

Nuclear Pollution & their control measure

The term pollution is derived from Latin word 'Pollutio' mean from polluto (Pol = Per & through + Luere = to wash) & to make dirty.

Pollution is the unfavourable alteration of our environment, largely because of human activities.

Pollution may be defined "as matter in the wrong place & anything released into the environment which degrades its quality".

A/c to Odum; E.P. Pollution is an undesirable alteration in the physical, chemical or biological characteristics of our air, land and water that harmfully affect the human life & the desirable species & that may waste & deteriorate our raw material resources.

National Academy of Science, U.S.A (1966) defined pollution "as pollution is an

undesirable change in physical, chemical & biological characteristics of air, water and soil that may harmful affect human, animals & plant life, the industrial progress,

living conditions & cultural assets.

Types of Pollution:-

Pollution - is of following type.

- (1) Air Pollution -
- (2) Water " -
- (3) Noise " -
- (4) Soil " -
- (5) Nuclear " -
- (6) Mercury " - etc.

Nuclear Pollution

Nuclear pollution is a significant source of environmental pollution. It may be natural & Artificial & Anthropogenic. The nuclear pollution is caused by different types of radiations. Such which come from UV, visible cosmic rays and microwave radiation. The biggest hazard comes from X-rays. The radiation may be ionizing & non-ionizing. The ionizing radiations come from natural resources. The radioisotopes persist much longer in the environment.

The substance which cause pollution may called pollutants. In nuclear pollution, pollutants may be -

- a) Ionizing radiations
- b) Non-ionizing Radiations

a) The Ionizing Radiations - It includes X-rays, gamma rays, & α & β particles

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It causes injury to the living tissue. Hence, called high energy radiation. These are capable of removing electrons from atoms & attach them to other ~~atoms~~ atoms, hence called ionizing radiation.

(b) Non-ionizing - It includes heat, light, radio waves, that carry enough energy to excite atoms but not enough to produce ions are called non-ionizing radiation. The UV-rays are the important example of non-ionizing radiation.

The radioactive fallout is the dust which fell on the ~~and~~ earth after atomic explosions. It is suspended at a height of about 10-15 km above the earth's surface & may come down to soil and water in the form of radioactive rain.

Radioactive fallout causing radiation pollution is of two types -

(A) Early fall out -

(B) Delayed fall out.

(A) Early fall out -

If the nuclear explosion is at a very low altitude, it sucks up large quantities of soil & water affecting severely all the living biota.

(B) Delayed fall out -

If the nuclear explosion occurs at a high altitude. It sucks little dirt & ~~water~~ water. It is also known as worldwide fallout.

Definition of Nuclear pollution

Nuclear pollution is pollution created by mishandling and inappropriate storage of spent nuclear fuel rods, and pieces of protective clothing & tools that have become contaminated and by insecure transportation of highly radioactive material over long distances to a processing plant.

Causes

i) Intense nuclear energy from radioactive fuel is used to heat water to steam, small amounts of radiation are released during this process into water which may then dispose off indiscriminately causing nuclear pollution.

~~The radioactive elements are released through various sources, and nuclear pollution~~

i) Nuclear accidents from nuclear energy generation plants

ii) the use of nuclear weapons as weapons of mass destruction (WMD)

iii) use of radio isotopes,

iv) Mining

v) Spillage of radioactive chemicals

vi) Tests on radiation

vii) Genetic mutations

viii) Diseases

The nuclear power plant releases the fission & fissionable radio wastes such as ^{90}Sr , ^{137}Cs , ^{134}Cs , ^{131}I , etc. from fragments such as ^{90}Sr , ^{90}Y , ^{137}Ba , ^{137}La , ^{134}Ba , ^{134}La , etc. and released from atomic bomb had been.

Heat release - It has been observed that one ton of uranium may produce 12 million barrels of energy. There are many radio-active elements that cause nuclear pollution such as -

| | | | |
|----------------|---|-------------------|--------------------|
| Uranium - 238 | - | 4.5×10^9 | - half life period |
| Radium - 226 | - | 166 | - " |
| Carbon - 14 | - | 5,574 | - " |
| Caesium - 137 | - | 30 | - " |
| Krypton - 85 | - | 10.8 | - " |
| Potassium - 40 | - | 1.3×10^9 | - " |
| Radon - 222 | - | 3.8 | - day - " |
| Strontium - 90 | - | 28 | - days - " |
| Zinc - 65 | - | 250 | - day - " |

(The rate of disintegration of radio active element is represented by a term 'half life' which may be defined as the period of time within which half of the nuclei in a sample of radioactive substance undergoes disintegration or decay.)

In Japan - Fukushima Daiichi nuclear disaster, Chernobyl disaster & Three mile Island accident their life may be affected and many more affected by radiation released.

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It has been observed that use of nuclear missiles & atomic bombs, a form of nuclear energy, in the second world war not only cause but also damaging the environment & contaminate. The effect of two strikes in Hiroshima and Nagasaki that (gas) causes disease and number of cancer.

The use of isotopes uranium and other elements in high concentration cause the environment contaminated. Consumption of these isotopes by fish cause serious disease &

many mining ores which are broken into small pieces (Radium, Uranium) increase the environmental problem. Other minerals such as Thorium, plutonium, radon, potassium, Carbon 2, phosphorus contaminate environment.

Various spillages of radioactive chemicals including petroleum products have a significant level of radiation which can be detected & detrimental to the environment.

Many test on radiation by the scientist also one of the major source of nuclear pollution. Chemotherapy a cancer curative health initiative uses radiation to prevent further growth of cancer cells and keep the immune system strong.

Cosmic rays, Gamma rays & x-ray also one of the major source of

Nuclear Pollution

The sources of nuclear pollution may be natural & man-made.

Sources of nuclear pollution

Natural sources

1. Cosmic rays from outer space
2. Emission from radioactive materials in the earth's crust (Rocks, minerals, sediments,

Man-made sources

1. Mining & processing of radioactive ores
2. Use of radioactive materials in power plants
3. Use of radioactive isotopes
4. Industrial applications include waste from nuclear reactions
5. Radioactive fallout during nuclear weapons testing
6. Air & water leak & accident in nuclear power plant.
7. Nuclear tests. Conducted under the ground & under oceans & which also release radiation.
8. Uranium mining & nuclear reactors and reprocessing of nuclear fuel cause nuclear pollution.

Effect:-

Shorter effects:-

Radioactive elements cause damage to cell membranes, mitochondria which resulting in abnormal cell function, cell division, growth & death.

2) Genetic effects:- Radioactive elements change the genetic make up of cells. These effects ~~the~~ are mainly due to damages to DNA molecules. People suffer from blood cancer & bone cancer if exposed to doses around 100 to 1000 roentgens.

3. Effects on plants -

Plants need some type of non-ionizing radiation like sunlight for photosynthesis. UV-radiation affects plant growth & sprouting & it also damage the stomata & ultimately the plant is destroyed.

4. Effects on human beings -

Ionizing radiation has sufficient energy to affect the atoms in living cells & thereby damage their genetic material (DNA). Exposure of high levels of radiation cause acute health effects such as skin burns & acute radiation syndrome. Exposure to low level of radiation encountered in the environment does not cause immediate health effects, but may cause a risk of cancer.

5) Effects on human environment.

Out of 450 known radio-isotopes, only some are of environmental concern like Strontium 90, tritium, Plutonium 239, argon 41, Cobalt 60, Cesium 137, Iodine 131, Krypton 85 etc. These can be both beneficial & harmful, depending on the way in which they are used.

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X-rays which is used to examine bones for fractures, treat cancer with radiation & diagnose disease with the help of radioactive isotopes. It damage the food chain. eg. Sr-90 behaves like Ca^{++} & is easily deposited & replaces Ca^{++} in the bone tissues. It could be passed to human beings through ingestion of Strontium-contaminated milk. Again another example is tritium, which is radioactive hydrogen.

Radon causes damage to lungs ruptures capillaries, collapses, structure & causes immediate death or injury. Radiation damage headache, nausea, vomiting, diarrhoea & even death, depending upon the dose of radiation received.

6. Beneficial aspects of Radiation:-

According to 2001 report, Food are loses about 10% due to ill storage. which cost about 10,000 crores loss every year.

Earlier food are prevented due to putrefaction by drying, Canning, Salting, heat treatment, dehydration & freezing. At present, nuclear technology ~~has~~ has added, this process is called "food irradiation". i.e. treatment & bombarding food substances with low energy gamma rays from a radioisotope such as Co-60 & Cs-137.

- ii) Irradiation diminishes microbial growth reduces spoilage
- iii) Irradiation destroys insects in cereals, grains, flour, peanuts, dried fruits, vegetables etc
- iv) Inactivate pathogens & parasites that endanger health
- v) Irradiation sterilization can be used successfully to store pork, sausage, beef, chicken, cod, fish etc
- vi) Recently DRDO scientists reported that food like chapatti, Puri^{et} can be safely irradiated
- vii) Irradiation can drastically reduce the use of food additives and fumigants, which pose genotoxic and even potential health hazards.
- viii) Co-60 is water insoluble so there is no risk of environmental contamination. Co-60 gets converted into non-radioactive nickel after its use. So, there is no problem of radioactive waste disposal.

Preventive measures from nuclear pollution

9) Following preventive measures should be adopted from nuclear pollution -

- ✓ Production of radioisotopes should be minimized
- i) minimum number of nuclear installations should be commissioned.
- iii) Fission reactions should be minimized

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- iv / In nuclear mines, wet drilling may be done underground to minimize the nuclear leak.
- v / Nuclear devices should never be exploded in air. It should be exploded underground.
- vi / use of high chimneys and Ventilation at the working place where radioactive contamination is high.
- viii / Nuclear medicines & radiation therapy should be applied only when absolutely necessary.
- x / No Laboratory generated nuclear waste should be disposed off safely & scientifically.
- x / Nuclear power plant should be located in areas after careful study of the geology of the area, tectonic activity & meeting other established conditions.
- xi / Appropriate protection against occupational exposure.
- xii / Safety measure against accidental release of radioactive demands must be ensured in nuclear plants.
- xiii / Regular monitoring of the presence of radioactive substance in high risk area should be ensured.