MIT Technology Review

New Nukes

The U.S. nuclear industry hopes that safer reactor designs can end decades of stagnation.

By Rob Edwards on October 20, 2008

For more than 30 years, no one has begun construction on a new nuclear reactor in the U.S. But amid growing concern about energy supplies, the U.S. Nuclear Regulatory Commission (NRC) has registered applications for licenses to build 25 new reactors since July 2007.

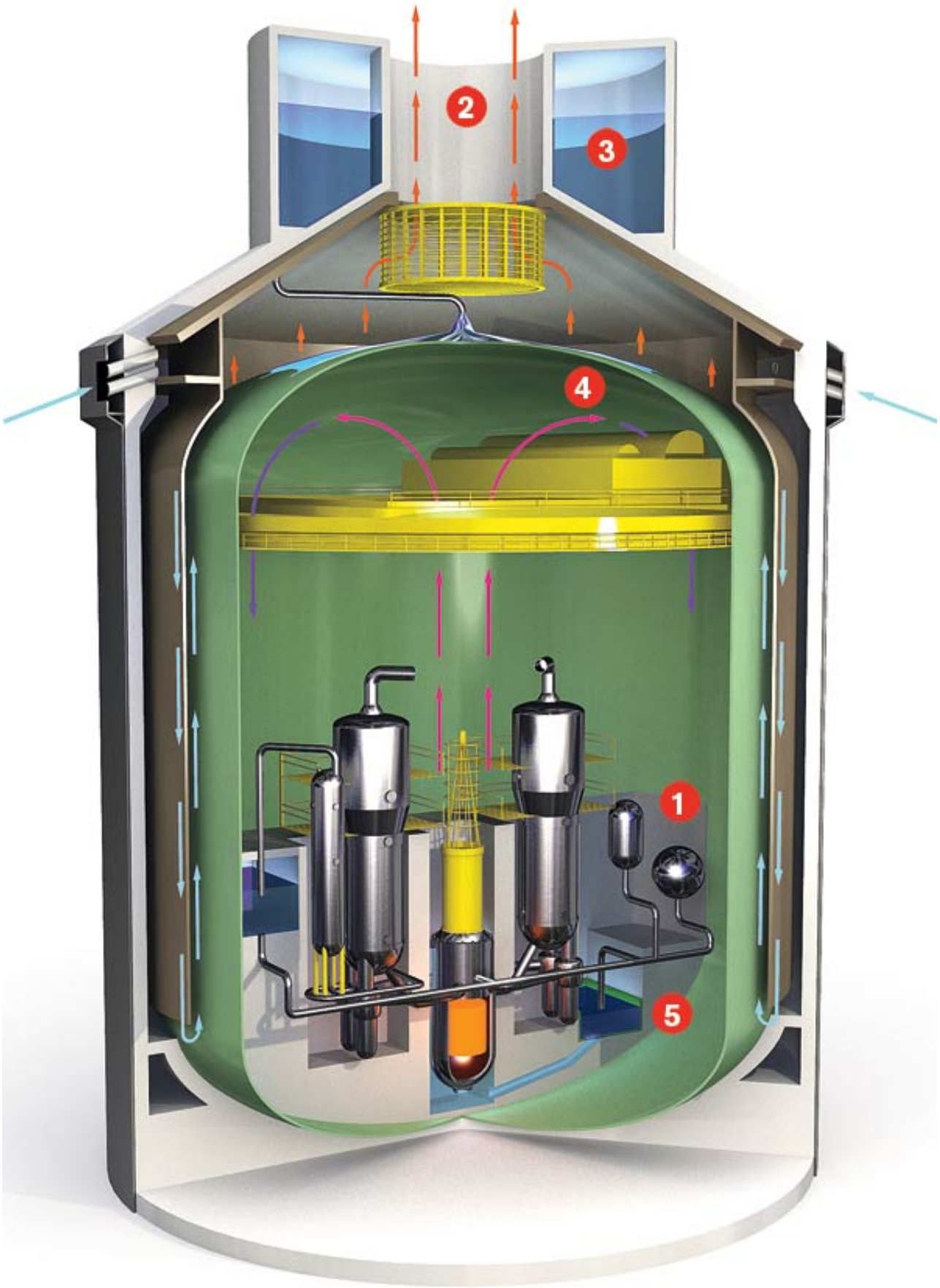
Two of the reactor designs specified in the applications feature passive safety systems, which are activated by natural forces and are intended to remove the risk of operator error or malfunctioning electronics. Of these, only one has been approved by the NRC: the Westinghouse Advanced Passive 1000, or AP1000 *(below)*. The first AP1000 is likely to be built in China, where construction is scheduled to start in March 2009.

A second design, from GE Hitachi, takes passive safety even further, eliminating pumps and relying on natural circulation of water and steam for cooling during normal operation. The reactor has yet to be approved by the NRC, but GE Hitachi says that it has been selected by four U.S. utilities for "potential projects" and is under consideration in Europe.

In Westinghouse's AP1000 reactor, if a pipe leading to the reactor vessel bursts and releases radioactive steam into the steel reactor containment (green), several emergency systems are activated automatically.

1. As steam escapes, falling pressure within the reactor's pipes causes a backup tank to send water to the reactor. If the pressure continues to fall, a second backup tank releases its contents.

2. If the containment grows hotter, it heats the air above it, which exits through an aerial opening, drawing in cool air (blue arrows) from outside.



3. Water to cool the

containment is drawn down by gravity, eliminating the need for pumps.

4. Rising steam (pink arrows) is cooled and condenses, falling back (purple arrows) to the floor.

5. A sump pumps water from the containment floor back into the system. If initial safety measures fail to stabilize the reactor core, the sump works in reverse, flooding the reactor vessel with water.

Credit: John Macneill

Tagged: Energy, energy, GE, nulcear, nuclear reactors