Topic Page: Hydrogen bomb

Definition: **hydrogen bomb** from *Dictionary of Energy*

Nuclear. an extremely powerful type of nuclear weapon, in which the fusion of deuterium and tritium (heavy isotopes of hydrogen) releases enormous amounts of energy in the form of heat.

Image from: **The first hydrogen bomb tested in 1952 by the...** in *Science in the Contemporary World: An Encyclopedia*

Summary Article: **hydrogen bomb**
from *The Columbia Encyclopedia*

or H-bomb, weapon deriving a large portion of its energy from the nuclear fusion of hydrogen isotopes. In an atomic bomb, uranium or plutonium is split into lighter elements that together weigh less than the original atoms, the remainder of the mass appearing as energy. Unlike this fission bomb, the hydrogen bomb functions by the fusion, or joining together, of lighter elements into heavier elements. The end product again weighs less than its components, the difference once more appearing as energy. Because extremely high temperatures are required in order to initiate fusion reactions, the hydrogen bomb is also known as a thermonuclear bomb.

The first thermonuclear bomb was exploded in 1952 at Enewetak by the United States, the second in 1953 by Russia (then the USSR). Great Britain, France, and China have also exploded thermonuclear bombs, and these five nations comprise the so-called nuclear club—nations that have the capability to produce nuclear weapons and admit to maintaining an inventory of them. The three smaller Soviet successor states that inherited nuclear arsenals (Ukraine, Kazakhstan, and Belarus) relinquished all nuclear warheads, which have been removed to Russia. Several other nations either have tested thermonuclear devices or claim to have the capability to produce them, but officially state that they do not maintain a stockpile of such weapons; among these are India, Israel, and Pakistan. South Africa's apartheid regime built six nuclear bombs but dismantled them later.

The presumable structure of a thermonuclear bomb is as follows: at its center is an atomic bomb; surrounding it is a layer of lithium deuteride (a compound of lithium and deuterium, the isotope of hydrogen with mass number 2); around it is a tamper, a thick outer layer, frequently of fissionable material, that holds the contents together in order to obtain a larger explosion. Neutrons from the atomic explosion cause the lithium to fission into helium, tritium (the isotope of hydrogen with mass number 3), and energy. The atomic explosion also supplies the temperatures needed for the subsequent fusion of deuterium with tritium, and of tritium with tritium (50,000,000 degrees Celsius and 400,000,000 degrees Celsius, respectively). Enough neutrons are produced in the fusion reactions to produce further fission in the core and to initiate fission in the tamper.

Since the fusion reaction produces mostly neutrons and very little that is radioactive, the concept of a “clean” bomb has resulted: one having a small atomic trigger, a less fissionable tamper, and therefore less radioactive fallout. Carrying this progression further results in the **neutron bomb**, which has a minimum trigger and a nonfissionable tamper; it produces blast effects and a hail of lethal neutrons but almost no radioactive fallout and little long-term contamination. This theoretically would cause minimal physical damage to buildings and equipment but kill most living things. Developed in 1958 by the United States and successfully tested, a number of countries are believed to have included such weapons in

their nuclear arsenals; the United States built several hundred neutron bombs in the 1980s but did not deploy them.

The theorized **cobalt bomb** is, on the contrary, a radioactively “dirty” bomb having a cobalt tamper. Instead of generating additional explosive force from fission of the uranium, the cobalt is transmuted into cobalt-60, which has a half-life of 5.26 years and produces energetic (and thus penetrating) gamma rays. The half-life of Co-60 is just long enough so that airborne particles will settle and coat the earth's surface before significant decay has occurred, thus making it impractical to hide in shelters. This prompted physicist Leo Szilard to call it a “doomsday device” since it was capable of wiping out life on earth.

Like other types of nuclear explosion, the explosion of a hydrogen bomb creates an extremely hot zone near its center. In this zone, because of the high temperature, nearly all of the matter present is vaporized to form a gas at extremely high pressure. A sudden overpressure, i.e., a pressure far in excess of atmospheric pressure, propagates away from the center of the explosion as a shock wave, decreasing in strength as it travels. It is this wave, containing most of the energy released, that is responsible for the major part of the destructive mechanical effects of a nuclear explosion. The details of shock wave propagation and its effects vary depending on whether the burst is in the air, underwater, or underground.

See disarmament, nuclear and nuclear weapons; see also nuclear energy.

See Rhodes, R. , Dark Sun: The Making of the Hydrogen Bomb (1995).

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