

4.6 Gas cooled reactors

Yet another alternative is the gas-cooled reactor design (see, for example, Gregg King 1964). Some 17 of these are currently (2013) in commercial operation (mostly in the UK), cooled by CO_2 and moderated by graphite. Early versions (now superseded) utilized natural uranium though this required large cores. The more recent, advanced gas reactors (AGR) use enriched uranium as fuel. Their design is shown conceptually in figure 1 (WNA 2015b, Winterton 1981). The CO_2 flows up through channels in the bricks of the graphite moderator. These channels are interspersed with control rod channels. The entire core is surrounded by a thermal shield and the CO_2 flow loop passes up the outside of the shield and down its inside before entering the bottom of the core. Heat exchanger/steam generator tubes to transfer the heat to the secondary water coolant circuit are enclosed with the core in the primary containment structure, a pre-stressed concrete vessel.

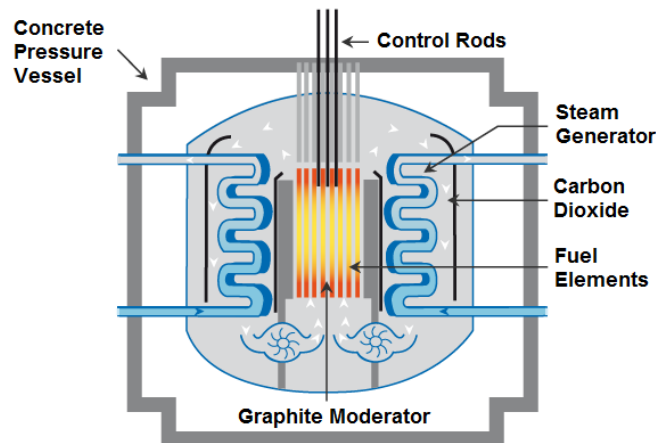


Figure 1: Schematic of the typical advanced gas reactor. Adapted from WNA (2015b).

Note should also be made of the more recently proposed design in the USA, the high-temperature gas-cooled reactor (HTGR) that utilizes high pressure helium as the coolant (Duderstadt and Hamilton 1976). This design has a quite different fuel cycle with an initial reactor core loading of highly enriched uranium carbide along with thorium oxide or carbide and graphite moderator. The design has the advantage of more efficient use of the uranium though whether it will be used for power generation remains to be seen.