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Fact Sheet

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Subject: HARDTACK Fact Sheet

HARDTACK was the designation given to the atmospheric nuclear weapon tests conducted by the United States in the Pacific Ocean and in Nevada in 1958. Operation Hardtack I was a series of 35 tests, all but two of which were detonated at Enewetak* and Bikini atolls in the Marshall Islands, the Atomic Energy Commission's (AEC) "Eniwetok Proving Ground" (EPG). The other two were detonations at 42 and 76 km above Johnston Island, which lies about 700 nmi (1.296 km) west-southwest of the Hawaiian Islands.

The tests were conducted by a joint military and civilian organization, designated Joint Task Force 7 (JTF 7). JTF 7 was a military organization in form but was made up of military personnel, Federal civilian employees, and contractors of the Department of Defense (DOD) and the AEC. The commander of this force was the appointed representative of the AEC and reported also to the Joint Chiefs of Staff (JCS) and the Commander in Chief, Pacific (CINCPAC).

TEST OPERATIONS

During HARDTACK the United States fired as many nuclear devices (35) as had been fired in all prior Pacific Ocean tests. Not only was the total number of shots in HARDTACK large, but the variety of types was great; land- and water-surface events, underwater detonations, and ballon-and rocket-borne high-altitude tests were conducted. The following page of this fact sheet lists the names, dates, and locations of the shots.

In a sense, HARDTACK was divided into three parts. The first was aimed at the development of nuclear weapons, continuing the type of testing that had taken place at Enewetak and Bikini during the early and mid-1950s. In these tests, the AEC weapon development laboratories (Los Alamos Scientific Laboratory and the University of California Radiation Laboratory) detonated their experimental devices, with the DOD providing support and conducting experiments that did not interfere with the AEC activities.

The second part, sponsored by DOD, consisted of the underwater test shots, WAHOO and UMBRELLA, the first in the open ocean and the second within the lagoon at Enewetak. The purpose of these tests was to improve the understanding of the effects of underwater explosions on Navy ships and material. These tests could be considered as a continuation of BAKER test of the CROSSROADS series at Bikini in 1946 and the WIGWAM test 500 nmi (927 km) off the U.S. west coast in 1955.

* Formerly Eniwetok. The spelling of Marshall Island place names has changed in recent years in order to more accurately render the sounds of the Marshall Island names using English spelling.

HARDTACK I detonations, 1958.

Local Date	Assigned Name	Location	Type Burst
28 April	YUCCA	Between Enewetak and Bikine	High Altitude (balloon)
6 May	CACTUS[a]	Enewetak	Surface
12 May	FIR	Bikini	Barge
12 May	BUTTERNUT	Enewetak	Barge
13 May	KOA[b]	Enewetak	Surface
16 May	WAHOO	Enewetak, in ocean	Underwater
21 May	HOLLY	Enewetak	Barge
22 May	NUTMEG	Bikini	Barge
26 May	YELLOWWOOD	Enewetak	Barge
27 May	MAGNOLIA	Enewetak	Barge
30 May	TOBACCO	Enewetak	Barge
31 May	SYCAMORE	Bikini	Barge
3 June	ROSE	Enewetak	Barge
9 June	UMBRELLA	Enewetak, lagoon	Underwater
11 June	MAPLE	Bikini	Barge
15 June	ASPEN	Bikini	Barge
15 June	WALNUT	Enewetak	Barge
18 June	LINDEN	Enewetak	Barge
28 June	REDWOOD	Bikini	Barge
28 June	ELDER	Enewetak	Barge
29 June	OAK[c]	Enewetak	Barge
29 June	HICKORY	Bikini	Barge
2 July	SEQUOIA	Enewetak	Barge
3 July	CEDAR	Bikini	Barge
6 July	DOGWOOD	Enewetak	Barge
12 July	POPLAR	Bikini	Barge
14 July	SCAEVOLA[d]	Enewetak	Barge
18 July	PISONIA	Enewetak	Barge
22 July	JUNIPER	Bikini	Barge
23 July	OLIVE	Enewetak	Barge
27 July	PINE	Enewetak	Barge
31 July	TEAK[e]	Johnston Island area	High Altitude (rocket)
6 August	QUINCE	Enewetak	Surface
11 August	ORANGE[e]	Johnston Island area	High Altitude (rocket)
18 August	FIG	Enewetak	Surface

Notes: Yields have not been announced except as noted below.

[a] 18 KT.

[b] 1.37 MT.

[c] 8.9 MT.

[d] Low.

[e] Megaton range.

The third part, also sponsored by DOD, addressed a military problem that was newer: nuclear weapons in air and ballistic missile defense. The HARTACK tests directed toward this problem consisted of three high-altitude shots, two of which (TEAK and ORANGE) were rocket borne and were conducted at Johnston Island. The third of these high-altitude tests. YUCCA, was carried aloft by a balloon over the ocean between Enewetak and Bikini. These high-altitude tests used device placement techniques and data-recording operations that were new to nuclear weapons testing.

Central to the test series was the experimental program. This program and its requirements dictated the form of the test organization and the detail of personnel participation. HARDTACK's experimental program incorporated two aspects, the first of which was the development of the weapons themselves, and the second involved the measurement of the explosive and radiation effects. Unlike earlier nuclear test series, the HARDTACK test operations supporting each aspect were in large part separate.

These two aspects can serve as a rough measure of differentiation of interest between the major participants: the AEC interest in weapon development, and the DOD interest in the military application of the effects of the explosions. The several parts of the weapon development and effects studies each had particular features that led to the possibility of radiation exposure.

RADIOLOGICAL SAFETY

For Operation HARDTACK, CJTF 7 was directed to "assume overall responsibility for the radiological safety of Task Force personnel and of populated islands." To carry out this responsibility, the JTF 7 Operation Plan further directed that a Fallout Plotting Center be set up and that the capability be established to keep the task force and CINCPAC informed of the fallout situation at all times, including the announcement of safe reentry times. Fallout stations were to be set up and technical assistance given to personnel in the Trust Territory of the Pacific Islands. Monitors and couriers were to be provided for radioactive sample centers.

In addition, the Operation Plan specified that task group commanders establish radiation safety (radsafe) units within the task groups with adequate special clothing and radiac instrumentation. Task groups were also to provide a roster of their personnel for film badge preparation.

The radsafe program for Operation HARDTACK was divided into two parts: on-site and offsite. Onsite radsafe activities were conducted by the various task groups, with the scientific task group given the responsibility for all radsafe functions associated with diagnostic experimental programs and for dosimetry and other technical services to the entire task force. The operation of the offsite program and the coordination of the onsite activities were conducted by the Radsafe Office of Hq JTF 7.

RADIATION SAFETY STANDARDS

A maximum permissible exposure (MPE) for personnel was set at 3.75 roentgens (R) (gamma only) per consecutive 13-week period with a maximum of 5 R for the operation. Exceptions were made for emergency and other tactical situations. The operation was defined as the period from 15 days before the first ready date to 15 days after the last shot. A special MPE of 10 R was authorized for crewmembers of air-sampling aircraft. In the event of operational error or emergency, an additional exposure of 10 R would be accepted. Any exposure in excess of 20 R total would be considered as an overexposure for aircrew samplers.

The limit of 3.75 R per 13-week period was slightly greater than the National Council on Radiation Protection and Measurements and the International Commission on Radiation Protection limit of 3 R per 13-week period in effect at that time. The limit of 5 R for the operation is equivalent to the exposure currently permitted per year by Federal guidelines for radiation workers. Appropriate remarks were to be included in the medical records of

personnel who exceeded the 3.75 and 5 R limits. Military personnel were to be advised that they should not be exposed to further radiation until sufficient time elapsed to bring their average radiation exposure down to 0.3 R/week. Civilian personnel in this category were to be informed that limitations of further radiation exposure were to be determined by the laboratory or agency having administrative jurisdiction over such personnel.

A film badge program provided an exposure-indicating device to all JTF 7 personnel to maintain complete exposure information on everyone entering the EPG during the operation. The commander of the scientific task group assigned overall badging responsibility to a special task unit. Beginning 1 April 1958, film badges were issued to all individuals upon their arrival at the EPG with instructions that the badge be worn at all times and turned in on recall, upon exit from any contaminated area, or upon departure from the EPG.

SUMMARY OF TASK FORCE EXPOSURES

The table on the following page documents the numbers and percent of task force personnel who received exposures in various categories. These data are based on the latest data available and may be added to as research is completed. Of the some 19,600 individuals badged at HARDTACK, 99 percent had exposures that did not exceed the current Federal guidelines of 5 R per year. The highest recorded exposure for the series was 12.41 R. The overall joint task force mean exposure was 0.87 R.

During the conduct of the series only one incident occurred of an exposure of a large group of JTF 7 personnel to significantly elevated radiation levels. This happened on 14 May when the base islands (Enewetak and Parry) at Enewetak Atoll received fallout from a test shot that had been detonated at Bikini two days before. This fallout episode, which lasted about 60 hours, could have contributed as much as 1.2 to 1.5 R total dose to personnel on Enewetak Atoll depending upon the island on which they lived and their work activities. However, since nearly all personnel wore film badges, this fallout exposure is reflected in the film badge doses.

There was one known incident of offsite fallout. Two Japanese research vessels operating outside the danger area set up around the EPG detected an increase in radiation after shot POPLAR. An investigation by the JTF 7 Staff Surgeon revealed that this exposure was small, amounting to, at most, 0.085 R for the crew, and even this figure did not reflect the decontamination procedures that were used to lower the contamination.

The detonations during HARDTACK I, including those at Johnston Island, did not expose the Hawaiian Islands to fallout.

Summary of HARDTACK I exposures

	No. of Persons Badged	Exposure Ranges (roentgens) 0	0.001-0.999	1.000-2.999	3.000-4.999	5.000-9.999	Over 10	High Recorded (R)
Army	1,574	136	371	1,011	54	2	0	6.63
% of Total		9	24	64	3	1	0	
Navy	8,704	1,024	6,637	1,029	12	2	0	5.96
% of Total		12	76	12	1	1	0	
Air Force	3,795	598	1,281	1,730	106	73	7	12.41
% of Total		16	34	45	3	2	1	
Marine Corps	219	24	151	43	1	0	0	3.23
% of Total		11	69	20	1	0	0	
Other Military	179	33	49	95	2	0	0	3.59
% of Total		19	27	53	1	0	0	
DoD Contractors	113	10	59	41	3	0	0	4.05
% of Total		9	52	36	3	0	0	
Other Participants	5,067	1,050	1,623	2,266	126	2	0	5.26
% of Total		21	32	45	2	1	0	
Total Participants	19,651	2,875	10,171	6,215	304	79	7	12.41
% of Total		15	52	31	1	1	1	