

Preview of Period 17: Uses of Nuclear Energy

17.1 Nuclear Power Plants

How do nuclear power plants differ from conventional power plants?

What types of nuclear reactors exist? How do their safety features compare?

17.2 Nuclear Fuel

What fuels a nuclear reactor?

What controls the nuclear reaction?

17.3 Radioactive Waste

How radioactive is the waste from nuclear reactors?

How should radioactive waste be disposed of?

Features of Conventional Nuclear Reactors:

a) **Fuel rods** filled with enriched Uranium

- ◆ Enriched Uranium is made by adding the isotope U-235 to Uranium-238 ore.
- ◆ U-235 atoms fission (split) into smaller atoms, giving off neutrons.
- ◆ Other U-235 atoms absorb the neutrons and fission, creating an exothermic chain reaction.

b) **Containment systems** to prevent radiation from escaping into the environment. Double containment systems are safer.

c) A **Moderator** (usually water or graphite) to slow the velocity of the fast-moving neutrons. Fuel rods are placed in the moderator.

The moderator slows the neutrons and speeds up the reaction.

Features of Conventional Nuclear Reactors, Continued

- d) **Control rods** to absorb the neutrons and control the rate of the reaction. Control rods (usually cadmium or boron) can slow down or stop the reaction.

- e) **Coolant** (usually water or Helium gas) to carry heat away. Loss of coolant can result in a meltdown if heat from the fission reaction melts the containment system.

Types of Conventional Nuclear Reactors

- ◆ RBMK Graphite moderated, water cooled.
(Chernobyl type reactor)

- ◆ Magnox: Graphite moderated, gas cooled.

- ◆ PWR (BWR) Water moderated, water cooled.
(Type used in U.S.)

Period 17 Summary

Conventional Nuclear Reactors use:

Fuel rods filled with enriched Uranium (U-235 is added to Uranium-238 ore).

Containment systems to prevent radiation from escaping into the environment. Double containment systems are safer.

A **Moderator** (usually water or graphite) to slow the velocity of the fast-moving neutrons. Fuel rods are placed in the moderator to slow the neutrons and speed up the reaction.

Control rods to absorb the neutrons and control the rate of the reaction. Control rods (usually cadmium or boron) are used to slow down or stop the reaction.

Coolant (usually water or Helium gas) to carry heat away. Loss of coolant can result in a meltdown if heat from the fission reaction melts the containment system.

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Reactor Type	Fuel	Moderator	Coolant	Advantages/Disa