Nuclear waste is radioactive waste, meaning that it spontaneously emits radiation. It usually originates from the by-products of nuclear reactions in applications such as medicine and research. Radioactive waste degrades with time, releasing alpha, beta, and gamma radiation that pose many health risks to the environment and most organisms, including humans. Due to the harmful nature of nuclear waste, there is strict government regulation on the safe disposal of it. There are several types of waste, and as such, many different ways of discarding it.

**Introduction**

The use of nuclear energy provides cheaper and more powerful energy through fission reactions. Fission is the process by which a heavy nucleus splits into two smaller, separate nuclei. For example, the splitting of a large atom such as Uranium creates neutrons and a substantial amount of energy. This energy is created due to the difference in mass between the two nuclei products and the large nucleus product. However, the remains of the nuclear reactor becomes nuclear waste, which is extremely lethal due to its radioactivity. As a response, researchers have found several ways to shield and isolate radioactive waste till it degrades completely.

**Importance of Nuclear Waste**

The controversy behind nuclear technology is due to the radioactive waste it creates. Some elements used in nuclear reactors have extremely long half-lives and must be shielded from humans and the environment for thousands of years. For example, plutonium-239, an isotope used in the production of nuclear weapons, has a half-life of 24,200 years while uranium-235 Hiroshima has a half-life of 700 million years. These elements emit large quantities of radioactivity that is extremely dangerous. Too much exposure can be followed by Acute Radiation Syndrome (ARS), which includes skin burns, nausea, vomiting, and eventually death within days if the exposure and dosage of radiation is high.

**Sources of Nuclear Waste**

There are currently a number of nuclear productions that result in radioactive waste.

1. **Nuclear Weapons**: From the weapons to the tools and machinery used in its production, proportional amounts of radioactivity can be found in all of them. After their use, these contaminated items must be disposed of while the radioactivity slowly degrades.

2. **Medicine and Research Applications**: X-rays and other disease detecting technology in the medical field also consist of radiation albeit in a less harmful amount. For example, technetium-99m is an isomer that can be consumed to allow doctors to take images of the body’s process. However, even the syringes contribute to the problem of nuclear waste.

3. **Nuclear Power**: Most radioactive waste comes from the nuclear power plants situated around the world. There is a 20-30 ton waste that comes from each nuclear reactor every month it is in use.

4. **Agriculture**: Nuclear power is also used in eliminating bacteria through the disruption of their genetic structure. This insures that they can no longer proliferate and grow in the food.
Classification of Nuclear Waste

There are four different types of radioactive waste that result from nuclear power:

1. **Low Level Waste** (LLW) – waste that is usually results from medicine or other industrial uses such as tools, rags, medical tubes, protective clothing, and others. There are three facilities in the U.S. that handle low-level waste by land disposal.

2. **Intermediate Level Waste** (ILW) – waste from processing-plants and reactors that require some shielding. The waste is usually mixed with cement and buried.

3. **High Level Waste** (HLW) – waste that is produced from the nuclear reactor cores that are highly radioactive. Because of the level of contamination, the waste must be discarded by some sort of geological repository. It is not uncommon for spent nuclear fuel to be stored underwater.

4. **Uranium Mill Tailings** – this category of waste comes from remains after extracting uranium from its natural ore. Large amounts are currently left out in the open of abandoned mining sites. However, if it remains uncovered and not disposed of correctly, the waste can mix with the sand and travel to water sources, polluting the environment to a great extent.

Management of Nuclear Waste

1. Deep Geological Repository: This method is currently still being tested and facilities are being built. The idea is to seal the radioactive waste into special casks and to deposit them hundreds meters deep into a geographically stable area to allow it to decay. There is currently only one facility in the U.S. but a few more located around the globe.

2. Transmutation: at the moment researchers are searching for a method to transmute the dangerous material into something less harmful, making it easier to dispose.

3. Re-use: Currently, there is a Canadian patent to filter the waste and reuse whatever material that has not been altered. However, this practice requires a substantial amount of energy and is still in the very early stages of development.

4. Space disposal: This has the best alternative to geological repositories because the waste can no longer harm the environment on earth. Of course, there are significant consequences of shooting radioactive waste into space such as damaging space shuttles and pollution. At the same time, space disposal would have to be agreed upon internationally.

References


Problems

1. Many citizens of Nevada are against geological repositories in the Yucca Mountains, which is situated far from Vegas but still in the state. Why do you think they protest nuclear waste duping in that location despite the distance from the human environment?
Contributors

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