Occasional Paper No. 1

Former Soviet Biological Weapons Facilities in Kazakhstan: Past, Present, and Future

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Chemical and Biological Weapons Nonproliferation Project

MONTEREY INSTITUTE OF INTERNATIONAL STUDIES

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FOREWORD

In April 1992, Russian President Boris Yeltsin admitted that the Soviet Union and then Russia had conducted a top-secret offensive biological warfare (BW) program in violation of the 1972 Biological and Toxin Weapons Convention banning the development, production, stockpiling, and transfer of these weapons. After his admission, President Yeltsin issued an edict committing Russia to eliminate its offensive BW activities and to comply fully with the treaty. Nevertheless, a number of former Soviet microbiological research centers under the control of the Russian Ministry of Defense remain shrouded in secrecy, and the US government has assessed that "some facilities [in Russia], in addition to being engaged in legitimate activity, may be maintaining the capability to produce BW agents."[*]

Four major BW research, production, and testing sites also existed in the Soviet republic of Kazakhstan, which in 1991 became an independent country. In contrast to Russia, the Kazakhstani government has been remarkably open with respect to the former Soviet facilities on its territory. Thus, a study focusing on the history and status of the Kazakhstani sites offers a valuable window into the nature and scope of the Soviet BW program.

In January 1998, the Center for Nonproliferation Studies (CNS) at the Monterey Institute of International Studies commissioned three Kazakhstani experts to prepare a report on the former Soviet BW facilities in Kazakhstan, their current status, and the prospects for economic conversion and environmental remediation. The authors of this report are all superbly qualified. Gulbarshyn Bozheyeva holds a Candidate of Sciences (Ph.D. equivalent) degree in chemistry from Kazakhstan State University and graduated from the Program in International Development Policy at Duke University in the United States. She is a member of the CNS Core Group of Nonproliferation Specialists and worked at CNS as a Visiting Scholar and Research Associate. Yerlan Kunakbayev has an M.S. in biology from Moscow State University and worked at the Kazakhstan National Center for Biotechnology in Stepnogorsk. Dastan Yeleukenov is an Advisor to the Kazakhstani Minister of Foreign Affairs. He holds a Candidate of Sciences (Ph.D.) degree in physics and is a member of the CNS Core Group of Nonproliferation Specialists. He is also affiliated with the CNS branch office in Almaty.

Commissioning local Kazakhstani experts to conduct the data collection and analysis not only resulted in better quality information than if foreign analysts had done the work, but it furthered the CNS mission of building communities of nonproliferation specialists in the Newly Independent States of the former Soviet Union. The study was carried out with the cooperation of the Government of Kazakhstan and the United States Embassy in Almaty, whose assistance is much appreciated.

This report should make a significant contribution to increasing public understanding of what remains a dark chapter of Soviet history. It is also to be hoped that the Russian Federation will follow Kazakhstan's lead by providing a full account of the offensive BW activities that took place on its territory during and after the Soviet era. Only by confronting the past will the successor states of the former Soviet Union be able to move forward with other nations, in a spirit of mutual confidence and security, to build a more stable and prosperous future.

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[*] US Arms Control and Disarmament Agency, *Threat Control Through Arms Control: Annual Report to Congress 1996* (Washington, DC: ACDA, 1997), p. 87.

FORMER SOVIET BIOLOGICAL WEAPONS FACILITIES IN KAZAKHSTAN: PAST, PRESENT, AND FUTURE

Kazakhstani facilities involved in the research and development, production, and testing of biological weapons (BW) played a key role in the former Soviet BW program.[1] Although a number of open publications have addressed the former Soviet program in recent years, few have examined the Kazakhstani portion of the system.[2] This report provides a history of Kazakhstani BW facilities and describes their current status and future prospects. The example of Kazakhstan also highlights the technical, economic, and financial problems associated with converting former BW facilities to peaceful activities in the post-Cold War era.

The first part of this report is devoted to an overview of the Soviet BW system. The second part deals with the history and current status of the four major BW facilities in Kazakhstan. The third part examines the potential for commercial production at these facilities and the obstacles they have faced on the road to conversion. The final part discusses the future prospects for conversion and environmental remediation and makes some policy recommendations.

A BRIEF HISTORY OF THE SOVIET BIOLOGICAL WEAPONS PROGRAM

The Soviet network of facilities involved in developing biological weapons consisted of two main groups: a system under military control dating back to the late 1920s, and a second, top-secret program under civilian cover that was created in the 1970s.[3] The Red Army opened the first laboratories for research on pathogenic microorganisms in 1928.[4] BW facilities under the direct authority of the Soviet Ministry of Defense (MOD) included the Scientific Research Institute of Microbiology in Kirov (now Vyatka),[5] the Center for Military-Technical Problems of Anti-Bacteriological Defense in Sverdlovsk (now Yekaterinburg),[6] and the Center of Virology in Zagorsk (now

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1 In terms of BW capability within the former Soviet Union, Kazakhstani BW facilities were second only to those in Russia. Anthony Rimmington, "Conversion of BW Facilities in Kazakhstan," Center for Russian and East European Studies, the University of Birmingham (UK), undated research paper; interview with specialists from the National Center for Biotechnology (NCB; the umbrella organization for most of the former Soviet military and civilian biotechnology facilities in Kazakhstan), 1998. Kazakhstan is not a signatory of the Biological and Toxin Weapons Convention (BWC) for financial reasons, but it participated as an observer at the Fourth Review Conference of the BWC in 1996.

2 Rimmington has prepared the most comprehensive report on Kazakhstani BW facilities. Rimmington, "Conversion of BW Facilities in Kazakhstan." Recently, the Kazakhstani author Samantay Tleubergenov provided some information on the Soviet BW program in Kazakhstan. Samantay T. Tleubergenov, *Poligony Kazakhstana* (*Kazakhstan's Test Sites*) (Almaty: Gylym, 1998).

3 Only the major elements of the Soviet BW system relevant to Kazakhstan are discussed here. Detailed material on other Soviet BW facilities can be found elsewhere. See, for example, Anthony Rimmington, "From Military to Industrial Complex? The Conversion of Biological Weapons Facilities in the Russian Federation," *Contemporary Security Policy* 17 (April 1996), pp. 81-112.

4 In 1928, Red Army authorities decided to create a laboratory on vaccine and serum research at the Vlasikha estate, 30 kilometers from the village of Perkhushkovo. The young scientist Ivan Velikanov was appointed head of the laboratory. In 1931, a laboratory for anthrax research was established in Tobolsk, Siberia, and in 1933, a secret bacteriological laboratory was opened at Pokrovskiy Monastery in the town of Suzdal to research highly pathogenic agents. The famous political and military official Kliment Voroshilov was one of the first heads of the Soviet BW program in the 1930s. Interview with specialists from the NCB.

5 The Red Army's Scientific Research Institute of Microbiology was opened in 1933 in the village of Perkhushkovo near Moscow. In 1942, it was relocated to Kirov, 900 kilometers from Moscow, to avoid capture by the advancing German Army. Rimmington, "From Military to Industrial Complex," p. 83.

6 The facility was previously named the Scientific Research Institute of Vaccine Preparations. It was built in 1947 and located within Military Compound No.19 in the city of Sverdlovsk. Rimmington, "From Military to Industrial Complex," p. 86.

Sergiyev Posad).[7] These facilities were administered by the 15th Directorate for Biological Protection of the MOD.[8] Another BW facility, the Scientific Research Institute of Military Medicine in Leningrad (now St. Petersburg), reported to the Military-Medical Directorate of the MOD.[9] Vozrozhdeniye Island, in the Aral Sea, reported to the 15th Directorate and was the main testing ground for biological agents developed at MOD facilities.[10]

In addition to the centers developing antipersonnel BW agents, another group of facilities worked on microbial agents harmful to livestock and plants. One such facility, the Scientific Research Agricultural Institute (NISKhI) in Gvardeyskiy, Kazakhstan, was established in 1958. While formally subordinated to the USSR Ministry of Agriculture, the institute was probably supervised by the MOD. After the institute opened, a military unit was posted there to guard the facility and, as a rule, the director of the institute held a high military rank. Facilities in Russia involved in the development of anti-livestock and anti-crop agents included the Scientific Research Institute for Animal Protection in Vladimir[11] and the center in Sverdlovsk. Biological agents harmful to livestock and plants were tested at a special site near Novosibirsk. Munitions for the delivery of all types of biological agents were assembled at the Sverdlovsk facility.[12]

The Biopreparat Complex

In the early 1970s, the Soviet authorities began creating a new network of BW facilities parallel to the military system. In 1972, the USSR signed the Biological and Toxin Weapons Convention (BWC), under which it was supposed to stop all offensive BW work. The new "civilian" network of biotechnology institutes conducted some civilian research, but it also served as a cover for military-related BW activities. These sites were formally run by civilian authorities and involved a large number of civilian biotechnological specialists and enterprises.[13] In 1972, the USSR Council of Ministers established a secret Interagency

7 The Sergiyev Posad facility is located about 70 kilometers from Moscow. Rimmington, "From Military to Industrial Complex," p. 86.

8 The 15th Directorate for Biological Protection of the General Staff was headed by General Yefim Smirnov. Interview with specialists from the NCB; Rimmington, "From Military to Industrial Complex," p. 99.

9 The Leningrad institute was created in 1969. The Central Military Medical Directorate, established in 1930, was the highest administrative body for medical institutions in the Ministry of Defense. Rimmington, "From Military to Industrial Complex," pp. 86-87, 99, 102.

10 The Kirov, Sverdlovsk, and Zagorsk centers also had their own small testing grounds. Rimmington states incorrectly that the Vozrozhdeniye site was under the authority of the Center of Virology in Zagorsk. In fact, the Vozrozhdeniye site was operated by the Soviet MOD, which sent orders to its Zagorsk, Kirov, and Sverdlovsk facilities to conduct certain tests at the island. The types of agents tested at the island included anthrax and plague bacteria developed at Sverdlovsk and Kirov, and viral agents developed at Zagorsk. Interview with specialists from the NCB.

11 "Informatsiya ob obyektakh i biologicheskoy deyatelnosti Rossiyskoy Federatsii, svyazannykh s Konventsiyey o zapreshchenii razrabotki, proizvodstva i nakopleniya zapasov bakteriologicheskogo (biologicheskogo) i toksinnogo oruzhiya i ob ikh unichtozhenii" ("Information on facilities and biological activities of the Russian Federation related to the Biological and Toxin Weapons Convention"), declaration by the Russian Federation under the confidence-building measures for the BWC, Moscow, May 2, 1994, p. 339.

12 BW tests on military hardware were also conducted in Afghanistan. Soviet mobile missiles equipped with BW warheads were stationed in the Arctic. Interview with NCB specialists.

13 The new network of facilities increased the capability of the Soviet BW system by attracting new human and material resources and supplementing military research with technological developments in the civilian sector. As early as the late 1960s, the Soviet authorities took measures to accelerate the development of the biotechnology industry as a whole. In 1966, microbiological enterprises were integrated into one industrial branch under the Main Directorate for the Management of Microbiological Industry (Glavmikrobioprom). On August 8, 1970, the Central Committee of the CPSU and the USSR Council of Ministers adopted the decree "On Measures for the Accelerated Development of the Microbiological Industry," which envisioned the creation of a number of new microbiological plants. Based on this decree, Glavmikrobioprom ordered the construction of the civilian biotechnological plant Progress in Stepnogorsk that later provided a cover for the nearby BW facility. Eduard I. Perov, "Trudnyye shagi 'Progressa'" ("The Difficult Steps of 'Progress'") in *Stepnogorsk: Zdes propisany nashi serdtsa. Stranitsy istorii goroda Stepnogorska Akmolinskoy oblasti* (*Stepnogorsk: Our hearts are registered here. Pages from the history of the city of Stepnogorsk, Akmofa Oblast*) (Almaty: Atamura, 1994), p. 107.

Science and Technology Council on Molecular Biology and Genetics, consisting of representatives of the Ministry of Defense, the military-industrial complex, the Soviet Academy of Sciences, the Ministry of Health, and the Ministry of Agriculture. The Council was chaired by the well-known virologist Vladimir Zhdanov and the members were approved by General Secretary of the Communist Party of the Soviet Union (CPSU) Leonid Brezhnev and Chairman of the USSR Council of Ministers Aleksey Kosygin.[14]

The All-Union Production Association Biopreparat, created in 1973 by a decree of the Central Committee of the CPSU and the USSR Council of Ministers, was tasked with implementing the programs approved by the Interagency Council. This organization comprised some 40 research and devel-opment (R&D) and production facilities. In addition to managing the civilian biotechnological industry and R&D, Biopreparat was actively involved in military BW programs.[15] Although formally subordinated to the civilian Main Administration of the Microbiological Industry (Glavmikrobioprom), Biopreparat was funded by the MOD and the head of the organization held the rank of lieutenant general.[16]

Leading Biopreparat facilities included the State Scientific Center of Applied Microbiology in Obolensk, the Institute of Immunological Studies in Lyubuchany, the State Scientific Center of Virology and Biotechnology (known as Vector) near Novosibirsk, the State Scientific Institute of Ultrapure Biological Preparations in Leningrad, and the Scientific Experimental and Production Base in Stepnogorsk, Kazakhstan.[17] The 15th Directorate of the MOD supervised the work of the Biopreparat facilities and coordinated their activities with those of the MOD's military biotechnological centers. As the Kazakhstani example will show, in addition to being run by the same upper echelon of the MOD, the military and Biopreparat BW systems shared some technologies and personnel.[18]

Other BW-Related Centers

In addition to the aforementioned centers within the offensive part of the Soviet BW program, other facilities were involved mainly in defensive BW developments. The system of anti-plague research institutes and field monitoring stations under the authority of the Main Directorate of Quarantine Infections of the USSR Ministry of Health included the Mikrob Scientific Research Anti-Plague Institute in Saratov, the Rostov Anti-Plague Institute, the Volgograd Scientific Research Anti-Plague Institute, and the Irkutsk Anti-Plague Institute for Siberia and the Far East.[19] These institutes were mainly responsible for civilian epidemiological investigations and did not have direct links with MOD or Biopreparat BW facilities.[20] As follows from the example of the Anti-Plague Scientific Research Institute in Alma-Ata (now Almaty), however, the anti-plague institutes developed vaccines and

14 Vyacheslav Yankulin, "Sindrom chumy, ili Khozhdeniye po mukam odnogo iz sozdateley bakteriologicheskogo oruzhiya" ("Plague Syndrome, or A walk through the torments of one of the creators of biological weapons"), *Izvestiya*, October 15, 1997.

15 Biopreparat, known by its postal code P.O. Box A-1063, controlled the world's second-largest antibiotics industry and produced a number of biopharmaceuticals and veterinary products, which were exported to many developing countries. Western sources believe that as many as 2,000 of Biopreparat's 9,000 scientific employees were experts on deadly pathogens. Laurie Garrett, "Inside Russia's Germ Warfare Labs," *Newsday*, August 10, 1997, pp. A5, A38-A39; Rimmington, "From Military to Industrial Complex," p. 87.

16 Rimmington, "From Military to Industrial Complex," p. 87; Yankulin, "Sindrom chumy."

17 The center in Obolensk, about 100 kilometers from Moscow, was founded in 1974. The institute at Lyubuchany, near Chekhov, Moscow Oblast, was created in 1980. Vector, in Koltsovo near Novosibirsk, was established in 1985. Rimmington, "From Military to Industrial Complex," pp. 86, 108.

18 Rimmington indicates that Nikolay Urakov, former deputy director of the MOD Kirov facility, became the director of the Biopreparat facility in Obolensk in 1986. Rimmington, "From Military to Industrial Complex," p. 108.

19 "Informatsiya ob obyektakh," pp. 339-341.

20 The network of Anti-Plague Institutes could provide assistance to MOD conventional forces by monitoring outbreaks of natural endemic diseases in the areas where troops were stationed.

diagnostic materials for microbial pathogens modified by the military. Moreover, given the exchange of top-ranking specialists between the anti-plague institutes and offensive BW facilities, their participation in some offensive BW programs cannot be ruled out. For example, Igor Domradskiy, the deputy chairman of the Interagency Council and a founder of Biopreparat, had previously headed the anti-plague institutes in Irkutsk and Rostov-on-Don.[21]

Finally, some institutes of the USSR Academy of Sciences represented in the Interagency Council may have been indirectly involved in BW developments. A common practice among Soviet scientific institutes was to seek research contracts from well-financed military-industrial organiza-tions. One academic institute that may have been indirectly involved in BW work was the Shemyakin Institute of Bioorganic Chemistry (IBKh) in Moscow, which was founded in 1980 and did research on advanced methods of genetic engineering and industrial microbiology.[22] The first director of IBKh, Academician Vadim Ovchinnikov, also served as head of the Biological Sciences Department of the USSR Academy of Sciences. It was widely believed among Russian scientists that Ovchinnikov actively sought research funding for his institute from military biotechnology programs.[23] As described in the next section, IBKh had links with the Biopreparat center in Stepnogorsk.[24]

[21] Yankulin, "Sindrom chumy."
[22] The IBKh building was constructed by Finnish builders and had up-to-date foreign and Soviet equipment not available at many other microbiological institutes of the Soviet Academy of Sciences. Interview with NCB specialists.
[23] Ovchinnikov wanted to discover how the three-dimensional structure of the protein albumin is determined by its primary amino acid sequence, hoping to win the Nobel Prize for his research. However, achieving this ambition proved to be impossible at the time. Interview with a former IBKh employee.
[24] Interview with NCB specialists.

KAZAKHSTANI ELEMENTS OF THE SYSTEM

Kazakhstani BW facilities belonged to various parts of the Soviet BW structure and reported to different central authorities in Moscow.[25] The four main facilities were the Vozrozhdeniye Island open-air test site in the Aral Sea, the Scientific Experimental and Production Base (SNOPB) in Stepnogorsk, the Scientific Research Agricultural Institute (NISKhI) in Gvardeyskiy, and the Anti-Plague Scientific Research Institute in Alma-Ata. These facilities are described in greater detail below.

Vozrozhdeniye Island

The Vozrozhdeniye Island test site in the Aral Sea was part of the older, military BW system. The island was apparently chosen for open-air testing of biological weapons because of its geographical isolation.[26] Vozrozhdeniye is

[25] This study of the structural links of the Kazakhstani elements shows how the Soviet BW system was organized. First, the system was clearly divided into separate parts, which were funded and managed by different authorities in accordance with technological specialization (anti-personnel vs. anti-crop and anti-livestock agents, defensive vs. offensive developments), military or civilian participation, and the level of involvement in the BW program (direct or indirect). Unified strategic guidance and top executive management over the far-flung system were provided by the Interagency Council and the MOD. Although the system observed the strictest secrecy rules, corporate links between facilities with similar or complementary expertise and the transfer or exchange of human, technological, and material resources were common. The expanded horizontal links and the short vertical chain of command, with little delegation of authority to intermediate elements, would probably have been the most effective mechanism in the event of wartime mobilization.
[26] Vozrozhdeniye Island was discovered by A. I. Butakov, Lieutenant of the Russian Fleet, on the *Konstantin* in September 1848. Butakov named it Nicholas Island after Tsar Nicholas the First. Seven miles northwest from Nicholas Island, he found another island, which he named Naslednik (Heir). To the south of Naslednik Island was one more island, which he named Konstantin Island after Grand Duke Konstantin Romanov, the official chairman of the Russian Geographic Society. Together, the three islands were called the Tsarskiye (Tsar) Islands. During the Soviet era, Nicholas and Naslednik Islands were renamed Vozrozhdeniye (Rebirth) and Komsomolskiy Islands. Due to the dessication of the Aral Sea, the three Tsar Islands later merged into one big island. Zhenis Darmenov, "Ostrov Vozrozhdeniya: Tayn stanovitsya

situated in the middle of the Aral Sea, surrounded by large, sparsely populated deserts and semi-deserts that hindered unauthorized access to the secret site. The island's sparse vegetation, hot, dry climate, and sandy soil that reaches temperatures of 60° C (140° F) in summer all reduced the chances that pathogenic microorganisms would survive and spread.[27] In addition, the insular location prevented the transmission of pathogens to neighboring mainland areas by animals or insects. The northern part of Vozrozhdeniye Island, which Kazakhs call Mergensay, is on Kazakhstani territory. The southern two-thirds of the island is in the Karakalpak autonomous region of Uzbekistan.[28]

In 1936, Vozrozhdeniye Island was transferred to the authority of the Soviet MOD for use by the Red Army's Scientific Medical Institute.[29] The first expedition of 100 people, headed by Professor Ivan Velikanov, arrived on the island that summer. The researchers were provided with special ships and two airplanes and reportedly conducted experiments involving the spread of tularemia and related microorganisms. In the fall of 1937, however, the expedition was evacuated from the island because of security problems, including the arrest of Velikanov and other specialists.[30]

In 1952, the Soviet government decided to resume BW testing on islands in the Aral Sea. A biological weapons test site, officially referred to as "Aralsk-7," was built in 1954 on Vozrozhdeniye and Komsomolskiy Islands. The MOD's Field Scientific Research Laboratory (PNIL) was stationed on Vozrozhdeniye Island to conduct the experiments.[31] Military unit 25484, comprising several hundred people, was also based on the island and reported to a larger unit based in Aralsk.[32] The PNIL developed methods of biological defense and decontamination for Soviet troops. Samples of military hardware, equipment, and protective clothing reportedly passed field tests at the island before being mass-produced. During the Soviet intervention in Afghanistan, military protective gear developed for Afghan conditions was tested at the PNIL.[33]

Infrastructure and BW Development

The BW test site on Vozrozhdeniye Island was divided into a testing complex in the southern part of the island and a military settlement in the northern part where officers, some with families, and soldiers lived. The settlement had barracks, residential houses, an elementary school, a nursery school, a cafeteria,

menshe" (Vozrozhdeniye Island: There are fewer and fewer secrets"), *Put Lenina*, Aug 14, 1990, p. 2.

27 Interview with a member of the 1990 Kazakhstani delegation to Vozrozhdeniye Island, November 1998.

28 It appears that no clear border demarcation yet exists between Uzbekistan and Kazakhstan on the territory of Vozrozhdeniye Island. Whereas the northern part of the island is owned by Kazakhstan, the airspace over the island is controlled by Uzbekistani air traffic authorities, and the southern part of the island is under the authority of the Uzbekistani Ministry of Defense. Residents of Aralsk recalled that Uzbekistani authorities prevented the mayor of the city from traveling to the island by helicopter. A similar incident happened to some Kazakhstani fishermen in 1994 when they landed on a part of the island that Uzbekistani authorities claimed was their territory. In May 1998, the authors of this paper and BBC television journalists, who had permission from the Kazakhstani government to travel to the island by helicopter, were forbidden to approach the island by Uzbekistani authorities.

29 Previously, Vozrozhdeniye Island and the city of Aralsk were used as exile camps for kulaks (private farmers) by the 15th Special Commandant's Office of NKVD (People's Commissariat of Internal Affairs, later the KGB). One such settlement in Aralsk was named "New America." Gennadiy Kruglyakov, "Kazakhstanskiye 'Solovki'" ("Kazakhstan's 'Solovetskiye' Islands"), *Kazakhstanskaya pravda*, October 28, 1998, p. 3. The Red Army's Scientific Medical Institute, established in 1933, was transferred to Kirov in 1942 and is now known as the Scientific Research Institute of Microbiology. Rimmington, "Conversion of BW Facilities," p. 2.

30 Rimmington, "Conversion of BW Facilities," pp. 2-3.

31 Interview with NCB specialists; Rimmington, "Conversion of BW Facilities," p. 3.

32 Interview with an official from the US Department of Defense (DOD), May 1998. The Aralsk military base was an important source of jobs for local residents, who supplied the troops with food and other services. Civilians also worked among sailors on dry cargo barges and tankers. Interview with local citizens in Aralsk and Kzylorda pilots, May 1998; Darmenov, "Ostrov Vozrozhdeniya." Rimmington indicates that over 1,000 people were stationed at the island. Rimmington, "From Military to Industrial Complex," p. 86.

33 Darmenov, "Ostrov Vozrozhdeniya."

warehouses, and a power station. Personnel were subjected to regular immunizations and received hardship benefits.[34] PNIL laboratory buildings, located near the residential area, possessed up-to-date equipment and a Biosafety Level 3 containment unit.[35] Also located in the northern part of the island was Barkhan Airport, which provided regular plane and helicopter transportation to the mainland, and a seaport at Udobnaya Bay. Special fast patrol boats protected the island from intruders.

The open-air test site in the southern part of the island was used for studying the dissemination patterns of BW agent aerosols and methods to detect them, and the effective range of aerosol bomblets with biological agents of different types.[36] The testing grounds were equipped with an array of telephone poles with detectors mounted on them, spaced at one-kilometer intervals.[37] BW agents tested at the Vozrozhdeniye site had been developed at the MOD facilities in Kirov, Sverdlovsk, and Zagorsk, and the Biopreparat center in Stepnogorsk, and included anthrax, tularemia, brucellosis, plague, typhus, Q fever, smallpox, botulinum toxin, and Venezuelan equine encephalitis. The experiments were conducted on horses, monkeys, sheep, and donkeys, and on laboratory animals such as white mice, guinea pigs, and hamsters.[38] In addition to common pathogenic strains, special strains developed for military purposes were tested at the island.[39] Bacterial simulants were also used to study the dissemination of aerosol particles in the atmosphere.

The fact that the island's prevailing winds always blow toward the south, away from the northern settlement, was probably an important factor in designing the site. The BW aerosol tests were also conducted in such a way as to avoid contaminating the northern military settlement, and a special service on the island was responsible for environmental control.[40] Nevertheless, the activities on the secret island caused serious concerns among local residents because of repeated epidemics and the mass deaths of animals and fish in the area.[41] Individual cases of infectious disease also occurred in people who spent time on the island.[42]

Desiccation of the Aral Sea

By the early 1990s, the desiccation of the Aral Sea, which had been taking place since the 1960s because of the diversion of water into irrigation projects, had begun to impair the operation of the Vozrozhdeniye test site.

34 For example, one year of service counted as two.

35 Rimmington, "From Military to Industrial Complex," p. 86.

36 Biological aerosols can be disseminated over a distance of up to 20 kilometers. Interview with specialists from the NCB.

37 Interview with an official from the DOD, May 1998.

38 Interview with NCB specialists.

39 For example, special strains may be resistant to standard antibiotics and vaccines and may have other militarily useful properties such as high virulence or greater environmental viability (resistance to ultraviolet rays, heat, desiccation, and shear forces). Such strains can be developed by simple selection techniques or by genetic engineering methods. Soviet scientists appear to have developed genetically modified strains of anthrax and plague. On BW technologies, see Office of Technology Assessment, United States Congress, *Technologies Underlying Weapons of Mass Destruction*, Background Paper, December 1993, pp. 71-117.

40 Accidents could not be completely avoided, however. In 1960, the wind shifted during a BW test on Konstantin Island, leading to widespread contamination and forcing an emergency evacuation. Thereafter, the island was never used again. Interview with NCB specialists.

41 In 1976, a mass death of fish occurred in the Aral Sea. In June 1986, outbreaks of plague were noted in the region and entire flocks of sheep lost their wool. In May 1988, over the course of only about an hour, approximately half a million saiga antelope dropped dead in the Turgay steppes northeast of the Aral Sea. "'Green' Activists Suspect Removal of BW Equipment from Aral Sea Site," JPRS-TAC-92-015, 8 May 1992, pp. 27-28. Rimmington indicates that during the mass death of the saiga, the entire human population of the area was evacuated as a precautionary measure. Rimmington, "Conversion of BW Facilities," p. 3. The cause of mass deaths among animals in the area remains unclear. It might be related to the unfavorable environmental situation in the Aral region caused by the desiccation of the sea, the heavy pesticide pollution of tributary rivers, or natural endemic outbreaks of plague.

42 Dr. Aykimbayev of the Almaty Anti-Plague Institute recalled that once an ichthyologist was urgently transported to an anti-plague station in Aralsk. She appeared to have contracted smallpox after accidentally reaching the island. Interview with Dr. Aykimbayev, October 1998.

Although the island was initially 200 square kilometers in size, it expanded to 2,000 square kilometers by 1990.[43] The shrinkage of the Aral Sea increased operational expenditures at the test site, particularly the cost of importing necessary items.[44] The site's port had to be relocated several dozen kilometers away from the settlement, increasing the need for ground transportation and the size of the labor force needed for loading and unloading operations.[45] Kazakhstani specialists believe that by 2010, the island will be connected to the mainland; there is already a shallow zone between the island and the settlement of Muynak on the Uzbekistani coast. The emergence of a land bridge would eliminate the major security benefits of the island.[46]

The Moscow authorities did not allow Kazakhstani public representatives to visit Vozrozhdeniye Island until 1990.[47] The first Kazakhstani commission, headed by N. I. Ibrayev, Deputy Chairman of the Kzylorda Oblast Executive Committee of the CPSU, visited the island in August 1990. The visit was hosted by Valeriy Sinevich, the commander of the military unit stationed on the island, and Victor Donchenko, deputy head of the PNIL.[48] In the spring of 1992, a second Kazakhstani government commission headed by Svyatoslav Medvedev, Minister of Ecology and Bioresources, visited the island. In August 1992, an independent expert commission of the Aral-Asia-Kazakhstan non-governmental organization also visited.[49] The Russian military authorities claimed that no offensive testing or research had been conducted on the island and that the site had tested only defenses against biological weapons.[50]

Evacuation of Russian military personnel from Vozrozhdeniye Island began in 1991, when the PNIL specialists left and the laboratories were mothballed.[51] On January 18, 1992, the Supreme Soviet of newly independent Kazakhstan issued the edict "On Urgent Measures for Radically Improving the Living Conditions of Aral Area Residents," which officially closed the Vozrozhdeniye military site. On April 11, 1992, Russian President Boris Yeltsin's Edict No. 390, "On Ensuring the Implementation of International Obligations Regarding Biological Weapons," ordered that all offensive BW programs be shut down. Following this decree, the Russian government declared that the Vozrozhdeniye site was closed, the special structures would be dismantled, and within two to three years the island would be decontaminated and transferred to Kazakhstani control.[52] In August 1995, specialists from the US Department of Defense visited Vozrozhdeniye Island and confirmed that the experimental field lab had been dismantled, the site's infrastructure destroyed, and the military settlement abandoned.[53]

After the Russian authorities left Vozrozhdeniye Island in 1992, local residents

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43 Rimmington, "Conversion of BW Facilities," p. 3

44 Fuel, food, and construction materials were regularly delivered to the site. Annually, the site required tens of thousands of metric tons of drinking water. Darmenov, "Ostrov Vozrozhdeniya."

45 Ibid. Initially, transport ships used Udobnaya Bay near the military settlement, but the pier had to be moved several times as the sea shrank.

46 Ibid.

47 Kazakhstani public activists, particularly from the Nevada-Semipalatinsk international anti-nuclear movement, the non-governmental organization Tamshy in Aralsk, and the Aral-Asia-Kazakhstan public movement, have made considerable efforts to penetrate the veil of secrecy over Vozrozhdeniye Island.

48 The delegation included parliamentarians, representatives of the Aral and Kazalinsk regions, and journalists, making a total of 24 people. Defensive means against BW, equipment for detecting air admixtures, and some tested military hardware were demonstrated to the public representatives. Darmenov, "Ostrov Vozrozhdeniya"; "'Green' Activists Suspect."

49 Ivan Chasnikov, *Ekho yadernykh vzryvov* (*The Echo of Nuclear Explosions*) (Almaty, 1996), p. 75.

50 "'Green' Activists Suspect."

51 Rimmington, "From Military to Industrial Complex," p. 86.

52 The evacuation from Vozrozhdeniye Island continued in 1992. Local authorities and environmentalists were concerned, however, by the lack of Kazakhstani control over the dismantlement of the site. On March 7, 1992, Bigali Kayupov, head of the Aralsk Regional Administration, attempted to detain a convoy from Military Unit 25484 that was removing heavy trucks, tractors, tanker trucks, and other equipment. "'Green' Activists Suspect."

53 Rimmington, "From Military to Industrial Complex," p. 86.

of Kazakhstan and Uzbekistan flocked to the island to seize abandoned military equipment that the Russian forces had been unable to take with them. It is to be hoped that the looting occurred in the safer, residential part of the island. Kazakhstan has not yet used the portion of the island under its jurisdiction for economic purposes, and specialists remain concerned about environmental contamination.

Stepnogorsk Scientific Experimental and Production Base (SNOPB)

The Scientific Experimental and Production Base (SNOPB) at Stepnogorsk was under the authority of the Biopreparat organization.[54] Known only by its post office box, No. 2076, this facility tested and certified pilot-scale and large-scale methods of producing BW agents developed in the laboratories of Biopreparat and the MOD, and issued technical documentation and recommendations.[55] SNOPB was also one of six mothballed plants in the Biopreparat system designed for the large-scale production and weaponization of biological agents during the so-called "special time"—mobilization for total war. It specialized in anthrax. Western and Russian experts have referred to SNOPB as the Soviet Union's main facility for the manufacture of biological weapons and one the largest installations ever created for this purpose.[56] Since the war did not materialize, the Stepnogorsk facility was never used at full capacity.

Construction of SNOPB began in 1982 on the desolate, windy Kazakhstani steppes, 14 kilometers from the city of Stepnogorsk, a military-industrial town under the authority of the Ministry for Medium Machine-Building (Minsredmash) and Glavmikrobioprom.[57] SNOPB was built in the backyard of a civilian biotechnological plant called Progress.[58] Documents concerning the construction of the facility show that the design incorporated the most advanced developments in industrial biotechnology at the time, including the use of special materials. The availability of power and heat-generating facilities, as well as qualified biotechnological and construction specialists from Progress and the city of Stepnogorsk, facilitated the building of SNOPB.[59] Eduard Perov, the former deputy director of Progress, headed SNOPB during its construction.[60] At the end of 1983, Kanatjan Alibekov, who had previously headed the Biopreparat facility in Omutninsk, was appointed director of SNOPB.[61] His deputy was Gennadiy

54 SNOPB stands for *Stepnogorskaya nauchnaya opytno-promyshlennaya baza* (Stepnogorsk Scientific Experimental and Production Base). The facility had other names: the Kazakhstani Branch of the Biokhimmashproyekt Institute, the Stepnogorsk Scientific Research Institute for Biotechnology, and the Biopreparat Kazakhstani Scientific Research Complex. Since 1993, it has been called the Biomedpreparat Joint Stock Company, or AO Biomedpreparat.

55 Interview with an official from the DOD, May 1998; Gennadiy Lepyoshkin, "Flagmanu farmindustrii byt" ("To be the flagship of the pharmaceutical industry"), in *Stepnogorsk: Zdes propisany nashi serdtsa*, p. 126.

56 Rimmington, "Conversion of BW Facilities," p. 2.

57 Other names of Stepnogorsk were Makinsk-2, Tselinograd-25, and Aksu. It is located about 200 kilometers north of Astana (formerly Tselinograd), the new Kazakhstani capital. Aksu is situated nine kilometers from the city of Stepnogorsk. Dual-use enterprises in Stepnogorsk included the Tselinnyy Uranium Mining and Chemical Combine (TsGKhK) and the 16th State Ball-Bearing Plant, which produced ball bearings for tractors as well as for tanks. The area has a number of uranium deposits, which was why Minsredmash, the USSR nuclear industry ministry, decided to create a city there. Lepyoshkin, "Flagmanu farmindustrii byt," p. 126; Perov, "Trudnyye shagi 'Progressa'," pp. 107-109; M. S. Koyshibayev, "Na krutom povorote vremeni" ("At a sharp turn in time"), in *Stepnogorsk: Zdes propisany nashi serdtsa*, pp. 5-6.

58 The construction of the Progress plant started in 1970 by the order of Glavmikrobioprom. It was done to implement the August 8, 1970 Decree of the Central Committee of the CPSU and the USSR Council of Ministers "On Measures for the Accelerated Development of the Microbiological Industry." The plant, worth 170-180 billion rubles, was the largest and most technologically advanced in the Soviet microbiological industry. Perov, "Trudnyye shagi 'Progressa'," pp. 107-108.

59 The Progress plant produced herbicides, supplements for animal feeds (amino acids, vitamins, antibiotics), and ethanol. It occupies an area of 300,000 square meters and employs 2,000 workers, including 800 engineers. The plant has huge stainless-steel fermentation tanks. Interview with NCB specialists.

60 In 1983, Perov became director general of Progress. Yuriy Davydkin headed SNOPB for a short time until he was replaced by Kanatjan Alibekov at the end of 1983. Lepyoshkin, "Flagmanu farmindustrii byt," p. 127.

61 In 1988, Alibekov, an ethnic Kazakh, became the first deputy director for research and production at Biopreparat, the

Lepyoshkin, who came to SNOPB from the MOD facility in Kirov in 1984.[62]

Research and Development Work

At Stepnogorsk, Alibekov directed the research team that in 1988 developed the Soviet Union's most deadly weapons-grade anthrax agent.[63] SNOPB continued research and development work on anthrax that previously had been conducted at the MOD institute in Sverdlovsk, but that had to be curtailed in 1979 after an accidental release of anthrax spores from the facility killed some 70 people. The accident in Sverdlovsk increased Western suspicions of the existence of a clandestine Soviet BW program in violation of the 1972 Biological and Toxin Weapons Convention. From 1984 to 1987, core specialists and equipment from Sverdlovsk were transferred to SNOPB.[64] In addition to anthrax, the Stepnogorsk facility produced staphylococcus toxin.[65] SNOPB also conducted development and experimental production of several civilian products, including vaccines, diagnostic tools, herbicides, and medicines.[66]

The best biotechnologists and talented young scientists from Russia were invited to work at SNOPB, and specialized courses at leading Russian research institutions were organized for new personnel.[67] The facility employed 350 people in 1984. By 1991, the staff had grown to about 800 people, among them 17 scientists with doctoral degrees and 100 researchers.[68] Some SNOPB specialists held military rank. Although subordinate to Biopreparat, SNOPB exchanged technological expertise with MOD facilities involved in similar research. In addition to staff from Sverdlovsk, specialists from the MOD research center in Kirov worked at SNOPB. The facility also appears to have had links with the Institute of Bioorganic Chemistry (IBKh) in Moscow. In 1989, IBKh specialists prepared technical documentation for the civilian production of human insulin at SNOPB, documentation that required detailed knowledge of the facility's production equipment.[69]

Although civilian access to the facility was strictly limited, SNOPB had technological links with and received specialists from Progress, the neighboring commercial biotechnological plant.[70] In addition to its role as a civilian cover

second-in-command of this organization. His former colleagues in Stepnogorsk describe him as an impressive, highly energetic person and a man of great erudition. In 1992 Alibekov (now Ken Alibek) became the highest-ranking defector from Biopreparat to the United States. He wrote a comprehensive classified study on the Soviet BW program that played a key role in revealing and subsequently halting this formidable program. Rimmington, "Conversion of BW Facilities," p. 6; Richard Preston, "The Bioweaponeers," *The New Yorker*, March 9, 1998, p. 52; Tim Weiner, "Soviet Defector Warns on Biological Weapons," *New York Times*, February 25, 1998, pp. A1, A8.

62 Lepyoshkin, having previously worked at the MOD facility in Kirov, brought to Stepnogorsk his expertise from the MOD BW system. Currently, he is Director General of the National Center for Biotechnology (NCB), which includes the Biomedpreparat Joint Stock Company (formerly SNOPB), NISKhI in Gvardeyskiy, and several Kazakhstani academic microbiological institutes. Rimmington provides a detailed biography of Lepyoshkin in "Conversion of BW Facilities," p. 15.

63 Alibekov's anthrax was ready in 1989. The anthrax agent developed at SNOPB was reportedly four times more effective than the standard product and was resistant to a wide spectrum of antibiotics and vaccines. Preston, "The Bioweaponeers"; Garrett, "Inside Russia's Germ Warfare Labs," p. A39; Rimmington, "Conversion of BW facilities," p. 2.

64 In particular, the Sverdlovsk facility had weaponization equipment necessary for loading biological agents into bombs and missile warheads. Sergey Volkov, "U Yekaterinburga byl svoy Chernobyl" ("Yekaterinburg had its own Chernobyl"), *Uralskiy rabochiy*, April 11, 1998, p. 3.

65 The Sverdlovsk facility, which supplied personnel and technology to SNOPB, appeared to have expertise in staphylococcus organisms. Under conversion programs, the Russian Center of Military-Technical Problems of Anti-Bacteriological Defense in Sverdlovsk (now Yekaterinburg) has worked on anti-staphylococcus preparations. Rimmington, "From Military to Industrial Complex," p. 95.

66 Commercial products produced at SNOPB were profesim, ginseng biomass, and BCG vaccine. Perov, "Trudnyye shagi 'Progressa'," in *Stepnogorsk: Zdes propisany nashi serdtsa*, p. 118.

67 Lepyoshkin, "Flagmanu farmindustrii byt," p. 127.

68 I. Fatkuldinova, "Neskolko tayn sekretnogo Progressa" ("A few secrets of the classified Progress"), *Leninskaya smena*, April 4, 1992.

69 The documents bear the signature of Ivanov, who replaced Ovchinnikov as director of IBKh. Interview with NCB specialists.

70 While both Progress and SNOPB were formally subordinated to the civilian ministry Glavmikrobioprom,

for the military-controlled SNOPB, Progress supplied electricity and heat to the facility. SNOPB also implemented its civilian technological developments at Progress, such as an improved process for ethanol production.[71] The two facilities began to cooperate more openly in 1989, when Soviet authorities decided to convert some of SNOPB's production lines to manufacture civilian preparations such as human insulin and to mothball the rest of the equipment.[72] These plans were never implemented, however, because of the breakup of the USSR and the subsequent cessation of funding from Moscow.

Infrastructure of the Facility

Occupying an area of about two square kilometers, SNOPB consisted of 25 buildings at which more than 700 people worked in 1991.[73] Building 211 held production equipment for the preparation of nutrient media and a storage complex for receiving and storing dry and liquid raw materials. Building 221 was the main production facility for the large-scale fermentation of microorganisms, and it also housed a genetics research laboratory. Buildings 241 to 244 were designed for the weaponization of the biological agents produced in Building 221. Building 231 was used for drying and milling of microbiological products, Buildings 251 and 252 for storing these products, Building 600 for conducting research and laboratory tests on biological agents, and Building 277 for waste treatment. Besides the numbered buildings, SNOPB had a number of support facilities, including an animal house, an administrative building, and a medical unit.

The SNOPB research laboratories employed highly qualified specialists and had the most modern equipment. From 1984 to 1990, research and development on technology for producing special microbial formulations was conducted in Buildings 221 and 600. Building 600 had a high-containment system and a specialized chamber for testing BW munitions. Made of stainless steel, the chamber was about 200 cubic meters in volume and had walls 1.6 centimeters thick. It was mounted on an octagonal cement platform, with a waste trap below. Monkeys, rabbits, and other animals kept in cages in the facility's vivarium were used for tests in the aerosol chamber.[74]

The numbered SNOPB buildings were components of an integrated technological chain. In Building 211, 17 different types of nutrient media could be prepared, with a production capacity of about 30,000 metric tons per year. Building 211 was linked by a system of pipes to Building 221, the six-story central production plant where cultures of microorganisms were grown in giant fermentors. Selected strains of biological agents from the bacterial culture collection were transferred to a high-containment (Biosafety Level 3) laboratory on an upper floor of the building. This laboratory was equipped with submarine doors, a shower, and a medical room where employees were examined before entering the laboratory and changing into disposable suits. After cultivation in small, one-cubic-meter fermentors, the bacterial mass descended by gravity into giant, 20-cubic-meter production fermentors located on the lower floors. Ten such production fermentors occupied four floors of Building 221. The solution of bacteria grown in the fermentors was then transferred to seven centrifugal separators on the lower floor. Spinning at 5,000 revolutions per minute, these centrifuges separated the bacterial cells from the nutrient

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SNOPB was a separate, military-run BW organization reporting to the Biopreparat authorities.

71 Interview with NCB specialists.

72 Ibid. Note that in 1989, Vladimir Pasechnik, a microbiologist from Biopreparat, defected to Great Britain. In addition, US President George Bush and British Prime Minister Margaret Thatcher were putting pressure on Soviet leader Mikhail Gorbachev to open up BW facilities in the USSR to international inspection. Preston, "The Bioweaponeers," p. 58.

73 The following description of SNOPB is based on the authors' visit to the Stepnogorsk facility in August 1998 and interviews with NCB specialists.

74 Interview with a DOD official, May 1998.

media and other waste products. In a single three-day production cycle, 1.5 metric tons of concentrated bacterial slurry could be produced.[75]

Buildings 241-244 and 251-271 were underground bunkers with reinforced-concrete walls two meters thick, reportedly capable of surviving a nuclear attack.[76] From the outside they resembled small hills covered by soil and grass. Bunkers 241-244 contained weaponization lines where special machines filled the concentrated slurry of pathogenic microorganisms into bomblets and then sealed them. Weaponization could be completed by installing explosive bursters in the bomblets.[77] The bomblets would then be installed in a large weapon, such as an aerial bomb or a missile warhead.[78] Bunkers 251-271 contained refrigerated rooms for storing biological agents, capable of maintaining temperatures down to -40° C in a volume of 800 cubic meters. Buildings 251-271 were connected by a railway spur with loading equipment, and had a small helicopter landing site nearby.

Buildings 221, 241-244, and 231 were equipped with biocontainment systems for the protection of plant personnel and the surrounding environment. These buildings had high efficiency air filters,[79] fans for maintaining negative air pressure, individual air supplies, sterilization autoclaves, and submarine doors. All wastes from the production process were handled in the waste-treatment building.

According to estimates by Western experts, the SNOPB facility, once mobilized, could produce 300 metric tons of weapons-grade anthrax over a ten-month period. [80] Full-scale production never took place, however. Financing for construction was reduced in 1990 in response to the scaling down of BW programs. After the collapse of the Soviet Union, Moscow stopped providing financial support for SNOPB, resulting in a large outflow of biotechnology specialists. A number of them left to work in commercial organizations, while others left Kazakhstan altogether. After work had ceased in the buildings at SNOPB, special decontamination measures were undertaken, and some military-related equipment was dismantled and destroyed.[81]

Scientific Research Agricultural Institute (NISKhI)

The Scientific Research Agricultural Institute (NISKhI) belonged to a separate group of Soviet BW facilities that developed agents harmful to livestock and plants. The institute was the only BW research center in Kazakhstan specializing in viruses. It had cooperative ties with Russian centers conducting similar research in Vladimir (under the Ministry of Agriculture), in Sverdlovsk (under the MOD), and at Vector in Novosibirsk (under Biopreparat),[82] where the agents produced at NISKhI were tested. The institute did not have direct links with the Stepnogorsk and Vozrozhdeniye facilities, evidently because of its special-ization in anti-crop and anti-livestock agents.

One of the oldest Soviet BW development centers, NISKhI was established in 1958 in the settlement of Gvardeyskiy outside the city of Otar, about 180 kilometers from Almaty.[83]

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75 Ibid.

76 Rimmington, "Conversion of BW Facilities," p. 2.

77 Interview with a DOD official, May 1998.

78 The weaponization equipment was removed to Russia in 1990-1991. Interview with a DOD official, May 1998.

79 Known as Petryanov filters, they were probably a Soviet version of the High Efficiency Particulate Air (HEPA) filters used in the West.

80 Interview with a DOD official, May 1998.

81 By order of Biomedpreparat authorities in 1991, the aerosol testing chamber was cut up and destroyed. Currently, only the octagonal platform remains at the facility. Interview with BBC journalists who visited Building 600 in May 1998.

82 Among other facilities, Vector incorporated the Experimental Agricultural Production Enterprise. Rimmington, "From Military to Industrial Complex," p.111.

83 NISKhI stands for *Nauchno-issledovatelskiy selskokhozyaystvennyy institut*. Gvardeyskiy, in the Korday region of Zhambyl Oblast, is 3 kilometers from the Otar railroad station and has a population of about 5,000. Information obtained during the authors' visit to Gvardeyskiy in October 1998; "NISKhI. Scientific Research Agricultural Institute. Settlement of Gvardeyskiy. National Center for Biotechnology of the

Although the institute was subordinated to the USSR Ministry of Agriculture, its director held military rank. Moreover, the institute was located within a military settlement and it was necessary to pass three security posts to reach it.[84] It occupied a territory of 19 hectares, including 15 laboratories, a vivarium, greenhouses, agricultural technology, and a vaccine production facility, and employed more than 400 people.[85]

Research on anti-crop agents possibly began in the 1970s, when NISKhI received orders from military authorities to study the resistance of crops to various biological pathogens.[86] The institute had broad expertise in highly pathogenic and exotic diseases of livestock, fowl, and crops caused by viruses and other agents, including Rinderpest virus, Newcastle disease virus, African swine fever virus, sheep pox virus, goat pox virus, fowl pox virus, blue-tongue virus (catarrhal fever of sheep), herpes virus (Aujeszky's disease), and cereal rust fungi.[87] In 1991, Moscow terminated all military research and left the NISKhI without central administration or funding. The director of the institute and some specialists left to work at institutes in Russia.[88]

Republic of Kazakhstan," brochure presented by NISKhI Director Dr. Seydigappar Mamadaliyev, October 1998, p. 1.

84 The military guards have remained to the present day because the Kazakhstani Ministry of Defense operates a large training center in Gvardeyskiy.

85 Interview with Dr. Seydigappar Mamadaliyev, Director of NISKhI, October 1998.

86 Anne M. Harrington, "Briefing on Stepnogorsk Initiative Discussions in Almaty, October 22-25, 1996. Institute Descriptions and Proposal Abstracts," p. 76.

87 The agents listed are considered to have potential BW applications. See The Royal Society, "Scientific Aspects of Control of Biological Weapons," Report of a Royal Society Study Group, supported by the Leverhulme Trust, July 1994, pp. 16-17. The pathogenic microorganisms studied by NISKhI were indicated in "NISKhI," pp. 4-5; and S. Mamadaliyev, "Determining the Probability of Bringing in Particularly Dangerous Infections to the Territory of the Republic of Kazakhstan and Developing Scientifically Based Measures of Control and Prophylaxis," in Harrington, "Briefing on Stepnogorsk Initiative Discussions in Almaty," p. 46.

88 Interview with Dr. Seydigappar Mamadaliyev, Director of NISKhI, October 1998.

Anti-Plague Scientific Research Institute

The Anti-Plague Scientific Research Institute was established in 1949 in the suburbs of Almaty under the authority of the Main Directorate for Quarantine Infections of the USSR Ministry of Health. It was part of the Soviet system for the control of highly pathogenic diseases and operated a Central Asian network of 19 epidemiological monitoring stations.[89] During the Soviet era, the Anti-Plague Institute employed about 450 people. The institute had four laboratories, including one devoted to genetic research, and a vaccine preparation plant with a capacity of 21 million vaccine doses per year. The institute developed diagnostic tests and vaccines for several infectious diseases, including anthrax, plague, tularemia, brucellosis, cholera, and listeria. In addition to serving civilian needs, the institute was involved in military-related research and development on defensive measures against BW agents. To this end, the institute received Soviet intelligence on biological agents developed by Western militaries, including pathogenic strains modified for military purposes, and prepared vaccines and diagnostic preparations against them.

The Almaty Anti-Plague Institute had no direct links with the BW research centers under the Soviet MOD, the Ministry of Agriculture, or Biopreparat, although it participated in exchanges of scientists and of technical knowledge.[90] Nevertheless, the possibility that the Anti-Plague Institute was involved in offensive BW developments cannot be ruled out.[91] In 1992, Moscow terminated funding for the institute's research and all military-related work ceased.

89 About 1,600 square kilometers of Kazakhstani territory, mostly located in Kzylorda and Atyrau Oblasts, contain endemic plague areas. Interview with Dr. Alim Aykimbayev, Deputy Director of the Anti-Plague Institute, Almaty, October 1998.

90 Ibid.

91 Ibid.

INITIAL EFFORTS AT CONVERSION

After the collapse of the Soviet Union, one of the many tasks facing independent Kazakhstan was to address the Soviet military-industrial facilities on its territory. In 1991-1992, Russia cut off funding for the former Soviet BW centers in Kazakhstan, closed down their military programs, and abandoned the sites. Since these facilities had all been subordinate to central Moscow agencies, local Kazakhstani authorities had little idea about their activities.

The government of Kazakhstan was committed to converting the former Soviet BW facilities to peaceful activities. In 1991, the Ministry of Health and the Ministry of Agriculture began planning the conversion of SNOPB and NISKhI, respectively, but these efforts were unsuccessful because the ministries lacked the necessary expertise. In 1992, the Kazakhstani government launched the State Conversion Program and allocated some budget funding for the civilian reorganization of the former BW facilities in Stepnogorsk. It was not until 1993, however, that new civilian institutions were established for this purpose.

At that time, Galym Abilseitov, then minister of science and new technologies, clustered together former military facilities and related civilian institutes of the Kazakhstan National Academy of Sciences into national centers for nuclear research, radioelectronics and communications, and biotechnology, which were financed and managed by the Ministry of Science. The new centers were designed to use the advanced expertise of former military facilities for Kazakhstan's peaceful needs. By organizing these centers, the Kazakhstani government introduced its administrative control and local specialists into biotechnological institutions that formerly had been operated exclusively by Moscow and staffed by Russian specialists.[92]

The National Center for Biotechnology (NCB), founded in 1993, brought together most of the former Soviet military and civilian biotechnology facilities in Kazakhstan.[93] In addition to SNOPB and NISKhI, the Center includes three civilian facilities: the Progress plant and the Institute of Pharmaceutical Biotechnology (both at Stepnogorsk) and the Almaty Biological Combine.[94] Also under the NCB umbrella are the microbiology institutes of the Kazakhstan National Academy of Sciences.[95] The NCB's main goal since its establishment has been to foster the application of biotechnology—including that developed at former military facilities—to medicine, agriculture, and industry, and to implement the most promising ideas and technologies.

The NCB has significant research potential: about 40 doctors of science and 160 candidates of science participate in its research

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92 Before he was appointed minister, Galym Abilseitov was director of one of the large laser centers outside of Moscow. His reform of the scientific research structure elicited the opposition of the Kazakhstani National Academy of Sciences because of the transfer of a few academic institutes to the new centers and the loss of the Academy's privileged financing. Abilseitov was also a deputy prime minister, and after stepping down from his post, he became one of the leaders of the Azamat political opposition movement.

93 The NCB was founded by Presidential Edict No. 1090, dated January 21, 1993, and Decree of the Cabinet of Ministers No. 1140, dated November 16, 1993.

94 The Progress factory, which served as a cover for SNOPB, was constructed in Stepnogorsk from 1971 to 1975. A total of 3,000 people worked at Progress and produced a variety of legitimate products, including antibiotics, amino acids, and feed additives. In 1993, Progress became a joint stock company (AO), and it was subsequently divided into three companies. The Institute of Pharmaceutical Biotechnology (IPB) in Stepnogorsk is a state enterprise created in November 1993 by reorganizing the Biomedpreparat Kazakhstani Scientific Production complex. IPB has a modern laboratory and experimental base that is developing technology for obtaining new drugs from microbial and animal sources. The Almaty Biological Combine was founded in 1931. Until 1991, it was subordinate to the Main Directorate for Biological Production of the Soviet Ministry of Agriculture; it became part of the NCB in November 1993. The facility, located in central Almaty, prepares vaccines and other preparations for the prevention, diagnosis, and treatment of infectious diseases of livestock and fowl.

95 The institutes include the M.A. Aytkhozhin Institute of Molecular Biology and Biochemistry; the Institute of Plant Physiology, Genetics, and Bioengineering; and the Central Laboratory for Biological Control, Certification, and Pre-Clinical Experiments (all based in Almaty).

and development activities. Biotechnological facilities belonging to the NCB also have considerable production capacity. The Almaty Biological Combine has a production facility of 40,000 square meters, suitable for the large-scale manufacture of vaccines. In Stepnogorsk, the Progress plant and the former SNOPB constitute a unique biotechnology complex with a combined production area of 500,000 square meters.[96]

The NCB participates in the Programs for Fundamental Research of the Kazakhstani Ministry of Science-Academy of Sciences, and is also the head organization for implementing three National Special Scientific and Technical Programs (NSSTPs): on the use of biotechnology methods and genetic engineering in medicine, agriculture, and industry; on scientific support for the agro-industrial complex of the Republic of Kazakhstan; and on the development and industrial production of phytochemicals to provide domestic medicines to medical institutions and the Kazakhstani population. NCB scientists also conduct joint research projects with universities and institutes in Belgium, Brazil, Germany, Hungary, Israel, Russia, Switzerland, the United Kingdom, and the United States. In the fall of 1998, under the US Department of Energy (DOE) Initiatives for Proliferation Prevention program, the NCB and DOE's Pacific Northwest Laboratory launched four projects worth a total of $771,000.[97]

The status of efforts to convert three former BW facilities in Kazakhstan—SNOPB, NISKhI, and the Almaty Anti-Plague Institute—is discussed below.

AO Biomedpreparat—Heir to SNOPB

In early 1993, SNOPB was reorganized into a joint stock company called AO Biomedpreparat.[98] Initial funding for this effort was provided by the Kazakhstani State Program on Conversion.[99] At that time, the Kazakhstani government developed plans for reconstruction and technical renewal of the facility that required a capital investment of approximately 58.9 million rubles. The Giprobioproyekt Institute in Moscow was given the task of designing production equipment for genetically engineered insulin, the antibiotic roseofungin, and other pharmaceutical products. The facility also began to manufacture disposable syringes and polymer products, and organized for the production of nutrient media and substrates.[100]

Biomedpreparat had high expenses, however, because of the costs associated with maintaining and amortizing the buildings owned by the enterprise, high energy consumption, the large workforce, and management and transport costs. As a result, the company's products were overpriced and noncompetitive. Kazakhstani government support, totaling about $1 million in 1993-1994, was not sufficient to fully reconstruct the facility for civilian needs or to provide all of the former BW specialists with civilian jobs.[101]

Cooperation between the governments of the United States and Kazakhstan on BW disarmament began at a March 1994 meeting

96 "Interview with specialists from the NCB; Interview with Mr. S. Ababkin, Deputy Director of Almaty Biological Combine, 1998."

97 The four projects are the following: "Production of Carotenoids and Related Products Using Fungal Fermentation," "Roseofungin-Macrolide: The Basis for Microbiological Production of the Pharmaceutical Product," "Phytoremediation: Phytosiderophore Augmentation for Environmental Cleanup," and "Diagnostic Probes for Plant Pathogen Identification." One more IPP biotechnological project, entitled "Development of a Process for a Novel Therapeutic Product for the Prevention of Food Contamination," was signed between the Kazakhstani Ministry of Science and the DOE Oak Ridge National Laboratory.

98 Initially, the facility was called the Kazakhstani Branch of the Biokhimmashproyekt Moscow Scientific Research Institute. Lepyoshkin, "Flagmanu farmindustrii byt," p. 126.

99 Decree No. 661of the Cabinet of Ministers of the Republic of Kazakhstan, dated June 17, 1994, "On Measures to Implement the Law of the Republic of Kazakhstan 'On Converting Defense Industries.'"

100 "Interview with specialists from the NCB."

101 "Interview with specialists from the NCB."

between the US and Kazakhstani committees on defense conversion, at which the two sides signed an agreement to allocate $15 million for the development of industrial cooperation. At a follow-on meeting in November 1994, the United States agreed to sponsor a conference for managers of US and Kazakhstani enterprises, at which Biomedpreparat received a grant for civilian industrial development. To implement the conversion of the former SNOPB, a joint venture called Kamed-Resources was founded with support from the US Department of Defense's Cooperative Threat Reduction (CTR) program. The two partners in the joint venture, Biomedpreparat and the US firm Allen & Associates International, agreed to undertake the commercial production of vitamins, antibiotics, and other pharmaceutical products at Stepnogorsk. Funding for the project was $5.8 million, of which $2.8 million was provided by the US government and the remainder by the US partner-firm. Unfortunately, the joint venture with Allen & Associates International failed for a number of reasons. The main problem was the lack of infrastructure to support the venture after the facility supplying utilities cut off service due to lack of payment by Biomedpreparat. Another problem was that contracts were drawn up and signed before a thorough evaluation of both sides could be undertaken. A poor working relationship between the two partner-firms also hindered progress.[102]

From 1993 to 1995, the Kazakhstani government maintained a "life support" regime for the buildings and structures at Stepnogorsk, but the costs of heat and power were high and the facility's debts to workers, the government, energy suppliers, and others rose quickly. Repaying these debts through production was impossible for the aforementioned reasons, so partial repayment was undertaken by selling unused equipment and other non-liquid assets. In 1995, the Kazakhstani government stopped providing funds for the conversion program at Biomedpreparat. In response, the enterprise halted production and cut power, and measures were taken to mothball the energy and technical systems and the production buildings. Personnel were laid off and workers took forced vacations. In June 1996, a special interagency committee appointed by decree of the Deputy Prime Minister reviewed the situation at Biomedpreparat. The committee issued its conclusions and prepared a draft government decree, but neither document had any effect. Most of the equipment at the Stepnogorsk plant was not converted to civilian use and remained virtually untouched for years.[103]

During a visit by Ambassador Richard Morningstar and Assistant Secretary of Defense Ashton Carter to Kazakhstan in March 1996, the parties reviewed a US proposal for cooperation between the United States and Kazakhstan at the Stepnogorsk facility. The United States proposed that it evaluate the factory infrastructure at Biomedpreparat and, based on this analysis, arrange to dismantle or destroy any militarily relevant equipment and systems that still posed a proliferation risk. The two sides also discussed the possibility of converting the remaining infrastructure and scientific expertise to civilian research and production. US officials indicated that the project would attract support from private foundations and would help to focus the efforts of various US government agencies and nonproliferation programs.[104]

On the basis of these intergovernmental negotiations, Kazakhstan and the United States signed a contract on December 5, 1996, that provided for dismantling the main and auxiliary equipment at Biomedpreparat designed for

102 "Interview with specialists from the NCB."

103 When program participants visited Biomedpreparat in June 1998, they found that the main production facility, Building 221, was not operating and needed massive repairs, but that the basic equipment—fermentors, pipes, and power lines—was in good condition.

104 "Interview with specialists from the NCB."

military microbiological production.[105] In February 1997, a technical conference was held in Washington, DC, to discuss the future of contract work under the Stepnogorsk initiative with the participation of leading specialists of the NCB and Biomedpreparat. In addition to agreeing on a list of dual-use equipment that would be subject to dismantlement, participants addressed the issue of setting up a modern environmental monitoring laboratory to determine the levels of microbial contamination at the facility. This Laboratory for Ecological Monitoring was founded in February 1998 and supplied by the United States with modern analytical equipment at a cost of $750,000.[106]

After the President of the Republic of Kazakhstan issued the edict "On Developing Small Business and Entrepreneurship" in June 1997, Biomedpreparat created a number of limited partnerships based on its subdivisions, using charter funds it had received. The goal of this restructuring was to provide the limited partnerships with the opportunity to manufacture profitable goods and, in the process, to start paying wages and taxes and contributing to the pension fund. For economic reasons, the production facilities used vacant space in Stepnogorsk. As of 1998, Biomedpreparat was managing the following limited partnerships (TOO, in Russian): TOO Plimed (production of disposable syringes, 31 employees); TOO Media (production of nutrient media and substrates, 10 employees); TOO Biogal (production of probiotic preparations, 52 employees); TOO Biotim (production of pharmaceutical tablets, seven employees); TOO Tulpar (production of agricultural products, five employees); TOO Biotrade (sale of unused equipment and materials, five employees); and Bioaz Joint Venture (production of medicines and supply and distribution activities, three employees).[107]

In September 1998, a new contract worth $1.5 million was signed for the dismantlement of main and auxiliary systems at Biomedpreparat.[108] The following month, in an effort to support and expand the cooperative program, a group of US experts in pharmaceuticals and industrial engineering visited Stepnogorsk. The main purpose of the visit was to find ways of reorienting work at the former BW facilities while retaining the existing personnel. The US experts visited Biomedpreparat, the Institute of Pharmaceutical Biotechnology, the Laboratory for Ecological Monitoring, and the NCB, and took part in discussions of joint biotechnology projects submitted earlier to international conversion foundations. After their visit, the experts prepared a report designed to attract investment from US companies in civilian joint ventures.

Although the economic situation at Biomedpreparat remains difficult to this day, there is reason to believe that if sufficient financing were available, the company could produce profitable items that would find a market in Kazakhstan and in the Central Asian region as a whole. A team of US specialists visited Biomedpreparat in 1997 and studied the condition of the buildings, equipment, and communications infrastructure. They concluded that if the facility is to be used to produce pharmaceuticals, a significant capital investment will be required because the buildings do not meet international quality-control standards for pharmaceutical production. As it currently stands, however, the facility could be used to manufacture products that do not require a sterile environment, such as ethanol or biological insecticides.[109]

105 "Preparation for Dismantling Infrastructure Equipment at AO Biomedpreparat," DSWA Contract 01-97-C-0018, dated December 5, 1996.

106 Interview with Laboratory Head Dr. Aleksandr Kosinov, Stepnogorsk, July 1998.

107 "Interview with specialists from the NCB."

108 "Dismantlement of Biological Weapons Infrastructure at AO B," DSWA Contract 01-98-C-0165, dated September 10, 1998.

109 "Summary Report on Conversion of Enterprises (Biological Weapons) in Stepnogorsk, Kazakhstan." Prepared by the

At present, the NCB is trying on its own to set up a production line for disposable, sterile syringes at Biomedpreparat, but it does not have sufficient funding to purchase the relatively low-cost equipment it still needs. Another problem is the lack of experience on the part of facility managers in adapting to civilian market conditions.[110]

NISKhI

After Moscow stopped funding NISKhI, the institute fell under the administrative control of the Kazakhstani Ministry of Agriculture, but the ministry was unable to make effective use of the institute's resources. Seydigappar Mamadaliyev, the new director of NISKhI, began to convert the institute to peaceful research. After the NCB was founded in 1993, NISKhI became a part of it.

At present, 230 individuals work at NISKhI, which consists of 15 research laboratories and a culture bank containing various strains of viruses, bacteria, and fungi harmful to plants and animals. The institute conducts fundamental research into the molecular biology of these pathogens. It also develops methods of preparing nutrient media for virology research. NISKhI's vaccine preparation plant can meet all of Kazakhstan's demand for vaccines, diagnostics, and antisera for veterinary diseases.[111]

The institute participates in six national projects on using genetic engineering and biotechnology in medicine, industry, and agriculture. Its two main lines of work are developing diagnostic tools and vaccines for combating animal viruses, and increasing the resistance of wheat to fungal plant diseases such as yellow and brown rust. NISKhI has commercial ties with Kazakhstani agricultural enterprises that need sera, vaccines, and other biological preparations. The institute has received two grants from the multilateral International Science and Technology Center (ISTC) and financing under the DOE's Initiatives for Proliferation Prevention (IPP) program.[112]

Anti-Plague Institute

The Anti-Plague Institute in Almaty currently employs 332 individuals, including 100 researchers. It is not part of the NCB and is under the authority of the Kazakhstani Ministry of Health, Education, and Sport. The Anti-Plague Institute is the scientific and methodological center for the eight anti-plague stations in Kazakhstan (Uralsk, Atyrau, Aktau, Aktyubinsk, Aralsk, Shymkent, Kyzyl-Orda, and Taldy-Korgan).

At present, the Anti-Plague Institute is developing diagnostic preparations and vaccines for particularly virulent infectious diseases, conducting epidemiological monitoring, and training specialists. Over the past few years, the institute has developed three diagnostic tests for anthrax, and in 1995, it developed a diagnostic test for a new natural strain of cholera from India, called "Bengal," that eludes all known diagnostic sera. The Anti-Plague Institute was also named as one of four World Health Organization regional centers on plague for Central Asia. Although the institute has experienced financial hardship since its transfer to Kazakhstani control in 1993, it has managed to obtain some foreign assistance from the ISTC and European foundations.[113]

PROSPECTS FOR CONVERSION

Through the Stepnogorsk initiative, the US government is pursuing the following goals: (1) to reduce the threat of facilities being converted back to production of dangerous pathogenic microorganisms; (2) to assure Western companies that Kazakhstan is

Technical Department of SKS, Huntsville, Alabama, 500DD(205)971700, 1997.

110 "Interview with specialists from the NCB."

111 "Interview with Dr. Mamadaliyev."

112 "Interview with Dr. Mamadaliyev."

113 Interview with Dr. Aykimbayev, Deputy Director of the Anti-Plague Institute, October 1998.

committed to putting the past behind it, thereby improving prospects for foreign investment; (3) to reduce the possibility of proliferation of BW-related knowledge by providing peaceful work to scientists formerly involved in biological weapons development; and (4) to reorient production at the Stepnogorsk facility to peaceful purposes.[114]

Preventing "brain drain," the exodus of specialists from military microbiology enterprises in Kazakhstan to countries of BW proliferation concern, is a key objective of the program. Economic decline, the prospect of unemployment, and the reduced prestige of scientific work may lead specialists to sell their knowledge and experience to countries of BW proliferation concern. Indeed, scientists in the former Soviet republics receive an average of 20 to 25 times less pay than their Western counterparts.[115]

Although much of the evidence for brain drain and the smuggling of biotechnology materials and technology is anecdotal, these problems appear to be real. According to data from the Russian Institute of Economic Problems of the Population, the number of scientists in the former Soviet Union has decreased over the last decade from 3.4 million to 1.3 million. Taking into account a small influx of young scientists, at least 2.5 million individuals have been forced to leave the field. People who spent numerous years in laboratories are now working in unskilled jobs. Moreover, the official statistics do not take into account the departure of scientists who go abroad on contracts for a few months to a few years.

NISKhI and the Anti-Plague Institute have retained at least half of their personnel, but since 1992, Biomedpreparat has lost 500 of a total of 700 biotechnologists with various levels of training. A few of the specialists who formerly worked at Biomedpreparat have been able to stay in Stepnogorsk, having secured jobs at the Institute of Pharmaceutical Biotechnology. Most of those who have left have gone to work in commercial organizations, or have moved to Russia, Ukraine, Belarus, and other former Soviet states. Unfortunately, this process is continuing. As a rule, the scientists who leave are accomplished specialists who are confident they will be able to find work in a new location. Defense conversion at the former BW facilities in Kazakhstan is therefore essential to prevent the recruitment of former weapons specialists by countries of proliferation concern.

Structural and Technological Constraints on Conversion

Because of the large scale of equipment to be dismantled or destroyed, the civilian conversion of Biomedpreparat will require considerable financial and material resources. NISKhI, which had fewer and much smaller items of military-related equipment to dismantle and convert, could make the transition to civilian production on its own. Most of the Almaty Anti-Plague Institute's equipment has always been suitable for civilian applications. Nevertheless, the task of converting weapons-related expertise to peaceful production will require considerable effort at all of the former Soviet BW facilities in Kazakhstan.

Although the Kazakhstani government has managed to incorporate former BW facilities into new administrative structures, it does not have the financial resources to complete the conversion of these centers. In particular, Biomedpreparat production facilities lack the Good Manufacturing Practice (GMP) quality-control systems needed to attract investment by Western pharmaceutical companies.

114 "Disarmament of the Biomedpreparat complex in Stepnogorsk," Report of the Joint Kazakhstan-United States Commission, November 19-20, 1996.

115 N. Milashevskaya, "Nauka v zerkale statistiki" ("Science in the mirror of statistics"), *Direktor*, No. 7, 1998, p. 23; Ya. Tudorovskiy, "Kogda ne kormyat svoyu nauku, kormyat chuzhuyu" ("When you don't feed your science, you feed someone else's"), *Direktor*, No. 1 (1998), p. 32.

Another problem has been a lack of managerial expertise needed to adapt the former military biotechnological facilities to new civilian market conditions. While these facilities were reorganizing, foreign pharmaceutical and biotechnology firms moved into Kazakhstan's domestic market, leaving limited opportunities for local producers. Kazakhstani biotechnology plants have also encountered tough competition for market share from Russian enterprises that played a complementary role in the former integrated military system. As a result, Kazakhstani biotechnological plants that once served the entire Soviet Union are now being crowded out of the domestic market. The low demand for specialists in agriculture, medicine, and biotechnology caused by the poor state of the Kazakhstani economy and competition from foreign producers has created considerable difficulties in finding civilian jobs for former bioweapons scientists.[116]

Role of Foreign Assistance Programs

Because of the lack of adequate resources on the part of the Kazakhstani government, foreign assistance programs have played an important role in the civilian conversion of former Soviet BW facilities. The US Department of Defense's CTR program has been oriented mainly toward the dismantlement of military BW infrastructure, while the DOE's IPP program has sought to promote the development of marketable civilian technologies at former weapons plants.[117] These assistance programs have been slow to get started at Kazakhstani BW facilities and, because of insufficient funding, the pace of conversion has been slow.

A great deal of hope rests on individual scientific grants provided by the ISTC, a multilateral conversion foundation based in Moscow. ISTC grants seek to enable former Soviet weapons scientists to use their knowledge and experience for peaceful purposes, to integrate them into civilian society, and to support the transition to a market economy. Nevertheless, ISTC procedures for the expert evaluation of NCB projects have been painfully slow: projects proposed in 1996 are still undergoing evaluation. Besides the ISTC, a number of other international foundations and programs support former Soviet weapons scientists, and some financing has been provided through private Western investment and the creation of joint ventures.

Until now, the implementation of the conversion program at the main former BW facility—AO Biomedpreparat—has been very difficult because of insufficient financing. Although foreign research grants have been helpful in slowing the emigration of Kazakhstani BW scientists with dangerous knowledge, they provide only a temporary source of support.[118] As an alternative, the conversion of Biomedpreparat to production of pharmaceuticals and other products for the civilian market could help it to become economically self-sufficient over the long run.

A model for cooperation with international foundations has been demonstrated by a former Biopreparat facility in Russia, the Institute of Immunological Studies in Lyubuchany. As part of a joint international project, the institute received $1 million from the ISTC, as well as additional support from NASA, the Soros Foundation, the European Union, and the British Royal Society. The money from these grants has allowed the institute to raise the salaries of its workers to $400 to $600 a month, compared with the typical salary of Russian scientists of no more than $50 per month. Many of the specialists who left Lyubuchany in search of

[116] "Interview with specialists from the NCB."

[117] Interview with official from the US Department of State, April 1998.

[118] In October 1998, financing was received for four NCB projects under the IPP program. NISKhI and the Anti-Plague Institute have also received a few ISTC grants.

better work and pay are now returning, and the future of the institute looks bright.[119]

CONCLUSIONS

Kazakhstan faces challenging problems with regard to the economic and environmental prospects of its former BW facilities. The direct subordination of these facilities to the Moscow authorities during the Soviet period, their huge military-designed infrastructure, and the weapons-related expertise of their personnel have complicated the process of conversion and integration into Kazakhstani civilian structures. Because of the lack of local resources, international assistance programs have provided most of the support for converting former BW facilities and reducing the exodus of personnel with military expertise.

More efforts are needed to help Kazakhstani biotechnological centers to become economically self-sufficient, so they need not rely in future on temporary foreign assistance programs. Although Kazakhstani biotechnological centers possess significant production facilities, the lack of financial resources and managerial expertise for reconstruction, delays in the conversion process, and stiff competition from Western and Russian firms in the domestic market have created serious economic difficulties. In this regard, Russia's successful strategies for attracting international financial assistance for the industrial conversion of its own BW facilities should be imitated in Kazakhstan. Collaborating with experienced foreign firms and attracting foreign investment could help Kazakhstani biotechnological facilities to establish their place in the civilian biotech and pharmaceuticals market.

Another priority is to attract the international expertise and assistance needed to deal with the environmental consequences of Soviet BW development and testing in Kazakhstan. Specialists from the NCB have expressed concerns that because of past BW tests, Vozrozhdeniye Island may remain contaminated for many years by pathogenic microorganisms, some of them military strains resistant to standard antibiotics. Anthrax spores can survive in soil for decades, creating an enduring source of contamination. Moreover, burrowing rodents such as gophers, field mice, and marmots are natural hosts of plague and other pathogens, and can migrate over long distances spreading infectious disease.

The contamination of Vozrozhdeniye Island presents a growing threat to the nearby population and the environment because of the desiccation of the Aral Sea, which has increased human and animal access to the formerly isolated island. As mentioned above, after the Russian military left in 1992, local residents started visiting the island to collect abandoned equipment. Economic activities in the area may increase in the future because some Kazakhstani and Uzbekistani oil companies plan to conduct oil exploration in the Aral Sea.[120] In 1997, specialists from the NCB and the Almaty Anti-Plague Institute submitted a proposal to the Kazakhstani government to study the environmental situation on Vozrozhdeniye Island, but the government still lacks the funds to support this research.

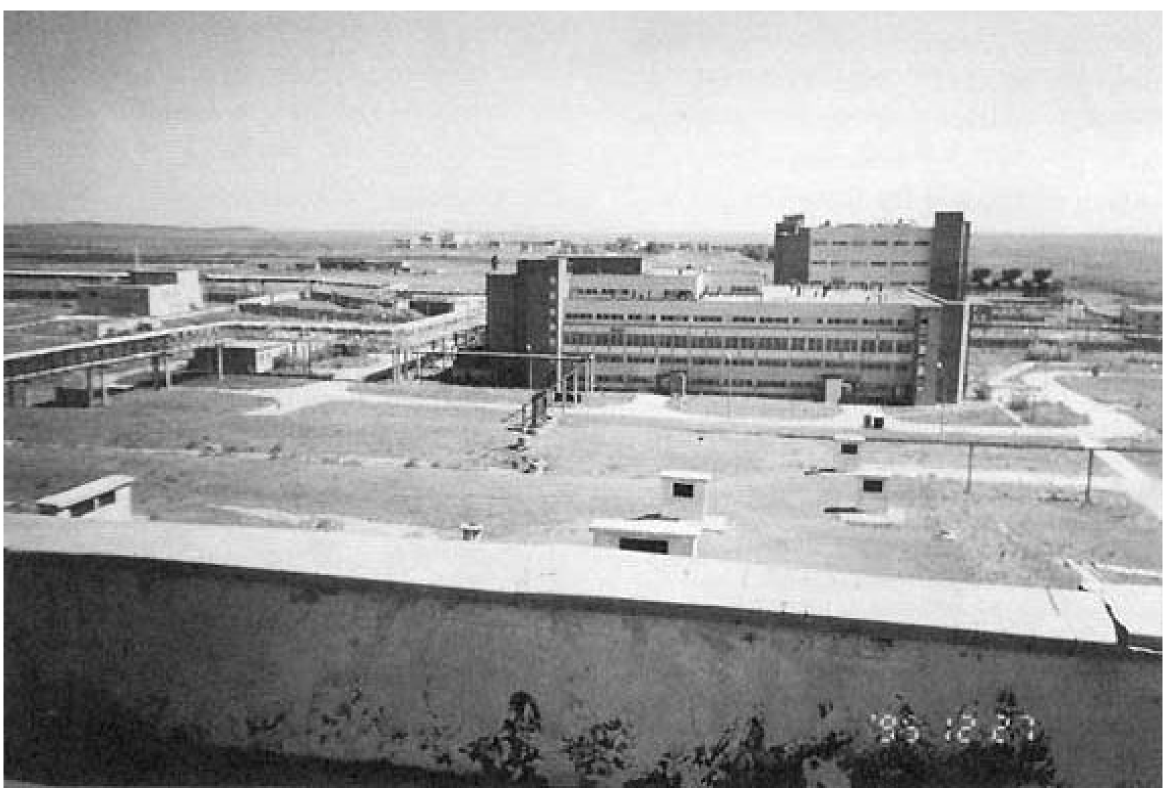
In conclusion, Kazakhstan has demonstrated an extraordinary degree of openness and transparency with respect to its role in the former Soviet BW program. It has also been a leader in cooperative efforts to destroy the infrastructure for producing weapons of mass destruction, setting a positive example for other countries. Yet Kazakhstan has not yet received the financial support it needs to convert former BW facilities to peaceful production activities. In return for its

[119] Rimmington, "From Military to Industrial Complex," p. 97.

[120] Specialists from NCB and Dr. Aykimbayev indicated that they had been approached by some foreign oil companies operating in Kazakhstan requesting a map of Vozrozhdeniye Island. The specialists recommended refraining from any activity on the island.

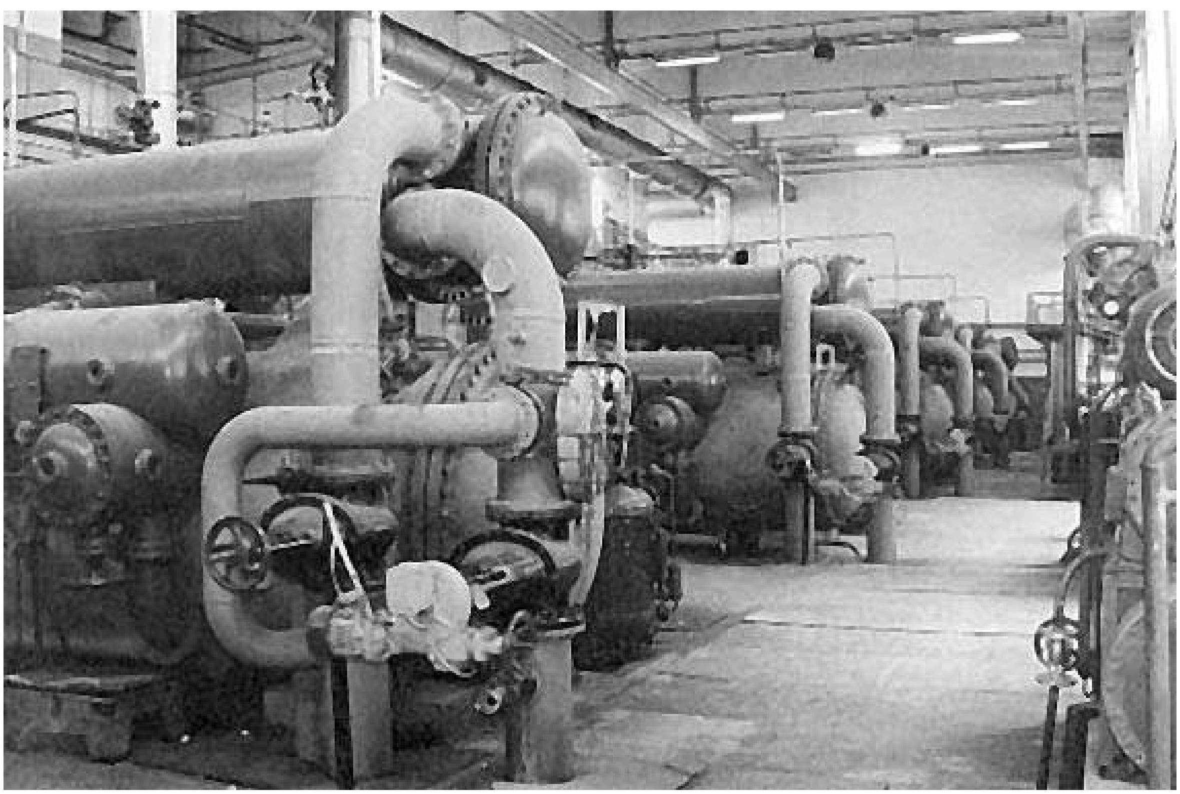
exemplary behavior, Kazakhstan deserves the active support of the world community in solving its conversion problems.

Building 600, where research was conducted

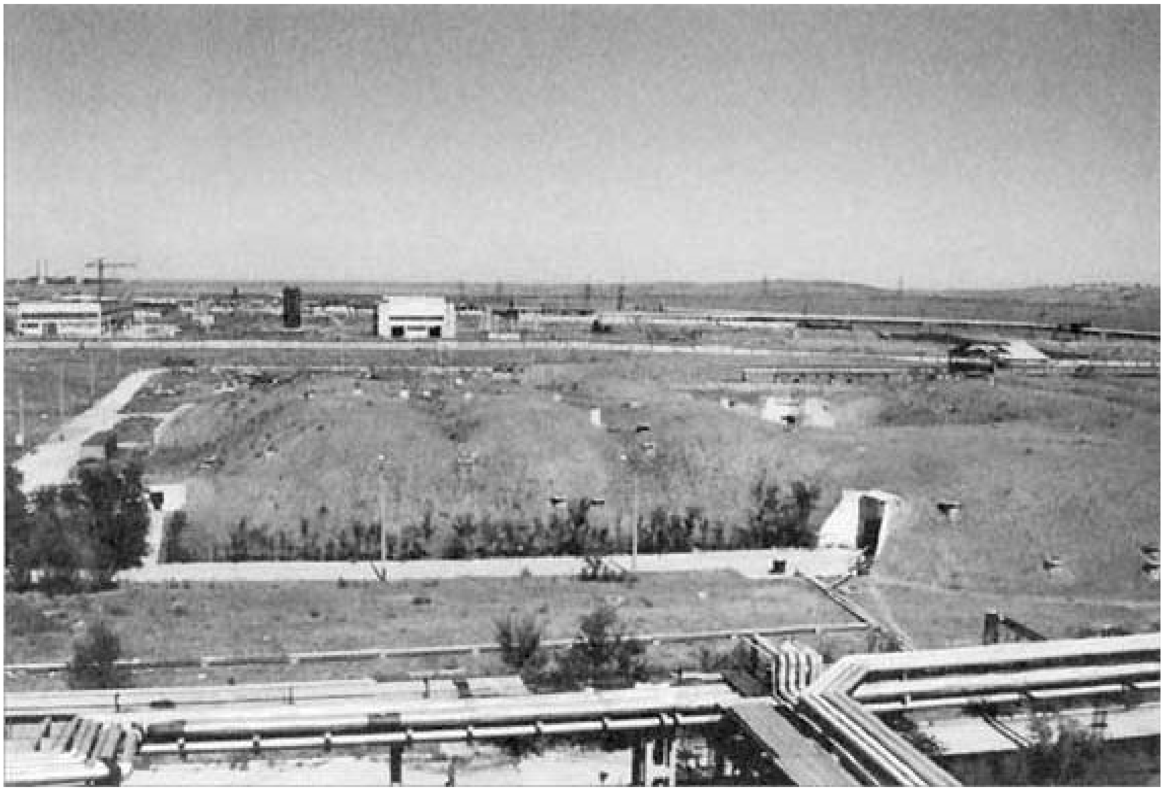


View of Buildings 600 and 241-244, from Building 221

Fermentors in Building 221



Refrigeration units at SNOPB



Buildings 251-252, used to store finished products

Entrance to bunker next to helicopter landing pad