

October 20, 1998

To: **Leon Fuerth**, National Security Advisor to the Vice President, FAX: 202-456-9500

From: Frank von Hippel, Professor of Public and International Affairs (609-275-7004)

Cc: Rose Gotemoeller, FAX: 202-586-0862; Leonard Spector/Jon Wolfstahl, DoE - 4452

Susan Koch c/o Sarah Lennon, DoD, FAX: 703-614-4365

Gary Samore c/o Jack Caravelli, NSC, FAX: 202-685-9180

Shirley Jackson c/o Carl Stoiber, NRC, FAX: 301-415-1672     **3 PAGES TOTAL**

**Conversion of Russia's Plutonium-production Reactors: Nuclear Terrorism and Safety Issues**

Dear Leon,

Five years ago, in December 1993, I got the Office of the Vice President (OVP) involved with the problem of the Russian plutonium-production reactors. I have therefore followed closely the progress of the resulting initiative, through discussions with the responsible DoD and DoE officials and with the U.S. and Russian experts responsible for the technical work.

During the past year, I have become concerned about two decisions being made by the project management:

- 1) The choice for replacement fuel of weapon-grade highly-enriched uranium (HEU), the most convenient fissile material for potential nuclear terrorists, and
- 2) Despite warnings of a possible "new Chernobyl," the decision to ignore very serious safety concerns raised by the Russian nuclear-regulatory agency, GAN, about the planned arrangement of fuel elements in the coolant channels.

Both these worrisome decisions appear to be driven by what is perceived by working-level officials as an over-riding need to meet the deadline in the September 23, 1997 Gore-Chernomyrdin agreement . This agreement requires that the three Russian plutonium-production reactors "shall cease by December 31, 2000 their production of non-reactor-grade plutonium by undergoing modification." The attitude seems to be that the train must run on time -- even if there are concerns about its direction.

Only the OVP can unlock this situation and require that outside expert reviews be made of the safety, materials security, and schedule analyses before final decisions on these critical issues are made.

In what follows, I provide essential background on the nuclear-terrorism and safety issues and then make specific recommendations for the reviews that should be undertaken.

**Fuel for nuclear terrorism?** The U.S. Government (USG) is moving toward acceptance of MinAtom's proposal that the new fuel for the reactors be weapon-grade highly-enriched uranium (HEU).

This "cure," which would involve putting four tons of HEU per year through inadequately safeguarded fuel-fabrication facilities and into long-distance transport across Russia, would be worse than the current "disease," which involves the annual separation of 1.5 tons of weapon-grade plutonium and its placement directly into on-site storage. Potential nuclear terrorists would find HEU much easier than plutonium to fabricate into nuclear weapons. Four tons of weapon-grade uranium would be sufficient to make 70 of the simple "gun-type" nuclear weapons that South Africa developed and produced in a program that cost only a few tens of millions of dollars.

The original basis for USG acquiescence to MinAtom's preference for HEU was a Pacific Northwest National Laboratory (PNNL) report which concluded that the use of non-weapons-usable low-enriched uranium (LEU) would be prohibitively costly. A year ago, I obtained a copy of this report. My critique convinced the Department of Energy (DoE) that the PNNL analysis had been carried out so incompetently as to be useless. The DoE therefore asked the Argonne National Laboratory to do an independent assessment of the LEU-fuel option. Argonne, which leads the enormously successful U.S. program to convert the world's research reactors from HEU to LEU-fuel, was already working with many of the same Russian institutes -- even some of the same experts -- that were working with PNNL on the development of HEU fuel.

In July, Argonne came back with a report from the Russian experts that their preliminary cost assessment "has not revealed any significant difference in the fuel-cycle cost of conversion with either LEU or HEU fuel if storage [the U.S. preference] is chosen for spent fuel disposal. There is considerable uncertainty about the comparative costs of spent fuel reprocessing [MinAtom's preference]."

DoE has therefore launched an LEU-fuel development program managed by Argonne. However, PNNL's HEU-fuel development program is further along and the LEU fuel-development program is being funded on a short-term basis because it was not planned for in the DoE budget. According to Argonne's estimate, testing and licensing for the LEU fuel could be completed about a year later than the HEU fuel. According to PNNL, it could take up to several years longer.

It appears that the conversion deadline cannot be met in any case. The July report of the Russian experts to Argonne shows that, even with HEU-fuel, conversion of the last two reactors would not be completed until late 2001. And they reported that even this was a "political" rather than a "realistic" projection.

In order to prevent the development of LEU fuel from complicating this already difficult situation, the interagency is apparently considering asking MinAtom to commit to use LEU fuel as soon as it can be developed. However, the DoD-MinAtom division of labor has DoD responsible for converting the reactors and MinAtom responsible for supplying the fuel once it has been developed. If the decision on LEU fuel is delayed until after the reactors are loaded with HEU fuel, the U.S. will have little real influence over subsequent fuel choices. The small cost savings associated with HEU fuel and its lower reprocessing cost will bias MinAtom toward continuing its use.

DoE is responsible for enhancing materials security at the MinAtom facilities where the HEU-fuel would be fabricated and stored. Even with full MinAtom cooperation (which is not yet forthcoming at one of the fuel-fabrication facilities), these security upgrades will not be completed before 2002 -- three years after HEU-fuel production is currently scheduled to begin. In the interim, the U.S. will share the responsibility for greatly increasing the quantities of HEU fuel being fabricated and transported between insecure facilities in a country verging on collapse. The management of HEU at the Novosibirsk fuel-fabrication facility is so lax that a portion of the plant was shut down in 1997 by a nuclear chain reaction in large quantities of HEU in a sludge barrel.

**"A New Chernobyl"?** Switching to LEU fuel might not cause any delay at all if conversion is delayed by the safety concerns of Russia's nuclear regulatory agency, GAN. For more than a year, there have been serious concerns within GAN about the safety of the proposed stacking of fuel and neutron absorbers in the reactor coolant channels. One message that I have received ends by warning that "the result is well known, it will be a new Chernobyl." PNNL has chosen to ignore these concerns -- apparently convinced by the Russian leadership of the conversion project that GAN will ultimately acquiesce.

GAN is not acquiescing, however. Indeed, as you know, GAN's chairman brought his staff's concerns to the attention of NRC Chairman Jackson at the IAEA General Meeting in September. GAN has considerable expertise in this area. Its review is being led by Alexander M. Dimitriev, a senior engineer who, as director of the Tomsk-7 production reactors, was responsible for their safety upgrades after the Chernobyl accident.

The USG needs an independent technical assessment of GAN's safety concerns. Argonne could do more but the PNNL group has refused for many months to provide the technical information about the Russian reactors that Argonne needs to make its own independent design and safety evaluations. PNNL, which claims that it is bound by a "proprietary" agreement with MinAtom, has offered to provide the information only if Argonne signs a legal agreement so restrictive as to make the information practically

useless. This impasse has not been resolved promptly because DoD funds PNNL to manage the conversion project while DoE funds Argonne to manage the LEU study.

**Recommendations.** Expenditures of funds related to the production of HEU fuel should not be authorized until:

- 1) An outside expert panel has evaluated the safety issues that have been raised by GAN. This review should include meetings with GAN experts.
- 2) PNNL has provided Argonne with the reactor-design information needed for independent studies of the reactor performance and safety with different fuels.
- 3) An outside expert panel has reviewed the cost and schedule estimates prepared by the HEU- and the LEU-fuel development teams. This review should include meetings with the Russian fuel experts and with GAN.
- 4) An outside expert review has assessed the security risks associated with producing and transporting the HEU fuel before and after the security upgrades at the Russian facilities have been completed.

These reviews should be made by committees of high-level experts -- perhaps organized under the auspices of the National Academies of Science and Engineering.

Please let me know if I can be of any further assistance.

With very best regards,

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To: **Armando Travelli, FAX: 55-11-257-3003, Room 1901F**

Todd Perry, FAX: 202-332-0905

Matt Bunn, FAX: 617-495-8963

From: Frank von Hippel (609-275-7004)

**4 Pages Total**

This is the final version.

With very best regards,