

## Technological Drawbacks in the Soviet Union

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*A dozen Swiss science journalists traveled through the Soviet Union for three weeks, visiting research institutes and industrial plants, as well as speaking with science officials. The first of these two reports describes a visit to the Center of Radiation Medicine in Kiev; the second one deals with science in Estonia.*

About 25 kilometers north of the Ukrainian metropolis Kiev near Pushtsha-Vodiza, we arrived in parklike surroundings at the Center of Radiation Medicine of the Soviet Academy of Medicine. Once a health resort for trade unionists, the buildings were converted by the Soviet government in the autumn of 1986 to cope with the victims of the Chernobyl nuclear disaster that occurred in April of that year. Among the duties of the Center are scientific research into the long-term effects of the disaster as well as clinical care of the victims. Vladimir Bebesko, director of the Center's Institute of Clinical Radiology, answered our questions. We also talked to staff members of the epidemiological institute and other medical departments. Bebesko gives the impression of being a clever, confident man. This comes as no surprise for we found out later on that the list of experts and journalists from the West who wish to speak to him is growing longer and longer.

The clinic has a staff of 550 employees and can accommodate 300 patients. A hundred scientists work in the Institute of Radiology in seven subdepartments. The department of radiation pathology handles the rehabilitation of patients who suffered from acute radiation sickness during the first few days of the accident (the people we spoke to used this word whenever they referred to the disaster). These patients were mainly workers and soldiers who had been exposed to radiation of up to 50 rem or more during rescue and cleanup work. Checking and treating the thyroid is given top priority because this organ is very sensitive to radioactive iodine 131, which posed the main danger during those first few weeks. Children were particularly endangered, and specialists in Kiev pointed out with satisfaction that potassium iodide pills had been given to millions of children and adults in those areas most affected. The pills protect against thyroid damages by loading the thyroid with stable iodine so the gland does not take up the radioactive form. This way damage to the thyroid could be kept to a minimum. In the beginning, however, there were some incidents of thyroid dysfunction. But within a year of the accident, all of these anomalies had become normal again, and up to now not a single case of thyroid insufficiency caused by radiation had been registered. In the next few decades, however, doctors reckon there will be about 1,400 cases of thyroid adenomas in those regions of the Ukraine, the Russian Soviet Republic and White Russia that had been most exposed to radiation. As a general rule, adenomas are benign tumors which can be operated or otherwise treated. Further attention must be paid to

changes in the blood-forming system, especially in bone marrow, and also to a weakening of the immune system. Through intensive check-ups, scientists also wish to continue doing research in lower radiation levels (up to 25 rem) to fill information gaps and to provide experts all over the world with data. Up to now not a single case of leukemia (blood cancer) caused by radiation had occurred in the Chernobyl area. When asked how they could differentiate between an ordinary case of leukemia and one caused by radioactivity, they gave us the following answer: through statistics because even more children had leukemia in 1972 than now.

Experts in Kiev had not observed any serious thyroid problems nor diseases in the blood-forming system up to now, yet there was still a general increase in diseases in the Chernobyl area after 1986. The explanation provided was that after the accident a great number of people, including those living in remote settlements, were given thorough medical examinations. This way many ordinary diseases were discovered which had not been registered before. Now this poses a fundamental problem because the effects of any disaster on human health can only be reliably assessed if diseases are registered in detail before the event.

Physicians in Kiev also mention another form of illness caused by Chernobyl: "Radiophobia". After the accident, people with an "unstable nervous system" were particularly prone to call even the slightest deviation in body function "radiation sickness", and so



*A woman patient from a village exposed to cesium. Radiation does not seem to be the cause of her thyroid dysfunction.*

there had been a whole series of cases of "radiation induced" varicose veins, headaches, hypertonia, inflammation of the sinus, etc. in the clinic. For treatment, psychotherapy had been used as well as such alternative methods as hypnosis, acupuncture, hydrotherapy and gymnastics. And what is the situation concerning radiation in and around Chernobyl like today? Iodine 131, with a half life of eight days, has disappeared, but the main problem is still cesium 137, which has a half life of thirty years. As before, no human beings may settle in the 30 kilometer zone surrounding Chernobyl. (According to Soviet sources, the radioactivity of the ground in Chernobyl and in the "ghost town" Pripyat four kilometers away is still about 1 milliroentgen per hour, despite the fact that the top layer of soil had been removed.) About a total of 116,000 people had definitively been evacuated from the zone with the most radiation. In the meantime, however, close to a thousand predominantly older people had illegally returned to the prohibited zone.

There are areas comprising about 10,000 sq km in the Ukraine, in White Russia and in the Russian Soviet Republic which scientists in Kiev designate as "cesium areas". Radioactivity is still high, but people can live there if certain precautionary measures are taken. Today close to 300,000 people inhabit these areas in about 300 urban settlements. In theory these inhabitants would have accumulated an average dose of 17 rem in the past three years. Thanks to massive prophylactic measures on the part of government officials - milk and meat, for example, are brought in from "clean" areas - it has been possible to keep radiation down to a limit of 6 rem (in comparison: the accumulated dose of radiation in the Italian-speaking part of Switzerland amounts to maximum 1 rem). The milk produced in the areas containing cesium is used for making cheese and curd. In this process, the cesium remains in the whey. In addition to milk and meat, there are also instructions and recommendations on how to treat vegetables and other food. Before mushrooms are eaten, they should be thoroughly washed. This reduces the cesium content by 20 to 30 percent. Maps published in newspapers show the population where it is strictly prohibited to pick mushrooms. Apparatus are also being developed which will enable individual householders to filter cesium out of the food. And if too much cesium does accumulate in the human body, then there is a special medicine (probably containing iron) which was successfully tested at the Kiev Institute. It accelerates the elimination of cesium in the intestinal tract and in the body, thereby reducing the amount by 20 to 30 percent. The cesium problem is now being increased because, as of 1990, the Soviet government is going to set a lifelong cesium limit of 35 rem for the population. Accurately trying to reconstruct the amount of radioactivity, which varies greatly depending on the area, after the event is difficult enough. But carrying out this decision, just on the basis of present estimates of radioactivity, would mean the additional evacuation of tens of thousands of people. In the Ukraine alone this would amount to another 14 villages; in White Russia and in

the Russian Soviet Republic, even higher figures are being discussed.

Before starting our round of the clinic, we wanted to know exactly how many patients with radiation sickness had been treated. Before the Kiev Center was set up, 203 patients suffering from an acute radiation syndrome (of probably 100 to 1,600 rem) had been treated, mainly in Moscow, during the first few days and weeks after the disaster. 31 of these patients finally died as a result of radiation or burns sustained from the reactor meltdown. But almost half of these patients, with doses of 500 rem or more, had survived thanks to intensive hematological therapy. The bonemarrow transplantations performed on 19 patients with the most radiation had not prevented 18 of these victims from dying. In the past three years, a total of 237 patients (mostly men who were sent to the reactor site) had been examined and treated for acute radiation sickness at the Kiev Center. Only 120 of these patients actually suffered from radiation sickness; the diagnosis for the others was not confirmed, but for psychological reasons they were given further medical treatment. Of these 237 patients, 80 percent is now back on the job. Not one of the patients is at present in the clinic; they only come from time to time for outpatient treatment and check-ups. In the meantime, 15 healthy children had been born to these patients (despite an average radiation dose of 100 rem in the fathers). Moreover, no genetic damage had been noticed in the 4,000 babies born in those areas hit hardest by the disaster.

As we were standing once more in the large square in front of the clinic, we began to wonder whether we had just visited a Potemkin village or not. Chernobyl had caused one hundred to one thousand the amount of radioactivity of Hiroshima and Nagasaki combined, and was the damage really so harmless? How can the Kiev Center be so optimistic when faced with the fact that the 135,000 people evacuated from the 30 kilometer zone in the days following the disaster had been exposed to an average of 12 rem? And that the ground in the cesium zone inhabited by hundreds of thousands of people still contains an average of 15 curie per square kilometer? And what about the much praised iodine prophylactic measures? Is it still possible to be so enthusiastic when you know iodine pills must be taken within hours of a disaster? In the case of Chernobyl, however, the majority of the population only took them several days afterwards. In Hiroshima and Nagasaki most of the cases of leukemia did not occur until five to eight years after the atomic bomb had been dropped. And higher rates of thyroid, breast and lung cancer did not appear until several years later. An American study made in 1987 predicts about 10,000 additional cancer deaths in the Soviet Union as a result of Chernobyl. But a recent reevaluation of the Japanese situation shows that the risk factor of two fatal cases of cancer per 10,000 persons-rem used in the US study was a massive underestimation. For the entire population the risk factor can be seven times higher, and for such sensitive groups as girls under ten even twenty times higher. Add to this an equally high number of nonfatal





People are now eagerly discussing the future of Estonia in front of the Town Hall of Tallinn.

cases of cancer. Then there is the risk of mental disturbances in embryos exposed to radiation between the 8th and 15th week of pregnancy – that is estimated at fifty cases per 10,000 persons-rem. Even if this future iceberg remains unseen in the national sea of general cancer figures, its tip will surface sooner or later in those areas with the highest radiation – should these supposed high risk factors ever be confirmed.

Meanwhile, the Soviet Press is taking an entirely different stand on the matter than the Kiev Center. In the wake of glasnost, a veritable spate of extremely critical articles on Chernobyl has appeared. For the first time "Pravda" printed detailed maps of local radiation, thus indirectly admitting that the present situation had been minimized by government officials. Various regional and supraregional newspapers even print articles containing open accusations: the population in the affected areas had only been alerted way after the accident, and when the warning did come, it was insufficient. And while most of the local party committee members, officials and even public health specialists fled from the cities Chernobyl and Pripjat, children were allowed to play in the streets of contaminated areas and swim in the river for days afterwards. Soldiers sent to decontaminate the area had been exposed to doses of up to 50 rem per day because of insufficient dosimetry. The Soviet Ministry of Health, and especially the Kiev Center of Radiation Medicine, have been accused of suppressing information on Chernobyl for the past three years. The decision to keep the three undamaged reactor blocks of the Chernobyl Nuclear Power Plant in operation has also been severely criticized. To replace Chernobyl and Pripjat, a new city called Slavutish has been created out of nowhere, and every

day 3,500 workers are driven to the reactor area, which is still highly radioactive. Demands are being made to shut down not only the Chernobyl plant but also the other graphite reactors of the RBMK type. Meanwhile, the Soviet government has at least decided not to construct any more RBMK reactors as of 1991 and to operate the about twenty existing blocks with additional safety facilities. But "moderate plans" are being made to double and even triple the present nuclear power capacity of 35 gigawatt by the year 2000.

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The Estonian Academy of Sciences is responsible for most of the scientific research done in this Baltic part of the Soviet Republic. The scientists, however, are not just interested in their scientific work; they are also very much committed to the ecological and political issues in their country.

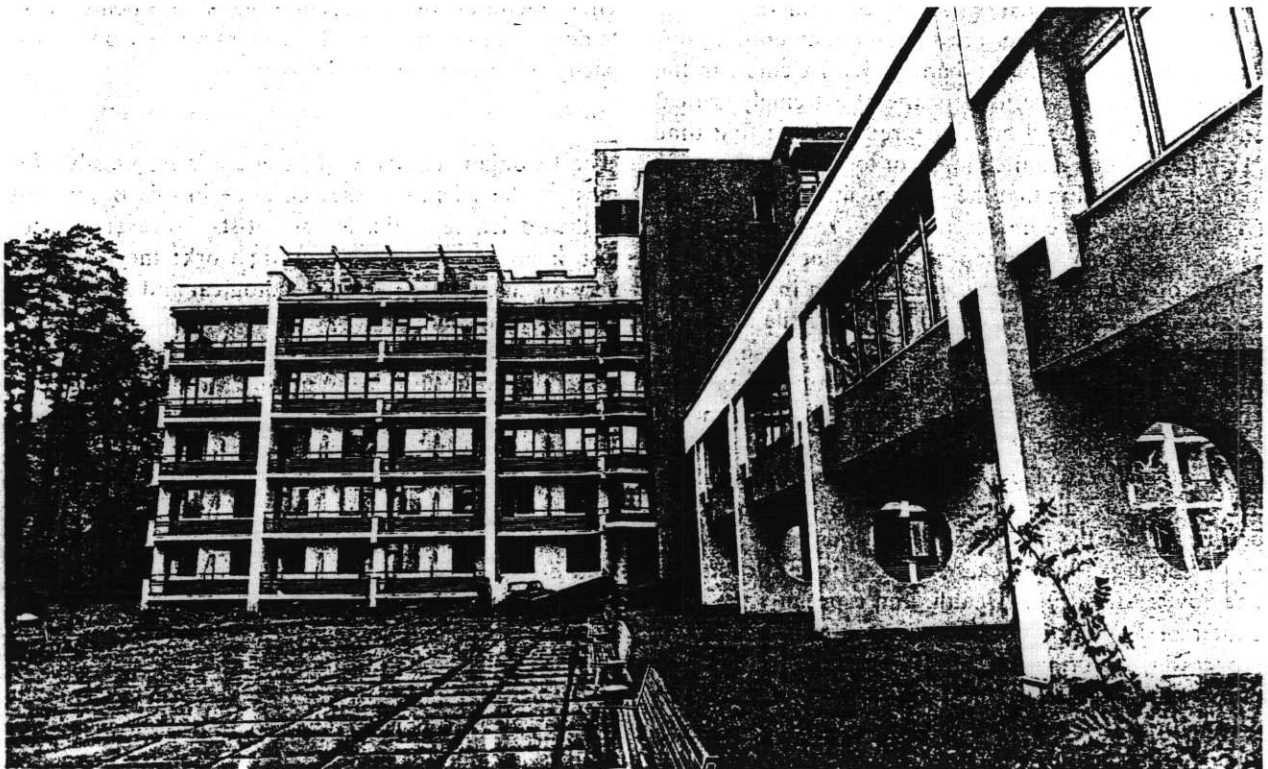
Even on your first visit to Estonia, you can feel that something important is happening. From the high tower of the city fortifications, the former blue-black-white Estonian flag flutters in the air instead of the hammer and sickle. The woman who is our tourist guide is not afraid of discussing the problems regarding the strong influx of Russians in the past few decades. In the Town Hall Square young people are collecting signatures to support the future self-determination of Estonia. And even the Academy of Sciences, which is responsible for research in the Republic, has recently removed "Socialist Soviet Republic" from its name. In Estonia, it seems, science is not retreating to an ivory tower. Anto Raukas, member of the executive committee, made his speech in the Academy's ornately decorated hall of mirrors. In it, however, he hardly mentioned science,

but he did talk about "the bad political and economic situation" and the wish of the Estonians to run their country's industry themselves. Despite all the criticism directed against Moscow's central domination, the Academy, with its 4,000 members in 13 institutes, seems to enjoy a certain degree of independence. It was by chance that we met Paul Walter in Tallinn. He is president of the Swiss Academy of Natural Sciences and he was there to sign a mutual agreement with the Estonian Academy to improve scientific collaboration between the two countries and to promote more the exchange of scientists. The main focus of common interests is on those fields for which Tallinn is particularly noted: physics, biology and biochemistry. According to Paul Walter, the exchange of scientific knowledge with the Soviet Union functions far better now than it did a few years ago. The problem concerning foreign currency, which is the cause of much trouble when scientists are exchanged with Switzerland, is being solved by having the host take over all the expenses for the scientist's stay when he arrives at the border. (A few days later the Swiss delegation signed a similar agreement with the Soviet Academy of Sciences in Moscow. This time the main focus is on future collaboration between Switzerland and the Soviet Union in the fields of ecology and climatological research.)

We also spoke with Endel Lippmaa, a scientist whose detailed account of science, politics and society was filled with sense of humor and sometimes cynical remarks. The 59-year-old scientist, with a lean, narrow face and rather strict features, is head of the Institute of Physical Chemistry and Biophysics. His special fields for a long time are radiospectroscopy and cryophysics, which made him well-equipped when high temperature

superconductors became a worldwide sensation a few years ago. Today Lippmaa belongs to the international elite in this field. But in his capacity as a deputy to the People's Congress in Moscow, he is also a politician. Probably his greatest concern is the struggle to solve ecological problems. His opponents are not to be found in Estonia, but in Moscow ministries where, according to Lippmaa, the "dialectics of a planned economy" prevail in spite of perestroika. Along with other colleagues of the Academy, Lippmaa has been using scientific arguments for years to combat the absurdities of bureaucracy. He is also one of the founders of the Estonian green movement which emerged in 1988. Through public work and by making use of all the legal means at their disposal, the people in this movement are trying to put a stop to dangerous developments. Although neither the Academy nor the Greens have any direct political power, Lippmaa is convinced that the ministries are being put more and more under pressure thanks to glasnost and the new open information policy.

Estonia has two great natural resources: oil shale and phosphate. These resources are very valuable, but years of irresponsible exploitation have caused a great deal of damage. In the '20s, for example, oil shale was burned underground to produce gas. The amount resulting with this method was not much, and the gas had a high sulfur content; it also caused widespread pollution of the air and the groundwater. It took decades for the fathers of today's Estonian Greens to win their first ecological battle in the '50s when this method of using oil shale was finally stopped. Oil, however, is still extracted from oil shale by means of an old-fashioned and uneconomical method. The factory which uses this



*The Center of Radiation Medicine in Kiev has the responsibility to assess the medical consequences of the Chernobyl disaster and to care for the population in the radioactive highly contaminated areas.*



process is in Kohtla-Järve, 100 kilometers east of Tallinn. It is suspected of emitting large amounts of poisonous and carcinogenic matter. Sweden and the USA abandoned this synfuel technique long ago because of great financial losses. In Moscow, however, planners tenaciously cling to this branch of their economy. "No one has the power to stop this nonsense," Lippmaa said with sarcasm in his voice, "because no one can tell you why 150 million roubles were wasted on this project and who's responsible for it."

Lippmaa advocates the use of oil shale in petrochemistry and for burning in thermal power plants. This way high-grade adhesives can be manufactured from Estonian oil shale and 19 million tons of it can be burned every year to produce electricity. But: the two chimneys of the power plants neither have facilities to remove sulfur nor filters to trap flue ash. And so 120,000 tons of sulfur dioxide plus large amounts of nitric oxide and ash escape into the air year after year. Dying forests are therefore also a problem in Estonia. Lippmaa went on to tell us that it was only all those years of protest from ecologically committed Estonians which made Moscow come to the decision that new thermal power plants could only be operated with sulfur-removing facilities. The Soviet government has also decided to revise an official plan to double the present capacity of power plants in Estonia and to drop plans for expanding oil shale production. This makes sense in the long run because one square meter of ground exploited for oil shale only makes a onetime profit of eight roubles, and afterwards the ground is useless for agriculture forever. Lippmaa, however, is sceptical concerning the decisions of the Soviet government because "the Ministry of Mining never has given a damn about what happens to the land they are exploiting."

Another gloomy story is the exploration of phosphate. In the '20s the deposits were still mined underground, but later strip mining was introduced. In view of geological facts, this had to lead to an ecological disaster because of the layer of black alum shale which is on top of the Estonian phosphate layers. Rich in organic substances, the shale begins to burn by itself as soon as it is exposed to the air, whereby large amounts of heavy metals and radioactive substances in the sulfides of the shale escape into the atmosphere. Just 20 kilometers away from Tallinn several square kilometers of land are burning. Moreover, through the mining of phosphate, large amounts of phosphorus are washed into the water which ultimately flows into the Baltic Sea, thereby contributing considerably to the already dangerous overfertilization of this sea. Lippmaa calls this kind of phosphate mining "barbarian". In this case the blame is put on the Moscow Ministry of Fertilizer because the phosphate is used to fertilize Soviet farming land. This makes even less sense when you consider that only a small percentage of this kind of phosphate fertilizer can be used by plants. But this is the problem of the plants and not of the Ministry, which is only carrying out its plan, Lippmaa adds in a mocking tone. By

joining their forces, representatives of the Estonian government, the green movement and the Estonian Academy defended themselves in Moscow, and in 1988 managed to get a court decision against the mining of phosphate. This does not, however, prevent the Ministry of Fertilizer from continuing to adhere to phosphate mining in Estonia.

To complete the ecological picture of horror, here is a brief story concerning Sillamäe. In this industrial area situated on the Estonian coast line to the Baltic sea, children began losing their hair at the beginning of the year. Finally 200 children were affected, and that's when their parents raised the alarm. The scientists of the Academy once more committed themselves to this cause and drove to Sillamäe with measuring instruments. What they found there made the Estonian press launch the kind of campaign which would have been unthinkable a few years ago. In the surrounding area of a factory in Sillamäe, they measured the ground for radioactivity and found about the same amount of contamination as there is now in Chernobyl (1 milliroentgen per hour). When asked what kind of factory it is, Lippmaa only gave a vague answer - it's obvious that he does not want to strain his freedom of speech. And so we only found out that the factory "processes raw materials from the peninsula Kola". For all other information, Lippmaa pointed out the detailed radiation map of the factory site and the housing development Sillamäe which was printed in this summer in the Estonian newspaper "Noorte Hääl". Later on we wanted to know from Swiss nuclear experts what they thought about this incident, and they provided the following scenario: thorium and radium were detected in a dump near the factory site, as well as in the Baltic Sea and in the village. This points to a factory which processes uranium ore. The radioactivity of the ground directly by the factory was indeed about 2,000 times higher than in the regular subsoil; in the village where the children live, radium activity (with values of up to 2,000 Becquerel per kilogram soil) was only about seven times higher than what is usually measured in the Swiss Alps. The additional dose for the inhabitants of Sillamäe is therefore probably below one rem per year, and this is way below the doses which cause the loss of hair. Yet the factory in Sillamäe could still be guilty because for the smelting of uranium ore large quantities of highly poisonous chemicals are usually employed.

The press campaign in Estonia seems to be having some measure of success, for as of January next year part of the production will be shut down. This is probably also because the people running the factory only found out about their dirty working methods through the ecologists, and this must have given them quite a shock. When we finally asked Lippmaa what the immediate future of his scientific and political work held in store, he warned us about having too many illusions: "The way to more independence for Estonian science and industry and society in general would have to be through economic self-determination. And in this respect Moscow has made it quite clear recently that such liberties for Estonia may not be at the expense of the rest of the Soviet Union."