Argonne NATIONAL LABORATORY

Nuclear Energy FAQs

What is nuclear energy?

Nuclear power plants split uranium atoms inside a reactor in a process called fission. At a nuclear energy facility, the heat from fission is used to produce steam, which turns a turbine to generate electricity. At this point a nuclear plant is similar to a coal, gas or solar thermal plant; those energy sources also generate steam through heat to spin a turbine. The main differences are how the heat is generated and the amount of fuel consumed – in a nuclear power plant, the amount of fuel consumed is tiny compared to that of a fossil fuel plant.

What is the difference between natural radiation and radiation from nuclear energy?

Radiation is naturally present everywhere people live. It comes from a variety of sources, including cosmic rays, solar radiation, and terrestrial radiation from the ground. The background radiation a person receives varies with activities (increases by eating certain foods, drinking ground water, flying on a plane, getting an x-ray) and location (increases by living at higher elevations or in a brick house). Humans evolved in an environment of ever-present natural background radiation, and the radiation from a nuclear plant is the same type as natural radiation, except it is far below background levels and thus poses no threat.

Do nuclear plants produce greenhouse gases? No greenhouse gases are emitted by nuclear power plants. Nuclear power also does not create particulate pollution. Nuclear energy is the only clean-air source of energy that produces electricity 24 hours a day, every day.

Isn't Fukushima a good reason not to build nuclear plants? Isn't that area now uninhabitable? No on both counts. The radiation levels near the Fukushima plants have been low enough for human habitation and growing crops for quite some time and people have begun to return to their homes. The Fukushima reactors are older designs that should have been updated to higher safety standards to avoid this failure (the few commercial reactors in the U.S. of this design were updated long ago). The latest commercial reactor designs differ considerably from the Fukushima reactors and have features that would have prevented the failures that occurred following the tsunami at Fukushima.

Will radiation from Fukushima be of concern along U.S. and Canadian coasts? Even near the Fukushima plants, the contamination in the sea is well below levels that pose a health hazard. In fact, the radiation levels are significantly below background radiation. Moreover, Fukushima contaminants in the ocean dilute by a factor of many thousands before their arrival to North America coasts.

Don't nuclear power plants spew out a lot of radiation?

Nuclear plants emit almost no radiation. Ironically, coal-fired power plants emit about three times as much radiation as nuclear power plants due to naturally occurring radiation from the ground. Radiation exposure from a nuclear power plant is about 1/300 the natural background level of radiation.

Won't a lot of radiation be released if a nuclear plant loses power because of an earthquake, hurricane, or terrorist attack? No. U.S. reactors have many more additional ways of cooling the reactors in a blackout than did the Fukushima reactors, which had not been updated to handle heat removal following a loss of electricity to the plant. If a blackout occurs, a reactor immediately shuts down (as did the Fukushima reactors); the difference with newer reactor designs is that the remaining heat from radioactive decay is continuously removed whether there is available electricity or not, thus preventing fuel melting and keeping the radioactive material secured within the reactor.

Can't a nuclear power plant explode like a nuclear weapon? It is impossible for a reactor to explode like a nuclear weapon. Nuclear weapons contain very special materials in unique arrangements, which is not the case in nuclear reactors. Explosions that occurred at Fukushima were driven by a build-up of high-pressure gases (hydrogen and steam). The resulting explosion is similar to a can of soda exploding upon impact. In the U.S., these explosions would not have occurred – the gases would not have been able to build up due to design differences.

Isn't it easy for terrorists to steal nuclear fuel from nuclear plants and make bombs?
Plutonium is present only in spent (used) fuel, and the high radiation levels of spent fuel, plus the very strong and thick steel and concrete structures where spent fuel is stored, make spent fuel very unsuitable for making bombs. This also makes it very secure against theft for making dirty bombs. Fresh (unused) fuel contains only non-weapons grade uranium, which is sealed inside fuel bundles that weigh roughly 1,000 pounds and are about 12 feet tall. Nuclear bombs need over 90% U235, whereas commercial nuclear fuel is no more than 5% U235. Finally, nuclear power plants have elaborate security, including sensors, barriers and armed guards, to provide added assurance that both fresh fuel and spent fuel remain secure.

What about the huge amounts of nuclear waste from nuclear power plants? There's no way to get rid of it, is there? The current amount of nuclear waste is a small volume compared to waste products from other on-demand energy sources. All of the spent nuclear fuel generated in every U.S. nuclear plant in the past 50 years would fill a single football field to a depth of less than 10 yards. Used fuel is not truly "waste" —96 % of spent fuel has the potential to be recycled to make new nuclear fuel in the future. And the radioactive material left over from recycling would need storage for less than 300 years to become no more radioactive than ordinary bricks and stones.

Isn't it dangerous to store spent nuclear fuel? No. Spent fuel is currently being safely stored at power plants, first in big pools of water, then, after several years, in concrete casks. Spent fuel is so well shielded that divers routinely plunge into the storage pools to complete surveillance inspections without receiving a significant radiation dose.

Why should we build nuclear plants that take 12 years to construct, when solar and wind farms can go up in a couple of years? Nuclear plants can be built in significantly less time. For example, in China it takes 5 years from initial construction to commercial operation of a nuclear plant. Besides, a nuclear power plant operates for up to 60 years (compared to about 15 years for wind turbines) producing emission-free electricity for 1 million homes with low fuel costs. Countries like China are building or planning for almost 100 reactors in the next few decades to reduce their carbon footprint while providing reliable electricity to support their projected economic growth.

Can we run out of uranium fuel for reactors? The U.S. has large uranium reserves and could obtain additional uranium from politically stable, friendly countries like Canada and Australia that also have large uranium deposits. Known reserves of economically accessible uranium should supply over 200 years of nuclear power production worldwide at existing consumption rates. However further exploration and improvements in extraction technology, enhancements to light water reactors (LWRs), plus the ability to recycle spent nuclear fuel, have the potential to extend the supplies to a thousand years. Fast breeder reactors under development generate more fuel than they consume, and use less than 1 percent of the uranium needed for current LWRs. Breeder reactors could provide today's level of nuclear power production for 30,000 years using existing reserves.

Why not use thorium reactor plants? Aren't they safer than uranium-fueled reactors? We may use the thorium cycle some day when uranium runs low, or in countries with little uranium. But uranium fuel technology (especially recycling) is much more developed than thorium technology and therefore more commercially viable. All of the arguments commonly made in favor of thorium reactors are also true for advanced uranium reactors, including the safety arguments, and uranium advanced reactors are far closer to commercialization than reactors using thorium technology, so there is not strong justification to abandon uranium in favor of thorium.