GNEP Glossary

Advanced Burner Reactor
A new type of nuclear reactor that accepts recycled nuclear fuel and consumes more transuranic elements than it creates, while generating electricity. It typically belongs to the class of nuclear power plants called "fast reactors." "Burn" does not mean incinerate or combust, it means to transmute or convert transuranics into shorter-lived isotopes.

Advanced Fuel Cycle Facility
A multi-purpose research and development laboratory to serve fuel cycle testing needs for the next 50 years or more.

Advanced Fuel Cycle Initiative
The mission of the current Advanced Fuel Cycle Initiative (AFCI) is to develop proliferation-resistant spent nuclear fuel treatment and transmutation technologies to enable a transition from the current once-through nuclear fuel cycle to a future sustainable, closed nuclear fuel cycle where valuable material is separated from waste and recycled, whereby extracting energy and reducing waste.

Advanced Simulation Laboratory
A laboratory to support robust research, computer simulation and visualization, reducing the cost of future experiments by state-of-the-art computer simulation of relevant chemical and physical processes.

Atom
At atom is the basic component of matter; all matter is divided into one hundred different chemical elements. It is the smallest particle of an element having all the chemical properties of the element.

Closed Fuel Cycle
An approach to handling used nuclear fuel in which useful parts of used nuclear fuel are recycled; also called "recycle" fuel cycle, in contrast with the "throw away" or "open" fuel cycle.

Energy Security
A reliable supply of affordable energy.

Enrichment
The physical process of increasing the proportion of isotope uranium-235 to uranium-238 to make the mixture more usable as nuclear fuel.

Enriched Uranium
Uranium in which the proportion of uranium-235 (to uranium-238) has been increased above the natural 0.7 percent uranium-235. Reactor-grade uranium is usually enriched to three to five percent uranium-235. Uranium can be fabricated into nuclear fuel and fissioned in a nuclear reactor to produce energy.

Engineering Scale Demonstration
Demonstration of the steps of a technology on a scale sufficient to obtain cost and performance data required to support potential subsequent commercialization of the technology.

Fast Reactor (fast spectrum reactor)
A nuclear reactor that can extract energy via fission from all types of uranium, including depleted uranium, which is otherwise waste from enrichment, and all isotopes of the transuranic elements. Neutrons are kept at higher average energy in a fast reactor than in a thermal reactor; these higher energy neutrons are able to fission more isotopes. Contrast with "thermal reactor."

Fission
The splitting of an atom into at least two other atoms and the release of a relatively large amount of energy. Two or three neutrons are usually released during this type of transformation.

Fission Product
The atoms (fission fragments) formed by the fission of heavy elements such as uranium.

Fuel Cycle
A fuel cycle describes where sources of fuel come from and where waste goes. The cycle includes "front end" steps that lead to the preparation of uranium for use as the original fuel for reactor operation and "back end" steps that are necessary to safely manage, prepare, and dispose of the waste. The two basic fuel cycle approaches are throw-away, in which used fuel is discarded, and recycle, in which valuable components of used fuel are recycled.

Fuel Supplier Nations
Nations that choose to operate nuclear power plants and fuel cycle facilities such as uranium enrichment and recycling. Contrast with "user nations."

G-8 (Group of 8)
A group consisting of the world's major industrial nations, Canada, France, Germany, Italy, Japan, Russian Federation, United Kingdom, United States.

Geologic Repository
A deep underground engineered facility used to permanently isolate used nuclear fuel or high-level nuclear waste while its radioactivity decays safely.

Greenhouse Gas Emissions
These are gases – such as carbon dioxide -- produced by burning of fossil fuels, and suspected by many scientists to contribute to global warming. (Note, per mass, there are other gases worse than CO_2.)

High-Level Radioactive Waste
The Nuclear Waste Policy Act defines high level waste, in general, as the highly radioactive material that results from reprocessing and requires permanent isolation. Under U.S. Nuclear Regulatory Commission rules, high-level waste can only be disposed of in a geologic repository where the waste is to be isolated. Contrast with "low-level waste."

International Atomic Energy Agency
The IAEA is the world's center of cooperation in the nuclear field. It was set up as the world's "Atoms for Peace" organization in 1957 within the United Nations family. The Agency works with its Member States and multiple partners worldwide to promote safe, secure and peaceful nuclear technologies. *Copyright 2003-2005, International Atomic Energy Agency.*

Isotope
An isotope is an atom with a specified number of protons and neutrons.

Light Water Reactor
A nuclear power reactor that uses water to cool the reactor and to moderate (slow down) neutrons. It belongs to the class of nuclear power plants called "thermal reactors."

Low-Level Radioactive Waste
A general term for a wide range of wastes having low levels of radioactivity and which stay hazardous for relatively short periods of time. Industries; hospitals and medical, educational, or research institutions; private or government laboratories; and nuclear fuel cycle facilities (e.g., nuclear power reactors and fuel fabrication plants) that use radioactive materials generate low-level wastes as part of their normal operations. These wastes are generated in many physical and chemical forms and levels of contamination. Nuclear Regulatory Commission rules indicate that low-level radioactive wastes are acceptable for disposal in a land disposal facility, i.e., one that is nearer the surface of the ground. Contrast with "high-level waste."

Next Generation Safeguards
Improved safeguard technologies to reduce nuclear weapon proliferation risk.

Nuclear Fuel
Fuel that produces energy in a nuclear reactor through nuclear fission.

Once Through Fuel Cycle
A process in which nuclear fuel is used once in a nuclear power plant and then thrown away; also called "open" or "throw away" fuel cycle. Contrast with "recycle or closed fuel cycle."

Open Fuel Cycle
Nuclear fuel is used once in a nuclear power plant and then thrown away; also called “throw away” or “once-through” fuel cycle. Contrast with “recycle or closed fuel cycle.”

Plutonium
An artificial radioactive isotope that can be fabricated into nuclear fuel and fissioned in a reactor to produce energy. Some plutonium isotopes also can be used in nuclear weapons. Others can’t.

Proliferation
The spread of nuclear weapon materials and/or technologies.

PUREX (Plutonium Uranium Extraction)
An older technology for separating used nuclear fuel into components that produces both pure plutonium and uranium, all else is waste. The separation uses a water-based acid dissolution of the used nuclear fuel. Contrast with UREX+.

Pyroprocessing
A technology for separating used nuclear fuel into components that separates uranium, but keeps all the transuranic elements together. The separation uses a molten chloride salt to dissolve the used nuclear fuel, rather than water-based acid as is used in PUREX and UREX+.

Radioisotope
An unstable isotope of an element that decays or disintegrates spontaneously, emitting radiation. Approximately 5,000 natural and artificial radioisotopes have been identified.

Reactor
A device in which nuclear fission may be sustained and controlled in a self-supporting nuclear reaction. The varieties are many, but all incorporate certain features, including fissionable material or fuel, a moderating material (unless the reactor is operated on fast neutrons), a reflector to conserve escaping neutrons, provisions of removal of heat, measuring and controlling instruments, and protective devices. The reactor is the heart of a nuclear power plant.

Recycling
A process that separates used fuel into: uranium; waste (fission products); and transuranics (a mixture of plutonium, americium, neptunium and curium) for reuse in reactors. The transuranic elements are incorporated into fuel for fast reactors and then destroyed while the reactor generates electricity. Recycling would be done with UREX+ or pyroprocessing depending on the type of fuel to be recycled. Contrast with “throw away” fuel cycle.

Spent Nuclear Fuel (used nuclear fuel)
Nuclear fuel that is used in a reactor for a number of years before losing its ability to efficiently create energy. As a typical nuclear reactor operates, the fission process creates energy to generate electricity. During this process, the uranium is being used up and fission products accumulate and interfere with efficiency until the fuel can no longer effectively produce energy. At this point, the used fuel is said to be "spent" and is replaced. If directly disposed, spent nuclear fuel can only be disposed in a geologic repository where the waste is to be isolated essentially permanently from the biosphere. Contrast with “low-level waste.”

Thermal Reactor (thermal pectrum reactor)
A nuclear power plant that can use only certain isotopes of uranium and the transuranic elements. Neutrons producing fission are slowed down or moderate to relatively low energies before creating new fission reactions. Contrast with “fast reactor”

Throw Away Fuel Cycle
A process in which nuclear fuel is used once in a nuclear power plant and then thrown away; also called “open” or “once-through”. Contrast with “recycle” or “closed” fuel cycle.

Tonnes (metric ton)
1,000 kilograms; 2,200 pounds.

Transmutation
The process of changing one isotope into another by changing its structure. There are two primary transmutation processes. Fission splits isotopes, releasing energy. Neutron capture adds one neutron to an isotope.

Transuranic Element (transuranic isotope)
Heavy radioactive elements formed artificially by neutron capture and possibly subsequent beta decay(s). Transuranic elements have higher atomic numbers than uranium (92). Neptunium (93), plutonium (94), americium (95), and curium (96) are the best-known. They are about 1 percent of used fuel from current nuclear power plants.

Uranium
A radioactive element with the atomic number 92 (hence 92 protons) and, as found in natural ores, an atomic weight of approximately 238. The two principal natural isotopes are uranium-235 (0.7 percent of natural uranium), which is fissile, and uranium-238 (99.3 percent of natural uranium), which is fissionable by fast neutrons and is fertile. Natural uranium also includes a minute amount of uranium-234.

Used Nuclear Fuel (spent nuclear fuel)
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User Nations
Nations that choose to only operate nuclear power plants, without fuel cycle facilities such as uranium enrichment or recycling plants. Contrast with “fuel supplier nations.

UREX+ (Uranium Extraction Plus)
A new technology for separating used nuclear fuel into its components. During this process, uranium is separated, while all of the transuranic elements are kept together. The separation uses a water-based acid dissolution of the used nuclear fuel. This process enables reuse of all the transuranics, minimizes waste, avoids creation of liquid waste, and makes the chemical separation more proliferation-resistant than an older reprocessing technology called PUREX (Plutonium Uranium Extraction). Contrast with PUREX.