

Since Russia possesses the world's largest stockpile of chemical weapons (CW)—a declared total of 40,000 metric tons—Russian ratification and implementation of the 1993 Chemical Weapons Convention (CWC) will be critical to the success of the global chemical disarmament and non-proliferation regime. To date, however, Moscow's ratification has been delayed by political, economic, and environmental concerns associated with CW destruction and the conversion of former Soviet chemical weapon production facilities (CWPFs) to legitimate commercial activities.¹

Whereas American CWPFs were all single-purpose military facilities that have lain dormant for years, former Soviet CWPFs are integrated into large civilian chemical production complexes and share the same industrial infrastructure. For example, several buildings that once produced nerve agents are embedded within the massive "Khimprom" Production Association in Volgograd, which comprises hundreds of buildings and employs about 10,000 people. Demolishing the former CWPFs could therefore create serious difficulties for other plants at the site that manufacture legitimate commercial products. According to General Anatoliy Kuntsevich, former director of the Russian president's Committee on Problems of the Chemical and Biological Weapons Conventions, razing the CWPFs to the ground would be "uneconomical, irrational, and simply ruinous financially."²

The United States, for its part, does not object to conversion in principle but wants to ensure that former Soviet CWPFs are converted *irreversibly* to commercial production, so that Moscow does not retain a standby capability to produce chemical weapons. Although Russian officials couch the conversion issue strictly in economic terms, U.S. government officials are concerned that senior military officers such as General Stanislav V. Petrov, chief of the Radiation, Chemical, and Biological Defense Troops, may wish to retain some former CWPFs as a mobilization base for CW production in wartime.³ Because of these divergent interests, bilateral negotiations between the United States and Russia over guidelines for CWPF conversion have been deadlocked for more than six years.

This essay lays out a brief history of the CWPF conversion issue and the contending U.S. and Russian positions. It then suggests a compromise approach based on industrial joint ventures that would enable Moscow to convert its former CWPFs in an economic manner, while satisfying the concerns of the United States and other countries that conversion be irreversible and verifiable.

**VIEWPOINT:
CONVERTING FORMER
SOVIET CHEMICAL
WEAPONS PLANTS**

by Jonathan B. Tucker

**CW PRODUCTION
ACTIVITIES**

Before, during, and after World War II, the Soviet Union produced many tens of thousands of tons of chemical weapons (both blister and nerve agents) at multiple facilities, most of them in the Volga River basin.⁴ On April 10, 1987, President Mikhail Gorbachev declared that the Soviet Union would henceforth cease all development and production of CW agents. Compelling evidence has since emerged, however, that Moscow secretly continued to produce CW agents into the early 1990s.

In October 1991, Vil S. Mirzayanov, a chemist who had worked for more than 25 years in the Soviet CW program, published an article in the Russian press in which he alleged that Moscow had developed a series of new and extremely lethal "third generation" nerve agents under a secret program code-named *Foliant*.⁵ According to Mirzayanov, this effort began in 1973-76 to match a U.S. research and development program on binary chemical weapons. (Binary weapons consist of two relatively non-toxic ingredients that when mixed together yield a lethal chemical agent.) Soviet development of several supertoxic nerve agents, both unitary and binary, was followed by

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the production and testing of experimental quantities in the late 1980s and early 1990s. Mirzayanov claimed that the new series of binary agents had the secret codename *novichok*, the Russian word for “newcomer,” and that about 200 scientists and engineers were involved in their development.⁶

The Russian government adamantly denied Mirzayanov’s allegations, and he was fired from his job in January 1992. After publishing two more articles about the secret CW program, he was arrested by the Federal Counterintelligence Service (formerly the KGB) on October 22, 1992, and jailed for 11 days in the infamous Lefortovo Prison in Moscow. The fact that Mirzayanov was charged with “divulging state secrets” strengthened suspicions that his revelations were true.⁷ His statements were also confirmed and expanded upon by two other scientists, Lev A. Fedorov and Vladimir Uglev. International pressure finally caused the Russian government to drop the charges against Mirzayanov in March 1994 and allow him to emigrate to the United States.⁸ Today, he maintains that the secret CW development program existed at least through the fall of 1993, months after Russia had signed the CWC. Although Moscow continues to deny the whistleblowers’ allegations, they have become a festering source of mistrust.⁹

Another problem complicating the conversion issue is the lack of comprehensive information on the number and location of former CWPFs in Russia. The Wyoming Memorandum of Understanding (MOU) between the United States and the Soviet Union, signed on September 23, 1989, provided for a two-phased data exchange and verification experiment designed to build confidence in the chemical weapons area and to facilitate completion and implementation of the CWC. Phase II of the MOU specified the exchange of detailed information on the names and locations of former chemical weapons development and production facilities, as well as the types of agents and munitions produced in them.¹⁰

Under the MOU, the Russians declared about 20 former CWPFs and filling plants that were operational after January 1, 1946, including multiple buildings within the large chemical production complexes at Chapayevsk, Dzerzinsk, Volgograd, and Novocheboksarsk. At Chapayevsk, the mustard and lewisite production plants were razed in 1952 and 1988, respectively. At Dzerzinsk, most if not all of the former CWPFs have been dismantled; at Novocheboksarsk, several production facilities were contaminated with nerve agent in an industrial accident

and will have to be demolished, so that only a few buildings are potentially suitable for conversion. At Volgograd, the Russians plan to convert five or six buildings that were formerly associated with nerve agent production and filling, including areas where specialized ventilation equipment was housed.¹¹ (See *Figure 1*.)

Although the information exchanged under the Wyoming MOU was not released publicly, a State Department spokesman noted “what appear to be omissions and inconsistencies in the data” provided by Moscow.¹² In particular, the Russian Phase II declaration did not list some facilities that had been included in the Phase I data, and lacked any information on development and production facilities associated with the *novichok* binary agent program.¹³ Testifying before the U.S. Senate Committee on Foreign Relations, then-Director of Central Intelligence R. James Woolsey stated after an initial review of the Russian MOU declaration:

I would say that we have serious concerns over apparent incompleteness, inconsistency, and contradictory aspects of the data. Russia did not declare any binary weapons programs either in development or production.¹⁴

According to Mirzayanov, production of binary CW agents in quantities ranging from a few metric tons to tens of metric tons took place at secret pilot-scale CWPFs in Shikhany, Volgograd, and Novocheboksarsk.¹⁵ Nevertheless, more recent information on the status of these facilities is lacking.

THE CHEMICAL WEAPONS CONVENTION

During the CWC negotiations in Geneva in the late 1980s, the Soviet Union opposed requiring the complete demolition of CWPFs that had produced chemical warfare agents at any time after January 1, 1946. At Moscow’s insistence, a provision was included in the draft treaty permitting the conversion of former CWPFs to legitimate activities. The rules for CWPF conversion were worked out jointly by the United States and the Soviet Union, and both sides were initially satisfied with the results. Moscow obtained a conversion option that would reduce the economic burden of implementing the CWC, in exchange for strict guidelines designed to minimize the risk of treaty violations at converted facilities.

According to the treaty text, states parties must either raze their CWPFs and CW munition-filling facilities, convert them temporarily for use as CW destruction fa-

Figure 1: Former Soviet CW Production Facilities Potentially Suitable for Conversion

City	Region	Name of facility	Former name(s)	Agents produced	Current status
Dzerzhinsk	Nizhniy Novgorod oblast	"Kaprolactam" Productio Association	"Zavodstroy" Plant No. 96	mustard lewisite	Most former CW production buildings at Dzerzhinsk were dismantled in 1992 and 1994, but a few may still be intact.
		"Orgsteklo" Production Association	"Roulon" Plant No. 148	hydrocyanic acid	
		"Korund" Production Association	M.I. Kalinin Plant in Chernorechenskiy	hydrocyanic acid phosgene	
Novocheboksarsk (near Cheboksary)	Chuvash Republic	"Khimprom" Cheboksary Production Association	Production Facility No. 3; Chuvash Productio Association Khimprom imeni Leninskiy Komsomol	VX Substance 33 (V-gas) binary agents?	The entire plant is mothballed but intact; several buildings are heavily contaminate with nerve agents
Shikhany	Saratov oblast	Volsk-17	Volsk affiliate of GosNIIOKhT	A-230 A-232 binary agents: --novichok-5 --novichok-7 --novichok-#	Mirzayanov alleges that secret CW agent production occurred at Shikhany, but Russia did not declare this site under the 1989 Wyoming MOU.
Volgograd (former Stalingrad)	Volgogradskaya oblast	S.M. Kirov "Khimprom" Production Association	VKhTOP Plant No. 3 Plant No. 91	V-gas sarin soman binary agents?	Some CW productio equipment has been removed from buildings at the site.

Sources: Aleksandr Dolgikh, "Chemical Weapons Must Be Destroyed. But Where? Perhaps Where They Were Being Produced Not So Long Ago," *Krasnaya Zvezda*, September 24, 1992, p. 3, in JPRS-TAC-92-030 (8 October 1992), pp. 39-40; Oleg Vishnyakov, "Binary Bomb Exploded" [Interview with Vil Mirzayanov and Lev Fedorov], *Novoye Vremya*, No. 44, October 27, 1992, pp. 4-9, in JPRS-TAC-92-033 (14 November 1992), pp. 44-49; Lev Fedorov and Vil Mirzayanov, "We Waged Chemical Warfare on Our Own Territory," *Nezavisimaya Gazeta*, October 30, 1992, pp. 1, 2, in JPRS-TAC-92-033 (14 November 1992), pp. 56-59; Douglas L. Clarke, "Chemical Weapons in Russia," *RFE/RL Research Report* 2(2), January 8, 1993, pp. 47-53; Lev Fedorov, "The Chemical Death Complex," *Rossiia*, No. 50, December 8-14, 1993, in JPRS-TAC-94-001 (18 January 1994); and Lev Fedorov, *Chemical Weapons in Russia: History, Ecology, Politics* (Moscow, 1994), in JPRS-TAC-94-008-L (27 July 1994).

cilities or, "in exceptional cases of compelling need," may request approval to convert them to "purposes not prohibited by the Convention" such as the production of commercial chemicals. A state party seeking to convert a CWPF must prepare a detailed justification for the request and a general facility conversion plan, which must then be approved by the Organization for the Prohibition of Chemical Weapons (OPCW), the international organization based in The Hague that will oversee CWC implementation after the treaty enters into force.¹⁶

The part of the OPCW that initially considers requests for CWPF conversion is the Executive Council, made up of representatives of 41 member states. The Executive Council then makes a recommendation to the Conference

of States Parties, encompassing all member states, which must vote unanimously to approve the conversion of each former CWPF.¹⁷ If any state party objects to the request and the associated conditions, consultations must be undertaken among the interested countries to seek a mutually acceptable solution. The CWC also specifies detailed procedures for CWPF declaration, conversion, and verification.¹⁸

At the CWC signing ceremony in Paris on January 13, 1993, Russian officials agreed to join the treaty regime but made known their continuing concerns over the provisions on CWPF conversion and the costs of verification. They asserted that these issues were still open and would have to be addressed by the CWC Preparatory

Commission (PrepCom), a group of signatory states that began meeting in The Hague in February 1993 to negotiate detailed procedures for implementing the Convention.¹⁹ In an interview with *Izvestia*, General Kuntsevich said, “We believe that all these questions can be resolved within the framework of the preparatory committee’s [*sic*] work. We have no political alternative to the Convention, but there are financial difficulties that we hope to resolve.”²⁰

In 1995, Pavel Syutkin, who had replaced Kuntsevich as chairman of the Russian president’s Committee on Problems of the Chemical and Biological Weapons Conventions after Kuntsevich was fired in April 1994, stated that in the view of his government:

the most prudent and economically rational decision is to convert [former CWPFs] after the removal and destruction of the equipment that was producing chemical weapons. These facilities will thereby meet the standards of general purpose chemical plants.... The possibility of conversion has been provided for in the Convention, however, concrete proposals and procedures should be determined separately.²¹

THE BILATERAL DESTRUCTION AGREEMENT

The CWC is not the only agreement that addresses the issue of CWPF conversion. On June 1, 1990, Presidents George Bush and Mikhail Gorbachev signed the “Agreement on the Nonproduction and Destruction of Chemical Weapons and on Measures to Facilitate the Multilateral Chemical Weapons Convention,” better known as the Bilateral Destruction Agreement (BDA). At the time the BDA was signed, it was assumed that the CWC would take several years to complete. Thus, the original intent of the bilateral agreement was to achieve an early Russian commitment to CW destruction and facilitate progress in the multilateral negotiations.

Under the BDA, the two largest possessors of chemical weapons agreed to halt any further CW production and destroy all but 5,000 metric tons of their respective stockpiles. The bilateral agreement thereby satisfied the U.S. interest in having Russia begin destroying the bulk of its chemical weapons—as the United States was already doing under congressional mandate—and the Russian interest in stopping the U.S. binary CW program.²² The BDA also established joint measures for monitoring

the U.S. and Russian CW destruction programs that were subsequently incorporated into the draft CWC. It was also envisioned that once the CWC entered into force, the United States and Russia would continue to inspect each other’s destruction and conversion efforts under the BDA, with general oversight by the international inspectorate. By avoiding redundant multilateral inspections, this arrangement promised to save substantial money and resources for the OPCW.²³

After the BDA was signed, the U.S. and Soviet delegations began meeting in Geneva to negotiate a protocol specifying detailed implementing procedures and updated provisions for the agreement. These negotiations soon bogged down, however, over U.S. insistence on—and Soviet resistance to—stringent guidelines for CWPF conversion and bilateral verification. With the opening of the CWC for signature in January 1993, the BDA was no longer required to give impetus to the multilateral negotiations. Even so, Washington continued to view the bilateral agreement as an important measure in its own right.

On March 26, 1993, the U.S. and Russian delegations agreed provisionally on a BDA implementing protocol, pending high-level political approval.²⁴ The United States accepted the document as final, but after further review in Moscow, the Russian side requested some significant changes to the provisions on CWPF conversion. Because the proposed changes would have weakened the regime, they were unacceptable to the United States.²⁵ Since then, the BDA negotiations have remained deadlocked, and the bilateral agreement has never been implemented.

DISCUSSIONS IN THE CWC PREPCOM

In late 1993, the CWC PrepCom in The Hague began discussing the CWPF conversion issue. The United States introduced a “non-paper” (an unofficial working paper) on this topic for discussion by the Expert Group on Chemical Weapons Issues, and Russia followed suit in spring 1994.²⁶ Whereas the U.S. paper demanded stringent measures to ensure the irreversibility of conversion, the Russian paper sought to limit its scope and cost.²⁷ In an attempt to broker a compromise, the PrepCom secretariat combined the two papers and highlighted areas of commonality and difference.²⁸ Given the large gap between the U.S. and Russian approaches, however, the Expert Group was unable to reach consensus on a set of guidelines for CWPF conversion and verification.²⁹

When the technical discussions in the CWC PrepCom

failed to bear fruit, Moscow decided to raise the debate on CWPf conversion to the political level. On March 23, 1995, the Russian delegation introduced a new paper in the Expert Group and also presented it several days later at the Tenth Plenary session of the PrepCom on April 3, 1995. Titled "The Issue of Declaration of Chemical Weapons Production Facilities," the Russian paper proposed a sweeping reinterpretation of the CWC that sought to define away the problem of CWPf conversion.

Article II of the Convention defines a CWPf as "any equipment, as well as any building *housing* such equipment, that was designed, constructed or used at any time since 1 January 1946."³⁰ The Russian paper argued that because the CWC definition uses the verb "housing" in the present tense, a building from which the CW production equipment has been removed prior to Convention's entry into force—and hence before the declaration of the facility—no longer fits the definition of a CWPf. In other words, simply removing the final-stage CW production equipment from a former CWPf would be tantamount to "destroying" it, thereby exempting the facility from the Convention's strict guidelines on conversion and requirement for frequent routine inspections.

The Russian paper went on to state explicitly that the CWC "does not provide for any procedures and methods for verification of declarations in regard to such ["destroyed"] facilities (with the exception of possibilities associated with the challenge inspection mechanism)."³¹ Thus, if the Russian reinterpretation were accepted, a country having concerns about possible treaty violations at a converted CWPf would have no choice but to request the international inspectorate to conduct a "challenge" inspection of the site—a politically difficult option, since it would require one state party to accuse another of a treaty violation.

During the Tenth Plenary, the Russian delegation reiterated Moscow's intention to declare all of its former CWPfs, including "those which, at the time of the Convention's entry into force, may already be destroyed." The Russian statement then added, rather disingenuously, that "chemical weapons production facilities that have already been destroyed...cannot be required to be destroyed a second time after the Convention has entered into force."³² In this context, the term "destroyed" clearly covered facilities that had been converted unilaterally by removing the final-stage CW production equipment.

By trying to redefine "CWPf" in the multilateral

PrepCom, Russia sought to sidestep the deadlocked BDA negotiations and gain international recognition and legitimacy for its position on CWPf conversion. If some countries sided with its reinterpretation of the CWC, Moscow would be in a stronger bargaining position with Washington. This bold gambit was not successful, however. During the Tenth Plenary, the Russian paper elicited strongly negative comments from the delegations of the United States, Great Britain, Germany, the Netherlands, and several states from other regional groups.³³ These countries argued that because the equipment and chemical ingredients involved in nerve agent production are similar to those used to produce legitimate products (such as pesticides and fire retardants), unilateral assurances cannot provide confidence that a former CWPf has been converted irreversibly. Thus, frequent routine inspections are essential to verify CWC compliance.³⁴

Comments on the Russian paper by a few countries went further, accusing Moscow of acting in bad faith. According to a strongly worded statement by the British delegation:

The Russian behavior calls into question her commitment to the principles of the CWC. It arouses the suspicion that the real intention is to remove—and perhaps conceal—equipment, while leaving the sites untouched. This would mean that they could quickly be reactivated. This is not what we have worked so long on the CWC to achieve.³⁵

The German delegation also stated pointedly that the Russian reinterpretation would exclude from the CWC verification regime "many facilities in which the largest possessor of chemical weapons produced thousands and thousands of tonnes of chemical weapons, including super-toxic nerve gases....Such an understanding would clearly be against the spirit of the Convention."³⁶

Despite this harsh criticism, the Russians moved ahead with their efforts to convert their former CWPfs to commercial production. At the Eleventh Plenary of the PrepCom in July 1995, the Russian delegate announced that more than half of the former CWPfs in Russia had already been converted unilaterally, although he did not specify the total number of such facilities.³⁷ This statement aroused concern on the part of many delegations, since it would now be difficult to verify that CW production equipment removed from the facilities in question had actually been destroyed.³⁸

Moscow defended its action on the grounds of economic necessity and its sovereign right to make such decisions prior to the entry into force of the CWC. The Russian delegation also claimed that opposition to its proposed reinterpretation of the Convention had been “artificially stirred up” by “certain countries” that were seeking to exempt from destruction some of their own plants for the production and filling of chemical weapons.³⁹ This statement was a clear reference to Moscow’s allegation that the United States had deliberately omitted from its Wyoming MOU declaration a number of facilities formerly associated with the U.S. binary CW program.⁴⁰

During the fall 1995 session of the CWC PrepCom, the United States proposed a compromise on CWPF conversion: after the entry into force of the Convention, the OPCW international inspectorate would perform an initial inspection of all former CWPFs and determine on a case-by-case basis what further verification measures, if any, would be required.⁴¹ In this way, the frequency and intrusiveness of on-site inspections would be tailored to the assessed risk to the Convention posed by each converted facility. Moscow responded by agreeing to a one-time inspection of its unilaterally converted CWPFs “to confirm that no features of chemical weapons production facilities have been retained.”⁴² At the same time, the Russians insisted that these facilities would not be declared as converted CWPFs but rather as a new category of “destroyed” CWPFs, which would not be subject to routine inspection. Not surprisingly, this Russian proposal was unacceptable to the United States and other like-minded countries.

One reason for the U.S. refusal to accept the Russian approach was concern that unilaterally converted CWPFs could provide a latent mobilization capacity for CW agent production in wartime, or that the manufacture of legitimate chemicals could serve as a cover for illicit activities.⁴³ These fears may be exaggerated. Even if Russia were to violate the CWC, it would be unlikely to produce CW agents at suspect sites such as former CWPFs. According to Vil Mirzayanov, a more likely evasion scenario would involve the production of binary CW components, which are relatively non-toxic and hence could be manufactured in ordinary plants under the cover of agricultural or industrial chemicals.⁴⁴

Apart from the plausibility of various evasion scenarios, the conversion issue is also a matter of principle: commercial production at former Soviet CWPFs will only be acceptable to the United States and other countries if it is

fully consistent with both the letter and spirit of the CWC. Indeed, Russian behavior in this area is widely viewed as a test of Moscow’s willingness to comply with the basic prohibitions of the Convention.

RENEWED BILATERAL DISCUSSIONS

In the fall of 1995, the Clinton administration, concerned that the CWPF conversion issue was deadlocked in both the bilateral and multilateral negotiations, launched a high-level effort to resolve the deadlock over the BDA. The primary motivation for this step was political—to facilitate a vote by the U.S. Senate to approve CWC ratification. Implementing the bilateral verification provisions under the BDA would reassure conservative senators that the United States would not have to rely entirely on multilateral verification but would have its own inspection teams on the ground in Russia to monitor the destruction of Moscow’s CW stockpiles and the conversion of its former CWPFs.

Another rationale for concluding the BDA is that a failure to establish bilateral verification measures could substantially increase the costs of implementing the CWC. To date, all planning assumptions for the OPCW budget have been based on the BDA being in effect before the entry into force of the Convention.⁴⁵ The current estimated annual budget for the OPCW is roughly \$100 million for an organization of about 400 people. Yet without a bilateral verification regime in place, the OPCW would have to hire as many as 100 more inspectors and administrative staff to monitor CW destruction activities in the United States and Russia. This 25 percent increase in staff size, combined with the cost of additional inspection equipment, could increase the OPCW budget by between \$30 million and \$50 million.⁴⁶ Nevertheless, these additional costs will not all come due immediately. Even assuming Russia ratifies the CWC in 1997, its planned CW destruction facilities do not yet exist. Thus, the systematic monitoring of such sites will not be required for at least the first few years after the entry into force of the CWC.

In the fall of 1995, bilateral CW issues were placed on the agenda of the Gore-Chernomyrdin Commission, a high-level political channel between U.S. Vice President Al Gore and Russian Prime Minister Viktor Chernomyrdin. To address the problem of CWPF conversion, the American side informally proposed a “visit” to Volgograd by a team of U.S. government officials and industry representatives. Washington’s approach was to

focus initially on the CWPFs at Volgograd and later arrange a separate visit to Novocheboksarsk. (Although the latter facility appears to be extensively contaminated, the Russians have not ruled out the possibility of converting some buildings there.)

At the seventh meeting of the Gore-Chernomyrdin Commission in Moscow on July 14-16, 1996, the Russian Prime Minister approved the U.S. visit to Volgograd. Even so, he continued to insist that unilaterally converted CWPFs could not be routinely inspected in the future because they had already been "destroyed."⁴⁷ The American and Russian sides also differed on the composition of the visiting delegation: Moscow wanted it to consist primarily of U.S. industry representatives interested in joint ventures at Volgograd, whereas Washington sought a majority of government verification experts and saw the visit as an opportunity for conversion planning consistent with the CWC.⁴⁸ Thus, the two sides continued to talk past each other.

Meanwhile, the Russians were sending mixed signals about their commitment to the bilateral process. At the Fourteenth Plenary of the CWC PrepCom on July 22-26, 1996, the Russian delegate said that Moscow's experience with the Wyoming MOU and the unfinished BDA had led to the conclusion that:

in the context of the Convention, *only a multilateral mechanism* can amply provide an adequate scope for the obligations on chemical disarmament and the required level of confidence in their implementation.⁴⁹

This statement implied that Russia intended to focus on the multilateral CWC PrepCom and abandon the bilateral process. Yet the bilateral talks continued. During their July meeting, Gore and Chernomyrdin set up a special channel on bilateral CW issues between John Holum, director of the U.S. Arms Control and Disarmament Agency, and Yuri Baturin, executive secretary of the Russian Defense Council and chairman of the Interdepartmental Commission on Chemical Disarmament.

At a press conference a few days before his first meeting with Baturin in August 1996, Holum said that Washington still wanted to implement the BDA because having U.S. inspectors on the ground in Russia monitoring CW destruction and CWPF conversion would provide additional assurances of Russian compliance. On the conversion issue, Holum declared that Moscow's proposed reinterpretation of the CWC was unacceptable because "it would take the most modern and most recently used

and most capable chemical weapons production facilities and remove them from the regime."⁵⁰ In the U.S. government's view, he said, the viability of the CWC:

depends on having routine access to the most modern and most capable facilities that have the greatest possibilities for being reconverted to chemical weapons production. What we are interested in doing, in working with the Russians, is to assist in a conversion that would be permitted and legitimate under the treaty. It doesn't escape long-term inspection, but it does serve their interest in having economically viable entities.⁵¹

When Holum and Baturin met in Moscow on August 10, 1996, they discussed several bilateral CW issues, including assistance for Russian CW destruction, unresolved data-declaration issues left over from the Wyoming MOU, and plans to implement some kind of bilateral verification system. In this regard, Holum sought to persuade Baturin that routine verification of converted CWPFs would be in Moscow's best interest. Although there were no major breakthroughs, the two sides made modest progress and agreed to meet again in the near future.⁵² Nevertheless, the date of the U.S. visit to Volgograd, which had originally been set for October, was subsequently postponed indefinitely by the Russian side on the grounds that the facility was not yet ready to receive visitors.

THE SHAPE OF A COMPROMISE

Resolving the deadlock over CWPF conversion will require a compromise formula that simultaneously reduces the financial cost of CWC implementation for Russia and reassures the United States and other governments that the converted facilities cannot be used for military purposes, thereby avoiding interminable battles over compliance. A useful model in this regard may be the conversion of former Soviet biological weapons (BW) facilities through joint ventures with American firms, with the blessing and financial support of the U.S. government. Of particular interest are the institutes belonging to Biopreparat, an ostensibly civilian pharmaceutical production association that from 1973 to 1992 was secretly involved in the Soviet/Russian BW program.⁵³

In April 1995, for example, the U.S. firm Allen & Associates International (AAI) signed a contract with a former Biopreparat facility in Stepnogorsk, Kazakstan, to form a joint venture company called "Kamed Re-

sources," which will manufacture painkillers, antibiotics, and vitamins. To convert this plant, the U.S. Defense Department is contributing \$2.6 million and AAI \$3 million. The American partner firm was interested in the joint venture because it had sought for three years to develop a pharmaceutical industry in the former Soviet Union.⁵⁴

In much the same way, the U.S. government could serve as a matchmaker and provide seed money for industrial joint ventures at former Soviet CWPFs.⁵⁵ Vil Mirzayanov believes that the idea of joint ventures at Volgograd is "a very promising idea, in theory." He cautions, however, that the converted facilities "must be subject to strict verification, because unfortunately they are still under the control of the Russian army—the same people responsible for CW development and production." Accordingly, Mirzayanov recommends that managers and technicians from the foreign partner firms be present on-site to ensure that the converted CWPFs are not diverted to illicit purposes; an arms-length partnership, in his view, would not be desirable.⁵⁶

U.S. and other foreign companies will probably decide to invest in joint ventures at Volgograd because of a desire to gain a foothold in the Russian market rather than in the expectation of immediate profits. It is still unclear, however, whether chemicals manufactured at former CWPFs could compete effectively on world markets or even if adequate domestic markets exist. Chemical company executives may also be concerned about the public-relations aspect of doing business at former Soviet CWPFs, given the unresolved allegations about Russia's secret binary agent program. No company wants to be accused of contributing—even inadvertently—to banned weapons-related activities. According to Michael Walls of the Chemical Manufacturers Association, "We don't yet have enough information about what is going on [at the former CWPFs] to evaluate the quality of the investment. There is some interest on the part of U.S. industry, but not overwhelming interest."⁵⁷ Walls notes that joint ventures involving American companies would be unlikely without an official agreement between the U.S. and Russian governments, as well as financial incentives such as risk insurance provided by the Overseas Private Investment Corporation (OPIC).

Uncertainties also remain about the safety of former Soviet CWPFs. Some buildings at Volgograd that are made of porous material such as brick may be contaminated with toxic CW agents, making it hazardous to use

them for legitimate production. Indeed, Mirzayanov claims that he analyzed probe samples from the smokestacks at Volgograd and found high concentrations of the lethal nerve agent soman. During years of soman production at the plant, he says, the supertoxic agent was absorbed into the walls through a physiochemical process. Even if the soman could be removed, Mirzayanov contends that toxic degradation products might still contaminate commercial products and endanger the health of plant workers. He also claims that plant managers at Volgograd refused to acknowledge his analytical results.⁵⁸

U.S. officials, in contrast, doubt the contamination problem at Volgograd is that severe. One expert who visited the site during a Wyoming MOU inspection said that only one building—a former munitions-filling area—was so contaminated that protective suits had to be worn.⁵⁹ According to Kevin Flamm, program manager for chemical demilitarization at the U.S. Army Aberdeen Proving Ground, the extent of contamination at Volgograd and Novocheboksarsk remains to be assessed. He notes, however, that concrete and mortar are chemically basic and thus would tend to accelerate the decomposition of nerve agents. If a residual hazard exists, Flamm says, the Russians might be able to seal the walls to prevent leaching of toxic material.⁶⁰

A final obstacle to joint ventures at former CWPFs is political—the fact that the CWC requires multilateral approval of any proposed conversion. A foreign company that perceives a potential market for chemicals in Russia and seeks to acquire and convert a former CWPF must first prepare a business plan for the financing bank and investors, environmental impact statements for the local and federal Russian governments, and a general conversion plan for the OPCW. As mentioned earlier, the international organization's 41-member Executive Council will recommend to the Conference of States Parties whether to approve the conversion request for a particular CWPF. The member states must then rule on the request by consensus, based on the assessed risk of illicit production at the converted facility.

Since even one state party could veto the conversion of a CWPF out of legitimate concerns or ulterior motives, there is no guarantee that a conversion request will be approved. Although the United States will probably support all of Russia's nominations, other countries might seek to block them. Poland, for example, could have an interest in preventing CWPF conversion at Volgograd because Russia competes for many of the same commer-

cial chemical markets or because Warsaw may not trust Moscow to comply with the CWC.

Another problem is that the conversion option is time-limited. According to paragraph 66 of Part V of the CWC Verification Annex, a state party has only four years after the Convention enters into force to request the conversion of a former CWPF. Since the evaluation of a facility's economic potential and the preparation of the necessary reports could take several months, time will quickly run out for the conversion option. Indeed, given the restrictive provisions of the CWC, a U.S. official worries that the United States may be "promising industry more than we can deliver. Our hands are tied by the Convention and there's only so much we can do within those constraints."⁶¹

One way to make the prospect of joint ventures at former Soviet CWPFs more attractive to prospective investors would be for the United States to assume some of the financial risks. For example, the U.S. government might offer to pay for preliminary studies such as a market analysis, the general conversion plan required by the CWC, and draft environmental impact statements. Interested U.S. chemical companies would then offer to purchase and convert CWPFs *contingent* on approval by the Conference of States Parties. In this way, industry's sunk costs would be zero prior to approval of the conversion plan. Although there would be some risk that the OPCW would reject the conversion request for a particular facility, the cost to the U.S. government of subsidizing the study phase would be more than offset by the high potential payoff in arms control and transparency. Moreover, keeping former CW scientists and workers employed at the converted facilities would reduce the risk of a "brain drain" of lethal expertise to proliferant countries and terrorist groups.

CONFIDENCE-BUILDING MEASURES

Even if American chemical companies are interested in joint ventures at former Russian CWPFs, the U.S. government has stated it will not authorize them unless the facilities are converted in a manner consistent with the CWC guidelines—a precondition that Moscow has so far shown no signs of accepting.⁶² Nevertheless, a compromise to break the current deadlock is still possible. By offering financial incentives such as seed money for CWPF conversion,⁶³ the United States may be able to persuade the Russian government to reconfigure its converted CWPFs to demonstrate they are low-threat, thereby

building confidence in CWC compliance.

For example, the Russians have a compelling economic need to retain the production *capacity* of their former CWPFs but not the capability to produce specific chemicals. For this reason, Moscow might agree to limit the range of compounds manufactured at converted facilities. One approach would be to rule out the production of any chemicals structurally related to nerve agents, such as organophosphorus compounds (i.e., chemicals containing a carbon-phosphorus bond) or, better yet, all compounds containing phosphorus. With such a ban in place, testing the production line for elemental phosphorus could verify rapidly that no organophosphorus compounds were being manufactured at the site—with no risk of compromising proprietary business information.⁶⁴ Moreover, periodic sampling by a small team of inspectors, or the use of a low-cost automated sampling system,⁶⁵ would be adequate to monitor CWC compliance, greatly reducing the verification burden.

As an additional incentive for Moscow to permit routine inspections of converted CWPFs, the United States might offer to cover some or all of the costs associated with systematic verification, either on a bilateral or multilateral basis. For example, the CWC requires the inspected state party to pay for in-country travel and *per diem* expenses of OPCW inspection teams and expendable items consumed during sampling and analysis, but not fixed costs such as inspector salaries, housing, and retirement benefits. If payment of reimbursable costs were the only obstacle to Russia's acceptance of routine inspections at converted CWPFs, the United States might well agree to subsidize them.

In conclusion, a U.S. offer of political and financial support for industrial joint ventures at former Soviet CWPFs, with the condition that these facilities are converted in a manner consistent with the CWC, could help break the current deadlock between Washington and Moscow. Such a compromise formula would reduce the economic burden on Russia of implementing the Convention, while addressing legitimate U.S. concerns that CWPF conversion be irreversible and subject to systematic verification.

¹ The decision by the U.S. Senate leadership on September 12, 1996, to postpone a vote on the CWC until after the November presidential election is likely to delay Russian ratification still further.

² Viktor Litovkin, "Moscow Votes For Chemical Disarmament Convention, Though It Doesn't Agree With Everything In It," *Izvestia*, August 27, 1992, pp. 1, 4; in *The Current Digest XLIV*(34), 1992, p. 15.

³ Author's telephone interview with a U.S. government official (name withheld on request), April 26, 1996.

⁴ A large number of facilities were involved in CW agent production in the Soviet Union before and during World War II. According to Vil Mirzayanov, a former chemical weapons scientist, "In Moscow alone there were at least six plants manufacturing toxic agents.... Generally speaking, you could say that in the European part of the country there was probably no population center of any size, any city, that did not manufacture chemical weapons." Transcript of 2 July 1994 TV Program on Shikhany CW Center, Ostankino Television First Channel Network; in JPRS-TAC-94-009-L (18 August 1994), p. 23. On Chapayevsk, see Andrei Maksimov, "A Look at the Former Chemical-Weapons Capital," *Segodnya*, July 25, 1996, p. 9; in *The Current Digest XLVIII* (31), 1996, pp. 16-17.

⁵ See Oleg Vishnyakov, "Binary Bomb Exploded" [Interview with Vil Mirzayanov and Lev Fedorov], *Novoye Vremya*, No. 44 (October 1992), pp. 4-9; in JPRS-TAC-92-033 (14 November 1992), pp. 44-49.

⁶ Mirzayanov claims that under the *Foliant* program, the Soviet Union secretly developed and tested three unitary CW agents. The first was Substance 33, a compound similar to the persistent nerve agent VX, of which 15,000 tons were produced in the early 1980s in a full-scale production facility near the city of Novocheboksarsk in the upper Volga region. (Although Western analysts believed that the Novocheboksarsk facility produced VX, Mirzayanov says it actually produced Substance 33.) Two other unitary nerve agents were also developed: A-230, which was officially approved by the Soviet Army in 1988; and A-232, an agent similar to A-230 that never received Soviet Army approval. These agents were produced in limited quantities and tested at military test sites in Shikhany, Russia, and at the Ust-Yurt site near the city of Nukus, Uzbekistan. The three unitary nerve agents were the basis for the development of the *novichok* series of binary weapons, which began in 1982 at the State Union Scientific Research Institute of Organic Chemistry and Technology (GosNIIOKhT) in Moscow and its affiliate in Volsk-17 (near Shikhany). The first Soviet binary agent, *novichok-5*, was derived from the unitary nerve agent A-232. A test batch of five to 10 metric tons of *novichok-5* was produced at a pilot-scale plant in Volgograd and field-tested in 1989 and 1990 at the CW testing ground in Nukus. According to Mirzayanov, *novichok-5* is five to eight times more lethal than VX and practically defies medical treatment. Indeed, one of the chemical engineers involved in its development, Andrei Zheleznyakov, was exposed to the agent in a laboratory accident and became an invalid for life. GosNIIOKhT also developed a binary form of Substance 33 that has no established name but that Mirzayanov calls "*novichok-#*." This binary agent was tested at Nukus and Shikhany and was adopted by the Soviet Army as a chemical weapon in 1990.

Mirzayanov also reports that GosNIIOKhT developed a third binary agent called *novichok-7*, which has a similar volatility to the nerve agent soman but is approximately 10 times more effective. This binary agent was produced in experimental quantities (tens of tons) at pilot-scale production facilities in Shikhany and Volgograd, and was tested in 1993 at the Shikhany test site. Two other binary nerve agents, designated *novichok-8* and *novichok-9*, were also reportedly under development at GosNIIOKhT but were not produced.

Although the chemical structures of the novel CW agents are unknown, they are reportedly organophosphate compounds derived from accessible raw materials. According to Vladimir Uglev, the inventor of A-232, "the weapon's originality lies in the simplicity of its components, which are used in civilian industry and which cannot therefore be regulated by international experts." Moreover, since binary components are much less toxic than unitary nerve agents, the *novichok* series could be produced at commercial chemical plants that manufacture fertilizers and pesticides.

Sources on the secret Russian CW program include: Oleg Vishnyakov, "Binary Bomb Exploded" [Interview with Vil Mirzayanov and Lev Fedorov], *Novoye Vremya*, No. 44 (October 1992), pp. 4-9, in JPRS-TAC-92-033 (14 November 1992), pp. 44-49; Douglas L. Clarke, "Chemical Weapons in Rus-

sia," *RFE/RL Research Report 2* (January 8, 1993), pp. 47-48; Oleg Vishnyakov, "Interview with a Noose Around the Neck" [Interview with Vladimir Uglev], *Novoye Vremya*, No. 6 (February 1993), pp. 40-41, in JPRS-TAC-93-007 (13 April 1993), pp. 39-42; Virginie Coulloudon, "Russia: Chemical Threat: The Terrible Secret," *Le Point*, February 12, 1994, pp. 14-15, in JPRS-TAC-94-001-L (22 February 1994), p. 14; Igor Ryabov, "'Chemical War' Against an Invisible Enemy," *Novoye Vremya*, No. 5 (February 1994), pp. 4-6, in JPRS-TAC-94-003 (7 March 1994), pp. 11-14; Lev A. Fedorov, *Chemical Weapons in Russia: History, Ecology, Politics* (Moscow, 1994), in JPRS-TAC-94-008-L (27 July 1994); and Vil S. Mirzayanov, "Dismantling the Soviet/Russian Chemical Weapons Complex: An Insider's View," in Amy E. Smithson et al., *Chemical Weapons Disarmament in Russia: Problems and Prospects*, Report No. 17 (Washington, D.C.: The Henry L. Stimson Center, October 1995), pp. 21-33.

⁷ Fred Hiatt, "Russia Jails Scientist Over State Secrets," *The Washington Post*, October 27, 1992, pp. A21, A27; Serge Schmemmann, "K.G.B.'s Successor Charges Scientist," *The New York Times*, November 1, 1992, p. 4; Gale Colby and Irene Goldman, "When Will Russia Abandon Its Secret Chemical Weapons Program?" *Demokratizatsiya* (Winter 1993/94), pp. 148-154.

⁸ Mirzayanov, "Dismantling the Soviet/Russian Chemical Weapons Complex," p. 26-28.

⁹ For examples, see James Ring Adams, "Russia's Toxic Threat," *The Wall Street Journal*, April 30, 1996, p. A14; Frank J. Gaffney, Jr., "Impending CWC Debate," *The Washington Times*, September 4, 1996, p. A16; and Thomas W. Lippman, "Senate Foes Derailed Chemical Weapons Treaty," *The Washington Post*, September 13, 1996, p. A1.

¹⁰ U.S. Arms Control and Disarmament Agency, *Threat Control Through Arms Control: Annual Report to Congress 1995* (Washington, D.C.: ACDA, 1996), p. 23.

¹¹ Author's telephone interview with an ACDA official, September 26, 1996.

¹² Celes Eckerman, "CWC Vote Delayed By U.S. Questions to Russia," *Arms Control Today* 24 (September 1994), p. 29; Martin Sieff, "U.S. Says Russia Isn't Coming Clean With Poison-Gas Data," *The Washington Times*, June 24, 1994, p. A16.

¹³ The Russian government reportedly did not comply with the MOU requirement to declare all development facilities that devoted more than 50 percent of their manpower, floorspace, and funding to CW activities. Whereas the United States declared more than 100 CW development facilities, Russia declared only one building. (Author's telephone interview with a U.S. government official (name withheld request) on April 26, 1996.) Yet reports in the Russian press indicate the existence of at least three clandestine CW development centers in the Moscow region alone, including the State Scientific Research Institute for Organic Chemistry and Technology (GosNIIOKhT), the Military Chemical Defense Academy, and the Scientific Research Institute for Chemical Machinery. See Vladimir Gusar, "Third-Generation Chemical Weapons Are Being Produced and Tested As Before," *VEK*, No. 12, March 26 - April 1, 1993, p. 2; in JPRS-TAC-93-007 (13 April 1993), p. 43.

¹⁴ Testimony by the Hon. R. James Woolsey, in U.S. Senate, Committee on Foreign Relations, *Hearings: Chemical Weapons Convention*, 103rd Congress, 2nd session [S.Hrg. 103-869], June 23, 1994, p. 164.

¹⁵ Mirzayanov, "Dismantling the Soviet/Russian Chemical Weapons Complex," p. 25.

¹⁶ CWC, Article V, paragraph 13.

¹⁷ CWC Verification Annex, Part V, Section D, para 75.

¹⁸ Article V of the CWC states that a converted facility must not be more capable of being reconverted into a CWP than any other facility used for legitimate purposes. In addition, Part V of the CWC Verification Annex places stringent conditions on CWP conversion. It precludes a converted facility from producing, processing, or consuming the toxic chemicals and precursors listed on CWC Schedules 1 and 2, or any other toxic chemicals unless specifically authorized by the OPCW's Executive Council and Conference of States Parties. The CWC guidelines also require the destruction of any "specialized" equipment and buildings used in CW agent production such as airtight enclosures, high-capacity ventilation systems, and reaction vessels and piping made of special corrosion-resistant materials. Without such specialized equipment in place, illicit CW production would pose serious hazards to plant workers and the environment.

Finally, Part V of the CWC Verification Annex requires that for the 10 years after the OPCW Director-General certifies that conversion is complete, the state party must give OPCW inspectors unimpeded access to the facility at any time. States parties possessing converted CWPFs must pay for the costs of verification over the entire 10-year period.

¹⁹ Litovkin, p. 15.

²⁰ *Ibid.*

²¹ Vladimir Orlov, "Destruction of Chemical Weapons Could Cost Russia 25 Trillion Rubles" [Interview with Pavel Syutkin], *The Monitor* 1 (Fall 1995), pp. 19-20. (*The Monitor* is published by the Center for International Trade and Security at the University of Georgia, Athens, GA.)

²² Binary CW munitions contain two separate canisters filled with relatively nontoxic precursor chemicals that react to form a lethal agent while the munition is in flight to the target. The United States developed three types of binary munitions: a 155mm artillery shell containing precursors of the volatile nerve agent sarin; the BIGEYE spray bomb containing precursors of the persistent nerve agent VX; and a warhead for the Multiple Launch Rocket System (MLRS) containing precursors of a mixture of intermediate-volatility nerve agents. Although the 155mm shell and the BIGEYE bomb were produced, the MLRS system was terminated in 1990 in the final stages of development.

²³ Michael Moodie, "Ratifying the CWC: Past Time for Action," *Arms Control Today* 26 (February 1996), pp. 7-8.

²⁴ The official title of the BDA implementing protocol is: "Protocol of Updated Provisions Relating to the Agreement Between the United States of America and the Union of Soviet Socialist Republics on Destruction and Non-Production of Chemical Weapons and on Measures to Facilitate the Multilateral Convention on Banning Chemical Weapons, agreed *ad referendum* in Geneva on March 26, 1993."

²⁵ Response to question for the record, in U.S. Senate, Committee on Foreign Relations, *Hearings: Chemical Weapons Convention (Treaty Doc. 103-21)*, 103rd Congress, 2nd session, March 22, 1994 [S.Hrg. 103-869], p. 42.

²⁶ United States, "Non-Paper: Guidelines for Conversion Plans for Chemical Weapons Production Facilities," October 14, 1993; and Russian Federation, "Non-Paper: Basic Guidelines to Implementing the Provisions on the Conversion of Chemical Weapons Production Facilities for Purposes Not Prohibited Under the Convention," May 30, 1994.

²⁷ The U.S. paper stated that by the end of the conversion process, "all specialized equipment and special features of buildings or structures" must be destroyed. In contrast, the Russian paper narrowed the scope of conversion by stating that by the end of the process, "the main production train and any chemical weapons filling machines" must be destroyed, plus "those specialized features of the buildings that make them distinct from standard buildings." The Russian paper further defined "specialized equipment" as items of equipment involved in the final stage of CW agent production and having specifications "distinct from prevailing commercial industry standards." The United States countered that commercial availability is not an adequate criterion, since commercial chemical plants are increasingly equipped with emission-control devices for enhanced environmental protection and worker safety, making them harder to distinguish from CWPFs. Thus, the U.S. paper stressed the need to assess the capability of the converted facility *as a whole*. Finally, the U.S. paper stressed the right of the OPCW Technical Secretariat to conduct routine inspections for 10 years after the conversion of a CWPF, while the Russian paper was silent on this issue.

²⁸ Expert Group on Chemical Weapons and Associated Issues, "Background Paper: Basic Guidelines to Implementing The Provisions On The Conversion Of Chemical Weapons Production Facilities For Purposes Not Prohibited Under The Convention," August 31, 1994 (Rev 1) and February 27, 1995 (Rev 2).

²⁹ In discussing the timetable for destruction of CWPFs, the Expert Group on Chemical Weapons Issues did manage to agree on a list of chemical production equipment that would be termed "specialized." [Expert Group on Chemical Weapons Issues, "Destruction of CW Production Facilities," document FOC CWPF 96/1.Rev 4, February 12, 1996.] The Expert Group also has been tasked to develop criteria for the toxicity and corrosiveness of chemicals that may be produced at a converted CWPF.

³⁰ Russian Federation, "The Issue of Declaration of Chemical Weapons Production Facilities," Preparatory Commission for the Organization for the Prohibition of Chemical Weapons, Tenth Session, document PC-X/B/WP.14, March 23, 1995, p. 1.

³¹ *Ibid.*, p. 4.

³² Russian Federation, "Statement by Mr. A.S. Ivanov, Head of the Delegation of the Russian Federation at the Tenth Session of the Preparatory Commission for the OPCW," April 3, 1995 (English translation).

³³ United Kingdom, "UK Comments on Russian Paper on Chemical Weapons Production Facilities (CWPFs)," The Hague, April 5, 1995.

³⁴ Matthew Meselson and Justin Smith, "The CWC and the Destruction or Conversion of Chemical Weapon Production Facilities," Working paper presented at the Third Workshop of the Pugwash Study Group on the Implementation of the Chemical and Biological Weapons Conventions, Noordwijk, The Netherlands, May 19-21, 1995.

³⁵ United Kingdom, "UK Comments on Russian Paper."

³⁶ Delegation of Germany, Statement by Dr. H.W. Beuth, Alternate Representative, on "The Issue of Declaration of Chemical Weapons Production Facilities," delivered in Working Group B session of the Tenth Plenary of the CWC PrepCom, April 5, 1995.

³⁷ Russian Federation, "Statement by the Head of the Delegation of the Russian Federation at the Eleventh Session of the Preparatory Commission for the Organisation for the Prohibition of Chemical Weapons," document PC-XI/11, July 25, 1995.

³⁸ According to a U.S. government source, the Russians have removed all CW production equipment from at least two buildings at Volgograd. During a visit to the chemical complex under the Wyoming MOU, U.S. inspectors entered the building where methylphosphonic difluoride (a nerve agent precursor) had been produced and found it was completely empty. Author's telephone interview with an ACDA official, September 26, 1996.

³⁹ Russian Federation, "Statement by the Head of Delegation," July 25, 1995.

⁴⁰ The items that Russia contends should have been declared are some mobile CW filling systems (which the United States considers free-standing equipment but Russia classifies as filling facilities) and a plant that mixed the "OPA" component of the sarin binary artillery shell. OPA consists of two common industrial chemicals, isopropyl alcohol and isopropylamine. Since these compounds are not listed in the CWC Schedules of Chemicals, the United States maintains that the mixing plant is not a CWPF and hence is not declarable.

⁴¹ Author's telephone interview with Richard D'Andrea, Acting Chief, Chemical and Biological Policy Division, U.S. Arms Control & Disarmament Agency, April 9, 1996.

⁴² Delegation of the Russian Federation, "The Issue of Chemical Weapons Production Facilities," Informal Working Paper, September 22, 1995 (English translation).

⁴³ One scenario for clandestine production of CW agent at a converted facility would be to produce an organophosphorus nerve agent such as sarin in short production campaigns, then flush the system and switch to production of an organophosphorus compound with a similar chemical structure such as the pesticide malathion or the fire retardant DMMP. In this case, on-site sampling and analysis might either fail to detect the nerve-agent residue or could yield ambiguous results.

⁴⁴ Author's telephone interview with Vil Mirzayanov, September 17, 1996.

⁴⁵ Author's telephone interview with Thomas Cataldo, Deputy Director, Chemical Weapons Treaty Management Office, U.S. On-Site Inspection Agency, September 3, 1996.

⁴⁶ *Ibid.*

⁴⁷ R. Jeffrey Smith, "U.S. to Discuss Concerns on Chemical Arms Pact With Moscow," *The Washington Post*, August 9, 1996, p. A22.

⁴⁸ Author's telephone interview with an ACDA official, September 3, 1996.

⁴⁹ Delegation of the Russian Federation, "Statement by the Delegation of the Russian Federation at the Fourteenth Session of the Preparatory Commission for the Organisation for the Prohibition of Chemical Weapons," document PC-XIV/16, July 22, 1996 (emphasis added).

⁵⁰ John Holum, Director, U.S. Arms Control and Disarmament Agency, statement at press conference on "Chemical Weapons Convention and Comprehensive Test Ban Negotiations," August 7, 1996. (Transcript by Federal News Service.)

⁵¹ *Ibid.*

⁵² Author's telephone interview with Richard D'Andrea, ACDA, September 10, 1996.

⁵³ See John Barry, "Planning a Plague?" *Newsweek*, February 1, 1993, pp. 40-

41; and Anthony Rimmington, "From Military to Industrial Complex? The Conversion of Biological Weapons' Facilities in the Russian Federation," *Contemporary Security Policy* 17 (April 1996), pp. 80-112.

⁵⁴ Bill Gertz, "Germ Warfare Gives Way to War on Germs," *The Washington Times*, April 6, 1995, p. A13.

⁵⁵ Rose Gottemoeller, "Development of Complex Incentive Strategies for Non-proliferation Policy," paper delivered at the Aspen Strategy Seminar, Aspen, Colorado, July 28, 1996.

⁵⁶ Author's telephone interview with Vil Mirzayanov, September 17, 1996.

⁵⁷ Author's telephone interview with Michael Walls, Chemical Manufacturers Association, September 13, 1996.

⁵⁸ Author's telephone interview with Vil Mirzayanov, September 17, 1996.

⁵⁹ Author's telephone interview with an ACDA official, September 26, 1996.

⁶⁰ Author's telephone interview with Kevin Flamm, U.S. Army Aberdeen Proving Ground, Maryland, September 23, 1996.

⁶¹ Author's telephone interview with Thomas Cataldo, U.S. On-Site Inspection Agency, September 25, 1996.

⁶² Author's telephone interview with Richard D'Andrea, ACDA, April 9, 1996.

⁶³ Since 1992, the U.S. Department of Defense's (DOD) Cooperative Threat Reduction (CTR) program has sought to help the newly independent states of Belarus, Kazakhstan, Russia, and Ukraine control and reduce threats posed by weapons of mass destruction inherited from the former Soviet Union. According to the Congressional General Accounting Office, DOD has allocated \$68 million in fiscal year (FY) 1992-96 CTR funds to support research and development on Russian CW destruction. On July 30, 1996, Congress approved another \$78.5 million in FY 1997 to continue program support, including further development of CW and munitions processing equipment and the design of a pilot CW destruction facility, and \$15 million for dismantlement of Russian chemical and biological weapons facilities. However, the final language of the conference bill specifically excludes the use of these funds for the conversion of former CWPFs, reflecting the long-held House position against supporting defense conversion in Russia. Thus, any U.S. funding for CWPF conversion would have to come from other sources. See "Congress OK's Increased Funds for Soviet Weapons Dismantlement," *Post-Soviet Nuclear & Defense Monitor* 3 (20), August 13, 1996, p. 1; and U.S. General Accounting Office, National Security and International Affairs Division, *Weapons of Mass Destruction: Status of the Cooperative Threat Reduction Program* (GAO/NSIAD-96-22, September 27, 1996), p. 20.

⁶⁴ Whereas the production equipment at a converted CWPF would be new, the walls and floors would almost certainly be contaminated with phosphorus from past production activities. Thus, sampling areas of the plant outside the production line would probably yield ambiguous results.

⁶⁵ One approach to remote monitoring, known as "Sample Now, Analyze Later" (SNAL) involves taking samples automatically from the production line at random intervals. A prototype SNAL device, developed by a team at the University of Hamburg, can store 1,200 samples over a period of the year on a single polyethylene cassette tape. The device extracts a few micrograms of material directly from the production line through a silicon transfer membrane and deposits the sample on the magnetic tape along with data on the date and time of sampling. Several months later, inspectors can use a portable instrument to analyze the accumulated samples retrospectively and read the associated data. See Gerhard Matz, University of Hamburg, "Sampling Organics on a Magnetic Tape Reporter System for Retrospective Analysis by a Mobile Mass Spectrometer," paper given at the Chemical Weapons Convention Verification Technology Research and Development Conference, Herndon, VA, March 3, 1993.