Interview: Dr. Richard Wilson

Tracking down data on health effects

Dr. Richard Wilson, a nuclear physicist, is Mallinckrodt Professor of Physics at Harvard University. He chaired the Nuclear Regulatory Commission-sponsored study group of the American Physical Society on "Radiological Consequences of Severe Nuclear Accidents," which released a report in February 1985, and he has frequently commented on the Chernobyl situation. He visited the Soviet Union in 1987 on an independent fact-finding tour not connected to any government or other institution. In June he plans a second visit, where he will help organize an international meeting, under the sponsorship of the Sakharov Foundation, to independently assess the effects of the Chernobyl accident. Wilson was interviewed on May 24 by Marjorie Mazel Hecht, managing editor of 21st Century Science & Technology.

Q: How much radioactivity was spread to the environment as a result of the accident and how fast?
Wilson: Almost all of the radioactive iodine (100 million curies) and 20% of the cesium (20 million curies), all of the noble gases, and 3% of the solids. Originally the Soviets (Dr. Denin of the Kurchatov Institute) thought that only 20% of the iodine and 12% of the cesium were released, but he did not account for the radioactivity that left the Soviet Union. Probably one-third of the gases were released within a few seconds and two-thirds slowly over the next 10 days.

Q: How long did it take for radioactive particles to disappear and which ones still remain?
Wilson: The iodine was gone in three weeks. Cesium-137 has a physical half-life of 30 years and an environmental half-life of 10 years when deposited on the ground. We know this from the study of the fallout from bomb tests. Originally, the Soviets, Prof. Oleg Pavlovsky of the Institute of Medical Physics, took the longer decay time. More recently their observations agreed better with the shorter decay time as suggested by the international expert opinion.

Q: How do these levels of radioactivity compare to accepted average dose rates?
Wilson: Just downwind of the plant, immediately after the accident, the levels were several hundred rems per hour. This is lethal in one hour or less. In the town of Pripyat, the levels were low at first, but went to 1 rem per hour at the nearest street to the plant, Kurchatov Street. Exposure to this for two weeks is lethal.

According to the International Committee on Radiological Protection (ICRB), one should evacuate if a total dose of 50 rems is expected. The U.S. Environmental Protection Agency (EPA) recommends evacuation at much lower levels. The levels at Pripyat on Saturday evening [April 26, 1986] exceeded both EPA and ICRB levels.

Q: What were the dangers of eating food produced in outlying areas of low fallout immediately after the accident—for example, milk in Europe and Scandinavia, or lichen eaten by reindeer?
Wilson: For 10 days, milk exceeded standards in Holland, southwest Germany, northern Italy, Belorussia, Poland, and Ukraine. Milk was impounded in most of these places, but not in Belorussia because nobody knew to do it, and not in the countryside downwind of Chernobyl, (Chistologovka) for reasons which were unclear. The European Economic Community ignored internationally agreed-upon standards to choose a level for cesium in meat 10 times lower than the agreed standard. England objected, but faced with a political ban from the EEC, reduced the level in June threefold. This caused a *delay* in killing Welsh lamb for market, which would not have otherwise been necessary.


Wilson at Chernobyl

Dr. Bo Lindell of Sweden was the scientist who urged a low level for reindeer meat. Apparently he assumed [in his calculations] that the Laplanders eat 1 pound of the most contaminated meat per day and must not have an internal dose of more than 500 millirems per year. Other authorities had assumed that no person always eats the most contaminated meat and always eats it every day. A study of the absorbed cesium in Laplanders has shown that they did not consume as much radioactivity as Lindell had feared; that previous rules were adequate to protect the public; and that the banning of reindeer meat was unnecessary. The unnecessary economic hardship caused by Dr. Lindell's pessimistic assumption in my view far outweighed any small advantage in public health.

Q: Four years later, there are reports that, in Belorussia, radioactivity in the soil in some places is at 40 curies per square kilometer, supposedly three times the accepted level. What does this mean for the food supply and the people who have been eating this?
Wilson: According to the calculations reported from the Institute of Medical Physics in Moscow, the integrated dose for people staying in this area of Belorussia might reach about 30 rems. But, alas, no one warned the people in May 1986, and milk was not banned. As a result, many thyroids were

unnecessarily exposed in 1986 to radioactive iodine and received perhaps 1,000 rems or more, which is enough to destroy the thyroid gland.

One of the reasons why that happened is because the Russians would not let any private individual measure radiation, and officially they did not measure in that area. Although the radiation figures at Gomel in Belorussia, which is closer to the power plant than the above area [where soil radioactivity is at 40 curies per square kilometer] was small enough so that no action was needed, the authorities forgot that pollution sometimes skips certain areas. Therefore, they did not measure farther away for several months. Worse still, they would not allow private individuals to buy geiger counters and measure for themselves. That's incredible incompetence. For some people it means about 30 rems total. Also, their thyroids were unnecessarily exposed in 1986.

Q: The Soviets are now planning to evacuate people from some villages in Belorussia. Does this make any difference now in terms of their health?
Wilson: No. There should be very little difference now if the 30 rem calculation above is correct. I want to go there and check, but the calculation seems sensible. If the calculation is correct, the lifetime cancer incidence might be reduced about one-quarter of 1% by leaving the area, but it is likely to increase several percent if they go to a city. No one knows why cities are worse [in cancer incidence] than the countryside, but this is true all over the world.

Q: The Soviets evacuated everything in a 20 mile radius around Chernobyl. What would we have done?
Wilson: There was no evacuation of the area for one and one-half days. And then only the town of Pripyat was evacuated. The rest of the area was evacuated a few days later and many of these people got a dose of 45 rems. We would have evacuated everyone within 10 miles within a few hours and then more after a day, to get below about 5 rems projected dose. They evacuated people too slowly, and we would have evacuated too many people.

Q: There are anecdotal reports from Ukraine of a high rate of a variety of illnesses attributed to radiation. Is this likely?
Wilson: Most of these illnesses have not been attributed to radiation before. Therefore, if the attribution is correct it is extremely important. The attribution also is not so likely, but it is vital to spend a lot of effort to be sure one way or another. I hope we will never have another Chernobyl. I hope we will never have another Hiroshima or Nagasaki. These are our major sources of the effects of radiation on people. If we fail to find out all that we can, our descendants will have every right to blame all of us for missing the opportunity to find out this important information.

Q: There are also reports of deformities in children and animals born since the accident. Is this to be expected?
Wilson: The deformities are typical of overuse of chemical pesticides, but are rare in the United States. They have not been attributed to radiation before.

Q: What kinds of information will you be looking for on your upcoming trip to Chernobyl?
Wilson: I'll be looking for data on health effects: Whether childhood leukemias appeared among children born to those evacuated (I would expect three by now); whether any children have a smaller head size (some Japanese survivors' children have a smaller head size); whether any of the above claims in the previous two questions are correct, whether there is any other unusual claim. I also want to encourage proper studies, in addition to those the Soviet establishment claims to be doing to see whether independent, but still proper thinking leads to the same conclusions.

Measuring radioactivity

Radioactivity is the radiation released as an atomic nucleus decays and breaks apart into particles—alpha particles (helium nuclei), beta particles (electrons), gamma rays, and neutrons.

The strength of a radioactive source is measured in curies, 1 curie being 37 billion nuclear decays per second. How long it takes half of the original amount of an isotope to decay is called the half-life of the radioactive isotope. Radiation is measured in rems (R) and millirems (mR), 1 rem being the radiation that transfers 6×10^7 million electron volts (MeV) of energy to a gram of biological tissue. (For comparison purposes, 1 watt of power is equivalent to an energy release of 6×10^{12} MeV per second.)

A large dose of radiation, 750 R, almost certainly means death within a few weeks. With a dose of 450 R, there is a 50% chance of recovery; with a dose of less than 200 R, recovery is almost certain. A dose less than 150 R produces no other signs than a temporary lowering of the red blood cells, and for doses less than 25 R, even this sign cannot be observed.

The International Commission on Radiation Protection recommends that the maximum permissible dose to the general public from nuclear energy sources be limited to 170 mR (0.17 R) per year. On average, Americans receive 130 mR of radiation from natural sources—cosmic rays, radioactivity in the body, and radioactivity in building materials.