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TOPIC: NUCLEAR POWER PLANTS

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Czech Republic**

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NUCLEAR POWER PLANTS



Content:

- What are nuclear power plants
- What circuits does the power plant consist of?
- How the fission reaction works in the reactor
- How electricity is produced in nuclear power plants
- How the reactor works
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What are nuclear power plants

- A nuclear power plant is an electrical power plant, or technological device, used to convert the binding energy of the nucleus of heavy elements into electrical energy.



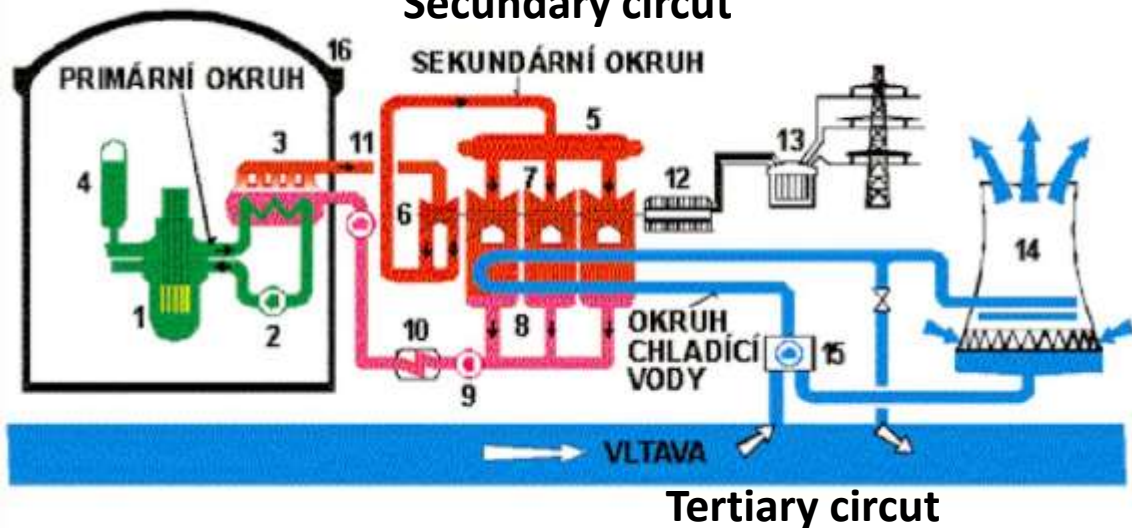
What circuits does the power plant consist of:

- The primary circuit consists of a reactor, piping systems to circulate water, a steam generator, a volume compensator and circulating pumps, and is used to transfer heat energy from the active zone to the steam generator.
- The secondary circuit consists of the secondary part of the steam generator, the secondary circuit piping systems, the turbogenerator, the capacitor and the pumps, and as a whole is used to transport steam and convert its internal energy into the rotating motion of the turbine, generating electrical energy.
- The tertiary circuit consists mainly of cooling towers, circulators, pipes and cooling water channels. The function is to create as much underpressure in the capacitor as possible so that the efficiency of the turbine is as high as possible. The lower the temperature of the cooling water in the tertiary circuit, the higher the underpressure in the capacitor.

Jak funguje jaderná elektrárna

Primary circuit

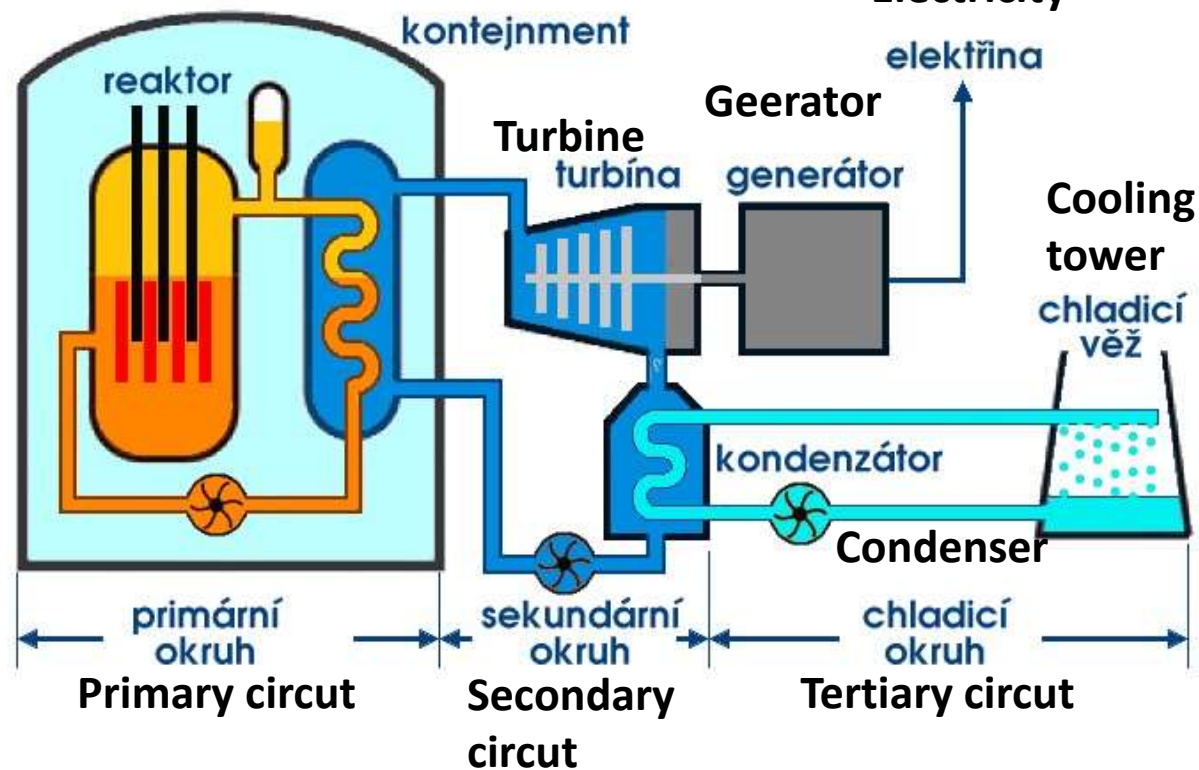
Secondary circuit



Reactor

Containment

Electricity

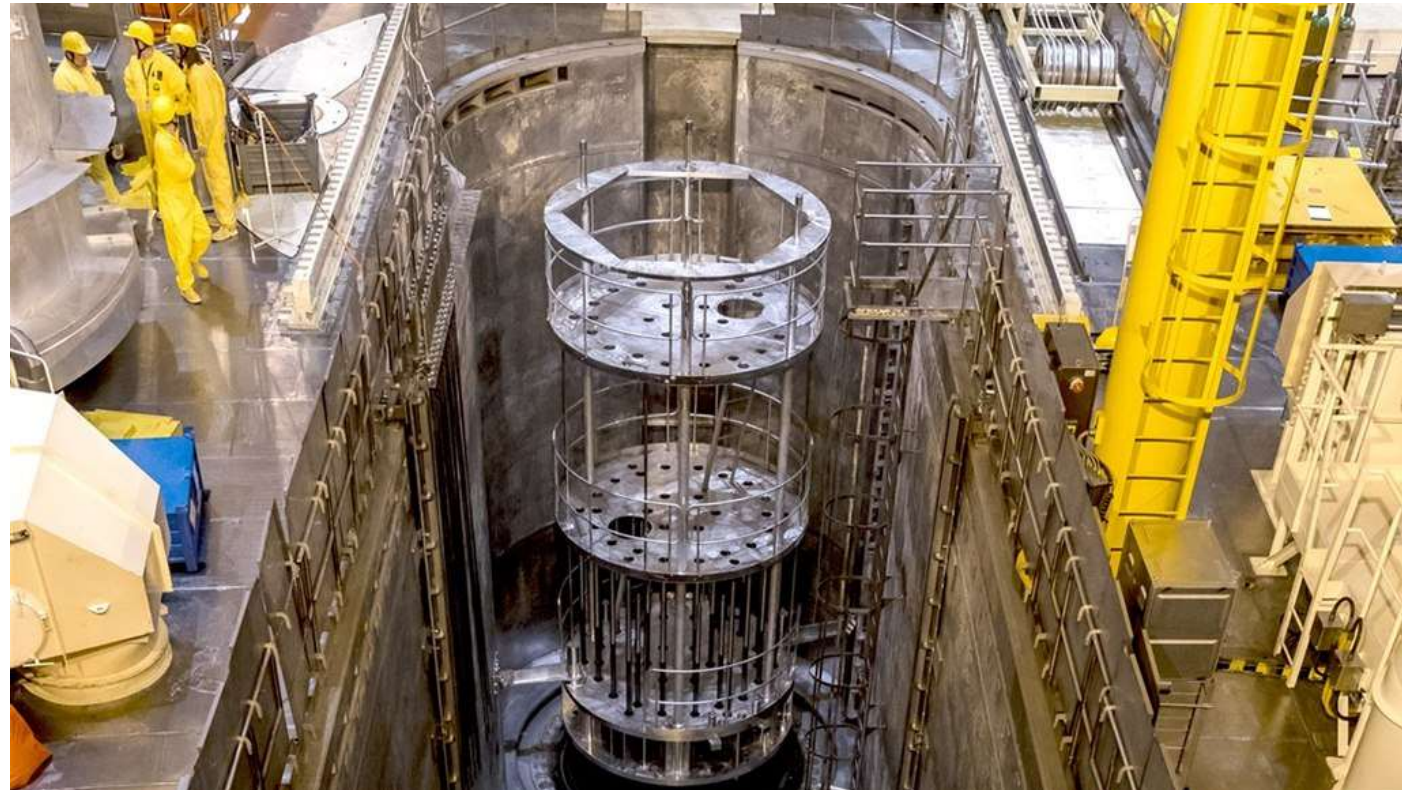


How the fission reaction works in the reactor:

- The fission nuclear reaction occurs in the heavy atomic nuclei of uranium U^{235} during their neutron bombardment.
- The neutron penetrates the uranium nucleus, is absorbed, and this gives this nucleus so much energy that it vibrates, splitting mostly into two splinters that move away from each other at great speed.
- However, they are very soon slowed down by shocks to the surrounding atomic nuclei and their motion energy is converted to thermal energy.

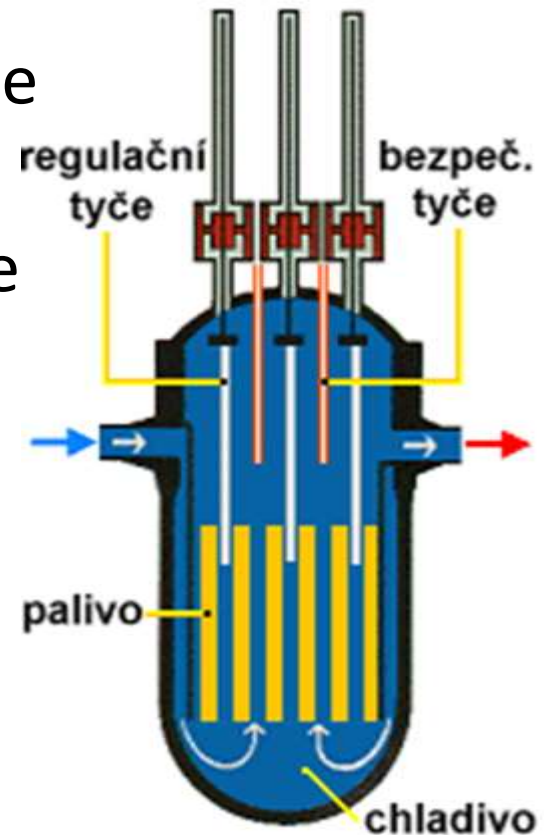
How electricity is produced in nuclear power plants:

- Heat is generated by uranium fission in a nuclear reactor. This in turn heats the water around and the resulting steam drives the turbine and the generator generates electrical energy.



How the reactor works:

- During fission, fast neutrons are formed.
- These are slowed down by a moderator, which surrounds the fuel.
- The slowed neutrons either fission the uranium nuclei or are absorbed by the control rods.
- The safety bars ensure that the reaction stops immediately.
- The coolant cools active zone and fuel.



Nuclear power plants in the Czech Republic:

- Two nuclear power plants are in operation in the Czech Republic, both operated by ČEZ.
- Dukovany Nuclear Power Plant with an installed capacity of 4×510 MW, put into operation in 1985 – 1988.
- Temelín Nuclear Power Plant with an installed capacity of 2×1050 MW, put into operation in 2002 – 2003.



Safety:

- When operating nuclear power stations, safety is an essential and paramount requirement.
- Emerging radioactive material and radioactive radiation must never enter the external environment and endanger the plant's personnel or even the population nearby and far away.
- The nuclear power plant must withstand earthquakes and other natural disasters, plane crashes, terrorist attacks, technical faults and operator failures.
- Nuclear energy is therefore more than safe.

Statistics:

- As of January 1, 2022, according to WNA (World Nuclear Association) statistics, there were 438 nuclear reactors in operation with a total installed capacity of 390,174 Mw_e.
- There are 57 under construction in 19 countries and the plan is to build another 97 reactors.
- The use of nuclear also plays an important role in the EU – around one quarter of the electricity generated here comes from nuclear power stations.

Curiosities:

- Most nuclear resources are in the USA (93), France (56) and China (53).
- The most serious accident of the nuclear power plant to date is the 1986 Chernobyl Block 4 explosion, in which 32 people died directly in an accident and thousands more over the years from radiation sickness.
- With 8 212 MWe of installed power, the Kashiwazaki-Kariwa nuclear power plant is the largest in the world, but after the 2011 earthquake, all reactors were shut down and there are debates about restarting them today.

Resources:

- https://cs.wikipedia.org/wiki/Jadern%C3%A1_elektr%C3%A1rna
- https://www.cez.cz/edee/content/file/static/encyklopedie/vykladovy-slovník-energetiky/hesla/prim_okruh.html
- https://www.cez.cz/edee/content/file/static/encyklopedie/vykladovy-slovník-energetiky/hesla/sekund_okruh.html
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- <https://www.svetenergie.cz/cz/energetika-zblizka/jaderne-elektrarny/jaderne-elektrarny-cez/jaderna-elektrarna-dukovany>
- <https://www.cez.cz/edee/content/microsites/nuklearni/k33.htm>
- https://cs.wikipedia.org/wiki/%C5%A0t%C4%9Bpn%C3%A1_jadern%C3%A1_reakce
- https://www.cez.cz/edee/content/file/static/encyklopedie/encyklopedie-energetiky/03/bezpecnost_2.html
- <https://www.cez.cz/cs/o-cez/vyrobní-zdroje/jaderna-energetika/je-ve-svete/statistiky-z-jaderných-elektraren>
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- https://cs.wikipedia.org/wiki/Energetika_v_%C4%8Cesku
- <https://www.cez.cz/edee/content/microsites/nuklearni/k35.htm>