

The real health effects of radiation

There are very real, specific dangers of radiation releases, and this subject has been much studied and refined since the atomic bombings of Hiroshima and Nagasaki in August 1945. Those bombings killed 67,000 people within the first day, and injured thousands. In the Chernobyl accident, 31 deaths occurred as a result of the immediate radiation release, all of them plant workers or others involved in the initial response to put out the fire at the plant. One of the deaths was immediate, and the others were within four months. There are about 200 other surviving victims of acute radiation sickness, and 400,000 uninjured exposed people.

Although the popular perception is that any dose of radiation is harmful and that the radiation release from the bombings and from Chernobyl were the same, this is not the case. Low-level radiation is not necessarily harmful, and

may in fact be beneficial. The tremendous radiation releases from the atomic bomb are a different matter. The deaths from the atomic bomb explosions were directly proportional to the amount of energy released by the blast, the heat, and the radiation. In the bombings, 50% of the energy released was from the blast, 35% from the heat, and 15% from the radiation; the causes of death are in corresponding proportion. At Chernobyl, in contrast, the explosion's blast and heat released relatively small amounts of energy.

An interesting comparison of the radiation and health effects in both cases appears in *Health Effects of Low-Level Radiation*, by Sohei Kondo, a Japanese radiation expert at the Atomic Energy Research Institute of Kinki University in Osaka (published in English by Medical Physics Publishing of Madison, Wisconsin in 1993). Professor Kondo, now 84, discusses how he was motivated to write this book after

What happened at Chernobyl

Early in the morning of April 26, 1986, plant operators at Chernobyl's Unit 4 were testing the ability of the plant equipment to provide electrical power if the main power source at the plant were not working. The plant was being run at very low power. Adequate safety precautions were not taken; there was a sudden, out-of-control surge of power. The sudden increase in heat ruptured the fuel, which then reacted with water to cause a steam explosion. The force of the explosion blew the 1,000-metric-ton cover off the top of the reactor and destroyed the reactor core. A second explosion followed.

Highly radioactive fuel was released into the atmosphere—radioactive iodine, cesium, and other isotopes. Wind and rain then spread this radiation irregularly (depending on weather conditions) over a large area of Ukraine, Belarus, and Russia. The Soviet authorities did not immediately tell the residents of Pripyat, the town adjoining the Chernobyl complex, to stay indoors; nor were surrounding regions warned.

Pripyat was evacuated two days later, although the 45,000 residents were not told exactly what was happening, and left without their belongings. In early May, another 10,000 residents within a radius of 6 miles were evacuated, and then another 116,000 were evacuated within a radius of 18 miles. This exclusion zone is still in force, although many people, mostly elderly, have been allowed to return to their homes.

Firefighters from Pripyat, who were trained to know the dangers of fires at Chernobyl, arrived on the scene within three minutes and immediately set to work. They

had two urgent tasks: to isolate the fire from the remaining three nuclear reactors on the site, and to make sure that the pool of radioactive water around the damaged reactor was pumped out of the way. Had more hot fuel from the damaged reactor come into contact with the water, there would have been another, more serious explosion.

Meanwhile, helicopters flew over to measure the radiation, while others dumped quantities of lead, sand, clay, boron, and dolomite onto the reactor to stop the radioactive emissions. By May 6, the radioactive releases from Unit 4 had stopped.

The radiation danger

The 31 deaths at Chernobyl occurred among the firefighters and others involved in the immediate cleanup, many of whom received massive doses of radiation. About 200 others in this group were also treated for acute radiation sickness and survived. Others who continued to work on the cleanup were officially limited to a dose of 25 rems, but the record-keeping concerning the dose received was slipshod. It is estimated that of the 600,000 cleanup workers at Chernobyl, one-third had radiation dose rates four times the normal annual dose for a radiation worker.

Radiation in high doses attacks the entire body. In addition to burns on the skin, internal organs are damaged. Both bone marrow and liver tissue transplants were carried out on all patients, even on those whom the doctors thought were certain to die. (It was later determined that such transplants were not useful.) American specialists joined the Moscow radiological specialists in early May, including Dr. Robert Gale, a hematologist.

At present, there are several joint programs with European nations to train medical personnel to carry out the record-keeping necessary for accurate follow-up health studies of the people in the contaminated areas.