

"I believe that Russia should create closed nuclear areas."

Vladimir Orlov visited Obninsk and met Victor Murogov, director of the Institute of Physics and Power Engineering (IPPE). They discussed a wide range of problems:

perspectives of the IPPE; feasibilities of use and reprocessing of plutonium; Western aid in reducing the nuclear danger in Russia; the IAEA's role in international nuclear cooperation; and counteracting nuclear theft. They also discussed

Russian power engineering. There is a full transcription of the recorded interview. Today we are publishing the first discussion.

Q. How does IPPE differ from other Russian nuclear research centers?

A. In one year IPPE will turn fifty. Unlike the Kurchatov Institute, ours was founded as a center for fundamental research. The Institute carries out research in the areas of nuclear physics, nuclear reactor physics, thermal physics and hydraulics, structural material corrosion, material studies, liquid metal coolant technology, chemistry and radio-chemistry. The Institute is the leader in the development of fast-neutron reactors, lead-bismuth cooled reactors for marine nuclear power installations (we have designed nine such reactors), and high-temperature small-size alkali metal reactors with direct energy conversion for space applications. (All 34 space power units, two "Topaz" units and 32 military units were designed at our institute.) I would especially like to emphasize our achievements in the design of fast-neutron reactors. We have been designing fast reactors since 1949. As you know, these reactors make it possible to fulfil nuclear fuel breeding. They are also most efficient at maintaining the plutonium balance necessary for nuclear power systems. They can burn out actinides, process nuclear fuel (uranium-233), and produce various isotopes. Theoretical foundations and calculation techniques have been developed at the Institute. In addition, basic physical and engineering experiments have been carried out, and the foundations of reactor technology have been developed here. The BR-1 reactor of zero power commissioned in 1955 made it possible to experimentally restrict the possibility of plutonium breeding. Since then, through BOR-60, BN-350, BN-600 we approached the BN-800 project that is of primary importance to us. Now BN-800 is at the South Urals site. The IPPE has shown the exceptional importance of fast reactors in the solution of such long-term problems as weapon-grade plutonium utilization, long-life alpha-active nuclear waste burning, and production of uranium-233 -- a very promising nuclear fuel for thermal reactors. I should say that the collapse of the planned economy has negatively affected our research in the area of

fast reactors. Soviet nuclear power engineering developed in a planned economy, and that is its main advantage over Western nuclear power engineering. Thanks to the planned economy, our reactors and other developments have been beyond comparison in the world nuclear market.

As a matter of fact, the IPPE is a closed cycle, an original subsistence economy, where everything is at hand: from nuclear data to pre-production specimen. Our possessions consist of three experimental workshops: 500 machines, and operating personnel. We have our own power plant. Often our possessions bring us much trouble, and still it is very important that we do not depend on our partners.

Q. Don't you think that your technological achievements are ahead of Russia's ability to use them?

A. This is partly true. This problem appeared three-five years ago. We have not been able to use our technologies, because the state does not have sufficient funds, and these technologies are gone very fast. Everything is happening like in fantasy novels: savages sit in front of a computer and cannot understand what is written on the display. Technology is very easy to lose. And it is not only Russia's problem. To resolve it Americans have begun to reserve information. The "Commerce for Today" approach, e.g. to give up what is now unprofitable, has been evidently demonstrated by the Americans. Thus, in the beginning of the seventies in a desert near Los Alamos laboratory, an experimental basis for fast reactors was created. We can only dream of such a basis. But then they stopped and Hollywood has been shooting movies there. The same concerns space research: twenty years ago they began a part of their space program, then they put it on hold and only recently returned to it, partly purchasing our technologies for that purpose. In this context it is clear that the United States succeeded in the reservation of information, and we are far behind them. But we should catch up with them. Experience has made us review our idealistic views about the commercial return from conversion. After we began to do the calculations, it turned out that it is very unprofitable. However, we have gradually begun to figure out what can be profitable and what should be closed down.

Yes, we should close it down despite the fact that it is interesting and is the first in the world. At the exhibition pavilion "Sredmash Conversion," the Americans called some exhibitions "unique." They were unique for two reasons: first, they were terribly expensive, second, nobody needs them.

Of course, Sredmash can do anything, it can also begin conversion at any cost. But the thing is that we do not need conversion at any cost. However, we have about fifty science doctors and four hundred Ph.D's. Their knowledge and

studies can be used with more benefit. Still there is an extensive approach: it has become almost a tradition that the Russian section at international exhibitions is distinguished by a large number of directors giving demonstrations. The French, on the other hand, install a video system that provides all demonstrations and explanations. The Russians say that it is less expensive to invite a director than to install a videosystem. Upon the whole, we have not learned to calculate and to work with banks.

Q. However, I think you have begun to calculate, since you are experiencing staff reductions at the Institute - isn't that true?

A. From the statistical point of view, major reductions took place when we gave up our sovkhos. Seven hundred people worked there.

Q. You mean your subsistence economy has been gradually disintegrating, has it not?

A. Yes, it has. There used to be 300 hectares of land. Now it is a joint-stock company with annual debts of 300 billion rubles. It is evident that we cannot manage it. But we would like to recover this land in the future. We had to give up real estate in Obninsk: we owned 60 percent of residential structures in Obninsk, which we have handed over to the city. It means that 700 people from the staff are no longer on the list.

Q. Do you mean to say that the scientific staff of IPPE has not been reduced?

A. Of course it has. We sense that we are beginning to lose specialists. They simply cannot work because of their age. The average specialist's age at IPPE is 60-61 years old, and some of our people work only because they are our front-rank specialists and cannot stay away from work despite the fact that they have not been paid for two months. They walk at least three kilometers to the Institute, work a shift in dangerous conditions, and then go home. I am aware of the fact that nobody will replace them for such a salary. It may happen so that in five years the state will find funds and promise wonders to specialists, but there will be no specialists left.

Q. You said that your staff has not been paid for two months. Does that happen often?

A. Yes, quite often. Sometimes we manage to get paid. But it takes much time, and people find themselves on the edge. However, it is not only our problem, but that of the whole nuclear complex. Our problem is that we do not produce tanks. (Hence, we do not sell them.) We conduct

research, we generate ideas. Thank God, these ideas are very often of dual-use: we have to seek applications for our ideas in different spheres to survive as a scientific center. We have established contacts with universities and companies from the United States, China, Japan, India, South Korea.

Q. What do they purchase?

A. China has been interested in radio-isotope specimens and technologies of out-dated reactors (approximately thirty years old). Japan has been purchasing our reactor technology and experience with BN-600. We consider the sale of isotopes to be very promising, too.

Q. Do you have to close down production centers and installations?

A. Now we don't. Minatom (the Ministry for Atomic Energy) asks us a traditional question: "What else have you closed down?" We answer: "Nothing. Instead we have commissioned a new unit - nuclear pumped laser."

This is a unique, really unique unit, unlike anything in the world... A number of countries in Western Europe, first of all France, have supported this contention. This conception is very close to ours, too.

Russia stores civilian plutonium, approximately 30 metric tons after reprocessing VVER fuel. Add to it one hundred tons of weapon-grade plutonium. As a result, we have 130-150 tons of plutonium, and all of this material has been stored at Mayak. A reprocessing facility has been almost completed at Mayak, and there is an experimental unit, too. A complete cycle from warhead dismantling to power production is expected to be built and cross-fed at Mayak. And all this will be located at one site - a military site with a military regime. As a matter of fact, a "state inside a state" has been created. Its borders are protected by armed guards, there is a frontier control and a border area that ensures the security of the facility.

Q. There is nothing like that in France, isn't there?

A. Indeed, plutonium has been circulating throughout the whole of France, all twenty power plants receive fresh plutonium. It is only half the problem in case of civilian plutonium, but in case of weapon-grade plutonium there will be no technical difficulties in creating a bomb: one simply needs finances and large quantities of nitric acid.

Q. Don't the Americans proceed from the same, justified assumption: if the material is dangerous, then it would be better to give it up?

A. No, there is another explanation. Unlike Russian reactors, all of which are state-owned, American reactors are all in private ownership. And the state is afraid to hand over plutonium to private companies. The United States has been shipping its plutonium to Canada, where there is a state-owned company. Thus, it turns out that the United States is sitting on a barrel of riches and a powder keg at the same time. In France plutonium has been given partly to private companies, and partly kept under the control of a state-owned company. The Russian method is optimal: we use plutonium intensely, but we use it in the way the Americans suggested - under full state control. In this area Russia has a very good perspective, which has been enhanced by the construction of the RT-2 facility in Krasnoyarsk. However, Russia is not hurrying to use its plutonium while it has much uranium. It is important not to get involved in a vicious circle, the way the French have: by using plutonium in VVERs they have accumulated more waste than used plutonium. They proceeded from a political decision - to get rid of harmful plutonium at any cost. So they have got rid of Pu-239, but at the same time they have accumulated Pu-241, which is forty times more dangerous. Of course, that gives them the chance to tell the public: "We have burned the plutonium." But that really isn't true: it has been accumulated. The United States produces 20 tons of plutonium in used fuel annually, and they pretend that it does not exist. Like ostriches they hide their heads in the sand. Meanwhile, some American specialists have been terrified: they have the most powerful nuclear industry (107 reactors, 20 tons of plutonium annually) and absolutely no fuel industry to reprocess it. How does one solve this problem? They have no plans or programs on this subject. Then there is only one way out, and that is to bury it.

To get out of this dead-lock, we have to work together. That's why Russia and the United States have been working on a contract, the joint "plutonium conception," that should be ready in 1996. To our benefit, we will help the United States answer the question of what to do with its plutonium.

Q. And in their turn, the French have been helping Russia, haven't they?

A. Yes, they have. In five years, if not earlier, all our work will begin to decay. The experimental plant I have mentioned to you before has not been producing heat-extracting units for two years, though it should produce ten per year. And now the French will help us produce forty units per year, only in this case we

will obtain industrial technology. We have concluded an agreement with Western Europe to create a fast reactor-plutonium utilizer on the basis of Beloyarsk nuclear power plant (NPP) (BN-600). This agreement has been concluded at the governmental level, but has not been implemented since there are no funds. Under this agreement each party to the contract will contribute its share. What we have now is heaps of forms and records and small sums of money that we have managed to get from ministries.

In this sense Russia has not been utilizing its potential. It could become an experimental basis for plutonium utilization in the world. The IAEA considers the Russian conception to be very successful, almost the best. Captive facilities based on the Mayak facility have been constructed by the largest power companies in the United States, Russia, and France. At such facilities plutonium is burnt to generate power, and an analog of low-enriched uranium is produced, which is then sent to third-world countries. There it is used only as uranium fuel. The conception has taken into account such problems as reduction of radio-toxicity, proliferation risk, and, at last, getting rid of plutonium fuel at civilian reactors. The conception provides for a harmonious system of international relations. On the one hand, there is an industrial world. On the other, for example, there is Africa, which needs to increase its per-capita power availability by a factor of four. But at what cost? At the cost of coal and woods? Then it will cause an environmental catastrophe. The same with China. The Chinese have to build 300 VVER-1000 units in twenty years in order to reach Russia's current level.

Q. Do you suggest that Russia create "closed nuclear areas"?

A. Yes, "closed nuclear areas." Though this idea is not new.

Q. Will there be three "closed nuclear areas": Mayak, Tomsk-7 and Krasnoyarsk-26?

A. Yes, I can name three theoretical possibilities. In reality I would name only Mayak. There is a plant for reprocessing RT-1 fuel. It reprocesses 400 tons of fuel per year and produces up to 2.5 tons of plutonium. There is also a waste-glazing plant, which means the cycle is closed like it should be at a regular industrial center-facility. They began constructing a plant (workshop-300) that will produce nine hundred heat-extracting units per year from this plutonium at Mayak. Three BN-800 units will also be constructed for burning plutonium and its recovery for reprocessing. In this way a closed nuclear area will appear.

Q. The question is, when it will appear?

A. There was a fixed date: a BN-800 and workshop-300 were to be commissioned in 1994. One should not wonder why, given that the present economic conditions, the schedule was not kept. Now three

BN-800 units must be commissioned, workshop-300 must be brought into use, and the cycle must be closed by the year 2010. All this will cost \$2.5 billion.

Q. And will all this take place with only insignificant financial participation from the American side?

A. Only the storage-facilities will be American. You should understand that the \$250 million allotted by the Americans to Mayak is a small sum. If you investigate the problem, you will see that we have been losing at least that much money supplying Ukraine with fuel to compensate for its transfer of warheads. Minister Mikhailov is constantly criticizing it, and he has a point: the American aide very often doesn't help us. It would be better if we used Mayak as a testing ground for developing new technologies, including technologies from third countries, as well as for the utilization of plutonium from third countries.

Q. You are expressing a "rebellious" idea. And what about Russian legislators who have been so actively speaking out against bringing nuclear waste to Russia?

A. I think that sensible legislators can't help realizing that a ton of foreign used fuel is a ton of gold for Russia. Apart from the pure financial advantages (they are unquestionable), we are ensuring Russia's energy independence in the next decades. I would like to draw your attention to the fact that nuclear power engineering is an indicator of a state's quest for real independence, of its ability to develop autonomously. Why does Lithuania hold on to Ignalinsk NPP (87 percent of all Lithuanian power engineering)? Why did Armenia begin restoring its NPP despite the great problems and dangers connected with it?

It seems to me that Russia's regions have realized that bringing in radioactive waste from abroad means jobs and money. But some people, primarily at the federal level, continue to speculate how "somebody has been attempting to ruin Russia by turning it into a nuclear dump." And all this despite the fact that the issue is the future of power engineering. For example, Japan brings two tons of plutonium from France across the world, and pays great money for that. Why? In order to turn the country "into a nuclear dump"? That is laughable! All these speculative statements may result in a situation where other countries will refuse to send their nuclear waste to Russia when the State Duma finally permits their import. There will be other markets. Finland has already been tired of being talked about each time it ships its nuclear waste to Russia: again you have brought your rubbish to us. Though along with the rubbish it has brought us money and provided us with work. We were monopolists in the area of nuclear fuel reprocessing. We could remain monopolists in the future as well, attaching Eastern Europe, Ukraine and other countries to Russian industry.

Q. Upon the whole, the leaders of the Russian nuclear power industry have not been getting along very well with legislators.

A. A year ago the following statements could have been heard in the Duma: "The Sredmash monster should be destroyed and broken into two parts. Let one ministry deal with nuclear wastes and another with reactors." - "How could it be done since an RBMK is an integral plant, and it has its own waste as well. Does such division mean two directors?" - "Yes, it does. Two directors." Do you realize what it will be like having two directors at one facility, and how it will affect the discipline there? Thank God, they gave up this attempt first to draw up a scheme and then to adjust everything to it.

There is another danger as well: our legislators are fond of drawing analogies to the experience of other countries from amongst twenty seven world nuclear power suppliers. At one moment they suggest to adopt Swedish methods, at another moment - American ones. At the same time, their main drawback is amateurism. And this has no place in science and nuclear power engineering.

Q. It follows from your words that plutonium is the key problem for the future of power engineering.

A. That's it. If they say (as they do in the United States) that plutonium is waste, then there is a logical conclusion that power engineering is a deadlock and that in a hundred years there will be nothing left but nuclear waste. That's why some State Duma deputies say: "The problem of plutonium and nuclear waste is the most important one and to radically solve it... let's close down nuclear power engineering."

During one of my speeches in the United States, somebody reproached me: "You have been promoting Mayak and the feasibility of its development, though there are publications saying that there is much radioactive pollution there." - "Read your "U.S.A. Today," I said, "read what it publishes about Hemford, that it has been choking with pollution. Where has our pollution at Mayak come from? From competition with the United States. The same with your Hemford. This is our mutual Cold War, and now we should together look for a way-out instead of reproaching each other."

What to do with this poisonous plutonium?

Let's proceed from the rule of contraries. There is a scenario for guarded storage for many thousand and million years. But you will never be able to experimentally substantiate "storage for a

million years." That's why we suggest glazing and storing it for a hundred years. A hundred years is a concrete engineer's way out.

But the problem is that any construction, any storage facility is

usually designed for 50-60 years. The coating falls to pieces, plutonium remains. Now Americans speak about charges put into storage ten years ago. They do not know the reason why the plutonium has reacted and appeared. For some reason polyethylene does not keep it. Found great funds were invested into them to increase their safety. Twenty years ago a fast reactor was 2.5 times more expensive than a VVER. Now they cost the same. Why? Safety requirements to a VVER have increased after what happened in Chernobyl, and a VVER became very complicated... On the contrary, a BN is becoming less and less complicated in the course of time, though nobody in the world believes it... Coming back to your question about Tomsk-7: in any case a miser pays twice. Americans have been showing us photos of their dangerous charges that have to be remotely assembled and reprocessed... almost like in Chernobyl. Americans had four incidents with bombs while we had none.

Q. Maybe our information is traditionally more secret?

A. No, it isn't. Americans know everything about us. And they admit that neither the USSR, nor Russia has had any accidents. After the nuclear accident over the Spanish territory, the Americans equipped their bombs with parachutes so that the bombs would not break up. Our bombs had parachutes from the very beginning, though it cost us large sums. Nevertheless, Americans had to pay more for that incident: they spent a billion dollars on clearing the soil. According to their estimates, what had happened there was one third as dangerous as Chernobyl.

Q. Meanwhile, the Chief Office in the Defense Ministry holds the opinion that the Americans have left Russia far behind in questions of warhead safety.

A. This is a financial problem. The better Evgeny Petrovich Maslin convinces people that the safety system of Russian nuclear warheads is imperfect, the more his office will receive in budget financing. This is a well known formulation of the matter: the more shortcomings there are, the more funds there will be. I do not know details of weapon safety and I am not going to discuss them, but let's look at the facts. Did the United States have accidents with their warheads? Yes, they did. Did Russia have any? No, it did not. The design of American war-charges was based on machine-made, automated assembling. We did not stipulate for such assembling from the very beginning. Now the Americans offer us their technology for machine-made disassembling of our warheads. This is, of course, impossible: our assembling methods, as well as disassembly methods are absolutely different. That might be one of the reasons why there is an impression that the Americans have solved the problem, while we have not.

We already have concluded an agreement on IPPE aide regarding the control and protection of fissile

materials, in particular, plutonium. The Americans have provided us with a wonderful system - a videocamera with software and a line-operated station that records changes in the position of materials in storage. At the end of the day you have a full trajectory of the material movement (this gram of material has moved from this point to that one). This is the latest technology, and they have already brought it to us, which is a great achievement in Russian-American cooperation. It is also very important that the Americans are establishing a portal that makes it impossible to steal even a microscopic amount of fissile material.

The IPPE has set up a center to train Minatom specialists in ensuring the non-proliferation of fissile materials. It is based on the nuclear security departments of companies in this industry. In this respect foreign institutes and centers have helped us a lot: they have provided us with software, data banks, computer facilities, they have taught our specialists how to handle machinery. There is unique technology in the West. There are also very simple and common machines, like a portal, which is, as a matter of fact, like an airfield gate that should be at any entrance check-point. But we don't have them (and without the Western aide I don't know when we would have received them), we do everything slowly and rely on the intuition of those who check.

Q. Does the IPPE offer the United States something in return under this cooperation?

A. On the one hand, the Americans know and respect the IPPE. In this connection, the director of the Los Alamos national laboratory made a speech at the U.S. Defense Department. Go to Obninsk, he said, and you will see that there are units that you have been dreaming about and that used to work here, but which you have closed down. Top-class specialists work in Obninsk, and it is a center on par with Western standards.

On the other hand, there is a long and hard road from words to deeds.

Example number one. We negotiated with the United States through the Russian Defense Ministry. As a result, we prepared very successful contracts for billions of dollars, under which the United States will purchase Russian dual-use technologies. We stipulated that those technologies should not exceed the limits of peaceful application. After we were through with the negotiations, we saw that at the end of the contract the Americans had added a paragraph regarding the legal basis for our agreement. According to this paragraph all agreements fall under the jurisdiction of New York State, and all disputes will be considered according to the laws of California State. We said, "You must be joking." "Can you offer any Russian laws as a legal basis for this agreement?" We answered, "What about the International Swedish court? We wrote

in our agreements with the Brookwin laboratory that all our disputes will be considered by this court, that this is a civilized way." - "We do not know this court." And that is what one of the best U.S. Defense Department lawyers said! This is some kind of narrowmindedness, as if there are no laws outside New-York or California or Washington.

The second example. The contract was signed, and all of a sudden the Americans announced: "To make it a reality we have to have various departments OK it." That means that bureaucracy in America is much worse than in Russia. The coordination system puts the contract on hold for another two years before becoming a "reality," though it took us only two weeks to work it out. Thus, American aide to our nuclear power engineering gets stuck.

Example number three. We received Americans at the IPPE, we shared detailed information with them, including confidential data. I mean confidential, not secret information. And out of the blue it turned out that the Americans spread our information at a conference. I met with them and asked: "Why did you do that without our permission? There is a conventional concept of confidentiality. Don't you understand that we will deny you access to our information the next time this happens." - "But did we tell anything special?" - "But there were Koreans from the South. Do you know that?" - "Yes, we do." - "And do you know how many State Duma deputies think that Russia has already given away a lot of secrets in exchange for Western aide?" - "Yes, we do." We talked a little more, and then the Americans admitted: "Yes, it was our mistake."

Americans think of Russia to be a lawless country with reactors in a wild desert, and which needs to be brought to order. Nevertheless, in attempting to bring it to order, they do not realize that Russians have to resolve global problems. One of them is plutonium: if something happens here, then it will be a problem not only for Obninsk or the Kaluga Region, but it will harm millions of people outside Russia, too. It will be the end of the world nuclear power industry. Another problem is that another Saddam Hussein should not appear in Russia, who will use plutonium as an argument and teach the West how to live. The Americans would do better to invest in nuclear safety and protection of the IPPE now, than spend terrific sums to get rid of a Russian Saddam Hussein later.

Q. I am afraid, I do not agree with you that Americans do not realize this. I think that they know it very well, that's why they are allotting funds for the "Nunn- Lugar" effort.

A. Until now this has only been a small amount. But even these small funds go to American companies. To prove that Americans are not the only ones who use this approach, let's have a look at our cooperation with France, which is regulated by an agreement signed

by Francois Mitterrand and Andrei Kozyrev. Funds have been allotted. Let's analyze the way they are spent. Only ten centimes out of each franc went to the IPPE, and ninety centimes stayed in French research centers. Why? "A French specialist's salary is a hundred times higher than that of a Russian specialist. That's why our specialists, patronising ten Russian specialists, receive ten times more than they do all taken together." Can we call this aide to Russia?

However, the situation has taken a turn for the better. In the West they have been gradually beginning to realize that we value our experiments just as much as they do. There should be a one-to-one division of funds in this part of the program. As far as the salary is concerned, let 15 percent of the project's cost be divided one to ten, but the remaining 85 percent should be divided one-to-one. We should step by step make the West realize that at Sredmash a ruble is equal to a dollar.

Q. There is not only bilateral, but also multilateral cooperation in the nuclear power industry. In this connection your evaluation of the IAEA role and possibilities is of special interest. Some experts believe that only it can ensure the fulfillment of Article IY of the NPT. Other specialists are very skeptical, citing the bureaucracy.

A. I think it makes sense to explain why the evaluations are so different. If I were in America's shoes, I would be dissatisfied and skeptical about the IAEA. Indeed, the IAEA has been getting in the way of the United States: it insists on establishing equal relations with Russia, introducing international control, not control by a world gendarme. If I were in the shoes of a third-world country I would consider the IAEA to be an ideal organization.

With the IAEA's help we have finally organized an international conference called, "The Future of Nuclear Power: The Reactor and Fuel Cycle of the 21st Century." There should be no politics at this conference. We have to exchange information and understand whether and to what extent our criteria for technologies of the future coincide. Upon the whole, the possibility of a wide international informational exchange makes the IAEA an indispensable organization.

At last, it is important that Mr. Blix [general director of the IAEA - Ed.] saw for himself what the IPPE has been working on. Afterwards, he won't believe rumors that have been circulating around us. He saw that an experimental basis for the substantiation of nuclear safety aspects has been created at the IPPE. He saw a plutonium unit that nobody else in the world possesses. I should be honest and say that bureaucracy at the IAEA worries me. If a deputy IAEA general director wants to call me, he has to ask for permission and write a request.

Q. Don't you do the same at your institute?

A. No, I don't. I just pick up a receiver and call him up in Vienna. At the IAEA you can't even enter a room without your superior's permission if you have not been summoned there. Subordination there is much tougher than one can imagine.

Q. As you said, the IPPE still lacks portals. Here is my question: what is the probability of nuclear deviations while American and other western aid is "on its way"?

A. I do not think it is very high. We have reliable data transmitters and counters. For example, we learnt about the Chernobyl accident the day after it happened, when one of our employees passed through the IPPE's entrance check-point, and all of a sudden our equipment began to buzz. It turned out that on that morning in a commuter train he sat near a woman who left the Chernobyl area the day before and polluted his clothes. We immediately measured a pollution spectrum and realized that it was fragments, not pure material. And nobody had been working with fragments for the previous month. That meant that they were brought from somewhere. Despite the fact that there were no reports, by noon of that day we already knew that there was a nuclear accident somewhere.

Q. And what about protection? Of course, I saw the submachine gunners at the entrance, but the institute is very large.

A. In the atomic industry there used to be disciplinary regulations: a director of a nuclear enterprise could at any moment express his distrust for an employee that was not honest, and that employee would be immediately sacked. Now some young people led by a middle-aged man climbed over our fence, then they are detained and sent to police, which set them free and qualified their action as petty hooliganism. This is the way our police treat people who penetrate the territory of a nuclear facility for a certain purpose. Thus, we do not rely on the police. What is the solution? We have dogs who do not know the laws, who bite hooligans, which at least prevents them from climbing our fence.

A man is detained at the check-point, he has attempted to carry away... not plutonium, thank God, but something else. His case is transferred to the criminal court, but in the court they say that it was not theft, it was attempted theft: "You have prevented him from stealing, you have detained him." The thief gets off easy, just slightly scared. In a similar case our colleagues in Podolsk acted more reasonably: they let a thief carry away nuclear materials through a check-point and arrested him at home... Our security protection has been so far supported by detection and denunciation, not by technical means. And what is interesting is that it works: our people peep in each other's pockets and

immediately know when their neighbor has something.

Sergei Stepashin visited our institute, and we demonstrated our security system and nuclear material protection. He carefully studied it and then reported to the State Duma that our system is good and reliable and nothing can be stolen from our place. As a result of his report, the Duma decided that we do not need funds to enhance security since everything is so good. Following this logic, it would have been better if Stepashin had said that there was complete disorganization at the institute.

Indeed, according to accepted norms, everything is very good and reliable at our institute. However, we understand that these norms were worked out ten years ago. We know the drawbacks and know what to do to improve this system so that it can work at its potential. For example, we know how many more people we need for safeguarding. We agree on this. They agree, too. And then they add: "Give us seven billion rubles for housing and we will provide you with security protection. We have to recall guards from Kamchatka, they will retire, and you will build houses for them." And such problems we have all the time. Of course, we cannot resolve the security problem in this way.

Three years ago a decision was taken that enterprises would pay for their security themselves. And guess what all those enterprises did?

Q. Did they get rid of safeguarding?

A. Of course! Thank God that we have not done that so far. But a number of our guards were substituted by babushkas and dedushkas [old men and women - Tran.], and now we cannot get rid of them.

Q. Even at your nuclear facilities?

A. Of course, not there. Nevertheless, we possess large material assets that are not connected with nuclear materials. They also should be guarded. Besides, there are dual-use materials at our territory, and there is no clear-cut border-line.

Q. What have been encroached on?

A. I would say that there were attempts to steal many things. It is no longer a secret that we have our own interior office, our own police and very professional detectives. They report to me about all incidents, and they have efficiently conducted a number of operations and revealed whole groups of people who climbed over our fence, checked safeguarding systems and the speed of our reaction. They have been sounding...

Q. Why?

A. To know how much time they will have.

Q. What for?

A. To steal something, for we have everything: gold, platinum, nickel. For example, we purchase nickel for research purposes. An experiment is over, time passes and it is considered that the government has financed this experiment, and the materials provided for it have allegedly been used and they should be written off. And a result, a sheet of nickel 12 millimeters thick and two to four meters wide lies somewhere in a corner. It exists, though it has been written off. There are smart people who know that nickel is a valuable material, and they have attempted walk away with it

Q. And what about fissile materials?

A. If there were a real market of fissile materials and there were no proper control, then, I think, there would be people who would invent how to steal them. I doubt that there is a market of fissile materials. And I know for sure that there is efficient control. Once I received a telegram from a nuclear congress in London: "Reportedly, three hundred grams of smuggled plutonium of Obninsk origin have been detected. Here is its composition..." We checked up and immediately sent a reply telegram: "We have never had plutonium of that composition. And everything that we have is available. We are sorry to say, but it is a forgery." The next day we received a telegram from London: "We are sorry, it was a forgery indeed." It was our luck that we had promptly reacted. Otherwise there would have been a scandal: "There has been another theft of plutonium in Russia."

At the same time, at some enterprises pieces of plutonium have been missing. In this connection, I think, it would be appropriate to introduce Nuclear Regulations in the atomic industry. For example, at the end of the forties - the beginning of the fifties, 17 grams of lost plutonium meant execution. A man should be aware of this responsibility: plutonium is not stainless steel.

Q. What do you think of statements by specialists who call for an end to nuclear power research?

A. I agree that Chernobyl with its two billion curie was something terrible. But what is more terrible is that there will be no centers (and, consequently, there will be no specialists) to control the situation in case all these billions of curie are left in abeyance and a nuclear facility is stopped and abandoned. At the very least our nuclear facilities have been working.

The environmental protection service in Kaluga has bought a detector that registers radon. And it turned out that there is a very high concentration of radon in apartments and premises on the

ground floor of granite buildings built in the 17-18th centuries. If a man remains there for a long time, he will receive a radiation exposure that exceeds all permissible doses. If a man receives such a dose at a nuclear production, there will be an accident... But people live in buildings and blame nuclear power engineering, and receive radiation doses that are not connected with nuclear power engineering.

One should realize that but for radiation there would not have been bisexual creatures and life on the Earth. This is not my idea, but it so evident! Radiation is harmful in large amounts, however, a man has developed under radiation and he cannot live without a certain radiation dose. Demand "to absolutely secure" a man against radiation is like demanding to put him in a cement sack.

And finally, nuclear power engineering is the only way to stop being a raw material appendage, to stop digging out and pumping out our natural resources. Fast reactors are especially prominent in this perspective: they simply do not need new fresh fuel, we produce more fuel than we burn. It is not for nothing that French call these reactors phoenixes.

It is another pair of shoes that the preparation for production of cheap energy is expensive and complicated in the nuclear power engineering. This is normal. A cheap and simple way is the way of Chernobyl. It is a criminal way.

Q. But even if we forget Chernobyl for now, you will not deny that nuclear power engineering entails obvious dangers, for example, in the form of radioactive pollution?

A. Major negative consequences are brought about by nuclear tests and other military activities. As a result of nuclear tests about thirty tons of plutonium have been spilled on the Earth. An American satellite with plutonium-238, which burnt over Africa, added approximately one-fifth of what nuclear tests have created. And similar satellites are flying now as well. Unlike the USSR, the Americans designed them to be based on plutonium-238, and not on uranium-235. That's why their satellites are by far much more dangerous than ours.

Q. I can guess that among your opponents there are not only "environmentalists," but the fuel and raw materials complex as well.

A. Yes, there is a struggle going on between the two monopolies, and the conventional power engineering is suppressing the nuclear one.

If it goes on like that, then we, the directors of nuclear facilities, will butt each other wrestling a million, while

trillions will go to the out-dated conventional power engineering. What will we do with millions won over in difficult struggles? At best we will spend them on grants for scientists. To develop the industry we will need trillions.

Q. Where from?

A. For example, from allotments of nuclear power plants. Last year 2.3 trillion rubles allotted by NPPs went to the Ministry for Fuel Energy for development while Minatom did not receive anything. Two and a half trillion rubles is enough to construct one block of a NPP. There is a government's decision on construction of a BN-800, it has passed all examinations. The government should realize that old blocks will soon fall into decay while there are no replacing capacities. NPPs in Balakhov, Kalinin and Rostov remain unfinished.

Q. Do you insist that power energy generated at a NPP is the cheapest?

A. Definitely. Many NPPs in Russia have been provided with fuel, and there will be no need in processing it for a long time. That's why the cost at such a NPP will be very low throughout a year. If you take, for example, any region in the Urals, you will see that specific self-costs of a nuclear kilo-Watt and of a coal kilo-Watt are absolutely incomparable.

Now in the West, in particular, in Western Europe, there is no big incentive for developing nuclear power engineering. They know for sure that they will purchase Russian gas and oil for at least another 15-20 years. Russian oil and gas pipe-lines feed Europe: they are a circulatory system that is born in Russia and keeps Western Europe's body alive.

While in the West conventional power engineering is civilized and takes into account environmental requirements, in Russia it is just barbarian. When the conventional power engineering in Moscow transferred from sulphurous coal to gas, the city seemingly became cleaner. Nevertheless, the level of nitric oxides has many times increased, and that causes cancer. Moscovites breathe in and feel happy: everything is clean and does not smell... Technology in Russian conventional power engineering is terribly outdated, while nuclear power technology is modern - here we are on the world level.

One would think that we should develop this modern nuclear technology. Nevertheless, we are closing it down and maintaining outdated technology of the conventional power engineering, which has not changed much since the thirties. So we have been ruining ourselves and increasing our cancer rate. Sharks have been winning in the power industry. These sharks can destroy the nuclear power industry altogether.

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