

General Electric Systems Technology Manual

Chapter 1.3

Boiling Water Reactors

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In a boiling water reactor, the coolant is water of high purity which boils adjacent to the fuel elements. The resulting steam-water mixture then proceeds to the steam separators, where the water is separated from the steam-water mix. The water then goes back to the reactor core and the boiling operation is repeated. The steam which is formed passes from the steam separators, through the steam dryers which provide a second stage of moisture removal, and to a turbine located outside the containment.

The major difference in the operating characteristics of a boiling water reactor core from other nuclear systems is a result of the steam void production. Water affects both the heat generation and the neutron flux characteristics of a nuclear system because it serves the dual function of coolant and neutron moderator. If this water is allowed to boil, which greatly lowers the density of the molecules, then there is a significant change in the nuclear performance. The boiling water reactor design results in a system that produces reactivity changes varying inversely with the steam void content in the core. This provides an inherent safety feature of the boiling water reactor; that is, a transient power increase will produce more steam voids, reducing reactivity, which reduces power and thus limits the excursion.

The fuel used in a boiling water reactor contains uranium in the form of an oxide. This eliminates the hazard involved in using uranium in metallic form. Moreover, before assembling into fuel elements, the uranium oxide is generally heated and converted into a ceramic material, somewhat like the bricks used to line fireplaces. This form of uranium oxide does not react chemically with the reactor coolant and does not burn in air.