Nuclear Power and Nuclear Waste

fission: the splitting of a large nucleus into small nuclei

A Canadian-designed nuclear reactor system known as CANDU makes use of a naturally occurring radioisotope of uranium: uranium-235. The fuel in a CANDU reactor is in the form of pellets that contain uranium oxide, prepared from uranium ore. About 0.7% of the uranium in the pellets is U-235. The pellets are assembled into a fuel bundle that is placed into the calandria, or reaction vessel (**Figure 5**). A U-235 atom undergoes nuclear **fission** when a "slow" neutron collides with its nucleus, resulting in the formation of two lighter nuclei. This reaction also produces more neutrons and releases a considerable amount of energy (**Figure 6**). When these new neutrons are released, they are travelling very quickly—too quickly to cause further fission reactions. To be useful (continue the chain reaction by colliding with other U-235 nuclei), the neutrons must be slowed down. The substance used to slow the neutrons is called the moderator. In CANDU reactors the moderator is heavy water (water that contains deuterium instead of hydrogen). Heavy water is also used to cool the fuel bundles in a CANDU reactor. The heavy water is pressurized to prevent it from boiling. The hot heavy water is used to heat ordinary water, producing the steam necessary to turn turbines connected to electric generators.

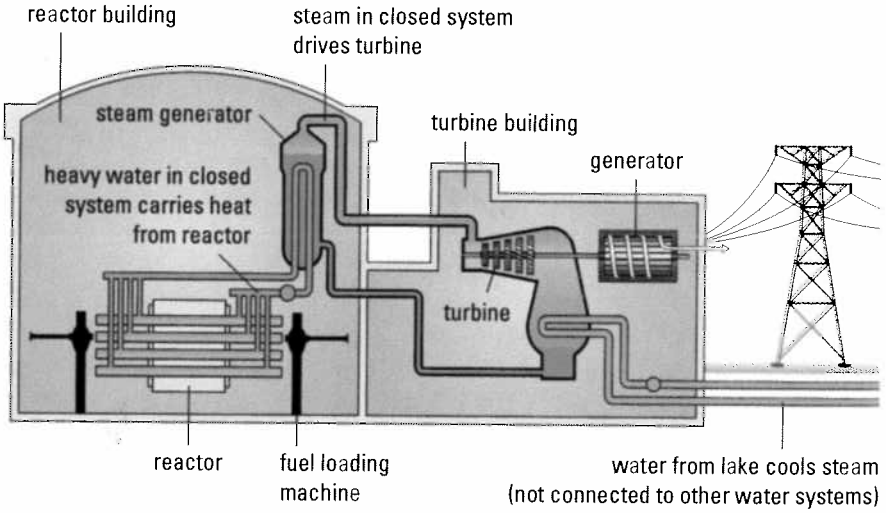

Figure 5
CANDU reactor and electricity generating station. CANDU is an acronym for Canadian deuterium and uranium.

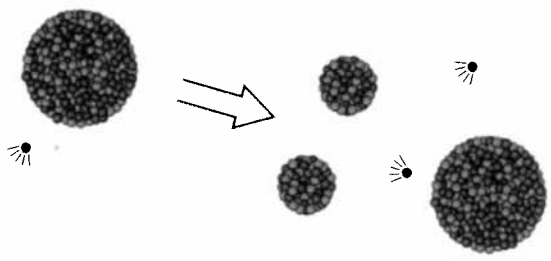

Figure 6
Nuclear fission of a uranium-235 atom