4576

PUBLIC HEALTH RISKS OF NUCLEAR EMERGENCIES

J. W. Thiessen, M.D.

What I will present expresses primarily my own opinion and not necessarily that of the Department by which I am employed. I will discuss three things: First, what we knew before Chernobyl about the consequences of large releases of radioactivity into the environment; second, how the released radioactivity was distributed over the USSR and the rest of the world, including the United States; and, third, the events at Chernobyl and the off-site consequences only.

RELEASES OF RADIOACTIVITY INTO THE ENVIRONMENT

To determine the impact of large releases of radioactivity, one must go through a number of steps. These begin with the release itself, include the dispersion of the released material into the environment, and end with the resulting exposure of people. Of course, one is primarily interested in the doses that people have received as a means of estimating the effects of those doses. To help us, a number of models have been developed during the last 40 years. As you know, we have not had any large radioactive releases, so we have worked with trace amounts of radioactivity. Also, the fallout years have taught us much.

The dispersion model now in use has been employed for Chernobyl. Exposure-dose and dose-effect models also have been developed. I believe the Chernobyl release has much to teach us, including the validation of a number of these models. We hope this will be the only such catastrophe, and we should attempt to get the maximum information from it.

Let us look at release factors. This camel-like curve (Figure 1) shows that the uranium atom is very unwilling to split in the middle. This is of extreme importance. It means that products resulting from the fission of uranium lie in two mass areas: one around 90, the other around 130. That explains why isotopes such as cesium-134 and -137 and iodine-131, -132, and -133 are produced in very high yield. But the total number of radionuclides is limited.

Also of importance is what the release fraction of these radionuclides is in, for example, a reactor with a melted core (Figure 2). Clearly the noble gases will be released entirely and the volatile ones, such as the halogens, the heavier metals, and the rare earths, will be released at a much lower fraction. Again, there is fractionation, and it is no wonder that it is the first nine or ten of the listed isotopes that are found most often. These are of public health importance because exposures to them can be rather substantial.

Deputy Associate Director for Health and Environmental Research. U.S. Department of Energy, Washington, D.C.