ENVIRONMENT

Reevaluating radiation-dose models

Models to predict human exposures to radionuclides routinely emitted by nuclear-power plants may need to be reconsidered as a result of presentations at a symposium in Vienna last month sponsored by the International Atomic Energy Agency. For example, scientists from the University of Heidelberg in West Germany claim that calculations adopted by their government and the U.S. Nuclear Regulatory Commission may underestimate potential cobalt exposures several thousand times.

The primary reason, according to W. Bruland, B. Franke, B. Hanske and D. Teufel, is that the agencies' handbooks for calculating dose ignore the fact that bacteria in the stomach of livestock and in soil will bond radioactive cobalt into vitamin B-12 which can then enter the food chain and be eaten by man.

They say that its high absorption into the gastrointestinal tract means that up to 70 percent of the B-12 found in human food can end up in the liver as opposed to only 0.7 percent of inorganic cobalt compounds. What's more, the biological half-life for inorganic- and organic-cobalt compounds differs markedly: 750 days for organic, 9.5 days for inorganic compounds.

The authors deliberately chose data for their analysis representing the most extreme departures from accepted values to illustrate a worst-case example, not necessarily a realistic one. Their goal was to exemplify why they feel there is a need to reevaluate how and to what extent radionuclides are transferred through the environment and up the food chain.

Human Three Mile Island survey

Some 720 persons living near the damaged Three Mile Island nuclear-power plant — most within three miles of the plant site — were scanned with portable, computerized radiation detectors to measure internally deposited radioactive materials. The tests, conducted jointly by the Nuclear Regulatory Commission and the Pennsylvania departments of health and environmental resources, took eight days and were completed April 18. According to NRC, no elements related to releases from the plant were found, although trace amounts of nuclides normally found in humans, such as potassium-40 and cesium-137, were identified. Although nine persons exhibited elevated levels of radon daughters, they were told it was unrelated to the accident and probably due to natural outgassing of radon (SN: 4/21/79, p. 264) from building materials used in their homes or workplaces.

Metal in paper and plastic wastes

An estimated 58 tons of waste paper and plastics are discarded annually. With an average heating value of 13 million btus and 36 million btus respectively per ton of each, they could make a sizable contribution to the nation's energy diet. But concerned about the quantity and source of heavy metals in such wastes — which might pose a health problem if not recovered — the Bureau of Mines conducted a pair of studies. They analyzed the content of wastes from Washington, D.C. and urban regions in Maryland, Florida and Oklahoma.

Results showed antimony and mercury concentrations in municipal solid wastes are approximately an "order of magnitude" higher than levels found in Eastern coal; antimony levels averaged 32 micrograms per gram of waste versus 1.6 micrograms per gram of coal. Levels of arsenic were generally equivalent to those in Eastern coal. Photocopy wastepaper proved the major contributor of zinc, whereas plastics were the primary source of cadmium. Most chromium and lead appeared in the form of lead chromate, an inorganic printing-ink pigment. Copper, too, was found in ink, while unprinted paper supplied cobalt and nickel.

EARTH SCIENCES

Shaking up the Northeast

Recent events have turned the heads of earthquake observers from California to the Northeast. On Jan. 30, an earthquake measuring 3.8 on the Richter scale rattled central New Jersey and was felt in Staten Island and southern Brooklyn. The New York Times ran stories for three days on this very un-northeastern event. In March (SN: 3/24/79, p. 184), five nuclear power plants were shut down because of a design error that prevented the cooling systems from meeting earthquake codes. Skeptics scoffed: The chance of a damaging earthquake was one in 10,000 years. But on April 18, a magnitude 4.0 quake (considered "nondestructive") struck about nine miles from Wiscasset, Me., home of one of the closed plants. (Workers inside the Maine-Yankee nuclear power plant "didn't even feel it" and an analysis of the plant since the shutdown shows it capable of withstanding a 6.0 quake, a spokesman said.) The quake was felt from Bangor, Me., to Plymouth, Mass., site of another nuclear power plant. About 29 aftershocks were recorded; five measured between 2.0 and 3.0.

Though the unfortunate timing spawned a flurry of attention, the Maine quake was not unusual for New England, Russel Ahner of Boston College's Weston Observatory told SCIENCE NEWS. The observatory regularly detects three to four earthquakes per month in that area that measure larger than magnitude 2.0, he said. This was, however, the largest New England tremor since a 4.8-magnitude quake struck the Maine-Quebec border in 1973.

Since 1974, under contract to the Nuclear Regulatory Commission (and with some help from the U.S. Geological Survey), the observatory, Pennsylvania State University, Columbia University, Massachusetts Institute of Technology and the Delaware State Geologic Survey have formed the Northeast United States Seismic Network, operating nearly 100 stations in order to monitor the capricious Northeastern seismicity. In contrast to Western quakes, which occur along well-defined fault systems and plate boundaries, quakes east of the Rockies occur in the "interior" of a plate and are not associated with obviously potentially active features. Eastern quakes occur much less often and are generally less energetic (produce less surface ground shaking) than Western quakes, but they are felt over greater distances than similar-sized Western quakes. The older and colder Eastern crust seems to propagate the waves more efficiently, according to Robert Wesson, chief of the USGS Office of Earthquake Studies. It is fairly easy, therefore, to keep from building a nuclear plant on an earthquake hot spot in California. East of the Rockies it becomes more difficult. And considering that, by one estimate, more than 80 percent of the plants in existence, under construction or being planned are east of the Mississippi River, and that the Northeast bears a heavy concentration of that 80 percent, a seismic network suddenly assumes more than passing importance.

Using records dating from 1534, Ahner said, the network has pinpointed several major centers of seismic activity in New England. The most active area, he said, is around the town of La Malbaie on the St. Lawrence River. Other historically active areas include: Moodus, Conn.; the Ossipee Mountain area in New Hampshire; Cape Ann, Mass.; Portland, Maine.; the northern New York State-Montreal region and the northern New Jersey-southern New York State area. Historically is the key word, Ahner stressed. In the Moodus, Conn., area, for instance, the network has picked up no activity for three to four years; before that, most of the tremors could be detected only by sensitive instruments. According to the USGS, the area's major quakes have been: east of Cape Ann, Mass., Nov. 18, 1755; St. Lawrence River region, Feb. 28, 1925; Grand Banks of Newfoundland, Nov., 18, 1929; Attica, N.Y., Aug. 12, 1929; and Massena, N.Y., Sept. 4, 1944. According to estimates, these quakes would have measured between 5.0 and 6.0 on the Richter scale.