FACT SHEET

Water Consumption at Nuclear Power Plants

July 2008

NEI
NUCLEAR ENERGY INSTITUTE

SUITE 400
1776 I STREET, NW
WASHINGTON, DC
20006–3708
202.739.8000
www.nei.org

Key Facts

- Power plants circulate significant volumes of water in the process of generating electricity, but actually consume a small amount of water relative to other uses in the modern world.

- Of all the freshwater consumed in the United States, electricity generation accounts for 3.3 percent—less than half of the freshwater consumed by residential use (6.7 percent), according to the U.S. Geological Survey (USGS).

- Nuclear power plants circulate water to cool equipment. This water continuously is returned to its source and never is exposed to radioactive material.

- Nuclear power plants consume less water per unit of electricity produced than some forms of renewable energy.

- Nuclear power plants have a small environmental impact and produce reliable electricity in a wide range of weather conditions.

Defining Water Withdrawal, Consumption

All power plants that generate electricity by producing steam to move a turbine rely on water for cooling. These plants—fueled by coal, natural gas and nuclear energy—produce about 90 percent of all the electricity that powers America's homes and economy. This electricity also powers water purification systems, pumping stations and waste-water treatment plants that residents, businesses and communities rely upon in society. In this way, electricity and water are interdependent.

The amount of water actually consumed by electric power generation is very small compared to other economic sectors. Thermoelectric power plants withdraw large volumes of water, but, depending on the design, most of the water is returned to its source.

A critical distinction is the difference between water *withdrawn* from a lake or river by a power plant and water actually *consumed* by the plant.

Plants that have an open-cycle cooling system withdraw water to cool steam and equipment through a system of pipes that circulates the water through components. After the water is withdrawn, virtually all of it is quickly *returned* to its source. This water never encounters the reactor or radioactive material.

For plants that have a closed-cycle cooling system using a cooling tower or cooling pond, water is withdrawn to cool steam and equipment through evaporation. Most of this water is not returned to its source.

Because rainfall in some areas of the country in 2007 was 15 to 20 inches below normal, energy companies have taken steps to reduce water consumption and otherwise conserve water supply.

Energy companies have worked with state and local governments and public water system operators to manage water use during drought conditions. In the Southeast, this coordinated approach to conservation resulted in more than a 20 percent water savings in 2007.

Electricity Generators Among Smallest Users

Electric power generation is among the smallest users of freshwater, accounting for about 3.3 percent of U.S. freshwater consumption, according to the USGS. This is about the same percentage of freshwater consumed by both industry and livestock raising. The largest consumption of freshwater is for irrigation (81.3 percent) and residential use (6.7 percent), the USGS said.

A typical nuclear plant supplies electricity around the clock for 740,000 homes. A nuclear power plant that returns cooling water directly to the source consumes the

Water Consumption at Nuclear Power Plants

equivalent of six to 16 gallons of water per day per household. The same plant would consume the equivalent of 20 to 26 gallons of water per day per household if it used cooling tower systems. By comparison, the average U.S. household of three people consumes about 300 gallons of water per day for indoor and outdoor uses, according to the USGS.

Nuclear Plants Perform Well in Severe Weather

All power plants that use water for cooling may reduce electricity generation to moderate discharge temperature to remain in compliance with environmental permit requirements. Depending on the plant's design and location, there may be environmental permit requirements associated with water levels or flow rates that may prompt power restrictions in drought conditions.

Although extremely high temperatures can reduce the efficiency of electricity production at nuclear power plants, the reactors can continue to operate safely.

Each reactor decreases power production if the cooling water source—lake, river or ocean—exceeds certain temperature or water-level requirements. The maximum allowed temperature for heat removal depends on the individual water source and is specified in each plant's operating license.

Reduction in power production because of environmental conditions (excessive temperatures or low water levels) has occurred in the United States. However, it often is unnoticed by consumers because the power company is able to compensate for that reduced electricity production through other power production assets on the electricity grid.

Although the southeastern United States recently has suffered from drought conditions, nuclear plants were not affected significantly. In fact, nuclear plants in the region were critical to meeting electricity demand during a two-week heat wave in August 2007.

With the drought and unusually high temperatures last summer, hydropower generation was reduced by as much as 40 percent below annual levels for some companies. Tennessee Valley Authority cut back on power production at its Browns Ferry Nuclear Plant in Athens, Ala., and at some of its most efficient coal plants last August to keep river temperatures from exceeding state environmental limits.

This fact sheet also is available at www.nei.org, *where it is updated periodically*.