Nuclear Power Essay, Research Paper

Nuclear Power

Most of the world’s electricity is generated by either thermal or hydroelectric power plants. Thermal power plants use fuel to boil water which makes steam. The steam turns turbines that generate electricity. Hydroelectric power plants use the great force of rushing water from a dam or a waterfall to turn the turbines.

The majority of thermal power plants burn fossil fuels because thermal power plants are cheaper to maintain and have to meet less of the governments requirements compared to nuclear power plants. Fossil fuels are coal and oil. The downfall of using fossil fuels is that they are limited. Fossil fuels are developed from the remains of plants and animals that died millions of years ago. Burning fossil fuels has other downfalls, too. All the burning that is required to turn the turbines releases much sulfur, nitrogen gases, and other pollutants into the atmosphere.

The cleanest, cheapest, and least polluting power plant of the two types is the hydroelectric power plant. The main reason most countries use thermal versus the hydroelectric is because their countries don’t have enough concentrated water to create enough energy to generate electricity. (World Book vol. 14, 586)

Nuclear power plants generate only about eleven percent of the world’s electricity. There are around 316 nuclear power plants in the world that create 213,000 megawatts of electricity. (INFOPEDIA)

Radioactive, or nuclear, waste is the by-product of nuclear fission. Fission occurs when atoms’ nucleus’ split and cause a nuclear reaction. (General Information) When a free neutron splits a nucleus, energy is released along with free neutrons, fission fragments that give off beta rays, and gamma rays. A free neutron from the nucleus that just split splits another nucleus. This process continues on and is called a chain reaction. (World Book vol. 14, 588)

The fission process is used to create heat, which boils water inside the nuclear reactor. The steam that boiling the water makes is used to turn turbines, which in turn, generate electricity. Fission happens inside a carefully monitored nuclear reactor, when being used in a nuclear power plant. The fission process that nuclear power plants use spends approximately 30,000 tons of highly radioactive waste a year. (General Information)

In a nuclear power plant, Uranium is used as fuel to boil the water for the steam that makes the turbines turn. So, uranium is, in a sense, the coal of a coal-fired power plant.

When fueling nuclear power plants, the uranium arrives as uranium-enriched pellets. These pellets are an equivalent to one ton of coal. The pellets are sealed in tubes that are made of a strong heat- and corrosion-resistant metal alloy. This metal alloy will protect people and the environment from the high levels of radiation that the uranium is giving off.

The tubes are bundled together to make a fuel assembly. The assemblies are put inside the reactor to create heat that will boil the water. The fuel assemblies are used until they are depleted. A fuel assembly is depleted when it no longer gives off enough energy to turn the turbines.

Once every year, one third of the nuclear fuel in a reactor is replaced with fresh fuel. The used-up fuel is called spent fuel. Spent fuel is highly radioactive and is the primary form of high-level nuclear waste. (General Information)

High-level radioactive waste is the by-product of commercial nuclear power plants generating electricity, and from nuclear materials production at defense facilities. This high-level waste must be isolated in a safe place for thousands of years so its radioactivity can die down and not be harmful to people and the environment.

The name of the “safe place” that the Department of Energy is trying to make is called a repository. But until a repository is made, spent fuel and high-level waste is being stored in temporary storage facilities called dry casks and cooling pools. By the end of the year 2000, there will be more than 40,000 metric tons of high-level waste in casks and storage pools. There will also be more than 8,000 metric tons of high-level waste from defense programs. The high-level waste from defense programs is currently being stored in Idaho, South Carolina, and Washington. (General Information)

Reprocessing is the chemical process by which uranium and plutonium are recovered from spent fuel. This means that it is the recycling process of high-level waste. The reason private industries aren’t reprocessing their high-level waste is because reprocessing costs more than mining and making new fuel. Several countries that actually care about their environment reprocess their high-level waste. (General Information)

Dry casks and cooling pools are being used to store spent fuel in power plants everywhere. (Shulman, 14) Dry casks and cooling pools are only meant to be temporary storage facilities until a permanent repository is made. The need for a permanent disposal for high-level radioactive waste is becoming more urgent every year because the dry casks and cooling pools at nuclear power plants are filling up.

A dry cask is a concrete of steel container that protects the outside world from its radioactive innards. A cooling pools is a pools of water that the spent fuel is put into. The water is a radioactive shield and coolant. (General Information)

The cooling pools were supposed to contain no more than 400 fuel assemblies, approximately 80,000 rods. The pools contain over four times as much of the spent fuel that they’re supposed to. Nearly all of the nations older power plants are in this state of overload.

In the late 1980’s, government industry researchers became concerned that if the rods were too closely stored in the pools, a nuclear reaction would occur. When researched further, the chain reaction theory became very remote. News of this resulted in even more densely packed cooling pools. (Shulman, 14)

The cooling pools are a type of concrete warehouse. Inside the warehouses are steel caskets containing the spent fuel rods and cooling pools. Scientists say that the cooling pool prevents the spent fuel to explode, but the extreme weight of the fuel inside the warehouses might cause the structures to rupture, especially in the case of an earthquake. (Shulman, 15)

A repository is a storage facility that stores high-level nuclear waste deep underground so the waste can not harm or effect people or the environment. (DOE’s Yucca Mountain Studies) With the technology that we [humankind] have toady. Scientists believe it to be possible to make a repository somewhere. The guidelines of a repository are mainly if the geologic location will work out (i.e. will an earthquake be able to rupture it, will water be able to corrode the repositories outer wall.).

To make sure that the repository would be able to stay unscathed for thousands of years, scientists in all areas of science are making predictions of what could happen over the time period.

According to U.S. Environmental Protection Agency (EPA) standards, a repository may pose no greater threat than unmined uranium from which the high-level waste was produced.

The repository the DOE is wanting to make has to be proven that it will still be isolated underground in 10,000. After this extensive time, the high-level waste should no longer be radioactive enough to harm the public health. (General Information)

A rem is a unit scientist use to measure radiation exposure. Over a persons lifetime, they usually receive 7-14 rems of natural sources of radiation, such as cosmic rays and ultraviolet rays from the sun. On a single exposure of 5-75 rems, there are few to no noticeable symptoms. For someone to receive 75-200 rems of exposure, vomiting, fatigue, and loss of appetite would occur. Recovery would take a few weeks. If someone were to be exposed to more than 300 rems, severe changes in blood cells and hemorrhage takes place. If someone were to receive more than 600 rems, symptoms would be hairloss, loss in your bodies ability to fight infection and usually results in death. (World Book vol. 16, 79)

As you can see, the effects of radiation sickness is not too pleasant. The main reason for building a repository is to keep people and the environment safe from deadly radiation.

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