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Types of Nuclear Weapons

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Nuclear bombs are the most dangerous weapons on earth. One can destroy a whole city, potentially killing millions, jeopardizing the natural environment and lives of future generations through its long-term catastrophic effects. The dangers from such weapons arise from their very existence. Although nuclear weapons have only been used twice in warfare – in the bombings of Hiroshima and Nagasaki in 1945 – about 22,000 reportedly remain in our world today and there have been over 2,000 nuclear tests conducted to date [1]. Disarmament is the best protection against such dangers, but achieving this goal has been a tremendously difficult challenge.

Nuclear bombs harness the forces that hold the nucleus of an atom together by using the energy released when the particles of the nucleus (neutrons and protons) are either split or merged. There are several ways that nuclear energy can be released from an atom:

1. Fission Weapons (Atomic Bombs)

Nuclear fission (Fig. 1) is a process in which a neutron collides with an atom's nucleus, splitting the atom into two smaller atoms and releasing a significant amount of energy. Every collision also releases more neutrons, which in a critical mass of fissile material will sustain a chain reaction of fission. By manipulating the size and speed of the chain reaction, nuclear fission can be exploited for power generation or alternatively, for weapons of mass destruction. The reduced

size and weight of these more advanced weapons also makes them much easier to deliver than earlier types [2, 3].

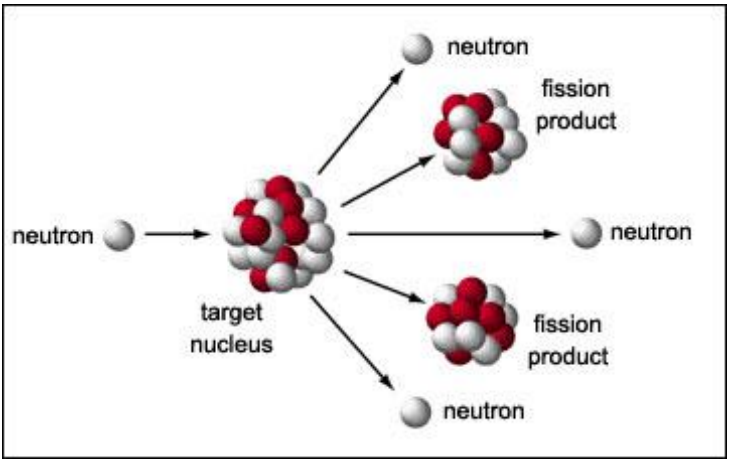

Fig. 1. Nuclear fission

2. Fusion Weapons

Fusion reactions power the sun and the stars. The fusion of deuterium and tritium, both heavy isotopes of hydrogen, releases energy as well as a neutron with seven times more energy than a fission neutron. Fusion's energy output per kilogram of source material is much higher than that of fission.

Fusion can be used inside a fission exploison to improve the efficiency of the weapon (boosting), or a large amount of fusion fuel can be triggered separately (thermonuclear weapon). The fusion of deuterium and tritium is initiated by the extremely high temperatures and radiation that result from fission.

3. Thermonuclear Weapons (Hydrogen Bombs)

Thermonuclear bombs yield explosions in the megaton range. This standard bomb uses a fission primary to trigger a powerful fusion secondary. The X-rays released from the primary explosion compress and ignite the secondary. The

main threat posed by thermonuclear weapons is their ability to pack huge amounts of explosive power into small, light-weight packages that can be delivered by missiles.

The first hydrogen bomb was exploded on November 1, 1952 at the small island Eniwetok in the Marshall Islands [3]. Its destructive power was several megatons of trinitrotoluene (TNT).

4. Gun-Type Design (HEU)

This is the "simplest" type of nuclear explosive and was detonated over the city of Hiroshima by the United States in World War II. The design uses highly enriched uranium (HEU) as fissile material, which is obtained by concentrating atoms of the rare uranium - 235 (U-235) isotope. It is believed that the fission of slightly less than one kilogram of U-235 released energy equivalent to approximately 15,000 tons of TNT. Due to its long, thin shape, the Hiroshima bomb was called "Little Boy".

"Little Boy"

Compared to the one used on Hiroshima, the Nagasaki bomb was rounder and fatter. It was called “Fat Man”. The material used was plutonium - 239 (Pu-239). The fission of slightly more than one kilogram of Pu-239 is thought to have released destructive energy equivalent to about 21,000 tons of TNT [4].

“Fat Man”

It should be noted that, the creation of nuclear weapons gave impetus to the development of a peaceful atom.

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