US-UKRAINIAN NUCLEAR COOPERATION: IS KYIV READY FOR IT?

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Cooperation between Ukraine and the United States for nonproliferation has recently intensified. After Ukraine agreed in April 1998 to forego participation in the Russian-led project to build the Bushehr nuclear power station in Iran, on May 6, 1998, US Ambassador to Ukraine Steven Pifer and Ukrainian Foreign Minister Boris Tarasyuk signed an *Agreement for Cooperation between the United States of America and Ukraine Concerning Peaceful Uses of Nuclear Energy*. Under this agreement, the US government will provide Ukraine with about $30 million to help the country to modernize its nuclear fuel sector. Furthermore, the agreement creates a framework that allows US private companies to conclude more deals with the Ukrainian nuclear sector in areas such as managing nuclear fuel supply, building a uranium enrichment facility, and completing construction of additional nuclear power reactors at Khmelnitsky and Rivne.

However, the prospects for long-term growth of Ukrainian-US cooperation in this area remain unclear. To a significant degree, such cooperation is based on the premise that in return for working with the United States on nonproliferation issues, Ukraine will receive US nuclear assistance and access to Western technology through deals with US companies. Unfortunately, US businesses have not been very successful in entering the Ukrainian market, due in part to an extremely unfavorable climate for foreign long-term investments and joint projects caused by corruption and economic uncertainty. In addition, Russia, the other major competitor in the Ukrainian nuclear technology market, has been more flexible than the United States in negotiating deals with Kyiv. As a result, the incentives for long-term Ukrainian nonproliferation cooperation with the United States are not nearly as strong as the signing of the recent agreements would indicate. Additional steps will need to be taken by both countries if this cooperation is to be placed on a more solid footing.

This report begins by outlining the current status of the Ukrainian nuclear sector. It then traces the history of past and current US nuclear and nonproliferation assistance to Ukraine, and provides a more detailed assessment of the prospects for increasing bilateral cooperation in the nuclear sector.

CURRENT STATUS OF THE UKRAINIAN NUCLEAR SECTOR

Ukraine has the fifth-largest nuclear energy program in Europe (after France, Germany, Russia, and the United Kingdom). There are five nuclear power plants in the country, located at Chernobyl, Khmelnitsky, Rivne, Mykolaiv, and Zaporizhye, with fourteen operational units. Research reactors are housed at the Institute for Nuclear Research in Kyiv and at the Sevastopol Institute of Nuclear Energy and Industry. About 72 kg of

highly enriched uranium (HEU) is stored at the Kharkiv Institute of Physics and Technology. Uranium mining and milling is conducted at facilities in the Kirovograd and Kryvy Rig regions. Overall, about 60 facilities in Ukraine produce nuclear-related goods and technology, and about 5,000 enterprises use radioactive sources and devices.[1]

Nuclear safety has been a continuing concern for the Ukrainian nuclear sector since the April 1986 disaster at Chernobyl. Nevertheless, there were 38 safety-related incidents at Ukrainian nuclear power reactors in 1998, and two incidents between January and April of 1999.[2] Equally troubling, the number of malfunctions at Ukrainian nuclear reactors increased 20 percent between 1997 and 1998, according to the Ukrainian Nuclear Society.[3] Owing to continuing economic difficulties, safety improvements are unlikely to take place in the near future. Financial shortfalls have delayed purchases of spare parts, equipment, instruments, and materials.[4] Balancing the demand for electricity output against safety considerations has become a constant challenge, especially in the winter, when electricity demand increases.

The ongoing problem of wage arrears is creating an additional safety concern. There were some protests by nuclear power plant workers in 1997, but the problems intensified in September 1998, when workers at all five Ukrainian nuclear power plants, who had not been paid for five months, began vocal protests. The government temporarily quelled the protests by promising repayment, but proved unable to follow through. By February 1999, nuclear plant employees were owed more than 150 million hryvna ($42 million), and another set of vocal protests, which were increasingly likely to undermine safe operation of the plants, began.[5] At all five nuclear plants, workers set up tent camps and stayed there between shifts, depriving themselves of sleep and food.[6] Eventually, the Ukrainian government had to yield, and replaced both the head of Energoatom and the Minister of Energy.

Unfortunately, these measures are unlikely to solve the problem, which stems from the generally poor state of Ukraine's economy and the "non-payments crisis." During 1998, Ukrainian nuclear power plants produced 4.5 billion hryvna ($2 billion) worth of power, but received only 5.5 percent of that amount in cash payments from customers.[7] Unfortunately, the cash-strapped Ukrainian government has neither money to subsidize the nuclear energy sector, nor effective leverage to make customers pay for electricity. These economic problems, combined with the technological obsolescence of Ukrainian nuclear plants, pose a serious safety problem. In February 1999, 28 leading Ukrainian nuclear experts sent an open letter to President Kuchma stating that "nuclear power stations operate in dangerous conditions," and concluding that the nuclear sector is in a "state of disintegration."[8]

Another safety challenge is the planned shutdown of the Chernobyl nuclear power plant, where currently only Reactor No. 3 is operational. In 1995, Ukraine and the Group of Seven (G-7) signed a memorandum on closing Chernobyl by the year 2000. This $3.1 billion aid deal consists of two major components: the construction of a new "sarcophagus" over the destroyed reactor, and completion of two new reactors to compensate for the lost power generation capacity at Chernobyl. Stabilizing the hastily built "sarcophagus" will cost approximately $750 million. So far, the G-7 nations have pledged only $300 million for the project, to the dismay of the Ukrainian government. However, some financial support is expected from the European Union and the European Bank for Reconstruction and Development (EBRD).[9] British Nuclear Fuels Ltd. has already begun design work on the stabilization project.[10] Despite some remaining financial questions, the project is moving ahead slowly but steadily.

The second part of the deal—building new reactors in Rivne and Khmelnitsky—is more controversial. The Ukrainian government views the completion of the two reactors, at an estimated cost of $1.2 to 1.72 billion, as a precondition for closing Chernobyl. Construction of these two Russian-designed VVER-1000 reactors started in the mid-1980s, but was suspended after the Chernobyl disaster and postponed indefinitely after 1991 for financial reasons. The G-7 countries have asked the EBRD for a loan to complete the reactors, but the bank has balked, saying Ukraine already has a large surplus of energy that it is not using efficiently. Under pressure from the G-7, the bank has now agreed in principle to back the project, but questions remain. According to Julia Zilberman, an EBRD spokeswoman, the bank is committed to making a decision on the loan by mid-1999.[11]

Despite the crumbling state of the nuclear sector, however, official Ukrainian policy remains committed to nonproliferation. Contingent upon receiving security guarantees from the nuclear nations, the Ukrainian Parliament approved Ukraine's accession to the Treaty on

the Non-Proliferation of Nuclear Weapons (NPT) as a non-nuclear weapon state on November 16, 1994. Guarantees from the United States, Russia, and the United Kingdom were provided in a memorandum at the Organization for Security and Cooperation in Europe (OSCE) on December 5, 1994, in Budapest. France and China provided security guarantees to Ukraine in separate documents. Thus, Ukraine formally became a non-nuclear weapon state party to the NPT on December 5, 1994. In September 1994, Ukraine signed an agreement on full-scope safeguards with the International Atomic Energy Agency (IAEA), which came into force on January 13, 1995. This agreement provides IAEA inspection on all Ukrainian peaceful nuclear activities. The first ad-hoc inspections began in February 1995.

When Ukraine ratified the NPT and signed the agreement on full-scope safeguards with the IAEA, it hoped doing so would open doors to membership in the Nuclear Suppliers Group (NSG). However, delays in creating the legal basis for a national export control system hampered Ukrainian admission to the NSG. It was not until March 1996 that the Ukrainian government adopted Decree No. 302, entitled "Regulations on the Procedure for Controls on the Export, Import and Transit of Commodities Which May Relate to Nuclear Activities and May be Used to Develop Nuclear Weapons," which established the basic framework for nuclear export control in Ukraine. At the subsequent May 1996 NSG meeting in Buenos Aires, Argentina, Ukraine joined the NSG as a full-fledged member.

NONPROLIFERATION AND INTERNATIONAL NUCLEAR COMMERCE

Many assumed that membership in the NSG would allow Ukraine to display its support for nuclear nonproliferation while also gaining access to world markets for peaceful nuclear technology, including the opportunity to legally export items on the NSG "trigger list." However, the controversy during 1997 and 1998 over the proposed sale of Ukrainian turbines to Iran for use in the Bushehr nuclear power station has demonstrated how easily commercial interests may come into conflict with nonproliferation goals.

In April 1997, President Kuchma promised the United States and Israel that Ukraine would not supply gas turbines (worth $50 million) for the Bushehr plant, which is being constructed by Russia, and also pledged never to do anything that would help Iran, Iraq, or Libya develop weapons of mass destruction. However, subsequent opposition from the Ukrainian plants involved in the potential Iranian deal was sufficiently strong that President Kuchma reconsidered his earlier decision, stating in November 1997 that Ukraine's participation in the Bushehr project "is not in the nuclear cycle but in electricity…. Ukraine's position is clear—we are looking for jobs for Ukrainian factories." Subsequently, Kuchma asked the United States to drop its opposition to the Ukrainian participation in the project.[12]

With respect to the turbine deal, Ukraine turned out to be "caught in the middle of a US-Russian tug of war," as Yuri Scherbak, Ukrainian ambassador in Washington, put it, "where both the United States and Russia were applying 'sticks' and 'carrots.'"[13] In exchange for dropping the Iranian deal, the Clinton administration offered the Ukrainian government a package of small business loans, Export-Import Bank credits, and joint ventures and space cooperation. The United States also offered to sign an agreement with Ukraine on peaceful nuclear cooperation that would provide Ukraine with access to US technology and fuel. At the same time, US officials warned that if Ukraine went forward with the Iranian deal, it would not receive US assistance, the US administration would not sign an agreement on nuclear cooperation with Ukraine, and US-Ukrainian economic and political cooperation would flag. By contrast, the Russian government warned Ukraine that backing out of the deal could lead Russia to reconsider plans to order components for its nuclear power reactors from Ukraine in the future. As a "carrot," Russia offered credits and technical assistance to Ukraine for the completion of the reactors at Rivne and Khmelnitsky, and a promise it would later supply the fuel to operate them.[14]

In the end, US policy prevailed, and on March 6, 1998, during US Secretary of State Madeleine Albright's visit to Kyiv, President Kuchma announced that Ukraine would abandon plans to supply turbines for the completion of the Iranian nuclear plant. As a result of this pledge, Albright and Gennady Udovenko, foreign minister of Ukraine, initialed a bilateral agreement on nuclear cooperation during the same visit. As noted at the outset, this agreement was subsequently finalized and formally signed in May 1998.

NUCLEAR MATERIALS PROTECTION, CONTROL, AND ACCOUNTING (MPC&A)

The most productive area of US-Ukrainian nonproliferation cooperation has been in the area of physical protection, control, and accounting for nuclear materials (MPC&A). After the 1991 collapse of the Soviet Union and the resultant end of centralized control over the nuclear industry, Ukraine faced the challenge of determining "where, what, and how much" nuclear material it had inherited. Since 1992, when the process of accounting for this nuclear material began, there have been several cases in which originally undeclared nuclear material was uncovered.[15] It took the State Committee on Nuclear and Radiation Safety and its successor, the Administration of Nuclear Regulation, almost six years to complete the job of accounting for Ukrainian nuclear materials. According to officials from the Administration of Nuclear Regulation, the accounting process was fully completed in September 1998.[16]

The initial accounting was conducted by Ukraine using indigenous resources. Projects aimed at improving MPC&A systems, however, have required substantial foreign assistance. In the former Soviet Union, there were no laws regarding MPC&A, and all physical protection, accounting, and control issues were handled on the basis of ministerial regulations or guidelines developed by individual facilities. In general, MPC&A of nuclear material at power plants and research facilities in the Soviet Union was not a priority, because employees and outsiders had no incentive to steal or smuggle nuclear material, and the probability of terrorist acts was extremely low.

In post-Soviet Ukraine, however, the situation has changed dramatically. Greater openness to foreign markets, porous borders, the rise of criminal activity, and ongoing economic difficulties have made the threat of theft or diversion of nuclear material a much more pressing concern than it was during the Soviet era. The first signal that the situation had changed for the worse came in 1993, when at the Chernobyl plant two 3.5-meter-long fuel rods were cut off from a fresh fuel assembly in the reactor building, which was supposed to be a highly protected area. The missing rods and the low-enriched uranium (LEU) they contained have never been recovered. Since then, open sources have reported a number of attempts to divert nuclear fuel from Ukrainian nuclear power stations. The most recent case was reported on December 4, 1998, when Ukrainian border guards and customs officers detained two Ukrainian nationals who were trying to smuggle 11.5 kg of uranium stolen from the Khmelnitsky power plant. They planned to smuggle a lead container with nuclear fuel to Western Europe via Moldova, and sell it there for $1.2 to 1.5 million to an unidentified customer.[17]

According to the *Law of Ukraine on the Use of Nuclear Energy and Radiation Security*, all nuclear material is exclusively owned by the state, which takes full responsibility for its protection. However, after the collapse of the Soviet Union, it became clear that the Ukrainian government lacked the resources to adequately protect its nuclear materials. Having realized that inadequate MPC&A at nuclear facilities in the NIS could enable relatively easy access to weapon-usable nuclear materials by "rogue" nations and terrorist groups, the US government in 1992 incorporated MPC&A projects into the Cooperative Threat Reduction initiative, often referred to as the Nunn-Lugar Program. On October 25, 1993, the "umbrella" *Agreement Between the United States and Ukraine Concerning Assistance to Ukraine in the Elimination of Strategic Nuclear Arms and the Prevention of Proliferation of Weapons of Mass Destruction* was signed, containing a provision to cooperate in developing Ukraine's MPC&A system. As a follow-up to that agreement, a new *Implementing Agreement Between Ukraine's State Committee on Nuclear and Radiation Safety and the US Department of Defense on the Development of a State System of MPC&A for the Purpose of Protecting Nuclear Materials Used for Peaceful Purposes in Ukraine* was signed on December 18, 1993, and became the basic legal document regulating bilateral cooperation.

Nunn-Lugar funding originally provided $12.5 million for MPC&A upgrades at the South Ukraine nuclear power station and the Kyiv Institute for Nuclear Research. The agreement was later amended in July 1995 to include upgrades at the Kharkiv Institute of Physics and Technology and the Sevastopol Institute of Nuclear Energy and Industry, and to create a training center in Ukraine for MPC&A specialists.[18] The US Congress provided an additional $10 million for these projects. MPC&A efforts were originally funded through the US Department of Defense (DOD), but since September 1995, they have been directed by the US Department of Energy (DOE). Argonne and Sandia National Laboratories have served as DOE contractors for MPC&A projects in Ukraine, with Sandia upgrading monitoring

systems at nuclear facilities, while Argonne provides MPC&A software, computers, and training.

The 1993 Agreement expired in December 1998. As of September 1998, upgrades at the Kyiv Institute for Nuclear Research, the Kharkiv Institute of Physics and Technology, and the Sevastopol Institute of Nuclear Energy and Industry were completed or nearing completion. In addition, a training center for MPC&A experts has been established at the Kyiv Institute for Nuclear Research. On the other hand, projects at the South Ukraine power plant are lagging behind schedule. Upgrades were originally planned at ten critical zones in the plant. The $2 million originally allocated to the project has turned out to be insufficient, however. As a result, physical protection upgrades will be fully completed in only five zones, three other zones will be upgraded only partially, and the remaining two will get no upgrade at all. According to an estimate by experts from Sandia National Laboratory, an additional $3 million is required to complete all the originally planned projects at the South Ukraine plant.[19]

Other Ukrainian nuclear power plants, which are not covered by the US-Ukrainian agreement, are in an even more desperate situation. The Zaporizhya power plant has signed an agreement on MPC&A upgrades with a French company, CEGELEC. The contract called for Ukraine to bear a share of the project's costs, and is now suspended for lack of funds. The Rivne and Khmelnitsky plants are negotiating financial assistance for MPC&A with Germany, Finland, and Japan, but chances for success appear shaky.[20]

The US government had originally signaled that it might not extend the 1993 agreement beyond its scheduled expiration in 1998. The Ukrainian Administration for Nuclear Regulation under the Ministry of Environmental Protection and Nuclear Safety, however, would like to see the agreement extended, arguing that MPC&A at some facilities is not adequate and that illegal trade in nuclear materials continues to take place in Ukraine. Ukraine has proposed a package of potential collaborative projects, including developing a national system of prevention of illegal trade of nuclear material, upgrading MPC&A at the Chernobyl plant, and developing a unified system of control and accounting of ionizing radiation sources (radioisotopes). As of February 1999, the US government had agreed in principle to further extend the MPC&A arrangements with Ukraine. The US Embassy in Kyiv and the Ukrainian government have started negotiations on this topic, but no details of the talks have yet been publicly released.

POTENTIAL MARKETS FOR US COMPANIES IN UKRAINE?

MPC&A projects have so far been the most notable involvement of US companies in Ukraine's nuclear sector. Prior to the May 1998 signing of the US-Ukrainian nuclear cooperation agreement, US companies were formally barred from negotiating any contracts with Kyiv. As a result, US firms are at a competitive disadvantage in the Ukrainian nuclear sector. Furthermore, Russia has been carefully using its traditional economic and political ties with Ukraine, as well as Ukraine's technological dependence on Moscow, to ensure that Russian companies retain the lion's share of the Ukrainian market for nuclear technology. These trends mean that it will be difficult for US nuclear companies to make major inroads into the Ukrainian market.

As an example, Ukraine does not have an indigenous nuclear fuel production capacity. Currently, it purchases 100 percent of the fuel needed for its nuclear power reactors from the Russian company TVEL. In November 1997, TVEL-Energy, a Russian-Ukrainian nuclear fuel joint venture, was created. TVEL, the Russian fuel maker, supplies nuclear fuel for Ukrainian power plants and takes back spent nuclear fuel for storage or reprocessing. On the Ukrainian side, the major party to the deal is the Ukrainian State Property Fund. TVEL, however, holds the largest percentage of shares—35 percent. According to Yevgeniy Kovalenko, deputy director of Energoatom, both sides are considering an arrangement under which Ukraine would pay for Russian nuclear fuel with a combination of cash and barter. The products most likely to be bartered are steel, metals, and chemicals. However, Kovalenko argues, "if something does not work out, there is a possibility for fuel supply problems at [Ukrainian] nuclear power stations. In this case, we could rely only on help from Russia, or we must simply cut off electricity to all those who do not pay."[21]

Fears that "something might not work out" have already started materializing. Since a final deal with TVEL on payment methods has not been concluded, Ukraine now has to pay for fuel supplies from Russia mostly in cash. Ukraine had been receiving "free fuel for warheads" through the Trilateral Agreement of 1994, under which Ukraine sent its inherited Soviet nuclear weapons to Russia in return for LEU. This program came

to an end in late 1998, and for the 1999 calendar year Ukrainian nuclear power plants need to purchase $250 million of nuclear fuel from Russia. To date, they have been unable to accumulate sufficient funds, and have had to cut energy output. In late March 1999, Reactor No. 1 at the Zaporizhye plant cut electricity output by 50 percent, while Reactor No. 3 at the South Ukraine plant cut output by 20 percent.[22]

Not surprisingly, then, one of Ukraine's major ambitions in the nuclear sector is to establish its own nuclear fuel industry. Producing nuclear fuel indigenously would free Ukraine from the expensive dependence on foreign sources that has plagued its nuclear industry since the country's independence. Since the collapse of the Soviet Union, Russia, the only source of fuel for Ukrainian nuclear reactors, has raised the price of nuclear fuel 30 times. Furthermore, fuel deliveries have been disrupted, the quality of Russian fuel has sometimes been dubious, and Ukraine has been chronically short of hard currency to pay for the Russian fuel. As a result of these factors, Mikhail Umanets, Ukrainian first deputy minister of energy, estimates that the costs of fuel production facilities would be repaid in four to five years.[23]

To that end, in 1996, Ukraine announced a tender to build a nuclear fuel production facility. The two major competitors were TVEL and Westinghouse. TVEL won the competition with a deal that provides for fuel to be fabricated from Russian and Ukrainian raw uranium, to be processed 80 percent in Russia and 20 percent at a projected facility in Ukraine. Although the project will not be launched until 2001 at the earliest, it has the potential to save Ukraine Hr 50 million ($27 million) annually in nuclear fuel costs. In another area of potential US-Ukrainian commercial collaboration, Westinghouse bid about $1.2 billion to complete the Rivne and Khmelnitsky reactors, but the Ukrainian government has clearly indicated that it is more inclined to cooperate with Russia on this project as well.

The author's discussions with officials at the Ukrainian Ministry of Energy and the Ukrainian Ministry of Environmental Protection and Nuclear Safety suggest three major reasons why TVEL won out over Westinghouse. First, opting for Westinghouse and using US-made nuclear fuel would have meant squeezing Russia out of the Ukrainian market—a scenario that was virtually unthinkable. The leaders of the Ukrainian and Russian nuclear industries used to work as one team in the Soviet era, and they still maintain close business and personal relationships. Many top Ukrainian officials are ethnic Russians. In both countries, key industries (including the nuclear industry) remain state-run, and nuclear projects are just one piece of the complex puzzle of bilateral intergovernmental relations. US companies, on the other hand, are viewed by many Ukrainian officials either as cash-driven newcomers, or as part of a deliberate campaign to make Ukraine dependent on US fuel and technology.

Second, the reactors in Khmelnitsky and Rivne were designed and constructed for Russian fuel, and completing them according to the original plans appears more cost-effective than re-designing them for US fuel. Third, the terms of payment that Russia will accept are much more favorable for Ukraine than those required by US business practice. Since it may be unable to make full payment in cash for nuclear fuel, the Ukrainian government prefers to deal with a supplier ready to agree to alternative forms of payment, such as barter, which is commonly used in Russia. As noted above, Energoatom and TVEL have discussed the possibility of Ukraine paying in cash, treasury bills, or barter, with each category amounting to about a third of the total price and with up to a six-month grace period. "Russian loans are more acceptable for us because we could repay them with our electricity or our products," says Gennady Sazonov, a high official at Energoatom.[24]

Another part of Ukraine's nuclear energy strategy for the next century is the introduction of a new type of reactor design that would meet international safety standards and help solve the spent fuel storage problem. In late February 1999, Mikhail Umanets, head of the Nuclear Energy Department, Ministry of Energy, stated that by 2012 Ukraine wanted to have an operating Western-style reactor, and eventually to replace some of its Soviet-designed reactors with Western units.[25] Western nuclear companies, including Westinghouse, have already approached Ukraine touting the benefits of their reactors. Russia, in turn, has made it clear that it is not going to surrender its traditional market to Westerners. Overall, however, it seems unlikely that Ukraine will be able to afford US equipment and technologies even by 2012, and Kyiv will probably be forced to look to Russia again. The pro-Russian nuclear lobby in Ukraine is still powerful, and technological dependence on Russian remains considerable. US companies appear to have only slim chances of winning contracts with Ukraine

for nuclear fuel supply or for the construction of fuel-fabrication facilities or nuclear power plants.

However, there are other areas where US companies may succeed: for example, in building storage facilities for spent nuclear fuel, and in improving the efficiency of energy production, distribution, and use. Storing spent nuclear fuel has become one of the most serious and costly problems for Ukrainian power stations. During the Soviet era, Ukrainian nuclear power plants sent spent fuel to Russia for reprocessing and storage essentially free of charge. After independence, Ukraine's nuclear power stations quickly filled up their on-site storage facilities and then faced a dilemma: either to pay to continue sending spent fuel to Russia, or to build new on-site storage facilities. The Zaporizhye Nuclear Power Plant, with its six VVER-1000 reactors, faces the greatest challenge in this regard. This plant alone generates 20-22 percent of all electricity in Ukraine. The storage problem became severe as early as 1993, when an option to shut down one or two reactors was considered. After reviewing many proposals to solve the problem, Ukraine opted for US assistance. A US company, Duke Engineering and Services, has offered a new and relatively cheap storage system for stockpiling almost 650 tons of spent fuel on-site and leaving it there for up to 50 years, which would eventually make the plant Europe's largest radioactive waste dump. The project is being carried out with $5.7 million in funding from DOE and a separate contract between Duke and the Zaporizhye plant, the amount of which has not been made public.[26] Duke and its subcontractors have provided the Zaporizhye plant with equipment and expertise to manufacture 12 storage casks for spent fuel a year. Each cask will be filled with 25 spent fuel rods, backfilled with inert helium gas, sealed by remote control, and transported to a concrete storage pad.

The pace of construction on this project has accelerated since November 1998, when authorities in Krasnoyarsk Kray, Russia, where the storage facilities for spent VVER-1000 reactor fuel are located, said they would no longer accept Ukrainian spent fuel at the previous price of $280 per kilogram (which is far below the world price of $1,000 for similar services). The Zaporizhye plant currently sends 120-200 tons of nuclear waste to the Krasnoyarsk Mining and Chemical Combine for storage.[27] Overall, Ukraine sent 510 nuclear fuel rods to Russia in 1997 and 560 rods in 1998, and expects shipments will increase to 600 rods in 1999. After much haggling, Ukraine and Russia compromised in mid-February 1999, and shipments of Ukrainian spent fuel will be resumed at a price of $330 per kilogram.[28]

The most problematic bilateral project, however, involves the US commitment to promote investment in the Kharkiv region. Among the incentives for the Ukrainian government to drop the Iranian deal was the US-Ukraine Kharkiv Initiative, a pledge to encourage US businesses to invest in Kharkiv-based Turboatom, the plant that would have sold turbines for Bushehr, and in other enterprises in the region. In June 1998, a US governmental delegation headed by Ambassador Richard Morningstar, President Clinton's adviser for the former Soviet republics, visited the Kharkiv region for the first time. Morningstar called US investments in the region a "problematic issue," but promised the United States would search for a solution. Many American investors find it difficult to do business in Ukraine, which is plagued by corruption, bureaucracy, and a complex taxation system. Secretary of State Albright, although describing the 1998 US-Ukrainian agreement on nuclear cooperation as a sign of a US-Ukrainian strategic partnership, has stated that "investors recognize no strategic partner—they move their capital where it is safe, the rule of law is strong, and bribery is not an expectation but an outrage."[29] Subsequent trips to Ukraine by US government officials in 1998 and 1999 have not pushed the Kharkiv Initiative forward, and it appears stalled. Statements made by the US Embassy in Ukraine have stressed that "the ultimate success of the [Kharkiv] mission would be enhanced by local efforts to provide an attractive investment climate by means of deregulation and privatization of enterprises."[30]

The Business Information Service for the Newly Independent States (BISNIS), an information network operating under the US Department of Commerce, recently began issuing a newsletter specifically targeted on the Kharkiv region. The purpose of the new project is to stimulate entrepreneurial activity in Kharkiv and increase economic cooperation between the United States and Kharkiv. The State Department and the US Commercial Service in Kyiv are working closely with BISNIS on this project. The results have so far been very modest, however. The February 1999 issue of the newsletter, *Search for Partners and Trade Leads for Kharkiv, Ukraine*, lists ten regional enterprises seeking investors for various projects and only one US-Ukrainian joint venture. This was the Westron Consortium, which was

established in 1994 as a joint venture between Khartron and Westinghouse to design and manufacture automated control systems for thermal power in the nuclear and non-nuclear industries in Ukraine, using US technologies and equipment. To date, Westron is the only company in Ukraine or the Commonwealth of Independent States (CIS) that has installed information processing systems in Ukrainian nuclear power plants. The joint venture is currently seeking financing for two additional projects related to nuclear power safety, with a total cost of about $156 million.[31]

CONCLUSION

Overall, the 1998 US-Ukrainian agreement on nuclear cooperation has created a paper basis for increased bilateral cooperation, but has not boosted such activities in reality. The major reasons for this unsatisfactory outcome are the unfavorable climate for US companies in Ukraine, Ukraine's financial instability, and the strong Russian presence in the Ukrainian nuclear market.

Despite this situation, many Ukrainian companies, lacking domestic markets or government subsidies, are eager to attract foreign, especially US, investors. In principle, then, grounds for more intensive cooperation in the future do exist. On November 9-10, 1998, a unique international conference on "US-Ukrainian Nuclear Trade and Cooperation" was held in Washington, DC. This meeting was sponsored by the DOE and focused on Ukrainian nuclear-related products and services, US experience in joint ventures in Ukraine, options for government and international funding, and Ukraine's tax system and legal infrastructure. About 50 Ukrainian government and industry officials, representing ministries and companies interested in doing business with the United States, hoped to attract US partners at the meeting. American companies did not, however, seem to be very interested in most of the projects offered by the Ukrainians, and were wary of making any promises even with respect to the projects in which they did express interest. The results of the meeting thus mirrored the general problems noted above.

In February 1999, Ukrainian government officials and experts from the IAEA began discussing Ukraine's nuclear strategy through the year 2030. At the request of the Ukrainian government, the IAEA will provide advice on Ukraine's plans by sometime in 2000. Whatever the recommendations, it seems likely that they will have to be implemented in a climate similar to the current one, which is unfavorable to long-term investments. In the near future one can hardly expect a dramatic increase in joint US-Ukrainian projects, as they are simply too risky for most private US companies. In this climate, it is all the more important that certain projects, where US contractors are secured and paid by the US government (like MPC&A activities supported by the US government, or projects sponsored by USAID) be intensified. It is exactly these kinds of joint projects that can succeed and make a difference in Ukraine.

[1] US Senate, Committee on Governmental Affairs, Permanent Subcommittee on Investigations, "Statement of Andrei Glukhov, Pacific Northwest National Laboratory, Battelle," March 13, 1996.
[2] "Small Explosion Reported at Europe's Largest Nuclear Plant," *CNN Custom News*, November 19, 1998; "Experts: Ukraine's Nuclear Sector Close to Degradation," *CNN Custom News*, March 24, 1999; "Nuclear Reactor Shut Down in Ukraine," *CNN Custom News*, March 29, 1999.
[3] "Experts: Ukraine's Nuclear Sector Close to Degradation," *CNN Custom News*, March 24, 1999.
[4] *Business Information Service for Newly Independent States (BISNIS)*, Russia/NIS Division, US Department of Commerce, February 26, 1999.
[5] "Nuclear plant workers escalating strike actions," *Kyiv Post*, March 4, 1999, p. 5. The dollar equivalent offered here is based on the currency conversion rate for February 1999 of Hr 3.57 = $1.
[6] *Fakty* (Kyiv), March 10, 1999, p. 2.
[7] Victor Lesnoy, "Savings and Security," *Argumenty I Fakty*, No. 8, February 1999, p. 5. The dollar equivalent offered here is based on the average currency conversion rate for 1998 of Hr 2.25 = $1.
[8] "Ukraine Nuclear Workers Demand Overdue Wages," *CNN Custom News*, February 24, 1999.
[9] "Nuclear and Missile Trade and Developments," *The Nonproliferation Review* 5 (Spring-Summer 1998), p. 144.
[10] "UK's BNFL in Group to Clean Up Chernobyl Nuclear Reactor," Reuters, September 1, 1998.
[11] Lily Hyde, "Is the West Pushing Nuclear Power on Ukraine?" *Kyiv Post*, March 4, 1999, p. 5.
[12] "World Leaders Raise Funds For Chernobyl Safety," *Kyiv Post*, November 21, 1997, p. 3.
[13] David Ottaway and Dan Morgan, "US, Ukraine at Odds Over Nuclear Technology Transfer," *Washington Post*, February 8, 1998, p. A25.
[14] Ibid.
[15] US Senate, Committee on Governmental Affairs, Permanent Subcommittee on Investigations, "Statement of Andrei Glukhov."
[16] Ukrainian Administration of Nuclear Regulation officials (names withheld by request), interview by author, Kyiv, Ukraine, October 1998.
[17] "Ukraine Customs Detain Two For Nuke Smuggling," Reuters, December 4, 1998.
[18] The Sevastopol Institute of Nuclear Energy and Industry (SINEI) was previously called the Sevastopol Naval Research Institute of the Naval Academy and was subordinate to the Ukrainian Defense Ministry. In September 1996, under a resolution of the Ukrainian Cabinet of Ministers, SINEI was founded on the basis of the old naval institute and transferred to the Ministry of Energy.
[19] Alexander Smyshlyaev and Valeriy Nosko, "Physical Protection of Nuclear Materials in Ukraine," *The Monitor: Nonproliferation, Demilitarization, and*

Arms Control 4 (Fall 1998), p. 18.
[20] Ministry of Environmental Protection and Nuclear Safety officials (names withheld by request), interviews with author, Kyiv, Ukraine, September-October 1998.
[21] Ruslan Korolchuk, "From Bargain to Burden," *Kyiv Post*, September 4, 1998, <http://thepost.kiev.ua>.
[22] "Ukraine Cash-Short Nuclear Plants Cut Output," *CNN Custom News*, March 29, 1999.
[23] Office of International Nuclear Safety and Cooperation, US Department of Energy, "Ukraine," < http://insp.pnl.gov:2080/?profiles/ukraine/>.
[24] "Ukraine Hopes to Build Two Nuclear Reactors in 1999," *CNN Custom News*, December 17, 1998.
[25] Tony Weselowsky, "Ukraine: Nuclear Power Considered Key To Energy Independence," Radio Free Europe/Radio Liberty online, February 22, 1999, <http://www.rferl.org>.
[26] Alex Barankevich, "Atom Plant Buys Time With Spent Fuel Storage Silos," *Kyiv Post*, September 29, 1998, p. 4.
[27] "Ukraine to Open Europe's Largest Nuclear Waste Dump," AFP, January 26, 1999; "Russia Hopes to Settle Conflict With Ukraine Nuclear Waste," *CNN Custom News*, January 31, 1999.
[28] "Russia, Ukraine Resolve Nuclear Waste Deadlock," *CNN Custom News*, February 17, 1999.
[29] "Transcript: Remarks of Albright and Udovenko in Kiev," USIA Washington File, March 9, 1998, <http://www.usia.gov/products/washfile.htm>.
[30] "Washington Has No Immediate Solution For Kharkiv's Turboatom," *Kyiv Post*, June 19, 1998, <http://www.thepost.kiev.ua>.
[31] *BISNIS: Search for Partners and Trade Leads for Kharkiv, Ukraine*, Special Ukraine Edition, February 1999, p. 4.