But slowness isn't the only thing the government is being criticized for—there's also controversy over how it's set up the studies. Decisions about the Wismut projects—what should be done, how it should be organized, and who should do the work—are made by the ministry of the environment, which is also Germany's nuclear regulatory agency, with input from their standing scientific advisory committee. But, says physicist Krüger: "[It's] missing the involvement of anyone who is critical of low-dose effects and risk estimates, critical about nuclear energy."

Critics also point out that there's been no peer review of the research plan, a common practice in the United States. And they argue that there are built-in conflicts of interest in the planning of the Wismut studies because the same scientists who advised the government on what projects should be done can apply for funds to do them. Kellerer, one of the scientific advisers, recognizes the problems with these arrangements but says that separating the tasks completely is difficult in Germany because there simply aren't enough researchers in radiation and epidemiology.

One solution some scientists favor is to involve researchers from outside Germany, either as reviewers or as direct participants in the work. Says Krüger: "There should be an internationally sponsored and monitored research effort, similar to what was done with the Japan data. Most important, it should involve independent scientists."

But the controversies surrounding Wismut go beyond nuclear energy, to the trauma of "a dark and difficult chapter of history," says Kellerer. Wismut was more than a uranium operation—it was an all-powerful state within a state, with its own secret police, Communist Party, and propaganda machine, dedicated to concealing what was happening. If this weren't hard enough to come to grips with, "we also need to face the fact...that most people went along and at least passively supported [Wismut]. That's what made the whole thing possible," says Beleites.

–Patricia Kahn

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RADIATION RISKS

Researchers Eager to See Soviet Data

In the early days of the cold war, Soviet atom bomb workers poured so much radioactive sludge into the Techa River in Siberia that today—40 years later—the entire waterway is untouchable. A person who managed to penetrate a wire fence and stroll on the river banks would enter a zone where radiation levels reach 1 rem per hour. That's enough to give a person in one morning the dose a U.S. worker is allowed to receive in a year. Nearby, other disasters—the explosion of a storage tank and the evaporation of a waste lagoon—have spread radionuclides over 27,000 square kilometers. Like the devastation left by uranium mining and processing in former East Germany (see previous story), this massive environmental mess is part of the legacy of Stalin's race to build the bomb. And in the aftermath of the cold war, scientists are learning the full extent of the damage—particularly the human toll.

Some of the most interesting data from the region has been put together by a group of Russian doctors, who disclosed recently that for decades they have been collecting health data on thousands of people in the military area of Chelyabinsk, near the Techa River. They now hope to collaborate openly with Westerners to reconstruct one of the largest accidental human "experiments" in history.

The Chelyabinsk tragedy ranks in scale with the best-known of all in the nuclear era: the atom bomb blasts in Japan. But, unlike the Japanese, who were exposed to a short, intense burst of radiation, the peo-ple of Chelyabinsk were exposed to low doses over a long period from a variety of environmental sources. Like the East German records, the data from Chelyabinsk could therefore be important in settling a bitter debate over whether the Japanese data overstate or understate the risks from lower radiation dose rates. For this reason, experts of every stripe in the United States are eager to get their hands on the files. By any measure, says Marvin Goldman, a biophysicist at the University of California, Davis, "this is a potential gold mine of data," if the information can be validated.

The data were collected by a team headed by Mira Kossenko, a Russian physician at the Institute of Biophysics Branch Number 4 (Chelyabinsk). Until recently, this information on one of the world's worst environmental catastrophes had not been given to the public. But in May, breaking a decades-long silence, Kossenko presented her findings at a conference organized by Russian doctors and the Physicians for Social Responsibility (PSR), a U.S. group that focuses on nuclear risks. In December, she published the results for the first time in PSR's journal, reporting that she had found 37 cases of leukemia in an exposed population of 28,000.* According to Kossenko, this represents a statistically significant increase in deaths, as compared with two control populations nearby that were not on the Techa River. However, after analyzing the doses these people received, she concluded that their risk of getting leukemia was much lower than that for survivors of the Hiroshima-Nagasaki blasts.

These findings support a benign view of certain radiation effects—namely, that a given dose of radiation is less risky if received over an extended period of time. That will be potentially good news for the U.S. Department of Energy (DOE): The United States is now poised to spend billions of dollars to clean up its own nuclear weapons sites to prevent environmental exposures of the low-dose-rate type, but it is currently pegging the cleanup to safety standards based on the high-dose-rate effects seen in Japan. Perhaps for this reason, DOE, manager of the U.S. nuclear weapons program, is eager to fund more research on the Chelyabinsk data. But leaders of PSR argue that DOE has too much at stake to serve as a sponsor. Speaking for PSR, David Rush, an epidemiologist at Tufts University, said, "DOE involvement presents a conflict of interest."

Ironically, the weapons community may be best qualified to solve some of the deep-rooted problems remaining in the Chelyabinsk data—such as poor information on individual exposures. Goldman, himself a DOE-funded scientist, claims DOE people have the world's greatest expertise in estimating doses, and he favors a collaboration between DOE's technicians and epidemiologists at other agencies. By using new indices—such as the electron spin resonance of tooth enamel or fluorescence-labeled chromosome aberrations—it ought to be possible, Goldman says, to reconstruct biological events that occurred even 30 to 40 years ago. But at the moment it's not clear who, if anyone, will be reconstructing the Chelyabinsk doses.

The Russians are preoccupied just now with mere survival, and their government may not be eager to investigate the Chelyabinsk tragedy in great detail—particularly if it leads to demands for reimbursing the injured. Meanwhile, according to Goldman, who visited Branch Number 4 of the Biophysics Institute last year, other mundane perils lurk. For example, many irreplaceable records are stored at Chelyabinsk on paper in cardboard files, and Russian researchers are fond of tobacco. He would hate to see the gold mine go up in smoke. He, among others, is eager to see the Russians transfer their data to computerized form, where they would be safer and easier to share with Western scientists.

–Eliot Marshall

*"Estimate of the Risk of Leukemia to Residents Exposed to Radiation as a Result of a Nuclear Accident in the Southern Urals," by Mira M. Kossenko, Marina O. Degteva, Nelly A. Petrushova, in *The PSR Quarterly* **2**, 187 (December 1992).