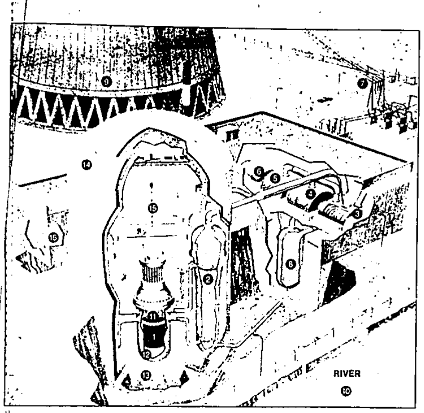

This is a diagram of a typical nuclear power generator.

A-power answer to energy woes?

Nuclear power plant explained

Although it's one of the most awesome structures in the world, a nuclear powerplant generates electricity in the same way as plants powered by fossil fuels such as coal.

Heated water becomes steam; steam drives a turbine that spins a generator; a generator produces electricity.

But unlike its fossil fuel counterpart, the heat source for a nuclear plant is the tremendous energy released from the fission, or splitting, of the nuclei of fissionable materials, principally Uranium 235 points out a major article on nuclear energy in the April National Geographic.

ONCE OPERATIONS begin in a typical pressurized water reactor — such as the controversal Three Mile Island nuclear power plant near Middletown, Pa. — the reactor's core rods are immersed in water. Thousands of tons of water circulate under high pressure to carry away the heat. Any interference with this flow is, as the past few weeks have shown, potentially dangerous.

Even after the plant is shut down, radioactive decay from fission products in the fuel rods continues to produce substantial heat. Consequently, cooling water is still needed.

In a pressurized water reactor — the most common in the United States today — energy from the chain reaction of fissioning uranium in the reactor core (1) heats the surrounding water, which is pumped under pressure into the tubes of a steam generator (2) to heat the water already in the generator.

Heat from the tubes converts water in the generator to steam, whose energy turns the rotors of a high-pressure turbine (3). Lower-energy steam proceeds to low-pressure turbines (4,5). An electric generator (6) converts the energy from the whirling turbine shaft into power for transmission to consumers through high-voltage lines (7).

Depleted steam from the turbines passes over the cooling coils of a condenser (8) and is converted to water, which returns to the steam generator. Water from the reactor's condenser coils is cooled by evaporation in an adjacent tower — only the base is shown (9) — and returned to the condenser for repeated use.

Small amounts of river water (10) are pipe-l to the condenser coils to re- cooling tower.

BUT THE HEART OF a nuclear power plant and the thing that keeps everything ticking is the reactor core (1) surrounded by water and comprised of fuel assemblies containing about 100 tons of uranium dioxide. The rate of fission in the powerful packet is controlled by neutron-absorbing rods (11).

Core and water are contained in a heavy steel pressure vessel (12). It, in turn, is shielded by concrete walls five to 10 feet thick (13), and the whole thing is topped off by a steel-and-concrete containment structure (14) to prevent radioactivity from escaping.

From time to time, a reactor must be shut down for refueling. A bundle of fresh fuel rods holding uranium (15) is lowered into the reactor core. Spent fuel assemblies are immersed in water to dissipate heat and confine radiation in a separate facility on the site (16).

Daily radiation exposure exists as a natural hazard

People are exposed to radiation all the time, whether they know it or not, but barring a nuclear accident, it's mostly "natural" radiation.

Cosmic rays from space, for example, give a person about 40 millirems a year at sea level, even more at higher altitudes. (A millirem is a thousandth of a rem, the standard unit of radiation exposure.)

More natural radiation comes from uranium, radium, and thorium in stone, concrete, and soil as well as radioactive carbon and potassium in the body and in water and food. These sources give the average person a whole-body dose of about a hundred millirems a year.

BESIDES ABSORBING natural radiation, many people are exposed to man-made ionizing emissions. Medical diagnostic X-rays, for example, give the average person 70 millirems a year. TV sets and radium-dial wristwatches add, perhaps, a millirem a year.

From these natural and man-made sources, the average person gets close to 200 millirems of radiation annually, reports Kenneth F. Weaver in a major nuclear energy story in the April National Geographic.

The story reports a properly operated nuclear reactor adds little to this burden: no more than a few millirems a year for the exposed public. Coal-powered plants emit about the same amount of radioactivity because of radium and uranium in the coal.

But radioactive elements such as Iodine 131, Cesium 137, and Strontium 90 — all produced in nuclear reactors — are especially hazardous to man if they get into the food chain, because of biological concentration.

How much radiation does it take to cause harm? Radiobiologists regard a single dose to the whole body of 600 rems (600,000 millirems) as lethal to most people; 100 whole-body rems can cause radiation sickness; 10 can damage the lymph nodes and spleen and decrease the bone marrow and blood cells, although the symptoms are not felt.

A FEW MILLIREMS or even a few rems seem small by comparison, expecially spread over a period of time. However, many scientists insist that no radiation level is harmless, and that ionizing radiation is something to avoid if at all possible.

When emissions from radioactive substances enter the human body, they injure cells by ionizing (tearing electrons from) atoms. If the damage is slight, or takes place slowly, the body usually makes repairs.