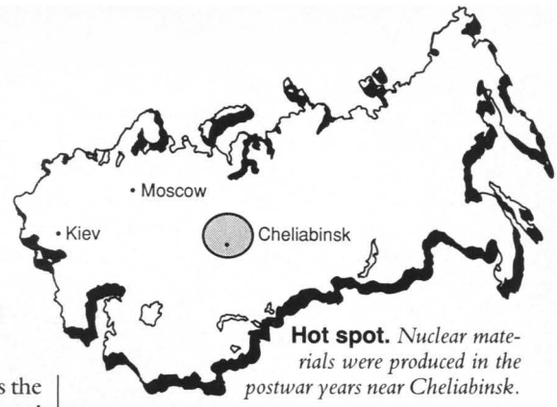
Radiation Exposure: Hot Legacy of the Cold War

An official account of the once-secret Soviet nuclear program reveals that workers were exposed to massive doses of radiation



Hot spot. *Nuclear materials were produced in the postwar years near Cheliabinsk.*

YOU WOULDN'T EXPECT a Soviet science magazine targeted at lay readers to carry much of interest to U.S. physicists. But a startling series of articles in the quarterly *Priroda* on the secret history of the Soviet nuclear establishment has made the journal a hot item in the United States.

Richard Wilson, a nuclear physicist at Harvard University, says an article in the February issue by the deputy minister of nuclear power and industry, Boris V. Nikipelov, is "very significant" for the story it tells about the routine management of nuclear safety in the U.S.S.R. and, more specifically, about the hazards of long-term exposure to big doses of radiation. Alexander Shlyakhter, formerly of the Leningrad Nuclear Physics Institute, now at Harvard, translated the paper and led a discussion about it at an American Statistical Society conference in Colorado last month. When the data were read out, "most people were aghast," says one of the conference goers, nuclear consultant Ralph Lapp. Half the workers at the Cheliabinsk site in the Ural Mountains east of Moscow were routinely receiving 100 rem* per year in the late 1940s and early 1950s.

For comparison, this is about 20 times the maximum annual dose a worker is allowed to get in the United States today. Lapp says that the U.S. government "cranked up our health physics efforts" beginning in 1943, and at that time "our limit [for workers' exposure] was 0.1 rem per day." The United States does not keep lifetime records for individuals, Lapp says. However, by interpreting data on employees at three big U.S. weapons plants, he estimates that the average lifetime dose from 1944 to the early 1980s was 3 rem per person. Meanwhile, at the Sellafield plant in Britain, where fewer tasks were automated, workers received an average lifetime dose of about 11 rem.

The consequences of the very large doses to workers in the U.S.S.R. are not fully revealed in the Nikipelov report. But it tantalizingly mentions that 8 to 9% of the staff who began work before 1958 and received high radiation doses (more than 100 rem) died of cancer. In addition, the Nikipelov report says that nearly a quarter of the workers between 1950 and 1952 were suffering from "chronic radiation disease," which Lapp takes to mean blood disorders. Although Nikipelov does not give the numbers, he mentions that cancer mortality among severely exposed workers (100 rem and above) was 88% higher than among those who received less than 100 rem."

*A rad is a unit of radiation in tissue and a rem is the equivalent dose multiplied by a scaling factor that reflects the type of radiation and its relative penetrating power.

Nikipelov explains that, shortly after the plant began running, managers realized they had "underestimated the irradiation factor" and appealed for permission to improve conditions. No changes were made until 1952, however, when new safety standards were imposed, but exceptions were always granted for urgent repairs. Trained workers were in short supply, but the bomb building had to go on. Technicians presumably relied on forced labor to do the nastiest jobs—which included doing repairs in hot radiation zones, the type of work done only by robot equipment in the United States.

Wilson maintains that the data in Nikipelov's report, if confirmed, show that the risks of exposure to gamma radiation are "slightly larger than those you'd have got from Nagasaki-Hiroshima data," but not so great as to support the worst-case projections of British epidemiologist Alice Stewart, who has argued for a tenfold increase in risk estimates. Stewart, who also attended the Colorado meeting, points out that Wilson's view at this point is speculative.

Wilson, Lapp, and others are seeking more information from the Soviets, hoping that it may be possible to fill in some gaps in the epidemiological picture.

Stewart, for her part, is combing through U.S. records for evidence of harmful effects of exposure to low-level radiation. She recently won access to detailed epidemiological data on U.S. bomb plant workers through a lawsuit financed by the Three Mile Island Public Health Fund—a nonprofit group in Pennsylvania.

Meanwhile, another chapter in the secret history of the cold war is being published in Moscow. The May issue of *Priroda* includes a technical description of the catastrophic explosion of a nuclear waste dump at Kyshtym in 1957. Shlyakhter is eager to translate it.

■ ELIOT MARSHALL

Hanford Releases Released

Just as U.S. physicists were studying accounts that Soviet workers had received large doses of radiation, the Department of Energy confessed that leaks from its plant in Hanford, Washington, may have seriously affected U.S. civilians. According to a 2-year study by the Pacific Northwest Laboratory, people living in the countryside around Hanford may have been exposed to a significant amount of radioactive iodine leaking from fuel processing tanks, which were not connected to vent filters in the early years (1944–1947). In the late 1960s they were also exposed to radionuclides in the Columbia River, a source of fish and drinking water.

The Hanford report finds that roughly 270,000 people lived in the area when the radiation reached its peak, and 5% of them could have received a dose to the thyroid greater than 33 rad. In addition, researchers have identified a high-risk group of about 1400 children who—if they drank fresh milk from cows in their own fields—could have received a very high dose of 15 to 650 rad. The median dose in this group is 70 rad. These reconstructed estimates have not as yet been correlated with sickness rates in the area, but the Centers for Disease Control has begun an epidemiological analysis. DOE has also agreed to finance a separate study of leukemia risk among the children of Hanford workers, designed to parallel work in England that found elevated cancer risk among children of some of the more exposed Sellafield workers (*Science*, 6 April, p. 24). ■ E.M.