET	12	
SURFACE	28	
BARGE	36	
TOTAL ATMOS.	212	
TOTAL UW	5	
TOTAL	715	14

TOTALS BY LOCATION

	U.S.	US/UK
PACIFIC	4	
JOHNSTON ISL. AREA	12	
ENEWETAK	43	
BIKINI	23	
CHRISTMAS ISL. AREA	24	
TOTAL PACIFIC	106	
NTS UNDERGROUND	487	14
NTS ATMOSPHERIC	100	
TOTAL NTS	587	14
TOTAL S. ATLANTIC	3	
CENTRAL NEVADA	1	
AMCHITKA	3	
ALAMOGORDO	1	
JAPAN	2	
CARLSBAD	1	
HATTIESBURG	2	
FARMINGTON	1	
GRAND VALLEY	1	
RIFLE	1	
FALLON	1	
BOMBING RANGE	5	
TOTAL OTHER	19	
TOTAL	715	14

TOTALS BY PURPOSE

	TOTAL
COMBAT	2
SAFETY EXPER.	33
STORAGE-TRANSP	4
VELA UNIFORM	7
PLOWSHARE	27
WEAPONS RELATED	562
WEAPONS EFFECTS	80
JOINT US-UK	14
TOTAL	729

TOTALS BY DETECTION OF RADIOACTIVITY

	TOTAL
NO RADIOACTIVITY DETECTED	
NTS	373
DETECTION ON-SITE ONLY	
NTS	92
BOMBING RANGE	1
TOTAL	93
DETECTION OFF-SITE	
NTS	136
BOMBING RANGE	4
TOTALS	140

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
TRINITY	07/16/45	ALAMOGORDO	TOWER	WEAPONS RELATED	19KT
FIRST TEST OF A NUCLEAR WEAPON.					
WORLD WAR II	08/06/45	JAPAN	AIRDROP	COMBAT	13 KT
FIRST COMBAT USE-HIROSHIMA					
WORLD WAR II	08/09/45	JAPAN	AIRDROP	COMBAT	23 KT
SECOND COMBAT USE-NAGASAKI					
		OPERATION CROSSROADS			
ABLE	06/30/46	BIKINI	AIRDROP	WEAPONS EFFECTS	23 KT
BAKER	07/24/46	BIKINI	UW	WEAPONS EFFECTS	23 KT
		OPERATION SANDSTONE			
X-RAY	04/14/48	ENEWETAK	TOWER	WEAPONS RELATED	37KT
YOKE	04/30/48	ENEWETAK	TOWER	WEAPONS RELATED	49KT
ZEBRA	05/14/48	ENEWETAK	TOWER	WEAPONS RELATED	18KT
		OPERATION RANGER			
ABLE	01/27/51	NTS	AIRDROP	WEAPONS RELATED	1KT
BAKER	01/28/51	NTS	AIRDROP	WEAPONS RELATED	8KT
EASY	02/01/51	NTS	AIRDROP	WEAPONS RELATED	1KT
BAKER-2	02/02/51	NTS	AIRDROP	WEAPONS RELATED	8KT
FOX	02/06/51	NTS	AIRDROP	WEAPONS RELATED	22KT
		OPERATION GREENHOUSE			
DOG	04/07/51	ENEWETAK	TOWER	WEAPONS RELATED	
EASY	04/20/51	ENEWETAK	TOWER	WEAPONS RELATED	47KT
GEORGE	05/08/51	ENEWETAK	TOWER	WEAPONS RELATED	
ITEM	05/24/51	ENEWETAK	TOWER	WEAPONS RELATED	
		OPERATION BUSTER			
ABLE	10/22/51	NTS	TOWER	WEAPONS RELATED	LESS THAN 0.1KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
BAKER	10/28/51	NTS	AIRDROP	WEAPONS RELATED	3.5KT
CHARLIE	10/30/51	NTS	AIRDROP	WEAPONS RELATED	14KT
DOG	11/01/51	NTS	AIRDROP	WEAPONS RELATED	21KT
EASY	11/05/51	NTS	AIRDROP	WEAPONS RELATED	31KT
		OPERATION JANGLE			
SUGAR	11/19/51	NTS	SURFACE	WEAPONS EFFECTS	1.2KT
UNCLE	11/29/51	NTS	CRATER	WEAPONS EFFECTS	1.2KT
		OPERATION TUMBLER-SNAPPER			
ABLE	04/01/52	NTS	AIRDROP	WEAPONS EFFECTS	1KT
BAKER	04/15/52	NTS	AIRDROP	WEAPONS EFFECTS	1KT
CHARLIE	04/22/52	NTS	AIRDROP	WEAPONS RELATED	31KT
DOG	05/01/52	NTS	AIRDROP	WEAPONS RELATED	19KT
EASY	05/07/52	NTS	TOWER	WEAPONS RELATED	12KT
FOX	05/25/52	NTS	TOWER	WEAPONS RELATED	11KT
GEORGE	06/01/52	NTS	TOWER	WEAPONS RELATED	15KT
HOW	06/05/52	NTS	TOWER	WEAPONS RELATED	14KT
		OPERATION IVY			
MIKE EXPERIMENTAL THERMONUCLEAR DEVICE	10/31/52	ENEWETAK	SURFACE	WEAPONS RELATED	10.4MT
KING	11/15/52	ENEWETAK	AIRDROP	WEAPONS RELATED	500 KT
		OPERATION UPSHOT-KNOTHOLE			
ANNIE	03/17/53	NTS	TOWER	WEAPONS RELATED	16KT
NANCY	03/24/53	NTS	TOWER	WEAPONS RELATED	24KT
RUTH	03/31/53	NTS	TOWER	WEAPONS RELATED	0.2KT
DIXIE	04/06/53	NTS	AIRDROP	WEAPONS RELATED	11KT

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
RAY	04/11/53	NTS	TOWER	WEAPONS RELATED	0.2KT
BADGER	04/18/53	NTS	TOWER	WEAPONS RELATED	23KT
SIMON	04/25/53	NTS	TOWER	WEAPONS RELATED	43KT
ENCORE	05/04/53	NTS	AIRDROP	WEAPONS EFFECTS	27KT
HARRY	05/19/53	NTS	TOWER	WEAPONS RELATED	32KT
GRABLE FIRED FROM 280MM GUN	05/25/53	NTS	AIRBRST	WEAPONS RELATED	15KT
CLIMAX	06/04/53	NTS	AIRDROP	WEAPONS RELATED	61KT
		OPERATION CASTLE			
BRAVO EXPERIMENTAL THERMONUCLEAR DEVICE	03/28/54	BIKINI	SURFACE	WEAPONS RELATED	15MT
ROMEO	03/26/54	BIKINI	BARGE	WEAPONS RELATED	11MT
KOON	04/06/54	BIKINI	SURFACE	WEAPONS RELATED	110 KT
UNION	04/25/54	BIKINI	BARGE	WEAPONS RELATED	6.9MT
YANKEE	05/04/54	BIKINI	BARGE	WEAPONS RELATED	13.5MT
NECTAR	05/13/54	ENEWETAK	BARGE	WEAPONS RELATED	1.69MT
		OPERATION TEAPOT			
WASP	02/18/55	NTS	AIRDROP	WEAPONS EFFECTS	1KT
MOTH	03/22/55	NTS	TOWER	WEAPONS RELATED	2KT
TESLA	03/01/55	NTS	TOWER	WEAPONS RELATED	7KT
TURK	03/07/55	NTS	TOWER	WEAPONS RELATED	43KT
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4KT
APE	03/22/55	NTS	TOWER	WEAPONS RELATED	8KT
ESS	03/23/55	NTS	CRATER	WEAPONS EFFECTS	1KT
APPLE-1	03/29/55	NTS	TOWER	WEAPONS RELATED	14KT
WASP PRIME	03/29/55	NTS	AIRDROP	WEAPONS RELATED	3KT
HA	04/06/55	NTS	AIRDROP	WEAPONS EFFECTS	3KT

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
POST	04/09/55	NTS	TOWER	WEAPONS RELATED	2KT
MET	04/15/55	NTS	TOWER	WEAPONS EFFECTS	22KT
APPLE-2	05/05/55	NTS	TOWER	WEAPONS RELATED	29KT
ZUCCHINI	05/15/55	NTS	TOWER	WEAPONS RELATED	28KT
		OPERATION WIGWAM			
WIGWAM	05/14/55	PACIFIC	UW	WEAPONS EFFECTS	30KT
NORTH 29 DEGREES WEST 126 DEGREES.					
		PROJECT 56			
PROJECT 56 NO 1	11/01/55	NTS	SURFACE	SAFETY EXPER.	ZERO
PROJECT 56 NO 2 PU DISPERSAL.	11/03/55	NTS	SURFACE	SAFETY EXPER.	ZERO
PROJECT 56 NO 3 PU DISPERSAL.	11/05/55	NTS	SURFACE	SAFETY EXPER.	NO YIELD
PROJECT 56 NO 4 PU DISPERSAL.	01/18/56	NTS	SURFACE	SAFETY EXPER.	VERY SLIGHT
		OPERATION REDWING			
LACROSSE	05/04/56	ENEWETAK	SURFACE	WEAPONS RELATED	40 KT
CHEROKEE	05/20/56	BIKINI	AIRDROP	WEAPONS RELATED	SEVERAL MT
FIRST AIR DROP BY U.S. OF A THERMONUCLEAR WEAPON					
ZUNI	05/27/56	BIKINI	SURFACE	WEAPONS RELATED	3.5 MT
TEWA	05/27/56	ENEWETAK	TOWER	WEAPONS RELATED	
ERIE	05/30/56	ENEWETAK	TOWER	WEAPONS RELATED	
SEMINOLE	06/06/56	ENEWETAK	SURFACE	WEAPONS RELATED	13.7 KT
FLATHEAD	06/11/56	BIKINI	BARGE	WEAPONS RELATED	
BLACKFOOT	06/11/56	ENEWETAK	TOWER	WEAPONS RELATED	
KICKAPOO	06/13/56	ENEWETAK	TOWER	WEAPONS RELATED	
OSAGE	06/16/56	ENEWETAK	AIRDROP	WEAPONS RELATED	
INCA	06/21/56	ENEWETAK	TOWER	WEAPONS RELATED	

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
DAKOTA	06/25/56	BIKINI	BARGE	WEAPONS RELATED	
MOHAWK	07/02/56	ENEWETAK	TOWER	WEAPONS RELATED	
APACHE	07/08/56	ENEWETAK	BARGE	WEAPONS RELATED	
NAVAJO	07/10/56	BIKINI	BARGE	WEAPONS RELATED	
TEWA	07/20/56	BIKINI	BARGE	WEAPONS RELATED	5 MT
HURON	07/21/56	ENEWETAK	BARGE	WEAPONS RELATED	
		PROJECT 57			
PROJECT 57 NO 1 PU DISPERSAL.	04/24/57	BOMBING RANGE	SURFACE	SAFETY EXPER.	ZERO
		OPERATION PLUMBBOB			
BOLTZMANN	05/28/57	NTS	TOWER	WEAPONS RELATED	12KT
FRANKLIN	06/02/57	NTS	TOWER	WEAPONS RELATED	140TONS
LASSEN MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY	06/05/57	NTS	BALLOON	WEAPONS RELATED	0.5 TONS
WILSON	06/18/57	NTS	BALLOON	WEAPONS RELATED	10KT
PRISCILLA	06/24/57	NTS	BALLOON	WEAPONS RELATED	37KT
COULOMB-A NO RADIOACTIVE RELEASE DETECTED	07/01/57	NTS	SURFACE	SAFETY EXPER.	ZERO
HOOD	07/05/57	NTS	BALLOON	WEAPONS RELATED	74KT
DIABLO	07/15/57	NTS	TOWER	WEAPONS RELATED	17KT
JOHN AIR-TO-AIR MISSILE.	07/19/57	NTS	ROCKET	WEAPONS EFFECTS	ABOUT 2KT
KEPLER	07/24/57	NTS	TOWER	WEAPONS RELATED	10KT
OWENS	07/25/57	NTS	BALLOON	WEAPONS RELATED	9.7KT
PASCAL-A UNSTEMMED HOLE.	07/26/57	NTS	SHAFT	SAFETY EXPER.	SLIGHT
STOKES	08/07/57	NTS	BALLOON	WEAPONS RELATED	19KT
SATURN NO RADIOACTIVE RELEASE DETECTED	08/18/57	NTS	TUNNEL	SAFETY EXPER.	ZERO

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE (GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
SHASTA	08/18/57	NTS	TOWER	WEAPONS RELATED	17KT
DOPPLER	08/23/57	NTS	BALLOON	WEAPONS RELATED	11KT
PASCAL-B	08/27/57	NTS	SHAFT	SAFETY EXPER.	
UNSTEMMED HOLE. NO RADIOACTIVE RELEASE DETECTED					
FRANKLIN PRIME	08/30/57	NTS	BALLOON	WEAPONS RELATED	4.7KT
SMOKY	08/31/57	NTS	TOWER	WEAPONS RELATED	44KT
GALILEO	09/02/57	NTS	TOWER	WEAPONS RELATED	11KT
WHEELER	09/06/57	NTS	BALLOON	WEAPONS RELATED	197 TONS
COULOMB-B	09/06/57	NTS	SURFACE	SAFETY EXPER.	0.3KT
LAPLACE	09/08/57	NTS	BALLOON	WEAPONS RELATED	1KT
FIZEAU	09/14/57	NTS	TOWER	WEAPONS RELATED	11KT
NEWTON	09/16/57	NTS	BALLOON	WEAPONS RELATED	12KT
RAINIER	09/19/57	NTS	TUNNEL	WEAPONS RELATED	1.7KT
FIRST DETONATION CONTAINED UNDERGROUND. NO RADIOACTIVE RELEASE DETECTED					
WHITNEY	09/23/57	NTS	TOWER	WEAPONS RELATED	19KT
CHARLESTON	09/28/57	NTS	BALLOON	WEAPONS RELATED	12KT
MORGAN	10/07/57	NTS	BALLOON	WEAPONS RELATED	8KT
		PROJECT 58			
PASCAL-C	12/06/57	NTS	SHAFT	SAFETY EXPER.	SLIGHT
UNSTEMMED HOLE MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
COULOMB-C	12/09/57	NTS	SURFACE	SAFETY EXPER.	0.5KT
		OPERATION PLUMBBOB			
VENUS	02/22/58	NTS	TUNNEL	SAFETY EXPER.	LESS THAN ONE TON
NO RADIOACTIVE RELEASE DETECTED					
		PROJECT 58 A			
URANUS	03/14/58	NTS	TUNNEL	SAFETY EXPER.	LESS THAN ONE TON
NO RADIOACTIVE RELEASE DETECTED					
		OPERATION HARDTACK I			

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
YUCCA	04/28/58	PACIFIC	BALLOON	WEAPONS EFFECTS	
NORTH 12 DEG. 37 MIN. EAST 163 DEG. 01 MIN.					
CACTUS	05/05/58	ENEWETAK	SURFACE	WEAPONS RELATED	18 KT
FIR	05/11/58	BIKINI	BARGE	WEAPONS RELATED	
BUTTERNUT	05/11/58	ENEWETAK	BARGE	WEAPONS RELATED	
KOA	05/12/58	ENEWETAK	SURFACE	WEAPONS RELATED	1.37 MT
WAHOO	05/16/58	ENEWETAK	UW	WEAPONS EFFECTS	
HOLLY	05/20/58	ENEWETAK	BARGE	WEAPONS RELATED	
NUTMEG	05/21/58	BIKINI	BARGE	WEAPONS RELATED	
YELLOWWOOD	05/26/58	ENEWETAK	BARGE	WEAPONS RELATED	
MAGNOLIA	05/26/58	ENEWETAK	BARGE	WEAPONS RELATED	
TOBACCO	05/30/58	ENEWETAK	BARGE	WEAPONS RELATED	
SYCAMORE	05/31/58	BIKINI	BARGE	WEAPONS RELATED	
ROSE	06/02/58	ENEWETAK	BARGE	WEAPONS RELATED	
UMBRELLA	06/08/58	ENEWETAK	UW	WEAPONS EFFECTS	
MAPLE	06/10/58	BIKINI	BARGE	WEAPONS RELATED	
ASPEN	06/14/58	BIKINI	BARGE	WEAPONS RELATED	
WALNUT	06/14/58	ENEWETAK	BARGE	WEAPONS RELATED	
LINDEN	06/18/58	ENEWETAK	BARGE	WEAPONS RELATED	
REDWOOD	06/27/58	BIKINI	BARGE	WEAPONS RELATED	
ELDER	06/27/58	ENEWETAK	BARGE	WEAPONS RELATED	
OAK	06/28/58	ENEWETAK	BARGE	WEAPONS RELATED	8.9 MT
HICKORY	06/29/58	BIKINI	BARGE	WEAPONS RELATED	
SEQUOIA	07/01/58	ENEWETAK	BARGE	WEAPONS RELATED	
CEDAR	07/02/58	BIKINI	BARGE	WEAPONS RELATED	
DOGWOOD	07/05/58	ENEWETAK	BARGE	WEAPONS RELATED	
POPLAR	07/12/58	BIKINI	BARGE	WEAPONS RELATED	

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
SCAEVOLA	07/14/58	ENEWETAK	BARGE	SAFETY EXPER.	LOW
PISONIA	07/17/58	ENEWETAK	BARGE	WEAPONS RELATED	
JUNIPER	07/22/58	BIKINI	BARGE	WEAPONS RELATED	
OLIVE	07/22/58	ENEWETAK	BARGE	WEAPONS RELATED	
PINE	07/26/58	ENEWETAK	BARGE	WEAPONS RELATED	
TEAK	08/01/58	JOHNSTON ISL AREA	ROCKET	WEAPONS EFFECTS	MEGATON RANGE
QUINCE	08/06/58	ENEWETAK	SURFACE	WEAPONS RELATED	
ORANGE	08/12/58	JOHNSTON ISL AREA	ROCKET	WEAPONS EFFECTS	MEGATON RANGE
FIG	08/18/58	ENEWETAK	SURFACE	WEAPONS RELATED	
		OPERATION ARGUS			
ARGUS I	08/27/58	SOUTH ATLANTIC	ROCKET	WEAPONS EFFECTS	1-2KT
ABOUT 300 MILES ALTITUDE. SOUTH 38.5 DEG., WEST 11.5 DEG.					
ARGUS II	08/30/58	SOUTH ATLANTIC	ROCKET	WEAPONS EFFECTS	1-2KT
ABOUT 300 MILES ALTITUDE. SOUTH 49.5 DEG., WEST 8.2 DEG.					
ARGUS III	09/06/58	SOUTH ATLANTIC	ROCKET	WEAPONS EFFECTS	1-2KT
ABOUT 300 MILES ALTITUDE. SOUTH 48.5 DEG., WEST 9.7 DEG.					
		OPERATION HARDTACK II			
OTERO	09/12/58	NTS	SHAFT	SAFETY EXPER.	38 TONS
UNSTEMMED HOLE					
BERNALILLO	09/17/58	NTS	SHAFT	SAFETY EXPER.	15 TONS
UNSTEMMED HOLE MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
EDDY	09/19/58	NTS	BALLOON	WEAPONS RELATED	83 TONS
LUNA	09/21/58	NTS	SHAFT	SAFETY EXPER.	1.5 TONS
UNSTEMMED HOLE. MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
MERCURY	09/23/58	NTS	TUNNEL	SAFETY EXPER.	SLIGHT
NO RADIOACTIVE RELEASE DETECTED					
VALENCIA	09/26/58	NTS	SHAFT	SAFETY EXPER.	2 TONS
UNSTEMMED HOLE. MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
MARS	09/28/58	NTS	TUNNEL	SAFETY EXPER.	13 TONS
SLIGHT VENTING. MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
MORA	09/29/58	NTS	BALLOON	WEAPONS RELATED	2KT
COLFAX	10/05/58	NTS	SHAFT	SAFETY EXPER.	5.5 TONS
UNSTEMMED HOLE. MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
HIDALGO	10/05/58	NTS	BALLOON	SAFETY EXPER.	77 TONS
TAMALPAIS	10/08/58	NTS	TUNNEL	WEAPONS RELATED	72 TONS
SLIGHT VENTING MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
QUAY	10/10/58	NTS	TOWER	WEAPONS RELATED	79 TONS
LEA	10/13/58	NTS	BALLOON	WEAPONS RELATED	1.4KT
NEPTUNE	10/14/58	NTS	TUNNEL	SAFETY EXPER.	115 TONS
SLIGHT VENTING. MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
HAMILTON	10/15/58	NTS	TOWER	WEAPONS RELATED	1.2 TONS
LOGAN	10/16/58	NTS	TUNNEL	WEAPONS RELATED	5KT
NO RADIOACTIVE RELEASE DETECTED					
DONA ANA	10/16/58	NTS	BALLOON	WEAPONS RELATED	37 TONS
VESTA	10/17/58	NTS	SURFACE	SAFETY EXPER.	24 TONS
FIRED IN SURFACE STRUCTURE.					
RIO ARRIBA	10/18/58	NTS	TOWER	WEAPONS RELATED	90 TONS
SAN JUAN	10/20/58	NTS	SHAFT	SAFETY EXPER.	ZERO
UNSTEMMED HOLE NO RADIOACTIVE RELEASE DETECTED					
SOCORRO	10/22/58	NTS	BALLOON	WEAPONS RELATED	6KT
WRANGELL	10/22/58	NTS	BALLOON	WEAPONS RELATED	115 TONS
RUSHMORE	10/22/58	NTS	BALLOON	WEAPONS RELATED	188 TONS
OBERON	10/22/58	NTS	TOWER	SAFETY EXPER.	ZERO
NO RADIOACTIVE RELEASE DETECTED					
CATRON	10/24/58	NTS	TOWER	SAFETY EXPER.	21 TONS
JUNO	10/24/58	NTS	SURFACE	SAFETY EXPER.	1.7 TONS
FIRED IN SURFACE STRUCTURE. MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
CERES	10/26/58	NTS	TOWER	SAFETY EXPER.	0.7 TONS
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
SANFORD	10/26/58	NTS	BALLOON	WEAPONS RELATED	4.9KT
DE BACA	10/26/58	NTS	BALLOON	WEAPONS RELATED	2.2KT
CHAVEZ	10/27/58	NTS	TOWER	SAFETY EXPER.	0.6 TONS
EVANS	10/29/58	NTS	TUNNEL	WEAPONS RELATED	55 TONS
VENTING					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
HUMBOLDT	10/29/58	NTS	TOWER	WEAPONS RELATED	7.8 TONS
MAZAMA	10/29/58	NTS	TOWER	WEAPONS RELATED	ZERO
NO RADIOACTIVE RELEASE DETECTED					
SANTA FE	10/30/58	NTS	BALLOON	WEAPONS RELATED	1.3KT
BLANCA	10/30/58	NTS	TUNNEL	WEAPONS RELATED	22KT
SLIGHT VENTING					
GANYMEDE	10/30/58	NTS	SURFACE	SAFETY EXPER.	ZERO
CONTAINED IN SURFACE STRUCTURE.					
NO RADIOACTIVE RELEASE DETECTED					
TITANIA	10/30/58	NTS	TOWER	SAFETY EXPER.	0.2 TONS
		OPERATION NOUGAT			
ANTLER	09/15/61	NTS	TUNNEL	WEAPONS RELATED	2.6KT
RELEASE OF RADIOACTIVITY DETECTED OFF SITE					
SHREW	09/15/61	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
BOOMER	10/01/61	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
CHENA	10/10/61	NTS	TUNNEL	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
MINK	10/29/61	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
FISHER	12/03/61	NTS	SHAFT	WEAPONS RELATED	13.4KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
GNOME	12/10/61	CARLSBAD	SHAFT	PLOWSHARE	3 KT
MULTIPLE-PURPOSE EXPERIMENT IN SALT.FORMED CAVITY 160-170 FT.DIAMETER					
60-80 FT.HIGH. RELEASE OF RADIOACTIVITY DETECTED OFF-SITE.					

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
MAD	12/13/61	NTS	SHAFT	WEAPONS RELATED	C.5CKT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
RINGTAIL	12/17/61	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
FEATHER	12/22/61	NTS	TUNNEL	WEAPONS RELATED	LOW
RELEASE OF RADIOACTIVITY DETECTED OFF SITE					
STOAT	01/09/62	NTS	SHAFT	WEAPONS RELATED	5.1KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
AGOUTI	01/18/62	NTS	SHAFT	WEAPONS RELATED	6.4KT
DORMOUSE	01/30/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
STILLWATER	02/08/62	NTS	SHAFT	WEAPONS RELATED	3.07KT
ARMADILLO	02/09/62	NTS	SHAFT	WEAPONS RELATED	7.1KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
HARD HAT	02/15/62	NTS	SHAFT	WEAPONS EFFECTS	5.7KT
DOD EVENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
CHINCHILLA	02/19/62	NTS	SHAFT	WEAPONS RELATED	1.9KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
CODSAW	02/19/62	NTS	SHAFT	WEAPONS RELATED	LOW
CIMARRON	02/23/62	NTS	SHAFT	WEAPONS RELATED	11.9CKT
PLATYPUS	02/24/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADICACTIVITY DETECTED ON-SITE ONLY					
PAMPAS	03/01/62	NTS	SHAFT	JOINT US-UK	LOW
RELEASE OF RADIOACTIVITY DETECTED OFF SITE					
DANNY BOY	03/05/62	NTS	CRATER	WEAPONS EFFECTS	0.43KT
DOD EVENT					
CRATER DIAMETER 265 FT. DEPTH 84 FT. IN BASALT					
RELEASE OF RADIOACTIVITY DETECTED OFF-SITE.					
ERMINE	03/06/62	NTS	SHAFT	WEAPONS RELATED	LOW
BRAZOS	03/08/62	NTS	SHAFT	WEAPONS RELATED	8.4KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
HOGNOSE	03/15/62	NTS	SHAFT	WEAPONS RELATED	LOW
HOOSIC	03/28/62	NTS	SHAFT	WEAPONS RELATED	3.40KT

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
CHINCHILLA II	03/31/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
DORMOUSE II	04/05/62	NTS	SHAFT	WEAPONS RELATED	10.6KT
PASSAIC	04/06/62	NTS	SHAFT	WEAPONS RELATED	LOW
HUDSON	04/12/62	NTS	SHAFT	WEAPONS RELATED	LOW
PLATTE	04/14/62	NTS	TUNNEL	WEAPONS RELATED	1.45KT
RELEASE OF RADIOACTIVITY DETECTED OFF SITE					
DEAD	04/21/62	NTS	SHAFT	WEAPONS RELATED	LOW

1962 TESTS IN THE CHRISTMAS AND JOHNSTON ISLAND AREAS AND ELSEWHERE IN THE PACIFIC WERE PART OF OPERATION DOMINIC I. INTERMEDIATE YIELD FOR THESE TESTS MEANS 20 TO 1000 KT.

ADOBE	04/25/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
AZTEC	04/27/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
BLACK	04/27/62	NTS	SHAFT	WEAPONS RELATED	LOW
ARKANSAS	05/02/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	LOW MEGATON
OPERATION DOMINIC I					
QUESTA	05/04/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
FRIGATE BIRD	05/06/62	PACIFIC	ROCKET	WEAPONS RELATED	
OPERATION DOMINIC I					
NORTH 4 DEGREES 50 MIN. WEST 149 DEG. 25 MIN.					
WARHEAD IN MISSILE LAUNCHED FROM POLARIS SUBMARINE					
PACA	05/07/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
YUKON	05/08/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
MESILLA	05/09/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
ARIKAPEE	05/10/62	NTS	SHAFT	WEAPONS RELATED	LOW
MUSKEGON	05/11/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
SHOPOFISH	05/11/62	PACIFIC	UW	WEAPONS EFFECTS	LOW
OPERATION DOMINIC I NORTH 31 DEGREES 14 MIN. WEST 124 DEGREES 13 MIN. ANTISUBMARINE ROCKET /ASROC/ SYSTEM PROOF TEST					
ENCINO	05/12/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
AARDVARK	05/12/62	NTS	SHAFT	WEAPONS RELATED	46KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
SWANEE	05/14/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
EEL	05/19/62	NTS	SHAFT	WEAPONS RELATED	LOW
RELEASE OF RADIOACTIVITY DETECTED OFF SITE					
CHETCO	05/19/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
WHITE	05/25/62	NTS	SHAFT	WEAPONS RELATED	LOW
TANANA	05/25/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	LOW
OPERATION DOMINIC I					
NAMBE	05/27/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
RACCOON	06/01/62	NTS	SHAFT	WEAPONS RELATED	LOW
PACKRAT	06/06/62	NTS	SHAFT	WEAPONS RELATED	LOW
ALMA	06/08/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
TRUCKEE	06/09/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
YESO	06/10/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	LOW MEGATON
OPERATION DOMINIC I					
HARLEM	06/12/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
DES MOINES	06/13/62	NTS	TUNNEL	WEAPONS RELATED	LOW
RELEASE OF RADIOACTIVITY DETECTED OFF SITE					
RINCONADA	06/15/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
DULCE	06/17/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
PETIT	06/19/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	LOW
OPERATION DOMINIC I					
DAMAN I	06/21/62	NTS	SHAFT	WEAPONS RELATED	LOW
OTOWI	06/22/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
BIGHORN	06/27/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	MEGATON RANGE
OPERATION DOMINIC I					
HAYMAKER	06/27/62	NTS	SHAFT	WEAPONS RELATED	57KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
MARSHMALLOW	06/28/62	NTS	TUNNEL	WEAPONS EFFECTS	LOW
DOD EVENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
BLUESTONE	06/30/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	LOW MEGATON
OPERATION DOMINIC I					
SACRAMENTO	06/30/62	NTS	SHAFT	WEAPONS RELATED	LOW
OPERATION STORAX					
SEDAN	07/06/62	NTS	CRATER	PLOWSHARE	104KT
EXCAVATION EXPERIMENT-CRATER 1280 FT.DIAM 320 FT.DEEP-THERMONUCLEAR DEV.					
RELEASE OF RADIOACTIVITY DETECTED OFF-SITE.					
THREE WEAPONS EFFECTS TESTS AT NTS IN JULY OF 1962 WERE PART OF OPERATION DOMINIC II					
LITTLE FELLEPII	07/07/62	NTS	SURFACE	WEAPONS EFFECTS	LOW
SLIGHTLY ABOVE GROUND. DOMINIC II SERIES.					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
STARFISH PRIME	07/09/62	JOHNSTON ISL AREA	ROCKET	WEAPONS EFFECTS	1.4 MEGATONS
OPERATION DOMINIC I					
HIGH ALTITUDE-450 KM					
SUNSET	07/10/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
PAMLICO	07/11/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	LOW MEGATON
OPERATION DOMINIC I					
JOHNIE BOY	07/11/62	NTS	CRATER	WEAPONS EFFECTS	0.5 KT
SLIGHTLY BELOW GROUND. DOMINIC II SERIES.					
RELEASE OF RADIOACTIVITY DETECTED OFF-SITE.					

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
MERRIMAC	07/13/62	NTS	SHAFT	WEAPONS RELATED	INTERMEDIATE
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
SMALL BOY	07/14/62	NTS	TOWER	WEAPONS EFFECTS	LOW
SLIGHTLY ABOVE GROUND. DOMINIC II SERIES.					
RELEASE OF RADIOACTIVITY DETECTED OFF-SITE.					
LITTLE FELLER I	07/17/62	NTS	SURFACE	WEAPONS EFFECTS	LOW
SLIGHTLY ABOVE GROUND. DOMINIC II SERIES.					
RELEASE OF RADIOACTIVITY DETECTED OFF-SITE.					
WICHITA	07/27/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
YORK	08/24/62	NTS	SHAFT	WEAPONS RELATED	LOW
BOBAC	08/24/62	NTS	SHAFT	WEAPONS RELATED	LOW
RARITAN	09/06/62	NTS	SHAFT	WEAPONS RELATED	LOW
HYRAX	09/14/62	NTS	SHAFT	WEAPONS RELATED	LOW
PEBA	09/20/62	NTS	SHAFT	WEAPONS RELATED	LOW
ALLEGHENY	09/29/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
ANDROSCOGGIN	10/02/62	JOHNSTON ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
MISSISSIPPI	10/05/62	NTS	SHAFT	WEAPONS RELATED	115 KT
BUMPING	10/06/62	JOHNSTON ISL AREA	AIRDROP	WEAPONS RELATED	LOW
OPERATION DOMINIC I					
ROANOKE	10/12/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
WOLVERINE	10/12/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
CHAMA	10/18/62	JOHNSTON ISL AREA	AIRDROP	WEAPONS RELATED	LOW MEGATON
OPERATION DOMINIC I					
TIOGA	10/18/62	NTS	SHAFT	WEAPONS RELATED	LOW
BANDICOOT	10/19/62	NTS	SHAFT	WEAPONS RELATED	LOW
RELEASE OF RADIOACTIVITY DETECTED OFF SITE					
CHECKMATE	10/20/62	JOHNSTON ISL AREA	ROCKET	WEAPONS EFFECTS	LOW
OPERATION DOMINIC I					
HIGH ALTITUDE - TENS OF KMS					

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
BLUEGILL 3PRIME	10/26/62	JOHNSTON ISL AREA	ROCKET	WEAPONS EFFECTS	SUBMEGATON
OPERATION DOMINIC I HIGH ALTITUDE - TENS OF KMS					
SANTEE	10/27/62	NTS	SHAFT	WEAPONS RELATED	LOW
CALAMITY	10/27/62	JOHNSTON ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
HOUSATONIC	10/30/62	JOHNSTON ISL AREA	AIRDROP	WEAPONS RELATED	MEGATON RANGE
OPERATION DOMINIC I					
KINGFISH	11/01/62	JOHNSTON ISL AREA	ROCKET	WEAPONS EFFECTS	SUBMEGATON
OPERATION DOMINIC I HIGH ALTITUDE - TENS OF KMS					
TIGHTROPE	11/04/62	JOHNSTON ISL AREA	ROCKET	WEAPONS EFFECTS	LOW
OPERATION DOMINIC I HIGH ALTITUDE - TENS OF KMS					
ST. LAWRENCE	11/09/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
GUNDI	11/15/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
ANACOSTIA	11/27/62	NTS	SHAFT	PLOWSHARE	LOW
DEVICE DEVELOPMENT MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
TAUNTON	12/04/62	NTS	SHAFT	WEAPONS RELATED	LOW
TENDRAC	12/07/62	NTS	SHAFT	JOINT US-UK	LOW
MADTSON	12/12/62	NTS	TUNNEL	WEAPONS RELATED	LOW
NUMBAT	12/12/62	NTS	SHAFT	WEAPONS RELATED	LOW
MANATEE	12/14/62	NTS	SHAFT	WEAPONS RELATED	LOW
CASSELMAN	02/08/63	NTS	SHAFT	WEAPONS RELATED	LOW
ACUSHI	02/08/63	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
FERRET	02/08/63	NTS	SHAFT	WEAPONS RELATED	LOW
HATCHIE	02/08/63	NTS	SHAFT	WEAPONS RELATED	LOW
CHIPMUNK	02/15/63	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
KAWEAH	02/21/63	NTS	SHAFT	PLOWSHARE	LOW
DEVICE DEVELOPMENT					

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
CARMEL	02/21/63	NTS	SHAFT	WEAPONS RELATED	LOW
JERROA	03/01/63	NTS	SHAFT	WEAPONS RELATED	LOW
TCYAH	03/15/63	NTS	SHAFT	WEAPONS RELATED	LOW
GERBIL	03/29/63	NTS	SHAFT	WEAPONS RELATED	LOW
FERRET PRIME	04/05/63	NTS	SHAFT	WEAPONS RELATED	LOW
COYPU	04/10/63	NTS	SHAFT	WEAPONS RELATED	LOW
CUMBERLAND	04/11/63	NTS	SHAFT	WEAPONS RELATED	LOW
KOOTANAI	04/24/63	NTS	SHAFT	WEAPONS RELATED	LOW
	MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY				
PAISANO	04/24/63	NTS	SHAFT	WEAPONS RELATED	LOW
	MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY				
GUNDI PRIME	05/09/63	NTS	SHAFT	WEAPONS RELATED	LOW
	MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY				
DOUBLE TRACKS	05/15/63	BOMBING RANGE	SURFACE	STORAGE-TRANSP	ZERO
	RADIOACTIVITY DETECTED OFF-SITE				
	PU DISPERSAL				
HARKEE	05/17/63	NTS	SHAFT	WEAPONS RELATED	LOW
TEJON	05/17/63	NTS	SHAFT	WEAPONS RELATED	LOW
STONES	05/22/63	NTS	SHAFT	WEAPONS RELATED	INTERMEDIATE
CLEAN SLATE I	05/25/63	BOMBING RANGE	SURFACE	STORAGE-TRANSP	ZERO
	RADIOACTIVITY DETECTED OFF-SITE				
	PU DISPERSAL				
PLEASANT	05/29/63	NTS	SHAFT	WEAPONS RELATED	LOW
	MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY				
CLEAN SLATE II	05/31/63	NTS	SURFACE	STORAGE-TRANSP	ZERO
	PU DISPERSAL.				
	MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY				
YUBA	06/05/63	NTS	TUNNEL	WEAPONS RELATED	LOW
	POST-TEST CONTROLLED RELEASE OF RADIOACTIVITY DETECTED OFF-SITE.				
HUTIA	06/06/63	NTS	SHAFT	WEAPONS RELATED	LOW
APSHAPA	06/06/63	NTS	SHAFT	WEAPONS RELATED	LOW
	MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY				
CLEAN SLATE III	06/09/63	BOMBING RANGE	SURFACE	STORAGE-TRANSP	ZERO
	RADIOACTIVITY DETECTED OFF-SITE				
	PU DISPERSAL.				

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
MATACO	06/14/63	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
KENNEBEC	06/25/63	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
OPERATION NIBLICK					
PEKAN	08/12/63	NTS	SHAFT	WEAPONS RELATED	LOW
SATSOP	08/15/63	NTS	SHAFT	WEAPONS RELATED	LOW
KOHOCTON	08/23/63	NTS	SHAFT	WEAPONS RELATED	LOW
AHTANUM	09/13/63	NTS	SHAFT	WEAPONS RELATED	LOW
BILBY	09/13/63	NTS	SHAFT	WEAPONS RELATED	249KT
FIRST UNDERGROUND TEST REPORTED FELT IN LAS VEGAS					
GRUNION	10/11/63	NTS	SHAFT	WEAPONS RELATED	LOW
TORNILLO	10/11/63	NTS	SHAFT	PLOWSHARE	LOW
DEVICE DEVELOPMENT					
CLEARWATER	10/16/63	NTS	SHAFT	WEAPONS RELATED	INTERMEDIATE
SHOAL	10/26/63	FALLON	SHAFT	VELA UNIFORM	12KT
NUCLEAR TEST DETECTION-RESEARCH EXPERIMENT NEAR FALLON NEVADA					
ANCHOVY	11/14/63	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
MUSTANG	11/15/63	NTS	SHAFT	WEAPONS RELATED	LOW
GREYS	11/22/63	NTS	SHAFT	WEAPONS RELATED	INTERMEDIATE
SARDINE	12/04/63	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
EAGLE	12/12/63	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADICACTIVITY DETECTED OFF SITE					
FORE	01/16/64	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
OCONTO	01/23/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
KLICKITAT	02/20/64	NTS	SHAFT	PLOWSHARE	20 TO 200KT
DEVICE DEVELOPMENT					
PIKE	03/13/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE					

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
HOOK	04/14/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
STURGEON	04/15/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
TURF	04/24/64	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
PIPEFISH	04/29/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
BACKSWING	05/14/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
MINNOW	05/15/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
ACE	06/11/64	NTS	SHAFT	PLOWSHARE	LESS THAN 20KT
DEVICE DEVELOPMENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
FADE	06/25/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
DUB	06/30/64	NTS	SHAFT	PLOWSHARE	LESS THAN 20KT
DEVICE DEVELOPMENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
OPERATION WHETSTONE					
RYE	07/16/64	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CORMORANT	07/17/64	NTS	SHAFT	JOINT US-UK	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
ALVA	08/19/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
RELEASE OF RADIOACTIVITY DETECTED OFF-SITE BY AIRCRAFT ONLY.					
CANVASBACK	08/22/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
HADDOCK	08/28/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
GUANAY	09/04/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
AUK	10/02/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
PAR	10/09/64	NTS	SHAFT	PLOWSHARE	3AKT
ISOTOPE PRODUCTION-EXPLOSIVE DEVELOPMENT					
BARBEL	10/16/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
SALMON	10/22/64	HATTIESBURG	SHAFT	VELA UNIFORM	5.3KT
NUCLEAR TEST DETECTION RESEARCH EXPERIMENT					

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EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
FOREST	10/31/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
HANDCAR	11/05/64	NTS	SHAFT	PLOWSHARE	12KT
EFFECTS OF CONTAINED EXPLOSION IN CARBONATE ROCK MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
CREPE	12/05/64	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
DRILL	12/05/64	NTS	SHAFT	WEAPONS RELATED	3.4 KT
RELEASE OF RADIOACTIVITY DETECTED OFF-SITE.					
PARROT	12/16/64	NTS	SHAFT	WEAPONS RELATED	1.3KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE					
MUDPACK	12/16/64	NTS	SHAFT	WEAPONS EFFECTS	2.7KT
DOD EVENT					
SULKY	12/18/64	NTS	SHAFT	PLOWSHARE	0.092KT
EXCAVATION TEST OF EXPLOSIVE BURIED AT GREATER DEPTH IN RELATION TO YIELD PRODUCED MOUND OF BROKEN ROCK RELEASE OF RADIOACTIVITY DETECTED OFF-SITE					
WOOL	01/14/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
CASHMERE	02/04/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
ALPACA	02/12/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE					
MERLIN	02/16/65	NTS	SHAFT	WEAPONS RELATED	10.1KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
WISHBONE	02/18/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
MAGTAIL	03/03/65	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CUP	03/26/65	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
KESTREL	04/05/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
PALANQUIN	04/14/65	NTS	CRATER	PLOWSHARE	4.3KT
CRATERING EXPERIMENT RELEASE OF RADIOACTIVITY DETECTED OFF-SITE.					
GUM DROP	04/21/65	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
TEE	05/07/65	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE					
BUTEO	05/12/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
SCAUP	05/14/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
CAMBRIC	05/14/65	NTS	SHAFT	WEAPONS RELATED	.75KT
TWEED	05/21/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
PETREL	06/11/65	NTS	SHAFT	WEAPONS RELATED	1.3KT
	MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY				
DILUTED WATERS	06/16/65	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
	DOD EVENT MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE				
TINY TOT	06/17/65	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
	DOD EVENT				
	MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY				
	OPERATION FLINTLOCK				
BRONZE	07/23/65	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
MAUVE	08/06/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
CENTAUR	08/27/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
	MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY				
SCREAMER	09/01/65	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
	MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY				
CHARCOAL	09/10/65	NTS	SHAFT	JOINT US-UK	20 TO 200KT
ELKHART	09/17/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
LONG SHOT	10/29/65	AMCHITKA	SHAFT	VELA UNIFORM	ABOUT 80KT
	DOD EVENT. NUCLEAR TEST DETECTION EXPERIMENT				
SEPIA	11/12/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
CORDUROY	12/03/65	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
EMERSON	12/16/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
	MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY				
RUFF	12/16/65	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
MAXWELL	01/13/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
LAMPBLACK	01/18/66	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
DOVEKIE	01/21/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 2.KT
PLAID II	02/03/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
	MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY				
REX	02/24/66	NTS	SHAFT	WEAPONS RELATED	19KT

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
RED HOT	03/05/66	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT. MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE					
FINFOOT	03/07/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
CLYMER	03/12/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
PURPLE	03/18/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
TEMPLAR	03/24/66	NTS	SHAFT	PLOWSHARE	LESS THAN 20KT
EXCAVATION DEVICE DEVELOPMENT					
LIME	04/01/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
STUTZ	04/06/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
TOMATO	04/07/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
DURYEA	04/14/66	NTS	SHAFT	WEAPONS RELATED	70KT
PIN STRIPE	04/25/66	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT. MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE					
TRAVELLER	05/04/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
CYCLAMEN	05/05/66	NTS	SHAFT	WEAPONS RELATED	12KT
INCLUDED HEAVY ELEMENT EXPERIMENT					
CHARTREUSE	05/06/66	NTS	SHAFT	WEAPONS RELATED	73KT
TAPESTRY	05/12/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
PIRANHA	05/13/66	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
DUMONT	05/19/66	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
DISCUS THROWER	05/27/66	NTS	SHAFT	WEAPONS EFFECTS	22KT
DOD EVENT					
PILE DRIVER	06/02/66	NTS	TUNNEL	WEAPONS EFFECTS	62KT
DOD EVENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
TAN	06/03/66	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
PUCE	06/10/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
DOUBLE PLAY	06/15/66	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT. MINOR LEVELS OF RADIOACTIVITY DETECTED OFF-SITE					
KANKAKEE	06/15/66	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
VULCAN	06/25/66	NTS	SHAFT	PLOWSHARE	25KT
DEVICE DEVELOPMENT. HEAVY ELEMENT PRODUCTION.					
HALFBEAK	06/30/66	NTS	SHAFT	WEAPONS RELATED	365KT
		OPERATION LATCHKEY			
SAXON	07/29/66	NTS	SHAFT	PLOWSHARE	LESS THAN 20KT
EXCAVATION DEVICE DEVELOPMENT					
ROVENA	08/10/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
DERRINGER	09/12/66	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE					
DAIQUIRI	09/23/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
NEWARK	09/29/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
SIMMS	11/05/66	NTS	SHAFT	PLOWSHARE	LESS THAN 20KT
EXCAVATION DEVICE DEVELOPMENT					
AJAX	11/11/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
CERISE	11/18/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
STERLING	12/03/66	HATTIESBURG	SHAFT	VELA UNIFORM	380 TONS
NUCLEAR TEST DETECTION EXPERIMENT					
NEW POINT	12/13/66	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
GREELEY	12/20/66	NTS	SHAFT	WEAPONS RELATED	870KT
NASH	01/19/67	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE					
BOURBON	01/20/67	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
WARD	02/08/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
PERSIMMON	02/23/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
AGILE	02/23/67	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
RIVET III	03/02/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
FAWN	04/07/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
CHOCOLATE	04/21/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
EFFENDI	04/27/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MICKEY	05/10/67	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
COMMODORE	05/20/67	NTS	SHAFT	WEAPONS RELATED	250 KT
SCOTCH	05/23/67	NTS	SHAFT	WEAPONS RELATED	155KT
KNICKERBOCKER	05/26/67	NTS	SHAFT	WEAPONS RELATED	76KT
SWITCH	06/22/67	NTS	SHAFT	PLOWSHARE	LESS THAN 20KT
EXCAVATION DEVICE DEVELOPMENT					
MIDI MIST	06/26/67	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT. RELEASE OF RADIOACTIVITY DETECTED OFF-SITE BY AIRCRAFT ONLY					
UMBER	06/29/67	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE					
		OPERATION CROSSTIE			
STANLEY	07/27/67	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
WASHER	08/10/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
BORDEAUX	08/18/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
DOOR MIST	08/31/67	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT. MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE					
YARD	09/07/67	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
MARVEL	09/21/67	NTS	SHAFT	PLOWSHARE	LESS THAN 20KT
EMPLACEMENT TECHNIQUE EXPERIMENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
ZAZA	09/27/67	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
LANPHER	10/18/67	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
SAZERAC	10/25/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
COBBLER	11/08/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
GASBUGGY	12/10/67	FARMINGTON	SHAFT	PLOWSHARE	29KT
JOINT GOVT-INDUSTRY GAS STIMULATION EXPERIMENT					
STILT	12/15/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
HUPMOBILE	01/18/68	NTS	SHAFT	WEAPONS EFFECTS	16.(KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE					

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
STACCATO	01/19/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
FAULTLESS	01/19/68	CENTRAL NEVADA	SHAFT	WEAPONS RELATED	200 TO 1000KT
SEISMIC CALIBRATION.					
CABRIOLET	01/26/68	NTS	CRATER	PLOWSHARE	2.3KT
RELEASE OF RADIOACTIVITY DETECTED OFF-SITE					
KNOX	02/21/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
DORSAL FIN	02/29/68	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
BUGGY	03/12/68	NTS	CRATER	PLOWSHARE	5.4KT
POW CHARGE EXPERIMENT - FIVE SIMULTANEOUS DETONATIONS					
RELEASE OF RADIOACTIVITY DETECTED OFF-SITE					
POMMARD	03/14/68	NTS	SHAFT	WEAPONS RELATED	1.5KT
STINGER	03/22/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
MILK SHAKE	03/25/68	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
NOOR	04/10/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
SHUFFLE	04/18/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
SCROLL	04/23/68	NTS	SHAFT	VELA UNIFORM	LESS THAN 20KT
NUCLEAR TEST DETECTION EXPERIMENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
BOXCAR	04/26/68	NTS	SHAFT	WEAPONS RELATED	1.3 MEGATONS
CLARKSMOBILE	05/17/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
TUB	06/06/68	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
PICKET	06/15/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CHATEAUGAY	06/29/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
		OPERATION BOWLINE			
TANYA	07/30/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
DIANA MOON	08/27/68	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
SLED	08/29/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
NOGGIN	09/06/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
KNIFE A	09/12/68	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
STODDARD EXCAVATION DEVICE DEVELOPMENT	09/17/68	NTS	SHAFT	PLOWSHARE	20 TO 200KT
HUDSON SEAL DOD EVENT	09/24/68	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
KNIFE C	10/03/68	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
CREW	11/04/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
KNIFE B	11/15/68	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MING VASE DOD EVENT AREA 15	11/20/68	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
TINDERBOX	11/22/68	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
SCHOONER RELEASE OF RADIOACTIVITY DETECTED OFF-SITE	12/08/68	NTS	CRATER	PLOWSHARE	30KT
TYG MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY	12/12/68	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
BENHAM	12/19/68	NTS	SHAFT	WEAPONS RELATED	1.15 MEGATON
PACKARD MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY	01/15/69	NTS	SHAFT	WEAPONS RELATED	7.4 KT
MINESKIN	01/15/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
VISE	01/30/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CYPRESS	02/12/69	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
BARSAC MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY	03/20/69	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
COFFER	03/21/69	NTS	SHAFT	WEAPONS RELATED	LESS THAN 100KT
THISTLE	04/30/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
BLENTON MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY	04/30/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
PURSE	05/07/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
TORRIDO	05/27/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
TAPPER MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY	06/12/69	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT

OPERATION MANDREL

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
ILOPIM	07/16/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
HUTCH	07/16/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200 KT
SPIDER	08/14/69	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
PLIERS	08/27/69	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
RULISON	09/10/69	GRAND VALLEY	SHAFT	PLOWSHARE	40KT
JOINT GOVT-INDUSTRY GAS STIMULATION EXPERIMENT					
MINUTE STEAK	09/12/69	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
JORUM	09/16/69	NTS	SHAFT	WEAPONS RELATED	LESS THAN 1 MEGAT
MILROW	10/02/69	AMCHITKA	SHAFT	WEAPONS RELATED	ABOUT 1 MEGATON
SEISMIC CALIBRATION.					
PIPKIN	10/08/69	NTS	SHAFT	WEAPONS RELATED	200 TO 1000KT
CRUET	10/29/69	NTS	SHAFT	WEAPONS RELATED	11 KT
POD	10/29/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFFSITE					
CALABASH	10/29/69	NTS	SHAFT	WEAPONS RELATED	110KT
SCUTTLE	11/13/69	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFF-SITE.					
PICCALILLI	11/21/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
DIESEL TRAIN	12/05/69	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
GRAPE A	12/17/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
LOVAGE	12/17/69	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
TERRINE	12/18/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
FOB	01/23/70	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
AJO	01/30/70	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
IN MINED SHAFT					
GRAPE B	02/04/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
LABIS	02/05/70	NTS	SHAFT	WEAPONS RELATED	25 KT

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
DIANA MIST DOD EVENT	02/11/70	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
CUMARIN	02/25/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
MANNIGAN	02/26/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CYATHUS	03/06/70	NTS	SHAFT	WEAPONS RELATED	8.7 KT
ARABIS	03/06/70	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
JAL	03/19/70	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
SHAPER	03/23/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
HANDLEY	03/26/70	NTS	SHAFT	WEAPONS RELATED	MORE THAN 1 MEGAT
SNUBBER MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE	04/21/70	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
CAN	04/21/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
BEEBALM	05/01/70	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
HOD MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY	05/01/70	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINT LEAF DOD EVENT. MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE	05/05/70	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DIAMOND DUST NUCLEAR TEST DETECTION EXPERIMENT MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY	05/12/70	NTS	TUNNEL	VELA UNIFORM	LESS THAN 20KT
CORNICE	05/15/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
MANZANAS MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY	05/21/70	NTS	SHAFT	WEAPONS RELATED	LESS THAN 2 KT
MORRONES	05/21/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
HUDSON MOON DOD EVENT MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY	05/26/70	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 2 KT
FLASK MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY	05/26/70	NTS	SHAFT	PLOWSHARE	105KT
ARNICA	06/26/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT

OPERATION EMERY

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
TIJERAS	10/14/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
ABEYTAS	11/05/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
ARTESIA	12/16/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CREAM	12/16/70	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
CARPETBAG	12/17/70	NTS	SHAFT	WEAPONS RELATED	220KT
BANEBERRY	12/18/70	NTS	SHAFT	WEAPONS RELATED	10 KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFFSITE					
EMBUDO	06/16/71	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
LAGUNA	06/23/71	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
HARERELL	06/24/71	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CAMPHOR	06/29/71	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20 KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
OPERATION GROMMET					
DIAMOND MINE	07/01/71	NTS	TUNNEL	VELA UNIFORM	LESS THAN 20KT
NUCLEAR TEST DETECTION EXPERIMENT					
MINIATA	07/08/71	NTS	SHAFT	PLOWSHARE	83 KT
DEVICE DEVELOPMENT EXPERIMENT					
ALGODONES	08/18/71	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
PEDERNAL	09/29/71	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
CATHAY	10/08/71	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
CANNIKIN	11/06/71	AMCHITKA	SHAFT	WEAPONS RELATED	LESS THAN 5 MEGAT
TEST OF WARHEAD FOR SPARTAN MISSILE					
DIAGONAL LINE	11/24/71	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED OFF-SITE BY AIRCRAFT ONLY.					
CHAENACTIS	12/14/71	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
LONGCHAMPS	04/19/72	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MISTY NORTH	05/02/72	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
ZINNIA	05/17/72	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
MONFRO	05/19/72	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
		OPERATION TOGGLE			
DIAMOND SCULLS DOD EVENT	07/20/72	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
OSCURO	09/21/72	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
DELPHINIUM	09/26/72	NTS	SHAFT	WEAPONS RELATED	15KT
FLAX	12/21/72	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
MIERA	03/08/73	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
ANGUS	04/25/73	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
STARWORT	04/26/73	NTS	SHAFT	WEAPONS RELATED	90KT
RIO BLANCO GAS STIMULATION EXPERIMENT	05/17/73	RIFLE JOINT GOVT-INDUSTRY	SHAFT	FLOWSHARE	THREE 3?KT DEVICE
DIDO QUEEN DOD EVENT	06/05/73	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
ALMENDRO	06/06/73	NTS	SHAFT	WEAPONS RELATED	200 TO 1000KT
PORTULACA	06/29/73	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
		OPERATION ARBOR			
HUSKY ACE DOD EVENT	10/12/73	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
BERNAL	11/28/73	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
LATIR	02/27/74	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
FALLON	05/23/74	NTS	SHAFT	JOINT US-UK	20 TO 200KT
MING BLADE DOD EVENT	06/19/74	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
		OPERATION BEDROCK			
ESCABOSA	07/10/74	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
PUYE	08/14/74	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
PORTMANTEAU	08/30/74	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
STANYAN	09/26/74	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
HYBLA FAIR DOD EVENT	10/28/74	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
TOPGALLANT	02/28/75	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CABRILLO	03/07/75	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
DINING CAR DOD EVENT	04/05/75	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
EDAM	04/24/75	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
OBAR	04/30/75	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
TYBO	05/14/75	NTS	SHAFT	WEAPONS RELATED	200 TO 1000KT
STILTON	06/03/75	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
MITTEN	06/03/75	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
MAST	06/19/75	NTS	SHAFT	WEAPONS RELATED	200 TO 1000KT
CAMEMBERT	06/26/75	NTS	SHAFT	WEAPONS RELATED	200 TO 1000KT
		OPERATION ANVIL			
MARSH	09/06/75	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
HUSKY PUP DOD EVENT	10/24/75	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
KASSERI	10/28/75	NTS	SHAFT	WEAPONS RELATED	200 TO 1000KT
INLET	11/20/75	NTS	SHAFT	WEAPONS RELATED	200 TO 1000KT
LEYDEN	11/26/75	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
CHIBERTA	12/20/75	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
MUENSTER	01/03/76	NTS	SHAFT	WEAPONS RELATED	200 TO 1000KT
KEELSON	02/04/76	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
ESROM	02/04/76	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
FONTINA	02/12/76	NTS	SHAFT	WEAPONS RELATED	200 TO 1000KT
CHESHIRE	02/14/76	NTS	SHAFT	WEAPONS RELATED	200 TO 500KT
ESTUARY	03/09/76	NTS	SHAFT	WEAPONS RELATED	200 TO 500KT

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
COLBY	03/14/76	NTS	SHAFT	WEAPONS RELATED	500 TO 1000KT
POOL	03/17/76	NTS	SHAFT	WEAPONS RELATED	200 TO 500KT
STRAIT	03/17/76	NTS	SHAFT	WEAPONS RELATED	200 TO 500KT
MIGHTY EPIC DOD EVENT	05/12/76	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
BILLET	07/27/76	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
BANON	08/26/76	NTS	SHAFT	JOINT US-UK	20 TO 150 KT
		OPERATION FULCRUM			
CHEVRE	11/23/76	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
REDWOOD	12/08/76	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
ASIAGO	12/21/76	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
RUDDER	12/28/76	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
MARSILLY	04/05/77	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
BULKHEAD	04/27/77	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
CREWLINE	05/25/77	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
STRAKE	06/04/77	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
SCANTLING	06/19/77	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
EBBTIDE	09/15/77	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
COULOMMIERS	09/27/77	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
		OPERATION CRESSET			
BOBSTAY	10/26/77	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
HYBLA GOLD DOD EVENT	11/01/77	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20 KT
SANDREEF	11/09/77	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
SEAMOUNT	11/17/77	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
FARALLONES	12/14/77	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
CAMPOS	02/13/78	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
REBLOCHON	02/23/78	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
ICEBERG	03/23/78	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
BACKBEACH	04/11/78	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
FONDUTTA	04/11/78	NTS	SHAFT	JOINT US-UK	20 TO 150 KT
TRANSOM	05/10/78	NTS	SHAFT	WEAPONS RELATED	ZERO
NO NUCLEAR YIELD DEVICE WAS DESTROYED BY HEARTS DETONATION ON 09/06/79.					
LOWBALL	07/12/78	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
PANIC	08/31/78	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
DIABLO HAWK DOD EVENT	09/13/78	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20 KT
DRAUGHTS	09/27/78	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
RUMMY	09/27/78	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
		OPERATION QUICKSILVER			
EMMENTHAL	11/02/78	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
QUARGEL	11/18/78	NTS	SHAFT	JOINT US-UK	20 TO 150 KT
FARM	12/16/78	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
BACCARAT	01/24/79	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
QUINELLA	02/08/79	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
KLOSTER	02/15/79	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
MEMORY	03/14/79	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
PEPATO	06/11/79	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
CHESS	06/20/79	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
FAJY	06/28/79	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
BURZET	08/03/79	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
OFFSHORE	08/08/79	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
NESSEL	08/29/79	NTS	SHAFT	JOINT US-UK	20 TO 150 KT
HEARTS	09/06/79	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
DETONATION DESTROYED TRANSOM DEVICE THAT DID NOT DETONATE ON 05/10/78.					

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
PERA	09/08/79	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
SHEEPSHEAD	09/26/79	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
		OPERATION TINDERBOX			
BACKGAMMON	11/29/79	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
AZUL	12/14/79	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
DETONATION DESTROYED PENINSULA DEVICE THAT WAS DAMAGED DURING EMPLACEMENT ON 10/23/75. THE PENINSULA DEVICE WAS NOT TESTED.					
TARKO	02/28/80	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
NORBO	03/30/80	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
LIPTAUER	04/03/80	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
PYRAMID	04/16/80	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
COLWICK	04/26/80	NTS	SHAFT	JOINT US-UK	20 TO 150 KT
CANFIELD	05/02/80	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
FLORA	05/22/80	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
KASH	06/12/80	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
HURON KING DOD EVENT	06/24/80	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20 KT
TAFT	07/25/80	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
VERDELLO	07/31/80	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
BONARDA	09/25/80	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
RIOLA	09/25/80	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFF-SITE.					
		OPERATION GUARDIAN			
DUTCHESS	10/24/80	NTS	SHAFT	JOINT US-UK	LESS THAN 20 KT
MINERS IRON DOD EVENT	10/31/80	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20 KT
DAUPHIN	11/14/80	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
SERPA	12/17/80	NTS	SHAFT	JOINT US-UK	20 TO 150 KT

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
BASEBALL	01/15/81	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
CLAIRETTE	02/05/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
SECO	02/25/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
VIDF	04/30/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
ALIGOTE	05/29/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
HARZER	06/06/81	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
NIZA	07/10/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
PINFAU	07/16/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
HAVARTI	08/05/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
ISLAY	08/27/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
TREBBIANO	09/04/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
CERNADA	09/24/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
		OPERATION PRAETORIAN			
PALIZA	10/01/81	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
TILCI	11/11/81	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
ROUSANNE	11/12/81	NTS	SHAFT	JOINT US-UK	20 TO 150 KT
AKAVI	12/03/81	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
CABOC	12/16/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
JORNADA	01/28/82	NTS	SHAFT	WEAPONS RELATED	20 TO 150KT
MOLBO	02/12/82	NTS	SHAFT	WEAPONS RELATED	20 TO 150KT
HOSTA	02/12/82	NTS	SHAFT	WEAPONS RELATED	20 TO 150KT
TENAJA	04/17/82	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
GIRNE	04/25/82	NTS	SHAFT	JOINT US-UK	20 TO 150KT
KRYPOST	05/06/82	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
BOUSCHET	05/07/82	NTS	SHAFT	WEAPONS RELATED	20 TO 150KT
KESTI	06/16/82	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY DATE

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
NEBBIOLO	06/24/82	NTS	SHAFT	WEAPONS RELATED	20 TO 150KT
MONTEREY	07/29/82	NTS	SHAFT	WEAPONS RELATED	20 TO 150KT
ATRISCO	08/05/82	NTS	SHAFT	WEAPONS RELATED	20 TO 150KT
QUESO	08/11/82	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
CERRO	09/02/82	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
HURON LANDING DOD EVENT SIMULTANEOUS WITH DIAMOND ACE	09/23/82	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DIAMOND ACE DOD EVENT SIMULTANEOUS WITH HURON LANDING	09/23/82	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
FRISCO	09/23/82	NTS	SHAFT	WEAPONS RELATED	20 TO 150KT
BORREGO	09/29/82	NTS	SHAFT	WEAPONS RELATED	LESS THAN 150KT
		OPERATION PHALANX			
SEYVAL	11/12/82	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MANTECA	12/10/82	NTS	SHAFT	WEAPONS RELATED	20 TO 150KT

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
AARDVARK	05/12/62	NTS	SHAFT	WEAPONS RELATED	40KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
ABEYTAS	11/05/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
ABLE	06/30/46	BIKINI	AIRDROP	WEAPONS EFFECTS	23 KT
ABLE	01/27/51	NTS	AIRDROP	WEAPONS RELATED	1KT
ABLE	10/22/51	NTS	TOWER	WEAPONS RELATED	LESS THAN 0.1KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
ABLE	04/01/52	NTS	AIRDROP	WEAPONS EFFECTS	1KT
ACE	06/11/64	NTS	SHAFT	PLOWSHARE	LESS THAN 20KT
DEVICE DEVELOPMENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
ACUSHI	02/08/63	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
ADOBE	04/25/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
AGILE	02/23/67	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
AGOUTI	01/18/62	NTS	SHAFT	WEAPONS RELATED	6.4KT
AHTANUM	09/13/63	NTS	SHAFT	WEAPONS RELATED	LOW
AJAX	11/11/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
AJO	01/30/70	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
IN MINED SHAFT					
AKAVI	12/03/81	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
ALGODONES	08/18/71	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
ALIGOTE	05/29/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
ALLEGHENY	09/29/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
ALMA	06/08/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
ALMENDRO	06/06/73	NTS	SHAFT	WEAPONS RELATED	200 TO 1000KT
ALPACA	02/12/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE					

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY EVENT NAME

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
ALVA	08/19/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
RELEASE OF RADIOACTIVITY DETECTED OFF-SITE BY AIRCRAFT ONLY.					
ANACOSTIA	11/27/62	NTS	SHAFT	PLOWSHARE	LOW
DEVICE DEVELOPMENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
ANCHOVY	11/14/63	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
ANDROSCOGGIN	10/02/62	JOHNSTON ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
ANGUS	04/25/73	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
ANNIE	03/17/53	NTS	TOWER	WEAPONS RELATED	16KT
ANTLER	09/15/61	NTS	TUNNEL	WEAPONS RELATED	2.6KT
RELEASE OF RADIOACTIVITY DETECTED OFF SITE					
APACHE	07/08/56	ENEWETAK	BARGE	WEAPONS RELATED	
APPLE-1	03/29/55	NTS	TOWER	WEAPONS RELATED	14KT
APPLE-2	05/05/55	NTS	TOWER	WEAPONS RELATED	29KT
APSHAPA	06/06/63	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
ARABIS	03/06/73	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
ARGUS I	08/27/58	SOUTH ATLANTIC	ROCKET	WEAPONS EFFECTS	1-2KT
ABOUT 300 MILES ALTITUDE. SOUTH 38.5 DEG., WEST 11.5 DEG.					
ARGUS II	08/30/58	SOUTH ATLANTIC	ROCKET	WEAPONS EFFECTS	1-2KT
ABOUT 300 MILES ALTITUDE. SOUTH 49.5 DEG., WEST 8.2 DEG.					
ARGUS III	09/06/58	SOUTH ATLANTIC	ROCKET	WEAPONS EFFECTS	1-2KT
ABOUT 300 MILES ALTITUDE. SOUTH 48.5 DEG., WEST 9.7 DEG.					
ARIKAREE	05/13/62	NTS	SHAFT	WEAPONS RELATED	LOW
ARKANSAS	05/02/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	LOW MEGATON
OPERATION DOMINIC I					
ARMADILLO	02/09/62	NTS	SHAFT	WEAPONS RELATED	7.1KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
ARNICA	06/26/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
ARTESIA	12/16/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
ASIAGO	12/21/76	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
ASPEN	06/14/58	BIKINI	BARGE	WEAPONS RELATED	
ATRISCO	08/05/82	NTS	SHAFT	WEAPONS RELATED	20 TO 150KT
AUK	10/02/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
AZTEC	04/27/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
AZUL	12/14/79	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
DETONATION DESTROYED PENINSULA DEVICE THAT WAS DAMAGED DURING EMPLACEMENT ON 10/23/75. THE PENINSULA DEVICE WAS NOT TESTED.					
BACCARAT	01/24/79	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
BACKBEACH	04/11/78	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
BACKGAMMON	11/29/79	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
BACKSWING	05/14/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
BADGER	04/18/53	NTS	TOWER	WEAPONS RELATED	23KT
BAKER	07/24/46	BIKINI	UW	WEAPONS EFFECTS	23 KT
BAKER	01/28/51	NTS	AIRDROP	WEAPONS RELATED	8KT
BAKER	10/28/51	NTS	AIRDROP	WEAPONS RELATED	3.5KT
BAKER	04/15/52	NTS	AIRDROP	WEAPONS EFFECTS	1KT
BAKER-2	02/02/51	NTS	AIRDROP	WEAPONS RELATED	8KT
BANDICOOT	10/19/62	NTS	SHAFT	WEAPONS RELATED	LOW
RELEASE OF RADIOACTIVITY DETECTED OFF SITE					
BANEBERRY	12/18/70	NTS	SHAFT	WEAPONS RELATED	10 KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFFSITE					
BANON	08/26/76	NTS	SHAFT	JOINT US-UK	20 TO 150 KT
BARREL	10/16/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
BARSAC	03/20/69	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
BASEBALL	01/15/81	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
BEE	03/22/55	NTS	TOWER	WEAPONS RELATED	8KT
BEEBALM	05/01/70	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY EVENT NAME

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
MIZZEN	06/03/75	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
MOHAWK	07/02/56	ENEWETAK	TOWER	WEAPONS RELATED	
MOLBO	02/12/82	NTS	SHAFT	WEAPONS RELATED	20 TO 150KT
MONERO	05/19/72	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MONTEREY	07/29/82	NTS	SHAFT	WEAPONS RELATED	20 TO 150KT
MORA	09/29/58	NTS	BALLOON	WEAPONS RELATED	2KT
MORGAN	10/07/57	NTS	BALLOON	WEAPONS RELATED	8KT
MORRONES	05/21/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
MOTH	02/22/55	NTS	TOWER	WEAPONS RELATED	2KT
MUDPACK DOD EVENT	12/16/64	NTS	SHAFT	WEAPONS EFFECTS	2.7KT
MUENSTER	01/03/75	NTS	SHAFT	WEAPONS RELATED	200 TO 1000KT
MUSKEGON OPERATION DOMINIC I	05/11/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
MUSTANG	11/15/63	NTS	SHAFT	WEAPONS RELATED	LOW
NAMBE OPERATION DOMINIC I	05/27/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
NANCY	03/24/53	NTS	TOWER	WEAPONS RELATED	24KT
NASH MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE	01/19/67	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
NAVAJO	07/10/56	BIKINI	BARGE	WEAPONS RELATED	
NEBBIOLO	06/24/82	NTS	SHAFT	WEAPONS RELATED	20 TO 150KT
NECTAR	05/13/54	ENEWETAK	BARGE	WEAPONS RELATED	1.69MT
NEPTUNE SLIGHT VENTING. MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY	10/14/58	NTS	TUNNEL	SAFETY EXPER.	115 TONS
NESSEL	08/29/79	NTS	SHAFT	JOINT US-UK	20 TO 150 KT
NEW POINT DOD EVENT	12/13/66	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
NEWARK	09/29/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
NEWTON	09/16/57	NTS	BALLOON	WEAPONS RELATED	12KT
NIZA	07/10/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
NOGGIN	09/06/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
NOOR	04/10/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
NORRO	03/08/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
NUMBAT	12/12/62	NTS	SHAFT	WEAPONS RELATED	LOW
NUTMEG	05/21/58	BIKINI	BARGE	WEAPONS RELATED	
OAK	06/28/58	ENEWETAK	BARGE	WEAPONS RELATED	8.9 MT
OBAP	04/30/75	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
OBERON	10/22/58	NTS	TOWER	SAFETY EXPER.	ZERO
NO RADIOACTIVE RELEASE DETECTED					
OCONTO	01/23/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
OFFSHORE	09/08/79	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
OLIVE	07/22/58	ENEWETAK	BARGE	WEAPONS RELATED	
ORANGE	08/12/58	JOHNSTON ISL AREA	ROCKET	WEAPONS EFFECTS	MEGATON RANGE
OSAGE	06/16/56	ENEWETAK	AIRDROP	WEAPONS RELATED	
OSCURO	09/21/72	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
OTERO	09/12/58	NTS	SHAFT	SAFETY EXPER.	38 TONS
UNSTEMMED HOLE					
OTOWI	06/22/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
OWENS	07/25/57	NTS	BALLOON	WEAPONS RELATED	9.7KT
PACA	05/07/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
PACKARD	01/15/69	NTS	SHAFT	WEAPONS RELATED	7.4 KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
PACKRAT	06/06/62	NTS	SHAFT	WEAPONS RELATED	LOW
PAISANO	04/24/63	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
PALANQUIN	04/14/65	NTS	CRATER	PLOWSHARE	4.3KT
CRATERING EXPERIMENT RELEASE OF RADIOACTIVITY DETECTED OFF-SITE.					

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
PALIZA	10/01/81	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
PAMLICO OPERATION DOMINIC I	07/11/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	LOW MEGATON
PAMPAS RELEASE OF RADIOACTIVITY DETECTED OFF SITE	03/01/62	NTS	SHAFT	JOINT US-UK	LOW
PANIR	08/31/78	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
PAR ISOTOPE PRODUCTION-EXPLOSIVE DEVELOPMENT	10/09/64	NTS	SHAFT	PLOWSHARE	38KT
PARROT MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE	12/16/64	NTS	SHAFT	WEAPONS RELATED	1.3KT
PASCAL-A UNSTEMMED HOLE.	07/26/57	NTS	SHAFT	SAFETY EXPER.	SLIGHT
PASCAL-B UNSTEMMED HOLE. NO RADIOACTIVE RELEASE DETECTED	08/27/57	NTS	SHAFT	SAFETY EXPER.	
PASCAL-C UNSTEMMED HOLE MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY	12/06/57	NTS	SHAFT	SAFETY EXPER.	SLIGHT
PASSAIC	04/06/62	NTS	SHAFT	WEAPONS RELATED	LOW
PEBA	09/20/62	NTS	SHAFT	WEAPONS RELATED	LOW
PEDERNAL	09/29/71	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
PEKAN	08/12/63	NTS	SHAFT	WEAPONS RELATED	LOW
PEPATO	06/11/79	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
PERA	09/08/79	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
PERSIMMON	02/23/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
PETIT OPERATION DOMINIC I	06/19/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	LOW
PETREL MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY	06/11/65	NTS	SHAFT	WEAPONS RELATED	1.3KT
PICCALILLI	11/21/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
PIKE MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE	03/13/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
PILE DRIVER DOD EVENT MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY	06/02/66	NTS	TUNNEL	WEAPONS EFFECTS	62KT

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
PIN STRIPE	04/25/66	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT. MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE					
PINE	12/26/58	ENEWETAK	BARGE	WEAPONS RELATED	
PINEAU	07/16/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
PIPEFISH	04/29/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
PIPKIN	10/08/69	NTS	SHAFT	WEAPONS RELATED	200 TO 1000KT
PIRANHA	05/13/66	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
PISONIA	07/17/58	ENEWETAK	BARGE	WEAPONS RELATED	
PLAID II	02/03/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
PLATTE	04/14/62	NTS	TUNNEL	WEAPONS RELATED	1.85KT
RELEASE OF RADIOACTIVITY DETECTED OFF SITE					
PLATYPUS	02/24/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
PLEASANT	05/29/63	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
PLIERS	09/27/69	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
POD	10/29/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFFSITE					
POMMARD	03/14/68	NTS	SHAFT	WEAPONS RELATED	1.5KT
POOL	03/17/76	NTS	SHAFT	WEAPONS RELATED	200 TO 500KT
POPLAR	07/12/58	BIKINI	BARGE	WEAPONS RELATED	
PORTMANTEAU	08/30/74	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
PORTULACA	06/28/73	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
POST	04/09/55	NTS	TOWER	WEAPONS RELATED	2KT
PRISCILLA	06/24/57	NTS	BALLOON	WEAPONS RELATED	37KT
PROJECT 56 NO 1	11/01/55	NTS	SURFACE	SAFETY EXPER.	ZERO
PROJECT 56 NO 2	11/03/55	NTS	SURFACE	SAFETY EXPER.	ZERO
PU DISPERSAL.					

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY EVENT NAME

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
PROJECT 56 NO 3 PU DISPERSAL.	11/05/56	NTS	SURFACE	SAFETY EXPER.	NO YIELD
PROJECT 56 NO 4 PU DISPERSAL.	01/18/56	NTS	SURFACE	SAFETY EXPER.	VERY SLIGHT
PROJECT 57 NO 1 PU DISPERSAL.	04/24/57	BOMBING RANGE	SURFACE	SAFETY EXPER.	ZERO
PUCE	06/10/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
PURPLE	03/18/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
PURSE	05/07/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
PUYE	08/14/74	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
PYRAMID	04/16/80	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
QUARGEL	11/18/78	NTS	SHAFT	JOINT US-UK	20 TO 150 KT
QUAY	10/10/58	NTS	TOWER	WEAPONS RELATED	79 TONS
QUESO	08/11/82	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
QUESTA OPERATION DOMINIC I	05/04/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
QUINCE	08/06/58	ENEWETAK	SURFACE	WEAPONS RELATED	
QUINELLA	02/08/79	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
RACCOON	06/01/62	NTS	SHAFT	WEAPONS RELATED	LOW
RAINIER FIRST DETONATION CONTAINED UNDERGROUND. NO RADIOACTIVE RELEASE DETECTED	09/19/57	NTS	TUNNEL	WEAPONS RELATED	1.7KT
RARITAN	09/06/62	NTS	SHAFT	WEAPONS RELATED	LOW
RAY	04/11/53	NTS	TOWER	WEAPONS RELATED	0.2KT
REBLOCHON	02/23/78	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
RED HOT DOD EVENT. MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE	03/05/66	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
REDMUD	12/08/76	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
REDWOOD	06/27/58	BIKINI	BARGE	WEAPONS RELATED	
REX	02/24/66	NTS	SHAFT	WEAPONS RELATED	19KT

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
RICKEY	06/15/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
RINCONADA	06/15/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
RINGTAIL	12/17/61	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
RIO ARRIBA	10/18/58	NTS	TOWER	WEAPONS RELATED	90 TONS
RIO BLANCO	05/17/73	RIFLE	SHAFT	PLOWSHARE	THREE 33KT DEVICE
GAS STIMULATION EXPERIMENT JOINT GOVT-INDUSTRY					
RIOLA	09/25/80	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFF-SITE.					
RIVET III	03/02/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
ROANOKE	10/12/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
ROMEO	03/26/54	BIKINI	BARGE	WEAPONS RELATED	11MT
ROSE	06/02/58	ENEWETAK	BARGE	WEAPONS RELATED	
ROUSANNE	11/12/81	NTS	SHAFT	JOINT US-UK	20 TO 150 KT
ROVENA	08/10/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
RUDDER	12/20/76	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
RULISON	09/10/69	GRAND VALLEY	SHAFT	PLOWSHARE	40KT
JOINT GOVT-INDUSTRY GAS STIMULATION EXPERIMENT					
RUMMY	09/27/79	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
RUSHMORE	10/22/58	NTS	BALLOON	WEAPONS RELATED	100 TONS
RUTH	03/31/53	NTS	TOWER	WEAPONS RELATED	0.2KT
SACRAMENTO	06/30/62	NTS	SHAFT	WEAPONS RELATED	LOW
SALMON	10/22/64	HATTIESBURG	SHAFT	VELA UNIFORM	5.3KT
NUCLEAR TEST DETECTION RESEARCH EXPERIMENT					
SAN JUAN	10/20/58	NTS	SHAFT	SAFETY EXPER.	ZERO
UNSTEMMED HOLE					
NO RADIOACTIVE RELEASE DETECTED					
SANDREEF	11/09/77	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
SANFORD	10/26/58	NTS	BALLOON	WEAPONS RELATED	4.9KT

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EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
SANTA FE	10/30/58	NTS	BALLOON	WEAPONS RELATED	1.3KT
SANTEE	10/27/62	NTS	SHAFT	WEAPONS RELATED	LOW
SARDINE	12/04/63	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
SATSOP	09/15/63	NTS	SHAFT	WEAPONS RELATED	LOW
SATURN	08/10/57	NTS	TUNNEL	SAFETY EXPER.	ZERO
NO RADIOACTIVE RELEASE DETECTED					
SAXON	07/28/66	NTS	SHAFT	PLOWSHARE	LESS THAN 20KT
EXCAVATION DEVICE DEVELOPMENT					
SAZERAC	10/25/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
SCAEVOLA	07/14/58	ENEWETAK	BARGE	SAFETY EXPER.	LOW
SCANTLING	08/19/77	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
SCAUP	05/14/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
SCHOONER	12/09/68	NTS	CRATER	PLOWSHARE	30KT
RELEASE OF RADIOACTIVITY DETECTED OFF-SITE					
SCOTCH	05/23/67	NTS	SHAFT	WEAPONS RELATED	155KT
SCREAMER	09/01/65	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
SCROLL	04/23/68	NTS	SHAFT	VELA UNIFORM	LESS THAN 20KT
NUCLEAR TEST DETECTION EXPERIMENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
SCUTTLE	11/13/69	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFF-SITE.					
SEAMOUNT	11/17/77	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
SECO	02/25/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
SEDAN	07/06/62	NTS	CRATER	PLOWSHARE	104KT
EXCAVATION EXPERIMENT-CRATER 1296 FT.DIAM 320 FT.DEEP-THERMONUCLEAR DEV.					
RELEASE OF RADIOACTIVITY DETECTED OFF-SITE.					
SEMINOLE	06/06/56	ENEWETAK	SURFACE	WEAPONS RELATED	13.7 KT
SEPIA	11/12/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
SEQUOIA	07/01/58	ENEWETAK	BARGE	WEAPONS RELATED	
SERPA	12/17/80	NTS	SHAFT	JOINT US-UK	20 TO 150 KT

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
SEYVAL	11/12/82	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
SHAPER	03/23/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
SHASTA	08/18/57	NTS	TOWER	WEAPONS RELATED	17KT
SHEEPSHEAD	09/26/79	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
SHOAL	10/26/63	FALLON	SHAFT	VELA UNIFORM	12KT
NUCLEAR TEST DETECTION-RESEARCH EXPERIMENT NEAR FALLON NEVADA					
SHREW	09/16/61	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
SHUFFLE	04/18/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
SIMMS	11/05/66	NTS	SHAFT	PLOWSHARE	LESS THAN 20K*
EXCAVATION DEVICE DEVELOPMENT					
SIMON	04/25/53	NTS	TOWER	WEAPONS RELATED	43KT
SLED	08/29/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
SMALL BOY	07/14/62	NTS	TOWER	WEAPONS EFFECTS	LOW
SLIGHTLY ABOVE GROUND. DOMINIC II SERIES.					
RELEASE OF RADIOACTIVITY DETECTED OFF-SITE.					
SMOKY	08/31/57	NTS	TOWER	WEAPONS RELATED	44KT
SNUBBER	04/21/70	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE					
SOCOPRO	10/22/58	NTS	BALLOON	WEAPONS RELATED	6KT
SPIDER	08/14/69	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
ST. LAWRENCE	11/09/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
STACCATO	01/19/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
STANLEY	07/27/67	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
STANYAN	09/26/74	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
STARFISH PRIME	07/09/62	JOHNSTON ISL AREA	ROCKET	WEAPONS EFFECTS	1.4 MEGATONS
OPERATION DOMINIC I					
HIGH ALTITUDE-450 KM					
STARWORT	04/26/73	NTS	SHAFT	WEAPONS RELATED	90KT
STEPLING	12/03/66	HATTIESBURG	SHAFT	VELA UNIFORM	380 TONS
NUCLEAR TEST DETECTION EXPERIMENT					

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY EVENT NAME

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
STILLWATER	02/08/62	NTS	SHAFT	WEAPONS RELATED	3.07KT
STILT	12/15/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
STILTON	06/03/75	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
STINGER	03/22/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
STOAT	01/09/62	NTS	SHAFT	WEAPONS RELATED	5.1KT
	MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY				
STODDARD	09/17/68	NTS	SHAFT	PLOWSHARE	20 TO 200KT
	EXCAVATION DEVICE DEVELOPMENT				
STOKES	08/07/57	NTS	BALLOON	WEAPONS RELATED	19KT
STONES	05/22/63	NTS	SHAFT	WEAPONS RELATED	INTERMEDIATE
STRAIT	03/17/76	NTS	SHAFT	WEAPONS RELATED	200 TO 500KT
STRAKE	08/04/77	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
STURGEON	04/15/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
STUTZ	04/06/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
SUGAR	11/19/51	NTS	SURFACE	WEAPONS EFFECTS	1.2KT
SULKY	12/18/64	NTS	SHAFT	PLOWSHARE	0.092KT
	EXCAVATION TEST OF EXPLOSIVE BURIED AT GREATER DEPTH IN RELATION TO YIELD				
	PRODUCED MOUND OF BROKEN ROCK				
	RELEASE OF RADIOACTIVITY DETECTED OFF-SITE				
SUNSET	07/10/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
	OPERATION DOMINIC I				
SWANEE	05/14/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
	OPERATION DOMINIC I				
SWITCH	06/22/67	NTS	SHAFT	PLOWSHARE	LESS THAN 20KT
	EXCAVATION DEVICE DEVELOPMENT				
SWORDFISH	05/11/62	PACIFIC	UW	WEAPONS EFFECTS	LOW
	OPERATION DOMINIC I				
	NORTH 31 DEGREES 14 MIN. WEST 124 DEGREES 13 MIN.				
	ANTISUBMARINE ROCKET /ASROC/ SYSTEM PROOF TEST				
SYCAMORE	05/31/58	BIKINI	BARGE	WEAPONS RELATED	
TAFI	07/25/80	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
TAMALPAIS	10/08/58	NTS	TUNNEL	WEAPONS RELATED	72 TONS
	SLIGHT VENTING				
	MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY				

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
TAN	06/03/66	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
TANANA OPERATION DOMINIC I	05/25/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	LOW
TANYA	07/30/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
TAPESTRY MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY	05/12/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
TAPPER MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY	06/12/69	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
TARKO	02/28/80	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
TAUNTON	12/04/62	NTS	SHAFT	WEAPONS RELATED	LOW
TEAK	08/01/58	JOHNSTON ISL AREA	ROCKET	WEAPONS EFFECTS	MEGATON RANGE
TEE MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE	05/07/65	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
TEJON	05/17/67	NTS	SHAFT	WEAPONS RELATED	LOW
TEMPLAR EXCAVATION DEVICE DEVELOPMENT	03/24/66	NTS	SHAFT	PLOWSHARE	LESS THAN 20KT
TENAJA	04/17/62	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
TENDRAC	12/07/62	NTS	SHAFT	JOINT US-UK	LOW
TERRINE	12/18/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
TESLA	03/01/55	NTS	TOWER	WEAPONS RELATED	7KT
TEWA	07/20/56	BIKINI	BARGE	WEAPONS RELATED	5 MT
THISTLE	04/30/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
TIGHTROPE OPERATION DOMINIC I HIGH ALTITUDE - TENS OF KMS	11/04/62	JOHNSTON ISL AREA	ROCKET	WEAPONS EFFECTS	LOW
TIJERAS	10/14/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
TILCI	11/11/81	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
TINDERBOX	11/22/68	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
TINY TOT DOD EVENT MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY	06/17/65	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY EVENT NAME

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
TIOGA	10/18/62	NTS	SHAFT	WEAPONS RELATED	LOW
TITANIA	10/30/58	NTS	TOWER	SAFETY EXPER.	0.2 TONS
TOBACCO	05/30/58	ENEWETAK	BARGE	WEAPONS RELATED	
TOMATO	04/07/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
TOPGALLANT	02/28/75	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
TORNILLO	10/11/63	NTS	SHAFT	PLOWSHARE	LOW
DEVICE DEVELOPMENT					
TORRIDO	05/27/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
TOYAH	03/15/63	NTS	SHAFT	WEAPONS RELATED	LOW
TRANSOM	05/10/78	NTS	SHAFT	WEAPONS RELATED	ZERO
NO NUCLEAR YIELD					
DEVICE WAS DESTROYED BY HEARTS DETONATION ON 09/06/79.					
TRAVELLER	05/04/56	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
TREBBIANO	09/04/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
TRINITY	07/16/45	ALAMOGORDO	TOWER	WEAPONS RELATED	19KT
FIRST TEST OF A NUCLEAR WEAPON.					
TRUCKEE	06/09/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
TUB	06/06/68	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
TURF	04/24/64	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
TURK	03/07/55	NTS	TOWER	WEAPONS RELATED	43KT
TWEED	05/21/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
TYBO	05/14/75	NTS	SHAFT	WEAPONS RELATED	200 TO 1000KT
TYG	12/12/69	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
UMBER	06/29/67	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE					
UMBRELLA	06/08/58	ENEWETAK	UW	WEAPONS EFFECTS	
UNCLE	11/29/51	NTS	CRATER	WEAPONS EFFECTS	1.2KT
UNION	04/25/54	BIKINI	BARGE	WEAPONS RELATED	6.9MT

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
URANUS	03/14/59	NTS	TUNNEL	SAFETY EXPER.	LESS THAN ONE TON
NO RADIOACTIVE RELEASE DETECTED					
VALENCIA	09/26/58	NTS	SHAFT	SAFETY EXPER.	2 TONS
UNSTEMMED HOLE.					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
VENUS	02/22/59	NTS	TUNNEL	SAFETY EXPER.	LESS THAN ONE TON
NO RADIOACTIVE RELEASE DETECTED					
VERDELLO	07/31/80	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
VESTA	10/17/59	NTS	SURFACE	SAFETY EXPER.	24 TONS
FIRED IN SURFACE STRUCTURE.					
VIDE	04/30/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
VISE	01/30/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
VULCAN	06/25/66	NTS	SHAFT	PLOWSHARE	25KT
DEVICE DEVELOPMENT. HEAVY ELEMENT PRODUCTION.					
WAGTAIL	03/03/65	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
WAHOO	05/16/59	ENEWETAK	UW	WEAPONS EFFECTS	
WALNUT	06/14/58	ENEWETAK	BARGE	WEAPONS RELATED	
WARD	02/08/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
WASHER	08/10/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
WASP	02/18/55	NTS	AIRDROP	WEAPONS EFFECTS	1KT
WASP PRIME	03/29/55	NTS	AIRDROP	WEAPONS RELATED	3KT
WHEELER	09/06/57	NTS	BALLOON	WEAPONS RELATED	197 TONS
WHITE	05/25/62	NTS	SHAFT	WEAPONS RELATED	LOW
WHITNEY	09/23/57	NTS	TOWER	WEAPONS RELATED	19KT
WICHITA	07/27/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
WIGWAM	05/14/55	PACIFIC	UW	WEAPONS EFFECTS	30KT
NORTH 29 DEGREES WEST 126 DEGREES.					
WILSON	06/18/57	NTS	BALLOON	WEAPONS RELATED	10KT
WINESKIN	01/15/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
WISHBONE	02/18/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY EVENT NAME

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
WOLVERINE	10/12/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
WOOL	01/14/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
WORLD WAR II	08/06/45	JAPAN	AIRDROP	COMBAT	13 KT
FIRST COMBAT USE-HIROSHIMA					
WORLD WAR II	08/09/45	JAPAN	AIRDROP	COMBAT	23 KT
SECOND COMBAT USE-NAGASAKI					
WRANGELL	10/22/58	NTS	BALLOON	WEAPONS RELATED	115 TONS
X-RAY	04/14/48	ENEWETAK	TOWER	WEAPONS RELATED	37KT
YANKEE	05/04/54	BIKINI	BARGE	WEAPONS RELATED	13.5MT
YANNIGAN	12/26/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
YARD	09/07/67	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
YELLOWWOOD	05/26/58	ENEWETAK	BARGE	WEAPONS RELATED	
YESO	06/10/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	LOW MEGATON
OPERATION DOMINIC I					
YOKE	04/30/48	ENEWETAK	TOWER	WEAPONS RELATED	49KT
YORK	08/24/62	NTS	SHAFT	WEAPONS RELATED	LOW
YUBA	06/05/63	NTS	TUNNEL	WEAPONS RELATED	LOW
POST-TEST CONTROLLED RELEASE OF RADIOACTIVITY DETECTED OFF-SITE.					
YUCCA	04/28/58	PACIFIC	BALLOON	WEAPONS EFFECTS	
NORTH 12 DEG. 37 MIN. EAST 163 DEG. 01 MIN.					
YUKON	05/08/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
YUMA	05/27/56	ENEWETAK	TOWER	WEAPONS RELATED	
ZAZA	09/27/67	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
ZEBRA	05/14/48	ENEWETAK	TOWER	WEAPONS RELATED	18KT
ZINNIA	05/17/72	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
ZUCCHINI	05/15/55	NTS	TOWER	WEAPONS RELATED	29KT
ZUNI	05/27/56	BIKINI	SURFACE	WEAPONS RELATED	3.5 MT

EVENT NAME	DATE (GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
BENHAM	12/19/68	NTS	SHAFT	WEAPONS RELATED	1.15 MEGATON
BERNAL	11/28/73	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
BERNALILLO	09/17/58	NTS	SHAFT	SAFETY EXPER.	15 TONS
UNSTEMMED HOLE MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
BIGHORN	06/27/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	MEGATON RANGE
OPERATION DOMINIC I					
BILBY	09/13/63	NTS	SHAFT	WEAPONS RELATED	249KT
FIRST UNDERGROUND TEST REPORTED FELT IN LAS VEGAS					
BILLET	07/27/76	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
BLACK	04/27/62	NTS	SHAFT	WEAPONS RELATED	LOW
BLACKFOOT	06/11/56	ENEWETAK	TOWER	WEAPONS RELATED	
BLANCA	10/30/58	NTS	TUNNEL	WEAPONS RELATED	22KT
SLIGHT VENTING					
BLENTON	04/30/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
BLUEGILL 3PRIME	10/26/62	JOHNSTON ISL AREA	ROCKET	WEAPONS EFFECTS	SUBMEGATON
OPERATION DOMINIC I HIGH ALTITUDE - TENS OF KMS					
BLUESTONE	06/30/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	LOW MEGATON
OPERATION DOMINIC I					
BOBAC	08/24/62	NTS	SHAFT	WEAPONS RELATED	LOW
BOBSTAY	10/26/77	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
BOLTZMANN	05/24/57	NTS	TOWER	WEAPONS RELATED	12KT
BONAPPA	09/25/80	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
BOOMER	10/01/61	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
BORDEAUX	08/18/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
BORREGO	09/29/82	NTS	SHAFT	WEAPONS RELATED	LESS THAN 150KT
BOURBON	01/20/67	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
BOUSCHET	05/07/82	NTS	SHAFT	WEAPONS RELATED	20 TO 150KT
BOXCAR	04/26/68	NTS	SHAFT	WEAPONS RELATED	1.3 MEGATONS

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY EVENT NAME

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
BRAVO	02/28/54	BIKINI	SURFACE	WEAPONS RELATED	15MT
EXPERIMENTAL THERMONUCLEAR DEVICE					
BRAZOS	03/08/62	NTS	SHAFT	WEAPONS RELATED	8.4KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
BRONZE	07/23/65	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
BUFF	12/16/65	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
BUGGY	03/12/68	NTS	CRATER	PLOWSHARE	5.4KT
ROW CHARGE EXPERIMENT - FIVE SIMULTANEOUS DETONATIONS					
RELEASE OF RADIOACTIVITY DETECTED OFF-SITE					
BULKHEAD	04/27/77	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
BUMPING	10/06/62	JOHNSTON ISL AREA	AIRDROP	WEAPONS RELATED	LOW
OPERATION DOMINIC I					
BURZET	08/03/79	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
BUTEO	05/12/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
BUTTERNUT	05/11/58	ENEWETAK	BARGE	WEAPONS RELATED	
BYE	07/16/64	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CABOC	12/16/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
CABRILLO	03/07/75	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CABRIOLET	01/26/68	NTS	CRATER	PLOWSHARE	2.3KT
RELEASE OF RADIOACTIVITY DETECTED OFF-SITE					
CACTUS	05/05/58	ENEWETAK	SURFACE	WEAPONS RELATED	18 KT
CALABASH	10/29/69	NTS	SHAFT	WEAPONS RELATED	110KT
CALAMITY	10/27/62	JOHNSTON ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
CAMBRIC	05/14/65	NTS	SHAFT	WEAPONS RELATED	.75KT
CAMEMBERT	06/26/75	NTS	SHAFT	WEAPONS RELATED	200 TO 1000KT
CAMPHOR	06/29/71	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20 KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
CAMPOS	02/13/78	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
CAN	04/21/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CANFIELD	05/02/80	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
CANNIKIN	11/06/71	AMCHITKA	SHAFT	WEAPONS RELATED	LESS THAN 5 MEGAT
TEST OF WARHEAD FOR SPARTAN MISSILE					
CANVASBACK	08/22/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
CARMEL	02/21/63	NTS	SHAFT	WEAPONS RELATED	LOW
CARPETBAG	12/17/70	NTS	SHAFT	WEAPONS RELATED	220KT
CASHMERE	02/04/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
CASSELMAN	02/08/63	NTS	SHAFT	WEAPONS RELATED	LOW
CATHAY	10/08/71	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
CATRON	10/24/58	NTS	TOWER	SAFETY EXPER.	21 TONS
CEDAR	07/02/58	BIKINI	BARGE	WEAPONS RELATED	
CENTAUR	08/27/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
CERES	10/26/58	NTS	TOWER	SAFETY EXPER.	0.7 TONS
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
CERISE	11/18/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
CERNADA	09/24/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
CERRO	09/02/82	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
CHAENACTIS	12/14/71	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CHAMA	10/18/62	JOHNSTON ISL AREA	AIRDROP	WEAPONS RELATED	LOW MEGATON
OPERATION DOMINIC I					
CHARCOAL	09/10/65	NTS	SHAFT	JOINT US-UK	20 TO 200KT
CHARLESTON	09/28/57	NTS	BALLOON	WEAPONS RELATED	12KT
CHAPLIE	10/30/51	NTS	AIRDROP	WEAPONS RELATED	14KT
CHARLIE	04/22/52	NTS	AIRDROP	WEAPONS RELATED	31KT
CHARTREUSE	05/06/66	NTS	SHAFT	WEAPONS RELATED	73KT
CHATEAUGAY	06/28/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CHAVEZ	10/27/58	NTS	TOWER	SAFETY EXPER.	0.6 TONS
CHECKMATE	10/20/62	JOHNSTON ISL AREA	ROCKET	WEAPONS EFFECTS	LOW
OPERATION DOMINIC I					
HIGH ALTITUDE - TENS OF KMS					

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY EVENT NAME

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
CHENA	10/13/61	NTS	TUNNEL	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
CHEROKEE	05/20/56	BIKINI	AIRDROP	WEAPONS RELATED	SEVERAL MT
FIRST AIR DROP BY U.S. OF A THERMONUCLEAR WEAPON					
CHESHIRE	02/14/76	NTS	SHAFT	WEAPONS RELATED	200 TO 500KT
CHESS	06/20/79	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
CHETCO	05/19/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
CHEVRE	11/23/76	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
CHIBERTA	12/20/75	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CHINCHILLA	02/19/62	NTS	SHAFT	WEAPONS RELATED	1.9KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
CHINCHILLA II	03/31/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
CHIPMUNK	02/15/63	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
CHOCOLATE	04/21/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
CIMARRON	02/23/62	NTS	SHAFT	WEAPONS RELATED	11.9CKT
CLAIRETTE	02/05/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
CLARKSMOBILE	05/17/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CLEAN SLATE I	05/25/63	BOMBING RANGE	SURFACE	STORAGE-TRANSP	ZERO
RADIOACTIVITY DETECTED OFF-SITE					
PU DISPERSAL					
CLEAN SLATE II	05/31/63	BOMBING RANGE	SURFACE	STORAGE-TRANSP	ZERO
PU DISPERSAL.					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
CLEAN SLATE III	06/09/63	BOMBING RANGE	SURFACE	STORAGE-TRANSP	ZERO
RADIOACTIVITY DETECTED OFF-SITE					
PU DISPERSAL.					
CLEARWATER	10/16/63	NTS	SHAFT	WEAPONS RELATED	INTERMEDIATE
CLIMAX	06/04/53	NTS	AIRDROP	WEAPONS RELATED	61KT
CLYMER	03/12/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
COBBLER	11/08/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
CODSAW	02/19/62	NTS	SHAFT	WEAPONS RELATED	LOW
COFFER	03/21/69	NTS	SHAFT	WEAPONS RELATED	LESS THAN 100KT
COLBY	03/14/76	NTS	SHAFT	WEAPONS RELATED	500 TO 1000KT
COLFAX	10/05/58	NTS	SHAFT	SAFETY EXPER.	5.5 TONS
UNSTEMMED HOLE. MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
COLWICK	04/26/80	NTS	SHAFT	JOINT US-UK	20 TO 150 KT
COMMODORE	05/20/67	NTS	SHAFT	WEAPONS RELATED	250 KT
CORDUROY	12/03/65	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CORMORANT	07/17/64	NTS	SHAFT	JOINT US-UK	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
CORNICE	05/15/73	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
COULOMB-A	07/01/57	NTS	SURFACE	SAFETY EXPER.	ZERO
NO RADIOACTIVE RELEASE DETECTED					
COULOMB-B	09/06/57	NTS	SURFACE	SAFETY EXPER.	0.3KT
COULOMB-C	12/09/57	NTS	SURFACE	SAFETY EXPER.	0.5KT
COULOMMIERS	09/27/77	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
COYPU	04/10/63	NTS	SHAFT	WEAPONS RELATED	LOW
CREAM	12/16/70	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
CREPE	12/05/64	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CREW	11/04/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CREWLINE	05/25/77	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
CRUET	10/29/69	NTS	SHAFT	WEAPONS RELATED	11 KT
CUMARIN	02/25/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CUMBERLAND	04/11/63	NTS	SHAFT	WEAPONS RELATED	LOW
CUP	03/26/65	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
CYATHUS	03/06/70	NTS	SHAFT	WEAPONS RELATED	8.7 KT
CYCLAMEN	05/05/66	NTS	SHAFT	WEAPONS RELATED	12KT
INCLUDED HEAVY ELEMENT EXPERIMENT					

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY EVENT NAME

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
CYPRESS	02/12/69	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DAIQUIRI	09/23/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
DAKOTA	06/25/56	BIKINI	BARGE	WEAPONS RELATED	
DAMAN I	06/21/62	NTS	SHAFT	WEAPONS RELATED	LOW
DANNY BOY	03/05/62	NTS	CRATER	WEAPONS EFFECTS	0.43KT
DOD EVENT CRATER DIAMETER 265 FT. DEPTH 84 FT. IN BASALT RELEASE OF RADIOACTIVITY DETECTED OFF-SITE.					
DAUPHIN	11/14/80	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
DE BACA	10/26/58	NTS	BALLOON	WEAPONS RELATED	2.2KT
DEAD	04/21/62	NTS	SHAFT	WEAPONS RELATED	LOW
DELPHINIUM	09/26/72	NTS	SHAFT	WEAPONS RELATED	15KT
DERRINGER	09/12/66	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE					
DES MOINES	06/13/62	NTS	TUNNEL	WEAPONS RELATED	LOW
RELEASE OF RADIOACTIVITY DETECTED OFF SITE					
DIABLO	07/15/57	NTS	TOWER	WEAPONS RELATED	17KT
DIABLO HAWK	09/13/78	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20 KT
DOD EVENT					
DIAGONAL LINE	11/24/71	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT MINOR LEVELS OF RADIOACTIVITY DETECTED OFF-SITE BY AIRCRAFT ONLY.					
DIAMOND ACE	09/23/82	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT SIMULTANEOUS WITH HURON LANDING					
DIAMOND DUST	05/12/70	NTS	TUNNEL	VELA UNIFORM	LESS THAN 2.KT
NUCLEAR TEST DETECTION EXPERIMENT MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
DIAMOND MINE	07/01/71	NTS	TUNNEL	VELA UNIFORM	LESS THAN 20KT
NUCLEAR TEST DETECTION EXPERIMENT					
DIAMOND SCULLS	07/20/72	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
DIANA MIST	02/11/70	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
DIANA MOON	08/27/68	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
DIDO QUEEN	06/05/73	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
DIESEL TRAIN	12/05/69	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
DILUTED WATERS	06/16/65	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT	MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE				
DINING CAR	04/05/75	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
DISCUS THROWER	05/27/66	NTS	SHAFT	WEAPONS EFFECTS	22KT
DOD EVENT					
DIXIE	04/06/53	NTS	AIRDROP	WEAPONS RELATED	11KT
DOG	04/07/51	ENEWETAK	TOWER	WEAPONS RELATED	
DOG	11/01/51	NTS	AIRDROP	WEAPONS RELATED	21KT
DOG	05/01/52	NTS	AIRDROP	WEAPONS RELATED	19KT
DOGWOOD	07/05/58	ENEWETAK	BARGE	WEAPONS RELATED	
DONA ANA	10/16/58	NTS	BALLOON	WEAPONS RELATED	37 TONS
DOOR MIST	08/31/67	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT.	MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE				
DOPPLER	08/23/57	NTS	BALLOON	WEAPONS RELATED	11KT
DORMOUSE	01/30/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
DORMOUSE II	04/05/62	NTS	SHAFT	WEAPONS RELATED	10.6KT
DORSAL FIN	02/29/68	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
DOUBLE PLAY	06/15/66	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT.	MINOR LEVELS OF RADIOACTIVITY DETECTED OFF-SITE				
DOUBLE TRACKS	05/15/63	BOMBING RANGE	SURFACE	STORAGE-TRANSP	ZERO
RADIOACTIVITY DETECTED OFF-SITE					
PU DISPERSAL					
DOVEKIE	01/21/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY EVENT NAME

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
DRAUGHTS	09/27/78	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
DRILL	12/05/64	NTS	SHAFT	WEAPONS RELATED	3.4 KT
RELEASE OF RADIOACTIVITY DETECTED OFF-SITE.					
DUB	06/30/64	NTS	SHAFT	PLOWSHARE	LESS THAN 20KT
DEVICE DEVELOPMENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
DULCE	06/17/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
DIMONT	05/19/66	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
DURYEA	04/14/66	NTS	SHAFT	WEAPONS RELATED	70KT
DUTCHESS	10/24/80	NTS	SHAFT	JOINT US-UK	LESS THAN 20 KT
EAGLE	12/12/63	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE					
EASY	02/01/51	NTS	AIRDROP	WEAPONS RELATED	1KT
EASY	04/20/51	ENEWETAK	TOWER	WEAPONS RELATED	47KT
EASY	11/05/51	NTS	AIRDROP	WEAPONS RELATED	31KT
EASY	05/07/52	NTS	TOWER	WEAPONS RELATED	12KT
EBBTIDE	09/15/77	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
EDAM	04/24/75	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
EDDY	09/19/58	NTS	BALLOON	WEAPONS RELATED	83 TONS
EEL	05/19/62	NTS	SHAFT	WEAPONS RELATED	LOW
RELEASE OF RADIOACTIVITY DETECTED OFF SITE					
EFFENDI	04/27/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
ELDER	06/27/58	ENEWETAK	BARGE	WEAPONS RELATED	
ELKHART	09/17/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
EMBUDO	06/16/71	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
EMERSON	12/16/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
EMMENTHAL	11/02/78	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
ENCINO	05/12/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					

EVENT NAME	DATE (GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
ENCORE	05/08/53	NTS	AIRDROP	WEAPONS EFFECTS	27KT
ERIE	05/30/56	ENEWETAK	TOWER	WEAPONS RELATED	
ERMINE	03/06/62	NTS	SHAFT	WEAPONS RELATED	LOW
ESCAROSA	07/10/74	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
ESROM	02/04/76	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
ESS	03/23/55	NTS	CRATER	WEAPONS EFFECTS	1KT
ESTUARY	03/09/76	NTS	SHAFT	WEAPONS RELATED	200 TO 500KT
EVANS	10/29/54	NTS	TUNNEL	WEAPONS RELATED	55 TONS
VENTING MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
FADE	06/25/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
FAJY	06/28/79	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
FALLON	05/23/74	NTS	SHAFT	JOINT US-UK	20 TO 200KT
FARALLONES	12/14/77	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
FARM	12/16/78	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
FAULTLESS	01/19/68	CENTRAL NEVADA	SHAFT	WEAPONS RELATED	200 TO 1000KT
SEISMIC CALIBRATION.					
FAWN	04/07/67	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
FEATHER	12/22/61	NTS	TUNNEL	WEAPONS RELATED	LOW
RELEASE OF RADIOACTIVITY DETECTED OFF SITE					
FERRET	02/08/63	NTS	SHAFT	WEAPONS RELATED	LOW
FERRET PRIME	04/05/63	NTS	SHAFT	WEAPONS RELATED	LOW
FIG	08/18/58	ENEWETAK	SURFACE	WEAPONS RELATED	
FINEDOT	03/07/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
FIR	05/11/58	BIKINI	BARGE	WEAPONS RELATED	
FISHER	12/03/61	NTS	SHAFT	WEAPONS RELATED	13.4KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
FIZEAU	09/14/57	NTS	TOWER	WEAPONS RELATED	11KT

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY EVENT NAME

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
FLASK	05/26/70	NTS	SHAFT	PLOWSHARE	105KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
FLATHEAD	06/11/56	BIKINI	BARGE	WEAPONS RELATED	
FLAX	12/21/72	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
FLORA	05/22/80	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
FOB	01/23/73	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
FONDUTTA	04/11/78	NTS	SHAFT	JOINT US-UK	20 TO 150 KT
FONTINA	02/12/76	NTS	SHAFT	WEAPONS RELATED	200 TO 1000KT
FORF	01/16/64	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
FOREST	10/31/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
FOX	02/06/51	NTS	AIRDROP	WEAPONS RELATED	22KT
FOX	05/25/52	NTS	TOWER	WEAPONS RELATED	11KT
FRANKLIN	06/02/57	NTS	TOWER	WEAPONS RELATED	140TONS
FRANKLIN PRIME	08/30/57	NTS	BALLOON	WEAPONS RELATED	4.7KT
FRIGATE BIRD	05/06/62	PACIFIC	ROCKET	WEAPONS RELATED	
OPERATION DOMINIC I					
NORTH 4 DEGREES 50 MIN. WEST 149 DEG. 25 MIN.					
WARHEAD IN MISSILE LAUNCHED FROM POLARIS SUBMARINE					
FRISCO	09/23/82	NTS	SHAFT	WEAPONS RELATED	20 TO 150KT
GALILEO	09/02/57	NTS	TOWER	WEAPONS RELATED	11KT
GANYMEDE	10/30/59	NTS	SURFACE	SAFETY EXPER.	ZERO
CONTAINED IN SURFACE STRUCTURE.					
NO RADIOACTIVE RELEASE DETECTED					
GASBUGGY	12/10/67	FARMINGTON	SHAFT	PLOWSHARE	29KT
JOINT GOVT-INDUSTRY GAS STIMULATION EXPERIMENT					
GEORGE	05/08/51	ENEWETAK	TOWER	WEAPONS RELATED	
GEORGE	06/01/52	NTS	TOWER	WEAPONS RELATED	15KT
GERBIL	03/29/63	NTS	SHAFT	WEAPONS RELATED	LOW
GIBNE	04/25/82	NTS	SHAFT	JOINT US-UK	20 TO 150KT
GNOME	12/10/61	CARLSBAD	SHAFT	PLOWSHARE	3 KT
MULTIPLE-PURPOSE EXPERIMENT IN SALT-FORMED CAVITY 160-170 FT.DIAMETER					
60-80 FT.HIGH. RELEASE OF RADIOACTIVITY DETECTED OFF-SITE.					

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
GABBLE	05/25/53	NTS	AIRBRST	WEAPONS RELATED	15KT
FIRED FROM 280MM GUN					
GRAPE A	12/17/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
GRAPE B	02/04/70	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
GREELEY	12/20/66	NTS	SHAFT	WEAPONS RELATED	870KT
GREYS	11/22/63	NTS	SHAFT	WEAPONS RELATED	INTERMEDIATE
GRUNION	10/11/63	NTS	SHAFT	WEAPONS RELATED	LOW
GUANAY	09/04/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
GUM DROP	04/21/65	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
GUNDI	11/15/62	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
GUNDI PRIME	05/09/63	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
HA	04/06/55	NTS	AIRDROP	WEAPONS EFFECTS	3KT
HADDOCK	08/28/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
HALFBEAK	06/30/66	NTS	SHAFT	WEAPONS RELATED	365KT
HAMILTON	10/15/58	NTS	TOWER	WEAPONS RELATED	1.2 TONS
HANDCAR	11/05/64	NTS	SHAFT	PLOWSHARE	12KT
EFFECTS OF CONTAINED EXPLOSION IN CARBONATE ROCK					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
HANDLEY	03/26/70	NTS	SHAFT	WEAPONS RELATED	MORE THAN 1 MEGAT
HARD HAT	02/15/62	NTS	SHAFT	WEAPONS EFFECTS	5.7KT
DOD EVENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
HARESELL	06/24/71	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
HARKEE	05/17/63	NTS	SHAFT	WEAPONS RELATED	LOW
HARLEM	06/12/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
HARRY	05/19/53	NTS	TOWER	WEAPONS RELATED	32KT
HARTER	06/06/81	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY EVENT NAME

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
HATCHIE	12/08/63	NTS	SHAFT	WEAPONS RELATED	LOW
HAVARTI	09/05/91	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
HAYMAKER	06/27/62	NTS	SHAFT	WEAPONS RELATED	67KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
HEARTS	09/06/79	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
DETONATION DESTROYED TRANSOM DEVICE THAT DID NOT DETONATE ON 05/10/78.					
HICKORY	06/29/58	BIKINI	BARGE	WEAPONS RELATED	
HIDALGO	10/05/58	NTS	BALLOON	SAFETY EXPER.	77 TONS
HOD	05/31/70	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
HOGNOSE	03/15/62	NTS	SHAFT	WEAPONS RELATED	LOW
HOLLY	05/20/58	ENEWETAK	BARGE	WEAPONS RELATED	
HOOD	07/05/57	NTS	BALLOON	WEAPONS RELATED	74KT
HOOK	04/14/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
HOOSIC	03/28/62	NTS	SHAFT	WEAPONS RELATED	3.4?KT
HORNET	03/12/55	NTS	TOWER	WEAPONS RELATED	4KT
HOSTA	02/12/82	NTS	SHAFT	WEAPONS RELATED	20 TO 150KT
HOUSATONIC	10/30/62	JOHNSTON ISL AREA	AIRDROP	WEAPONS RELATED	MEGATON RANGE
OPERATION DOMINIC I					
HOW	06/05/52	NTS	TOWER	WEAPONS RELATED	14KT
HUDSON	04/12/62	NTS	SHAFT	WEAPONS RELATED	LOW
HUDSON MOON	05/26/70	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
HUDSON SEAL	09/24/68	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
HUMBOLDT	10/29/54	NTS	TOWER	WEAPONS RELATED	7.9 TONS
HUPMOBILE	01/18/68	NTS	SHAFT	WEAPONS EFFECTS	10.3 KT
MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE					
HURON	07/21/56	ENEWETAK	BARGE	WEAPONS RELATED	

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
HURON KING DOD EVENT	06/24/80	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20 KT
HURON LANDING DOD EVENT SIMULTANEOUS WITH DIAMOND ACE	09/23/82	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
HUSKY ACE DOD EVENT	10/12/73	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
HUSKY PUP DOD EVENT	10/24/75	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
HUTCH	07/16/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200 KT
HUTTA	06/06/63	NTS	SHAFT	WEAPONS RELATED	LOW
HYBLA FAIR DOD EVENT	10/28/74	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
HYBLA GOLD DOD EVENT	11/01/77	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20 KT
HYRAX	09/14/62	NTS	SHAFT	WEAPONS RELATED	LOW
ICEBERG	03/23/78	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
ILDRIM	07/16/69	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
INCA	06/21/56	ENEWETAK	TOWER	WEAPONS RELATED	
INLET	11/20/75	NTS	SHAFT	WEAPONS RELATED	200 TO 1000KT
ISLAY	08/27/81	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
ITEM	05/24/51	ENEWETAK	TOWER	WEAPONS RELATED	
JAL	03/19/70	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
JEROA	03/01/63	NTS	SHAFT	WEAPONS RELATED	LOW
JOHN AIR-TO-AIR MISSILE.	07/19/57	NTS	ROCKET	WEAPONS EFFECTS	ABOUT 2KT
JOHNIE BOY SLIGHTLY BELOW GROUND. DOMINIC II SERIES. RELEASE OF RADIOACTIVITY DETECTED OFF-SITE.	07/11/62	NTS	CRATER	WEAPONS EFFECTS	0.5 KT
JORNADA	01/28/82	NTS	SHAFT	WEAPONS RELATED	20 TO 150KT
JORUM	09/16/69	NTS	SHAFT	WEAPONS RELATED	LESS THAN 1 MEGAT
JUNIPER	07/22/58	BIKINI	BARGE	WEAPONS RELATED	

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY EVENT NAME

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
JUNO	10/24/58	NTS	SURFACE	SAFETY EXPER.	1.7 TONS
FIRED IN SURFACE STRUCTURE. MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
KANKAKEE	06/15/66	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
KASH	06/12/80	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
KASSERI	10/28/75	NTS	SHAFT	WEAPONS RELATED	200 TO 1000KT
KAWFAH	02/21/63	NTS	SHAFT	PLOWSHARE	LOW
DEVICE DEVELOPMENT					
KEELSON	02/04/76	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
KENNEBEC	06/25/63	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
KEPLER	07/24/57	NTS	TOWER	WEAPONS RELATED	10KT
KESTI	06/16/82	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
KESTREL	04/05/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
KICKAPOO	06/13/56	ENEWETAK	TOWER	WEAPONS RELATED	
KING	11/15/52	ENEWETAK	AIRDROP	WEAPONS RELATED	500 KT
KINGFISH	11/01/62	JOHNSTON ISL AREA	ROCKET	WEAPONS EFFECTS	SUBMEGATON
OPERATION DOMINIC I					
HIGH ALTITUDE - TENS OF KMS					
KLICKITAT	02/20/64	NTS	SHAFT	PLOWSHARE	20 TO 200KT
DEVICE DEVELOPMENT					
KLOSTER	02/15/79	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
KNICKERBOCKER	05/26/67	NTS	SHAFT	WEAPONS RELATED	76KT
KNIFE A	09/12/68	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
KNIFE B	11/15/68	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
KNIFE C	10/03/68	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
KNOX	02/21/68	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
KOA	05/12/58	ENEWETAK	SURFACE	WEAPONS RELATED	1.37 MT
KOHOCTON	08/23/63	NTS	SHAFT	WEAPONS RELATED	LOW
KOON	04/06/54	BIKINI	SURFACE	WEAPONS RELATED	110 KT

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
KOOTANAI	04/24/63	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
KRYOPOST	05/06/82	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
LARIS	02/05/70	NTS	SHAFT	WEAPONS RELATED	25 KT
LACROSSE	05/04/56	ENEWETAK	SURFACE	WEAPONS RELATED	40 KT
LAGUNA	06/23/71	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
LAMPBLACK	01/19/66	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
LANPHER	10/18/67	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
LAPLACE	09/08/57	NTS	BALLOON	WEAPONS RELATED	1KT
LASSEN	06/05/57	NTS	BALLOON	WEAPONS RELATED	0.5 TONS
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
LATIR	02/27/74	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
LEA	10/13/58	NTS	BALLOON	WEAPONS RELATED	1.4KT
LEYDEN	11/26/75	NTS	SHAFT	WEAPONS RELATED	LESS THAN 2.KT
LIME	04/01/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
LINDEN	06/19/58	ENEWETAK	BARGE	WEAPONS RELATED	
LIPTAUER	04/03/80	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
LITTLE FELLER I	07/17/62	NTS	SURFACE	WEAPONS EFFECTS	LOW
SLIGHTLY ABOVE GROUND. DOMINIC II SERIES.					
RELEASE OF RADIOACTIVITY DETECTED OFF-SITE.					
LITTLE FELLERII	07/07/62	NTS	SURFACE	WEAPONS EFFECTS	LOW
SLIGHTLY ABOVE GROUND. DOMINIC II SERIES.					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
LOGAN	10/16/58	NTS	TUNNEL	WEAPONS RELATED	5KT
NO RADIOACTIVE RELEASE DETECTED					
LONG SHOT	10/29/65	AMCHITKA	SHAFT	VELA UNIFORM	ABOUT 80KT
DOD EVENT. NUCLEAR TEST DETECTION EXPERIMENT					
LONGCHAMPS	04/19/72	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
LOVAGE	12/17/69	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
LOWBALL	07/12/78	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
LUNA	09/21/58	NTS	SHAFT	SAFETY EXPER.	1.5 TONS
UNSTEMMED HOLE.					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY EVENT NAME

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
MAD	12/13/61	NTS	SHAFT	WEAPONS RELATED	0.5CKT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
MADISON	12/12/62	NTS	TUNNEL	WEAPONS RELATED	LOW
MAGNOLIA	05/26/58	ENEWETAK	BARGE	WEAPONS RELATED	
MANATEE	12/14/62	NTS	SHAFT	WEAPONS RELATED	LOW
MANTECA	12/13/82	NTS	SHAFT	WEAPONS RELATED	20 TO 150KT
MANZANAS	05/21/70	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
MAPLE	06/10/58	BIKINI	BARGE	WEAPONS RELATED	
MARS	09/28/58	NTS	TUNNEL	SAFETY EXPER.	13 TONS
SLIGHT VENTING.					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
MARSH	09/06/75	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MARSHMALLOW	06/28/62	NTS	TUNNEL	WEAPONS EFFECTS	LOW
DOD EVENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
MARSILLY	04/05/77	NTS	SHAFT	WEAPONS RELATED	20 TO 150 KT
MARVEL	09/21/67	NTS	SHAFT	PLOWSHARE	LESS THAN 20KT
EMPLACEMENT TECHNIQUE EXPERIMENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
MAST	06/19/75	NTS	SHAFT	WEAPONS RELATED	200 TO 1000KT
MATACO	06/14/63	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
MAUVE	08/06/65	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MAXWELL	01/13/66	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MAZAMA	10/29/58	NTS	TOWER	WEAPONS RELATED	ZERO
NO RADIOACTIVE RELEASE DETECTED					
MEMORY	03/14/79	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20 KT
MERCURY	09/23/58	NTS	TUNNEL	SAFETY EXPER.	SLIGHT
NO RADIOACTIVE RELEASE DETECTED					
MERLIN	02/16/65	NTS	SHAFT	WEAPONS RELATED	10.1KT
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
MERRIMAC	07/13/62	NTS	SHAFT	WEAPONS RELATED	INTERMEDIATE
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					

ANNOUNCED UNITED STATES NUCLEAR TESTS - BY EVENT NAME

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
MESILLA	05/09/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
OPERATION DOMINIC I					
MET	04/15/55	NTS	TOWER	WEAPONS EFFECTS	22KT
MICKEY	05/10/67	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
MIDI MIST	06/26/67	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT. RELEASE OF RADIOACTIVITY DETECTED OFF-SITE BY AIRCRAFT ONLY					
MIERA	03/08/73	NTS	SHAFT	WEAPONS RELATED	20 TO 200KT
MIGHTY EPIC	05/12/76	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
MIKE	10/31/52	ENEWETAK	SURFACE	WEAPONS RELATED	10.4MT
EXPERIMENTAL THERMONUCLEAR DEVICE					
MILK SHAKE	03/25/68	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
MILROW	10/02/69	AMCHITKA	SHAFT	WEAPONS RELATED	ABOUT 1 MEGATON
SEISMIC CALIBRATION.					
MINERS IRON	10/31/90	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20 KT
DOD EVENT					
MING BLADE	06/19/74	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
MING VASE	11/20/68	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT AREA 16					
MINTATA	07/08/71	NTS	SHAFT	PLOWSHARE	83 KT
DEVICE DEVELOPMENT EXPERIMENT					
MINK	10/29/61	NTS	SHAFT	WEAPONS RELATED	LOW
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
MINNOW	05/15/64	NTS	SHAFT	WEAPONS RELATED	LESS THAN 20KT
MINT LEAF	05/05/70	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT. MINOR LEVELS OF RADIOACTIVITY DETECTED OFF SITE					
MINUTE STEAK	09/12/69	NTS	SHAFT	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					
MINOR LEVELS OF RADIOACTIVITY DETECTED ON-SITE ONLY					
MISSISSIPPI	10/05/62	NTS	SHAFT	WEAPONS RELATED	115 KT
MISTY NORTH	05/02/72	NTS	TUNNEL	WEAPONS EFFECTS	LESS THAN 20KT
DOD EVENT					

APPENDIX C

RADIATION EXPOSURE STANDARDS
U.S. NUCLEAR TEST SERIES*

*Summary of dose limits provided in the continental and oceanic series volumes.

APPENDIX C

RADIATION EXPOSURE STANDARDS
U.S. NUCLEAR TEST SERIES

OPERATION	RECOMMENDED DOSE LIMITS BY AGENCY NCRP	ICRP	FRC	ROUTINE MPE*	CLOUD SAMPLERS	DESERT ROCK	SPECIAL GROUPS	REMARKS
TRINITY (Alamogordo, NM) 7/16/45	0.1 R/day, 0.5 R/wk	0.2 R/day, 1.0 R/wk		5R/2 month period	N/A	N/A	N/A	Personnel were to evacuate before 30 min. if gamma reading outside shelter reached 1R/h, put on gas masks & evacuate if alpha reading reached 5 c/m
CROSSROADS (Bikini) 7/1/46-7/25/46				0.1R/day not to exceed 50-60R in 2 wks. If individual received 10R in one day or 60R in 2 wks, he was withdrawn from operation	N/A	N/A	N/A	Cloud trackers adhered to same standards as other units at CROSSROADS
SANDSTONE (Enewetak) 4/14/48-5/15/48				0.1R/24 hrs, not to exceed 3R for the operation	Cloud samplers were Drone B-17s	N/A		Higher exposures approved only by Cdr/JTF7 & individual was prohibited from further exposure for 30 days
RANGER (NTS) 1/27/51-2/6/51	0.3 R/wk	0.3 R/wk		3R/operation, 2R for personnel participating in GREENHOUSE, AEC workers: 3.R/wk	Manned sampler aircraft first used at RANGER	N/A	Public could receive up to 25R w/out danger	Cloud sampling aircraft in NV operated out of Indian Spgs. AFB. All samplers required to wear oxygen masks
GREENHOUSE (Enewetak) 4/8/51-5/25/51				3.9 R/13 wks; 0.1 R/day, not to exceed 0.7R/week	Drone B-17s used as Cloud Samplers	N/A		
BUSTER-JANGLE (NTS) 10/22/51-11/29/51				3R/3 month period	3.9R for 13 wk. operation; cloud sampling aircraft were B-29's	1R total (DR I) 3R (DR II & III)	All observers wore film badges (DR II,III)	AEC's Div. of Biology & Medicine agreed to unpublicized exposure of 3.9R. 3R MPE could be exceeded if Test Director approved
TUMBLER-SNAPPER (NTS) 4/1/52-6/5/52				3R/operation	Cloud samplers B-29's, T-33's, F-84's; cloud trackers. B-29's, B-25's	DR-3R/operation, recommends exposure level be raised above 3R	When transporting radioactive samples, aircrew members were limited to 10mR/h	1.1% of test participants exceeded exposure level of 3.9R
IVY (Enewetak) 11/1/51-11/16/52				3.9R/operation - gamma only	Crews on sampling aircraft total MPE of 20R for operation	N/A	AEC approved emergency exposure of 25R total	
UPSHOT-KNOTHOLE (NTS) 3/17/53-6/4/53				3.9R (gamma only) unless reduced by Test Director	Cloud samplers F-84's;Cloud tracker's B-29's & B-25	6R for operation	Aircraft crew limited to 20 mR/h when transporting samples of radioactive material	No limits set on rate of accumulation of MPE
CASTLE (Bikini Enewetak) 3/1/54-5/14/54	3.0 R/13 wk 0.3 R/wk (max) 15 rem/y			3.9R/13 weeks; augmented by .3R/ week after that	Special MPE of 20R (gamma only)	N/A	MPE waiver approved by Dir., OBM, Surgeons General , Maximum received was 7.8 R	
TEAPOT (NTS) 2/18/55-5/15/55				3.9R/operation	Cloud samplers: F-84's; Cloud trackers. B-25's B-50,B-29's	DR VI-6R total-no more than 3R prompt for one test, 6R in six months	DR VI: Volunteers: 10R total w/5R prompt, not more than 25R/operation	Exposure of personnel above (3.9/R) was authorized in advance by the Test Manager upon recommendation of the TD as to operational necessity

OPERATION	RECOMMENDED DOSE LIMITS BY AGENCY: NCRP	ICRP	FRC	ROUTINE MPE	CLOUD SAMPLERS	DESERT ROCK	SPECIAL GROUPS	REMARKS
WIGWAM (Pacific) 5/14/55				Whole body 3.9R/operation; hands & feet 20R/ operation	Only Cloud trackers, no Sampler's at WIGWAM	N/A	Approx. 10 water sample collectors were authorized 20R/operation	
REDWING (Bikini, Eneweta) 5/5/56- 7/22/56				3.9R/13 weeks only	20R (gamma only) authorized for operational period	N/A	Emergency MPE 7R/operation, Authorization to exceed MPE limits granted by CJTF-7	600 persons exceeded 3.9R exposure limit
PLUMBBOB (NTS) 4/27/57- 10/7/57	5 rem/y (avg) 12 rem/y (max)			3R (whole body gamma)/13 weeks, 5 R/yr; Alpha:max. of 10,000 units/13 consec. wks	7.5R B-57's used for cloud sampling	5R/6 months no limit on rate of accumulation. No more than 2R prompt	AFSWC Aircrew or passengers not to be exposed to dose rate greater than 20 mR/h during flight	MPE limits recommended by AEC's Div. of Biology & Medicine
HARDTACK I (Bikini, Enewetak, Johnston Is.) 4/28/58- 8/18/58	0.5 rem/wk (max) 3.0 rem/13 wks 12 rem/y (max) 5(N-18)rem	0.1 rem/wk 3.0 rem/ 13/wk 5(N-18)rem		3.75 R/13 wks; 5R for operation	B-57's	N/A	TG7.5 (H&N) requested that 3.75R be increased (unspec.) & that 5R be increased to 10R for 35 H&N employees	22 individuals are known to have exceeded the 5R limit
ARGUS (South Atlantic) 8/27/58- 9/6/58					None	N/A		
HARDTACK II (NTS) 9/19/58- 10/30/58				3R/operation 3rem/quarter 5rem/year neutron	10R-15R for those also participating Hardtack I	N/A	12 personnel (FC/ AFSWP) authorized by T.M. to get 25R	Provisions of NBS Handbook 59 prevailed in case of accidental or emergency exposure.
DOMINIC I (Christmas & Johnston Islands; and Eastern Pacific) 4/25/62- 11/4/62			3 rem/13wk 5 rem/y (avg) 12 rem/year (max) 5(N-18)rem	Over age 19:3R/13 wks, 5R/year (whole body gamma) Under age 19:1.25R /13 weeks	None	N/A	Emergency MPE 25R	Grave emergency MPE 50R. Pers. under age 19 had to evacuate if cumulative dose reached 1R
DOMINIC II (NTS) 7/7/62- 7/17/61				Small Boy 3 rem/ quarter	Shot Small Boy Aircrews 3rem/ quarter	N/A		
PLOWSHARE Project Gnome (Carlsbad, NM) 12/10/61 Sedan (NTS) 7/6/62				3 rem/quarter established by Test Director Sedan Shot		N/A		Sedan Maximum personnel exposure was 300 mR, Average was 250 mR

* Selected abbreviations used in this radiological matrix are:

AFB	Air Force Base
Cdr	Commander
CJTF	Commander Joint Task Force
DBM	Division of Biology and Medicine, AEC
DR	Desert Rock
FC	Field Command
FRC	Federal Radiation Council
H&N	Holmes and Narver, Inc.
ICRP	International Commission on Radiological Protection

APPENDIX C

RADIATION EXPOSURE STANDARDS
U.S. NUCLEAR TEST SERIES

OPERATION	RECOMMENDED DOSE LIMITS BY AGENCY NCRP	ICRP	FRC	ROUTINE MPE*	CLOUD SAMPLERS	DESERT ROCK	SPECIAL GROUPS	REMARKS
TRINITY (Alamogordo, NM) 7/16/45	0.1 R/day, 0.5 R/wk	0.2 R/day, 1.0 R/wk		5R/2 month period	N/A	N/A	N/A	Personnel were to evacuate before 30 min. if gamma reading outside shelter reached 1R/h, put on gas masks & evacuate if alpha reading reached 5 c/m
CROSSROADS (Bikini) 7/1/46-7/25/46				0.1R/day not to exceed 50-60R in 2 wks. If individual received 10R in one day or 60R in 2 wks, he was withdrawn from operation	N/A	N/A	N/A	Cloud trackers adhered to same standards as other units at CROSSROADS
SANDSTONE (Enewetak) 4/14/48-5/15/48				0.1R/24 hrs, not to exceed 3R for the operation	Cloud samplers were Drone B-17s	N/A		Higher exposures approved only by Cdr/JTF7 & individual was prohibited from further exposure for 30 days
RANGER (NTS) 1/27/51-2/6/51	0.3 R/wk	0.3 R/wk		3R/operation, 2R for personnel participating in GREENHOUSE; AEC workers: 3.R/wk	Manned sampler aircraft first used at RANGER	N/A	Public could receive up to 25R w/out danger	Cloud sampling aircraft in NV operated out of Indian Spgs. AFB. All samplers required to wear oxygen masks
GREENHOUSE (Enewetak) 4/8/51-5/25/51				3.9 R/13 wks; 0.1 R/day; not to exceed 0.7R/week	Drone B-17s used as Cloud Samplers	N/A		
BUSTER-JANGLE (NTS) 10/22/51-11/29/51				3R/3 month period	3.9R for 13 wk. operation; cloud sampling aircraft were B-29's	1R total (DR I) 3R (DR II & III)	All observers wore film badges (DR II,III)	AEC's Div. of Biology & Medicine agreed to unpublicized exposure of 3.9R. 3R MPE could be exceeded if Test Director approved
TUMBLER-SNAPPER (NTS) 4/1/52-6/5/52				3R/operation	Cloud samplers: B-29's,T-33's, F-84's; cloud trackers: B-29's, B-25's	DR-3R/operation; recommends exposure level be raised above 3R	When transporting radioactive samples, aircrew members were limited to 10mR/h	1.1% of test participants exceeded exposure level of 3.9R
IVY (Enewetak) 11/1/51-11/16/52				3.9R/operation - gamma only	Crews on sampling aircraft: total MPE of 20R for operation	N/A	AEC approved emergency exposure of 25R total	
UPSHOT-KNOTHOLE (NTS) 3/17/53-6/4/53				3.9R (gamma only) unless reduced by Test Director	Cloud samplers F-84's;Cloud tracker's B-29's & B-25	6R for operation	Aircraft crew limited to 20 mR/h when transporting samples of radioactive material	No limits set on rate of accumulation of MPE
CASTLE (Bikini Enewetak) 3/1/54-5/14/54	3.0 R/13 wk 0.3 R/wk (max) 15 rem/y			3.9R/13 weeks; augmented by .3R/ week after that	Special MPE of 20R (gamma only)	N/A	MPE waiver approved by Dir., DBM, Surgeons General ; Maximum received was 7.8 R	
TEAPOT (NTS) 2/18/55-5/15/55				3.9R/operation	Cloud samplers: F-84's, Cloud trackers: B-25's B-50,B-29's	DR VI-6R total-no more than 3R prompt for one test; 6R in six months	DR VI: Volunteers: 10R total w/5R prompt, not more than 25R/operation	Exposure of personnel above (3.9/R) was authorized in advance by the Test Manager upon recommendation of the TD as to operational necessity

OPERATION	RECOMMENDED DOSE LIMITS BY AGENCY NCRP	ICRP	FRC	ROUTINE MPE	CLOUD SAMPLERS	DESERT ROCK	SPECIAL GROUPS	REMARKS
WIGWAM (Pacific) 5/14/55				Whole body: 3.9R/operation; hands & feet 20R/ operation	Only Cloud trackers, no Sampler's at WIGWAM	N/A	Approx. 10 water sample collectors were authorized 20R/operation	
REDWING (Bikini, Enewetak) 5/5/56- 7/22/56				3.9R/13 weeks only	20R (gamma only) authorized for operational period	N/A	Emergency MPE 7R/operation; Authorization to exceed MPE limits granted by CJTF-7	600 persons exceeded 3.9R exposure limit
PLUMBBOB (NTS) 4/27/57- 10/7/57	5 rem/y (avg) 12 rem/y (max)			3R (whole body gamma)/13 weeks, 5 R/yr; Alpha max. of 10,000 units/13 consec. wks	7.5R B-57's used for cloud sampling	5R/6 months no limit on rate of accumulation. No more than 2R prompt	AFSWC Aircrew or passengers not to be exposed to dose rate greater than 20 mR/h during flight	MPE limits recommended by AEC's Div. of Biology & Medicine
HARDTACK I (Bikini, Enewetak, Johnston Is.) 4/28/58- 8/18/58	0.3 rem/wk (max) 3.0 rem/13 wks 12 rem/y (max) 5(N-18)rem	0.1 rem/wk 3.0 rem/ 13/wk 5(N-18)rem		3.75 R/13 wks; 5R for operation	B-57's	N/A	TG7.5 (H&N) requested that 3.75R be increased (unspec.) & that 5R be increased to 10R for 35 H&N employees	22 individuals are known to have exceeded the 5R limit
ARGUS (South Atlantic) 8/27/58- 9/6/58					None	N/A		
HARDTACK II (NTS) 9/19/58- 10/30/58				3R/operation 3rem/quarter 5rem/year neutron	10R-15R for those also participating Hardtack I	N/A	12 personnel (FC/ AFSWP) authorized by T.M. to get 25R	Provisions of NBS Handbook 59 prevailed in case of accidental or emergency exposure.
DOMINIC I (Christmas & Johnston Islands; and Eastern Pacific) 4/25/62- 11/4/62			3 rem/13wk 5 rem/y (avg) 12 rem/year (max) 5(N-18)rem	Over age 19:3R/13 wks, 5R/year (whole body gamma) Under age 19:1.25R /13 weeks	None	N/A	Emergency MPE: 25R	Grave emergency MPE 50R. Pers. under age 19 had to evacuate if cumulative dose reached 1R
DOMINIC II (NTS) 7/7/62- 7/17/61				Small Boy: 3 rem/ quarter	Shot Small Boy: Aircrews: 3rem/ quarter	N/A		
PLOWSHARE Project Gnome (Carlsbad, NM) 12/10/61 Sedan (NTS) 7/6/62				3 rem/quarter established by Test Director Sedan Shot		N/A		Sedan Maximum personnel exposure was 300 mR, Average was 250 mR

* Selected abbreviations used in this radiological matrix are:

AFB	Air Force Base
Cdr	Commander
CJTF	Commander Joint Task Force
DBM	Division of Biology and Medicine, AEC
DR	Desert Rock
FC	Field Command
FRC	Federal Radiation Council
H&N	Holmes and Narver, Inc.
ICRP	International Commission on Radiological Protection

JTF	Joint Task Force
MPE	Maximum Permissible Exposure
NBS	National Bureau of Standards
NCRP	National Council on Radiation Protection and Measurements
NTS	Nevada Test Site
R	Roentgen
TD	Test Director
TG	Task Group
TM	Test Manager

APPENDIX D

FOREIGN NUCLEAR DETONATIONS -- THROUGH DECEMBER 31, 1982*

SUMMARY

Total Events for U.S.S.R.	-	314
Total Events for Britain	-	35
Total Events for France	-	43
Total Events for China	-	25
Total Events for India	-	1
Total Events for Unknown	-	0

*Prepared by Department of Energy, January 1983.

APPENDIX D

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Note 1 The date given is the date of announcement, not necessarily the shot date.					
Note 2 These tests, announced by the AEC on 10/24/58, were of high yield, probably in the MT range.					
Note 3 USSR denotes the explosion was in Soviet territory but the test site was not identified.					
Test	08/29/49	USSR	Atmos*		First USSR Test
Test	10/03/51	USSR	Atmos	White House	See Note 1.
Test	10/22/51	USSR	Atmos	White House	See Note 1.
Test	08/12/53	USSR	Atmos		Thermonuclear
Part of a series					
Test	08/23/53	USSR	Atmos		Fission
Part of a series. Energy release equivalent to type detonated at NTS					
Test	10/26/54	USSR	Atmos	AEC	See Note 1.
Part of a series that began in mid-September and continued at intervals to the announcement date					
Test	08/04/55	USSR	Atmos	AEC	See Note 1.
Part of a series detonated in the preceding few days					
Test	09/24/55	USSR	Atmos	AEC	See Note 1.
Part of a series recently detonated					
Test	11/10/55	USSR	Atmos	AEC	See Note 1.
Part of a series recently detonated					
Test	11/23/55	USSR	Atmos	AEC	Megaton Range
Part of a series			See Note 1		

*Atmospheric

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Test	03/21/56	USSR	Atmos	AEC	See Note 1.
Part of a series detonated in preceding few days					
Test	04/02/56	USSR	Atmos	AEC	See Note 1.
Part of a series detonated in preceding few days					
Test	08/24/56	Siberia	Atmos		Less Than Megaton.
Part of a series					
Test	08/30/56	Siberia	Atmos		Large
Part of a series					
Test	09/02/56	USSR	Atmos		
Part of a series					
Test	09/10/56	USSR	Atmos	Soviet Union	
Part of a series					
Test	11/17/56	USSR	Atmos		Large
Part of a series					
Test	01/19/57	USSR	Atmos		
Part of a series					
Test	03/08/57	USSR	Atmos		
Part of a series					
Test	04/03/57	USSR	Atmos		
Part of a series					
Test	04/06/57	USSR	Atmos		
Part of a series					

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Test	04/10/57	USSR	Atmos		Large
Test Part of a series	04/12/57	USSR	Atmos		
Test Part of a series. Largest tested so far this series	04/16/57	Siberia	Atmos		Large
Test	08/22/57	Siberia	Atmos		Substantial
Test Detonated within preceding two days	09/09/57	Siberia	Atmos	AEC See Note 1.	Moderate
Test	09/24/57	Arctic	Atmos		Megaton Range
Test Announced by USSR as a hydrogen device. AEC said it was of substantial size.	10/06/57	USSR	Atmos	Soviet Union	Substantial
Test	10/10/57	Arctic			Small
Test	12/28/57	Siberia	Atmos		
Test	02/23/58	Arctic	Atmos		Megaton Range
Test	02/27/58	Arctic	Atmos		Megaton Range
Test	02/27/58	Arctic	Atmos		Large
Test	03/14/58	Arctic	Atmos		Below Megaton Range
Test	03/14/58	Arctic	Atmos		Below Megaton Range

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Test	03/15/58	Arctic	Atmos		Below Megaton Range
Test	03/20/58	Arctic	Atmos		Small
Test	03/21/58	Siberia	Atmos		
This detonation was in a larger range than the test the day before.					
Test	03/22/58	Arctic	Atmos		Medium
Test	09/30/58	Arctic	Atmos		Moderate to High
Test	09/30/58	Arctic	Atmos		Moderate to High
Test	10/02/58	Arctic	Atmos		Moderate
Test	10/02/58	Arctic	Atmos		Moderate
Test	10/05/58	Arctic	Atmos		Smaller Than 4 Above
Test	10/10/58	Arctic	Atmos		Relatively Large
Test	10/12/58	Arctic	Atmos		Large. See Note 2.
Test	10/15/58	Arctic	Atmos		Large. See Note 2.
Test	10/18/58	Arctic	Atmos		Large. See Note 2.
Test	10/19/58	Arctic	Atmos		Small
Test	10/20/58	Arctic	Atmos		Large. See Note 2.
Test	10/22/58	Arctic	Atmos		Large. See Note 2.

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Test	10/24/58	Arctic	Atmos		Large. See Note 2.
Test	10/25/58	Arctic	Atmos		Relatively Large
Test	11/01/58	Siberia	Atmos		Relatively Low
Test	11/03/58	Siberia	Atmos		Relatively Low
Test	09/01/61	Semipalatinsk	Atmos	White House	Intermediate Range
Test	09/04/61	Semipalatinsk	Atmos	AEC	Low Kiloton Range
Test	09/05/61	Semipalatinsk	Atmos	AEC	Low to Intermediate
Test	09/06/61	E of Stalingrad	Atmos	AEC	Low to Intermediate
Test	09/10/61	Novaya Zemlya	Atmos	AEC	Several Megatons
Test	09/10/61	Novaya Zemlya	Atmos	AEC	Low to Intermediate Kiloton Range
Test	09/12/61	Novaya Zemlya	Atmos	AEC	Several Megatons
Test	09/13/61	Semipalatinsk	Atmos	AEC	Low to Intermediate
Test	09/13/61	Novaya Zemlya	Atmos	AEC	Low to Intermediate
Test	09/14/61	Novaya Zemlya	Atmos	AEC	Several Megatons
Test	09/16/61	Novaya Zemlya	Atmos	AEC	Order of a MT
Test	09/17/61	Semipalatinsk	Atmos	AEC	Intermediate

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Test	09/18/61	Novaya Zemlya	Atmos	AEC	Order of a MT
Test	09/20/61	Novaya Zemlya	Atmos	AEC	Order of a MT
Test	09/22/61	Novaya Zemlya	Atmos	AEC	Order of a MT
Test	10/02/61	Novaya Zemlya	Atmos	AEC	Order of a MT
Test	10/04/61	Novaya Zemlya	Atmos	AEC	Order of Several MTs
Test	10/06/61	Novaya Zemlya	Atmos	AEC	Several Megatons
Test	10/08/61	Novaya Zemlya	Atmos	AEC	Low Yield Range
Test	10/12/61	Semipalatinsk	Atmos	AEC	Low to Intermediate
Test	10/20/61	Novaya Zemlya	Atmos	AEC	Several Megatons
Test	10/23/61	Novaya Zemlya	Atmos	AEC	About 25 Megatons
Test	10/23/61	S of Novaya Zemlya	UW*	AEC	Low Yield
Test	10/25/61	Novaya Zemlya	Atmos	AEC	Intermediate to High
Probably less than a megaton					
Test	10/27/61	Novaya Zemlya	Atmos	AEC	Low to Intermediate
Test	10/30/61	Novaya Zemlya	Atmos	AEC	58 Megatons
Detonated in vicinity of 12,000 feet					
Test	10/31/61	Novaya Zemlya	Atmos	AEC	Several Megatons

*Underwater.

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Test	10/31/61	Novaya Zemlya	Atmos	AEC	Intermediate to High
Probably below a megaton					
Test	11/02/61	Novaya Zemlya	Atmos	AEC	Low to Intermediate
Test	11/02/61	Novaya Zemlya	Atmos	AEC	Low to Intermediate
Test	11/04/61	Novaya Zemlya	Atmos	AEC	Several Megatons
On 12/09/61, AEC stated in a preliminary analysis of the recent Soviet nuclear test series that the USSR had conducted approximately 50 atmospheric tests.					
Test	02/02/62	Semipalatinsk	UG*	AEC	
Announced as apparently conducted well above the threshold of underground detectability even by a single national system. The absence of acoustic signals indicates it occurred underground.					
Test	08/05/62	Novaya Zemlya	Atmos	AEC	30 Megatons
On 08/06/62, the AEC stated that tests in the low kiloton range had been conducted a few days prior to the test on 08/05/62.					
Test	08/07/62	Central Siberia	Atmos	AEC	Low Kiloton
Test	08/10/62	Novaya Zemlya	Atmos	AEC	Less Than 1 MT
Test	08/20/62	Novaya Zemlya	Atmos	AEC	Order of Several MTs
Test	08/22/62	Novaya Zemlya	Atmos	AEC	Low Megaton
Test	08/25/62	Novaya Zemlya	Atmos	AEC	Order Several MTs
Test	08/25/62	Semipalatinsk	Atmos	AEC	Low

*Underground.

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Test	08/27/62	Novaya Zemlya	Atmos	AEC	Several Megatons
Test	09/02/62	Novaya Zemlya	Atmos	AEC	Intermediate
Test	09/08/62	Novaya Zemlya	Atmos	AEC	Megaton Range
AEC announced this was the 10th specific test in the current series, but all detected tests are not specifically announced and a number of additional tests had been conducted.					
Test	09/15/62	Novaya Zemlya	Atmos	AEC	Several Megatons
Test	09/16/62	Novaya Zemlya	Atmos	AEC	Several Megatons
Test	09/18/62	Novaya Zemlya	Atmos	AEC	A Few Megatons
Test	09/19/62	Novaya Zemlya	Atmos	AEC	Multimegaton
Announced by AEC as the 2nd largest atmospheric test in the current series and the 4th multimegaton test in the past 5 days.					
Test	09/21/62	Novaya Zemlya	Atmos	AEC	A Few Megatons
Test	09/25/62	Novaya Zemlya	Atmos	AEC	Multimegaton
Slightly larger than test on 09/19/62					
Test	09/27/62	Novaya Zemlya	Atmos	AEC	Less Than 30 MT
Test	10/07/62	Novaya Zemlya	Atmos	AEC	Intermediate
Test	10/14/62	Semipalatinsk	Atmos	AEC	Low Yield Range
Test	10/22/62	Central Asia	HA*	AEC	A Few Hundred KT

*High altitude.

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Test	10/22/62	Novaya Zemlya	Atmos	AEC	Several Megatons
Test	10/27/62	Novaya Zemlya	Atmos	AEC	Intermediate
Test	10/28/62	Central Asia	HA	AEC	Intermediate
Test	10/28/62	Semipalatinsk	Atmos	AEC	Low
Test	10/29/62	Novaya Zemlya	Atmos	AEC	Intermediate
Test	10/30/62	Novaya Zemlya	Atmos	AEC	Intermediate
Test	11/01/62	Central Asia	HA	AEC	Intermediate
Test	11/01/62	Novaya Zemlya	Atmos	AEC	Intermediate
Test	11/03/62	Novaya Zemlya	Atmos	AEC	Intermediate
Test	11/03/62	Novaya Zemlya	Atmos	AEC	Intermediate
Test	11/04/62	Semipalatinsk	Atmos	AEC	Intermediate
Test	11/17/62	Semipalatinsk	Atmos	AEC	Low
Test	12/18/62	Novaya Zemlya	Atmos	AEC	Intermediate
Test	12/18/62	Novaya Zemlya	Atmos	AEC	Intermediate
Test	12/20/62	Novaya Zemlya	Atmos	AEC	Low
Test	12/22/62	Novaya Zemlya	Atmos	AEC	Intermediate

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Test	12/23/62	Novaya Zemlya	Atmos	AEC	See Comment Below.
AEC 12/26/62 announcement said a number of atmospheric tests were held during 12/23-25/62. The largest was about 20 MT; the others were low to a few megatons.					
Test	12/24/62	Novaya Zemlya	Atmos	AEC	About 20 Megatons
Test	12/25/62	Novaya Zemlya	Atmos	AEC	See Comment Above.
Seismic Signal	09/18/64	Novaya Zemlya	UG	ACDA	Low
Seismic Signal	10/25/64	Novaya Zemlya	UG	ACDA	Low
Seismic Signal	11/16/64	Semipalatinsk	UG	AEC	Low to Low Interm
Test	01/15/65	Semipalatinsk	UG	AEC	Intermediate
Seismic Signals	03/03/65	Semipalatinsk	UG	AEC	Low to Low Interm
Seismic Signals	10/08/65	Semipalatinsk	UG	AEC	Low to Low Interm
Seismic Signals	11/21/65	Semipalatinsk	UG	AEC	Low to Low Interm
Seismic Signals	02/13/66	Semipalatinsk	UG	AEC	Low Intermediate
Seismic Signals	03/20/66	Semipalatinsk	UG	AEC	To Intermediate
Seismic Signals	04/21/66	Semipalatinsk	UG	AEC	Low
Seismic Signals	06/29/66	USSR	UG	ACDA	Low Intermediate
William C. Foster stated on 7/07/66 that as recently as 8 days ago the US recorded seismic signals from the Soviet nuclear testing area.					

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Seismic Signals	10/19/66	Semipalatinsk	UG	AEC	Low to Intermediate
Test	10/27/66	Novaya Zemlya	UG	AEC	Intermediate to High
Test	12/18/66	Semipalatinsk	UG	AEC	Low Intermediate
Seismic Signals	02/26/67	Semipalatinsk	UG	AEC	Intermediate
Seismic Signals	04/20/67	Semipalatinsk	UG	AEC	Low Intermediate
Seismic Signals	10/17/67	Semipalatinsk	UG	AEC	Low Intermediate
Seismic Signals Lower end of range	10/21/67	Novaya Zemlya	UG	AEC	Intermediate
Seismic Signals	04/24/68	Semipalatinsk	UG	AEC	Low
Seismic Signals	06/11/68	Semipalatinsk	UG	AEC	Low
Seismic Signals	06/19/68	Semipalatinsk	UG	AEC	Low Intermediate
Seismic Signals	07/01/68	N of Caspian Sea	UG	AEC	Low Intermediate
Seismic Signals	09/05/68	Semipalatinsk	UG	AEC	Low Intermediate
Seismic Signals Lower end of range	11/07/68	Novaya Zemlya	UG	AEC	Intermediate
Seismic Signals	12/18/68	Semipalatinsk	UG	AEC	Low
Seismic Signals	03/07/69	Semipalatinsk	UG	AEC	Low Intermediate

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Seismic Signals	05/16/69	Semipalatinsk	UG	AEC	Low Intermediate
Seismic Signals	05/31/69	Semipalatinsk	UG	AEC	Low
Seismic Signals	07/23/69	Semipalatinsk	UG	AEC	Low Intermediate
Seismic Signals	09/08/69	Ural Area	UG	AEC	Low
Seismic Signals	09/11/69	Semipalatinsk	UG	AEC	Low
Seismic Signals	09/26/69	S of Volvograd	UG	AEC	Low Intermediate
Seismic Signals	10/01/69	Semipalatinsk	UG	AEC	Low Intermediate
Seismic Signals	10/14/69	Novaya Zemlya	UG	AEC	Intermediate
Seismic Signals	11/30/69	Semipalatinsk	UG	AEC	Intermediate
Seismic Signals South of Urals	12/06/69	Kazakh Desert	UG	AEC	Low Intermediate
Seismic Signals	12/28/69	Semipalatinsk	UG	AEC	Low Intermediate
Seismic Signals	01/29/70	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	06/28/70	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	07/21/70	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	07/24/70	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	09/06/70	Semipalatinsk	UG	AEC	20 to 200 KT

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Test	10/14/70	Novaya Zemlya	UG	AEC	3 to 6 Megatons
Seismic Signals	11/04/70	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	12/12/70	Kazakh Desert	UG	AEC	200 KT to 1 MT
Seismic Signals	12/17/70	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	12/23/70	Kazakh Desert	UG	AEC	200 KT to 1 MT
Seismic Signals	03/22/71	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	03/23/71	Ural Area	UG	AEC	20 to 200 KT
Seismic Signals	04/25/71	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	06/06/71	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	06/19/71	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	06/30/71	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	07/10/71	Ural Area	UG	AEC	20 to 200 KT
Western Slopes of Ural Mountains					
Test	09/27/71	Novaya Zemlya	UG	AEC	2 to 4 Megatons
Seismic Signals	10/09/71	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	10/21/71	Semipalatinsk	UG	AEC	20 to 200 KT

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Seismic Signals	10/22/71	Ural Area	UG	AEC	20 to 200 KT
Seismic Signals	11/29/71	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	12/22/71	N of Caspian Sea	UG	AEC	200 KT to 1 MT
Seismic Signals	12/30/71	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	02/10/72	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	03/10/72	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	03/28/72	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	06/07/72	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	08/16/72	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	08/20/72	N of Caspian Sea	UG	AEC	20 to 200 KT
Seismic Signals	08/26/72	Semipalatinsk	UG	AEC	20 to 200 KT
Test	08/28/72	Novaya Zemlya	UG	AEC	About 1 Megaton
Seismic Signals	09/21/72	Ural Area	UG	AEC	20 to 200 KT
Seismic Signals	10/03/72	S of Volvograd	UG	AEC	200 KT to 1 MT
Seismic Signals	11/02/72	Semipalatinsk	UG	AEC	200 KT to 1 MT
Seismic Signals	11/24/72	Ural Area	UG	AEC	20 to 200 KT

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Seismic Signals	12/10/72	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	12/10/72	Semipalatinsk	UG	AEC	200 KT to 1 MT
Seismic Signals	02/16/73	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	04/19/73	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	07/10/73	Semipalatinsk	UG	AEC	20 to 200 KT
Test	07/23/73	Semipalatinsk	UG	AEC	200 KT to 1 MT
Seismic Signals	08/15/73	NW of Tashkent	UG	AEC	20 to 200 KT
Seismic Signals	08/28/73	Kazakh Desert	UG	AEC	20 to 200 KT
Test	09/12/73	Novaya Zemlya	UG	AEC	6 Megatons
Seismic Signals	09/19/73	Kazakh Desert	UG	AEC	20 to 200 KT
Seismic Signals	09/27/73	Novaya Zemlya	UG	AEC	20 to 200 KT
Seismic Signals	09/30/73	Ural Area	UG	AEC	20 to 200 KT
Seismic Signals	10/26/73	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	10/26/73	Ural Area	UG	AEC	Less Than 20 KT
Test	10/27/73	Novaya Zemlya	UG	AEC	3 to 6 MT
Seismic Signals	12/14/73	Semipalatinsk	UG	AEC	200 KT to 1 MT

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Seismic Signals	01/30/74	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	05/16/74	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	05/31/74	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	08/14/74	Tazovskiv Penins	UG	AEC	20 to 200 KT
Test	08/29/74	Novaya Zemlya	UG	AEC	1 to 3 Megatons
Seismic Signals	10/16/74	Semipalatinsk	UG	AEC	20 to 200 KT
Test	11/02/74	Novaya Zemlya	UG	AEC	3 to 4 Megatons
Seismic Signals	12/27/74	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	02/20/75	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	03/11/75	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	04/27/75	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	06/08/75	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	08/07/75	Semipalatinsk	UG	AEC	20 to 200 KT
Test	08/23/75	Novaya Zemlya	UG	AEC	Multimegaton
Test	10/18/75	Novaya Zemlya	UG	AEC	Multimegaton
Test	10/21/75	Novaya Zemlya	UG	AEC	Multimegaton

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Seismic Signals	10/29/75	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	12/25/75	Semipalatinsk	UG	AEC	20 to 200 KT
Seismic Signals	04/21/76	Semipalatinsk	UG	ERDA	20 to 150 KT
Seismic Signals	06/08/76	Semipalatinsk	UG	ERDA	20 to 150 KT
Seismic Signals	07/04/76	Semipalatinsk	UG	ERDA	Not Given
Seismic Signals	07/29/76	N of Caspian Sea	UG	ERDA	Not Given
Seismic Signals	08/28/76	Semipalatinsk	UG	ERDA	Not Given
Test	09/29/76	Novaya Zemlya	UG	ERDA	Not Given
Seismic Signals	10/20/76	Novaya Zemlya	UG	ERDA	Not Given
Seismic Signals	11/05/76	Central Siberia	UG	ERDA	Not Given
Seismic Signals	11/23/76	Semipalatinsk	UG	ERDA	Not Given
Seismic Signals	12/06/76	Semipalatinsk	UG	ERDA	Not Given
Seismic Signals	03/29/77	Semipalatinsk	UG	ERDA	Not Given
Seismic Signals	05/29/77	Semipalatinsk	UG	ERDA	Not Given
Seismic Signals	06/29/77	Semipalatinsk	UG	ERDA	Not Given
Seismic Signals	07/26/77	Central Siberia	UG	ERDA	Not Given

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Seismic Signals	08/20/77	Central Siberia	UG	ERDA	Not Given
Seismic Signals	09/01/77	Novaya Zemlya	UG	ERDA	Not Given
Seismic Signals	09/05/77	Semipalatinsk	UG	ERDA	Not Given
Seismic Signals	09/30/77	N of Caspian Sea	UG	ERDA	Not Given
Seismic Signals	10/29/77	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	10/29/77	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	11/30/77	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	03/19/78	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	03/26/78	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	04/22/78	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	06/11/78	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	07/05/78	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	07/28/78	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	08/09/78	Eastern Siberia	UG	DOE	Not Given
Seismic Signals	08/10/78	Novaya Zemlya	UG	DOE	Not Given
Seismic Signals	08/24/78	N Central Siberia	UG	DOE	Not Given

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Seismic Signals	08/29/78	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	09/15/78	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	09/21/78	NW Siberia	UG	DOE	Not Given
Seismic Signals	09/27/78	Novaya Zemlya	UG	DOE	Not Given
Seismic Signals	10/17/78	N of Caspian Sea	UG	DOE	Not Given
Seismic Signals	10/17/78	Far NW Siberia	UG	DOE	Not Given
Seismic Signals	10/31/78	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	11/04/78	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	11/29/78	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	11/29/78	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	12/18/78	N of Caspian Sea	UG	DOE	Not Given
Seismic Signals	01/17/79	N of Caspian Sea	UG	DOE	Not Given
Seismic Signals	02/01/79	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	02/16/79	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	06/23/79	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	07/07/79	Semipalatinsk	UG	DOE	Not Given

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Seismic Signals	07/14/79	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	08/04/79	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	08/18/79	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	09/24/79	Novaya Zemlya	UG	DOE	Not Given
Seismic Signals	10/04/79	E of Ural Mountains	UG	DOE	Not Given
Seismic Signals	10/18/79	Novaya Zemlya	UG	DOE	Not Given
Seismic Signals	10/24/79	N of Caspian Sea	UG	DOE	Not Given
Seismic Signals	10/28/79	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	12/02/79	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	12/23/79	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	04/25/80	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	05/22/80	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	06/12/80	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	06/29/80	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	09/14/80	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	10/11/80	Semipalatinsk	UG	DOE	Not Given

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** U.S.S.R. **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
Seismic Signals	10/12/80	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	11/01/80	N Central Siberia	UG	DOE	Not Given
Seismic Signals	12/14/80	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	12/27/80	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	03/28/81	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	04/21/81	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	05/25/81	NW USSR	UG	DOE	Not Given
Seismic Signals	05/26/81	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	09/12/81	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	10/01/81	Novaya Zemlya	UG	DOE	Not Given
Seismic Signals	10/17/81	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	11/28/81	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	12/26/81	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	04/24/82	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	07/03/82	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	08/30/82	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	10/11/82	Novaya Zemlya	UG	DOE	Not Given
Seismic Signals	12/04/82	Semipalatinsk	UG	DOE	Not Given
Seismic Signals	12/25/82	Semipalatinsk	UG	DOE	Not Given

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** BRITAIN **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
HURRICANE	10/03/52	Monte Bello Is	Ship	First UK Test	Kiloton Range
TOTEM	10/14/53	Woomera	Tower		Kiloton Range
TOTEM	10/26/53	Woomera	Tower		Kiloton Range
MOSAIC	05/16/56	Monte Bello Is	Tower		Kiloton Range
MOSAIC	06/19/56	Monte Bello Is	Tower		Kiloton Range
BUFFALO	09/27/56	Maralinga	Tower		Kiloton Range
BUFFALO	10/04/56	Maralinga	Surface		Low
BUFFALO	10/11/56	Maralinga	Air	First Air Drop	Low
BUFFALO	10/22/56	Maralinga	Tower		Kiloton Range
GRAPPLE 1957	05/15/57	Christmas Is	Air		Megaton Range
GRAPPLE 1957	05/31/57	Christmas Is	Air		Megaton Range
GRAPPLE 1957	06/19/57	Christmas Is	Air		Megaton Range
GRAPPLE 1957	11/08/57	Christmas Is	Air		Megaton Range
ANTLER	09/14/57	Maralinga	Tower		Low
ANTLER	09/25/57	Maralinga	Tower		Kiloton Range
ANTLER	10/09/57	Maralinga	Balloon		Kiloton Range
GRAPPLE 1958	04/28/58	Christmas Is	Air		Megaton Range

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** BRITAIN **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
GRAPPLE 1958	08/22/58	Christmas Is	Balloon		Kiloton Range
GRAPPLE 1958	09/02/58	Christmas Is	Air		Megaton Range
GRAPPLE 1958	09/11/58	Christmas Is	Air		Megaton Range
GRAPPLE 1958	09/23/58	Christmas Is	Balloon		Kiloton Range
PAMPAS	03/01/62	NTS	UG	Joint US-UK	Low
TENDRAC	12/07/62	NTS	UG	Joint US-UK	Low
CORMORANT	07/17/64	NTS	UG	Joint US-UK	Low
CHARCOAL	09/19/65	NTS	UG	Joint US-UK	20 to 200 KT
FALLON	05/23/74	NTS	UG	Joint US-UK	20 to 200 KT
BANON	08/26/76	NTS	UG	Joint US-UK	20 to 150 KT
FONDUTTA	04/11/78	NTS Pahute	UG	Joint US-UK	20 to 150 KT
QUARGEL	11/18/78	NTS	UG	Joint US-UK	20 to 150 KT
NESSEL	08/29/79	NTS	UG	Joint US-UK	20 to 150 KT
COLWICK	04/26/80	NTS	UG	Joint US-UK	20 to 150 KT
DUTCHESS	10/24/80	NTS	UG	Joint US-UK	Less Than 20 KT
SERPA	12/17/80	NTS	UG	Joint US-UK	20 to 150 KT
ROUSANNE	11/12/81	NTS	UG	Joint US-UK	20 to 150 KT
GIBNE	04/25/82	NTS	UG	Joint US-UK	20 to 150 KT

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** FRANCE **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
	02/13/60	Reggan	Tower		60-70 KT
First test of a nuclear device by France. Tower 350 feet high					
	04/01/68	Reggan	Surface		Small
	12/27/60	Reggan	Tower		Small
	04/25/61	Reggan	Tower		Small
AGATE	11/07/61	Sahara	UG		Weak
BERYL	05/01/62	Sahara	UG		Middle
EMERAUDE	03/18/63	Sahara	UG		Weak
AMETHYSTE	03/30/63	Sahara	UG		Weak
RUBIS	10/20/63	Sahara	UG		Middle
OPALE	02/14/64	Sahara	UG		Weak
TOPAZE	06/15/64	Sahara	UG		Weak
TURQUOISE	11/28/64	Sahara	UG		Weak
SAPHIR	02/27/65	Sahara	UG		Middle
JADE	05/30/65	Sahara	UG		Weak
CORINDON	10/01/65	Sahara	UG		Weak
TOURMALINE	12/01/65	Sahara	UG		Weak
GRENAT	02/16/66	Sahara	UG		Weak

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** FRANCE **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
	07/02/66	Mururoa	Barge		Small
	07/19/66	Mururoa	Air		Small
	09/11/66	Mururoa	Balloon		Small
	09/24/66	Fangataufa	Barge		Small
	10/04/66	Mururoa	Barge		200-300 KT
	06/05/67	Mururoa	Balloon		Small
	06/27/67	Mururoa	Balloon		Small
	07/02/67	Mururoa	Balloon		Small
	07/07/68	Mururoa	Balloon		Small
	07/15/68	Mururoa	Balloon		0.5 Megaton
	08/03/68	Mururoa	Balloon		Low Intermediate
	08/24/68	Fangataufa	Balloon	First H-Bomb	Low Megaton
	09/08/68	Mururoa	Balloon	Second H-Bomb	Low Megaton
ANDROMEDE	05/15/70	Mururoa	Balloon		Intermediate
CASSIOPEE	05/22/70	Mururoa	Balloon		Intermediate
DRAGON	05/30/70	Fangataufa	Balloon	Megaton Range	Intermediate
ERIDAN	06/24/70	Mururoa	Balloon		Low

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** FRANCE **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
LICORNE	07/03/70	Mururoa	Balloon	Hydrogen Bomb	1 Megaton
PEGASE	07/27/70	Mururoa	Balloon		Low
ORION	08/02/70	Fangataufa	Balloon		Low Intermediate
TOJOAN	08/06/70	Mururoa	Balloon		Intermediate
DIONE	06/05/71	Mururoa	Atmos		Low
ENCELADE	06/12/71	Mururoa	Atmos		Intermediate
JAPET	07/04/71	Mururoa	Atmos		Low
PHOEBE	08/08/71	Mururoa	Atmos		Low
RHEA	08/14/71	Mururoa	Atmos		High

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** CHINA **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
	10/16/64	LOP NOR	Atmos	White House	Low
First Chinese Communist Test. Fission. U-235					
	05/14/65	LOP NOR	Atmos	State Department	Higher Than First Test
	05/09/66	LOP NOR	Atmos	State Department	Low Intermediate
Fission. U-235. Thermonuclear material involved. Low end of range					
U-235	10/27/66	LOP NOR	Atmos	AEC	Low-Low Intermediate
	12/28/66	LOP NOR	Atmos	AEC	Few Hundred KTs
U-235. Thermonuclear material involved					
	06/17/67	LOP NOR	Atmos	AEC	Several Megatons
Thermonuclear					
	12/24/67	LOP NOR	Atmos	AEC	Low
	12/27/68	LOP NOR	Atmos	AEC	About 3 Megatons
Thermonuclear device					
	09/22/69	LOP NOR	UG	AEC	Low Intermediate
	09/29/69	LOP NOR	Atmos	AEC	About 3 Megatons
	10/14/70	LOP NOR	Atmos	AEC	About 3 Megatons
	11/18/71	LOP NOR	Atmos	AEC	About 20 KT
	01/07/72	LOP NOR	Atmos	AEC	Less Than 20 KT
	03/18/72	LOP NOR	Atmos	AEC	20 to 200 KT

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** CHINA **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
	06/26/73	LOP NOR	Atmos	AEC	2 to 3 Megatons
	06/17/74	LOP NOR	Atmos	AEC	200 KT to 1 MT
	10/26/75	LOP NOR	UG	AEC	Less Than 20 KT
	01/23/76	LOP NOR	Atmos	ERDA	Low
	09/26/76	LOP NOR	Atmos	ERDA	20 to 200 KT
	10/17/76	LOP NOR	UG	ERDA	Low
	11/17/76	LOP NOR	Atmos	ERDA	About 4 Megatons
4th Chinese test this year. Largest one detected					
Test	09/17/77	LOP NOR	Atmos	ERDA	Less Than 20 KT
Test	03/15/78	LOP NOR	Atmos	DOE	Less Than 20 KT
Test	12/14/78	LOP NOR	Atmos	DOE	Less Than 20 KT
Test	10/16/80	LOP NOR	Atmos	DOE	200 KT to 1 MT

APPENDIX D (Continued)

FOREIGN NUCLEAR DETONATIONS ** INDIA **

EVENT NAME	DATE	LOCATION	TYPE	ANNOUNCED BY	YIELD RANGE
	05/17/74	Northern India	UG		10 to 15 KT
First nuclear test by India. Rajasthan Desert					

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New Hanover County Public Library
ATTN: Librarian

Nebraska University
ATTN Acquisitions Dept

OTHER (Continued)

New Mexico State Library
ATTN: Librarian

New Mexico State University
ATTN: Lib Documents Div

University of New Mexico
ATTN: Director of Libraries

University of New Orleans Library
ATTN: Govt Documents Div

New Orleans Public Lib
ATTN: Library

New York Public Library
ATTN: Librarian

New York State Library
ATTN: Doc Control, Cultural Ed Ctr

New York State Univ at Stony Brook
ATTN: Main Lib Doc Sect

New York State Univ Col at Cortland
ATTN: Librarian

State Univ of New York
ATTN: Library Documents Sec

State Univ of New York
ATTN: Librarian

New York State University
ATTN: Documents Center

State University of New York
ATTN: Documents Dept

New York University Library
ATTN: Documents Dept

Newark Free Library
ATTN: Librarian

Newark Public Library
ATTN: Librarian

Niagara Falls Pub Lib
ATTN: Librarian

Nicholls State Univ Library
ATTN: Docs Div

Nieves M. Flores Memorial Lib
ATTN: Librarian

Norfolk Public Library
ATTN: R. Parker

North Carolina Agri & Tech State Univ
ATTN: Librarian

Univ of North Carolina at Charlotte
ATTN: Atkins Library Documents Dept

Univ of North Carolina at Greensboro, Library
ATTN: Librarian

OTHER (Continued)

North Carolina Central University
ATTN: Librarian

North Carolina State University
ATTN: Librarian

North Carolina University at Wilmington
ATTN: Librarian

University of North Carolina
ATTN: BA SS Division Documents

North Dakota State University Lib
ATTN: Docs Librarian

University of North Dakota
ATTN: Librarian

North Georgia College
ATTN: Librarian

North Texas State University Library
ATTN: Librarian

Northeast Missouri State University
ATTN: Librarian

Northeastern Illinois University
ATTN: Library

Northeastern Oklahoma State Univ
ATTN: Librarian

Northeastern University
ATTN: Dodge Library

Northern Arizona University Lib
ATTN: Government Documents Dept

Northern Illinois University
ATTN: Librarian

Northern Iowa University
ATTN: Library

Northern Michigan Univ
ATTN: Documents

Northern Montana College Library
ATTN: Librarian

Northwestern Michigan College
ATTN: Librarian

Northwestern State Univ
ATTN: Librarian

Northwestern State Univ Library
ATTN: Librarian

Northwestern University Library
ATTN: Govt Publications Dept

Norwalk Public Library
ATTN: Librarian

OTHER (Continued)

University of Notre Dame
ATTN: Document Center

Oakland Comm College
ATTN: Librarian

Oakland Public Library
ATTN: Librarian

Oberlin College Library
ATTN: Librarian

Ocean County College
ATTN: Librarian

Ohio State University
ATTN: Libraries Documents Division

Ohio University Library
ATTN: Docs Dept

Oklahoma City University Library
ATTN: Librarian

Oklahoma City University Library
ATTN: Librarian

Oklahoma Dept of Libraries
ATTN: U.S. Govt Documents

University of Oklahoma
ATTN: Documents Div

Old Dominion University
ATTN: Doc Dept Univ Library

Olivet College Library
ATTN: Librarian

Omaha Pub Lib Clark Branch
ATTN: Librarian

Oregon State Library
ATTN: Librarian

University of Oregon
ATTN: Documents Section

Ouachita Baptist University
ATTN: Librarian

Pan American University Library
ATTN: Librarian

Passaic Public Library
ATTN: Librarian

Paul Klapper Library
ATTN: Documents Dept

Pennsylvania State Library
ATTN: Government Publications Section

OTHER (Continued)

Pennsylvania State University
ATTN: Library Document Sec

University of Pennsylvania
ATTN: Director of Libraries

Penrose Library
University of Denver
ATTN: Penrose Library

Peoria Public Library
ATTN: Business, Science & Tech Dept

Free Library of Philadelphia
ATTN: Govt Publications Dept

Philipsburg Free Public Library
ATTN: Library

Phoenix Public Library
ATTN: Librarian

University of Pittsburg
ATTN: Documents Office G 8

Plainfield Public Library
ATTN: Librarian

Popular Creek Public Lib District
ATTN: Librarian

Association of Portland Lib
ATTN. Librarian

Portland Public Library
ATTN: Librarian

Portland State University Library
ATTN. Librarian

Prescott Memorial Lib
Louisiana Tech Univ
ATTN: Librarian

Princeton University Library
ATTN: Documents Division

Providence College
ATTN: Librarian

Providence Public Library
ATTN: Librarian

Cincinnati & Hamilton County Public Library
ATTN Librarian

Public Library of Nashville and Davidson County
ATTN Library

University of Puerto Rico
ATTN: Doc & Maps Room

Purdue University Library
ATTN: Librarian

OTHER (Continued)

Quinebaug Valley Community Col
ATTN: Librarian

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

Rapid City Public Library
ATTN: Librarian

Reading Public Library
ATTN: Librarian

Reed College Library
ATTN: Librarian

Reese Library
Augusta College
ATTN: Librarian

University of Rhode Island Library
ATTN: Govt Publications Office

University of Rhode Island
ATTN: Director of Libraries

Rice University
ATTN: Director of Libraries

Richard W. Norton Mem Lib
Louisiana College
ATTN: Librarian

Richland County Pub Lib
ATTN: Librarian

University of Richmond
ATTN: Library

Riverside Public Library
ATTN: Librarian

University of Rochester Library
ATTN: Documents Section

Rutgers University, Camden Library
ATTN. Librarian

Rutgers State University
ATTN: Librarian

Rutgers University
ATTN: Government Documents Dept

Rutgers University Law Library
ATTN: Federal Documents Dept

Salem College Library
ATTN: Librarian

Samford University
ATTN: Librarian

San Antonio Public Library
ATTN: Bus Science & Tech Dept

OTHER (Continued)

San Diego County Library
ATTN: C. Jones, Acquisitions

San Diego Public Library
ATTN: Librarian

San Diego State University Library
ATTN: Govt Pubs Dept

San Francisco Public Library
ATTN: Govt Documents Dept

San Francisco State College
ATTN: Govt Pub Collection

San Jose State College Library
ATTN: Documents Dept

San Luis Obispo City-County Library
ATTN: Librarian

Savannah Pub & Effingham Libty Reg Lib
ATTN: Librarian

Scottsbluff Public Library
ATTN: Librarian

Scranton Public Library
ATTN: Librarian

Seattle Public Library
ATTN: Ref Doc Asst

Selby Public Library
ATTN: Librarian

Shawnee Library System
ATTN: Librarian

Shreve Memorial Library
ATTN: Librarian

Silas Bronson Public Library
ATTN: Librarian

Simon Schwob Mem Lib
Columbus College
ATTN: Librarian

Sioux City Public Library
ATTN: Librarian

Skidmore College
ATTN: Librarian

Slippery Rock State College Library
ATTN: Librarian

South Carolina State Library
ATTN: Librarian

University of South Carolina
ATTN: Librarian

OTHER (Continued)

University of South Carolina
ATTN: Government Documents

South Dakota Sch of Mines & Tech
ATTN: Librarian

South Dakota State Library
ATTN: Federal Documents Department

University of South Dakota
ATTN: Documents Librarian

South Florida University Library
ATTN: Librarian

Southdale-Hennepin Area Library
ATTN: Government Documents

Southeast Missouri State University
ATTN: Librarian

Southeastern Massachusetts University Library
ATTN: Documents Sec

University of Southern Alabama
ATTN: Librarian

Southern California University Library
ATTN: Documents Dept

Southern Connecticut State College
ATTN: Library

Southern Illinois University
ATTN: Librarian

Southern Illinois University
ATTN: Documents Ctr

Southern Methodist University
ATTN: Librarian

University of Southern Mississippi
ATTN: Library

Southern Oregon College
ATTN: Library

Southern University in New Orleans, Library
ATTN: Librarian

Southern Utah State College Library
ATTN: Documents Department

Southwest Missouri State College
ATTN: Library

Southwestern University of Louisiana, Libraries
ATTN: Librarian

Southwestern University School of Law Library
ATTN: Librarian

OTHER (Continued)

Spokane Public Library
ATTN: Reference Dept

Springfield City Library
ATTN: Documents Section

St. Bonaventure University
ATTN: Librarian

St. Joseph Public Library
ATTN: Librarian

St. Lawrence University
ATTN: Librarian

St. Louis Public Library
ATTN: Librarian

St. Paul Public Library
ATTN: Librarian

Stanford University Library
ATTN: Govt Documents Dept

State Historical Soc Lib
ATTN: Docs Serials Section

State Library of Massachusetts
ATTN: Librarian

State Library of Ohio
ATTN: Librarian

State University of New York
ATTN: Librarian

Stetson Univ
ATTN: Librarian

University of Steubenville
ATTN: Librarian

Stockton & San Joaquin Public Lib
ATTN: Librarian

Stockton State College Library
ATTN: Librarian

Superior Public Library
ATTN: Librarian

Swarthmore College Lib
ATTN: Reference Dept

Syracuse University Library
ATTN: Documents Div

Tacoma Public Library
ATTN: Librarian

Tampa, Hillsborough County Public Lib
ATTN: Librarian

Temple University
ATTN: Librarian

Tennessee Technological University
ATTN: Librarian

OTHER (Continued)

University of Tennessee
ATTN: Dir of Libraries

Terteling Library
College of Idaho
ATTN: Librarian

Texas A & M University Library
ATTN: Librarian

University of Texas at Arlington
ATTN: Library Documents

University of Texas at San Antonio
ATTN: Library

Texas Christian University
ATTN: Librarian

Texas State Library
ATTN: U.S. Documents Sect

Texas Tech University Library
ATTN: Govt Docs Dept

Texas University at Austin
ATTN: Documents Coll

Texas University at El Paso
ATTN: Documents and Maps Lib

University of Toledo Library
ATTN: Librarian

Toledo Public Library
ATTN: Social Science Dept

Torrance Civic Center Library
ATTN: Librarian

Traverse City Public Library
ATTN: Librarian

Trenton Free Public Library
ATTN: Librarian

Trinity College Library
ATTN: Librarian

Trinity University Library
ATTN: Documents Collection

Tufts University Library
ATTN: Documents Dept

Tulane University
ATTN: Documents Dept

University of Tulsa
ATTN: Librarian

UCLA Research Library
ATTN: Public Affairs Svc/US Docs

OTHER (Continued)

Uniformed Svcs Univ of the Hlth Sci
ATTN: LRC Library

University Libraries
ATTN: Dir of Libraries

Upper Iowa College
ATTN: Documents Collection

Utah State University
ATTN: Librarian

University of Utah
ATTN: Special Collections

University of Utah
ATTN: Dept of Pharmacology
ATTN: Director of Libraries

Valencia Library
ATTN: Librarian

Vanderbilt University Library
ATTN: Govt Docs Sect

University of Vermont
ATTN: Director of Libraries

Virginia Commonwealth University
ATTN: Librarian

Virginia Military Institute
ATTN: Librarian

Virginia Polytechnic Inst Lib
ATTN: Docs Dept

Virginia State Library
ATTN: Serials Section

University of Virginia
ATTN: Public Documents

Volusia County Public Libraries
ATTN: Librarian

Washington State Library
ATTN: Documents Section

Washington State University
ATTN: Lib Documents Section

Washington University Libraries
ATTN: Dir of Libraries

University of Washington
ATTN: Documents Div

Wayne State University Library
ATTN: Librarian

Wayne State University Law Library
ATTN: Documents Dept

Weber State College Library
ATTN: Librarian

Wagner College
ATTN: Librarian

OTHER (Continued)

Wesleyan University
ATTN: Documents Librarian

West Chester State Coll
ATTN: Documents Dept

West Covina Library
ATTN: Librarian

University of West Florida
ATTN: Librarian

West Hills Community Coll
ATTN: Library

West Texas State University
ATTN: Library

West Virginia Coll of Grad Studies Lib
ATTN: Librarian

University of West Virginia
ATTN: Dir of Libraries

Westerly Public Library
ATTN: Librarian

Western Carolina University
ATTN: Librarian

Western Illinois University Lib
ATTN: Librarian

Western Washington Univ
ATTN: Librarian

Western Wyoming Community College Lib
ATTN: Librarian

Westmoreland Cty Comm Coll
ATTN: Learning Resource Ctr

Whitman College
ATTN: Librarian

Wichita State Univ Library
ATTN: Librarian

William & Mary College
ATTN: Docs Dept

William Allen White Library
Emporia Kansas State College
ATTN: Govt Documents Div

William College Library
ATTN: Librarian

Willimantic Public Library
ATTN: Librarian

Winthrop College
ATTN: Documents Dept

University of Wisconsin at Whitewater
ATTN: Governments Documents Library

OTHER (Continued)

Wisconsin Milwaukee University
ATTN: Librarian

Wisconsin Oshkosh University
ATTN. Librarian

Wisconsin Platteville University
ATTN: Librarian

Wisconsin University at Stevens Point
ATTN: Docs Section

University of Wisconsin
ATTN: Govt Pubs Dept

University of Wisconsin
ATTN: Acquisitions Dept

Worcester Public Library
ATTN: Librarian

OTHER (Continued)

Yale University
ATTN: Director of Libraries

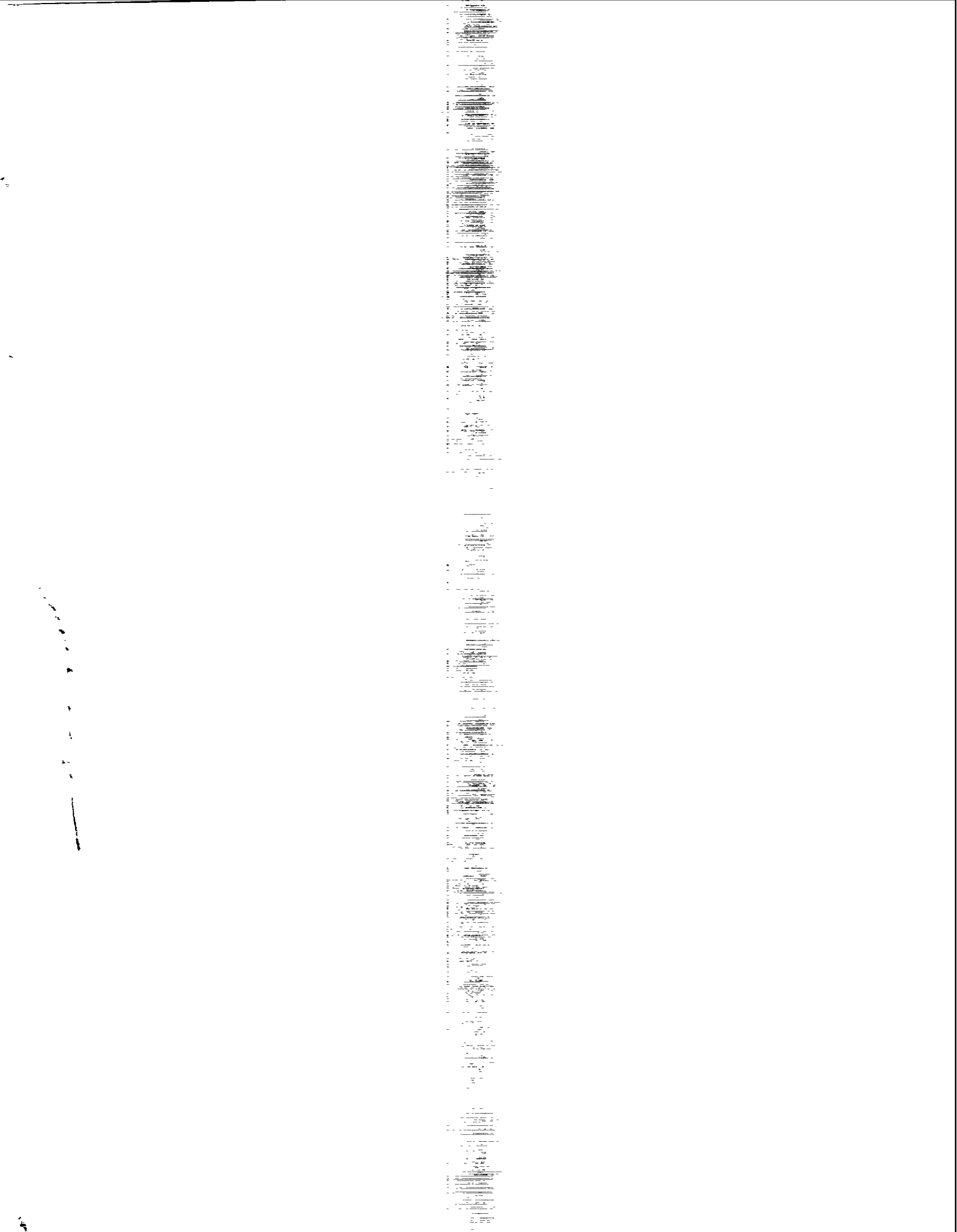
Yeshiva University
ATTN: Librarian

Yuma City County Library
ATTN: Librarian

Wright State Univ Library
ATTN: Govts Documents Dept

Wyoming State Library
ATTN: Librarian

University of Wyoming
ATTN: Documents Div



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