Pollution OF RADIATIONS FROM NUCLEAR POWER PLANTS

Nuclear energy promised limitless amounts of clean electric power with the commencement of first power plant. There were about 600 nuclear power reactors in developed countries upto 1985. US alone have 100 licensed nuclear plants. About 53 power plants were cancelled between

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1980 and 1984 due to enormous radiation danger. No plant has been ordered since 1978. Nuclear electric power first became available in early 1950s. At that time few realised the potential risk by nuclear power plants. The first mishap occurred within a few months after the commissioning of power plant. By the end of 1960s there had been no less than half a dozen major reactor accidents in UK, USA. Canada and Switzerland, which resulted in enormous radiation pollution all over the globe.

Three Mile Island power plant leakage in 1979 in USA and the **'melt down'** of reactor case of **Chernobyl** power plant in USSR (CIS) in 1986 are some of the sad instances of nuclear plant accidents.

Although nuclear power plants are more convenient to run. Once fuelled, they can operate for several months. These plants are different from conventional electricity generating plants. In the fuelled plants, fossil fuel is burnt to produce heat. But the fuel used in nuclear plants, being radioactive is critically dangerous and the waste materials are equally so. No power plant is perfectly contamination proof. Leakage may occur from several points which may be chronically radioactive.

Radiowaste generated by nuclear power plants : The radioactive wastes generated by power plants may be in the following forms :

(a) Low-level radioactive liquid wastes : Radioactive wastes in solution coming from power plants contaminate with aquatic life. These radioelements are eventually conveyed to man from water supplies to food chain through soil, vegetation or livestock.

(b) Gaseous and particulate radiowastes : Stack effluents from atomic power plants contain gaseous and particulate radioisotopes such as H-3, C-14, Kr-85 and I-129 etc. Some of these radionuclides have critically long halflives and may be distributed in the environment for several years. When these radioisotopes are inhaled by man, they get concentrated in specific organs posing injurious health effects. According to a recent estimate about 36 megagrams per giga watts per year spent nuclear fuels are discharged from a pressurised water reactor causing deleterious effects on living organisms.

(c) Fission fragments : The largest volume of radioactive wastes comes from reprocessing of irradiated fuel. These radionuclides include Sr-90, I-131, Cs-137 and Co-58 etc. These wastes and traces of induced radionuclides such as P-32, Fe-59 and Zn-65 are released into the rivers, ditches, waste holding ponds and aquatic environment. Sr-90 released from atomic power plants concentrates in the aquatic food web.

(d) Release of tritium : The heavy water reactors contain high tritium (H-3) inventories because of its production through irradiation of deuterium (D_2) in heavy water (D_2O). Tritium is also released from primary coolants in which lithium hydroxide in added to slow down corrosion in PWR. Tritium so released from power reactors emits beta (β) radiations like radioactive carbon, strontium and other radionuclides. Tritium becomes distributed to an altitude of about 10 km. in the atmosphere and in the oceans to a depth of 40 feet emanating radiations in the environment.

(e) Heat release : In power plants, atomic pellets of uranium metal are used as fuel in nuclear reactors which contain **three million times** as much potential energy as fossil fuel. An estimate shows that **one tonne** of uranium produces as much energy as **12 million barrels of oil.** This nuclear fuel produces enormous heat. One gram of fissionable material releases 23000 K. watt hours of heat causing thermal pollution in air and water bodies.

Products of nuclear explosions in nature : Since 1945, when nuclear bombs were exploded

on Hiroshima and Nagasaki in Japan, a large number of nuclear and thermonuclear explosions have been carried out in various parts of the world. As a consequence, the products of nuclear explosions have spread through the atmosphere over the earth's surface. An **atom bomb** contains U-235 or Pu-239 in which there occurs a chain reaction of fission of the atomic nuclei of uranium or plutonium at the instant of explosion. The action of **hydrogen bomb** is based on the thermonuclear reaction between deuterium and tritium.

$$^{2}_{1}H + ^{3}_{1}H \rightarrow ^{4}_{2}He + ^{1}_{0}n$$

This reaction takes only 3×10^{-6} seconds and proceeds with the release of an enormous amount of energy. But for the reaction to be triggered, an excessively high temperature is required as the **match** to induce fusion. Such a temperature can be provided by an atom bomb. Therefore, a hydrogen bomb, which contains a mixture of deuterium and tritium, is detonated by an atomic plutonium bomb. In the thermonuclear explosion of a hydrogen bomb, actually the atomic bomb is exploded first, followed by a thermonuclear or fusion reaction.

The fission or U-235 or Pu-239 in the explosion of an atomic bomb and also of a hydrogen bomb (also called a fusion bomb or thermonuclear device) releases an enormous amount of neutrons which bombard the surrounding substances and form radioactive isotopes. In this way, large amount of radioactive carbon-14 and tritium are formed. Besides, a large quantity of fission products is also ejected into the atmosphere. The most dangerous of these are Sr-90 and Cs-137.

NUCLEAR INSTALLATIONS