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Effects of Nuclear Earth-Penetrator and Other Weapons—*Short Summary*

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Background

Underground facilities are used extensively by many nations to conceal and protect strategic military functions and weapons' stockpiles. Many of these facilities represent potentially serious threats to U.S. national security and, therefore, are potential military targets. Because of their depth and hardened status, however, many of these strategic hard and deeply buried targets (HDBTs) could only be put at risk by conventional or nuclear earth penetrating weapons (EPW). Since 1960, Department of Defense and Department of Energy laboratories have maintained EPW programs, which have resulted in the development of a nuclear EPW. More recently, an engineering feasibility study, the robust nuclear earth penetrator (RNEP) program, was started to determine if a more effective EPW could be designed using major components of existing weapons. This activity has created some controversy about, among other things, the level of collateral damage that would ensue if such a weapon were used. To help clarify this issue, the Congress, in P.L. 107-314, directed the Secretary of Defense to request from the NRC a study of the anticipated health and environmental effects of nuclear earth-penetrators and other weapons. In addition, the study also examined the effect of both conventional and nuclear weapons against the storage of biological and chemical weapons.

Findings

Many of the more important strategic hard and deeply buried targets (HDBTs) are beyond the reach of conventional explosive penetrating weapons and can be held at risk of destruction only with nuclear weapons. Many—but not all—known and/or identified hard and deeply buried targets can be held at risk of destruction by one or a few nuclear weapons.

Nuclear earth-penetrator weapons (EPWs) with a depth of penetration of 3 meters capture most of the advantage associated with the coupling of ground shock. While additional depths of penetration increases ground-shock coupling, it also increases the uncertainty of EPW survival. To hold at risk hard and deeply buried targets, the nuclear yield must be increased with increasing depth of the target. The calculated limit for holding hard and deeply buried targets at risk of destruction with high probability using a nuclear EPW is approximately 200 meters for a 300 kiloton weapon and 300 meters for a 1 megaton weapon.

Current experience and empirical predictions indicate that earth-penetrator weapons *cannot* penetrate to depths required for total containment of the effects of a nuclear explosion.

For the same yield, and weather conditions, the number of casualties from an earth-penetrator weapon detonated at a few meters depth is, for all practical purposes, equal to that from a surface burst of the same weapon yield. Any reduction in casualties due to the use of an EPW is attributable primarily to the reduction in yield made possible by the greater ground shock produced by buried bursts.

The yield required of a nuclear weapon to destroy a hard and deeply buried target is reduced by a factor of 15 to 25 by enhanced ground-shock coupling if the weapon is detonated a few meters below the surface.

For attacks near or in densely populated urban areas using nuclear earth-penetrator weapons on hard and deeply buried targets (HDBTs), the number of casualties can range from thousands to more than a million, depending primarily on weapon yield. For attacks on HDBTs in remote, lightly populated areas, casualties can range from as few as hundreds at low weapon yields to hundreds of thousands at high yields and with unfavorable winds.

For urban targets, civilian casualties from a nuclear earth-penetrator weapon are reduced by a factor of 2 to 10 compared with those from a surface burst having 25 times the yield.

In an attack on a chemical or biological weapons facility, the explosive power of conventional weapons is not likely to be effective in destroying the agent. However, the BLU-118B thermobaric bomb, if detonated within the chamber, may be able to destroy the agent. An attack by a nuclear weapon would be effective in destroying the agent only if detonated in the chamber where agents are stored.

In an attack with a nuclear weapon on a chemical weapons facility, civilian deaths from the effects of the nuclear weapon itself are likely to be much greater than civilian deaths from dispersal of the chemical agents. In contrast, if the target is a biological weapons facility, release of as little as 0.1 kilogram of anthrax spores will result in a calculated number of fatalities that is comparable on average to the number calculated for a 3 kiloton nuclear earth-penetrator weapon.

For Further Information

Copies of the complete report, *Effects of Nuclear Earth-Penetrator and Other Weapons,* can be obtained on the National Academy Press Web site <www.nap.edu/catalog/ >

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COMMITTEE ON THE EFFECTS OF NUCLEAR EARTH-PENETRATOR AND OTHER WEAPONS

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