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# Radiation Exposure Could Curtail Workers' Efforts

By **HENRY FOUNTAIN**

As radiation levels rise at the crippled reactors in northern [Japan](#), a basic question arises: how long can workers keep struggling to ward off full meltdowns?

The workers are performing what have been described as heroic tasks, like using fire equipment to pump seawater into the three failing reactors to keep the nuclear fuel from melting down and fighting the fire at a fourth reactor.

They are operating in places that have been contaminated by radioactive isotopes from all four reactors. Technicians who have not been evacuated face an escalating exposure, and will have to be replaced if the fight is to go on.

"If they exceed a certain amount, they can't go back in for a day or a week or longer," said Dr. Lew Pepper, a professor at the [Boston University](#) School of Public Health who has studied the effects of radiation on nuclear weapons workers. And the pool of available replacements is finite, he said: "What do you do? You don't have a lot of people who can do this work."

The nuclear plants' operator, Tokyo Electric Power, has declined to provide details about the workers.

But Arnold Gundersen, a consultant who worked in American plants nearly identical to the stricken Japanese ones, said it was likely that the company was calling in retirees and workers from unaffected plants for help. And perhaps for sacrifice, as well. "They may also be asking for people to volunteer to receive additional exposure," he said.

People who are working close to the reactor — pumping water, or operating valves inside the secondary containment structure — would almost certainly be wearing full bodysuits and air packs, Mr. Gundersen said. But some forms of radiation can penetrate any gear.

Gamma rays and other penetrating radiation can cause cancers and other long-term illnesses or, in high amounts, near-term illness or death.

Health physicists should gauge the radiation level in the work area, and the workers would normally be told how long they can remain. "There may be a health physicist who will say, You only have an hour or two to do this job," Mr. Gundersen said. Each worker would carry a dosimeter, which measures radiation exposure, "and they'll be looking at it," he added. "When it hits a certain number, they should leave."

Suits and air packs are meant to keep radioactive particles off the skin and out of the lungs until the workers return to a safer area.

Workers are trained to remove the gear in a specific way to avoid leaving any particles on their skin that would result in continuing exposure.

While regulations may differ somewhat in Japan, in the United States the usual radiation exposure limit for nuclear power plant workers is 50 millisieverts, or 5 rem, per year (compared with the 0.3 rem that the [Environmental Protection Agency](#) says most people get from normal background radiation). When there is an emergency, the limit can be raised to 25 rem, which is still far below the level at which people would show symptoms or get sick.

The explosion at Fukushima's Reactor No. 2 on Tuesday morning sent radiation levels spiking, to 8,217 microsieveverts an hour from 1,941 about 40 minutes earlier. Later Tuesday, Japanese nuclear officials announced much higher levels and evacuated most of the emergency workers.

During the Chernobyl accident in Ukraine in 1986, when the reactor caught fire, operators and firefighters received high doses of radiation, sometimes within minutes and without being made aware of the dangers. More than two dozen of them died of acute radiation illness. "People in Chernobyl were just over overexposed," Dr. Pepper said. "The outcome for those folks was death."

Determining allowable exposure is usually based on three principles: distance, time and shielding. In the Japanese plants, extensive contamination would mean that distance and shielding are not really factors, so the controlling variable is time.

Mr. Gundersen said that when he worked at the Vermont Yankee plant, which is nearly identical to some of the crippled Japanese reactors, he had one maintenance task where the "stay time," in which workers would be exposed to their yearly limit, was three minutes. He hired local farmers, trained them on a mock-up for two weeks, and then sent them in for their brief stint. "Then I'd send them home for a year," he said.

In Japan, the plant operators do not have the luxury of time for training. “You need somebody who is familiar with the plant, because you need somebody to do it now,” Mr. Gundersen said.

Japanese workers might be so committed that they might be willing to exceed accepted levels of exposure. But that might not extend to extremely high radiation.

“I don’t think anyone is going to take 50 rems,” he said. “But if it’s a difference between 5 and 7, they might say: ‘I’ll take it. It’s worth the risk.’ ”