Nuclear Power Is Efficient and Safe for the Environment

What Energy Sources Should Be Pursued?, 2005

The Nuclear Energy Institute (NEI) is the policy organization of the nuclear energy industry whose objective is to promote policies that benefit the nuclear energy business.

> Nuclear energy is a clean, stable way to generate power. Unlike coal, gas, and oil generators, nuclear power plants do not emit toxic pollutants into the air. Nuclear plants are relatively small and have less of a "footprint" on the land than wind or solar farms. The areas around nuclear plants are often parklike habitats that are home to many types of endangered species. Compared to many sources of electrical generation, nuclear power plants are relatively benign.

Using the Opposing Viewpoints Resource Center, research the proposed Yucca Mountain repository for nuclear waste. Write a letter to the editor of your local newspaper discussing the pros and cons of the project. Be sure and mention how the project fits into the government's nuclear energy policy.

The use of nuclear energy has increased in the United States since 1973. Nuclear energy's share of U.S. electricity generation has grown from 4 percent in 1973 to almost 20 percent in 1999. Part of the increase is due to improved plant performance. Just since 1990, the increased output from the nation's nuclear plants has been the equivalent of bringing 19 new 1,000-megawatt nuclear plants on line.

This is excellent news for the environment. Nuclear energy and hydropower are the two large-scale means of producing electricity while keeping the air clean. Because nuclear power plants do not burn fuel, they emit no combustion byproducts—like air pollutants and carbon dioxide—into the atmosphere.

Emissions of nitrogen oxide and sulfur dioxide are regulated by the 1990 Clean Air Act amendments....

Nitrogen oxide (NO_X) plays a major role in the formation of ozone, which is detrimental to human health. NO_X is also a significant contributor to acid rain....

By substituting for fossil fuels in electricity generation, U.S. nuclear power plants currently avoid almost two million tons of NO_X emissions annually.... Between 1973 and 1999, nuclear energy avoided emission of 31.6 million tons of NO_X....

Sulfur dioxide (SO_2) is thought to contribute to acid rain. A main objective of the Clean Air Act amendments is to reduce the amount of SO_2 emitted into the atmosphere. Between 1990 and 1995, generation from nuclear power plants serving the states affected by the act's initial emission reduction targets increased by more than 16 percent. By displacing fossil fuels to generate electricity, this increased generation avoided 480,000 tons of (SO_2) emissions....

Since the 1973 oil embargo nuclear energy has contributed even more significantly to U.S. air quality. By substituting for fossil fuels, U.S. nuclear power plants displaced a cumulative total of 61.9 million tons of (SO_2) between 1973 and 1999.

Reducing carbon dioxide emissions

As sunlight passes through the air and reaches the ground, it turns into heat. Certain gases in the atmosphere act like the glass in a greenhouse, preventing some of this heat from escaping back into space. This trapped heat helps keep the Earth comfortably warm.

But many scientists believe that carbon dioxide emissions from human activities add to the warming effect, bringing about changes in climate....

Carbon dioxide is estimated to be responsible for one-half of any global warming.

By substituting for fossil fuels, U.S. nuclear plants reduced total U.S. greenhouse gas emissions by 168 million metric tons of carbon equivalent in 1999. Without nuclear energy, U.S. electric utility emissions of carbon equivalents would have been approximately 30 percent higher.

Generating one million kilowatt-hours of electricity produces about 150 metric tons of carbon from a natural gas-fired plant, 265 metric tons from a coal-fired plant and 220 metric tons of carbon from an oil-fired plant—but no carbon from a nuclear power plant. (In the United States, coal-fired power plants supply electricity to the facilities that enrich uranium for fuel. About 10 metric tons of carbon are emitted from these plants in the enrichment of enough fuel to produce one million kilowatt-hours of electricity.)

Long term, nuclear energy reduced total U.S. CO_2 emissions by 2.61 billion metric tons of carbon between 1973 and 1999, by replacing fossil fuels for electricity generation.

Worldwide, nuclear energy has significantly reduced greenhouse gas emissions. Approximately 430 nuclear power plants in 31 nations produce 17 percent of the world's electricity—while reducing CO_2 emissions by some 500 million metric tons of carbon....

Strict standards, careful control

All methods of producing electricity affect the environment to some degree, but the impacts from nuclear energy are minimal—one of the lowest on a per-kilowatt-hour basis.

Because the fuel in nuclear power plants is radioactive, nuclear plants are carefully designed, built and monitored to prevent releases of radioactive material. The Environmental Protection Agency [EPA] sets—and the NRC [Nuclear Regulatory Commission] enforces—strict standards governing radiation emissions.

To make sure that nuclear power plants operate well within those standards, radiation levels at every plant are monitored 24 hours a day, seven days a week. Even soil, cows' milk from neighboring farms, and fish and sediment in nearby rivers and lakes are monitored periodically. The monitoring instruments are so sensitive that they can measure even trace amounts of radiation. Nuclear power plant emissions are always well below the

safe levels permitted by federal standards. That is why the environment has never been harmed by radiation emissions from a U.S. nuclear power plant.

Even the people living closest to a nuclear power plant receive an average of only one extra day's worth of radiation—about one millirem—each year. In comparison, the average American is exposed to 360 millirem annually from the natural environment and man-made sources, like medical X-rays.

Protecting aquatic resources

Before a plant begins operating, an environmental impact statement examines all potential impacts to water quality from the operation of the plant. These include concerns about the discharge of heated water and the possibility of trapping aquatic life in the intake. All issues are resolved by the time the plant is licensed. If a license is later renewed, the plant must certify that no significant adverse impacts have been observed during the plant's operating life.

Like all steam-electric generating plants, nuclear power plants must take in water for cooling. That is why many of them are located on rivers, lakes and bays. After it is used for cooling, the water—now slightly warmed—needs to be discharged. (This water has never come in contact with radioactive materials.)

Cooling water discharged from a plant contains no harmful pollutants, but still must meet federal Clean Water Act requirements and state standards designed to protect water quality and aquatic life. If the water is warm enough to possibly harm aquatic life, it is cooled before it is returned to its source river, lake or bay. It is either mixed with water in a cooling pond or pumped through a cooling tower before it is discharged. In addition, power plants operate under National Pollutant Discharge Elimination System permits, which specify standards and monitoring requirements for all water discharges from the plants. These permits, which must be renewed every five years, require plants to use the best technology available, thus minimizing environmental impacts.

The Nuclear Regulatory Commission also reviews plant operations to be sure there is no adverse impact to water quality and aquatic ecology. Many early aquatic resource concerns have not materialized at any nuclear power plant.

Protecting wildlife and habitats

Because the area around a nuclear power plant is so clean, the areas around cooling ponds are often developed as environmentally rich wetlands, providing better nesting areas for waterfowl and other birds, new habitats for fish, and preservation of other wildlife, flowers and grasses.

Electric utilities voluntarily work to protect the fish, mammals, reptiles, birds and plants found on or near power plant sites. Many have created special nature parks or wildlife sanctuaries on plant sites.

For example, Virginia Power protects a bald eagle nesting site at its Surry nuclear plant and nesting boxes for wood ducks and barn swallows at its North Anna nuclear plant. It also built 20 underwater block-and-brush structures in Lake Anna, where young fish can find cover and large fish can feed and spawn. When the Turkey Point nuclear power plant in Florida dredged some 160 miles of cooling canals, they became a safe nesting ground where newly hatched crocodiles—often hunted for their skin—have a chance to survive.

Managing spent fuel

Management of used nuclear fuel is one of the most successful solid waste management programs ever for dealing with the byproduct material of our industrial society. The fuel is radioactive and, therefore, is kept safely stored away from the environment.

What is used fuel? Like other power plants, nuclear plants create electricity by boiling water into steam, which turns a turbine-generator. Nuclear power plants do not burn anything to create this heat. Instead, they fission—or split—uranium atoms in a chain reaction. This is a clean, non-polluting process.

Uranium fuel, in the form of small ceramic pellets, is placed inside metal fuel rods, which are grouped into bundles, called assemblies. Over time, the fuel's energy is consumed. Thus, every 18-24 months the reactor is shut down and the oldest fuel assemblies—which have released their energy but have become radioactive as a result of fission—are removed and replaced.

Relatively small volume—All of the country's nuclear power plants together produce about 2,000 metric tons of used fuel annually. All the used fuel ever produced by the U.S. nuclear energy industry in more than 40 years of operation—some 40,000 metric tons—would cover an area only the size of a football field to a depth of about five yards, if the fuel assemblies were stacked side by side and laid end to end.

Losing its radioactivity—Used fuel is highly radioactive when it is removed from the reactor, but it loses its radioactivity as time goes by. Most used fuel loses about 50 percent of its radioactivity after three months and about 80 percent after one year. Less than 1 percent will remain radioactive for thousands of years. (In contrast, chemical waste remains toxic forever.) All used fuel is carefully isolated from people and the environment.

Safe storage—Today, this used fuel is stored at the plant sites, either in steel-lined, concrete vaults filled with water, called used fuel pools, or in above-ground steel or steel-reinforced concrete containers with steel inner canisters. On-site storage is an interim measure, however, and licenses issued by the NRC limit the amount of used fuel that a utility is permitted to keep on site. Although the NRC determined that used fuel could be stored at plant sites for 100 years without adverse health or safety consequences, it also believes that timely disposal is necessary.

In the Nuclear Waste Policy Act of 1982 and its 1987 amendments, Congress created a timetable for a long-term solution: a deep, mined geologic repository built in an unpopulated desert area in Nevada. A scientific study of that site, called Yucca Mountain, is under way and is nearing determination of its suitability.

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