

## Operation SANDSTONE

**Note:** For information related to claims, call the Department of Veterans Affairs (VA) at 800-827-1000 or the Department of Justice (DOJ) at 800-729-7327. For all other information, call the Nuclear Test Personnel Review (NTPR) Program at 800-462-3683.

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

### SANDSTONE Nuclear Weapons Tests<sup>a</sup>

| Shot  | Local Date | Location                                   | Yield (kt) <sup>b</sup> |
|-------|------------|--|-------------------------|
| X-RAY | April 15   | 200-foot (61-meter) tower on Enjebi Island | 37                      |
| YOKE  | May 1      | 200-foot (61-meter) tower on Aomon Island  | 49                      |
| ZEBRA | May 15     | 200-foot (61-meter) tower on Runit Island  | 18                      |

<sup>a</sup> Source: *United States Nuclear Tests, July 1945 through September 1992*, DOE/NV-209 (Rev. 15), Dec 2000.

<sup>b</sup> One kiloton equals the approximate energy release of one thousand tons of TNT.

### Historical Background

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

The weapons were tested at Enewetak by a joint military and civilian organization designated Joint Task Force 7 (JTF 7). This was a military organization in form, but contained military, civil service, and contractor personnel of the Department of Defense (DoD) and the AEC. The commander of this force was the appointed representative of the AEC and reported to both the Joint Chiefs of Staff and the Commander-in-Chief, Pacific. Peak DoD numerical strength at SANDSTONE was approximately 19,700 personnel.

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

## **Radiation Protection Standards**

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

1. Keeping personnel radiation exposure at the lowest possible level consistent with medical knowledge of radiation effects and the importance of the test series.
2. Avoiding inadvertent contamination of populated islands and transient shipping.

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

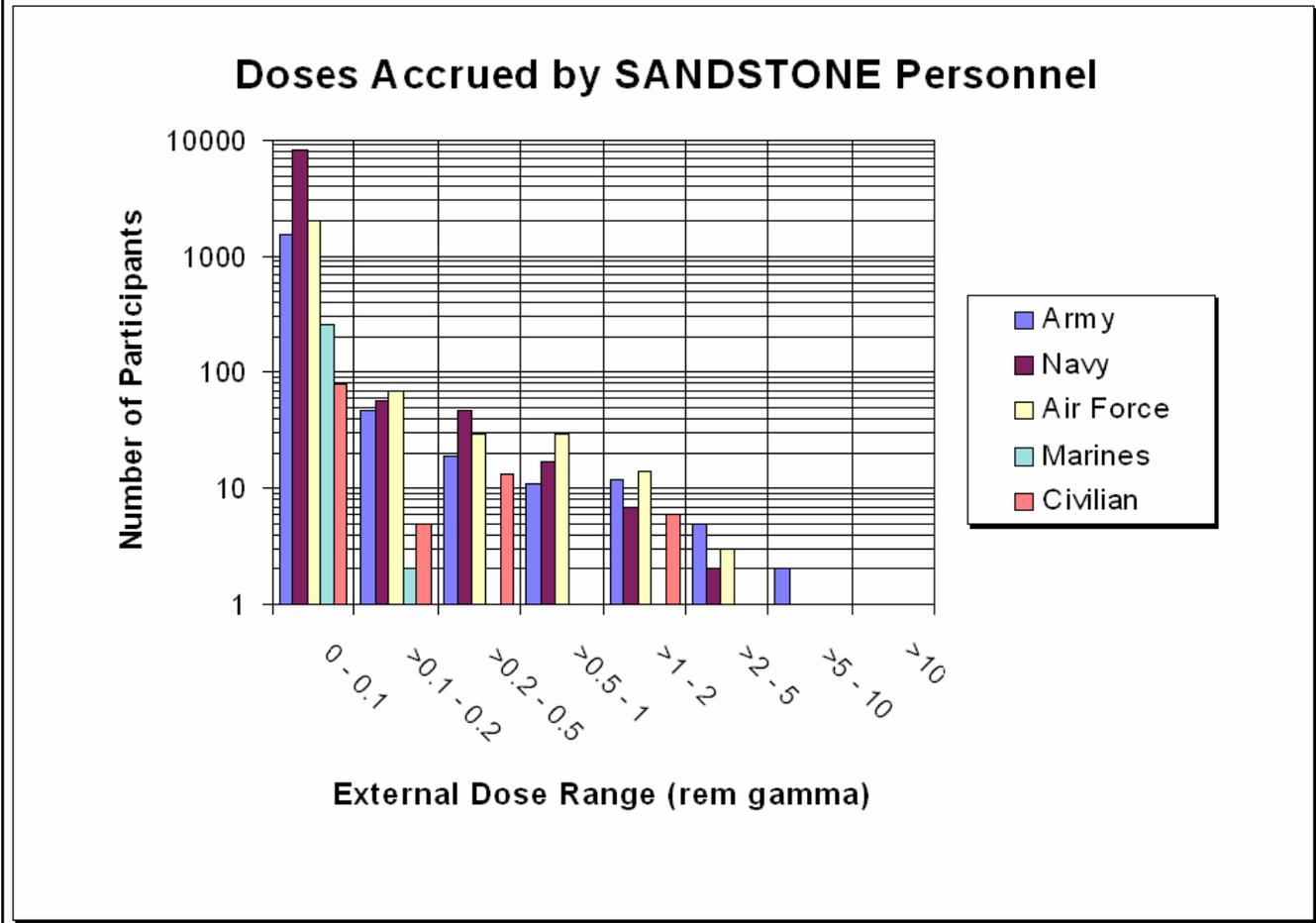
## **Radiation Doses at Operation SANDSTONE**

Most of the inhabited islands and support ships in the area did not receive appreciable fallout from the three SANDSTONE shots. The reconstructed dose from fallout for most persons who were resident on Enewetak or Kwajalein, or were shipboard for the entire operation, is less than 1.0 rem.\* Kwajalein Atoll received the principal amount of fallout among these on May 3, two days after Shot YOKE.

The only personnel who received more than the fallout on the residence islands were those working where exposures were expected to occur, such as handling cloud samples, recovering instruments from the forward islands, and monitoring areas of high radiation.

The highest DoD dose for the Army was 6.1 rem, accrued by a individual supporting scientific projects; for the Navy the highest dose was 4.7 rem recorded for a radiation monitor with the Joint Radiological Safety Group. Only eight personnel received doses in excess of the limit of 3 rem. In fact, the total dose recorded on film badges for badged JTF 7 personnel at SANDSTONE averaged less than 0.2 rem, and approximately 65 percent of these had total readings of zero rem.

The totals of reconstructed and film badge doses for SANDSTONE participants are depicted below.



\* A rem is a radiation protection unit of measure that quantifies the risk of biological effects resulting from exposure to ionizing radiation. Ionizing radiation is any radiation (gamma, x-ray, beta, neutron or alpha) capable of displacing electrons from atoms or molecules, thereby producing ions. According to the National Council on Radiation Protection and Measurements (NCRP, Report No. 93, Table 8.1), the general U.S. population receives about 0.36 rem per year from natural background radiation sources (radon, cosmic rays and rocks) and man-made radiation sources (medical diagnostic x-rays and consumer products).

For more information on dose reconstruction, see the report “Analysis of Radiation Exposure for Naval Personnel at Operation SANDSTONE” (DNA-TR-83-13), available online at <http://www.dtra.mil/documents/rd/DNATR8313.pdf>. Also see the report “Operation SANDSTONE 1948” (DNA 6033F), available online at [http://www.dtra.mil/rd/programs/nuclear\\_personnel/atr.cfm](http://www.dtra.mil/rd/programs/nuclear_personnel/atr.cfm).

July 2007