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Short Communication

Radioactive Pollution in Drinking Water

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A radionuclide or radioisotope is an atom that has the same atomic number but different atomic mass i.e. same number of electrons and protons and a different number of neutrons e.g. $^{12}C_6$, $^{13}C_6$, $^{14}C_6$. They are carrying excess nuclear energy by which they are unstable in the environment. This excess energy can be used in different ways such as either direct emission from the nucleus in the form of Gamma (γ) radiations or it may be transferred to one of its electrons which is released as a conversion electron or it can be used to emit new particles viz. Alpha (α) and Beta (β) particles from the nucleus itself. This process of energy conversion is known as radioactive decay.

There are two major types of radionuclide one is primordial radionuclide which is existing on the earth since its formation whereas, the cosmogenic radionuclide is formed in the atmosphere as well as the upper layer of the earth crust.

The sources of such ionizing radiation in the environment are natural and manmade. Naturally, occurring radionuclide are Uranium (^{234}U, ^{235}U, ^{238}U), Potassium^{40}, Thorium, etc. The radioactive elements are useful for nuclear power plants for the generation of electricity and in the military as a high-density penetrator. However, it is also used in nuclear weapon testing. Radioactive materials are generally introduced in drinking water through naturally occurring radioactive elements like Uranium and Thorium. Technological processes like minerals processing, mining, phosphate-containing fertilizers production, etc. Radionuclide also discharged into the environment through the nuclear fuel cycle, inappropriate use of an unsealed form of manufactured radionuclide, unacceptable way of use in the medical and industrial field, improper ways of disposal of radioactive material, past evidence of the release of radionuclide into the environment which ultimately reaches into the water resources.

Monitoring and assessment of radionuclide in drinking waters are carried out in two basic steps.

Screening level for Alpha (α) and Beta (β) activity of the sample in Bq/lit. Where, 1Becquerel= 1 disintegration/second (SI unit). Gross α and Gross β activity can be analyzed by using standardized methods:

- **Evaporation:** It is recommended by the International organization for standard 1991a and 1991b. ISO-9695 (for gross β) and ISO -9696(for gross α).
- **Co-precipitation:** It is recommended by American Public Health Association (APHA 1998).

If initial screening exceeded guidance level then the concentration of individual radionuclide has to be determined. Individual radionuclide concentration should be ≤ 0.1mSv. Where, 1Sv (Sivert) = 1J/Kg (SI unit).

The current guidelines for drinking water are based on reference dose level (RDL) 0.1mSv from possible availability of radioactive isotopes consumption through drinking water per year, recommended by International Commission on Radiological Protection (ICRP) 1991 and International basic safety standard (IAEA) 1996 and are accepted by World Health Organization (WHO).

There are various treatments available to reduce heavy radionuclide concentration from the water viz. Aeration, air stripping, adsorption by activated carbon with efficiency 67-99%, >99%, 70-100% respectively.

Factors instrumental in human exposure to the radiations include height above the mean sea levels, radionuclide composition in air, food and drinking water, types and amount of radionuclide

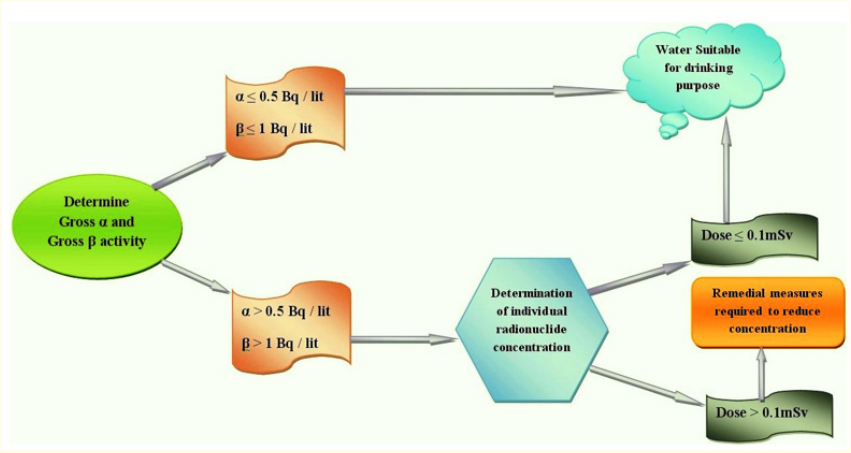

Figure 1: Systematic representation of monitoring radioactive pollution in drinking water.

in soil, etc. The health impacts are significantly dependent on the amount of radionuclide taken into the body through ingestion and inhalation. These ionizing radiations are more powerful and harmful to the health and environment. Such radiations are responsible for health effects viz. hereditary effects, genetic malformation, non-fatal cancer, fatal cancer, reduction in blood cell count. Sometimes death is occurred due to higher dose exposure.

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