Chapter V: The Anti-plague System of Kazakhstan

1. History of the Kazakh Anti-plague System

In the desert and steppes of Kazakhstan, plague cases most frequently occur in late summer and early fall. Transmission of *Y. pestis* usually is through wild rodent fleas, which bite humans who come near the burrow entrances of rodent colonies. Large outbreaks of plague also have been associated with the slaughtering and cooking of plague-stricken camels. In rarer instances, human plague has resulted from direct contact with rodents and hunted prey. Plague outbreaks recur in the same areas, but unpredictably. Some natural plague foci may present annual outbreaks for decades at a time, and then remain dormant for a few years, only to suddenly and unexpectedly reemerge. Kazakh scientists have not yet determined the factors that allow *Y. pestis* to survive in the environment, making predictions about when such pathogens may reactivate in natural foci problematical.

To deal with the regular outbreaks of plague in Kazakhstan, Soviet authorities created several AP stations, one of which—the Almaty AP station[108]—grew to become one of the Soviet Union's six main AP institutes. After the Soviet Union's dissolution, Kazakhstan's inherited AP facilities were reorganized along with the public health system. Today, the Kazakh AP system is the largest of the national AP systems in the Central Asian region and among the NIS. In 2004, the system consisted of one institute, 10 regional stations, 18 field stations, and 46 seasonal laboratories. The Almaty AP institute, now called the M. Aikimbaev Kazakh Scientific Center for Quarantine and Zoonotic Diseases (KSCQZD), has the widest range of activities of any of the AP organizations in the region. These range from disease monitoring and supervision of regional stations and research on and production of biomedicines, to training. Regional AP stations conduct disease monitoring on specific territories assigned to them, and a few of them also conduct research and training activities. The field stations, on the other hand, only monitor the territory assigned to them.

Since independence most of the Kazakh AP facilities have experienced serious financial difficulties, which have made them unable to retain or attract qualified personnel or to purchase the materials and equipment required to conduct epidemiological monitoring and microbiological research activities. This, in turn, has adversely affected their ability to maintain internal security and biosafety regimes and to perform disease monitoring activities.

Pre-1992 History

The Soviet MOH established Kazakhstan's leading AP facility, the Almaty AP station, in 1934.[109] The AP station was created on the foundation of the former AP laboratory of the Kazakh Sanitary Bacteriological Institute. It had a staff of 14, and reported to the Saratov AP Institute (Mikrob) in Russia. The AP stations' mandate was to take preventive measures against human plague, respond to plague outbreaks, and study the causes of plague among humans and rodents, all based on an antiepidemic plan approved by the Soviet MOH and Mikrob. To support the station's field work, AP posts were established in various areas of the country. Between 1934 and 1948, the station's staff increased from 14 to 134.

In 1945, the natural plague foci of Central Asia, especially in Kazakhstan, suddenly became more active and generated numerous epidemics. A large epidemic occurred along the northern coast of the Aral Sea at the same time as an outbreak in the Atyrau Region, both located in southwest Kazakhstan. These were followed in 1946 by epidemics in the western regions of Kazakhstan. A serious epidemic of pneumonic plague in the Almaty area began in late 1947 and was suppressed in early 1948. Several months later, plague broke out again in various regions of Kazakhstan and other Central Asian republics.

As a result of these outbreaks, in 1949 the Soviet MOH decided to transform the Almaty AP station into an AP institute, named the Central Asian Anti-plague Research Institute, to develop techniques for eliminating natural plague foci. In addition to supervising the work of the other Central Asian AP stations, the newly established institute was to become a central research, production, training, and outreach organization. The institute's main tasks included:[110]

- conducting research on the prevention and suppression of plague and other high-risk diseases such as tularemia and brucellosis;
- suppressing outbreaks of plague and other high-risk diseases and studying their epidemiology;
- producing specific bacterial preparations (vaccines, test kits);
- training AP staff and developing methodological instructions, programs, textbooks, and exhibits for university courses on high-risk diseases;
- providing scientific support for field work;
- publishing research, instruction manuals, handbooks, and public-health outreach materials; and
- organizing meetings and conferences, and supervising public-health outreach work.

In 1949, the institute had a staff of 194, including 30 scientists. As its activities increased, its staff grew to 400 employees by 1979. The latter number included 121 scientists, of whom 65 were Ph.D. candidates and seven held Ph.D.s in medical-related sciences. The institute directed the activities of the 17 stations reporting to various government agencies as follows:

- 10 AP stations reported to the MOH Second Directorate[111] (Aral Sea, Atyrau, Qyzylorda, Taldyqorghan, Mangghystau, Oral, Shymkent, Tajik, Uzbek, and Karakalpak);
- four AP stations reported to the Ministry of Railways (Almaty, Atyrau, Qasaly, and Kazalinsk), and the Central Asia station located in Tashkent, Uzbekistan); and
- three AP stations reported to the MOH Third Directorate[112] (Medical Sanitation Unit 104 located in Aqtau, the Aqsuyek station, and the Uchquduq station).

During the 1970s, the institute also trained physicians and biologists from Burma, Indonesia, Vietnam, and Mongolia, who came on WHO scholarships to study epidemiological monitoring methods for plague and cholera. More significantly during that period, the institute also became engaged in the Soviet biological weapons defense program, codenamed "Problem 5."[113] Under Problem 5, a small team of the institute's researchers conducted research on the immunogenicity, reactivity, and safety of vaccine strains of *Y. pestis* and *Brucella suis*.

Post-Independence History

After independence, the Kazakh AP system was reorganized. In 1992, by decree of the Kazakh Ministry of Public Health,[114] the Central Asian Anti-plague Research Institute was renamed “Anti-plague Research Institute of the Republic of Kazakhstan.” Nine years later, on May 2, 2001, the institute was given its present name—“M. Aikimbaev Kazakh Science Center for Quarantine and Zoonotic Diseases (KSCQZD)” in honor of its first director.[115] The institute became the central AP facility of Kazakhstan in charge of overseeing the work of the country’s AP stations.

In the mid-1990s, the Kazakh MOH started reorganizing the public health sector and decreasing its personnel, including in the AP system. The AP stations that were under the Ministry of Railways in Soviet times were closed, as well as some of those that once reported to the Soviet MOH Third Directorate.[116] Because of the lack of serious outbreaks during the period, Ministry officials briefly entertained the idea of merging the AP system with the Kazakh SES. In effect, this would have placed the AP system under the authority of the SES, which at that time enjoyed a closer relationship with the Kazakh MOH. The AP system resisted the move, explaining that SES personnel were neither certified nor experienced in conducting work with dangerous diseases. The dispute was settled in 1999, when an outbreak of human plague occurred in the northern regions of Kazakhstan, resulting in nine cases of plague, of which two were fatal (see Map 2). Another outbreak occurred in 2001 in the same region, further convincing MOH officials of the importance of the AP system’s independence.

Other structural changes took place between 1994 and 2004, which resulted in the closure of several former AP stations and the opening of new ones. These changes were instituted to adjust to the fluctuations in the activity level of natural foci: new stations were created where the natural foci activity level increased, and existing stations were downgraded or closed where activity levels decreased. As a result, the Kazakh AP system grew to include 10 regional AP stations, 18 field stations, and 46 seasonal laboratories.

The relationship between AP stations and KSCQZD also evolved over time. Until 1994, AP stations were subordinate to KSCQZD, which reported to the Kazakh MOH. In 1994, KSCQZD changed its status and became a “state-treasury” institute (“государственно-казенное” in Russian) while AP stations remained state organizations. This change had two important consequences. First, AP stations were no longer subordinate to KSCQZD, but instead reported directly to the Department for Quarantine and Highly Infectious Diseases under the Kazakh MOH Committee for State Sanitary-Epidemiological Monitoring, from which they receive funding. Although AP stations submitted their work plans to the KSCQZD for review, KSCQZD’s role was reduced to providing consultative-methodological assistance to the stations; the Deputy Minister of Health approved each AP station’s work plan.

Second, with its new status, KSCQZD acquired relative financial independence from the MOH. From then on the institute was allowed to conduct commercial activities —for instance the sale of vaccines and other medical products—and use the profits for its own needs.[117]

Map 2. Plague Outbreaks in Kazakhstan, 1999 – 2001

KSCQZD's management also changed after Kazakhstan's independence. In 1995, after eight years of serving as its director, Professor V.M. Stepanov resigned and later joined the Sanitary Epidemiological Station in Almaty. He was replaced by Doctor of Medical Sciences V.P. Dobrin, who served three years, before resigning in 1998 to move to Russia. He was succeeded by Dr. Bakyt Atshabar, who was appointed director by the Ministry of Public Health, Education, and Sports (Order No. 61 of 21 December 1998) and directs the institute to this day.

The AP system's organizational changes together with the financial crisis that Kazakhstan endured in the early 1990s caused a sharp decrease in funding for the AP system. This in turn led to cuts in salaries and pay delays, sometimes exceeding six months.[118] With the simultaneous streamlining of the medical service in general and the AP system in particular, staffing levels in the AP system started to decrease as early as 1992. By 2004, the number of Kazakh AP system staff had dropped by 80 percent. The decrease came in waves, however, and was unequal among facilities.

The AP system's staff decreased from 2,173 persons in 1991 to 1,526 by the end of 2000. Among the staff, the number of scientific personnel (physicians, biologists, and laboratory technicians) decreased from 641 people in 1995 to 420 in 2000, a drop of 34.5 percent. In individual facilities, the drop in personnel could exceed 50 percent. For instance, personnel at the AP institute of Almaty dropped from 440 in 1991 to 120 by the year 2000, a 70 percent decrease. The composition of scientific staff at the institute also changed dramatically: of the 93 scientists employed at the institute in 1991, only 50 remained by the year 2000, with only 30 of them possessing an advanced scientific degree. Some of the specialists returned to Russia or retired, while others took higher paying jobs in other medical institutions or privately owned companies.

The personnel situation stabilized in 2001 as funding improved in the aftermath of the 1999 and 2001 plague outbreaks. As a result, salaries increased and were paid on time. Newly hired specialists at AP stations were also offered a hazard premium of 40 percent over the base salary, and a 10 percent annual salary increase. These measures increased the average AP specialist's salary from 8,000 Tenge (about $60) to 12,000 Tenge (about $90) with the 40 percent hazard premium. After 10 years of experience, the average salary increases to between 16,000 and 18,000 Tenge/month (between $130 and $140).

Despite these improvements, monthly salaries at AP facilities were still very low compared to the national average salary and much lower than the salaries paid in industry. In 2004, the national average monthly salary was 28,270 Tenge (about $217);[119] while in businesses engaged in research and development, monthly salaries averaged 52,000 Tenge ($400), and in the oil and gas industry they were more than 63,000 Tenge (about $480).[120]

As of 2004, the AP system employed 420 people, an 80 percent drop from the 2,173 people employed in 1991. Of the total staff, 16.9 percent had higher education degrees (248). These specialists included physicians (59.3 percent) and biologists (40.7 percent). Of the 248 degreed specialists, 17 had advanced degrees: two had PhDs in science, and 15 were Ph.D. candidates in science. In addition, 172 specialists with secondary medical education were employed at AP stations, representing 39.7 percent of the total staff.

Financial and organizational turmoil exacted an uneven toll on AP facilities. For instance, personnel at the AP facility located in Aktau by the Caspian Sea dropped from 198 people in 1992 to 88 in 1998, a 55 percent drop in six years, reflecting the average decrease across the AP system. However, the drop in experienced personnel was more dramatic. Many of the station's scientists returned to Russia, immigrated to foreign countries (most often to Germany), while others left the system and severed contact with their former colleagues. As a result, in 2002 the station had only five experienced scientists left on its staff.

The booming economic activity in the Aktau region, caused by the development of the oil and gas industry, surprisingly had two negative impacts on the Aktau station. First, because of the higher salaries offered in the oil and gas industry, the AP station experienced severe difficulties in hiring new staff to replace departed scientists. As salaries in the region increased, with a regional average of 35,000 Tenge (about $240) per month, the AP station's highest salary was less than half the regional average, at 12,000 Tenge per month ($82). This is hardly enough to live on in a region where a booming economy has also caused local prices to soar. In ten years, between 1992 and 2002, the station was able to hire only two physicians. As a result, most of its personnel are near or past retirement age, working sometimes until the age of 70.

The second negative impact caused by the growth of the oil and gas industry is the increased need for epidemiological surveillance. Oil and gas rigs and their personnel are now located in previously uninhabited areas. Since they drill in areas located on active plague foci, oil and gas personnel disrupt the natural habitat of *Y. pestis* hosts (rodents) and vectors (fleas) thereby increasing worker susceptibility to disease. To prevent this, the Aktau AP station conducts disease surveillance campaigns and preventive measures in the new areas in addition to the previously inhabited areas that it protected. The region is also endemic for Crimean-Congo Hemorrhagic Fever (CCHF), which increases the need for surveillance in areas where the oil and gas industry is operating. In other words, at a time when its scientific and support staff was shrinking and aging, the Aktau AP station faced an increase in demand for its services.

In contrast, the Atyrau AP station, which monitors a territory as large as the Aktau station's (165,000 square kilometers), employed 279 people in 2002.[121] Between 1992 and 2002, personnel at Atyrau AP station increased by 10 percent, and in 2003, 302 people were employed at the station.[122] In spite of the fact that the Atyrau station also faced financial difficulties, it has been able to weather the crisis better than the Aktau station.

Simply put, personal connections or the proximity of the station to the seat of power determines the level of a station's funding. Since funding for each station is allocated directly by the MOH, stations located close to government centers in Almaty (former capital) and Astana (new capital), where the MOH is located, have generally been more successful in obtaining funding than those located in more distant regions. In addition, personal connections between station directors and MOH officials improve funding allocations. In 2004, the Aktau station had no personal connections with government officials and its location – three time zones away from Almaty and Astana - provided the facility's management with only limited opportunities to confer with MOH officials. Even though the Atyrau station is equally far removed from power centers, its personal connections with MOH officials explain its more advantageous funding circumstances.[123]

Inequality in the distribution of funds among AP facilities was further deepened by a budgetary practice called "Centralized Distribution" that allowed MOH officials to distribute discretionary funds to select AP facilities. These funds supplement a facility's formal budget.[124] Here, too, AP facilities with connections in the MOH were more likely to garner larger budgets, irrespective of the comparative need.

AP facilities were and probably still are today entirely dependent on government funding for support. As state-owned institutions, they are to this day not allowed to receive funding from other sources. As a result, the stations located in areas with a booming economy or industry (such as the oil and gas industry) cannot charge private companies for disease surveillance work performed in areas of industrial activity.

In addition, AP facility budgets are not fungible. Line items have to be used for stipulated purposes, and cannot be reallocated to other expenses as the need arises. This lack of budgetary flexibility not only prevents AP facilities from adjusting to a sudden rise in activity at specific natural disease foci, for instance by redistributing funds to cover the cost of more intensive epidemiological work, but sometimes it is also an additional reason for decreased funding. Indeed, during their annual review of AP station budget expenses, MOH officials tend to eliminate or reduce unused or little used line items in the following year's budget. Personal connections and proximity to government centers allow some AP station directors to prevent this from happening, while those without connections are left helpless. AP directors often complain of a lack of understanding by MOH officials of the cyclical character of certain diseases such as plague, which led them to confuse the absence of outbreaks with the disappearance of the diseases from those areas. The financial consequences of these cutbacks are significant.

2. Public Health Activities of the Kazakh Anti-plague System

Disease Surveillance: Theory and Practice

Plague is enzootic in nearly 40 percent of Kazakhstan's territory, which is also endemic for anthrax, CCHF, and tularemia. In addition, new plague foci have been discovered in recent years.

Instructions for epidemiological surveillance of natural plague foci in Kazakhstan were prepared by leading specialists at KSCQZD and approved by the MOH. These instructions are binding for all AP institutions in Kazakhstan. The instructions state that the key element of epidemiological surveillance is to monitor and detect epizootics before they affect human health. Therefore, AP personnel are responsible for:

- detecting plague epizootics in a timely manner, determining their intensity and boundaries, and identifying the risk of epidemic;
- identifying potential movements of epizootics and predicting when they may occur;
- determining the location, occupation, and travel routes of the human population; and
- determining the nature and scope of preventive measures against possible outbreaks.

Each station's management determines the station's work plan annually. The plans are sent to KSCQZD for review and comment. The intensity of and methods used for surveillance work in each disease focus are determined based on previous outbreak data, as well as on a multiyear analysis of the epizootic situation in individual foci. As a result, the surveillance programs differ for each focus and for each facility.

If the monitoring process suggests that a natural focus has become active, AP specialists institute the following control measures. AP personnel set up a mobile laboratory or open an existing seasonal laboratory and then collect rodents and other animals, as appropriate. The collected field material is then checked for ectoparasites. AP specialists also extract samples of blood and organ tissue for serological testing for antibodies to disease agents. The collected ectoparasites are then processed and cultured for *Y. pestis,* or other bacteria or viruses as applicable, at the field laboratory. If negative, the sampling continues for the predetermined length of the expedition. If positive, the samples are transported to the parent AP station for confirmation and further analysis. In addition, the area of the natural focus is treated with rodenticides and/or insecticides. If villages are located nearby, AP personnel will apply rodenticide in powder form around a perimeter located 0.5 km from the inhabited area, including in holes where the rodents live. AP staff may also decide to conduct village-wide immunizations of the inhabitants and public outreach work on plague prevention.

When an AP field team recovers a pathogenic strain during its investigations, it creates a "strain passport," which is a document containing the following information: the strain/serotype number, date of isolation, date when the host was caught, date of inoculation into media, method of isolation, growth in liquid medium, and reaction to glycerin. Whenever possible, additional tests are conducted at the field/regional station, such as the phage test.[125] The results of these tests are added to the strain passport. The strains identified by the AP stations are then sent to KSCQZD, which confirms the strain type and conducts further analysis to identify the characteristics of the strains. After completion of the confirmatory analysis at the institute, regional stations are allowed to keep non-virulent strains in their collection. Virulent strains can be stored only at KSCQZD's culture collection, and regional AP stations must destroy all original or duplicate samples they might possess. All destructions and transfers are documented at the AP stations, with copies sent to KSCQZD.

The general health-care system serves as an adjunct to the AP system, by routinely monitoring people living in or traveling through plague and other enzootic areas. In areas where health services are sparse, a network of sanitary specialists with special training in the clinical aspects and prevention of plague are responsible for alerting medical authorities if a case arises. Additionally, veterinarians are trained to differentiate plague symptoms in camels which are the most common domestic animal carrying the disease. In many rural areas of Kazakhstan, most notably in Western Kazakhstan, humans become infected when they slaughter sick animals for their meat and/or hide.[126]

In practice, however, due to the financial constraints noted previously, most AP facilities have decreased their disease surveillance activities, and the control measures listed above might not be applied or may only be partially applied. In fact, all Kazakh AP stations visited by CNS staff had, on an average, decreased their monitoring activities by 60 percent since independence due to a simultaneous lack of funding, equipment, and qualified staff (see Table 4). Monitoring campaigns were shortened from two or three months during the Soviet era, to two to four weeks as of 2004 as a result of a lack of reliable transportation at AP facilities. Often old military trucks made in the 1960s and 1970s were the only means of transport. Due to lack of maintenance and repair since independence, many of these trucks were out of service at the time of the CNS site visit, decreasing the mobility of AP teams. This is in sharp contrast with Soviet times, when AP personnel had small aircraft at their disposal that took them where they were needed to be. The aircraft also re-supplied field teams, allowing for extended monitoring campaigns. Due to their decreased mobility, most AP facilities can now monitor only a third to one half of the territory falling under their responsibility.

Taking into consideration that most of the natural plague foci in Kazakhstan are active, this situation created a risk that a potential epizootic outbreak could remain undetected until it affected nearby communities. This became more probable with the development of the petroleum and natural gas sectors because areas that once were uninhabited are increasingly becoming populated due to growing economic development. In addition, due to the lack of monitoring, AP scientists and epidemiologists can no longer thoroughly investigate the cyclical characteristics of natural plague foci.

As of 2004, most of the AP stations had also decreased their analytical activities for financial reasons. In theory, regional AP stations should have been sufficiently equipped and supplied to correctly characterize the properties of strains isolated by field stations. In reality, regional AP stations conducted only preliminary testing of isolated strains, and then transferred the strains to KSCQZD for complete analysis. In addition, due to financial constraints, most AP stations have either cut back or entirely stopped their research activities.

Financial constraints also hampered the regular transfer of isolated strains. In Soviet times, each AP station had extensive culture collections of pathogens, because as new strains were isolated and identified they were stored at the station that discovered them. As a result, pathogen culture collections at AP stations tended to grow annually as the stations' field teams recovered an increasing number of bacterial strains. After independence, the Kazakh government adopted new regulations to centralize pathogen storage at KSCQZD.[127] In theory, all pathogen transfers from regional stations to KSCQZD should be performed through a courier service of the Kazakh post office called "*Spetspochta*" (special postal delivery service). *Spetspochta* provides armed guards to safeguard cultures during transport and, in theory, the state budget covers payment for this service. The transfers of strains from field AP stations to regional AP stations typically take place at the end of each monitoring campaign, while transfers from regional AP stations to KSCQZD usually occur on a semi-annual basis.

In reality, however, very few facilities could transfer their isolated strains to KSCQZD as often as they should, and in general they did not use *Spetspochta*. For cost reasons, facilities with tight budgets tended to postpone transfers of strains, particularly those stations located thousands of miles away from KSCQZD. In general, the transfers of strains were accomplished by having a trustworthy person hand carry them and travel by car, train, or aircraft, depending on the distance that separates the station from KSCQZD.

Outreach activities, such as informing the local population, local physicians, and veterinarians, also were discontinued due to a lack of funding and personnel. As of 2004, only KSCQZD maintained a wide range of activities, including disease surveillance, production, and training.

KSCQZD's Activities

As noted previously, because of its unique legal status, KSCQZD is the only AP facility in Kazakhstan that has been able to maintain a relatively healthy financial situation. As a result the institute has also been able to sustain its disease monitoring, research, production, and training activities.

Disease Surveillance

In terms of disease surveillance, KSCQZD's main responsibility is to supervise the work of its regional stations and provide them with appropriate methodological guidance. KSCQZD's scientists also regularly participate in disease surveillance campaigns organized by regional stations.

Research

One of the areas that remains KSCQZD's virtually exclusive domain is research. The center's main area of research concerns the study of the epizootic process in different types of natural plague foci. The institute also conducts research on priority problems in microbiology, epidemiology, prevention, clinical practices, and therapy for plague, cholera, tularemia, brucellosis, and other quarantine and zoonotic infections. In 1998, KSCQZD also instituted methods for the molecular study and identification of suspected bioterrorism materials. Equipment for this purpose was installed at the Zoonotic Disease Department.

Since 2002, KSCQZD administers Kazakhstan's national collection of microorganisms and is the national repository for high-risk pathogens. The institute's collection of live cultures contains over 2,000 strains of microorganisms[128] collected during both Soviet and recent times.

Production

Since Soviet times, KSCQZD has produced various biological products for diagnostic and prophylaxis of highly dangerous diseases, including plague vaccines and diagnostics, and cholera diagnostics.[129] During the Soviet period, these products were distributed to 260 facilities across the USSR. For example, about 40 facilities belonging to the ministries of health, defense, and other agencies used diagnostics based on monoclonal antibodies produced at KSCQZD.[130] In addition, the institute's products were exported to 20 countries, including countries in Asia (Burma and Vietnam), Africa (Guinea and Zaire), Latin America (Brazil), and Eastern Europe (Bulgaria and Hungary).[131]

In 2004, the institute produced 30 types of biological products that were exported to various NIS, including diagnostics for plague, cholera, tularemia, brucellosis, and other infectious diseases. KSCQZD's production component includes a nutrient media laboratory and a laboratory of experimental animals. In 2004, the nutrient media laboratory produced 90 types of media, including those required for the culturing and conservation of pathogens such as *Y. pestis*, *V. cholerae*, *B. suis*, *Francisella tularensis*, and other disease agents.[132]

Training

In Soviet times, the Almaty AP institute was one of the AP system's central training centers for plague specialists. Since its foundation in 1950, the institute's training department has trained over 3,000 physicians, zoologists, and biologists from Russia, Ukraine, Byelorussia, Moldova, Georgia, Azerbaijan, Armenia, Uzbekistan, Kyrgyzstan, and Kazakhstan, as well as from the Soviet MOD. Those attending became specialists in high-risk infections. Starting in 1970, the institute also provided training in high-risk infections to specialists from Vietnam, Mongolia, Burma, China, Cuba, and Laos. In 1989, the institute offered a specialization course for physicians, and in 1994 a similar course was developed for biologists.[133] Later, a comparable course was developed for laboratory technicians as well.

After the Soviet Union's dissolution, the number of trainees decreased due to financial difficulties besetting Kazakhstan and neighboring Central Asian states. The condition of KSCQZD's training equipment and materials also deteriorated. In spite of these difficulties, training activities have been maintained.[134] In 2004, the training department had a classroom of laboratory counters with glass protection windows for 30 students, enabling individual bacteriological research on many of the most dangerous disease pathogens. The institute also used one biosafety level II cabinet located in the molecular laboratory for student demonstrations. After independence, the KSCQZD also started organizing seminars for physicians and laboratory employees of the Kazakh SES.

As of 1999, 2,500 SES physicians and laboratory employees had been trained at the institute.[135]

3. Analysis of the Kazakh Anti-plague System's Weaknesses and Proliferation Potential

The main proliferation threats identified in Kazakhstan include the risks of pathogen theft or diversion, brain drain, and threats associated with unauthorized transfer or theft of laboratory equipment.

Risks of Pathogen Diversion

The risk of theft of dangerous material from AP facilities was in 2004 one of the highest proliferation threat posed by the AP system. It stemmed from the absence of appropriate physical security measures at AP facilities, the weak chain of material custody and the lack of background checks for new personnel.

<u>Poor physical security measures</u>

As of 2004, apart from KSCQZD, most Kazakh AP facilities had little or no biosafety equipment and only modest to negligible physical security.

In 2000–2001, a number of security upgrades were introduced at KSCQZD under the CTR Program, and have been reinforced since then. The outer perimeter of the Center was reinforced with a new concrete fence topped with razor wire, a new guard station and metal gates. To improve visibility, trees and bushes were removed, and several obsolete buildings were torn down. In addition, outdoor light poles as well as façade lighting were installed. Workrooms containing dangerous pathogens are now protected 24 hours a day by trained and armed guards. Each laboratory has metal doors with combination locks that prevent unauthorized access. The windows and air conditioners were protected with metal grids, and the windows and doors equipped with electrical alarm systems connected to a central control post at the guard station.

Most of the other AP facilities however remained largely accessible to outsiders. For instance, during our visit to one station, we witnessed local inhabitants entering the grounds of a regional station through a hole in the fence to take a short cut to the city. The local population also used the station's grounds as pasture for sheep and goats, and occasionally cut trees located on the station's grounds for firewood.

Most stations were guarded by unarmed pensioners, and had no check points, pass system, or alarm system.[136] Some stations presented additional threats due to their location in the midst of residential areas, increasing the risk of dangerous consequences from a laboratory accident.

Stations' directors were aware of these vulnerabilities and some took steps to improve security. For instance at one facility, the management fitted iron bars over windows, covered the doors with metal sheets, placed safes inside the laboratory to store cultures, and set up an alarm system with multiple sensors on walls, windows, and doors. The station's management also organized security training for personnel, reminding them of the sensitive nature of their work. The employees were warned against discussing the specific content of their work with outsiders. Although several directors told CNS staff that intruders have penetrated their facility's grounds on several occasions, they added that the perpetrators only intended to steal coal or scrap metal stored outside the buildings. As of 2005, no attempt had been made to break into the buildings.[137]

Weak Material Chain of Custody

None of the AP stations visited by CNS staff had a reliable communication system to communicate with either the field teams during monitoring campaigns or with the scientists in charge of transferring pathogens to KSCQZD. The most common communication tool used in the AP system was a radio system with very limited range that many still use today. With such equipment, personnel performing work in the field are often out of reach for several days, increasing the risk that in case of an incident or accident during the isolation or transport of pathogens, the chain of custody might be broken voluntarily or involuntarily.

No Personnel Background Checks

In theory, specialists who work with group I–II pathogens must have higher or secondary medical, biological, or veterinary education and must complete a mandatory professional specialization course. Personnel working with material infected or suspected of being infected with group I–II pathogens must not be contraindicated physically (defects of the hand or impaired spatial vision), psychologically, or immunologically (congenital immunodeficiencies, hypersensitivity to antibiotics). New hires must pass a preliminary medical examination by several physicians (a general practitioner, neurologist, ophthalmologist, dermatologist, surgeon and, as appropriate, gynecologist), as well as undergo laboratory analyses and clinical studies. Letters of recommendation and personnel files from previous employers or schools are also requested. New hires have a probationary period of two months, during which they are introduced to working with group III and IV pathogens.

In reality, however, most facilities to this day do not conduct any background checks. In some cases, good health and appropriate degrees are the only criteria for hiring new staff. In addition, the AP system has traditionally favored employing members of the same family. During Soviet times, this helped reinforce loyalty to the AP institutes and stations. Today, this characteristic continues to help support loyalty in time of crisis and transition. However, it also increases the risk of an insider threat, as members of one family may avoid reporting on each other in case of wrongdoing or could even collude to remove strains or allow unauthorized access to the station. Considering this, the two-man rule applicable to laboratory work with dangerous pathogens has little effect. In the absence of appropriate security systems and with no background check for newly hired employees, the insider threat was and remains very high today.

Risk of Brain Drain

Some Kazakh AP personnel have worked directly on Problem 5 projects and others were trained or spent part of their careers in Russian AP facilities, which concentrated most of the BW-related work conducted in the Soviet AP system. Because of this, they could have BW-related knowledge that poses a direct proliferation threat. The risk of brain drain is increased by the low salaries at AP facilities, and the fact that several facilities are located on drug and arms trafficking routes crossing Kazakhstan and going north to Russia, and south towards Iran and Turkey through Uzbekistan.

It is important to note however, that because the Soviet BW research program was compartmentalized, the proliferation potential of each person may vary considerably. Unfortunately, due to the lack of historical data—AP facilities tend to not keep personnel records—it is difficult to identify the personnel with specific BW knowledge, which makes the development of brain drain prevention programs a daunting task.

Risk of Transfer of Dual-use Equipment

Most of the equipment (thermostats, autoclaves, etc.) used at Kazakh AP facilities during CNS staff visits dated back to the 1970s and 1980s. Because the equipment was outdated and unreliable it did not present a substantial proliferation concern. Even though terrorist or criminal groups might have found it useful to steal some items required to grow and propagate small quantities of classical pathogens suitable for contaminating food and beverages, any theft or transfer of laboratory equipment by insiders would have been immediately obvious given the shortage or total lack of replacement funds.