REACTOR ACCIDENTS

Public Health Strategies and Their Medical Implications

David V. Becker, M.D.

Power reactors contain a large inventory of radionuclides generated from fission of uranium and plutonium; in a core melt accident that breaches the containment, these radionuclides can be released into the atmosphere as gases or aerosols. Depending on meteorologic conditions, this release could constitute a ground-level plume or a cloud that can be carried high into the atmosphere for long distances by wind currents and eventually deposited on the ground as fallout. Acute radiation effects can occur in the event of a major release that might follow an explosion or fire, but they are likely to be confined to the immediate vicinity of the reactor. From a public health perspective, aside from such local impact, what medical consequences might occur are likely to result from relatively small radiation exposures to near and distant populations from the deposition and ingestion of fallout contamination.

Of the radionuclides potentially available for release, in the short-term, radioiodines, particularly iodine 131, are by far the most significant in view of their huge quantities in the reactor core and their volatility, which contributes to their wide, although nonuniform, dispersion. In addition, they are readily absorbed by the body and rapidly and highly concentrated by the thyroid gland. At some level, thyroid irradiation can cause the late appearance of thyroid nodules and/or cancer, while at higher radiation doses thyroid destruction and hypothyroidism could result.

The recent accident at Chernobyl, Union of the Soviet Socialist Republics, which released into the atmosphere more than 3.7×10^{18} Bq (100 million Ci) of iodine isotopes (of which 7.4×10^{17} to 1.85×10^{18} Bq [20 to 50 million Ci] were ^{131}I), brought attention once again to the issue of the use of potassium iodide (KI) as a blocking agent to decrease thyroid irradiation in the event of a reactor accident. While KI is undoubtedly effective under optimum circumstances, its potential use in large, medically unsupervised populations as a public health measure in radiation emergencies requires careful evaluation of the actual risks of thyroid irradiation compared with the risks and benefits of KI use. Information to resolve these issues is limited. This article explores the available information and some of the concerns that have been voiced about KI use.

Director, Division of Nuclear Medicine and Professor of Radiology and Medicine, New York Hospital-Cornell Medical Center, New York. Published in JAMA 1987;258:649-654. Reprinted with permission.