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THE LABORATORIES AND THE FORMER SOVIET UNION

Frank von Hippel  
Professor of Public and International Affairs  
Princeton University

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The Cold War has left many huge and dangerous residual problems in the former Soviet Union (fSU) including:

- o Controlling and dismantling tens of thousands of nuclear warheads and disposing of their fissile materials;
- o Destroying a huge stockpile of chemical weapons;
- o Preventing the further contamination of the environment by the enormous amount of radioactivity that has been dumped into it by the military-plutonium production facilities; and
- o Redeploying the energies and talents of hundreds of thousands of scientists and engineers formerly devoted to the development and production of weapons.

The U.S. has all these problems as well. But here we have an economy that works. In the fSU, the breakdown of the central-planning system has created a chaotic situation in which an increasing fraction of the population is surviving by barter and buying and selling on black and gray markets.

The U.S. government is trying to help. The effort focused on the former Soviet nuclear-weapons complex began with the "Soviet Nuclear Threat Reduction Act of 1991" which allocated \$400 million -- increased to \$800 million in 1992 -- to assist the former Union to:

- (1) "destroy nuclear weapons, chemical weapons and other weapons, (2) transport, store, disable, and safeguard weapons in connection with their destruction, and (3) establish verifiable safeguards against the proliferation of such weapons."

Thus far, most of the money has been committed to providing Russia with very specific equipment or design assistance relating to the transport of nuclear warheads, storage of their fissile components after dismantlement and destruction of chemical weapons. A similar effort is now being mounted in Ukraine which is expected to focus on the problems associated with the elimination of the 176 silo-based ICBMs there. Virtually all of this money will be spent in the U.S.

However, \$25 million has been committed by the U.S. to the establishment of a Science and Technology Center in Moscow and \$10 million to one in Kiev to fund projects that would engage former weapons experts in useful nonweapons activities. The EEC, Japan, and Sweden have increased the amount of money that is to go to the Moscow Center to about \$100 million. Because of the currently very low ruble exchange rate, the full salary and benefits of a Russian engineer is equivalent to about \$1000 per year.

The \$35 million provided by the U.S. is expected to fund principally projects in which U.S. organizations would collaborate. If say, \$20 million goes to fund salaries in Russia and Ukraine, this would support about 20,000 person years.

U.S. collaborators are essential to assure that the money is actually spent for the intended purposes. In the case of the Russian nuclear-weapons laboratories, which have been a principal focus of attention, the U.S. nuclear-weapon laboratories are obvious collaborators: they have the expertise and this work is a natural extension of their primary mission: to protect the U.S. against nuclear threats. Now, however, the route to protection is through conversion rather than through deterrence.

This is a potentially major mission for the U.S. labs. If we assign one U.S. lab employee to work on these projects for every ten former Soviet personnel, an expenditure of \$20 million in the fSU would require a commitment of 2000 person-years in the U.S. However, person-years don't cost \$1000 over here. Including overhead and benefits, they cost between one and two hundred thousand dollars. We might therefore be talking about up to \$200 to 400 million dollars being spent in the labs -- which is a first step toward their conversion as well. This mission could go on for at least a decade.

But what should the projects be? They will have to be relatively big in order to put all those people to work. Some major missions that have already surfaced are: environmental cleanup at the nuclear production facilities -- the counterpart of our own \$100+ billion task; reactor-safety analyses; and nuclear safeguards. These are all urgent tasks and they are tasks to which the expertise and equipment of the nuclear labs of both countries are especially well suited.

Let me start by talking about the problem of safeguards, because a loss of central control over former Soviet nuclear weapons and materials would be the ultimate disaster. The problem of preventing any leakage of warheads or weapons-useable materials is even more critical than preventing a leakage of experts -- and it should be easier because weapons and materials do not have human rights to travel and emigrate.

Saddam Hussein spent billions of dollars on an aborted effort to produce plutonium and highly-enriched uranium. How much money might he or others like him offer for a few tens of kilograms of these materials?

Such offers have already proved irresistible to fSU base commanders who have become millionaires overnight by selling off the conventional weapons under their control. This is understandable -- if not forgivable -- in view of the grinding poverty in the present and uncertain future faced by the vast majority in the fSU.



David Kay, the hero of the Bagdad parking lot and now the Secretary General of the Uranium Institute in London is pessimistic about our ability to prevent similar developments with nuclear materials. Recently he stated that he thinks that is likely that plutonium or highly enriched uranium will be smuggled out of Russia within the next five years.\* However, we need not be only passive bystanders to such a development. We can and should move rapidly to reinforce the safeguards over nuclear warheads and materials in the fSU.

It is probably not realistic to expect that we will be allowed to help safeguard the warheads on strategic missiles and stored for strategic and tactical bombers that are to remain active after the START II reductions. However, we might hope to be allowed to help with:

- o Civilian nuclear facilities such as the four enrichment plants in Russia. (Gorbachev announced in 1989 that no more highly-enriched uranium would be produced for weapons.)
- o Facilities that are either to be shutdown or converted to civilian use such as the three reprocessing plants in Russia where plutonium is separated from irradiated uranium. (One such facility, which was converted to civilian use in 1976 has 26 tonnes of plutonium stored at it.)
- o Facilities in Russia where surplus warheads are stored whose fissile materials is to be transferred to nonweapons use after dismantlement. (These warheads might have to be segregated from warheads that are in the active inventory or are to be recycled into new warheads.)
- o The four facilities where these surplus warheads will be dismantled. (Once again, any activities involving the production of new warheads or recycling of old warheads would have to be segregated.)
- o Setting up materials accounting systems and safeguards for the fuel cycles of all the reactors in the fSU. (Ukraine has inherited about as many power reactors as Russia and Kazakhstan has inherited one of the fSU's demonstration plutonium breeder reactors.)

The West must assure -- with financial assistance if necessary --that there are adequate safeguards at these facilities. Although I have not made careful estimates, I suspect that hundreds of fSU nuclear experts could be employed in a crash effort to establish strengthened safeguards systems and thousands of nuclear technicians could be retrained to implement them. At a ratio of one U.S. lab employee per ten fSU personnel, several hundred people in the U.S. national labs could be engaged in supporting this effort with equipment and training.

But there is a problem that has been blocking the full development of such a program. On the one hand, we cannot support such an effort if we cannot check how it is being implemented. On the other, there are natural sensitivities within the Russian government about providing unilateral U.S. access to key Russian nuclear facilities. Indeed, the Russian Minister of Atomic Energy was recently

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\* David Hughes, "Arms Experts Fear Nuclear Blackmail," *Aviation Week and Space Technology*, 4 January 1993, pp. 61-62.

accused of selling out Russian national security for the \$400 million Nunn-Lugar funds.\* This stems from the fact that the U.S. Congress required that, in return for the Nunn-Lugar assistance, Russia forgoe "any use of fissionable and other components of destroyed nuclear weapons in new nuclear warheads" and facilitate "U.S. verification of weapons destruction" carried out with U.S. assistance. The U.S. government is trying not to feed these perceptions by being pushy in demanding access.

However, our delicacy prevents us from assuring ourselves and the world that the safeguards are adequate at these facilities -- and some of us believe that they are *not* adequate under the new conditions prevailing in the fSU.

In my view the only way out of this impasse is to offer reciprocal access. As I testified before the Senate Armed Services Committee on August 4th,\*\* an unofficial working group of U.S. and Russian nuclear experts showed two years ago that this could be done without revealing key design secrets. In particular, it would not be necessary for the other country's personnel to be present when nuclear warheads were actually being dismantled -- or even to ever see a warhead outside of its storage and transport containers.\*\*\*

The Bush Administration -- and some members of the Senate -- did not like the idea of committing the U.S. to lock in our reductions even if the Russians do so. Hopefully that position will be reconsidered now.

There are similar opportunities in the reactor-safety and cleanup area. A lot more is required than having Western groups drop by for a day and kibitz.

The West is intimidated by the huge costs and responsibilities that would be incurred if we went in and actually tried to help upgrade the reactors. In any case, we hope that the worst ones will be shut down. However, there are severe power shortages in the western parts of the former Soviet Union where most of the reactors are located and it is not at all certain how many will be shut down. We might be able to accomplish quite a bit for not very much money if we supported efforts by the nuclear-energy institutes and the Russian weapons labs to mount joint reviews of the safety problems at the different classes of reactors, make proposals for what types of improvements should be made and help retrain some of their engineers to become expert nuclear operators.

Similarly, the weapons labs could join other civilian institutes in efforts to analyze the more threatening environmental problems at the nuclear-production

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\* "Treaty of Unequals," *Sovietskaya Rossiya*, 8 December 1992. An interview with Iona Andronov, Deputy Chairman of the Committee of International Affairs and Foreign Economic Relations of the Russian Supreme Soviet and also with Georgi Kornienko, former Deputy Minister of the USSR Foreign Ministry.

\*\* Controls on Nuclear warheads and Materials. In Disposition of U.S. and Commonwealth of Independent States (CIS) Strategic Nuclear Warheads Under the START I Treaty and the June 17, 1992 U.S.-Russian Joint Understanding on Further Reductions in Strategic Offensive Arms, hearing before the Senate Armed Services Committee, 4 August 1992.

\*\*\* Ending the Production of Fissile Material for Weapons, Verifying the Dismantlement of Nuclear Warheads: The Technical Basis for Action. Washington, D.C.: Federation of American Scientists, June 1991, 58 pp.



complex. Indeed, because of the prolonged delay in actually getting the Moscow Science and Technology Center into operation, a small U.S. foundation, the Ploughshares Fund, recently provided through the Natural Resources Defense Council a small startup grant to one of the Russian nuclear-weapons laboratories. The project is to prepare a preliminary plan for dealing with the huge quantities of radionuclides that are leaking into the ground water from the infamous radioactive Lake Karachay at the reprocessing facility near Chelyabinsk. The hope is that this pilot study will lay the basis for a larger-scale study involving the U.S. labs. Indeed, the strategy seems to be working already. I understand that a group at Livermore is already having discussions about cooperating in the study.

Salaries are so low in Russia that private foundations can have a significant impact. As another example, small foundation grants made it possible to establish a Center for Arms Control, Energy and Environmental Studies at Russia's elite technical University, the Moscow Institute for Physics and Technology -- a university that was founded in 1946 to train scientists for the Soviet Union's high-tech weapons programs. This Center, which is collaborating with the arm-control groups at MIT and Princeton, is already proving to be an important source of independent technical expertise to the policy debate in Moscow.

These private efforts are helpful but, if we are to facilitate the safeguarding and conversion of Russia's nuclear complex on a large scale, our national labs -- and especially the weapons labs -- are going to have to get involved on a large scale.

The U.S. nuclear-weapons labs can also help the Russian scientific establishment link up with the West more generally -- especially especially the Russian weapons labs, which have been very isolated. We could send in teams that could identify groups with world-class expertise in materials processing, programming and other areas with which Western firms might make contracts. This would facilitate the conversion of these key groups to non-weapons missions. Once they got involved in hard-currency-making activities with opportunities to visit in the West, it would be to be very difficult to induce them to go back to weapons work.

In summary, there is a huge new mission for the U.S. weapons labs in helping to establish high-quality-safeguards on fSU warheads, fissile materials and fissile-material processing facilities. There are other huge missions in helping to improve the safety of the nuclear-power reactors in the former Soviet Union and in helping to contain the threat to the environment from the legacy of past nuclear-production activities there.

We can't afford to carry out any of these tasks for the former Soviet Union. But, because of the 100-to-1 purchasing power ratio of the U.S. dollar there, we have huge leverage with which to facilitate the redeployment of the fSU nuclear experts to work on these problems. And, because of the scaling down of our own nuclear-weapons programs, we have experts that we can deploy to assure that our money is well spent. Finally, in the process, we can help integrate the best of fSU science and engineering into the world economy. What a great opportunity after 50 years of work designing weapons to blow those people up!

