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Khayetski Y., Puchynski R., Matusevich O.

Electricity from Nuclear Energy

Belarusian National Technical University
Minsk, Belarus

The huge amount of energy released in a chain reaction can be used to generate electric energy. Figure 1 shows a nuclear power plant, where this energy conversion occurs. Using a fuel like uranium-235 (U-235), the energy produced by the chain reaction changes water into steam. The steam turns a turbine, a rotating wheel with blades. The rotating turbine spins the generator to which it is connected. The generator, as we know, then changes this mechanical energy into electric energy. After the steam runs the turbine, it is condensed and returned to the reactor [1].

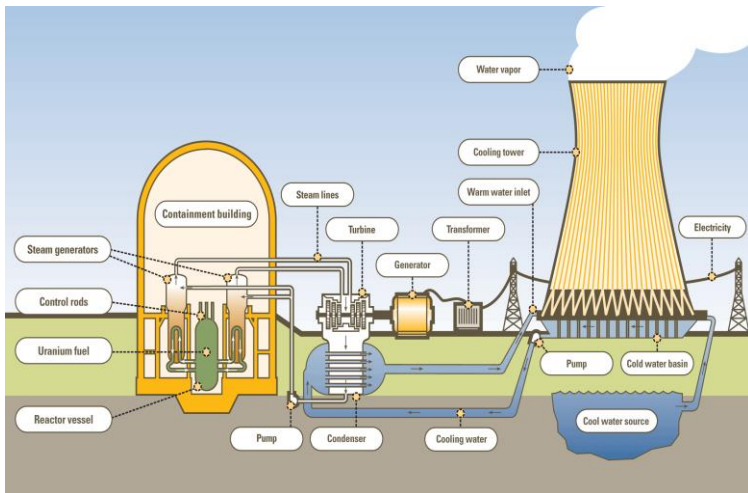


Fig. 1 – Diagram of a Nuclear Power Plant

For example, nuclear power plants of this kind are in use all over the United States. They produce energy by fission. The only real way that nuclear power plants differ from fossil-fuel power plants is in the kind of fuel.

As for the effects of the radioactivity, we know that radioactive particles can expose a photographic plate. They also ionize the air they travel through. Radioactive particles also produce another important effect. They can kill cancer cells and harmful bacteria. But if powerful enough, they can also cause illness or even death. Gamma rays are especially harmful because they can penetrate the body and damage its cells. That is why people working with radioactive materials wear protective clothing [2].

Radioactivity can be dangerous to a person's health. Yet when used wisely, it can be beneficial. The nucleus of cobalt-60 is unstable. As it decays, the cobalt-60 nucleus emits radiation. The radiation it produces can destroy cancer cells. However, this radiation can also kill healthy cells. So, the radiation must be carefully aimed at the cancer tissue.

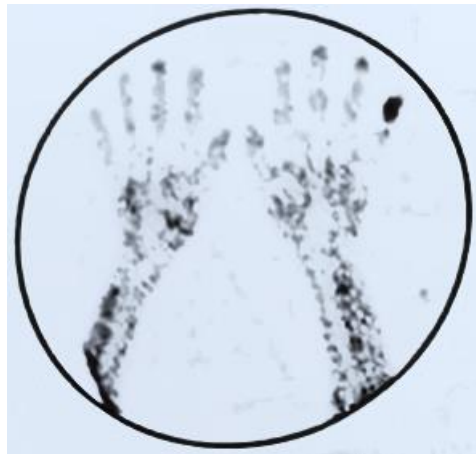


Fig. 2 – A Radioactive Isotope Located a Tumor in This Hand

Radioactivity can also help detect tumors. A solution containing a small amount of radioactive material is used. This solution, called a tracer, is injected into a patient. The radioactive tracer collects in the tumor. As a result, the location of the tumor can be found. See Figure 2.

The advantages of using nuclear energy:

1. The use of nuclear power plants saves such fossil fuels as oil and natural gas, which are becoming scarce nowadays.
2. A fission reactor uses much less fuel than power plants running on coal or oil.
3. The application of nuclear fuel reduces air pollution.
4. In an effort to find better ways to use nuclear energy, scientists are trying to create fusion reactors.

The disadvantages of using nuclear power are the following:

1. Nuclear power plants are incredibly expensive to build, the average cost is from \$2 – 4 billion to \$9 billion.
2. Fission reactors produce radioactive elements and waste materials, which can destroy human body cells.
3. The disposal of nuclear waste that contains materials with long half-lives.
4. Impact on the environment.
5. Limited fuel supply and others.

References:

1. How Does Nuclear Power Plant Work? [Electronic resource]. – Mode of access: <https://www.explainthatstuff.com/how-nuclear-power-plants-work.html>. – Date of access: 13.03.2022.
2. Applications of Radioactivity [Electronic resource]. – Mode of access: <https://www.britannica.com/science/radioactivity/Applications-of-radioactivity>. – Date of access: 22.03.2022.