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Nuclear Power

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Using energy has been the main issue in the process of the development of society since ancient times when people learned how to control fire. But one of the most important things that changed the life of the whole world was the discovery of electricity. Nowadays electricity is used for industry, agriculture, communication, in sphere of transport, for everyday use. Electrical power has become the essential part of our daily life. There are different types of producing electricity such as energy of coal and oil, sun, renewable and geothermal energy, but one of the most effective and sustainable is nuclear power.

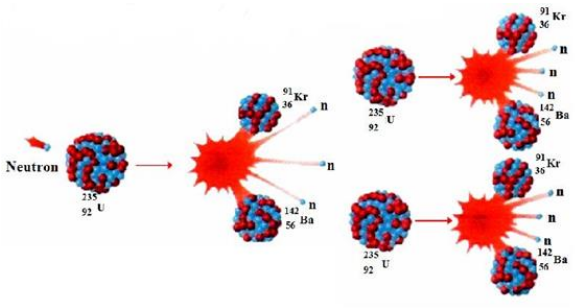
Nuclear energy accounts for about 12.9 % of all global energy production. An energy source that has zero emissions, provides electricity around-the-clock, **prevents climate change** and has some other benefits [1].

Today nuclear energy is a rather promising means of producing electricity. Due to the characteristics of nuclear reactions, fuel consumption is very small in comparison with the energy received.

The history of the development of the nuclear power is closely related with the activity of Marie Curie. In 1898 Marie and her husband Pierre discovered a new element in pitchblende. They named it polonium (Po) in honor of her native country. Polonium gives off radiation as uranium does. Later the Curies separated still another radiation-emitting element from the ore. They named it radium (Ra).

Radioactivity is the breaking down of atomic nuclei by releasing particles or electromagnetic radiation. Radioactive nuclei give off radiation in the form of streams of particles or energy. There are three forms of radiation: alpha particles, beta particles, and gamma rays [1]. Nuclear energy is based on such process as radioactive decay. It means the changing of one element into another one by the release of radiation. All radioactive isotopes pass through radioactive decay. The latter is continuous, but stops when a stable isotope is formed.

Furthermore, there is also such definition as a half-life. This is the time that is needed for half an amount of a radioactive material to decay. The main process of nuclear power engineering is nuclear fission. It is the splitting of a nucleus with a large mass into two nuclei with smaller masses.



Chain Reaction

What happens after a nucleus splits? When the shooter (neutron) hits the first atom of uranium, it splits and nucleus emits three neutrons. They, in their turn, split. Now there are nine neutrons. The process described above is a chain reaction. The products of the reaction cause the reaction to keep going.

All processes mentioned above occur in a nuclear reactor. It's a device that produces energy from radioactive fuels through controlled chain reactions. The main parts of each

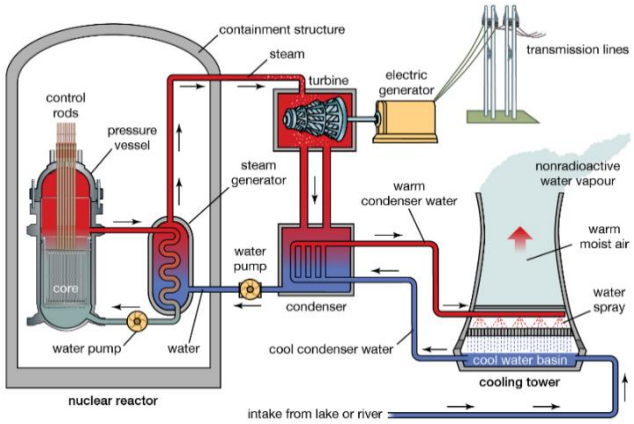
nuclear reactor include the core, the moderator, the control roads, and the safety system. The core contains the nuclear fuel. This fuel is often a mixture of many isotopes. The core is the central part of the reactor, and is the place where the fission actually occurs.

The neutrons emitted during the fission of uranium-235 (U-235) travel too fast to be captured easily by other U-235 nuclei. A moderator slows down these neutrons to a speed that makes it easier for U-235 nuclei to capture them. Control rods help control the rate of a chain reaction by absorbing neutrons. The farther a control rod is pushed into a reactor, the more neutrons are absorbed. The chain reaction slows down.

The safety system of a reactor is the set of devices designed to prevent serious reactor accidents. The safety system includes rods that can be dropped into the reactor that will stop the chain reaction at once. The system also includes a coolant that circulates through the reactor. It removes the heat from the core. Both these parts of the system help to prevent a meltdown – a melting of the nuclear fuel. Shielding is a very heavy multi-ton coating for a nuclear reactor building, capable of withstanding a reactor accident and ensuring the integrity of surrounding structures.

The huge amount of energy released in a chain reaction can be used to generate electric energy. Using a fuel like U-235, the energy produced by the chain reaction changes water into steam. The latter turns a turbine, a rotating wheel with blades. The rotating turbine spins the generator to which it is connected. The generator, in its turn, changes the mechanical energy into electric one. After the steam runs the turbine, it is condensed and returned to the reactor.

Nuclear power plants of this kind are in use all over the world. 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 [2].



The Diagram of a Standard Nuclear Power Plant

There are advantages and disadvantages of nuclear power stations. Pluses: small fuel costs in comparison with coal or oil; they save oil and gas which are becoming scare; they are environmentally-friendly. Minuses: the difficulty of radioactive waste disposing; the risk of accidents [3].

References:

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