

# Pressurized Heavy Water Reactors: A Comprehensive Guide

Pressurized Heavy Water Reactors (PHWRs) are a type of nuclear reactor that uses heavy water as both a coolant and a moderator. Heavy water is a form of water that contains deuterium, an isotope of hydrogen with an atomic mass of 2. Deuterium is not radioactive, and it does not absorb neutrons as readily as ordinary hydrogen. This makes heavy water an ideal moderator for nuclear reactors, as it allows neutrons to travel further and react with more uranium atoms.



## Pressurized Heavy Water Reactors: CANDU (JSME Series in Thermal and Nuclear Power Generation)

★★★★★ 5 out of 5

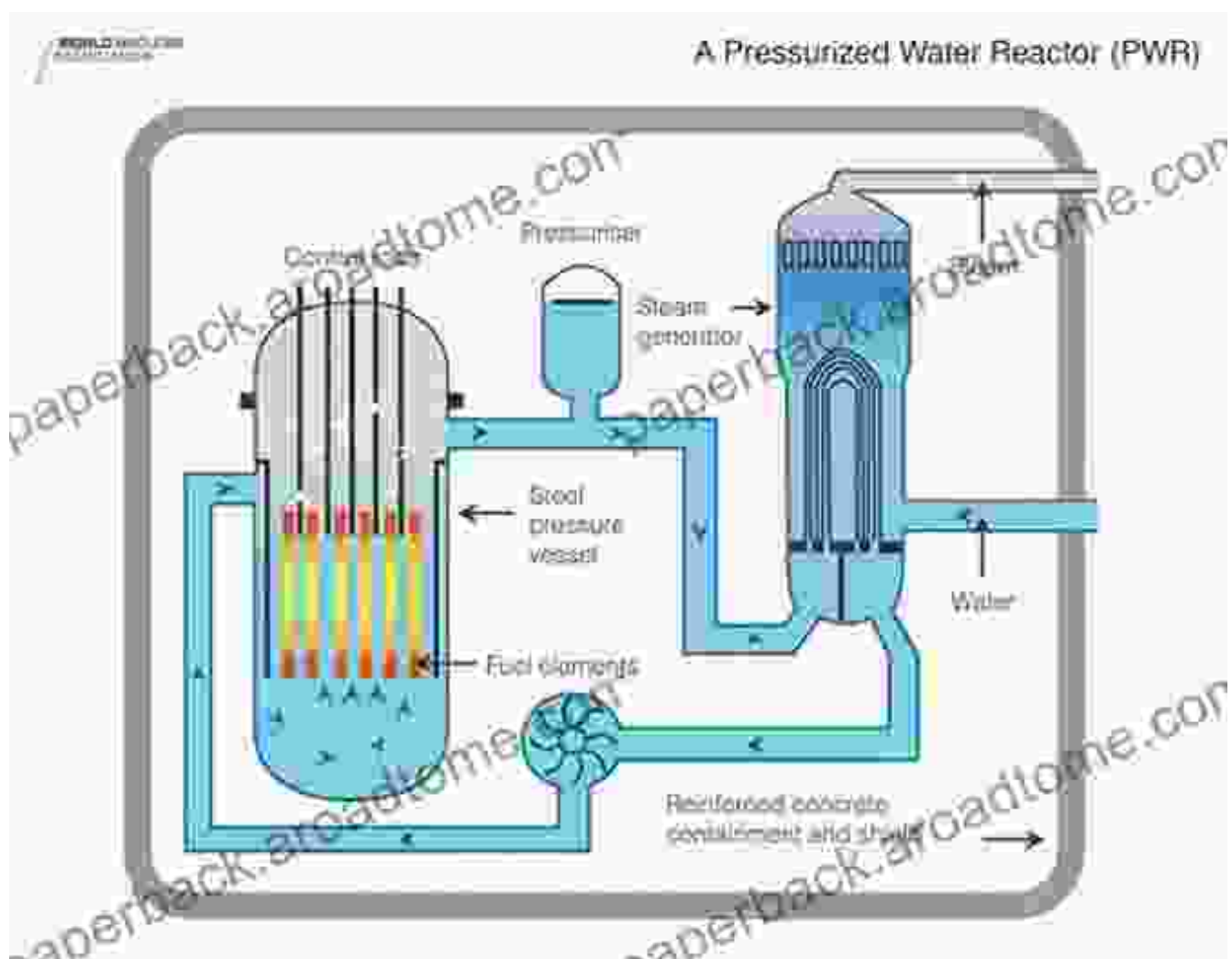
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PHWRs were first developed in Canada in the 1950s, and they are now used in several countries around the world. PHWRs are known for their high efficiency, low operating costs, and excellent safety record.

## Design

PHWRs are typically designed with a vertical pressure vessel that contains the reactor core. The core is made up of a fuel assembly that contains uranium fuel rods. The fuel rods are surrounded by heavy water, which acts as both a coolant and a moderator. The heavy water is heated by the fission reaction that occurs in the fuel rods, and it is then pumped out of the pressure vessel and through a steam generator. The steam generator converts the heat of the heavy water into steam, which is then used to drive a turbine that generates electricity.



## Operation

PHWRs are operated by a team of licensed operators. The operators monitor the reactor's operating parameters, such as temperature, pressure, and flow rate. They also perform routine maintenance and repairs on the reactor and its components.

PHWRs are designed to operate continuously for long periods of time. They typically undergo a refueling outage every 12 to 18 months, during which time the fuel assembly is replaced.

## **Fuel Cycle**

The fuel cycle for PHWRs is similar to the fuel cycle for other types of nuclear reactors. Uranium is mined from the earth and then converted into uranium oxide. The uranium oxide is then enriched to increase the concentration of uranium-235, which is the fissile isotope of uranium. The enriched uranium oxide is then used to fabricate fuel rods.

The fuel rods are inserted into the reactor core, where they undergo a fission reaction. The fission reaction releases energy, which is used to heat the heavy water coolant. The heavy water is then pumped out of the pressure vessel and through a steam generator, where it is converted into steam. The steam is then used to drive a turbine that generates electricity.

The spent fuel rods are removed from the reactor core and stored in a spent fuel pool. The spent fuel rods can be reprocessed to extract the remaining fissile material, or they can be disposed of in a deep geological repository.

## **Safety**

PHWRs are designed with a number of safety features to prevent and mitigate accidents. These safety features include:

- A thick pressure vessel that contains the reactor core
- A heavy water moderator that absorbs neutrons and prevents them from escaping from the core
- A shutdown system that can quickly insert control rods into the core to stop the fission reaction
- An emergency core cooling system that can inject water into the core to prevent it from overheating

PHWRs have a strong safety record. There have been no serious accidents involving PHWRs in the world.

Pressurized Heavy Water Reactors are a safe, efficient, and reliable source of electricity. They are used in several countries around the world, and they are likely to play an important role in the future of nuclear energy.



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