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Study on the effect of advancement of nuclear technology on human civilization

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Abstract

Human is supposed to be a creature which always uses mind to think for the betterment of future. This thought process generates new ideas which converts later in form of physical laws and finally in technology. Human civilization has experienced great influence of science and technology which is reflected in life standard. In the journey of technological development, technologists have developed several techniques in which few are threatening the life of human being. So many scientists have contributed in developing technologies in the field of space science, missile technology, arms, artillery and digital technology. Although the basic idea behind the development of these techniques was to provide safety and security and to sustain human life. But now a days in competitive world, it seems threatening to human life.

Through this paper consequences of technological development in the field of nuclear energy on human civilization have been discussed. Merits and demerits, provisions and policies available for the nuclear weapons and present scenario in the field of nuclear energy have been discussed.

Keywords: Nuclear energy, power generation, warheads, human civilization.

1. Introduction

Rigveda, Puranic texts and Shatapatha brahmana have referenced about human existence^[1]. Scientific evidence also exists to support Charles Darwin's theory of evolution about human existence. In ancient time human civilization sustained by hunting and creating society to live and support each other^[2]. Human has extraordinary mind to think, to create new ideas and new ways to live life more comfortably. Therefore, as per Hinduism, it is considered that the main four goals of human life are dharma, artha, kama and moksha. Following this thought and to achieve these goals, human mind generated various good things in which few converted into curse because these are dangerous to human life.

Science has solved numerous mysteries which are directly related to human existence. In long journey of science and technology, solution of various mysteries came as blessings to human by which human life flourished but simultaneously few of them became dangerous to human existence. Most of the discoveries and the inventions have both positive and negative aspects. For example: Michael Farady (1791-1867), produced current through magnet and a coil. On the other side, in 1800, Italian physicist Alessandro Volta discovered that by constructing the voltaic pile and by creating a steady flow of electric charge, a steady electric current can be produced. After that, uses of electricity started for betterment of human life. Now a days electrical energy generated from power plants is used to power devices, appliances and transportation. On the other hand, it becomes dangerous to human life during contact with parts of living being causing shock, burns and sometimes life loss. Faults which could cause fires, causes explosive where electricity could be source of ignition. Nuclear fission and fusion technology is also one of the important achievements discovered by scientists.

In this paper, application of nuclear fission and fusion technology, nuclear weapons based on this technology, present status and its consequences have been discussed in detail.

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2. Nuclear fission and fusion technology

Fission is the process in which a heavy, unstable nucleus splits into two or more lighter nuclei with generation of energy. For example, uranium can split into strontium, krypton and free neutrons with generation of huge amount of energy. Fusion is the process in which two atoms combine together to form a heavier atom with generation of lots of energy. For example, when two hydrogen atoms fuse to form one helium atom then it gives several times greater energy than fission. This process of generation of energy is safe as it does not produce highly radioactive fission products. Fusion can also be combined with fission reaction which is known as hybrid nuclear reaction. Devices designed to harness this energy are known as fission and fusion reactors in which heat generated from nuclear fission and fusion reactions can be used to generate electricity^[3].

Nuclear power reactors are used to generate electricity but nuclear waste produced by nuclear reactors is unsafe to human life^[4]. At present approx 11% of the world's electricity is generated by approx 450 nuclear power plants which produces lots of nuclear waste. Few other nuclear reactors are under construction which will fulfill our electricity requirements in near future. In India, twenty-one nuclear power reactors are operational in seven nuclear power plants and seven more nuclear reactors are under construction.

On the other side, nuclear fission and fusion technology is used to make nuclear weapon^[5] or bombs which is an explosive device that derives its destructive force from nuclear reactions which have the capacity to destroy the human existence.

The United States was the first country to manufacture nuclear weapons and it also tested and used it. World has witnessed after effect of nuclear bombs on human life, when first time the uranium bomb detonated by USA over Hiroshima which yielded explosive equal to 15000 tonnes of TNT and Plutonium bomb exploded over Nagasaki (Japan). During the use of these two bombs, around two lacs people were killed and many more were affected by the harmful radiation emitted from radioactive waste material produced by the explosion. This incidence gives idea about deadly nature of the nuclear technology.

3. Provisions and policies for nuclear weapons

Considering destructive nature of nuclear weapons and threat on human beings, few nuclear weapon possessing countries have prepared and signed nuclear ban treaties^[6]. Some of them are:

- 1968 Nuclear Nonproliferation Treaty (NPT)
- 1996 Comprehensive Nuclear Test Ban Treaty (CTBT)
- 2010 Treaty on measures for the further reduction and limitation of strategic offensive arms
- 2017 Treaty on the prohibition of nuclear weapons

Various organizations like International Campaign to Abolish nuclear weapons (ICAN) are also working to implement UN nuclear ban treaty.

But most of the countries are violating above treaties and continuously modernizing their nuclear weapon and missile technology. North Korea announced its withdrawal from the NPT in January 2003 and is expanding nuclear weapon program. Israel, India and Pakistan never signed the NPT.

4. Present scenario of warheads

The front part of a guided missile or rocket that carries the nuclear explosive material is known as warheads and may be considered as bullet used in nuclear weapon. Most of the nuclear power countries are working to make advance and deadly warheads and continuously increasing number of nuclear warheads.

1461 strategic warheads^[6] deployed on 524 intercontinental ballistic missiles, submarine launched ballistic missiles, and strategic bombers by Russia. While approximately 4490 stockpiled warheads and 2000 retired warheads i.e. a total of roughly 6490 warheads are available with Russia.

USA has approximately 3800 stockpiled warheads and 2385 retired warheads i.e. a total of 6185 warheads. Warheads in retirement means that these are no longer stockpiled.

Russia and USA both are decreasing their nuclear warheads, but simultaneously both have long term program under way to replace and modernize their nuclear warheads, missile and aircrafts delivery systems and nuclear weapon production facilities.

China has approx 290 warheads and France has about 300 warheads. United Kingdom has approx 200 warheads. Pakistan has approximately 150-160 nuclear warheads while as India has approximately 135 nuclear warheads. Israel has approx 90 nuclear warheads.

China is continuously modernizing its nuclear weapons and its delivery systems and is slowly increasing the size of its nuclear weapons. Other countries are also increasing their nuclear weapons. They are also modernizing and developing space, air, sea and land-based missile delivery systems. Use of digital communication technology in modernizing nuclear weapons and its delivery system have made them more deadly.

At present North Korea is developing and testing nuclear weapons and new types of long-range ballistic missile delivery systems at very high rate which is very much dangerous to human existence. Approx. 100 nuclear warheads will be with North Korea by year 2020 because North Korea have approx 40 Kg of plutonium and approx 500 Kg uranium to be converted in warheads.

Stockholm International Peace Research Institute (SIPRI)^[6] clearly states that all the nuclear weapon possessing countries are developing new nuclear weapon systems and modernizing their existing systems.

On the other hand, the number of personnel deployed with peace operations worldwide continues to fall while the demand is increasing.

Conclusions

Considering destruction due to use of only two nuclear weapons on Hiroshima and Nagasaki and presently available and deployed nuclear weapons it is clear that nuclear weapons developed by the various countries threatens the human civilization. Thus, future nuclear war may be considered as the end of human civilization. In the light of above facts, it is concluded that-

- Modern technology should be used for the peace and for the positive use of human being.
- Nuclear disarmament is the urgent need of the present time and highly demanded.
- The world needs a clear commitment from the nuclear weapon possessing countries to an effective, legally

binding towards nuclear disarmament.

- The fissile material should be used only for peaceful work like space programmes, transportation and power generation through nuclear reactors.

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