



COMMENTARY

Scientific Integrity and Adequate Health Services: Twin Casualties of the Nuclear Arms Race

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The former U.S.S.R.'s largest plutonium production site, the so-called "Mayak" complex, is located near the Russian city of Chelyabinsk. Because the site and its location bear several similarities to the U.S. Department of Energy's Hanford Nuclear Reservation, Northwest PSR chapters were contacted in late 1991 by organizers of a first-ever radioecology conference in Chelyabinsk. Following months of joint planning, the author headed a delegation of 30 PSR members and other regional and national scientists, activists, and media representatives to Chelyabinsk in May 1992.

SCIENCE AND SECRECY

Documented public health and environmental outcomes from the 50-year nuclear arms race present interesting contrasts in "open" and "closed" societies. In the United States, the prospect of scientific openness caused our nuclear establishment to refrain from conducting radiation health studies

on off-site populations near nuclear production and testing sites. Consequently, the U.S. only recently initiated the first such radiation epidemiological research. In the former U.S.S.R., the opposite situation prevailed. This closed society was willing, with impunity, to carry out extensive environmental and health monitoring, beginning with the initiation of nuclear weapons production, in the secure knowledge that there would be no public disclosure.

In neither country did the cloak of national security serve the people. In the U.S., it thwarted sorely needed research on radiation health effects. In both nations, it allowed egregious exposures of thousands of residents without giving them information with which to make fundamental choices to protect themselves.

It is in this environment, medical and political, that the work reported in this issue by Dr. Mira Kossenko, a Russian physician and researcher, must be viewed. Her important scientific contribution comes at an immeasurable cost of personal and professional pain and conflict: health care and science bludgeoned by secrecy for more than 20 years. Only in the past two of her 22 years as a clinician treating patients, including radiation victims, has she been allowed to communicate openly the explanations for their problems. The most fundamental moral obligation of a physician, honest communication in the healing relationship, was blocked.

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The agony of this aberration brought choking emotion when such ethical intrusions were discussed during the recent visit to Chelyabinsk. The real impact of closed societies, the toll on the human spirit, suddenly was not theoretical or impersonal. Its impact was visceral, as, physician to physician, she presented the impact of narrow nationalistic repression on professional integrity.

Her scientific studies were publicly supported, although no results were allowed to be published. The leukemia study in this issue is the first radiation health study from the Chelyabinsk region. Some background information is critical, both to appreciate the context of Dr. Kossenko's work and to understand PSR's evolving collaboration with her and her colleagues in this region of Russia.

NUCLEAR PRODUCTION VERSUS PUBLIC HEALTH

The Russian city of Chelyabinsk, with 1.2 million residents, is about 1,000 miles east of Moscow, just beyond the Ural mountains. Sixty miles to the northwest is Chelyabinsk-65, known as Mayak, the former Soviet Union's largest plutonium production site. Construction began in 1945, and by 1948 it had begun to produce plutonium. With production being propelled by the nuclear arms race, public health and environmental considerations were minimal. Between 1948 and the early 1970s, three untoward events, in large measure due to poor design or risk assessment, resulted in massive contamination of the region with radionuclides, exposing at least 500,000 residents to varying levels of radiation.

The first untoward event was a consequence of the urgent push for plutonium production. There were minimal environmental controls on the production reactors or chemical reprocessing plants, resulting in both atmospheric and surface water contamination. It was not until 1958 that the systematic control of emissions from the stacks of iodine-131 and plutonium was initiated. No data on iodine-131 releases have been made public, although, with the rush for production and resultant minimal "cooling" times for the irradiated uranium before chemical extraction of plutonium, the amount of iodine-131 released from the stacks is presumed to have been substantial. (It was during the first several years at Hanford, under similar production demands, that more than 725,000 Ci of iodine-131 were released into the atmosphere.) In addition, the

production and chemical separation facilities produced prodigious volumes of contaminated liquid wastes. Most high-level liquid wastes were stored in tanks, similar to storage measures at Hanford. Mayak scientists reported in 1990 an estimated 823 million Ci of high-level liquid wastes in tanks stored on the site [1]. (The Hanford tank farm, by comparison, currently contains an estimated 446 million Ci of high-level liquid wastes [2]). The Mayak complex abuts the Techa River, and massive volumes of liquid wastes were discharged into the river, both from reactor accidents such as ruptured fuel rods and from active disposal of lower-level wastes directly into the river. More than 120 million Ci of radiation are acknowledged to have been disposed of into this small meandering stream and later into a storage lake, Lake Karachay. While viewing the Techa River, the current director of the Mayak complex was questioned about the wisdom of these discharges. It was anticipated that the radioactive material would be diluted, "like you did at Hanford," he replied. The fundamental difference between a meandering stream and the massive Columbia River at Hanford was not referenced, even if dilution is posited as an appropriate waste management policy. In an effort to control the dense concentration of radionuclides deposited in the river silt (although huge amounts contaminated the river and affected settlements for hundreds of miles downstream, including swamps in this flat Siberian plain), a series of dams was built. They now hold back large lakes of highly contaminated water. One or more of these dams is now threatened by channeling, as water flow is emerging from its earthen base.

The second major untoward event was the explosion on September 29, 1957, of one of the high-level waste tanks. Because of failure of the cooling pipes, the tank overheated, causing a thermal explosion. An estimated 20 million Ci of radioactivity were discharged. The Russians insist that 18 million Ci settled in close proximity to the tank, and 2 million Ci were dispersed into the atmosphere, settling over an area of at least 23,000 km². There is no way to confirm the quantities of radioactivity in the tank, and it is of interest to the author that both U.S. and Russian officials, when discussing such events, invariably talk in "round" numbers, with great authority. It is well known that, at Hanford, the government and contract scientists have just begun to "core" the tanks' contents for study and

characterization. There is no evidence that careful monitoring was done as liquid wastes were pumped into the tanks during the period of frenzied production, at either Mayak or Hanford. Information on the radioactive quantities in the tank that exploded at Mayak, therefore, must be treated with skepticism.

The Russians report that an area of at least 110 km² was contaminated with more than 100 Ci/km², and another 400 km² received at least 10 Ci/km² [3]. The total region had a population of about 272,000, and there were 217 towns and villages. It took two years to resettle 10,200 people from the most highly contaminated areas. This so-called Kyshtym explosion was actually closer to the village of Kasli, which is less than 12 km from the site of the explosion. When members of the PSR delegation, the first outsiders in 50 years, visited this village, the resentment of local residents who only

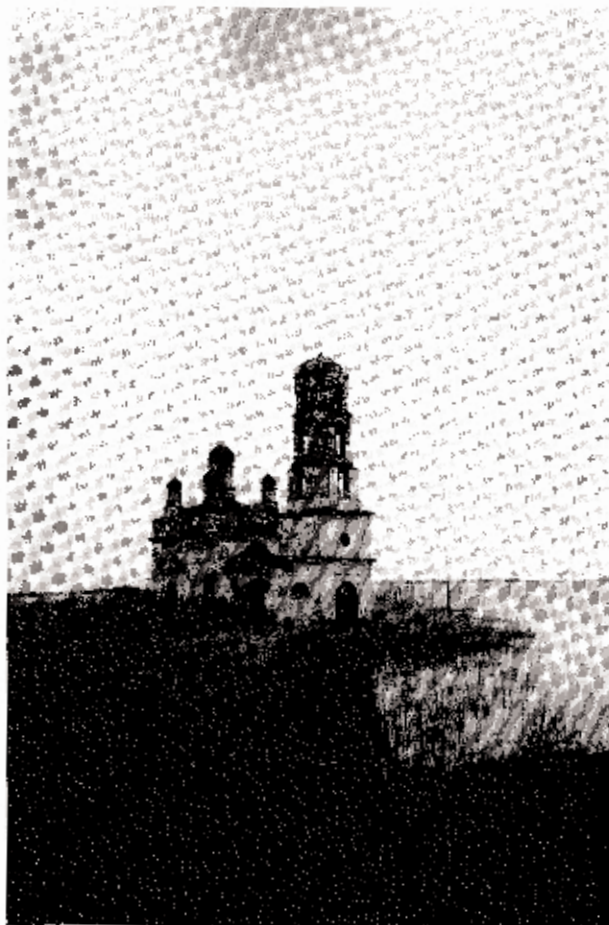


FIGURE Abandoned church in the evacuated village of Metlino on the Techa River, about 12 to 15 km from Mayak.

two years ago were notified of this major accident 33 years earlier was strikingly familiar to those acquainted with Hanford. Local health officials describe an impressive, though unverified, range of health problems including reproductive problems, birth defects, cancers, premature degenerative diseases, immune disorders, and other diseases.

The third major untoward radiation event occurred in 1967. Lake Karachay dried up during an unusually warm and dry spring. Contaminated dust and soil were carried by the wind over an estimated 2,700 km² containing a population of about 41,500 people. Fallout consisted mainly of cesium-137 (half-life 30 years) and strontium-90 (half-life 29 years).

In total, approximately 1 billion Ci of radioactivity have been stored at Mayak or dispersed over the region. Of this amount, at least 150 million Ci have been spread off-site, into the environment over an area of about 26,700 km², by both air and surface water pathways [4]. Two comparisons are useful to put these data into some perspective. The Chernobyl accident is estimated to have released approximately 100 million Ci of radioactivity into the environment, although over a much larger area. Total off-site releases from the Hanford Nuclear Reservation in Washington state are not yet known. Preliminary results from the Hanford Environmental Dose Reconstruction Project suggest that iodine-131 releases (about 725,000 Ci) constitute about 80% of the total off-site doses. Although an additional several million curies of short-lived radionuclides were released into the Columbia River, their contribution to human doses appears to have been less than that of the iodine-131. At any rate, the total amount of these releases represents only a fraction of the off-site releases from Mayak.

The environmental situation at the Mayak complex and the surrounding regions represents an ecological problem of unprecedented complexity and magnitude. International efforts are just beginning to address the engineering, organizational, and waste-management issues posed by the current situation. The Chelyabinsk oblast (political region) was declared an "ecological disaster zone" in November 1990, and Russian President Boris Yeltsin visited and committed support to the region. Considering the current status of the Russian economy, it is not surprising that there was no evidence of significant resources for environmental management arriving

in the region. Also, it is believed that the Mayak complex continues to produce plutonium, contributing to further environmental contamination and waste problems.

THE CONFERENCE

Late in 1991, local environmentalists, physicians, and public health officials in Chelyabinsk began organizing a conference on the impact on the regional environment of the Mayak complex. A request was forwarded through International Physicians for the Prevention of Nuclear War to the Northwest chapters of PSR to participate as coorganizers and presenters. Russian interest in the Pacific Northwest was triggered by the similarities between Hanford and Mayak in terms of the history of plutonium production, environmental issues, and roughly equivalent regional populations. Northwest PSR chapters, with Seattle as chapter coordinator, together with the Center for Common Initiatives in San Francisco, agreed to participate and to provide speakers on a variety of subjects. These included health issues, environmental cleanup, citizen action, legal issues, the role of the media, physician involvement in nuclear activities, and ethical aspects of nuclear weapons production. About 50 U.S. delegates and speakers, 30 from the Pacific Northwest, attended the first International Conference on Radioecology in Chelyabinsk, Russian Federation, on May 20 to 25, 1992.

For delegates arriving at the conference in this city only opened to outsiders, domestic or foreign, in January 1992, it was immediately clear that the content, size, and significance of the conference had changed substantially from what had been understood by U.S. collaborators. At least two factors contributed to the changes at the conference: 1) a call from the organizing committee for presentations resulting in a veritable flood of applications from Russians (reflecting the prolonged isolation of their scientists, physicians, and academics); and 2) agreement by Mayak officials and scientific staff to participate in both planning and presenting.

As a result, instead of the estimated 100 to 150 attendees, 540 people registered, representing 284 organizations, 36 Russian cities, and seven nations including 61 foreign delegates. There was immense interest and media coverage, both locally and across Russia, in the conference content and recommendations.

U.S. delegates witnessed both the excitement and confusion of the first-time conference organizers as they struggled with the complexity of sponsoring a conference of such magnitude. Several members of the U.S. delegation served as cofacilitators with the Russians in the seven interest sections. The fascinating dynamics of newly won free speech were observed, as health professionals and members of the public confronted official scientists and administrators about their activities of past decades and the data being presented.

For the first time, Mayak scientists presented to the world community initial data on the health effects on the worker population. They acknowledge 2,267 cases of "radiation diseases" in workers (no total worker population figures were presented although a local researcher indicated a total current work force of about 10,000), 77% of which were described as "chronic radiation diseases." They announced 41 cases of acute radiation sickness and indicated that 20% of the total were various "acute radiation syndromes" including encephalopathy. Exposures as high as 12 Sv were reported, but no data were given regarding the numbers of such exposures.

Dr. G. N. Romanov, Director of the Experimental Research Station, Mayak Industrial Complex, reported the maximum allowable levels of strontium-90 for land used for agricultural production: below 100 Ci/km², land can be used for hog production; below 10 Ci/km², land can be used for beef production; and, below 2.5 Ci/km², land can be used for dairy operations.

RADIATION RESEARCH ON SURROUNDING POPULATIONS

Dr. Kossenko and her colleagues at the Branch Number 4, Institute of Biophysics of the Ministry of Health, have been the primary investigators of the population surrounding the Mayak complex. The first medical examinations of affected persons, in this case residents along the Techa River, were begun in 1951. (Radiation monitoring of women doing their laundry in the Techa River in 1951 recorded up to a startling 20 rem/hr external gamma radiation.) In the ensuing 41 years, data have been compiled at the Institute of Biophysics from clinical examinations and treatment. These include names, residence locations, diagnoses, causes of death, and diagnostic test results. Individual dose estimates

have been calculated although the reliability of these data has not been confirmed. Data have been compiled on 28,000 persons exposed along the Techa River. More than 36,000 persons exposed by the Kyshtym explosion have been examined. This information probably represents the largest data base on low- and mid-level radiation nonworker exposures in the world. The article in this issue is the first epidemiological analysis of this remarkable and, until recently, unknown data set.

Medical care to the above persons is provided mostly in the building housing the Institute of Biophysics, recently renamed the Urals Research Center for Radiation Medicine, as it has declared its independence from the Moscow Institute of Biophysics. The facility includes 50 inpatient beds, as well as the research offices. It is worth noting briefly the overall conditions under which this research has been conducted. A tour of this aging facility located on a rutted back street in Chelyabinsk makes apparent that, in most of the Western world, it would have long ago been razed. The floors sag, the rooms are barely lit, and the clinical wards are spartan. Resources of all types are glaringly inadequate, and Dr. Kossenko confirmed that funding beyond a few months is very uncertain. Yet, 10 networked IBM-compatible PCs, with one laser jet and two dot-matrix printers, provide the technological anchor for their continuing work. One other striking piece of technology is a unique, locally crafted whole-body radiation counter, built and operated by Dr. V. P. Kozheurov. It measures strontium 90 levels and has been used to study exposed residents. Since 1973, Dr. Kozheurov has performed more than 45,000 whole-body examinations on approximately 12,000 patients. Only preliminary results have been reported [5].

The opening paragraphs of this commentary describe the immense excitement and emotion Dr. Kossenko and her colleagues have experienced as they have finally been allowed to interact with outside physicians and researchers, to travel abroad, and to begin to publish their very important findings. The PSR delegation was only the second group of foreigners into Chelyabinsk, after Secretary of State James Baker's visit earlier in 1992. The hunger for dialogue and interaction, as well as Russian interest in hosting U.S. attendees in homes and offices, was remarkable.

THE HANFORD-CHELYABINSK MOVEMENT

The formal positions and resolutions from the conference were bold and far-reaching (A copy is available from the author.) Following the conference, physicians, scientists, and community activists from both countries formally established the Hanford-Chelyabinsk Movement (HCM). Its goals and activities are best viewed as subsets of the broad goals articulated at the close of the International Conference on Radioecology. It is important, however, to recognize that the goals of the HCM derive primarily from PSR's mission of ridding the world of nuclear weapons and grappling realistically with the environmental implications of past (and present) nuclear weapons production and testing.

In a lively and complex session, punctuated by all the challenges of cultural and language impediments, the physicians' leadership from the two countries identified the following activities for the initial collaborative work of the HCM:

- To establish electronic mail communication and to initiate leadership exchanges, the latter to begin as early as February 1993;
- To define the needs and opportunities for the exchange of health personnel and students;
- To establish a hospital-hospital linkage between a Russian facility that serves people from the radiation zones and a U.S. facility preferably in a community near the Hanford Nuclear Reservation (the symbolism of healing connections between the two communities that have been producing life-destroying products was compelling);
- To establish a regional model of health care excellence in Chelyabinsk and to establish a flow of information, skills, personnel, and supplies for both patient care and education;
- To support continuing relationships and exchanges between a number of physician specialists that were begun by participants attending the conference;
- To support contacts and communication between community organizations in both countries and to generate communication through translated newsletters and educational materials, to further build effective public activism on nuclear issues.

Since the PSR delegation returned to the U.S., efforts have been initiated to build a coalition of

PSR members from the Northwest chapters and the British Columbia affiliate of Canadian Physicians for the Prevention of Nuclear War in order to carry forward this agenda. Major funds will need to be raised, and contacts in both the U.S. and Russia have been initiated.

The outcomes of the conference and the goals of the HCM exceeded in both vision and boldness the expectations that preceded our trip to Chelyabinsk.

President Vaclav Havel's dream for Czechoslovakia captures nicely the vision of both U.S. and Russian physicians in Chelyabinsk. Dr. Havel says,

Life in the towns and villages will have overcome the legacy of greyness, uniformity, anonymity, and ugliness inherited from the totalitarian era. It will have a genuinely human dimension. A whole new health system should be built. It will be a liberal system, which means that patients and doctors will have a choice. State and university health facilities will be interconnected with local and private systems and the systems run by churches and charities. . . the former

centralist, bureaucratic, and dysfunctional system of support for what cannot be self-supporting is collapsing. The new system, in all its aspects, is being born, prepared, thought-through. . . that means a state that will no longer suppress, humiliate, and deny the free human being, but will serve all the dimensions of that being [6].

REFERENCES

1. Sayfer V, Degteva M, Kossenko M, Akleeve A. Radiation accidents in the southern Urals. *Nature*. In press.
2. Complex cleanup—the environmental legacy of nuclear weapons production. Washington, D.C.: Office of Technology Assessment; 1991. OTA-0-484.
3. Nikipelov BV, Romanov GN, Beridakov LA, et al. Radiation accident in the south Urals in 1957 [In Russian]. *Atomnaya Energiya* 1989;6-7(2):74-80.
4. Periyagin A. Speech before U.S.S.R. Supreme Council, Subcommittee on Nuclear Energetics and Nuclear Ecology; February 11, 1990.
5. Belyi US, Kuvtun AN, Kozhurov VP. Whole body levels of strontium 90 in human populations [In Russian]. *Meditsinskaya Radiologiya* 1975;20(6):52-58.
6. Havel V. A dream for Czechoslovakia. *New York Review of Books*, June 23, 1992; 8-13.