



Nuclear Power Can't Stand the Heat

Not only is nuclear power expensive, unsafe, and polluting, it presents yet another problem – it is unreliable in hot weather. Contrary to claims that nuclear power is a solution to climate change, nuclear reactors actually have to reduce output or be shut down during heat waves, when electricity demand is the highest.

Nuclear reactors produce electricity through the heat generated by splitting atoms. The heat is used to create steam, which turns a turbine hooked up to a generator that supplies electricity to the grid. Water from nearby rivers or lakes is used to cool the steam. Water used for cooling elements in the generators is usually heated to 125 degrees Fahrenheit (°F) and then air-cooled in towers to 95°F before being re-circulated. But when the air temperature outside rises above 95°F, the water in the towers cannot cool sufficiently and the reactor cannot run at peak capacity. Moreover, if the water is too hot, it cannot be returned to the river or lake without jeopardizing aquatic life.

REDUCED ELECTRICITY SUPPLY

During heat waves, which are becoming more frequent and intense due to global warming, nuclear power plants are forced to reduce output or even shut down. At the same time, energy demand during heat waves increases due to greater use of air conditioning. The heat wave of 2007, 2006, and 2003 had this effect on reactors around the world. Just a few examples include:

- ◆ On August 16, 2007, the Tennessee Valley Authority shut down Browns Ferry Unit 2 and reduced the output from the Units 1 and 3 reactors to 75%, because water in the Tennessee River was too hot due to a heat wave across the Southeast. TVA had to buy power from elsewhere to meet demand, which was at an all-time high.¹
- ◆ D.C. Cook 1, a nuclear reactor in Michigan, was shut down on July 30, 2006. The high summer temperature, along with warmer-than-usual Lake Michigan water, raised the containment air temperature above 120°F. After unsuccessful attempts to cool the plant for 8 hours, the plant was required to be shut down.² The plant could

only be returned to full power five days later, after the heat wave had passed.³

- ◆ On August 1, 2006, because of high water temperatures, Limerick Generating Station in Pennsylvania had to cut back production by a little over 1%, the equivalent of power for 12,000 homes.⁴
- ◆ During the 2006 heat wave, electricity production of the Quad Cities reactors 1 and 2 in Illinois was cut by about 19% due to the high temperature of the water in the Mississippi River. Three reactors in Minnesota and one in Illinois also had to reduce their power output.
- ◆ On July 24, 2006, the nuclear reactor at Santa Maria de Garoña in Spain was shut down because of high temperatures in the river Ebro, used for cooling the plant. This power plant provides 20% of Spain's electricity.⁵
- ◆ During the European heat wave of 2003, 17 reactors in France had to reduce output or were shut down. In Germany, the Obrigheim nuclear power plant was shut down, and two other reactors were decreased to 80% capacity, due to high river temperatures.⁶

HIGHER ELECTRICITY PRICES

This combination of nuclear plant outages and increased electricity demand can result in higher energy prices, because other energy sources are used to meet demand. For example, the 2006 summer heat wave caused U.S. natural gas prices to increase by more than 14%.⁷ In France, during the 2003 heat wave, the French utility Électricité de France (EDF) had to buy power from other countries on the open market. The cost of electricity rose to \$1,350 per megawatt hour (MWh), compared to \$128/MWh in normal summer months. EDF was not allowed to pass along the cost to consumers, which cost the company \$300 million.⁸

ENVIRONMENTAL DAMAGE

In order to avoid power shortages that could result from reduced energy production, countries sometimes waive environmental regulations and allow the water used to cool

the reactors to return back to its source at a higher temperature. This can be harmful to river ecosystems, which cannot maintain healthy aquatic life above a certain temperature. Hot water discharges may also lead to high concentrations of ammoniac, which is toxic to aquatic plants. Some examples of such environmental waivers include:

- ◆ During the 2006 heat wave in Germany, reactors Isar 1 and Neckarwestheim received waivers to discharge hotter water than allow by law into the nearby rivers.⁹
- ◆ On July 19, 2006, France lifted restrictions on the water temperatures at three plants Bugey, de Tricastin, and Golfech.¹⁰ On July 24, France set aside its regulations for all reactors situated near rivers saying that the measure was intended “to guarantee the provision of electricity for the country.” Thirty-seven of France’s 58 reactors discharge water from their cooling systems into rivers.¹¹
- ◆ During the August 2003 heat wave, the French government granted a similar waiver for seven nuclear sites, consisting of 24 reactors. The waiver lasted until the end of September. For most reactors, the temperature limit was increased by 1 degree. At Tricastin and three other reactors, it was raised 3 degrees resulting in significant damage to the aquatic life in the rivers. As a result of waiving the temperature restriction, one reactor at Blayais legally dumped hot waste water 50 times.¹² The heat wave was so intense that air temperatures at nuclear reactors came within two degrees of requiring emergency shutdown. In an attempt to cool the reactor, employees used garden hoses to spray cold water on the outside walls of the reactors.¹³

DROUGHTS

In addition to heat waves, droughts are also expected to become more frequent and intense with climate change and can also have a profound effect on nuclear power production.

- ◆ In 2005, a drought brought the Vienne River in France to a trickle. The Civaux nuclear plant, which takes in 350,000 cubic meters of water from the river per day, should have been shut down under French law because of the lack of water, but was kept running.¹⁴
- ◆ Drought in the summer of 1999 almost required the shutdown of two nuclear power plants in northern Ohio, Perry and Davis-Besse. Low water levels in Lake Erie and hot temperatures

brought lake temperatures close to the limit considered safe for electricity generation. FirstEnergy Corp went so far as to request the Nuclear Regulatory Commission to raise the temperature cutoff at Davis-Besse. The heat wave ended before the NRC responded.¹⁵

- ◆ During the 2003 drought, the Cernavoda nuclear plant in Romania, which supplies 10% of the country’s electricity, was closed for almost a month due to low water levels in the Danube. Demand was met by increasing output from coal plants.¹⁶

SAFETY THREATS

In addition to problems relating to hot coolant water, nuclear reactors have experienced other difficulties due to intense summer weather.

- ◆ On July 31, 2006, fire alarms went off unexpectedly at the Fermi 2 nuclear power plant in Michigan. According to the Nuclear Regulatory Commission, high humidity set off the alarms. As a result, carbon dioxide, a fire-suppression gas, was discharged into an auxiliary building, requiring the evacuation of 25 workers in that building.¹⁷
- ◆ In August 2006, the lightning arrester, which is used to limit surge voltages, at the Zion reactor in Illinois was damaged by high temperatures. Zion was shut down in 1998, but power still goes to the plant.¹⁸
- ◆ During 2003 heat wave in France, scheduled maintenance for reactors on the French coast was postponed and kept running at risk to the public in order to meet demand.¹⁹

Hot weather clearly presents numerous difficulties for nuclear power plants – another reason why nuclear power should not be seen as a safe and reliable source of alternative energy. When high temperatures heat up water from rivers or lakes that is used to cool down nuclear plants, either the plant has to decrease its energy output which can result in electricity outages or the plant must return hot water back to its source which is unsafe for aquatic flora and fauna. Furthermore, these compromises can sometimes lead to public safety risks. With the effects of climate change becoming more pronounced and heat waves becoming more common, nuclear energy is simply too unreliable to solve our nation’s energy problems.

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References available at:

http://www.citizen.org/cmep/energy_enviro_nuclear/nuclear_power_plant/s/reactor_safety/articles.cfm?ID=17013