Answers on Nuclear Power and Indian Point

Q. **How does a nuclear power plant work?**

A. Power plants, whether they are coal, gas, oil or nuclear, use steam to make electricity. They operate like a giant tea kettle, turning water into steam which spins giant turbines that power generators to make electricity. The primary difference between fossil and nuclear power plants is that nuclear plants use uranium as the fuel to produce steam instead of burning fossil fuels.

In a nuclear power plant reactor, water is heated by a process called nuclear fission.

1. Uranium atoms are split when they are struck by neutrons.
2. When the atoms split, they release heat, along with two or three more neutrons.
3. These neutrons then strike other uranium atoms, again causing the atoms to split, release heat and again, two or three more neutrons. This is called a chain reaction.

The steam then spins the turbines that are connected to the generators to produce electricity.

Q. **Is Indian Point a safe plant?**

A. Nuclear power plants are very safe and nuclear power generation has proven to be the safest way to produce large amounts of electricity.

The U.S. nuclear industry has operated for more than 30 years without a single nuclear-related fatality.

Indian Point, like all nuclear power facilities, was designed with multiple and redundant safety systems and components – first, to prevent accidents, and second, to minimize the effects of any malfunction, if one did occur.

The plant staff is frequently and rigorously trained, drilled and evaluated to deal with any emergency. The plant can be shut down, and the nuclear fission process stopped, in less than two seconds. In fact, the plant will shut down automatically if even one safety component malfunctions.

Structural safety is another intrinsic element to ensure the continued operation of the plant. The containment structure around the reactor provides multiple physical layers of protection. In fact, the containment building has four primary layers of safety built in:

- Nuclear fuel—The fuel itself is actually designed to contain the radioactive gases generated during the fission process.

- Reactor coolant system—Within the system there are multiple cooling capabilities, each with back up systems in place to ensure the cooling process continues without interruption.
- Primary containment structure—This consists of a one-inch thick steel wall surrounded by a wall of steel-reinforced concrete five feet thick. This ensures that radioactivity is contained even in the most serious situations.
- Reactor building—This is the secondary containment level. In addition to having walls of two more feet of steel-reinforced concrete, the building itself is kept at a lower atmospheric pressure level than the outside air to keep any radioactivity inside. Anyone entering this building must pass through an air-lock door which helps to maintain the negative pressure area.

In fact, Three Mile Island is a perfect example of how well all of these components work. Studies conducted by the University of Pennsylvania at 10 and 20 years following the 1979 incident show there were no adverse health affects from the event, further supporting the claim that the safety systems worked as they should have.

To read more about nuclear safety at Indian Point, click here.

Q. **Is Indian Point secure?**

Indian Point is both safe and secure against natural and man-made events for several reasons. IPEC provides protection at the plant through a highly trained security force, detection capabilities and physical barriers, and a highly qualified brigade of first responders and local, state and federal security agencies.

In addition to skilled security personnel, there are several security barriers on-site within each building and only a limited number of employees are able to access to the highly restricted areas. Assuming one has the authority to access sensitive areas, there are cameras, stationary and patrolling armed guards, turn-styles and, digital access points, which make it nearly impossible for any individual to go unnoticed.

The containment structure, while it plays a significant safety role, also plays a major security role as well. In addition to the numerous safety measures in place from to protect contain the materials in the reactor core, the rugged and robust physical structure also plays a key role in securing keeping the core from outside attacks of any kind.

Security experts call Indian Point Energy Center, “The best-defended industrial facility in America.” Indian Point remains at its highest possible alert status, 24 hours a day, 7 days a week.

Q. Can a nuclear plant explode?

A. No, a nuclear explosion cannot occur at commercial nuclear plants.

Fuel for nuclear plant uranium is mined from the earth and then goes through the process of "enrichment." From that process, comes uranium-235 (which makes up approximately 4% of nuclear fuel used at a commercial facility) and uranium-238 (which makes up the other 96% of the fuel). In order to have an explosion, unranuim-235 must make up nearly 100% of the fuel. Scientifically speaking, an explosion at a nuclear facility in the U.S. would counter the laws of physics.

Q. Can Chernobyl happen here?

A. No. Though people often compare U.S. nuclear facilities to Chernobyl, U.S. nuclear facilities have several safeguards that Chernobyl did not, including a high-integrity containment building and multiple safety systems.

There are several significant distinctions that should be understood:

- There was no containment structure at Chernobyl. Instead, there was a graphite cylinder with a tin roof that surrounded the nuclear fuel. All U.S. plants are required to have a high-integrity containment structure in place.
- Safety systems at the Chernobyl facility were disconnected prior to the explosion.
- The explosion at Chernobyl was a hydrogen explosion, not a nuclear explosion. Hydrogen was used to generate the heat that powered the turbines and generators to create electricity. In the U.S., steam is used to operate the turbines.
- Once the top of the reactor was literally blown off by the hydrogen explosion, irradiated graphite was scattered into the distance which is why the effects were seen so far away. The radioactive isotopes from the nuclear fuel (because of their weight) remained in the reactor.

The type of uranium used at a commercial facility in the U.S. and the structure of the containment dome required to operate a plant here would rule out the possibility of any Chernobyl-type event. That type of plant could NOT be – nor has one ever been – licensed in the U.S. because of the substantial design flaws at Chernobyl. Thus, the accident that occurred there could not be duplicated here in the U.S.

Consider the only nuclear accident that has occurred in the U.S. in the 35-year history of nuclear power, Three Mile Island—the containment dome successfully contained the radioactivity preventing dangerous exposure levels from ever leaving the core, much less reaching the public. And, even though no one was harmed in that accident, the industry learned from the event and implemented even more safeguards in the form of plant equipment and training.

Q. What assurances are there that the plant is safe and that the public is protected from radiation or a nuclear explosion?

A.

- There **cannot** be a nuclear explosion at the Indian Point plants as a result of an aircraft crash or any other event. It would counter the laws of physics.
- The plants can be shut down and the nuclear fission process stopped in less than two seconds. The plant staff is trained and drilled to deal with any emergency.
- There **cannot** be a Chernobyl-type event at Indian Point Energy Center. Indian Point has safeguards that Chernobyl did not, such as a high-integrity containment building.
- The Indian Point plants were designed with multiple, redundant safety systems and components. First, to prevent accidents, and second, to minimize the effects of any accidents if they did occur.

Q. How is spent fuel stored at Indian Point?

A. Spent fuel is stored in a spent fuel pool which is housed in a building attached to each reactor. Each plant has its own spent fuel pool. The walls of the storage facilities for nuclear fuel are five feet thick, reinforced concrete with a steel-reinforced liner to ensure safety and protection from all kinds of natural disasters or manmade assaults.

Water provides shielding from radioactivity and keeps the fuel cool. Redundant safety systems ensure that the water level is maintained and fuel integrity is not compromised.

Indian Point has recently begun to transfer some of the spent fuel from the spent fuel pool of Unit 2 into dry cask units which will be stored on a special pad onsite at IPEC.

For additional information, visit the environmental section of our Web site.

Q. What do I need to know about emergency planning?

A. Entergy spends millions of dollars to ensure that residents and businesses within the 10 mile emergency planning zone (EPZ) are well informed of what to do in the event of an emergency. In the emergency preparedness section of our website, you will find checklists and other important notification information on emergency planning.

Q. Has security been updated at Indian Point since September 11, 2001?

A. Less than 12 months after the Entergy's purchase of Indian Point 2 and 3, we were forced to deal with the tragedy and reality of terrorism on September 11. In addition to the requirement that were developed by the Nuclear Regulatory Commission (NRC) to

ensure nuclear facilities nationwide addressed and were prepared to deal with these potential security issues.

- The Federal Government provides military air cover and aircraft interdiction. The National Guard patrols on site and the Coast Guard patrols adjacent waters.
- Indian Point's armed, well-trained security force maintains on-going contact with local, county, state and federal public safety and law enforcement agencies.
- Access to the controlled property is restricted to identified personnel only. Roadways are controlled by multiple barricades. Access to the plant is restricted to plant employees who have passed in-depth security background checks, and who undergo lengthy entry and exit examinations at our security checkpoint. Access to vital plant areas is restricted to an even smaller number of authorized personnel.

In addition to the security and training measures implemented by the NRC, Entergy has exceeded those requirements at Indian Point and its other facilities through a series of extensive investments.

The Nuclear Regulatory Commission (NRC) has two full-time resident inspectors at Indian Point who monitor all operations daily.

For additional information, visit the security section of our Web site.

Q. **Is the age of Indian Point Station a security or safety factor?**

A. No. Opponents charge that Indian Point's age renders the plants less safe than newer plants. The fact is that the external structure of all three plants on site were constructed to last well beyond its original license of 40 years. Internally, millions of dollars in upgrades have been made to the plant since Entergy purchased them back in 2001—to the point where its parts are almost entirely new.

There is also routine maintenance that occurs every day to ensure the safe continued operation of the plant and to minimize the need for unscheduled shutdowns.

Q. What would happen if a large aircraft struck Indian Point?

A. The reactors and most radioactive materials in the plants are within containment structures of high-strength steel-reinforced concrete that is 3½ to 4½ feet thick, with a half-inch steel inner liner. They are designed to safeguard plant personnel and the community even under extreme scenarios.

There have been several tests of containment-like facilities using aircraft. In one test an F-4 Phantom fighter jet collided at 480 mph with a target similar to a nuclear containment

facility, and did not penetrate the structure. Even a larger aircraft could not penetrate because the steel-reinforced concrete is designed to resist and disperse the impact.

Q. What if an airplane struck the spent fuel pool for used nuclear fuel?

A. Storage facilities for nuclear fuel have walls 6 feet thick from top to bottom and are made of steel-reinforced concrete, with a steel inner liner. The structures are relatively small in size, are mostly underground and are shielded by surrounding structures.

The used fuel is under 23 feet of water, and there are multiple ways to assure the fuel remains covered with water.

Q. How Important is Indian Point to our electricity supply?

A. Indian Point Energy Center contributes 20 percent to 40 percent of the electricity in the metropolitan area. Millions of homes, thousands of businesses and hundreds of critical transportation, health and municipal systems rely on its reliable, low-cost power.

Without Indian Point's 2,000 megawatts, energy costs would rise over an estimated $1 billion a year in the New York area. There could be wholesale price spikes as high as 40 percent, and rolling blackouts. This would create a situation disturbingly similar to the troublesome energy markets experienced in California.

Such an energy crisis would deliver a severe blow to the local economy, and would have a major impact on business development and efforts to rebuild the economy.

The head of the agency that administers New York State's power supply said shutting down Indian Point would lead to a five-fold increase in the likelihood of power shortages in the New York metropolitan area during the summer.

Replacing Indian Point's 2,000-megawatt contribution would require building a fleet of new generating facilities that burn fossil fuel, adding new high voltage transmission lines and laying new gas pipelines.

Q. What direct impact does Indian Point have on the local economy?

A. Indian Point Energy Center employs 1,500 highly skilled, highly trained workers. Closing the plants would wipe out their jobs, plus those of outside contractors.

Indian Point's annual payroll, plus the value of goods and services purchased locally for the plants, is $356 million, which would be eliminated from the area's economy if the plants were to close.

Local governments would see a noticeable drop in tax revenues that would need to be recovered through other means. In 2001 Indian Point Energy Center paid $34 million in local taxes.

Q. What about converting Indian Point to a gas-fired plant, or bringing in replacement power from New England?

A. Conversion to gas fuel would require construction of a gas pipeline larger than the proposed Millennium Pipeline, and would take as long as 10 years to complete, during which Indian Point's 2,000 megawatts would need to be replaced.

Due to transmission constraints in the electrical grid for Southeastern New York, not enough power could be imported from New England to replace Indian Point's contribution.

Q. What is the emergency evacuation plan?

A. The emergency evacuation plan serves as a blueprint for evacuations for any cause, including natural disasters or man-made events like chemical spills, not just for possible events at nuclear facilities.

The current plan has been developed and certified by the state and officials of the four counties involved-Westchester, Rockland, Orange and Putnam. It is based on years of scientific data collection and is constantly being updated, improved and kept current with changing conditions.

Q. What is radiation?

A.

Comparison of Radiation Sources

Source	**Average Per Year**
Inside the Body (air—radon)	200 millirem (mrem)

Inside the Body (food and water)	40 millirem
Earth’s Crust (Colorado plateau)	90 millirem
Earth's Crust (Atlantic or Gulf Coast)	23 millirem
Earth's Crust (elsewhere in the U.S.)	46 millirem
Outer Space [Cosmic Rays] (5,000-6,000 feet)	55 millirem
Outer Space [Cosmic Rays] (sea level)	26 millirem
Medical X-Ray	40 millirem
Living in Stone, Brick, or Concrete Building	7 millirem
Airline Flights (round-trip cross-country)	5 millirem
Airline Flights (per 1,000 miles flown)	1 millirem
Watching Television	1–2 millirem
Computer Terminal	0.1 millirem
Luminous Wrist Watch	0.06 millirem
Coal-Fired Power Plant (living within 50 miles)	0.03 millirem
Nuclear Power Plant (living within 50 miles)	0.009 millirem
Smoke Detector	0.008 millirem

The average American receives radiation exposure of about 360 millirems annually from all sources, according to the National Council on Radiation Protection and Measurements (NCRP). More than 80 percent of that comes from nature—from radon in the air, from rocks and soil, and from outer space. The next largest source of radiation exposure for the public is medical treatment, which accounts for about 11 percent—or 54 millirems—annually to the average person. The average public exposure from the nuclear fuel cycle is 0.5 millirem per year.

The Nuclear Regulatory Commission’s annual limit for occupational exposure to radiation is 5,000 millirems (mrem). The average U.S. nuclear power plant worker receives 160 millirems. A typical X-ray, by comparison, provides 10 millirems.

Source: NCRP and the U.S. Environmental Protection Agency (EPA)