What are the Health Risks of Living Near a Nuclear Power Plant?

Nuclear reactors routinely emit radionuclides
It doesn't take an accident for radionuclides to be released. Radioactive gases are routinely leaked, with the blessing of the Nuclear Regulatory Commission (NRC) at every nuclear power plant.

- A reactor's fuel rods, pipes, tanks, and valves leak, even if there is no human or mechanical error. As it ages, its leaks increase. Leaked radioactive gases are routinely "vented" to the outside air through purposely drilled holes in the reactor roof and steam generators. The leakages amount to 100 cubic feet of radioactive gases every hour.
- Contaminated water is intentionally flushed to reduce radioactive, corrosive chemicals that damage valves and pipes (actually called CRUD) from further damage to the reactor. Releasing these materials into the air, soil and water is called "purging." The NRC allows 22 purges per year per reactor.
- Radioactive gases are purged from the cooling water into the surrounding environment when they become too hazardous for maintenance workers.
- Water in the primary cooling system that flows past the fuel rods becomes highly radioactive. A 1000-megawatt (MW) reactor takes in 20,000 gallons of tritiated water (containing radioactive tritium) per minute for cooling, then returns 5.000 gallons per minute to the lake, river, or sea and 15,000 gallons per minute to the atmosphere as steam. At Victoria, the water will be returned to the Guadalupe River. The reactors proposed by Exelon are each 1535 MW, for a total of 3070 MW from the site.

These routine releases happen at every reactor. Most are not monitored, reported, or even fully detected.

Accidental releases of radionuclides
Accidental releases of radioactive materials are called "incidents" by the industry. They occur because of human or mechanical error or because the operator needs to vent the radioactive gases for some reason. Well-known incidents include Three Mile Island in the U.S. and Chernobyl in Russia, but these events occur on smaller scales frequently.

With the aging fleet of 104 existing U.S. reactors, "incidents" will increase because mechanical structures are becoming fragile and brittle with metal fatigue. The potential is becoming even higher for both small and catastrophic releases because the NRC has decided to extend the operating life of aging reactors from 45 to 70 years.

Then NRC is failing to adequately monitor reactor safety levels. In Walking a Nuclear Tightrope, Unlearned Lessons of Year-plus Reactor Outages, nuclear engineer David Lochbaum of the Union of Concerned Scientists pointed out that following the Three Mile Island meltdown, 38 nuclear reactors had to be shut down for at least one year while safety margins were restored to minimally acceptable levels. Seven of these reactors experienced two year or longer outages. The vast majority of these extended outages were caused not by broken parts but a general degrading of components to the point that safe operation of the plant required a shutdown for broad, system-wide maintenance. This all too frequent state of disrepair makes accidents more likely.

What pollutants are emitted by nuclear power plants?
Radioactivity is measured in "curies." A large medical center with 1000 laboratories may have a total of 2 curies of radioactive materials. By contrast, an average operating nuclear power reactor will have approximately 16 billion curies in its reactor core. This is the equivalent radioactivity of 1000 Hiroshima bombs. The nuclear power industry collectively releases millions of curies annually. Radionuclides that are emitted include the following:

Tritium or tritiated water
- As a gas tritium can be absorbed directly through the skin
- 1,360 curies of tritium are released annually
- As an isotope of water, it acts like water in the body, becoming part of cells
- Can be ingested through contaminated food, drunk as water, inhaled, or absorbed through the skin
- Has a half –life of 12.5 days, making it dangerous for 120-248 years
- Is taken up by plants and animals in the environment and bio-concentrates in the food chain
- Causes tumors and cancer in the lungs and GI tract
- Shrinks the testicles and ovaries even at quite low doses and causes birth defects, mental retardation like Down's Syndrome, decreased brain weight, loss of reproductive abilities of offspring, and stunted, deformed fetuses
- After ingestion tritium is found in body fluids, organs, and tissues, and within hours is uniformly distributed through all biological fluids within one to two hours

Plutonium-239

- Is part of the waste stream of nuclear reactors; its discoverer, Glen Seaborg, called it the "most dangerous substance on earth"
- Less than one-millionth of a gram will cause lung cancer if it is inhaled
- Causes blood cancers such as lymphoma or leukemia
- Resembles iron, so the body treats it like iron and delivers it to the bone marrow
- Stored in the liver, where it causes liver cancer
- Teratogenic - crosses the placenta into a developing embryo; it is stored in testicles, causing mutations in reproductive genes and testicular cancer
- Has a half-life of 24,000 years making it dangerous for at least half a million years

Iodine-131

- Is quickly absorbed by the thyroid, especially in children whose tiny, growing thyroids absorb it like a sponge
- Potassium iodide tablets can help lower risks from exposure and are supposed to be distributed in communities near nuclear plants, but are rarely made available

Strontium-90

- Routinely released by reactors in small amounts daily and in large amounts during accidents
- Radioactive danger lasts for 600 years
- The body treats it like calcium, so Strontium-90 concentrates in breast milk. causing breast cancer years later and bone cancers

Cesium-137

- Acts like potassium in the body so it is captured by muscle cells, causing cancer
- Dr. John Gofman, the discoverer of uranium-233, estimates that if 100 reactors operated for 25 years, preventing cesium leaks 99.9% of the time, the amount released over this period would still be equal to that of 4 Chernobyl accidents

Radioactive Noble gases

- 2.97 million curies of radioactive noble gases were released by U.S. reactors in 1974. Some can be trapped by filters, some cannot
- Cannot chemically react with other elements but are still extremely radioactive and usually decay into other elements, some of which are more dangerous than the original gas. Ex: Xenon-135 decays into cesium-135 which has a half-life of 3 million years
- Irradiate lung, liver, skeleton, and gastrointestinal tract (GI tract)
- Tend to locate in fat near the testes and ovaries, causing mutations in eggs and sperm

How do radionuclides affect human health?

There is no safe dose of radiation exposure. There are small amounts of natural radiation, but they are also harmful. Dr. John W. Gofman says, "…the safe-dose hypothesis [of radiation] is not merely implausible—it is disproven."

Humans can be exposed to radiation internally from eating or drinking contaminated food or water, or breathing contaminated air, or through cuts in the skin. Humans can also be exposed externally if the radiation is strong enough to pass right through the skin, as in beta and gamma rays, both of which can directly harm cells.

Radiation can cause most types of cancer. Some cells or organs - breast tissue and the thyroid, for example - are very sensitive to radiation. Whether or not exposure to radiation will cause cancer depends on a variety of factors. These include: the amount and type of radiation dose; individual characteristics that make some people more susceptible to cancer than others include age; gender; whether the exposure occurred over a short or a long time; and the presence of other substances that enhance the cancer-causing power of radiation.

Acute effects include death within days or weeks from radiation sickness, as happened to the highly exposed people in the atomic bombings in Japan. Other acute effects include vomiting and loss of hair.

Sources of information for this factsheet include Dr. Helen Caldicott's *Nuclear Power Is Not the Answer (2006) and the websites for Nuclear Information Resource Service, Union of Concerned Scientists, Beyond Nuclear and Public Citizen.*