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RADIOACTIVE WASTE MANAGEMENT

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Abstract- The safe disposal of radioactive waste presents one of the most difficult environmental problems faced by industrial countries. The important issues are safe custody of the received radioisotopes, surveillance for their safe applications in the department and the disposal of the radioactive wastes generated from human use of these radioisotopes. The radioactive waste disposals must take into account permissible concentrations applicable from the standpoint of community safety, ensure that the degree of dilution envisaged is achieved at the discharge point (from the institution into the sewage system), and the hazard to the general population is worst in the event of the sludge containing radioactive waste material being used as fertilizer.

KEYWORDS: Radioactive, Nuclear Waste, Environment

1. INTRODUCTION-

Radioactive, Nuclear Waste, Environment, Radioactive decay, also known as nuclear decay or radioactivity, is the process by which a nucleus of an unstable atom loses energy by emitting particles of ionizing radiation. A material that spontaneously emits this kind of radiation, which includes the emission of energetic alpha particles, beta particles, and gamma rays, is considered radioactive. There are many different types of radioactive decay.

Alpha decay occurs when the nucleus ejects an alpha particle (helium nucleus). Beta decay occurs when the nucleus emits an electron or positron and a type of neutrino, in a process that changes a proton to a neutron or the other way around. The nucleus may capture an orbiting electron, converting a proton into a neutron (electron capture). In both alpha and beta decay some amount of energy is also released. In gamma decay, a nucleus changes from a higher energy state to a lower energy state through the emission of electromagnetic radiation (photons). In the present age, the increasing demand of electric energy, the race among the countries to create nuclear weapons, advancement in medical science and also some advance research programs necessitate the use of radioactive element.

Aim of Study:
Radioactive contamination, also called radiological contamination, is the deposition of, or presence of radioactive substances on surfaces or within solids, liquids or gases (including the human body), where their presence is unintended or undesirable (from Iaea definition)[1].

Such contamination presents a hazard because of the radioactive decay of the contaminants, which emit harmful ionizing radiation such as alpha particles or beta particles, gamma rays or neutrons. The degree of hazard is determined by the concentration of the contaminants, the energy of the radiation being emitted, the type of radiation, and the proximity of the contamination to organs of the body. It is important to be clear that the contamination gives rise to the radiation hazard. The purpose of this paper is to provide information.

Radioactive Waste:
Radioactive waste consists of a variety of materials having different physical and chemical properties and containing different types of radioactivity. There are no international standard definitions of waste, although the Iaea has proposed five categories [3] and each nation tends to have developed its own classification system Radioactive wastes are the leftovers from the use of nuclear materials for the production of electricity, diagnosis and treatment of disease and other purposes. Radioactive waste is classified into following main categories

Exempt waste (Ew):
This is waste with such a low radioactivity content, which no longer requires controlling by the regulatory authority. Once the material is cleared by the regulatory authority it is no longer considered as radioactive waste.
This is waste that can be stored for a limited period of up to a few years to allow its radioactivity content to reduce by radioactive decay. It can subsequently be cleared from regulatory control according to

arrangements approved by the regulatory authority for disposal as ordinary waste, for use or for controlled discharge. This class includes waste containing radionuclides with very short half-lives often used for research and medical purposes.

Very low level waste (Vllw):
This waste usually has higher radioactivity content than EW but may, nonetheless, not need a high level of containment and isolation. It is suitable for disposal in near-surface landfill type facilities with limited regulatory control. Typical waste in this class includes soil and rubble with low levels of radioactivity which originate from sites formerly contaminated by radioactivity. It may contain small amounts of longer-lived radionuclides.

Low level waste (Llw):
This waste has a high radioactivity content but contains limited amounts of long-lived radionuclides. It requires robust isolation and containment for periods of up to a few hundred years and is suitable for disposal in engineered near surface facilities. It covers a very broad range of waste and may include short-lived radionuclides at higher levels of activity concentration, and also long-lived radionuclides, but only at relatively low levels of activity concentration.

Intermediate level waste (Ilw):
This is waste that, because of its radioactivity content, particularly of long -lived radionuclides, requires a greater degree of containment and isolation than that provided by near surface disposal. However, Ilw needs no provision, or only limited provision, for heat dissipation during its storage and disposal. Ilw may contain long-lived radionuclides that will not decay to a level of activity concentration acceptable for near surface disposal during the time for which institutional controls can be relied upon. Therefore, waste in this class requires disposal at greater depths, of the order of tens of metres to a few hundred meters.

High level waste (Hlw):
This is waste with levels of activity concentration high enough to generate significant quantities of heat by the radioactive decay process or waste with large amounts of long-lived radionuclides that need to be considered in the design of a disposal facility for such waste. Disposal in deep, stable geological formations usually several hundred meters or more below the surface is the generally recognized option for disposal of Hlw.

2. METHODS OF RADIOACTIVE WASTE DISPOSAL:

Proper disposal of radioactive waste is key to protecting the public's health and safety and the quality of the environment. However, because it can be so hazardous and can remain radioactive for so long, finding suitable disposal facilities for radioactive waste is difficult. However, some useful methods of disposal of radioactive waste are:

Ecological Disposal:
The principle of geological disposal is to isolate the waste deep inside a suitable rock formation to ensure that no significant or harmful quantities of radioactivity ever reach the surface environment. The benefits of geological disposal include:
1. Removing the burden of responsibility from future generations to actively manage this hazardous material.
2. Removal of the safety and security risks and ongoing costs inherent in having to indefinitely maintain and protect surface storage facilities for this material which will remain hazardous for many years.
3. Reducing the waste’s environmental impact.

Reprocessing:
Reprocessing has also emerged as a viable long term method for dealing with waste. As the name implies, the process involves taking waste and separating the useful components from those that aren’t as useful. Specifically, it involves taking the fissionable material out from the irradiated nuclear fuel. Concerns regarding re-processing have largely focused around nuclear proliferation and how much easier re-processing would allow fissionable material to spread.

Transmutation:
Transmutation also poses a solution for long term disposal. It specifically involves converting a chemical element into another less harmful one. Common conversions include going from Chlorine to Argon or from Potassium to Argon. The driving force behind transmutation is chemical reactions that are caused from an outside stimulus, such as a proton hitting the reaction materials. Natural transmutation can also occur over a long period of time. Natural transmutation also serves as the principle force behind geological storage on the assumption that giving the waste enough isolated time will allow it to become a non-fissionable material that poses little or no risk.

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Space Disposal:

Space disposal has emerged as an option, but not as a very viable one. Specifically, space disposal centers around putting nuclear waste on a space shuttle and launching the shuttle into space. This becomes a problem from both a practicality and economic standpoint as the amount of nuclear waste that could be shipped on a single shuttle would be extremely small compared to the total amount of waste that would need to be dealt with. Furthermore, the possibility of the shuttle exploding en route to space could only make the matter worse as such an explosion would only cause the nuclear waste to spread out far beyond any reasonable measure of control. The upside would center around the fact that launching the material into space would subvert any of the other issues associated with the other disposal methods as the decay of the material would occur outside of our atmosphere regardless of the half-life.

Basic measures to be adopted:

1. Nuclear power plants should be located in areas after careful study of the geology of the area, tectonic activity and meeting other established conditions.
2. People should be aware about the hazardous effects of radioactive wastes to avoid a mishap.
3. Leakage of radioactive elements from nuclear reactors, careless use of radioactive elements as fuel and careless handling of radioactive isotopes must be prevented.
4. Regular monitoring of the presence of radioactive substance in high risk area should be ensured.

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