

RADIOACTIVE WASTE DISPOSAL METHODS

Radioactive waste includes any material that is either intrinsically radioactive, or has been contaminated by radioactivity, and that is deemed to have no further use.

Nuclear materials are often used for medical treatment and diagnosis, as well as producing energy. For example-The waste that comes out of nuclear reactor is dangerously radioactive and remains so for thousands of years. The nuclear waste also known as spent fuel is kept underwater for a few years until the radiation decays and it can safely disposed off.

There are four main types of nuclear waste:

High-level waste: This is the waste that remains when nuclear fuel is used to make energy via a nuclear reactor. Because the fuel has been used, the waste takes the form of small pellets and fuel rods.

Intermediate-level waste: This in-between level of radioactive waste is typically inclusive of materials that need to be properly stored away from land or human exposure, but doesn't need to go through a cooling process before doing so. Oftentimes decommissioned nuclear plants have this level of radioactivity, and waste is typically handled depending on the time it takes for the radioactivity to decay.

Low-level waste: This is typically materials used during a nuclear process that have become contaminated, such as rags used to clean up, tubes used to hold materials, or even clothing and tools. Hospitals commonly produce this kind of waste, which is one of the easiest to dispose of.

Mill Tailings waste: Nuclear materials – particularly thorium and uranium – come from a special process of extraction used to remove them from naturally occurring ore. Mill tailings are the forms of residue produced during this extraction process.

Geological disposal

The process of geological disposal centers on burrowing nuclear waste into the ground to the point where it is out of human reach. There are a number of issues that can arise as a result of placing waste in the ground. The waste needs to be properly protected to stop any material from leaking out. Seepage from the waste could contaminate the water table if the burial location is above or below the water level. Furthermore, the waste needs to be properly fastened to the burial site and also structurally supported in the event of a major seismic event, which could result in immediate contamination. Also, given the half-life noted above, a huge concern centers around how feasible it would be to even assume that nuclear waste could simply lie in repository that far below the ground.

However, when it comes to properly disposing nuclear waste, from low-level to high level, there are certain standard types of making sure it is handled and irradiated properly.

1) Incineration: Burning radioactive waste is largely done through commercially-operated incinerators developed for this purpose, although certain large companies have the means to do this on their own. Incineration is common with low-level waste, as this material usually consists of clothing or other common items that have simply been contaminated.

2) Storage: Over time, the radioactivity of nuclear material does decay, so storing this material until it is no longer radioactive is another way to deal with proper nuclear waste disposal. This process, called radioactive decay, depends on the amount of materials and the radioactivity level. Therefore, storage is typically only done with radioactive waste that has a shorter half-life, or the amount of time it takes for the material's radioactivity to be reduced by half. There are commercial storage facilities for this waste, while some approved companies have their own means of storage.

3) Shallow Burial: Highly radioactive material is hard to bury, but when it comes to mill tailings, these remnants can often be buried in a specially-crafted spot nearby the mill itself. Often, this includes creating a pile of tailings, covering it with a non-permeable material like clay. The pile is often typically buttressed by a mix of rocks and soil so that it doesn't erode.

4) Deep Burial: While shallow burials can be done with low-level waste, the most common way of disposing of high-level waste is in deep burial pits. Many countries with natural resources follow this procedure of geological disposal, which consists of burying the material deep within the earth. Often times, underground laboratories are built to monitor usage and storage of the materials.

5) In water: At nuclear sites, a common way of storing material is in water. Nearly all of these sites have a special pond or have a special pool constructed, which is a place that they can store fuel that has already been used for the process of generating power.

6) Recycling: For some radioactive material, such as previously used fuel, certain radioactive elements can be processed or extracted for reuse. Uranium and plutonium elements have long lives, so they can be separated and recycled.

7) The Ocean: A very small amount of liquid waste that is common when waste is reprocessed to extract usable elements is released into the ocean. This process is highly controlled, and radiation levels are deemed to be so low that they are inconsequential. However, recent agreements between companies that rely on nuclear materials have phased out this procedure.

While these are commonly used ways to dispose nuclear waste, there have been some proposals for alternate methods, although none of have been seriously considered. Some of these alternate disposal forms include:

Space Disposal: The expense related to this is far too prohibitive when compared with the positive effects.

Seabed Disposal: Another proposal was to embed waste deep within the seabed. However, international powers decided that the risk was far greater than the benefits.

Long-term aboveground Storage Bunkers: While some nuclear companies do have storage facilities above-ground, these are temporary and meant to make the waste more accessible for reuse, or to have it decay enough for another form of disposal. However, permanent above ground storage has been discarded in favour of deeper burials within the ground.

Some of the harm from improperly disposed material includes:

Affecting Human Populations: Humans are significantly impacted by exposure to levels of radiation. Oftentimes, this exposure will affect many future generations, as it leads to a number of birth and developmental disabilities. Down syndrome, thyroid cancer, and a number of other issues have been found in people affected by radiation.

Affecting Wildlife: One only need look to the Chernobyl disaster to see what the effects of radiation can be on wildlife in the area. Unfortunately, despite the fact that the event was 30 years ago, most of the animals are deemed to be affected by radioactivity. This manifests in reduced brain sizes, physical deformities, and other concerns that impact the survival of these creatures.

Affecting Local Flora: Plant life is also susceptible to damage from nuclear radioactive waste. After Chernobyl, an entire pine forest needed to be destroyed because it was affected by radiation. Not to mention, radioactive soils and plants dissuade bees and other important creatures from fertilizing and helping flora grow, which again, serves to impact future generations.

Affecting Nuclear Workers: It goes without saying that those who work around nuclear materials are highly susceptible to negative effects. While rare, nuclear reactor accidents have led to many deaths in the past, both from those exposed and even some of whom were irradiated during the research or testing phases. Improperly stored waste at a nuclear site can also lead to levels of exposure that are beyond what is acceptable for humans.