EDITORIAL
NPT GLOBALIZATION AND NEW MODELS FOR NONPROLIFERATION CONTROL
by Dmitri Yevstafiev
PIR Center Senior Research Associate

For the time being, the possibilities of enhancing the system of nuclear non-proliferation using traditional methods, both in terms of quality and in terms of quantity (i.e., to increase the number of IAEA and NPT members) have essentially been exhausted. Hence the necessity of developing a new model of nuclear non-proliferation system development. It would be premature to state that classic nuclear non-proliferation has no meaning at all and that it must be replaced by a new system aimed at counter-proliferation as well as at such threats as nuclear terrorism and illegal nuclear material trafficking.

At the same time, there is no need to overestimate the danger of nonproliferation from so-called rogue states and to reduce all problems to this factor. There are a number of states for which the question of developing nuclear weapons is a political decision from the financial and technological standpoints, but they are completely free in their actions and, moreover, try to force their rules of play onto the world community in such important areas as export control. It is hardly worthwhile to consciously demonize Japan and Germany because of suspicions about their nuclear ambitions, but one cannot preclude the possibility that their security policy will become denationalised (this is highly probable for Japan), so means of securing this policy (one of which may become nuclear weapon) should be taken into account.

In order to discuss coordinated actions in the event of danger to nonproliferation system stability, it is necessary to develop a procedure for crisis consultations among the leading countries in the field of nuclear energy nonproliferation (the five permanent UN Security Council members, Germany, Japan and some other countries), and to strengthen the UN Security Council's influence over nuclear nonproliferation. In principle, the UN Security Council may become the main legitimising body to form international reaction against violations of the nuclear nonproliferation regime. It is necessary to develop an international system for monitoring the global nonproliferation environment which would have the ability to collect and summarise information and to draft recommendations on the basis of which the UN Security Council or any other body occupying a dominant position within the global nonproliferation framework would make subsequent decisions. As a result, international exchanges of information would become freer and more objective.

Discussion of these questions by a limited number of parties would most likelylead to the accusation of neo-imperialism, and from the rational point of view the real effectiveness of sanctions is clearly to be provided by UN legitimising procedures and IAEA experience, with consensus among the G-7 countries as well as China and Russia. In addition, the initiation of such a discussion could probably play a positive role as a tool for developing and formulating new approaches to strategic confidence-building measures in this area, where consensus is considered to be more easily reached than in other spheres. The question is whether to develop the nuclear nonproliferation system based upon the NPT, while increasing the amount of work to be done and trying to resolve emerging

contradictions by interpreting the NPT, or using it as legal basis for practical activity. The two main tasks to modify the nuclear nonproliferation system are, on the one hand, to provide for structural unity of various elements of the global nuclear nonproliferation regime with the main decision-making functions being transferred over to the IAEA and, on the other hand, to closely and functionally (maybe even formally) integrate the IAEA and the UN Security Council, which would necessarily further the integration of regional and global initiatives on nonproliferation.

It is within the framework of regional agreements that one encounters the shortcomings which are inherent to the global regime, cannot be eliminated and do not depend on NPT extension. Regional security systems organised under the control of the UN Security Council, having the direct participation of the five permanent UN Security Council members and targeting non-proliferation could consist of the following elements: a system for monitoring the military-political situation; an expanded system of confidence-building measures and military danger reduction; a reciprocal monitoring system in the field of WMD; a system of measures to limit the conventional arms race; a system of regional agreements on export control which would probably be based upon principles other than those developed by the exporters' clubs; a security guarantee system for participants.

The question that is critical for developing the non-proliferation system is that of drawing countries which are not NPT and IAEA members into the discussion. However, it should avoid granting such countries the same voting rights as full members. Such equal suffrage could enable them to use their participation in the process as a tool to undermine the Treaty, which would be an especially dangerous precedent if a state that is not legally party thereto acquired the right to influence the development of the arms control regime. The negotiations with India, which is not an NPT member, concerning its accession to the Comprehensive Test Ban Treaty (CTBT) is such an example.

The one conclusion which may be drawn is that nuclear weapon non-proliferation system development cannot be cheap. At the stage of its creation we should be ready for an increase in spending. As for Russia, it is necessary to comprehend that within the current international relations framework, the role played by the state in a specific situation is directly dependent on the amount of finances invested. Finally, the most important factor in non-proliferation system development is to preserve a multilateral approach to the problem. The transition of one of the leading countries, the system members, and many more of the countries to actions based upon individual or group decisions may soon bring about an uncontrolled situation in the field of nonproliferation.

INTERVIEW
NUCLEAR TRADE: SPECIAL AGENCIES WERE BOTH SELLERS AND BUYERS
Russian Minister of Nuclear Energy Victor Mikhailov
interviewed by Yaderny Kontrol journal correspondent*

- How is nuclear materials accounting, control and physical protection carried out at the plants of the Ministry of Nuclear Energy (Minatom)?

A system of materials accounting, control and physical protection (MPC&A) has always existed at the Minatom plants. About ten years ago the primary emphasis was placed upon MPC&A against external intrusion. With the transition to a market economy and plants paying bills themselves, a system of protection against external, as well as possible internal, theft had to be developed. There are several reasons for internal theft: the meagre workers' budget, greater possibilities for certain plants to strike deals with foreign companies and to make business both in this country and abroad. In addition, any system has to be updated. For example, this applies to technological, pipe and operational loss problems. While in the past technical means provided one level of control, today (our branch of industry has existed for fifty years) technological loss control is much better in terms of both scope and quality.

We co-operate with many countries on MCA & PP, primarily with the US. Within the Nunn-Lugar programme's framework $30 million are allocated. We are implementing a number of projects with some EU countries, but the sum is only 10% of that allocated by the US. Eighty percent of the money from the US goes to US developers, and part of it is spent on the delivery of specific equipment, separate spare parts and units. The system is made in such a way that it will be impossible to determine any sensitive element, for example, the geometry of units or details about where nuclear material is stored. We have developed experimental as well as industrial samples. Initial transducers of gamma, neutron and X-ray radiation, contact sensors of mechanic damage or opening-up of containers, doors etc. and software are the main Russian contribution. The Eleron Production Association, which has existed for 35 years, is a leader in the field of PP. With the equipment production plants, the total number of personnel working at the research institutes, design departments, production associations and plants is about 25 thousand. If the amount of state budget or plants' spending to improve MPC&A is 100%, that of the US and other countries' aid is estimated as being from 25 to 30%, so two thirds is the plants' own money or budget money and one third is foreign funds.

The Ministry of Medium Machine-Building was a very classified organisation, but during the last 10 years we unclassified practically all the fields connected with the peaceful use of nuclear energy. There are more than a hundred intergovernmental and departmental agreements on co-operation in these fields which enable our plants to work jointly. And there were in fact cases of theft by an insider to earn money for living. It is a new situation for us, so we must actively acquire Western experience as to ways of protecting material from insiders. I suppose that PP is the most sensitive element. Today special attention is paid to internal losses, to internal possibilities of material theft by insiders. Taking into account the partial unemployment in the branch, as well as in closed cities, we can choose the right persons for the cities among those who are experienced in handling the material and working at the plants.

- What measures are taken to prevent nuclear terrorism and nuclear material theft when transporting?

Special containers and special guarded trains have been and are being provided. We have communication with the trains and vans. Distance between points is controlled.

During transport, in the event of accident shielded containers provide nuclear material security. They are made in accordance with the IAEA requirements, as well as with our specific requirements which are more strict than the IAEA ones. Annually we conduct exercises, imitate such accidents and examine joint actions of all the teams from the Civil Defence Department, the Ministries of Emergency Situations, Nuclear Energy and Defence, which refine their team-work in handling emergencies. They are well-equipped with modern foreign equipment especially designed to cut large-size items and units. It is necessary to reach, withdraw and neutralize radiation sources.

- What you can say about co-operation with other CIS countries in this field?

Co-operation with CIS countries is carried out in a rather strange way due to centrifugal forces and the desire for independence, which caused many links to be severed. We even encountered the problem of the point or destination that our guard could reach? Now such procedures have been worked out for the special agencies and guard. We would return to the scheme which worked effectively when the Soviet Union existed. Then there was no theft during transport.

We co-operate closely with Kazakhstan and Ukraine, and the question of delivery of waste and fuel from Armenia and Uzbekistan is raised. There are other interests connected not with MAC&PP system but with Western interests.

A special centre based upon the IPPE in Obninsk has been constructed. The Institute will provide standards for specialists' training as well as conduct specific seminars on MAC&PP involving existing samples, and all CIS countries can take part in these seminars. But the desire to participate is required. Many countries set their hearts on dealing with the West because of dollars.

I have been to Uzbekistan and other former Soviet republics and the Chiefs of Departments go to such places as Uchcuduc, Zaravshan in Uzbekistan, Stepnoy in Kazakhstan. In Ukraine we organise joint ventures, a financial industrial group. It will be very difficult to develop until we have the same financial and economic basis and legislation, and unfortunately we are not always ready to give financial support to a plant.

It is known that the nuclear material which appeared in the Munich case has finally been given to Minatom for bench research. What can you tell us about the results?

The research, performed by the Bochvar Inorganic Material Institute, is coming to an end. To get the conclusion a fine chemical and isotopic analysis should be carried out. There are certain details which influence the conditions and structure of production: humidity, temperature, atmospheric conditions. The fine analysis is underway now, and it has taken a lot of time. I believe that it will soon be completed.

- It has sometimes been said that the plutonium came from Obninsk

I have no comments now in this regard. Everything will become clear as soon as the specialists finish their work and write a complete report. But as I have said before, special agencies were both sellers and buyers right from the beginning, but at the present time I cannot say which agencies.

Speaking about co-operation in the field of MPC&A, people speak of institutes and federal nuclear centres. What are the results of promoting the system at nuclear facilities?

The system is being promoted at the Mayak Enterprise, the Mashinostroitelny zavod [Machine-Building Factory] joint stock company in Electrostal, and at our enterprises which produce fuel rods and reprocess spent nuclear fuel and medical isotopes.

- In what way is co-operation with the US and Western Europe being carried out?

We enjoy large-scale co-operation with the US because the Russian level of technology, science and nuclear potential is similar to the American one. The European level is much lower. Up to now we have determined about 15 plants which use nuclear energy for peaceful purposes, including conversion and joint activity as well as perimeter construction not touching sensitive workshops and buildings. As for sensitive facilities, we work alone and use Russian equipment and systems, although the basis is Russian-American development for peaceful activity, but for the nuclear weaponry complex.

- Leakage of information is said to take place in the process of such co-operation

A very limited number of people has access to that sensitive information which is actually protected by the state. Most of those 25 thousand people who produce and develop PP equipment or MAC systems have no conception of it. Russian and American specialists visit each other's nuclear centres and facilities. But according to our information, neither they nor we have learned anything (insofar as sensitive areas are concerned). As for production size in closed cities there is space surveillance and the Americans are well versed in them but they do not know the details.

The US and Russia are known to understand excess weapon-grade plutonium in different ways. Specifically, for Russia it is the immediate material extracted from warheads, that is Category 1 material, for the US it is material which can be used to develop weapons, that is Categories 2 and 3 material. The problem of how to standardize the meaning will be resolved. Moreover, the composition and structure of nuclear ammunition may be recognised from the composition and form of Russian Pu extracted from the ammunition and stored at Mayak, which is against Article 1 of the NPT How can this problem be resolved?

Now procedures and technical means of the IAEA are being worked out. The control will exist. If by that time the plutonium is split, there will be no access to either parts or chemical composition. The main isotope is one of the problems to be studied by the US, the IAEA and Russia. But still, the Americans will put a part of such material under control.

We know they have other material, but they will put real weapons-grade material under control too.

- How do you perceive the future of nuclear trade with such countries as Iran, India and Cuba?

We have intergovernmental agreements with India and Cuba, signed when the SU and Russia made commitments to fulfil them. Thus, in accordance with the agreements, both Russia and Minatom are simply restoring science, technical and commercial links in construction, mainly in nuclear plant building. It is a very important process and it is important for Russia to maintain friendly relations with these countries, especially today. Russia rejects double standards in world trade, all the more so since methods of resolving conflicts are emerging. Today Russia largely co-operates with those countries which provide IAEA guarantees for our facilities. Speaking about new contracts or co-operation, Russia concludes only similar agreements and with those countries which put their nuclear activity under the IAEA guarantees.

India does not meet this requirement, but there is an agreement that we have to implement and the NPP being built by Russia in Kudanculam and its environment will be put under the IAEA guarantees. I suppose it is very important: that the country's nuclear activity is not under the IAEA guarantees, but this facility will be. We are approaching a situation in which one facility is under the IAEA guarantees. So, sooner or later the country will put its activity under guarantees and international control because it is peaceful.

The situation with Iran is simple. Its nuclear activity is under the IAEA guarantees and controlled. It is one of the diligent members of the IAEA. You may ask whether there is any clandestine activity? We are in favour of increasing the IAEA control, to make it possible, in a country under the IAEA guarantees, to expose such activity at earlier stages. On the other hand, international rules and laws to severely punish a country with illegal activity have to be developed. If a country joins the NPT and adopts all the IAEA rulings and at the same time engages in clandestine activity, as does North Korea, than it must be punished under international laws with economic and trade sanctions, boycotts and frozen accounts.

- Was it possible in respect to India to co-ordinate political and economic conditions? Was it possible to exert pressure upon India in order to force it to sign the NPT?

It is not for Minatom to make foreign policy. Without the agreement, Minatom could not build. It is for the Foreign Ministry and top politicians to co-ordinate the intergovernmental agreement with political conditions, to exert pressure. Minatom always acts as an executive body of the Russian Government, which can build NPPs or sell isotopes for medicine, industry and agriculture.

The situation with India is more serious. The issue is that in 1992 Russia joined the agreement on large-scale guarantees on the part of the group of nuclear suppliers. Under the agreement there are certain materials which should not be sold or exported to

countries, such as India, which have not joined the NPT and put their activity under the IAEA guarantees. But the agreement with India was signed in 1988 and the document on export control - in April, 1992. No agreement is retroactive.

The scandal around the supercomputers deal was absolutely inadequate. When Russia was signing the CTBT it meant supercomputers shipment to Russia.

No, it did not. It is very difficult to provide for nuclear ammunition security under the conditions of a full test ban treaty. Our experts put the question to US experts. Now the US repudiates its promises. There was no official promise, but they took our request for supercomputers a year and a half ago, then put it aside. Those computers we did buy, with speeds of five and ten billion operations per second, we obtained legally in Europe (US computers bought through European dealers). As for the supercomputers we requested from the US, their speed is scores of times higher than those. Our demand has not been met yet, although they develop computers with a speed of a billion operations per second.

- At a press conference you named North and South Korea, Indonesia and Brazil as potential Russian partners. Could you describe the prospects for cooperation in greater detail?

We enjoy commercial science and technical co-operation with South Korea. We supply it with nuclear fuel. There have been no contacts with North Korea yet. We have been invited to join the KEDO (consortium of the US, Japan, South and North Korea) as an ordinary member, so we will have to allocate some money and use it. But we do not have such free money. Especially since we have spent enough and prepared sites for NPPs. They even owed us about five million US dollars because we joined the sanctions against North Korea when it began to depart from the NPT. Today we happen to be excluded from the North Korean market.

So far there are only intentions in regard to Indonesia and Brazil, with which we signed agreements on peaceful nuclear energy use. It is much more difficult there because their markets, as well as the Japanese one, are mainly occupied by the US and European countries. The Americans deliver 80% and the Europeans - 20% of the fuel for Japanese NPP.

ROUND TABLE
On April 8-9 the Conference "On the Possibilities and Prospects for a Nuclear-Weapon Free Zone in Central and Eastern Europe" was held in Minsk.

The initiative to convene it had been exercised by President of Belorussia Alexander Lukashenko, who delivered the opening speech.

President Lukashenko stressed the reliability and predictability of the Belorussian position. However, Ural Latypov, an aide to the President, was evasive when answering journalists'

questions about the negotiations between Belorussia and NATO. According to him, Russia negotiates with NATO from the position of a superpower. Belorussia, because of its small size, necessarily has different interests. Alexander Lukashenko reiterated that he would like for the money earmarked for the alliance's expansion to be spent on assistance for Chernobyl victims.

The Foreign Ministry supported the initiative. Russian Foreign Minister Yevgeni Primakov made a speech at the conference. Admitting that NATO expansion was inevitable, he spoke about strategic stability in the region and the necessity of providing legal guarantees of security, and emphasized that Russia and Belorussia did not accept the alliance's position. Calling NATO's expansion the most serious mistake since the Cold War, Minister Primakov stressed that the OSCE would have to become the guarantor of stability in the region. But the US asserts there will be no OSCE control over NATO. According to Mr.Primakov, the legalized Belorussian initiative has to promote agreement with NATO on the non-deployment of nuclear weapons on the territory of the alliance's new members.

Although the Chief of the Russian Foreign Office announced that "the Belorussian initiative was supported by Russia and Ukraine (Kiev did say something of the sort), the "spirit of Kiev" differs from both Minsk's and Moscow's hopes. Firstly, unlike Moscow and Minsk, Kiev was not represented by dignitaries. The Ukrainian Foreign Ministry's position was submitted by officials who are not experts on the subject. It was they who suggested not fighting for the primary role in this initiative and who made it clear that under US pressure their position on nuclear-weapon free zone (NWFZ) development had changed to a certain extent. At this stage, it may be called passive: in 1996 Kiev supported the initiative to develop NWFZ, nowadays it observes regional events because the Ukrainian position on NATO expansion differs from the Russian and Belorussian ones. Ukraine is one of the main recipients of US financial aid, and is trying to preserve its position in Eastern Europe. The main speakers' ideas led to arguments in favor of the prohibition of nuclear tactical weapons, which they called an anachronism of the Cold War. According to the speakers, rearming and updating US tactical nuclear forces does not provide Russia with the ability to make an adequate response and the alliance has no intentions of using it.

Speaking on the differences between a NWFZ and a nuclear-weapon free space (this was one of the questions raised at section meetings), a Russian Foreign Ministry representative noted that restrictions on conventional arms were part of conception of the nuclear-free space and mentioned that there would probably be an additional NWFZ in the Central and Eastern Europe protocol on conventional arms restrictions. The Russian Minister also stressed the CFET.

According to him, the framework of the conventional armed forces agreement has already been formed as a result of negotiations in Vienna. Several rounds of negotiations with NATO's Secretary General Javier Solana were conducted when the question of non-deployment of NATO's conventional arms was considered.

The speech of China's ambassador to Belorussia, stressing the fact that he spoke on behalf of the Chinese Government, was an unscheduled but important one. According to him, the Chinese Government supports the idea of any NWFZ development (for those which do not infringe upon Chinese national interests, as for example in Northeast Asia).

Representatives from 26 states, including Central Asian and Transcaucasian republics, took part in the Conference. During two days 40 speakers presented their reports. Belorussian Defense Minister Alexander Chumakov and Deputy Foreign Minister Sergei Martynov made presentations. The report by scientist Yan Prawitz of the Stockholm Peace Research Institute was a central one.

NWFZs were created to counter threats to regional security. Up until now, countries of the third world have displayed the initiative to develop NWFZ. However, Poland, the USSR, Rumania, Finland and other states presented their proposals even earlier. In 1990, at the 45th UN General Assembly session, Belorussia spoke in favor of a nuclear-weapon free zone from the Black Sea to the Baltic Sea (in order to free Belorussia and the Baltic region from Soviet nuclear weapons). But the antagonism between East and West made them somewhat short-sighted. The West considered it unrealistic to provide CEE with nuclear-weapon free status. The events of 1992, 1993 and 1994 confirmed the full reality of Belorussia's intentions. The desire of some countries to become NATO members in 1994-95 and to fill in the political vacuum in the region was naturally a cause for concern on the part of Russia and Belorussia.

In July 1996, talks about developing a nuclear-free space in CEE were resumed. The structure of the nuclear-free space in CEE was to be formed step by step, stage by stage. Working out nuclear and non-nuclear states' commitments is supposed to be the first step. As for nuclear states, they may commit not to deploy nuclear weapons in CEE, and as for non-nuclear states - to make unilateral political commitments not to deploy nuclear weapons in their territories, backed primarily by guarantees from such nuclear states as the US and Russia. The European Security Charter has to be adopted. None of the states has to create new spheres of influence or new lines of demarcation. A document envisaging an international legal procedure for recognizing the club of states emerging in Europe will have to be a condition precedent for NWFZ development.

From the geopolitical point of view, Belorussia and Poland are the regions where estern and Eastern interests intersect. The union and subsequent integration with Russia prevent Belorussia from then becoming a buffer zone. However, from this point of view the main issue of concern for Belorussia is Poland's longing to join the first NATO echelon under any conditions (including the condition of becoming NATO's avantgarde in the battle area). "We want our frontiers, in this case with Poland, to stay boundaries of friendship and cooperation, not of separation and confrontation. I have no doubt that our neighbors have the same interests. Unfortunately, for the time being we have to state the opposite. I mean, advancing separate parts of NATO's infrastructure to Belorussian frontiers," - Mr.Lukashenko announced. Thus, he considered it necessary to continue consultations in order to find ways to free Central and Eastern Europe from nuclear weapons. In his

opinion, a legally binding document on non-deployment of nuclear weapons in Central and Eastern Europe needs to be drawn up.

However, neither Poland nor Hungary is in the mood to be in the second NATO echelon, to be a second-class country that is not to be taken into account. For them, the question of NWFZ development in Central and Eastern Europe is just premature and should maybe put on the agenda only after the Madrid Summit. Romania, which considers itself to be quite deserving to join the alliance, has the same attitude to the situation in Central and Eastern Europe. In this case, the fact that Russia and the US are negotiating about the alliance's new members as superpowers hardly promotes an adequate perception of the joint Belorussian-Russian initiative (the support from the Russian Foreign Ministry makes it possible to call it a joint one). And it is doubtful that in the near future the new members of the alliance will have the same status as Germany, Britain or France. So there is an unwillingness to be third-class countries and, moreover, to be without sources to finance their rearmament. With Belorussian invitations ignored by the US and German representatives, as well as by representatives of other NATO members including future ones, the positions of participants in the Conference can not be recognized as an official point of view.

If the proposal had been in harmony with their longing to become full alliance members, it would have been realistic for the future members. But NWFZ is only a part of strategic stability in Europe and it is undesirable to make its significance absolute. According to military experts, developing NWFZ is more of a political step than an action caused by actual security requirements. Strategic potential being is still no less dangerous from the standpoint of its usage by five nuclear states. Besides, in the first place, Belorussia is within the range of the tactical weapons deployed in other NATO members, and secondly, it will take as much as an hour to deliver tactical weapons from Germany to new alliance members. Because the surveillance satellites designed to monitor the nuclear activity of other countries are becoming obsolete, Russia does not even have the capability of verifying nuclear-weapon free zone development.

Councilor Alla Karimova, the Uzbekistan representative, described the initiative to develop a NWFZ in Central Asia. As was said in the report, the initiative had an effect on the so-called Alma-Ata Declaration signed by Kazakhstan, Uzbekistan, Kirghizia, Turkmenistan and Tadjikistan on February 27, 1997. In addition to political tasks, the zone - if created - is also supposed to resolve ecological ones. Unlike the NWFZ in Central and Eastern Europe, the Central Asian NWFZ is not likely to infringe upon any interests and has a chance of being created in the near future.
BY MASHA KATSVA

First-hand report: High officials speak exclusively to Yaderny Kontrol :

Russian Foreign Minister Yevgeni Primakov:

What status can the Kaliningrad region have? It is a part of Russia, there are no questions at all. Russia will not be nuclear-weapon free. It may be nuclear-weapon free only when all states are nuclear-weapon free.

President of Belorussia Alexander Lukashenko:
Belorussia has already acquired nuclear-weapon free status. And integration with Russia will not hinder it. As soon as the West and the US get rid of nuclear weapons, I am convinced that Russia will not have them either.

Ural Latypov, an aide to the President of Belorussia:
The integration with Russia will not influence Belorussian nuclear-weapon free status. Closer ties with Russia and the merging of the General Staffs and military structures are not envisaged.

Deputy Foreign Minister of Belorussia Sergei Martynov:
The most significant Belorussian contribution to strategic stability development is the withdrawal of nuclear weapons from Belorussian territory, not to mention that it was Belorussia which was the first of the former Soviet republics to ratify START I, join the NPT and contribute to the conceptual study of the Lisbon Protocol. This was in 1990, when we displayed the initiative to develop a nuclear-weapon free zone from the Black Sea to the Baltic Sea. Then no one believed that it could become reality, but the actual state of affairs now confirms it. De-facto the zone has been formed. If the situation allows, we will immediately begin moving towards the de-jure formation of such a space, and if it does not - we will do so stage by stage. Closely integrated relations with Russia do not mean that Belorussia will change its nuclear policy. Belorussia is a member of the NPT and it will meet its commitments under the Treaty. Russia is ready to reduce arms on a balanced and equal basis with the US, which makes it possible to speak about comparing the tasks facing Russia and Belorussia. Up until now, taking into account the political aspects of NATO expansion at the expense of some Central and Eastern European countries, there has been a watchful attitude on the part of such countries as to whether or not to deploy nuclear weapons. Some time clearly must pass until they feel more comfortable about such commitments, and it will be possible to make the next decision at that stage.

We consider the evolution of NATO positions towards the problem to be a positive factor promoting creation of the zone. In particular, three "Nos" are known to be have formulated by NATO in December 1996:No plans, no intentions, no needs. We understand that there are different positions towards the idea: some are more cheerful, others are more restrained. At the official level, we receive quite balanced answers, where the idea is not rejected, but the need for the proper time and circumstances is implied. As for ourselves, we plan and are ready to conduct some stages of less formal and completely informal consultations, both with NATO member states at both the bilateral level and the multilateral level, and at the bilateral level with our neighbours, whether or not they are among the first to join NATO. So we realise that this is a difficult and serious initiative which affects the most important security factors, the presence or absence of nuclear weapons.

We realise that the countries do not take these matters lightly. And we have measures we are ready to offer to ease their concerns. None of the commitments the countries can make as NATO members is contrary to the implementation of the initiative. As, for example, in the case of the unilateral Norwegian and Spanish statements on the refusal to deploy nuclear weapons on their territory. There is a precedent with the German Democratic Republic (GDR), when the agreement not to deploy nuclear weapons in the former GDR was concluded not in the form of a unilateral statement but in the form of a multilateral understanding. We hope for gradual NATO evolution in accordance with its own statements about its internal developments towards a larger political component as compared to the military one. As a result, we rely on the soberness of Western strategists' thinking, not to mention that the de facto formalisation of the nuclear space does not contradict these interests as they are outlined by NATO itself.

The development of the present security situation is heading in a direction where we can not have even a slight idea about the possibility of deploying nuclear weapons in Belorussia. We hope that the development will continue in the same direction: i.e., that the soberness of strategists on either side will be maintained.

Our primary idea was to combine the efforts of the maximum possible number of states, including our neighbours Ukraine and Russia, to achieve a nuclear-weapon free zone. I hope that Ukraine also holds a position of a keen interest in the absence of nuclear weapons in the region because of its complete objectivity, and that it will help to promote the initiative's implementation. I suppose it would be premature to individualise the positions of particular other states. Our perspectives and concerns in relation to the zone are in broader categories shared by particular states or groups of states. These positions may influence the positions of individual states during the stages which follow.

ANALYSIS

NATO EXPANSION AND MODERNIZATION OF THE CFE TREATY

By Yuri Fyodorov,
professor of Moscow State Institute for International Relations (MGIMO)

"NATO eastward expansion" is leading to strategic changes in Europe and poses the question of Russia's reaction to NATO expansion. The tough "counter-measures" spoken about in Moscow would result in a new arms race, the isolation of Russia and, finally, would destroy its economy which is already in grave crisis.

However, confrontation may be prevented by improving coordinated measures to provide security and stability in the regions of contact or approach between Russia and the zones of responsibility of NATO. In this respect, it may be important to modernize the Conventional Armed Forces in Europe Treaty (CFE Treaty). The consultations on this topic began at the end of January 1997 in Vienna. They were based upon a document on the CFET's scope and on the conditions for its adaptation. The document was adopted at the Lisbon Summit in December 1996. It is necessary to prevent these consultations from

being converted into a forum where deliberately unacceptable requirements and mutual accusations will be made. In particular, it may lead to a loss of time, if basically irreversible strategic changes take place which are unfavourable for Russia.

One of the crucial issues for the CFET's modernization is the question of foreign troops overseas. When the Treaty was worked out, neither the USSR nor the USA was interested in restrictions on foreign military presences. The Soviet Union had fully equipped military forces numbering some hundred thousand personnel in the former GDR, Poland, Hungary and Czechoslovakia. In turn, the US, Britain and some other Western states deployed their troops in West Germany and some other NATO member nations. The Treaty does not specifically restrict armaments deployed on foreign territories. Article 4.5 of the Treaty states: "Those States Parties being among the same group of States Parties can deploy combat tanks, armoured combat vehicles (ACV) and artillery pieces in regular units in each of the areas named in the Article and Subpoint A, Point 1, Article 5, up to the quantitative restrictions applied in the area in accordance with top levels for availability, notifying according to Article 7, and under condition that no State Party deploys conventional armed forces on the territory of another State Party without this State Party's consent". Otherwise, it is only important that the total quantity of arms in the relevant zone that belong to states within the zone, as well as those deployed on their territories by other states, not exceed the established ceilings.

PROBLEMS WITH THE CFE TREATY'S REVISION

The question of what has to be changed in the CFE Treaty is most probably to become the subject of disputes. In particular, Russia suggests three directions for its modification: to restrict armaments of particular states and groups of states; not to deploy foreign troops and armaments in those states where they are now absent; to set a quota of less than fifty percent of the total number of armaments allowed in the area of Treaty implementation for military unions and groups of states .

In addition, "NATO expansion" has posed two groups of problems which cannot be avoided during negotiations. Will the armament ceilings set for a group of States Parties by the Treaty have to be preserved? In what way will the Treaty, first and foremost the regional ceilings, be adapted to the new military and political reality in Europe?

The Treaty does not give answers to these questions. Article 22 envisages that the Treaty's custodian may convene an Extraordinary Conference of the States Parties at the request of a State Party, supposing that exceptional circumstances have arisen. The Article stresses "in particular, if the State Party has announced its intention to withdraw from the group or to join another group of the States Parties, as determined in Subpoint A, Point 1, Article 2". Hence, NATO expansion may be considered to be an exceptional circumstance demanding the convocation of an Extraordinary Conference. However, the Treaty does not stipulate what may or must be done in such a situation.

THE PROBLEM OF GROUP CEILINGS IN THE EVENT OF NATO EXPANSION

Three alternatives for resolving the problem of group ceilings generate the deepest interest. The first one envisages that changes in the group's composition do not have to cause changes in its ceilings, either in the area of implementation or in the corresponding regions. Such an approach would probably meet Russian interests, but is hardly suitable for NATO. In this case, taking into account the new NATO members (Poland, Hungary, the Czech Republic, Slovakia) the armaments of NATO members actually stationed in Central Europe would exceed the relevant ceilings by about 1,700-1,800 tanks and 2,500 artillery pieces. Consequently, the problem of reducing armaments already stationed would emerge and the possibility for the US to significantly build up troops and armaments as compared with present levels would be excluded . Russia would acquire an opportunity to increase its ceilings, because some would withdraw from the Budapest group with their ceilings, while group ceilings would be retained and could be redistributed among the remaining members of the group.

In light of this issue, the West is hardly likely to agree to the Russian proposal that ceilings for a group of states may not exceed fifty percent of the total quantity in the area of Treaty implementation. At first glance, the idea is just and actually reproduces the stance adopted by the States Parties to the CFE Treaty. But in practice, it means that group ceilings for NATO cannot be changed in the event of an increase in its composition.

The second alternative is the following: with a change in the group's composition, its ceilings change automatically by an amount equal to the sum of the national ceilings of the states changing their group affiliation. This alternative suits NATO, because its group ceilings would increase by 4,000 tanks, 5,900 ACVs and 3,600 artillery pieces with the Vyshegrad group's countries' joining the Alliance. However, it is absolutely unsuitable for Russia.

Lastly, the third alternative is to give up considering group ceilings at all. This makes sense, because in the 1990s there is only one group of states which are members of the alliance. Individual ceilings based upon the group approach were set in due course. These ceilings are to be preserved or changed on the basis of consensus among all of the Treaty's States Parties and group affiliation or the lack thereof does not have to influence them. However, as a result fundamental changes to the most important Treaty's Articles are to be undertaken.

In addition, the group approach consolidated in the CFE Treaty is not formally adequate to the block approach. The correlation between them is rather complex. The Article stipulates a group of the States Parties, specified as being the ones that signed the Brussels, Washington or Warsaw agreements in due course. But the Treaty itself was concluded not between two blocks but between individual states as members of the blocks. Its preamble stresses that the country signatories " have the right either to be or not to be participants of alliance agreements". This statement did not appear by chance. The Treaty's elaboration was completed in the end of 1990, when the Warsaw Pact was clearly on the edge of disbanding. It can be interpreted in such a manner that withdrawal from an alliance's agreement does not necessarily signify withdrawal from the corresponding group of the Treaty's States Parties.

However, in this case the main problem is the absence of a procedure to determine the ceilings on foreign troops and armaments stationed on other territories. Under the provisions of the Treaty currently in effect, the ceilings on foreign military presence are determined on the basis of the disparity between the group ceilings and the sum of the national ceilings in the corresponding region. If this approach is used at the national level, the total sum of foreign troops and armaments deployed on the territory of the state and the state's own troops and armaments cannot exceed the national level designated for the state.

In theory, this alternative is suitable for Russia but not for the West. If it is chosen, it will be next to impossible to deploy foreign troops and armaments on the territory of the Vyshegrad group's countries upon their joining NATO. Poland, Hungary, the Czech Republic and Slovakia have reached their ceilings for tanks and artillery pieces, and in order to deploy foreign (for example, US) troops or arms depots, their own armaments would have to be reduced.

Hence, in the event of NATO expansion the problem of group ceilings will prove to be one of the most difficult to resolve. This, in turn, is linked with the question of arms restrictions and military activity which can be raised by Russia.

ARMS RESTRICTIONS AND BALANCE OF FORCES IN EUROPE

The consent of all the CFE Treaty's States Parties to arms restrictions can in theory become a basis for Treaty revision, but only when the current balance of forces in the world and in particular regions is recognized by all of the Treaty's States Parties as being a stabilizing one that corresponds to their conceptions of security.

At first sight, the views of Russian experts and military on this point are contradictory in a way. With the Warsaw Pact disbanding, a serious disparity in conventional arms in favor of West is said to have emerged. The ratio between the respective combat potential of Russia and NATO's general purpose forces is sometimes said to be estimated at one to four. But at the same time, they propose to freeze this ratio. Actually, the ratio between general purpose forces in Europe is much more complicated and ambiguous than it would appear on the basis of the politically alarmist statements of the Russian military and some civilian analysts' judgments reproducing such statements.

The one to four ratio between Russia and NATO cited by some Russian experts for personnel and general purpose armaments limited by the Treaty is not true even when the actual level of Russian armaments and NATO's top ceilings are compared. Such a comparison is not correct, because either Russian and NATO ceilings or actual quantities of armaments should be compared. But this is not the point. In essence, comparing the quantitative features of overall Russian and NATO forces would be worthwhile if all armed forces of all NATO members were stationed along Russian frontiers and could actually be engaged in a conflict. However, such a course of events is excluded even in the case of a "big" war in Europe.

To be more realistic, it is necessary to compare Russian troops with NATO forces stationed in Central Europe and the forces of the Vyshegrad group countries. With these countries joining NATO and an agreement on the adjustment of group ceilings in accordance with changes among the groups being reached, the ratio between current Russian and NATO troops and armaments stationed will be 1 to 1.12 in personnel, 1 to 1.68 in tanks, 1 to 1.07 in ACVs, 1 to 1.19 in artillery pieces, 1 to 0.77 in strike helicopters and 1 to 0.62 in combat aircraft. Otherwise, an expanded NATO will greatly exceed Russia in tanks, by about 70 percent, but yield to Russia by 20 to 30 percent in strike helicopters and combat aircraft. This means that if Poland, Hungary, the Czech Republic and Slovakia join NATO, the North Atlantic Treaty Alliance will not gain a decisive advantage over Russia in Central Europe.

Needless to say, such calculations are very approximate and do not take into account some important circumstances. The bulk of Russian forces within the area of Treaty implementation are stationed in the North Caucasus Military District and should not be taken into account when the ratio of forces in respect to Central Europe is analyzed. Besides, in the event of military or
political crisis in Europe, NATO can rapidly redeploy to Central Europe, including the territories of new NATO members, a large number of aircraft which contribute significantly to total combat potential.

However, until Ukraine is neutral the armed forces of Hungary, the Czech Republic and Slovakia can not come closer to with Russian troops and the possibility of their redeployment to Poland in case of crisis is slim, if indeed it exists at all.Furthermore, Russia can redeploy large forces of ground troops and aircraft from regions to the East of the Urals.

From our point of view, the most important thing is that the countries of the yshegrad group are surrounded by states with powerful armies: by Russia, Ukraine and Belorussia to the East; and by Germany, which posseses from 50 to 60 percent of NATO's troops and armaments in Central Europe, to the West. The uncertain political future of the former Soviet republics and the historic experience of the Vyshegrad countries (including their relations with Germany) force the latter to seek extremely sound guarantees of security. That is why they are unlikely to agree with the idea of freezing the current balance of forces, arms restrictions and non-deployment of foreign troops 0n their territories even in symbolic quantities.

DIRECTIONS TO REVISE THE CFE TREATY IN LIGHT OF THE EMERGING STRATEGIC SITUATION IN EUROPE

The divergence of interests outlined above forces one to address the principal basis of the CFE Treaty and to try to adapt these interests to the new military and political realities. The initial idea of the Treaty was to set ceilings on offensive armaments in areas contiguous to the lines of contact between NATO and Warsaw Pact armed forces in order to exclude the possibility of initiating large-scale offensive operations or conducting

surprise attacks. And the Treaty's principal provisions resulted from the structure of strategic opposition on the Continent. Consequently, under the new conditions it is also necessary to determine emerging lines and zones of either real or potential confrontation and then, proceeding on this basis, to try to outline areas where arms restrictions have to be imposed and probably to determine so-called security regimes to ensure the regional balance of forces.

Under the conditions of NATO expansion, three zones having special strategic significance are probably to emerge. The first and the most important of them comprises Poland, the Baltic states, Belorussia and the western regions of Russia contiguous thereto. There are both unsolved territorial problems and the question of Russian lines of communications (including military ones) with the Kaliningrad region. It is there that direct contact between NATO's and Russian armed forces will take place. Relations between Russia and the Baltic states, aggravated by both politics and a negative historical and psychological heritage, are formed with difficulty. A grave crisis can emerge in the event of the deployment of foreign troops in the Baltic states. In essence, the Russian military doctrine considers it to be a pretext to use armed forces .

The armed forces of the Baltic states are weak. The numbers of the Belorussian and Polish armed forces are much the same. Russian forces in the Kaliningrad region contribute greatly to the military balance in the zone.

The equalization, in the spirit of the CFE Treaty, of the offensive possibilities of Poland and the Baltic states, on the one hand, with those of Russia or a Russian-Belorussian alliance, on the other hand, will probably be a necessary condition to ensure stability and security in the zone in the event of NATO expansion (or without it). Such an agreement, which can be reached within the framework of CFET revision, may prevent NATO troops on the territories of Poland and the Baltic states from deploying or limit their deployment to symbolic figures.

The question arises as to the extent to which military alliance with Belorussia and subsequent integration in the military field correspond to Russian security interests. On the one hand, it can significantly strengthen Russian positions in the zone, for example in air and antimissile defense, and enable Russia to use airfields, lines of communications and other elements of infrastructure. On the other hand, a long line of direct contact of Russian and NATO's armed forces will emerge.

To preserve guaranteed Belorussian neutrality may contribute more greatly to Russian security than would a military alliance with Belorussia. Russian armed forces would be divided from NATO's troops by a vast neutral zone (with the exception of the Kaliningrad region). This could promote the non-deployment of foreign and tactical nuclear weapons in Poland. Moreover, if the question of equalizing the respective military potential of Russia and NATO in the southern part of the Baltic region arises, Belorussian neutrality may be profitable for Russia because in this case parity will be established not between the Russian-Belorussian coalition and NATO but between Russia and the North Atlantic Treaty Alliance. Consequently, Russia could preserve far more armed forces in the region

than in the case of union with Belorussia. Finally, military union with Belorussia could cause concern in Poland and the Baltic states. Besides, Lukashenko will not be in power forever and there are no guarantees that future Belorussian leaders will have a pro-Russian and anti-Western position.

The second strategic zone comprises Ukraine, Moldova, Hungary, Slovakia, the Czech Republic, Rumania and the Russian regions contiguous to Ukraine. Whether or not Ukraine ultimately joins NATO will determine the future of security there. Lately, the Ukrainian attitude towards the issue has become somewhat ambiguous. But this is largely due to not military disbalances but political circumstances, primarily the complex Russian-Ukrainian relations marred by continuous claims to Sevastopol, outstanding Black Sea Fleet problems, and delays with concluding the major Russian-Ukrainian agreement. In this connection, the CFET revision may play a rather subordinate role in military and political developments in the region.

The third strategic zone is the Transcaucasus. It divides Russian and Turkish armed forces. Turkey is a NATO member. Stability and security in this zone, as in the previous one, are largely determined not by parity or disparity of armed forces, but rather by the Armenian-Azerbaijani conflict over Nagorno-Karabakh, internal instability in Georgia and Azerbaijan and rivalry between Russia and Turkey. However, NATO's expansion touches the region to a slight degree.

THE CFE TREATY MODERNIZATION AND MILITARY REFORM IN RUSSIA

The Russian approach to CFE Treaty modernization may in fact be wholly determined by the views on the nature and the main areas of military reform which predominate among the military and bureaucratic elite.

In 1993-94 the idea of reforming the Army by organizing so-called mobile forces played rather a serious role within the Russian military community. In essence, the inevitable serious reduction of Russian armed forces makes it necessary to organize some groupings of large mobile units capable of providing an immediately available force in any region where the military and political situation worsens. Such mobile forces were supposed to consist of two components: immediate reaction forces and rapid deployment forces. The former were to be in immediate operation readiness and to consist of airborne troops, some light motorized brigades, marine infantry, a special mission unit, some air defense missile brigades, up to twelve separate helicopter units, fighter aircraft, bomber aircraft, attack aircraft, troop-carrier aircraft and some other units. The rapid deployment forces had to be in increased readiness and were to consist of three Army corps, motorized and armored divisions, rocket artillery brigades, helicopter units, bomber aircraft, troop-carrier aircraft etc. According to one of the alternatives discussed, the forces were to be stationed in the Volga and Urals Military Districts .

The implementation of this idea would significantly promote the process of CFE Treaty revision in such a way that the Treaty would correspond to security interests of Russia and the states adjacent to it.

SUMMARIES OF ARTICLES SELECTED FROM MONTHLY RUSSIAN-LANGUAGED ISSUES OF YADERNY KONTROL

No 29, May 1997
The Editorial is dedicated to the Yeltsin-Clinton Summit, held on Helsinki in March 21-22. Five joint statements - "On European Security", "On the Parameters of Future Reductions in Nuclear Forces", "Concerning the ABM Treaty", "On the Chemical Weapons Convention", "On the U.S.-Russia Economic Initiative" - have been signed. At the Helsinki meeting the Presidents reached a mutual understanding that after START-II comes into force, talks on START-III, under which the nuclear stockpiles will be reduced to 2,000-2,500 warheads for each side, will begin immediately. The deadline for the elimination of strategic nuclear delivery vehicles under the START II Treaty will be extended to December 31, 2007. The sides will agree on the specific language to be submitted to the Duma and, following Duma approval of START II, to be submitted to the United States Senate. President Yeltsin promised that the State Duma would have ratified START-II by the spring. President Clinton announced that "today, after three years of negotiations, we agreed to preserve the ABM treaty, while giving each of us the ability to develop defenses against theater missiles". So Russia will destroy heavy MIRVed ICBMs and its number of long-range warheads will be limited up to 3,101. For if Russia does ratify START-II, the United States has proposed to Moscow to postpone the date for meeting the conditions of the Treaty and then the US Senate would vote on the Treaty again.

According to Colonel Ivan Serebryakov, a consensus has actually been reached among parties in the United States concerning the necessity of building up and developing ABM systems in the immediate future which will cover not only U.S. troops overseas (TMD) but all the US territory. Certain disagreements exist over the terms of development and specific configuration of the National ABM System. The Republicans majority in the US Congress just recently launched its next attack against the ABMT, at the end of January this year, given that it is a constant protagonist in the anti-missile race. On the initiative of Trent Lott, Republican Senate leader, the National Missile Defence Act 1997, was submitted for the consideration of the US Congress. This Bill envisages building-up and developing the NMD system by 2003, and its prototype testing would have to be completed by the year 2000. Regarding the ABMT of 1972, the new Bill points out the need to reach an agreement with Russia about the Treaty's amendments aimed at allowing the build-up and development of an ABM system for U.S. territory.

In the Library column Ambassador Roland Timerbayev and Alexander Rumiantsev (the Kurchatov Institute), analyse the Nuclear Encyclopaedia edited by Alla Yaroshinskaya. The Nuclear Encyclopaedia considerably fills in the gap nuclear sphere information, where there were traditionally editions which targeted a narrow community of experts and popular publications directed towards a wide range of readers but were characterised by lack of information and reliability. So there can be no doubts as to the usefulness and

timeliness of the edition. It contains articles covering physical, ecological, biological, social and political aspects of military and peaceful usage of nuclear energy, as well as information about international and national organisations that are active in the nuclear sphere, intergovernmental agreements and present legislation in this field. However, the factual information that is cited in the Nuclear Encyclopaedia and based upon officially published necessaily includes evaluations of the articles' authors which may be imperfect or even mutually contradictory.

ANALYSIS

THE DISPOSAL OF SPENT NUCLEAR FUEL: WHAT IS TO BE DONE?*

By Valeri Menshikov, Center for Russian Environmental Policy

The unresolved problems of radioactive waste disposal and the treatment of spent nuclear fuel treatment pose a serious and still insurmountable obstacle to the future development of nuclear technology. Like any production cycle, current nuclear technologies generate waste. Over the last fifty years, tens of billions of curies of radioactive waste have been produced, and the amount of such waste continues to increase, damaging the biosphere and potentially threatening human life and health.

Spent nuclear fuel-fuel extracted from a nuclear reactor after a certain period of time-represents the most radioactive material in nuclear power engineering. Initially, fresh fuel is packaged in fuel rods. A fuel rod is a circuit (rod, armature, plate), made out of fissionable material (uranium, uranium dioxide), and covered by a hermetically sealed cladding of aluminum, zirconium, or stainless steel. In many nuclear reactors fuel rods are united into fuel assemblies. Enriched uranium is the most common nuclear fuel. Natural uranium consists of a mixture of the three uranium isotopes in the following proportions: 99.28% U-238; 0.7% U-235; and 0.006% U-234. Of the three, only U-235 is able to maintain a chain reaction in a nuclear reactor. As natural uranium contains only a small proportion of U-235, enrichment is necessary to create nuclear fuel. Nuclear power reactors in the former Soviet Union and Eastern Europe use ceramic uranium dioxide as fuel. The level of U-235 enrichment varies from 2.4% to 26%, depending on the type of reactor. VVER-1000 reactors use fuel enriched to 4-5% U-235; RBMK-1000 reactors use 2.4-2.6% enriched fuel; VVER-440 reactors use 3.6% enriched fuel; while for BN-600 reactors there are three zones in which fuel enriched to 17%, 21% and 26% is used. The reactors of nuclear-powered submarines and ships use highly enriched fuel composed of uranium alloys and other metals. For third generation Russian nuclear submarines, for example, there are three reactor zones using fuel ranging from 21% to 45% U-235. Some reactors, however, use fuel of up to 90% enrichment.

The so-called peaceful nuclear industry is actually the result of military nuclear science and industrial development. The rapid production of fissionable materials-enriched uranium and plutonium-was one of the main tasks involved in developing and improving nuclear weapons. As it is very difficult and time-consuming to produce enriched uranium, the Soviet nuclear weapons program relied on the quicker process of producing weapons-grade plutonium. Thirteen military industrial reactors at three integrated nuclear works in closed cities located in the Southern Urals and Siberia (Chelyabinsk-65 or Mayak, Tomsk-7, and Krasnoyarsk-26) were built and operated for this purpose. Natural uranium was the fuel for these reactors and U-238 was converted into Pu-239. Spent nuclear fuel

extracted from these reactors was not industrial waste, but a necessary raw material for weapons-grade plutonium production. In the above cities, large radiochemical plants were built to extract plutonium and uranium and then clear and convert both elements into oxide form. Likewise, special metallurgical works were built to produce the final hardware for nuclear warheads. The facilities were successful at producing the necessary fissile material: an estimated 140 to 180 tons of weapons-grade plutonium was produced at these reactors.

Currently, the production of plutonium in both Russia and the United States has ceased. The last of the 14 military reactors in the United States closed in 1988, and stocks of plutonium there are estimated to total 100 tons, including plutonium in nuclear warheads. Three military industrial reactors converted for electric power and heat production are still in operation at the Mayak plant until 2000, as are two reactors that are producing dual-purpose radioisotopes.

At all the above stages of plutonium production, large quantities of radioactive waste are produced. This waste varies in its form and level of radioactivity, however. In terms of generating medium and highly-active radioactive waste, the radiochemical stage of uranium and plutonium extraction from spent military industrial reactor fuel is the dirtiest. 40 years of operating the Mayak, Tomsk-7, and Krasnoyarsk-26 facilities produced 2.4 billion curies of liquid radioactive waste. This waste was pumped into underground internal steam collectors, storage pools, or kept in special reservoirs. These surface and underground radioactive waste storage areas pose an enormous threat to the biosphere, and will continue to do so for many hundreds of years.

SPENT NUCLEAR FUEL IN NUCLEAR POWER ENGINEERING

Peaceful nuclear research began in 1954 when the world's first nuclear power plant went into operation in the city of Obninsk. Nuclear power engineering had been considered to be a safe and promising trend in the development of power engineering until the Chernobyl catastrophe (1986). Nuclear power plants have been constructed in many countries, and as of the end of 1995, 430 plants are operating in 33 countries around the world. Since the 1970s, however, and especially after Chernobyl, the number of new plants ordered has consistently declined. Combined with the closing of a number of older plants in the 1990s, this trend has meant that the number of plants closing has recently been exceeding the number of those going into service. At the same time, a whole range of problems connected with the recovery, transport, reprocessing and/or storage of spent nuclear fuel and radioactive waste is generating growing public concern.

Nuclear power plants produce the overwhelming majority of spent nuclear fuel. The annual weight of the spent fuel unloaded from the world's nuclear power plants is more than 9,000 tons. Regardless of how it is processed or stored, experts estimate that about 220,000 tons of spent nuclear fuel will have accumulated by the year 2000, and 600,000 tons by 2020. As a result, to prevent radioactive contamination of the biosphere, enormous effort and financial expenditures will be required.

Consider in more detail the process of spent nuclear fuel generation in nuclear power engineering. Fresh nuclear fuel, placed in fuel rods, lasts about three years in a reactor's active zone. During this time, U-235 is depleted as the chain reaction progresses. U-238, which is present in large quantities in reactor fuel, absorbs surplus neutrons and is converted into plutonium, at the same time moderating the speed of the chain reaction. In the chain of conversions started by the irradiation of U-238 by neutrons, the isotope Pu-239 plays the main role; all the other isotopes (Pu-240, Pu-241, Pu-242), are generated in far smaller amounts. So the entire nuclear cycle for reactors of the VVER-1000 type may be presented as follows:

Of 100 kg of spent nuclear fuel unloaded from this reactor, about 740 grams are highly-active plutonium isotopes (alpha-radiators) with a long-half life; and about 4 kg are highly radioactive products of fission, which are also alpha-radiators. So the bulk of highly radioactive substances generated by the operation of the nuclear reactor remains in the spent nuclear fuel. Fuel rods, extracted after three years in the reactor core, have radioactivity of about 26,000 curies per kilo of spent nuclear fuel when they are unloaded. Considering that the average fuel loading of a VVER-1000 reactor is 90 tons, and that the thirty tons of material which are unloaded each year have a total activity on the order of 780 million curies, it is clear why spent fuel cannot be immediately removed to specialized storage sites or reprocessing plants.

Instead, fuel rods removed from the reactor are stored in specialized storage pools beneath a 3 meter layer of distillate water at the power plant itself for no less than three years. During this time, the fuel rods cool, and many of the short-lived radionuclides in them decay. This standard storage interval, followed at all nuclear power plants, completes the fuel cycle of the reactor itself. After a year of storage, the activity level of the spent fuel decreases by 12 times; after three years, it decreases 32 times.

Typically, plants of Soviet design have storage pools that are designed to hold enough spent fuel to allow unloading of the entire reactor core. Now, some plants storage pools are filled to a critical level. According to the Russian Federal Committee on Nuclear Safety and Security Supervision (Gosatomnadzor), spent nuclear fuel at the plants has accumulated beyond the designed limits. The problem is the result of the failure to ship fuel from RBMK-1000 reactors for reprocessing and the shipment of only a limited quantity of spent fuel from plants equipped with BN-600 and VVER-1000 reactors.

Although plants with VVER-1000 reactors are designed with storage pools large enough to allow an emergency unloading of the entire reactor core, at two plants (Novovoronezhskaya and Kola), the pools are so full that emergency unloading of the core is now impossible. The most critical situation, however, is at plants with RBMK-1000 reactors, because their storage pools are not designed to allow emergency unloading, and if their storage pools are allowed to become completely full, these reactors may have to be removed from service. At the Kursk plant, for example, the storage pool is full and an adjacent special storage facility for spent fuel is also full. In 1995, a partial transition to packed storage in a facility adjacent to a reactor at the Leningrad plant was permitted, but it did not resolve the problem of spent fuel storage there. At the Bilibinskaya plant, the

current rate of fuel consumption will fill the storage pool to capacity within five years, and the plant cannot afford to build additional storage facilities. At the Beloyarskaya plant, problems have emerged in reprocessing the spent fuel from two shut-down reactors there. It should be pointed out that this highly active nuclear fuel is stored at sites in densely populated areas in the European part of Russia, where most of the country's nuclear power plants are located.

The quantity of spent nuclear fuel stored at the nine Russian nuclear power plants is 7,200 tons, of which 6,100 tons are spent fuel from RBMK-1000 reactors while 1,000-1,100 tons is from VVER-100 reactors. In addition, about 1000 tons of spent VVER-1000 reactor fuel is stored in a specialized facility at Krasnoyarsk-26, while 465 tons of spent fuel are at the Mayak plant. The trend toward ever-increasing amounts of spent nuclear fuel being stored at Russian scientific and nuclear research centers also persists.

Taking into account the quantity of spent nuclear fuel to be removed from all currently operating reactors during the next two years (for example, 135 tons of spent nuclear fuel is annually removed from the VVER-1000 reactors), the total amount of spent fuel in Russia is estimated at 10,000 tons with a total activity level of about 5 billion curies.

What should be done with spent nuclear fuel? In global nuclear power engineering there are two options discussed by atomic scientists, ecologists, and economists. The first one, called the closed fuel cycle, is to reprocess spent fuel at radiochemical plants and then to recover and separate uranium and plutonium for use as nuclear fuel again. The second one, called the open fuel cycle, is to store the spent fuel for a long time and then to bury it without reprocessing. Each option has pluses and minuses. The open fuel cycle is characterized by extremely inefficient use of uranium, as a negligible one percent of it is used in nuclear fuel production and the other portion goes to disposal areas (see chart 1) or stays in spent nuclear fuel. Highly efficient use of natural uranium and the involvement of a new energy transporter in the fuel cycle, plutonium, are the primary arguments in favor of the closed cycle. However, there are very serious problems involved in the closed cycle, as it generates a large quantity of radioactive waste.

In Russia there are two trends toward dealing with spent nuclear fuel: immediate burial as wastes, that is the open fuel cycle; and spent fuel processing to extract fissionable materials (plutonium-239, uranium-235) and raw fuel material (U-238) in order to reuse in a fuel cycle, that is the basis for the closed fuel cycle. In actual practice the closed fuel cycle is not performed to completion (recovered power-generating plutonium is placed in special storage and is not reused); while as for the open fuel cycle the final stage of burial is not carried out. As a result, both schemes currently reach only a certain intermediate phase.

Historically, the nuclear states built radiochemical reprocessing plants at the sites of weapons-grade plutonium production plants. There is no substantial difference between the technologies involved in producing weapons-grade plutonium and reprocessing spent nuclear fuel for reuse in power reactors. In both processes the same reagents, equipment, and facilities are used. The only real distinction is that weapons- grade

plutonium production plants possess specialized nuclear reactors to generate weapons-grade plutonium.

In 1977, the RT-1 facility for the reprocessing and recovery of spent nuclear fuel was built at the Mayak plant. With an annual capacity of 400 tons, the facility was based on the first Russian military radiochemical plant, also at the Mayak plant. The RT-1 facility is still in operation today, reprocessing spent fuel from the VVER-440, BN-600, and BN-350 type power reactors. It also reprocesses fuel from all the nuclear submarines and ships of the Russian fleet, as well as some research reactors. The facility has a spent fuel storage pool, three areas of room-dissolvance, and an extraction site with separate outputs for plutonium and neptunium built under the PUREX scheme as modified by the plant's technicians.

Reprocessing produces the following: uranium extraction in the form of uranile-nitrate sodium chloride alloy (the level of U-235 enrichment is up to 2.5%), which can be used in fuel for RBMK-1000 reactors; power-generating plutonium extraction in the form of plutonium dioxide; and also granular powder generation for uranium-plutonium (so-called MOX fuel) production. The MOX fuel is used in fast breeder reactors and it contains between 5-25% plutonium. However, the idea of using fast breeder reactors to reuse plutonium in the nuclear fuel cycle has not been implemented yet, because there is no industrial experience in using reactors in accordance with this scheme, and no production of MOX fuel. As a result, the power-generating plutonium produced at the RT-1 facility is stored at the Mayak plant and stocks of it now total around 30 tons. Consequently, the reprocessing of spent nuclear fuel at the Mayak plant has not resulted in the creation of a closed fuel cycle, and the highly-active power-generating plutonium which it produces requires careful and very expensive storage.

The Mayak plant receives spent nuclear fuel not only from Russian nuclear power plants, but also from Ukrainian, Hungarian, Czech, Slovenian, Bulgarian, and Finnish plants built to Soviet designs. (Currently, delivery of spent fuel from Finland is suspended.) At one time, deliveries also took place from the Iraqi research reactor. Spent fuel from these foreign nuclear plants is delivered to Mayak under intergovernmental agreements between the former USSR and the states where the reactors are located. Under these agreements, the countries where the USSR build nuclear power plants were obliged to return spent nuclear fuel to the country where it was produced. Aside from shipment to Mayak, some spent fuel from Bulgarian, Russian, and Ukrainian reactors of the VVER-1000 type is taken for storage to Krasnoyarsk-26.

The accumulated activity of spent nuclear fuel is high. Following reprocessing at the RT-1 nuclear plant, a part of the spent fuel's activity is transferred to nuclear waste. The total radioactivity of all kinds of wastes resulting from reprocessing a ton of spent nuclear fuel is about 600,000 curies per ton. Under an agreement with the Chelyabinsk oblast administration, the Mayak plant can annually reprocess 250 tons of spent nuclear fuel, so radioactive wastes with a total activity of up to 150 million curies are generated at the Mayak plant each year. The quantities of both solid and gaseous waste are relatively small. The solid waste is buried in special burial grounds, while much of the liquid waste

is dumped into the Karachay Lake in accordance with sanitary inspection regulations. The liquid waste is the most dangerous.

The reprocessing of one ton of spent nuclear fuel generates the following quantities of radioactive waste:

45 cubic meters of highly active liquid waste
150 cubic meters of medium active liquid waste
2000 cubic meters of low active liquid waste
1000 kg solid waste of the 3rd group of activity
3000 kg solid waste of the 2nd group of activity
3500 kg solid waste of the 1st group of activity
gaseous waste with annual activity of .23 curies.

The resulting highly active liquid waste is evaporated to 3.0-4.5 cubic meters per ton of spent nuclear fuel and fractionating (the worlds first highly active waste fractionating facility was put into service in August, 1996), then it is solidified by vitrification (lead phosphate glass). Since June of 1992 two direct heated electric furnaces have been in operation, vitrifying highly radioactive wastes. The productivity of the second furnace for initial solution was the highest in the world-550 liters/hour-which allowed vitrification of both the highly active waste from current spent fuel reprocessing, and also the vitrification of highly active liquid waste accumulated earlier as a result of weapons development. These wastes had been stored in special reinforced concrete tanks and pose one of the most serious potential environmental threats. Since 1992, 12,873 thousand cubic meters of highly active wastes have been reprocessed and 2,188 tons of glassy substance have been produced. The total activity of the vitrified radionuclides is 297.6 million curies, or 35% of earlier accumulated waste of this kind. After the tanks have cooled down, they are put into a steel canister. The canisters are hermetically welded up and put into a temporary storehouse with controlled heat removal-a pool filled with distillate water. The process of controlled heat removal must continue for twenty or more years before the canisters can be buried. Industrial radioactive waste vtirification has been introduced in Britain and France, and a French vitrification facility is still in operation. Vitrification technology was developed in Germany and refined in Japan. Vitrification operations are scheduled to open in the United States in 1998.

On 14 January 1997, the only remaining vitrification furnace at Mayak broke down, after having operated for twice its designed service. Plans call for constructing a second-stage vitrification facility with two furnaces-one as a stand-by. These are to be brought into service in 1998. Until then, the highly active liquid radioactive waste will be stored in reinforced concrete tanks at Mayak, as was done before the development of vitrification technology. In the meantime, the storage of the liquid waste is very dangerous, as in 1957, the explosion of a similar tank at the Mayak plant caused one of the most serious radiation accidents in the former Soviet Union. Of 20 million curies stored in that tank, about 90% of the activity was deposited near the explosion site, while the other 2 million curies formed a radioactive trace that contaminated 20,000 square kilometers (the eastern Urals radiation trace was 105 km long and 8 to 9 km wide, causing the evacuation of

10,800 people from the area). Taking into account the increased radiation danger and the lack of any contingency plan for the break-down of the vitrification furnace, Gosatomnadzor halted reprocessing of spent fuel at Mayak on 21 March 1997.
Although a portion of the medium active liquid waste generated as a result of spent fuel processing at Mayak is evaporated (10,000 cubic meters if the annual quantity of fuel reprocessed is 150-250 tons), the bulk of solution with a high sodium chloride content (16,000 cubic meters) is dumped into the shallow, marshy Lake Karachay. To nullify these dumpings, which have already totaled 120 million curies of liquid waste, a facility to reprocess the medium active liquid waste is under construction and the lake is being filled. Currently, however, Lake Karachay is one of the main sources of air contamination in the region. There is the possibility of a large-scale regional contamination if a tornado should happen to cross the surface of the lake. To eliminate the possibility of wind transferring radionuclides from the surface of the lake, it is necessary to fill in twelve more hectares. In addition, the ground water around the lake has already been contaminated (the so-called underground lens), and the annual filtrate escape of radioactive substances from the lake exceeds one million curies.
Low active liquid waste is sent to purification facilities and cleaned-up water is dumped into process bodies of water, the Techensky cascade, the most unstable and potentially dangerous source of underground water contamination in the area of the Mayak plant. About 400 million cubic meters of contaminated water with total long-lived beta-active radionuclides activity of about 300 thousand curies have accumulated in this cascade of water reservoirs. The development of a drainless water system in the valley of the Techa river disrupted natural water drainage and resulted in the rapid filling of the final reservoir, where the level of the water table has reached a critical level. Because of the hydrostatic head the annual filtrate losses amount to as much as 10 million cubic meters. Another danger is the possibility of a breach in the final dam, which would lead to the dumping of more than 200 million cubic meters of contaminated water into the valley below. Combined with water and contaminated ground sediment the activity of about 215 million curies may enter the open hydrographic network of the Techa river.
So the fulfillment of military programs has created a very unfavorable ecological situation in the region around the Mayak plant, which remains a potentially dangerous source of environmental radioactive contamination. The estimated costs of damage from previous accidents and associated social and economic problems caused by the plant are $8.6 billion. Potential future accidents at the facility could have an impact greater than that of the Chernobyl catastrophe. Radiation security at Mayak is continuing to deteriorate despite considerable efforts by the plant's personnel. Without serious financial support from the Russian federal government it would be impossible to assure the radiological and environmental security of the region in the nearest future.

WHAT HAPPENS WITH SPENT FUEL TAKEN FROM THE RBMK-1000 AND VVER-1000 REACTORS?

The future of spent fuel from the RBMK-1000 reactors has not yet been determined. Owing to the low U-235 content of this fuel and the large stocks of energy-generating plutonium which can be extracted by reprocessing it, studies have concluded that its reprocessing is economically impractical, at least until 2010. The current strategy for managing this type of spent fuel is to place it in long-term storage, pending permanent burial in deep geological formations or possibly reevaluating the economics of

reprocessing it after 2010. Currently, about 6,000 tons of spent nuclear fuel from RBMK-1000 reactors with activity of 1 billion curies (as of 1 January 1995) is kept in storage pools at the Smolenskaya, Kurskaya, and Leningradskaya power plants, which are adjacent to large cities. The quantity of spent fuel at these plants increases annually by about 750 tons, so that by 2005 the storage pools at the plants will be filled to capacity and the reactors will have to be shut down. As a temporary measure, packed storage of spent nuclear fuel at these plants has been introduced. However, the accumulation of spent fuel in the storage pools of these plants is leading to a situation in which it will be impossible to unload the entire active zone of the reactor in case of an emergency, as safety regulations require.

A new RT-2 radiochemical plant located at the Mining and Chemical enterprise near Krasnoyarsk was to reprocess spent nuclear fuel from VVER-1000 reactors. The construction of the RT-2 plant began in 1984. The plant was designed to reprocess 1500 tons of spent nuclear fuel each year. However, in 1990 construction was suspended as a result of financial difficulties, and of the entire facility, only a storage area designed to hold 3,000 tons of spent fuel is in operation. This storage area is already filled to 30% of capacity. Spent fuel from VVER-1000 reactors is currently accumulating at the rate of 150 tons a year, and may increase with the development of new reactors. So even if new reactors do not enter service, the Krasnoyarsk storage facility will be filled to capacity by 2015. Some scientists want to complete the RT-2 plant, but many experts from Gosatomnadzor, in addition to ecological activists and other groups oppose the idea. Discussion of the issue should focus on formulating criteria to evaluate the advisability of finishing the plant. It would take an estimated $2.5 billion to complete the plant, of which about $400 million have already been spent.

While not a comprehensive listing, the following factors should be taken into consideration when deciding whether to finish the facility.

1) The dangers to human health and the environment: if the proposed plant increases these dangers, it should be cancelled even if it brings economic benefits. As demonstrated above, reprocessing spent nuclear fuel at the RT-1 plant has produced considerable quantities of medium and low active waste. In addition, about 950 kg of uranium oxide and several kilograms of highly active power-generating plutonium result from reprocessing a ton of spent nuclear fuel. If these products of reprocessing are not reused in a nuclear fuel cycle, they will become highly active nuclear waste. Only a thorough government ecological study of the proposed plant can asses the level of danger it would pose to human health and the environment.

2) Cost-effectiveness ratio: While the cost of the building the RT-2 plant is high, it was originally planned to offset these costs by accepting technically compatible foreign nuclear fuel for reprocessing. Potential contracts with South Korean, Japanese, German, and Swiss firms were considered. However, the delivery of spent nuclear fuel from these countries for reprocessing violates the Russian Federal Law on Environmental Protection, which prohibits the importation of nuclear waste for storage and burial. The Ministry of Atomic Energy (Minatom) managed to persuade President Yeltsin to sign a decree on 25 January 1995, which would allow the Krasnoyarsk Mining and Chemical enterprise to import spent nuclear fuel for reprocessing. But three Russian Greenpeace activists appealed this decree to the Russian Supreme Court, which overturned the provision allowing the import of spent nuclear fuel, as it contradicts the federal law cited above. As

a result, financing the plant by reprocessing spent fuel from foreign reactors is impossible. Furthermore, a full study comparing the costs of the open and closed fuel cycles has not yet been undertaken. In March 1995, the Interdepartmental Commission on Ecological Security of the Russian Federation Security Council held a meeting devoted to the problems of ecological security of the closed fuel cycle in the nuclear power industry. The commission concluded that no reliable ecological and economic data comparing the pros and cons of the closed and open fuel cycles had yet been gathered. It suggested that Minatom and other concerned departments and ministries should submit to the government estimates justifying an ecologically safe way to develop the nuclear power industry. At the present time, however, these estimates have not been completed.

3) Resolving the power-generating plutonium problem. What should be done with power-generating plutonium extracted from spent nuclear fuel during reprocessing? According to the US National Academy of Sciences, global plutonium stocks total 1600 to 1700 tons. More than 75% of this total is power-generating plutonium extracted from spent nuclear fuel, but not reused in a nuclear fuel cycle. It must be treated carefully as weapons-grade plutonium, and taking into account its long life, this will be necessary for more than 1,000 years! During this entire time, it will be necessary to maintain and improve the system of controls which makes it possible to account for plutonium stocks down to the level of a few grams. It would be easier if power-generating plutonium were not suitable for producing nuclear weapons, but recently declassified data from the United States shows that plutonium produced in a nuclear power plant was used in 1962 to create a nuclear explosive which was then tested. In addition, power-generating plutonium could also be used as a weapon by dusting it over the territory of an enemy. As a result, the production of power-generating plutonium raises non-proliferation issues.

4) Legal foundation for managing spent nuclear fuel. For forty years the operation of the nuclear power industry in the USSR was regulated only by departmental standards, regulations, and instructions, most of which were classified. Since 1989, the USSR Supreme Soviet and now the Russian parliament have prepared draft legislation on the nuclear industry. Of these drafts, only one Russian Federal Law on Using Nuclear Energy was adopted, in October 1995. It is necessary to pass legislation regulating the management of radioactive waste and spent nuclear fuel, which has a direct impact on public health and the environment. A draft law was proposed in 1992, and it has been debated in the Russian parliament but not yet adopted. Minatom opposes provisions of the law which would ban the burial of medium and highly active liquid waste; prohibit the storage of waste on the surface, and outlaw dumping of waste into natural or artificial bodies of water. The solution of all the problems related to spent nuclear fuel is complicated by the lack of necessary federal legislation.

The need to shut down power reactors because their service life has expired also poses serious questions. By 2020 hundreds of nuclear power stations will be taken out of service all over the world. In Russia more than 30 will leave service by that time. By 2001, the thirty-year service life of nine Russian nuclear power plants will expire. Between now and 2020, one or two nuclear power plants will be decommissioned in Russia each year. The decommissioning process is an object of concern for both financial and ecological reasons. For previous generations of nuclear power plants, removal was not envisaged at all. However, some standards and plans for dealing with the problem were worked out. There was an all-USSR program for putting in dead storage and burying the

equipment and steel structures of decommissioned nuclear power plants through 2000. However, in 1991, this program was terminated, and an equivalent Russian plan has not yet been developed. Only on 2 April 1997 did the Russian government pass a resolution "on financing the decommissioning of nuclear facilities, radiation sources, nuclear material storage points, radioactive substance and waste storage sites and R & D facilities." According to the resolution, a special fund to finance the decommissioning of such objects will be created. In addition, the relevant federal ministries are to submit to the government during 1997 a program for removing such objects from service through 2010.

What is the situation at Russian nuclear power reactors that have already been removed from service? At the moment, two reactors at the Beloyarskaya plant and two reactors at the Novovoronezhskaya plant have been shut down. At Beloyarskaya the shut-down reactors have been completely unloaded, and the spent nuclear fuel is stored in pools at the site. The work of examining, decontaminating, and disassembling the plant is underway. At Beloyarskaya's first unit the spent nuclear fuel is completely unloaded from the reactor, while at the second unit some fuel assemblies remain in the reactor, although most have been unloaded. 4,900 fuel assemblies are stored in pools at the site. A number of assemblies are no longer hermetically sealed, however, and there is direct contact between the uranium and the water, resulting in activity increasing by 1.6 times during the last three years. Many years have passed since Beloyarskaya's first unit was shut down in 1980, but preparations to dismantle it have not yet been completed.

Let's summarize our discussion of the problems of spent nuclear fuel reprocessing. Reprocessing at the RT-1 plant is halted. At the moment in Russia only the delayed open fuel cycle is being carried out and unreprocessed spent nuclear fuel is stored in temporary facilities at the nuclear power plants or in storage sites at the Mayak plant or the Krasnoyarsky Mining and Chemical enterprise. Regional storage facilities located at a distance from heavily populated areas have not been constructed. In October 1995, the Russian government approved a special federal program entitled "Radioactive Waste and Spent Nuclear Material Treatment: Utilization and Burial, 1996-2005. The program envisions creating a system of sites to bury and store radioactive waste and spent nuclear fuel and developing technology to solve the problems involved in treating the waste and spent fuel. However, in practice this program is not likely to be fulfilled soon, and at the current level of financing it would take decades to complete. In 1996, only about 37% of the funds budgeted for the R & D program and only about 20% of the funds budgeted for capital expenditures were actually disbursed. The priorities of the program are now dictated by budgetary constraints, and do not address all the real problems in the area. As a result, the whole intent of the program has been distorted. Overall, the level of radioactive security in Russia is decreasing, and in some regions-Chelyabinsk and the Kola peninsula (Murmansk oblast)-it has reached a critical point.

VIEWPOINTS

THE LACK OF CONTROL OVER RADIOACTIVE MATERIALS AT CUSTOMS

Nikolai Cherepanov, Department Head of the Urals Customs Administration of the RF State Customs Committee (SCC), describes to Yadernyi Kontrol's correspondent the difficulties faced by his administration*

Nikolai Cherepanov is convinced that only formal control, rather than real control, is being implemented at customs houses. Located on the territory of his administration are the Mayak Production Association, VNIITF in Snezhinsk, Lesnoy (Sverdlovsk-45), the Chepets Combine and military stores of nuclear materials which do not have direct contact with the customs workers since the Customs Administration controls 14 check points, 2 railroad crossings and 6 airports. In recent years (the service of the SCC replaced the Federal Border Service in 1995) no cases of nuclear materials smuggling have been observed. However, according to customs house representatives, such possibilities cannot be precluded, especially in the near future, due to technical shortcomings of the equipment and the low level of SCC personnel training.

In the opinion of Mr. Cherepanov, this situation is typical of many customs points, with the probably exception of the Moscow and Pulkov Customs Houses, which have been more or less provided with equipment (this concerns first and foremost the airlines). Thus, the customs officers of the Urals Customs Administration use the equipment left over from the Federal Border Service - SRPS-2, SRPS-2-01, SPR-68 and 78 search devices, PEN and "Polymaster" dosimeters and DBG-01-T totaling some 30 items, the so-called "crickets" and "nutcrackers" (a device which is a square panel of approximately 5 x 5 x 1 cm with three lights, one green, one yellow and one red. At normal background radiation levels, the green light flashes, at higher levels the yellow one flashes and at dangerous levels - the red one.). A device this primitive is not suited for serious precedents. However, even with this kind of service complications arise.

As for the three existing spectrometers for determining the level of enrichment, in order to work with them you need physicists competent in spectrometric analysis. There are not even any guidelines for the practical activities of the customs officers using the spectrometers. Moreover, not even these devices completely identify the isotope content. Nor is the "Yangar" system (produced in Dubna) satisfactory, which the SCC is proposing to use. Indeed, muses Dr. Cherepanov, there are several analogous systems which have undergone state attestation and have been used in production for some time. The systems are similar, but differ in terms of the base on which they operate. For example, the "Yangar" system can be "fooled" if you walk through it very slowly. During the processing of background radiation, the margin of error and the range of fluctuations will vary from one place to another. Other systems have managed to eliminate the unstable base, having changed the processing of background radiation.

Motor vehicle passageways do not have a stationary control system. In order to determine radioactivity using a dosimeter, it is necessary to stand in such a zone for not less than a minute. It is not possible for the operator of the dosimeter to stand in each spot for a minute in the case of short-term motor vehicle parking. In addition, any metal can set it off - i.e., is radioactive - and so the device would be going off constantly. There is no control along railway passageways. A train is stopped at the passageway for only 10 minutes, and in such a short time it is not even possible to walk the length of the train, let alone to monitor. However, the Railroad Ministry is making no move to change its schedules.

The area within the jurisdictionof the administration has only one external border, which is a water border. Once a year, a steamship arrives in the northern port of Igarka bringing all necessities. Despite the fact that smugglers would probably not have recourse to such means, the unlawful removal of fissile materials over the border is most likely to occur via

water routes, where control is the weakest. If a container is small in size, then it can easily be transported by train, a fact which can be confirmed by smuggling routes (as ascertained based on reports in the press). Mr. Cherepanov even put forth that the most possible method, in his opinion, would be the transporting of a radiation source (or fissile materials) in potash fertilizer. Potassium-40 gives off radiation, and therefore no one would pay any attention to the heightened radioactivity.

There is only one international customs house on the administration's territory, Koltsovskaya, which has five SRPS devices. These instruments go off "as they please" and during the course of a year there are more than 200 false alarms, so few people pay attention to their evidence. It is impossible to perform the necessary measurement verification. The directors sign out to themselves the devices that are handed out to rank-and-file customs employees and lock them up in the safe so that they are not lost or broken before being re-released. The same thing happens with the director's shift. According to the personnel's testimony, they held the devices in their hands one time only - i.e., when setting them. An all-too-typical situation for the customs houses is one in which the devices being set "beep", and so people turn them off in order to keep them from "beeping". But the SCC has no laboratories.

Customs personnel are not sufficiently knowledgeable, and young employees often either make omissions or overdo things (for example, they detain people who have been exposed to X-ray radiation). The average employee's salary is around 800 thousand roubles, and so the temptation is great during customs inspections - you can go through a customs inspection in one day, or it can take ten days. At the sites there are four people handling problems relating to fissile materials (at three customs houses, plus two people not working permanently in the administration). An order has been issued designating additional rates, but it is unclear whether or not this order will reach the local sites. Thus, last year two rates were switched over to other needs, since it is by far not only the SCC's departments for the prevention of nuclear materials smuggling which are ill equipped. On the other hand, if someone has been trained to work to prevent nuclear materials smuggling, then that is what that person should be doing, or else he will lose his qualifications. Thus, many trainees were switched over to other sub-departments and some left. In addition, cargoes from Kazakhstan with a natural uranium component come through five or six times a year, from "Mayak" radioactive materials pass through twice a month, and from the ElectrochemicalCombine - once per quarter. What should the customs officers be doing the remainder of the time?

The general inadequacy of customs officers' training also has its effect. In order to work with a professional-quality spectrometer (and it is proposed to have customs officers work with professional-quality instruments), five or six years of special spectrometric training are required, but no one is supplying customs houses with simpler, less unwieldy devices. Existing textbooks are also complicated and overstocked with formulas. Customs employees can make do with self-sufficiency courses - i.e., someone explains to them, without formulas, what an abnormal situation is and how to cope with it, how to monitor radiation and how to use the devices. They have their own methods, and the Personnel Education Department does the training. Experts from the Urals Branch of the Academy of Sciences assist with determining the materials, and the VNIITF is also offering its services - they are proposing to create a customs post on VNIITF territory, where customs processing can be carried out. However, in Mr. Cherepanov's opinion, it would be

considerably better for employment levels in this city if a testing center were to be established on the basis of VNIITF, which would prepare and test standard samples of fissile materials for the monitors. This Institute is in a position to develop standard models from spectroscopy.

The policy with which the SCC armed itself, according to Mr.Cherepanov, was introduced too rapidly and should now be reviewed. For example, there is not point in placing a special unit for determining alpha-, beta- and gamma-ray levels at a pedestrian crossing, since people are hardly likely to be carrying radioactive materials around in their pockets and the unit is very expensive. A metal detector could be set up at the crossing that had been designed for the minimum potential mass corresponding to the smallest container.

Mr. Cherepanov maintains that the multitude of functions relegated to the customs services are causing major complications in its work. He states that the SCC is performing functions which really belong to the State Committee on Atomic Power Oversight, the Sanitary and Epidemiological Oversight Agency, the Ministry of Emergency Situations, Ministry of Foreign Affairs and the Federal Security Service. The SCC should not be involved in eliminating the consequences of radiation pollution in the event of unauthorized shipment of radioactive materials or searching for appropriate repositories for confiscated materials. Moreover, only the State Committee on Atomic Power Oversight and Minatom know which facilities have been accredited as isotope repositories and when their storage period end. Ideally, the Ministry of Foreign Affairs should handle security, the FSC - the causes underlying nuclear smuggling and the ways in which it occurs, the State Committee on Atomic Power Oversight - clarification as to whether or not containers are being used lawfully and the development of norms, and the Sanitary and Epidemiological Oversight Agency - the decontamination of localities. For the time being, there is no inter-ministerial coordination, and interaction takes place only on the level of personal contacts.

Fundamental violations are still being discovered at the level of document verification. Naturally, the major difficulties here are related to dual use materials - they cannot be checked against documentation.

The customs union, according to Mr. Cherepanov, destroyed the normative base that was so long in the building, and the internal boundaries of the customs union are the greatest concern, since they are an "open field" for smuggling. Customs officers are still collecting information about the transporting of cargoes, especially those generating suspicion within the customs union, and in the event of the transit of nuclear material they send a telegram stating how much radioactive material will be arriving and in what container. However, the data still remain unasked-for. The most complicated border is the one with Kazakhstan (Kurganskaya Customs House). Despite the many notices in the press concerning the smuggling of uranium from the combine in Ulbinsk, according to the administration head the main problem is the illegal flow of drugs coming out of Kazakhstan. It is difficult to transport fissile materials, no one's going to buy half a gram of plutonium anyway, and you would have to be moving a shipment of goods, which is costly, complicated in terms of services and cumbersome. In response to the question of how classified enterprises are guarded and whether or not it would be easy to take something out of them, Nikolai Cherepanov cited the example of Lesnoye (which also sells dual use materials and tritium in neutron tubes. These materials are passing in large volumes through the Nizhetatil

Customs House): during the dismantling of a warhead, a small part (2 x 5 mm) containing plutonium was lost. Production was halted for two weeks, until the part was found.
Most frequently of all, people are stopped at customs if they don't have a transit permit or if the transportation category assigned to the container doesn't correspond to the actual background radiation. Difficulties are also caused by the high likelihood of one material being transported in the guise of another. There have only been a few instances of the unlawful import and export of radioactive materials: at the beginning of 1997, zirconium was seized at the Chitinsk Customs House which had been stolen from the Chepets Combine. In 1997, while checking a cargo from Mayak, a customs officer noticed that the prices of containers being returned and delivered to an enterprise of the Emf Shan company did not conform to one another. During the check to see whether or not there had previously been instances of collusion between the customs house and the enterprise, the containers were opened. Instead of five radiation sources, 10 were found, and the material being transported did not correspond to that specified in the declaration.
On two other occasions could it be said that the material undergoing customs control was not what was declared. In 1994, for example, certain documents concerned the transporting of cobalt. However, one of the containers was designated for transporting iridium. In actuality, documents place no requirements upon containers, but it is often at this stage of processing "on paper" that smugglers can be apprehended.

INTERVIEW
Eleron" Scientific and Production Association General Director Yevgeni Mishin responds to the questions of Yaderny Kontrol correspondent*
"THE REPORTS OF POOR NUCLEAR MATERIALS SECURITY IN THE NAVY ARE NO EXAGGERATION"

"Eleron" Specialized Scientific and Production Association had its 35th anniversary in March of 1997. What has changed over these years?
Large-scale scientific and production associations have gradually grown out of the first small laboratory. We created the entire industry for developing technical means of guaranteeing security. Over these 35 years, more than 4.5 thousand of the most important facilities have been equipped, including those of the Ministry of Defense, the FSC (KGB), the Ministryof Finance and the Ministry of Nuclear Industry. We have also provided equipment for 14 thousand kilometers of the state border. I can proudly say that there are no major state facilities whose physical protection systems have not involved "Eleron".
"Eleron" is now working with the Kurchatov Institute Russian Scientific Center, "Mayak" Production Association, VNIITF (Snezhensk), ITEF Russian Scientific Center, NIKIET SF, the Siberian Chemical Combine, the Novosibirsk Chemical Concentrate Plant and the United Institute for Nuclear Research.
At the Kurchatov Institute, work has been done for the design, manufacture and delivery of equipment, for assembly and repair, for training of personnel and for putting buildings 114, 116 and 128 into use. Work is underway on building 106. In 1997, we hope that the Siberian Chemical Combine will be equipped. However, the work to improve physical protection systems, in conjunction with American laboratories, is being done very slowly. At the present time, financing is being channeled primarily into the development of a

conceptual plan or feasibility study and into the drafting of technical structures, but not enough is being done to improve particular facilities and units.

Both foreign and Russian experts recognize the high quality of the equipment developed by "Eleron". When the Americans, who had been dissatisfied with the models shown at the last exhibit, admired the additional work accomplished over the year, your people just laughed - everything had been done over the course of two months, not one year. But how are your systems implemented at actual facilities, primarily those of the Ministryof Defense, given the obvious lack of financing in this sector?

When means of technical security were being developed and there was adequate financing, we provided equipment to protect the facilities of the former Ministryof Medium Machine-Building (now Minatom) from perpetrators of external theft. Now we must give heed primarily to protection against internal theft. Furthermore, after a quarter of a century of use, the equipment is aging and needs to be replaced. We will, of course, replace it, and our plants, ministries and institutes are seeking the funds to do so. Our center devotes much attention to these issues. But we have proven that our equipment not only meets international standards, it exceeds them. For example, the "Protva-4", the "MSV-2", perimeter sensors and gateways (so that fissile materials cannot be taken out and weapons cannot be brought in), among many other items. The equipment is manufactured through assembly-line production. The used equipment at hundreds of facilities has proven to be extremely sturdy, and the Americans have agreed to a certain level of financing given the installationof Russian equipment. This plan is currently underway, albeit only at a dozen or so facilities:

8 % (of total work volume for 1997) consists of budget financing, while 4-5% of financing comes from the United States. There is a laboratory we are jointly running with the Americans for the creation of physical protection systems to be used during the transport of nuclear materials by railroad, and we are now working together with them to make equipment for use during motor vehicle transport and on other projects. We are also earning our own money by providing equipment for a large number of facilities, first and foremost those of the Ministry of Finance, NPPs, the facilities of the Central Bank, repositories and the facilities of the Ministry of Defense, where we have direct agreements on R & D. We also have agreements with the Ministry of Defense and the border guards, and this is the total financing that we receive.

We pay salaries on time. The average salary at "Eleron" is 1,200,000 roubles, while designers and valuable researchers make between 1,500,000 and 1,600,000. In the cafeteria, we pay for 60% of each employee's lunch.

Does the Ministry of Defense pay for its orders?

As a rule it does, although sometimes it is late. It is true, though, that the border guard service currently owes us 6 billion roubles. We were supposed to have put this money into circulation, since our R & D is done primarily using profits. We create technical security and safety instruments on the basis of various physical principles - seismic, acoustic, microwave, ultrasound, vibration, capacity and so forth. It is important that the facilities' security systems, especially at the border and along extended boundaries, be able to distinguish between people and animals, and we have learned how to do this.

In general, it is very important for a security department to operate reliably, not to give any false alarms and to offer a high degree of likelihood of discovery. In our case, these figures are in the area of 100%. However, the fewer false alarms there are, the less

sensitive the equipment may be - this is the difficulty. What is most important is for the degree of likelihood of discovery to be high (in our case, it is very high), with a minimum number of false alarms. We have equipment that allows no more than one false alarm to occur every six months.

Have there been instances in which your equipment reacted to the removal of fissile materials?

Yes, there have been instances in which our equipment reacted to the passage of uranium and sounded the alarm. We have never had any cases of plutonium theft, because the buildings and structures in which nuclear materials are kept are protected. No one can get around them, since the equipment will send an alarm to this center, which is then duplicated at another level. It is impossible to get around the alarm signal or to eliminate it. The lines between the sensor and the information processing center are protected. Not even the person who developed, designed and equipped the system can de-block it. Hence the highly reliable security. Attempts at evading the equipment have been made, but nothing has ever managed to be taken out. The equipment is made by one group of experts, designers and scientists, and there is a laboratory where they check its operation and try to evade it. For entire days it is left running and is monitored by other equipment.

Who are your main competitors?

We don't have any real "competitors", since the development of these other companies is not grounded in an industrial base. Moreover, they use outside contractors. We have a staff numbering in the thousands and three institutes, in addition to which forty-four enterprises in the sector operate according to our documentation.

I draw the conclusion that we must not allow commercial structures access to hazardous nuclear facilities.

As the designer, you are in the best position to know the shortcomings of your equipment.

While we have very high-quality sensors and systems and superior perimeter units for any type of facility, control and accounting of people, control over the removal of nuclear materials, metals and people on the territory of the facility, we have a serious need for sound locking and bolting devices, we do not have enough special units for stopping cars at control and check points and preventing break-ins. We would like to become involved in this, because the Ministry of Internal Affairs has specialists who work on these problems. We obtain these devices at the Ministry of Internal Affairs. One other thing we have not succeeded in doing is producing good television systems. Our television systems are considerably lagging behind their foreign counterparts. In my opinion, the basic equipment for military facilities should be strictly Russian-made - and this goes for all systems, including television systems.

Could you describe the ways in which you cooperate with the other ministries?

As early as the 1960s, our enterprise was designated as the head enterprise for the creation of security systems for Minatom and for the former KGB. It then expanded and became the leader for the USSR. In 1993, "Eleron" was made the head organization for the creation of equipment and technical means of security, and by ministerial order it became the head organization here at the ministry.

The enterprise was founded for Minatom, the KGB and the Ministry of Defense, and our cooperation continues. On the other hand, now there is no financing. The financing for these ministries themselves has been severely cut, and so the ties have weakened

somewhat. Yet we are still in contact with the border guard service, we define technical tasks jointly with them and with the FSB. The KGB, the border guard service, the Ministry of Defense and 50 ministerial and academic scientific research institutes in the former USSR were all involved in the creation of our equipment. I obtain the base components from various enterprises of the other ministries, but they were made at our request and in accordance with our requirements, generally in conjunction with the requirements of the Ministry of Internal Affairs.

It is the troops of the Ministry of Internal Affairs which guard us, and "Eleron" designs equipment as per their specifications and assists with the operation thereof. We devote a great deal of attention to training people: our ministry has departments where training is held for experts from the armed forces, the Ministry of Internal Affairs and all those who operate our equipment at sites. We also train them at "Eleron". We act according to the principle: create a good project, apply the very best equipment for a particular object in this project, do the assembly and the adjustments, train people to operate the equipment and then offer services.

We are cooperating with the headquarters of the Head Committee of the Navy and the Kurchatov Institute. Not long ago we developed a large-scale program for equipping naval facilities.

Could you tell us which facilities you have already equipped?

I can show you any kind of equipment, but where I installed it and how I arranged the technical security elements are secrets of the enterprise in question.

Apart from the railroad shipments you mentioned, are there other sea or air shipments?

We have not yet shipped nuclear materials by plane. Insofar as railroad shipments are concerned, even in the time of the USSR we had a lot of work, but then we didn't have enough money so we stopped those shipments. Now we have concluded a contract with the U.S. Department of Energy and have completed the first stage. We have shown the Americans and sixty representatives of our facilities what we did in an actual railcar in a real situation. The car needs to be mechanically fortified, so that transgressors cannot destroy it. This was done by our ministry at "Atoll" KB. If something has happened inside the car, once the alarm goes off the control point should be able to see what is going on, and this requires satellite communications. If there has been an attack, then the security system safeguarding this railcar along its route is protected and withstands the attack as long as it can, while we need to react immediately with reserve forces from among the troops deployed in the vicinity in order to catch the perpetrators and maintain the integrity of the cargo being shipped.

In order to accomplish this, we use any and all measures: there are substances that release smoke, thereby reducing visibility, and noise attacks that leave people paralyzed for long periods of time. We now have computer simulations of all these cases, and can detain a transgressor for up to two hours - during which time we will be able to assist the security accompanying the cargo. We have also developed equipment for collecting information. The security system can always signal for help, but we can already see what the system is doing.

Once we finish this stage, we will begin solving the problems relating to motor vehicle shipments. This second step will be easier, although there will still be some difficulties. Thus, we address comprehensive tasks: firstly, providing a facility, nuclear reactor or fissile materials with a reliable physical protection system, and secondly, transportation.

The cargo needs to be taken from the facility being protected, loaded onto the railcar, brought safely to its destination, and then unloaded. This problem will soon be resolved, given our cooperation with American laboratories. For the time being, the means of protection for shipments have not been installed.

But the rolling stock has aged...

We are not going to install our equipment into obsolete railcars. New railcars are being made by order of the ministry. Do not think that dangerous cargoes are going to be transported in worthless railcars with high-quality equipment. No, both the railcars and the physical protection system will be sound.

How is your cooperation with the CIS ? Are there other companies working on the problems of physical protection in the CIS ?

We work primarily in Russia. Within the framework of the CIS, cooperation has essentially been halted. Potential clients from Ukraine and Belorussia ask me, "Can you make us physical protection systems?" But then they fall silent - clearly, they don't have any money. Ours are not goods for common consumption. These are military products, and so naturally they are somewhat expensive.

So in other words, no one in the CIS is handling physical protection for facilities?

I think that in the CIS there are only a few "loners" working in this area -and not very seriously, at that - because there are no requests. Apparently there has been a great deal of decline in this respect.

Do you often install custom-made, high-cost equipment, only for soldiers to simply end up breaking it, on purpose or by accident, because they don't know how to use it? On the Russo-Estonian border, when your employees installed the equipment, they were immediately told that the most important thing was to teach them how to disconnect it. And they did in fact disconnect it after several false alarms. The control panel had chewing gum stuck on it, and they used it to put out their cigarettes...

When we install equipment, we train the personnel how to operate it: turning it on, turning it off, and more. But the equipment is never turned off. If operated correctly, it functions reliably. There can be incidents for various reasons - it could be due to incorrect utilization or because a mistake was made in the design or the assembly - but this does not mean that the entire unit has to be shut down. So they call our experts, who deal with the defects, do on-site repairs or replace the motor... In this respect, every facility always has reserve equipment.

The military prefers human security guards to equipment - its more reliable and less expensive.

We went through all of this upheaval a long time ago. Thirty years ago things were very difficult for us, but then the position of Deputy Head of Staff for Technical Means was created, or special officers for dealing with this equipment. We use to provide continuing education for these officers on a regular basis, but now we do so less frequently. There are even warrant officers on contract. The psychology of the security guards has long since changed. For the first ten years, no one believed in technical means of security. They believed in soldiers and in seals. If they came and saw that the seal was intact, then everything was in order, and no one bothered about the fact that someone might have come down through the ceiling, or up through the floor or in through the window.

Once again, these days the thinking has changed. Many facilities have already been equipped, and all of the officers and the classified services couldn't live without this

equipment. Over hundreds of thousands of electronic sensors are operating in the security systems of the ministries. If all of these sensors were disconnected on the same day, imagine how many divisions would be required in order to guard the main facilities! Thanks to the installation of technical means of security, the large number of people has been reduced. People are now better-informed, they understand the equipment, can appreciate it and take care of it. Equipment should be the mainstay of a service, while soldiers and security guards are only a small group, depending on the facility. When the strategy is developed, the group is determined which, in the event of an alarm, could get to the location from which the alarm came within two to three minutes.

Does it often happen that there are gateways at the entrance and the exit and security - but there's a hole in the fence, so the employees swipe whatever will fit through the hole ?

We guard the perimeter with technical means of security: you can neither jump over it, nor break through it, nor dig underneath it. The alarm reacts to all movements. Fissile materials cannot be brought through the entryway, because the alarm will go off, the gateway will close and the person in question will be detained until security guards arrive in response to the alarm. There may well be holes in certain places, but after all, the buildings themselves are also being guarded. In the buildings there are appropriate units for storing fissile materials. A multi-boundary system is being built - that is, three or four equipment boundaries, with it all leading to a unified security center. I therefore cannot imagine that there would be such holes at our ministry's enterprise.

Yet materials continue to be taken out. What is generally being removed?

There was a period of time when people were not getting their money, and so they thought, "Well, I'll just take some uranium, it doesn't even have to be enriched uranium, and sell it." Of course, there were also cases in which people were provoked into stealing, and naturally they didn't get to take the uranium out and they were stopped. The sensors stopped them at the exit as they were taking it out. Now such people have understood that no one will buy the uranium from them, and that it's not as simple as all that, i.e., I'll just take some uranium and sell it on the market.

But the possibility cannot be excluded that if theft of fissile materials does not in fact occur, it could well be done by experts, people who understand how to make an atomic device. This is why we ascribe such tremendous significance to the issue of physical protection. This is not an area for skimping on costs. Facilities need serious protection, because if a few kilograms of plutonium or uranium are taken out, there can be very serious damage to the area or territory in question.

When there were wild attempts, they were on the part of people who did not understand and who simply wanted to make some money. This is not serious. But if such an attempt is planned and organized, if nuclear material to be taken out and sold to a particular customer - and one cannot preclude this possibility - then this is serious.

This is the very reason why we are constructing such a physical protection system, so that nothing will be taken out. Indeed, this is the point of physical protection: protection against internal and external theft which is differentiated to match a particular facility yet integrated, so that there is accounting and control of people and so that a person who is authorized to be in a particular place or facility is only there in person, himself and no one else. Only two or three people can open the premises (if there are two, then they work with different codes in order for there to be no collusion).

The accounting and control of materials are tasks for other institutes. Two institutes are involved in accounting and control: the institute at Arzamas-16 (VNIIEF) and the Obninsk Physics and Power Engineering Institute. Thus, if there is an attempt to take materials over the threshold and off of the premises, then I must discover this material, the security must react immediately and the security booth must detain this person right away. However, in the process of accounting, control and physical protection, we cooperate amongst ourselves. There is a Security Department at Minatom (director - Vladimir Bogdanov) which handles the organization, cooperation and overall ideology behind the establishment of a high degree of accounting and control. In 1995, an order was issued at the Ministry of Atomic Energy, signed by the minister, for the purpose of regulating the performance of work for the physical protection of nuclear facilities, reactors and materials at the Minatom of Russia. In accordance with the order, VNIIEF (director - Radii Ilkaev) spearheads the scientific and methodological work to ensure the accounting and control of nuclear materials. The Central Scientific Research Institute of Atomic Information renders legal and informational services relating to the system for accounting and control of nuclear materials, VNIIA (director - Yuri Bormakov) handles equipment-related services for the accounting and control of nuclear materials, VNIINM (director - Mikhail Solonin) and the Physics and Power Engineering Institute (director - Anatolii Zrodnikov) provide methodological services for assessing the accounting and control system for nuclear materials. "Eleron" is the scientific and production leader providing for the physical protection of nuclear and radiation-related facilities, nuclear reactors and materials during their production, utilization, processing, storage and transport and for the organization of physical protection using technical means, to include development, manufacture, design, installation and certification, as well as the functions of the head organization in relation to this problem of the given sector.

It is said that during cooperation with the United States, there are leaks of sensitive information.

Insofar as our facilities are concerned, we are working productively, especially with specialists from the national laboratories of the U.S. Department of Energy. We understand what information they can give us and what information we can give them. Neither of us will supply the other with sensitive information. We are working with equipment which in and of itself is sensitive, but only once it is known at which facility the equipment is located. The equipment is not secret. Of course, every piece of equipment has its own know-how, whichwe cannot share because it is an achievement of our specialists. Nor do the Americans require this of us, they are behaving very well with us. I have not noticed one single instance of digging for or attempting to learn sensitive information in regard to security equipment or security alarm systems. Both sides are being very open, where such is possible. I have been to American facilities and polygons, they showed me everything and explained everything to me and answered my questions. Holding on to know-how and not disclosing it are in the interest of our experts.

The Americans could offer such specialists big money.

We have a disciplined workforce. Staff members are selected over decades, and there are classified units so everyone knows what can be said and what cannot be said. The most valuable asset of any enterprise is its staff. We send people to the United States and to other countries, but they know how to keep secrets.

The equipment you showed at the exhibit of the international conference on accounting, control and physical protection of nuclear materials, held in Obninsk in March, is not everything that you make, and they weren't even the most recent models.
Some of the equipment is indeed of a certain age, even though there are also the most recent models.
But there is also equipment which must not be shown at such exhibits. It is to be applied in other cases - when guarding boundaries, borders and facilities that are of especial importance.
We also handle the protection of personal information there, and there is a large sub-department to guarantee the security of the flow of information from audio fluctuations into electric power fluctuations using electronic radio units.
We hope that "Eleron" will continue to expand, and that the number of orders for the creation of physical protection systems will increase.
MISHIN Evgeni Trofimovich - General Director of "Eleron" State Enterprise Scientific and Production Association of Minatom since 1989 (1963-1989 - deputy head of the Main Administration of the Ministry of Medium Machine-Building), doktor of technical sciences, twice awarded the USSR State Prize, graduated from Budenny Military Academy of Communications, signaler, author of over 20 scientific works dealing with issues concerning tactical and technical provisions for the security of important state facilities.

Nikolai Cherepanov is convinced that only formal control, rather than real control, is being implemented at customs houses. Located on the territory of his administration are the Mayak Production Association, VNIITF in Snezhinsk, Lesnoy (Sverdlovsk-45), the Chepets Combine and military stores of nuclear materials which do not have direct contact with the customs workers since the Customs Administration controls 14 check points, 2 railroad crossings and 6 airports. In recent years (the service of the SCC replaced the Federal Border Service in 1995) no cases of nuclear materials smuggling have been observed. However, according to customs house representatives, such possibilities cannot be precluded, especially in the near future, due to technical shortcomings of the equipment and the low level of SCC personnel training.
In the opinion of Mr. Cherepanov, this situation is typical of many customs points, with the probably exception of the Moscow and Pulkov Customs Houses, which have been more or less provided with equipment (this concerns first and foremost the airlines). Thus, the customs officers of the Urals Customs Administration use the equipment left over from the Federal Border Service - SRPS-2, SRPS-2-01, SPR-68 and 78 search devices, PEN and "Polymaster" dosimeters and DBG-01-T totaling some 30 items, the so-called "crickets" and "nutcrackers" (a device which is a square panel of approximately 5 x 5 x 1 cm with three lights, one green, one yellow and one red. At normal background radiation levels, the green light flashes, at higher levels the yellow one flashes and at dangerous levels - the red one.). A device this primitive is not suited for serious precedents. However, even with this kind of service complications arise.
As for the three existing spectrometers for determining the level of enrichment, in order to work with them you need physicists competent in spectrometric analysis. There are not even any guidelines for the practical activities of the customs officers using the

spectrometers. Moreover, not even these devices completely identify the isotope content. Nor is the "Yangar" system (produced in Dubna) satisfactory, which the SCC is proposing to use. Indeed, muses Dr. Cherepanov, there are several analogous systems which have undergone state attestation and have been used in production for some time. The systems are similar, but differ in terms of the base on which they operate. For example, the "Yangar" system can be "fooled" if you walk through it very slowly. During the processing of background radiation, the margin of error and the range of fluctuations will vary from one place to another. Other systems have managed to eliminate the unstable base, having changed the processing of background radiation.

Motor vehicle passageways do not have a stationary control system. In order to determine radioactivity using a dosimeter, it is necessary to stand in such a zone for not less than a minute. It is not possible for the operator of the dosimeter to stand in each spot for a minute in the case of short-term motor vehicle parking. In addition, any metal can set it off - i.e., is radioactive - and so the device would be going off constantly. There is no control along railway passageways. A train is stopped at the passageway for only 10 minutes, and in such a short time it is not even possible to walk the length of the train, let alone to monitor. However, the Railroad Ministry is making no move to change its schedules.

The area within the jurisdictionof the administration has only one external border, which is a water border. Once a year, a steamship arrives in the northern port of Igarka bringing all necessities. Despite the fact that smugglers would probably not have recourse to such means, the unlawful removal of fissile materials over the border is most likely to occur via water routes, where control is the weakest. If a container is small in size, then it can easily be transported by train, a fact which can be confirmed by smuggling routes (as ascertained based on reports in the press). Mr. Cherepanov even put forth that the most possible method, in his opinion, would be the transporting of a radiation source (or fissile materials) in potash fertilizer. Potassium-40 gives off radiation, and therefore no one would pay any attention to the heightened radioactivity.

There is only one international customs house on the administration's territory, Koltsovskaya, which has five SRPS devices. These instruments go off "as they please" and during the course of a year there are more than 200 false alarms, so few people pay attention to their evidence. It is impossible to perform the necessary measurement verification. The directors sign out to themselves the devices that are handed out to rank-and-file customs employees and lock them up in the safe so that they are not lost or broken before being re-released. The same thing happens with the director's shift. According to the personnel's testimony, they held the devices in their hands one time only - i.e., when setting them. An all-too-typical situation for the customs houses is one in which the devices being set "beep", and so people turn them off in order to keep them from "beeping". But the SCC has no laboratories.

Customs personnel are not sufficiently knowledgeable, and young employees often either make omissions or overdo things (for example, they detain people who have been exposed to X-ray radiation). The average employee's salary is around 800 thousand roubles, and so the temptation is great during customs inspections - you can go through a customs inspection in one day, or it can take ten days. At the sites there are four people handling problems relating to fissile materials (at three customs houses, plus two people not working permanently in the administration). An order has been issued designating

additional rates, but it is unclear whether or not this order will reach the local sites. Thus, last year two rates were switched over to other needs, since it is by far not only the SCC's departments for the prevention of nuclear materials smuggling which are ill equipped. On the other hand, if someone has been trained to work to prevent nuclear materials smuggling, then that is what that person should be doing, or else he will lose his qualifications. Thus, many trainees were switched over to other sub-departments and some left. In addition, cargoes from Kazakhstan with a natural uranium component come through five or six times a year, from "Mayak" radioactive materials pass through twice a month, and from the ElectrochemicalCombine - once per quarter. What should the customs officers be doing the remainder of the time?

The general inadequacy of customs officers' training also has its effect. In order to work with a professional-quality spectrometer (and it is proposed to have customs officers work with professional-quality instruments), five or six years of special spectrometric training are required, but no one is supplying customs houses with simpler, less unwieldy devices. Existing textbooks are also complicated and overstocked with formulas. Customs employees can make do with self-sufficiency courses - i.e., someone explains to them, without formulas, what an abnormal situation is and how to cope with it, how to monitor radiation and how to use the devices. They have their own methods, and the Personnel Education Department does the training. Experts from the Urals Branch of the Academy of Sciences assist with determining the materials, and the VNIITF is also offering its services - they are proposing to create a customs post on VNIITF territory, where customs processing can be carried out. However, in Mr. Cherepanov's opinion, it would be considerably better for employment levels in this city if a testing center were to be established on the basis of VNIITF, which would prepare and test standard samples of fissile materials for the monitors. This Institute is in a position to develop standard models from spectroscopy.

The policy with which the SCC armed itself, according to Mr.Cherepanov, was introduced too rapidly and should now be reviewed. For example, there is not point in placing a special unit for determining alpha-, beta- and gamma-ray levels at a pedestrian crossing, since people are hardly likely to be carrying radioactive materials around in their pockets and the unit is very expensive. A metal detector could be set up at the crossing that had been designed for the minimum potential mass corresponding to the smallest container. Mr. Cherepanov maintains that the multitude of functions relegated to the customs services are causing major complications in its work. He states that the SCC is performing functions which really belong to the State Committee on Atomic Power Oversight, the Sanitary and Epidemiological Oversight Agency, the Ministry of Emergency Situations, Ministry of Foreign Affairs and the Federal Security Service. The SCC should not be involved in eliminating the consequences of radiation pollution in the event of unauthorized shipment of radioactive materials or searching for appropriate repositories for confiscated materials. Moreover, only the State Committee on Atomic Power Oversight and Minatom know which facilities have been accredited as isotope repositories and when their storage period end. Ideally, the Ministry of Foreign Affairs should handle security, the FSC - the causes underlying nuclear smuggling and the ways in which it occurs, the State Committee on Atomic Power Oversight - clarification as to whether or not containers are being used lawfully and the development of norms, and the Sanitary and Epidemiological Oversight Agency - the decontamination of localities. For the time

being, there is no inter-ministerial coordination, and interaction takes place only on the level of personal contacts.
Fundamental violations are still being discovered at the level of document verification. Naturally, the major difficulties here are related to dual use materials - they cannot be checked against documentation.
The customs union, according to Mr. Cherepanov, destroyed the normative base that was so long in the building, and the internal boundaries of the customs union are the greatest concern, since they are an "open field" for smuggling. Customs officers are still collecting information about the transporting of cargoes, especially those generating suspicion within the customs union, and in the event of the transit of nuclear material they send a telegram stating how much radioactive material will be arriving and in what container. However, the data still remain unasked-for. The most complicated border is the one with Kazakhstan (Kurganskaya Customs House). Despite the many notices in the press concerning the smuggling of uranium from the combine in Ulbinsk, according to the administration head the main problem is the illegal flow of drugs coming out of Kazakhstan. It is difficult to transport fissile materials, no one's going to buy half a gram of plutonium anyway, and you would have to be moving a shipment of goods, which is costly, complicated in terms of services and cumbersome. In response to the question of how classified enterprises are guarded and whether or not it would be easy to take something out of them, Nikolai Cherepanov cited the example of Lesnoye (which also sells dual use materials and tritium in neutron tubes. These materials are passing in large volumes through the Nizhetatil Customs House): during the dismantling of a warhead, a small part (2 x 5 mm) containing plutonium was lost. Production was halted for two weeks, until the part was found.
Most frequently of all, people are stopped at customs if they don't have a transit permit or if the transportation category assigned to the container doesn't correspond to the actual background radiation. Difficulties are also caused by the high likelihood of one material being transported in the guise of another. There have only been a few instances of the unlawful import and export of radioactive materials: at the beginning of 1997, zirconium was seized at the Chitinsk Customs House which had been stolen from the Chepets Combine. In 1997, while checking a cargo from Mayak, a customs officer noticed that the prices of containers being returned and delivered to an enterprise of the Emf Shan company did not conform to one another. During the check to see whether or not there had previously been instances of collusion between the customs house and the enterprise, the containers were opened. Instead of five radiation sources, 10 were found, and the material being transported did not correspond to that specified in the declaration.
On two other occasions could it be said that the material undergoing customs control was not what was declared. In 1994, for example, certain documents concerned the transporting of cobalt. However, one of the containers was designated for transporting iridium. In actuality, documents place no requirements upon containers, but it is often at this stage of processing "on paper" that smugglers can be apprehended.

SUMMARIES OF ARTICLES SELECTED FROM MONTHLY RUSSIAN-LANGUAGED ISSUES OF YADERNY KONTROL

No 25, January 1997
North Korea's nuclear missile policy has led to a sharp deterioration in the present crisis on the Korean Peninsula. In detailing the history of the DPRK's nuclear missile program, Vladimir Belous discusses the country's overall development. Being ranked fourth in the world in its number of armed forces, North Korea, nevertheless, plays no visible role on the global scene and finds itself practically isolated politically as well as economically This is why Kim Il Sung was pinning his hopes on increasing North Korea's international status by developing his country's nuclear power program. The article focuses special attention on North Korean attempts to disregard the Non-Proliferation Treaty. Since the Treaty has been in effect, North Korea has been the first country to threaten not to adhere to the Treaty. If their threat were to be implemented, it would deal a serious blow to the idea of nonproliferation. Analysis of North Korean activity in the nuclear area shows that its program of works is aimed at the development of a plutonium warhead. Such a path of nuclear weapons development allows hidden accumulation of fissile materials, but creates serious difficulties in the manufacturing of a nuclear warhead. The author believes that the North Korean nuclear program has not yet spoken its final word on the subject, which might force the international community to return to the Russian proposal to convene an international conference with the participation of the USA, Russia, China, Japan and both Koreas, as well as representatives of the UN and the IAEA, which will provide for the development of measures intended to strengthen peace and harmony on the Korean Peninsula, adherence to the nonproliferation program, and step-by-step rapprochement and reunification of North and South Korea.

Yuri Volodin and Alexander Sanin, from the Department of MC&A of the Russian Gosatomnadzor (Federal Nuclear and Radiation Safety Authority of Russia), write about nuclear proliferation, countries which have the potential to develop nuclear weapons, and ways to prevent proliferation. The world is a witness to the process of nuclear energy development, which carries the potential danger of the accumulation of nuclear materials, especially weapons-grade plutonium. Since the plutonium extracted from used nuclear reactors fuel is essentially weapons-grade, there is a serious potential threat of the proliferation of nuclear weapons. Analyzing the components of the nonproliferation program, the authors come to the conclusion that IAEA inspections represent only one component of the nonproliferation program control, but this, as experience with Iraq has shown, is not a sufficiently effective measure for detecting undeclared nuclear activity. They believe that the major role in the reinforcement of the nonproliferation program should be played by respective government structures and, first and foremost by national control agencies (this relates primarily to export control, accounting and control of nuclear materials and to their physical protection). An important measure to prevent nuclear proliferation will be the implementation of the "93+2" program to reinforce guarantees. The program's major goal is the development of a solid technical, legal and financial basis to reinforce and increase the effectiveness of guarantees by extending of the IAEA's scope to include information on the nuclear activity of states, development of new technical means of control over nuclear activity, extension of cooperation with government system of nuclear materials accounting and control, introduction of new technologies, and implementation of surprise inspections at nuclear facilities. It is also necessary to develop further methods to provide a wide range of indicators, both direct and indirect, which, with

the help of custom-developed equipment, will make it possible to implement effective controls for determining the nature of the nuclear activity of any country.

Igor Khripunov, Associate Director of the Center for International Trade and Security of the University of Georgia, proposes paying special attention to countries with a high level of technical development which are hypothetically capable, under certain geopolitical conditions, of implementing a nuclear program. The decision to use the nuclear option would not require a lot of time for its practical implementation. Here, members of the nuclear club are not striving very hard to support the dynamics of the nuclear demilitarization process. The recent decision of the Clinton administration to retain, practically without any changes, the US nuclear strategy, was far from fostering reinforcement and extension of anti-nuclear standards and norms. Decisions to install new and increasingly accurate nuclear warheads on four more strategic submarines remained in force. Russia has deviated from the principle of no first-use of nuclear weapons, proclaimed already by the Soviet Union, and makes its nuclear component a major guarantee of her security. In 1995, France conducted a series of nuclear weapons tests, the goal of which, inter alia, was to demonstrate the credibility of her nuclear potential. China continues to have sophisticated missiles and nuclear weapons, and the question of its joining the nuclear disarmament problem is not yet on the agenda. If the nonproliferation program proves to be inadequate, a number of countries which in the past had canceled their nuclear programs, either under pressure or voluntarily, might actually want to reconsider their decisions. This category could include all former Soviet Republics, which might consider the compensation they received for giving up their nuclear status, even a temporary and abortive one, to be insufficient, and the security guarantees provided in exchange for it - to be ineffective.

No 26, February 1997

The question: of what position Japan will take in the event of a nuclear crisis on the Korean peninsula is of major interest to analysts and political scientists. One should read the article on this matter by Major-General Vladimir Belous. It is clear that Japan possessed the advanced technologies to develop nuclear weapons without making great efforts. Onsofar as the political decision is concerned, the right wing of the Japanese parliament representing the nationalistic forces of the country, is in favor of a more active military policy, the denunciation of three non-nuclear principles and Japanese nuclear armament. To counterbalance it, their political opponents demonstrate that because of its geographical position, high density of population, and the nearness of the probable enemies, Japan's possession of nuclear weapons will not give any guarantees of security. According to their assertion, the same thing underlies the need to preserve the US "nuclear umbrella", which has to cover the country in the event of probable nuclear strike. The arguments of the opponents of nuclear weapons are the following: the possession of nuclear weapons can cause other states to have a a negative attitude towards Japan, pose obstacles along the way to foreign markets, sources of raw materials and energy. Besides, having suffered the tragedy of nuclear attacks, the country has gained the most stable immunity against nuclear weapon, firmly and unambiguous stated in the basic law of the country. However, at the same time, Japan has turned out to be vulnerable to attempts of nuclear blackmail and threats to use mass destruction weapons against it. There is a high possibility of the Japanese leaders' coming to the conclusion that it is

necessary to possess nuclear weapons to secure national interests, taking into account the balance of forces in Asia. The main threat from Pyongyang's nuclear missile program lies in its provocation of its nearest neighbors - Japan and South Korea - to possess nuclear weapons. The effect of the "nuclear domino" can inflict heavy damage upon nonproliferation policy.

During the meeting in Paris in October 28-31, 1996 the experts considered possible methods to use or reprocess fissile materials declared to be useless for military purposes. Nikolai Yegorov, Deputy Minister of Atomic Energy, tells about the results of the meeting, the problems discussed and the methods for plutonium storing and reprocessing. Russia considers fissile materials, especially weapon-grade uranium and plutonium, to be valuable for power generation. These materials need to be reprocessed and put to good use in civil power engineering. The problem of weapons grade plutonium reprocessing is much more difficult than that of enriched uranium. There are two ways to utilize it. They are to use plutonium as MOX in civil reactors with fast- and thermal mode and to encase the plutonium in glass plutonium with high-active waste which can be buried in deep geological structures. Both methods are suitable and will be carried out simultaneously in Russia and the United States. Nikolai Yegorov, in analyzing the arguments presented by the protagonists of one reprocessing method or another, touches upon the economic sides of it. Speaking of the indispensable stage of any reprocessing technique- the intermediate storage of plutonium- one can not fail to mention the problem of materials accounting, control and physical protection. During planning and building the storages, great consideration is given to this stage: it is envisaged to develop the most advanced automated system of material counting and control. Methods of physical protection have been developed jointly by the Arzamas-16 Nuclear Center and American laboratories. Once brought into use, at first the storages will be under bilateral Russian-American control. The Deputy Minister outlined the importance of taking into account environmental considerations when dealing with plutonium.

NPT EXTENSION AND THE WORLD: A REVIEW OF THE OFFICIAL POSITIONS OF THE STATES BEFORE AND DURING THE 1995 CONFERENCE

By Vladimir A. Orlov, PIR Center Director