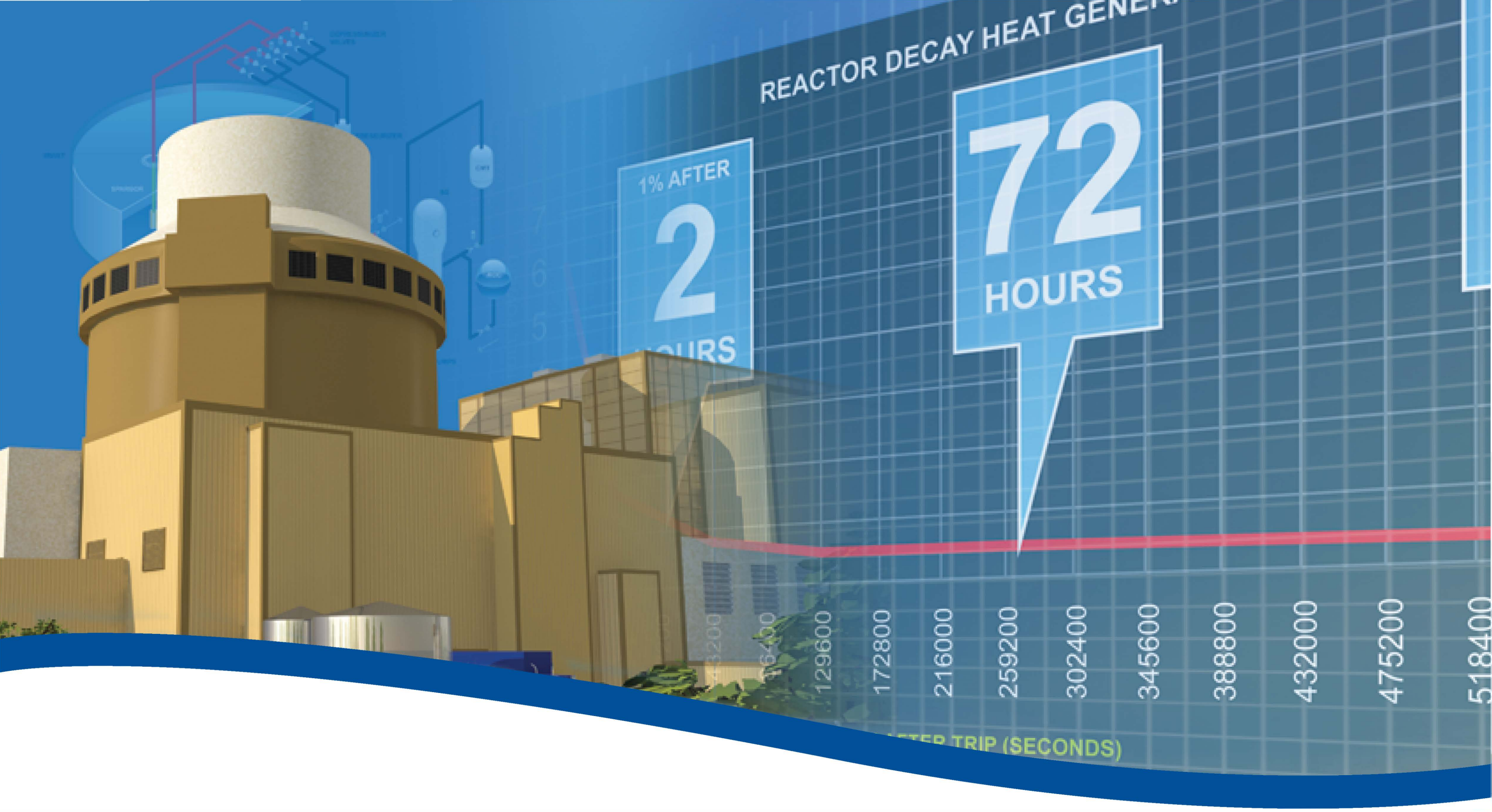


AP1000® Plant

Passive Safety Systems and Timeline for Station Blackout

Westinghouse

Simply *Safer* — Naturally

The Westinghouse ***AP1000***® Pressurized Water Reactor (PWR) is simply more advanced than other nuclear power plant technologies available today in the worldwide commercial marketplace.

Today, Westinghouse is more focused than ever on making clean, safe and reliable energy possible and practical.

Safety is always the number one priority of the ***AP1000*** plant. During a station blackout, or loss of all electrical power, the ***AP1000*** plant's passive safety system shuts down the reactor automatically, with no need for human intervention for up to 72 hours.

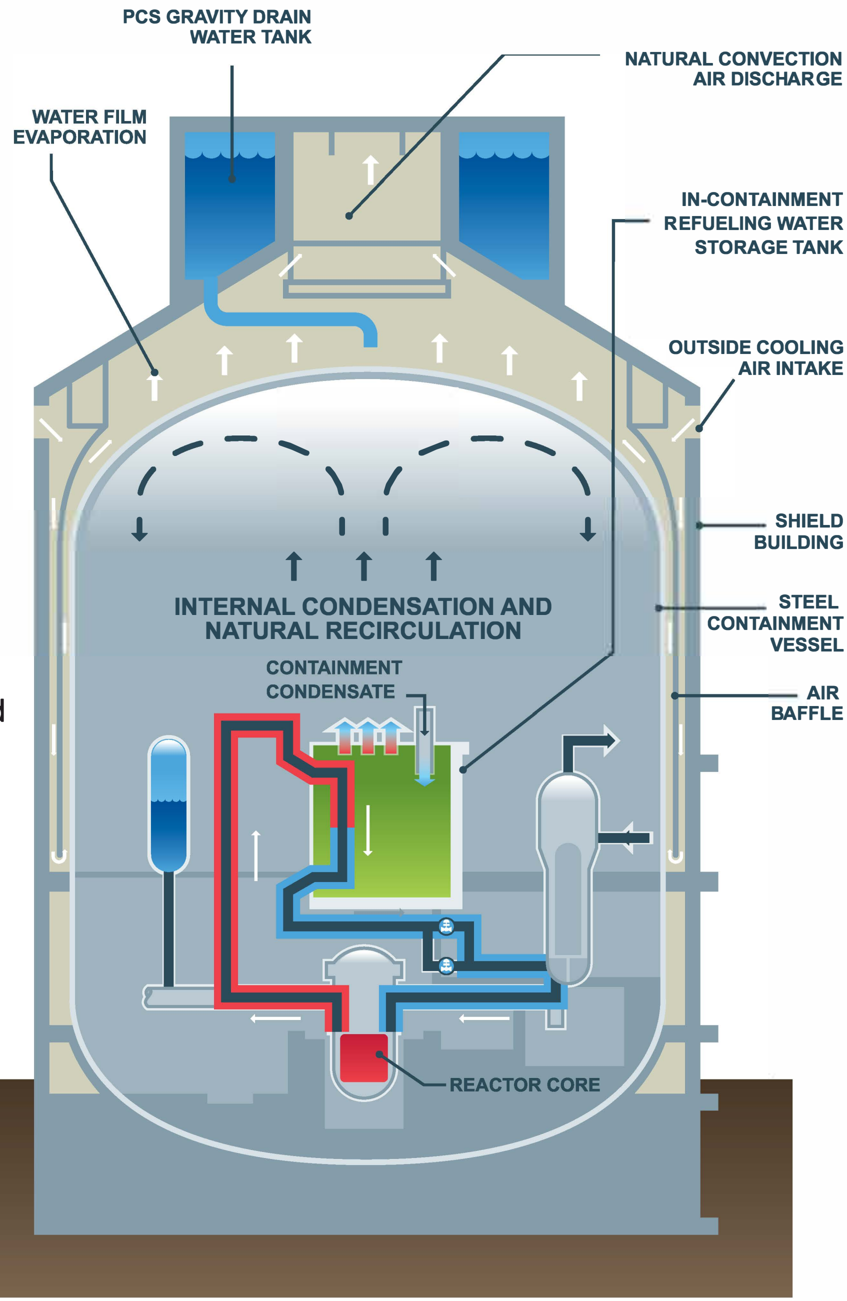
The ***AP1000*** plant's truly innovative technology harnesses natural forces like gravity, convection and condensation to achieve safe shutdown of the reactor.

In 2018 and early 2019, 4 ***AP1000*** units entered commercial operation, marking the first successful deployment of Generation III+ reactors. They then went on to achieve record-breaking first cycle and first refuelling outage performance. The AP1000 plant is now recognized as the most advanced, proven nuclear technology available, delivering safe, clean, reliable power.

Sanmen Site, China

Simply *More* Advanced

- AC power is not required for safe shutdown
- Core cooling provided for long-term safe shutdown state:
  72 hours without operator action
- The ***AP1000®*** Pressurized Water Reactor (PWR) is designed so that the core stays inside of the reactor vessel during a severe accident
- The ***AP1000*** PWR incorporates 60 years of operational lessons-learned
- After 72 hours with some operator actions to transfer water, core cooling and containment cooling are maintained indefinitely
- The ***AP1000*** PWR Spent Fuel Pool Cooling System is capable of providing cooling for spent reactor fuel indefinitely, with minimal need for operator action



TRANSFER OF REACTOR DECAY HEAT TO OUTSIDE AIR

0 Station Blackout Occurs:

Loss of offsite power occurs. At the same time, the standby diesel generators fail to start, resulting in a station blackout.

1 minute

Control rods are inserted into the reactor core, terminating the fission process and shutting down the reactor. The reactor core continues to produce decay heat that needs to be removed by cooling.

Active pumping of cooling water through the spent fuel pool stops due to loss of power. The used fuel in the spent fuel pool continues to transfer decay heat to the pool of water, causing the water to heat up.

2 minutes

The steam generator water level decreases and activates the Passive Core Cooling System.

Natural circulation flow is started automatically because of density differences between the cold reactor coolant in the passive heat exchanger and the hot fuel in the reactor core.

2 hours

Reactor decay heat has decreased to one percent of full power.

3 hours

The cooling water in the spent fuel pool begins to boil. Decay heat from the spent fuel is transferred from the water to the steam. Any evaporated water is replaced from a supply located in the adjacent cask washdown pit, which is gravity-fed to the spent fuel pool.

5 hours

The passive heat exchanger has transferred enough decay heat from the reactor to the water inside the in-containment tank that the tank begins to boil. Steam is produced inside of the containment vessel.

6 hours

The instrumentation monitoring system detects the need for containment cooling and opens valves to start cooling water flow (Passive Containment Cooling System).

Water in the containment cooling tank, located on the roof of the shield building, automatically drains through gravity and cools the top and sides of the steel containment vessel.

6-7 hours

The steam generated by the in-containment tank transfers the decay heat to the steel of the containment vessel through condensation of the steam. The water cooling the steel containment vessel removes decay heat through evaporation.

Natural convection airflow passing through the shield building promotes the water cooling of the containment.

>7 hours

As the steam from the in-containment tank transfers decay heat to the steel containment vessel, the steam condenses back to water and is redirected back to the in-containment tank for continued use in removing decay heat from the reactor core. This cooling cycle continues indefinitely.

36 hours Safe Shutdown Condition

The reactor has reached safe shutdown condition without operator action and without the use of active AC power sources, using passive cooling. Reactor decay heat generation is one half of one percent of full power.

72 HOURS

The operators start the ancillary diesel generators to provide power for post-accident monitoring, water makeup pumps and main control room lighting.

Water makeup pumps are used to transfer water from the ancillary water storage tank to the passive containment cooling water storage tank to maintain water cooling of the containment.

These pumps also transfer water from the ancillary water storage tank to the spent fuel pool to continue its cooling of the spent fuel.

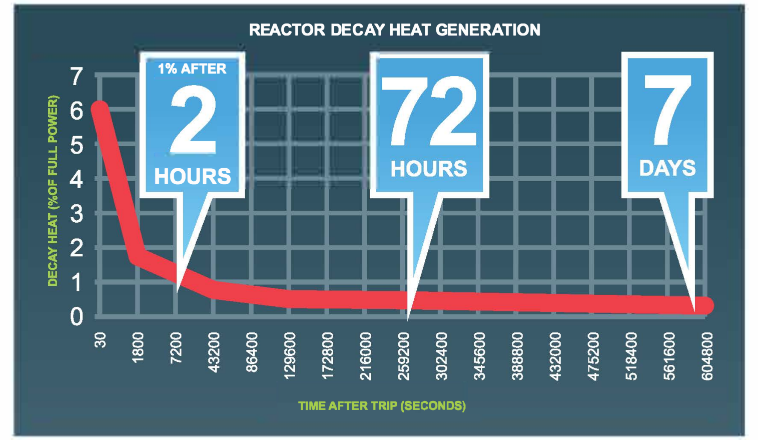
7 DAYS

Diesel fuel is replenished in the ancillary generators if power is not restored to the site, to maintain the ancillary functions.

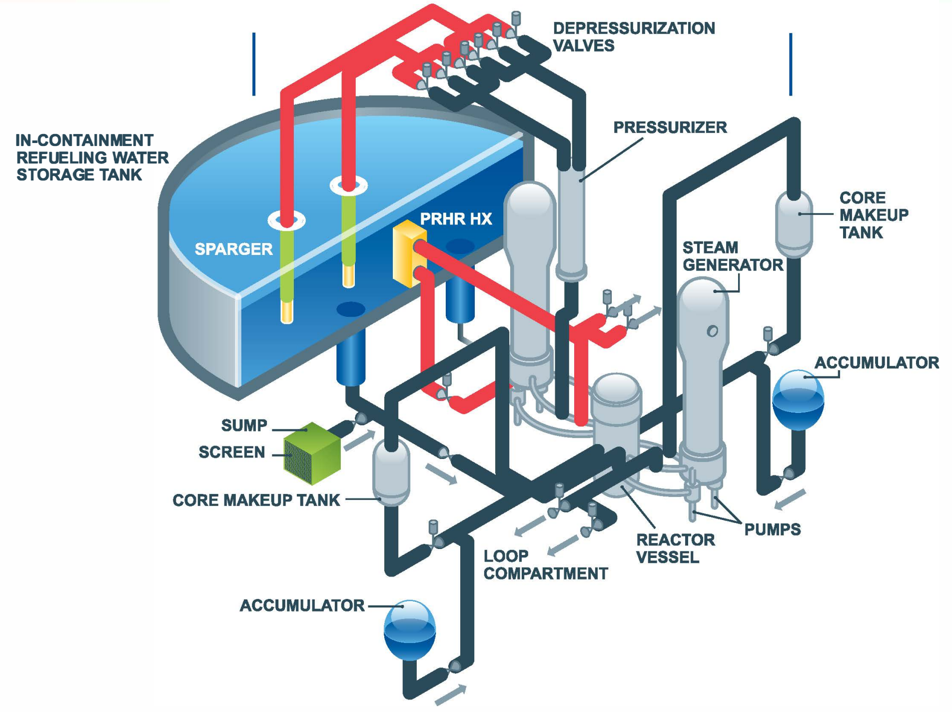
Water from other available sources, including on-site tanks, sea water, or other off-site water supplies is transferred to the ancillary water storage tank or the safety-related makeup water flanged connection in the yard. Portable equipment could be used to continue cooling of the containment vessel and the spent fuel pool.

The operator can continue to transfer water to maintain containment and spent fuel pool cooling indefinitely.

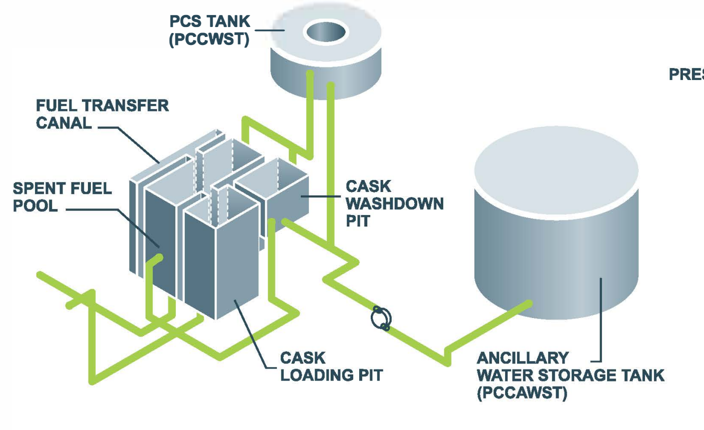
Reactor decay heat is slightly more than one third of one percent of full power.



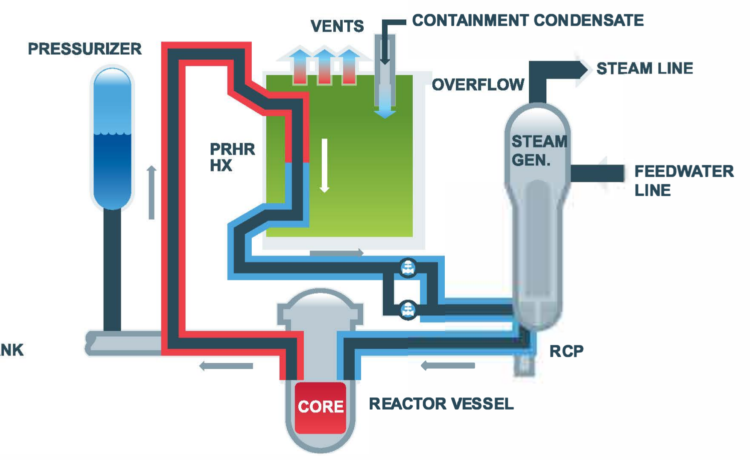
AP1000 DECAY HEAT CURVE 0 - 7 DAYS



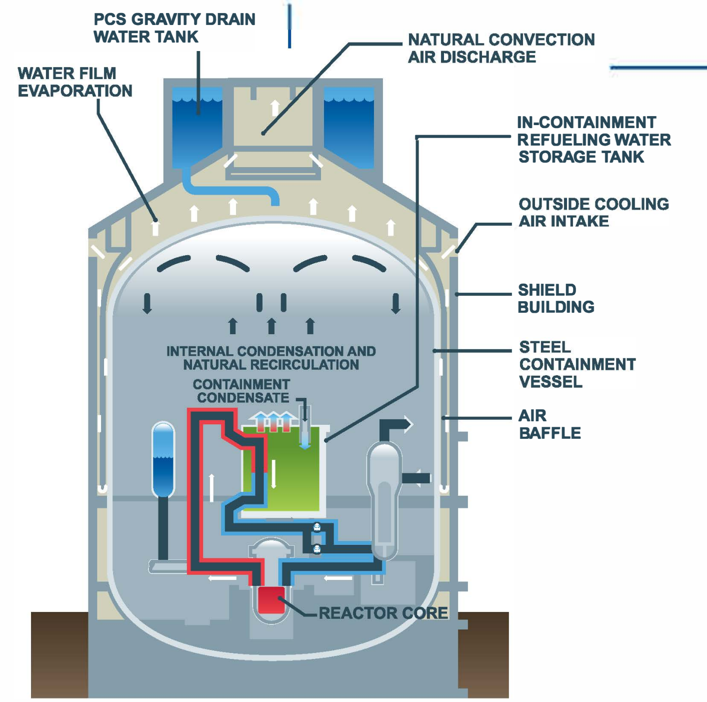
3D VERSION OF PXS AND REACTOR COOLANT SYSTEM



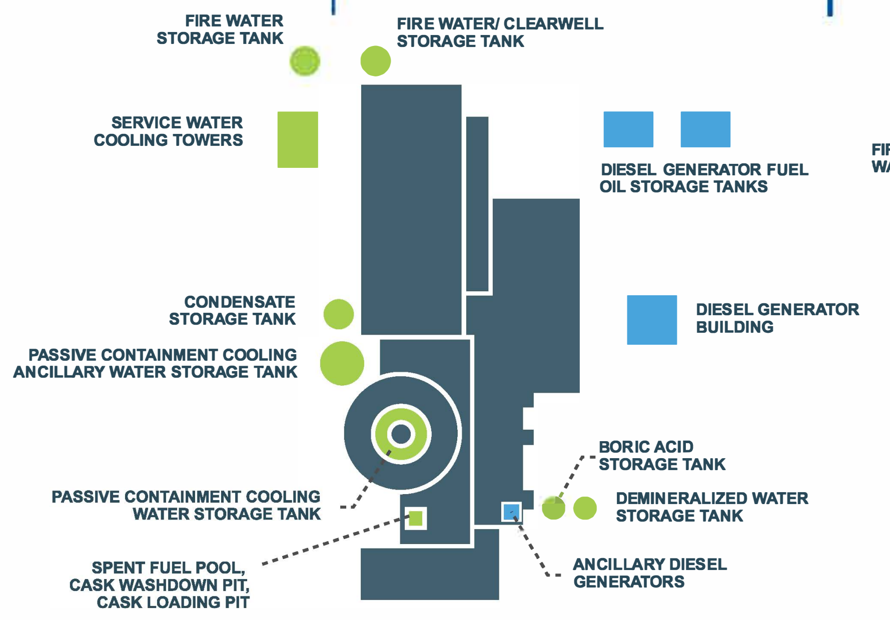
SPENT FUEL POOL WATER SOURCES FOR 7 DAYS



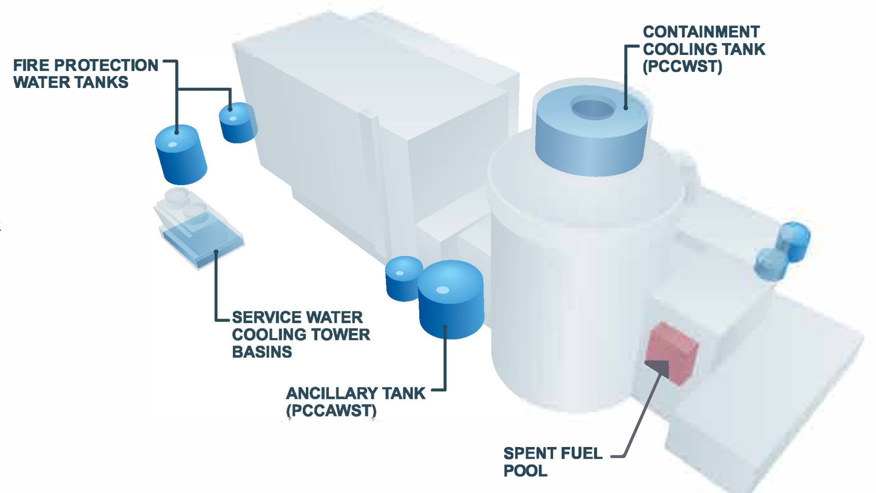
NATURAL CIRCULATION & DECAY HEAT TRANSFER



TRANSFER OF REACTOR DECAY HEAT TO OUTSIDE AIR



EMERGENCY COOLING WATER TANK LOCATIONS



AP1000 TANK LAYOUT

AP1000®

SIMPLY ELECTRIC™

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