Fact Sheet

Defense Threat Reduction Agency

Radiation Exposure in U.S. Underground Nuclear Testing (1962-1992)

Historical Background

Between 1945 and 1992, the United States conducted 1,054 nuclear weapons tests, 839 of them underground. The U.S. nuclear testing program moved exclusively underground as a result of the Limited Test Ban Treaty (LTBT), which was developed in part to reduce excessive release of nuclear fallout into the planet's atmosphere. The LTBT, signed by President Kennedy on August 5, 1963, prohibited testing nuclear weapons in the atmosphere, underwater and in outer space. The nation's underground nuclear test (UGT) program concluded on September 23, 1992. On September 24, 1996, President Clinton signed the Comprehensive Nuclear Test Ban Treaty, which prohibits any nuclear weapons test explosion by any State Party.

More than 98% of all U.S. UGTs (828 of 839) were conducted at the Nevada Test Site (NTS), including all but one Department of Defense (DOD) sponsored test, which took place in Alaska ("Long Shot"). The DOD sponsored 58 these UGTs, the first of which was "Hard Hat" on February 15, 1962, at the NTS. The remaining UGTs were sponsored by the Atomic Energy Commission (AEC) (now the Department of Energy [DOE]); however, some AEC/DOE tests still had significant DOD involvement. In general, the purposes of the UGTs are listed as: Joint US-UK, Plowshare, Safety Experiments, Vela Uniform, Weapons Effects, and Weapons Related. While most tests were engineered to completely contain the release of radiation from underground, some releases did occur that resulted in measurable personnel exposure.

On January 2, 1980, the Director of the Defense Nuclear Agency (now the Defense Threat Reduction Agency [DTRA]) expanded the Nuclear Test Personnel Review (NTPR) Program to include the UGT participants. This was done in response to the public's growing concern over the biological effects of personnel exposure to radiation during atmospheric nuclear testing. Currently, in support of the NTPR Program, the DOE and DTRA maintain a database of personnel exposures from the U.S. nuclear weapons test program.

Radiation Safety Standards

The DOD UGT program, which started more than a decade into the AEC nuclear testing program, had the benefit of using the lessons learned and technology advances in radiation safety developed during the AEC's program. Comprehensive radiation safety standards were established to limit the exposure of participants to the radiological effects of nuclear detonations while, at the same time, allowing them to receive the unavoidable small doses of radiation as they performed their missions.

The maintenance of conservative radiation safety standards was a top priority during UGTs, which included stringent engineered, supervisory, and administrative controls. Engineered and supervisory controls included details such as: the design and construction of underground containments, placement of radiation monitoring devices to track any radioactive releases, and individually assigned oversight responsibilities to maintain personnel and equipment accountability and safe operations. Administrative standards included details like: site-specific test and radiological procedures, area re-entry limits, exclusion areas, and exposure limits. All

personnel involved in UGTs were required to wear personal dosimetry, be vigilant while at the test site, report anomalies, and maintain exposure as low as reasonably achievable while conducting their official duties.

Radiation Doses from the UGT Program

The UGT program lasted more than 30 years, during which approximately 54,500 DOD-affiliated participants (military, DOD civilian employees, and DOD contractor personnel) were exposed to ionizing radiation attributed to the tests. As technology improved and regulatory requirements evolved, state-of-the-art radiation detection devices were adopted to account for exposure to the low radiation levels present in manned areas during and after testing. All personnel involved with on-site UGTs were monitored for radiation exposure with personal dosimetry devices in addition to the radiation detection devices placed throughout the test site. In general, personal exposure was obtained with film badges (1962-1986) and then solid state dosimeters (1987-1992), supplemented as necessary by extremity, neutron, beta, and real-time indicating dosimeters.

Radiation doses from the DOD UGT program were closely monitored, assessed, and permanently documented for each participant in a comprehensive personnel exposure database. Table 1 gives an overview of the simple average annual occupational radiation exposure received by DOD-affiliated personnel, as well as the single maximum exposure received by an individual each year. In fact, less than 5 percent of participants received measurable radiation exposure. During testing, two personnel exceeded the annual administrative dose limit of 5 rem/year, and six personnel exceeded the quarterly administrative dose limit of 3 rem/quarter. Additionally, due to the potential release of gaseous and particulate radioactivity from UGTs, internal monitoring and bioassay were performed periodically on all personnel with a reasonable potential of ingesting radioactive contamination. All internal monitoring and bioassay results from DOD UGTs were within annual administrative radionuclide intake limits; only four results were recorded above minimum detectable activity.

Table 1. DOD-Affiliated UGT Participant Radiation Exposure by Year

YEAR	Number of Participants	Avg. Exposure (mR)	Max. Exposure (mR)	YEAR	Number of Participants	Avg. Exposure (mR)	Max. Exposure (mR)
1962*	3,953	136	5,790	1967	2,165	21	4,320
1963	1,132	32	3,780	1968	1,983	28	2,215
1964	1,514	9	2,575	1969	1,224	9	1,960
1965	1,826	37	5,300	1970	1,185	29	1,600
1966	2,131	43	4,290	1971 - 1992	47,957 (total)	<10 per year	<1,000 per year

*The 1962 data include DOD personnel exposure from four AEC atmospheric tests.

For more information concerning this program, please call the NTPR Program Helpline at 1-800-462-3683.

Sep 2015