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## CHAPTER 8

# HIGH-ALTITUDE NUCLEAR WEAPONS EFFECTS INFORMATION

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### A. General Information

This chapter provides guidance for determining if historical records containing NSI, pertaining to high-altitude nuclear weapons effects are to be declassified or have their classification retained beyond 25 years in accordance with the provisions of E.O. 12958. **Documents containing RD and FRD are not addressed by this document and retain present classification.**

In the early years of nuclear testing, little effort was devoted to determining the effect of air density at high altitudes upon the partitioning of primary weapon energy output into blast, and thermal and nuclear (i.e., *neutron and gamma*) radiation. The first test addressing this area was the HA (High Altitude) shot in the Teapot Series on April 6, 1955. The weapon was airdropped and detonated at 40,000 feet with a yield of 3kt. The test was intended to study the energy partition phenomena as a function of air density in the region from 4,000 to 40,000 feet. On April 28, 1958, the balloon launched Yucca shot in the Hardtack Phase I series was detonated at 86,000 feet. During test series in the remainder of 1958 and in 1962, a total of 10 rocket launched "high altitude" shots were conducted. Based on these tests, it was determined that the interaction of the weapon energy with the surroundings (i.e., energy partition) at high-altitude is markedly different from that at lower altitudes. A "high altitude burst" as defined in *The Effects of Nuclear Weapons*, (Glasstone, 1962; Glasstone and Dolan, 1977), is one in which the explosion takes place at an altitude in excess of 100,000 feet. In the context of the Limited Test Ban Treaty, a high-altitude detonation is defined as one above 250,000 feet. For the

purposes of this guide, the weapon effect phenomena definition from *The Effects of Nuclear Weapons* is used to identify high-altitude tests. However, the HA and Yucca shots, although conducted below this altitude, are also included.

When a nuclear weapon is detonated at high altitude, there is little or no air present in which to deposit the radiative output of the weapon. Therefore, a radiation opaque fireball does not form, other attenuation effects are minimized, and the radiation can travel great distances while remaining at significant energy levels. One result of such detonations can be widespread radio and radar blackout.

The United States has performed a limited number of high-altitude nuclear weapon effects tests to gather data about these phenomena. These tests are identified in section D of this chapter.

### B. Broad Guidance

Theoretical or generic information about high-altitude phenomenology, including radio frequency blackout phenomena, is unclassified. Measurements and empirical data from high-altitude nuclear weapons tests as well as the related analysis and calculations must be referred to the Defense Threat Reduction Agency (DTRA) for a classification review. All analyses of classified data on radio frequency blackout and other high-altitude effects, obtained from the few such tests the United States conducted, must be treated the same as the data. For an unclassified treatment of the results of these tests, see *The Effects of Nuclear Weapons*, an unclassified publication, by Glasstone and Dolan (1977).

Most generic nuclear weapon effects information has already been released for civil defense or scientific purposes. The DTRA [formerly Defense Special Weapons Agency (DSWA), Defense Nuclear Agency (DNA), Defense Atomic Support Agency (DASA) and Armed Forces Special Weapons Project (AFSWP)] has published a series of unclassified reports that discuss the operations and purposes of DoD tests, including high-altitude tests. In the relatively infrequent instances where effects information remains classified, the overriding reason is the protection of classified nuclear weapon design (RD), outputs (RD and FRD), yield (FRD), or vulnerability and hardness information about a specific weapon. Some information about high-altitude phenomenology and radio frequency blackout is classified as NSI. The availability of data on high-altitude tests is extremely limited. There is no opportunity to obtain additional data without a high-altitude nuclear test, which is prohibited by the 1963 Limited Test Ban Treaty. Therefore, retaining classification of data and analyses of data from U.S.

high-altitude tests effectively denies such data to all potential adversaries.

Historical records, 25 years or older, containing high altitude effects NSI not covered by the specific guidance below are unclassified. This does not include records containing information classified by statute such as RD and FRD (AEA of 1954, as amended). These records shall be handled, protected, classified, downgraded, and declassified in accordance with the provisions of the AEA and regulations issued under that Act. Reviewers who are not authorized by DOE/NNSA to classify or declassify such documents should not attempt final determinations. Refer to appendix A for information on identifying and handling documents containing potential RD/FRD. In all cases where there is a question concerning the sensitivity of the information, it should be referred to the DOE HQ classification office for a classification determination.

**Topics describing information likely to contain or closely related to RD or FRD are marked "(potential for RD/FRD)".**

**C. Topics**

**8.0 HIGH-ALTITUDE NUCLEAR WEAPONS EFFECTS INFORMATION**

8.1 Empirical data from nuclear tests conducted at high-altitudes as defined herein  
*NOTE: Refer to DTRA for review.* **Refer (potential for RD/FRD)**

8.1.1 Theory and generic descriptions of high-altitude phenomenology and radio frequency blackout **U**

8.2 Results of tests conducted at high-altitudes as defined herein  
*NOTE: Refer to DTRA for review.* **Refer (potential for RD/FRD)**

8.3 Previously declassified high altitude-test information **U**  
*NOTE: See Section D, below.*

### D. Previously Declassified High-Altitude Test Information

1. A total of 12 (10 rocket, 1 airdrop, 1 balloon) nuclear weapons effects tests were conducted to study the effect of air density (altitude) on weapon output (i.e., thermal/blast energy partition). Although the HA and Yucca shots (see list below) do not meet the 100,000 ft minimum burst height for onset of high-altitude effects, it is appropriate they be included herein as they were instrumental in determining this lower altitude limit. Officially announced unclassified information about these tests is provided in DOE/NV 209 (Rev. 15), *United States Nuclear Tests, July 1945 through September 1992*, December 2000. Unclassified information about high-altitude test results can also be found in *The Effects of Nuclear Weapons* by Glasstone and Dolan (1977).

Test	Operation (DOE/DOD)	Type	Date	Yield Range	Altitude <sup>a</sup>
HA	Teapot	Airdrop	04/06/55	3 kt	40,000 ft
Yucca	Hardtack I/Newsreel	Balloon	04/28/58	1.7 kt	86,000 ft
Teak	Hardtack I/Newsreel	Rocket	08/01/58	3.8 Mt	252,000 ft
Orange	Hardtack I/Newsreel	Rocket	08/12/58	3.8 Mt	141,000 ft
Argus I	Argus	Rocket	08/27/58	1-2 kt	~300 miles
Argus II	Argus	Rocket	08/30/58	1-2 kt	~300 miles
Argus III	Argus	Rocket	09/06/58	1-2 kt	~300 miles
Starfish Prime	Storax/Dominic I (Fishbowl)	Rocket	07/09/62	1.4 Mt	250 miles
Checkmate	Storax/Dominic I (Fishbowl)	Rocket	10/20/62	low	10s of miles
Bluegill 3 Prime	Storax/Dominic I (Fishbowl)	Rocket	10/26/62	sub-megaton	10s of miles
Kingfish	Storax/Dominic I (Fishbowl)	Rocket	11/01/62	sub-megaton	10s of miles
Tightrope	Storax/Dominic I (Fishbowl)	Rocket	11/04/62	low	10s of miles

<sup>a</sup> Altitude is expressed in feet/miles. Historical documents would most likely contain measurements expressed in these units.

2. For all NSI documents discussing high-altitude tests (at an altitude in excess of 100,000 feet), initially consult DOE/NV 209 or consult *The Effects of Nuclear Weapons*. If the only information in the document(s) is also in those publications, then the information is unclassified. Any elaboration beyond the information in those publications should be referred to DTRA under topics 8.1 and 8.2 above (for weapons effects) or will generally be RD if device design is revealed.
3. For the tests conducted during Operation Argus, any description of yield other than what is specifically given in DOE/NV 209 (i.e., other than "1-2 kt") is FRD and is not subject to release under E.O. 12958.

4. High-altitude tests Checkmate, Bluegill 3 Prime, Kingfish, and Tightrope have not had their yields announced. Their yields are FRD and are not subject to release under E.O. 12958.
5. The heights of burst of Checkmate, Bluegill 3 Prime, Kingfish, and Tightrope are expressed only as 10s of miles (kilometers). Any descriptions other than those in DOE/NV 209 or *The Effects of Nuclear Weapons* are FRD under the "mosaic compilation" concept and are not subject to release under E.O. 12958.
6. High-altitude tests conducted as Operation Newsreel (Yucca, Teak, and Orange), and Operation Fishbowl (Starfish Prime, Checkmate, Bluegill 3 Prime, Kingfish, and Tightrope) were DoD tests. All documents not revealing RD/FRD information (i.e., design, output, yield) must be coordinated with DoD prior to declassification.
7. Frigate Bird, the May 6, 1962, operational test of a Polaris missile (Operation Nougat/Dominic I), is often confused with the high-altitude test program because it was rocket launched. It is properly characterized as an atmospheric test and per the topical classification guide on weapon testing, its height of burst is unclassified. Its yield is FRD and, therefore, not subject to release under E.O. 12958.

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