Critical Reviews in Microbiology, 32:33–46, 2006

ISSN: 1040-841X print / 1549-7828 online
DOI: 10.1080/10408410500496839

Growth of the Anti-Plague System during the Soviet Period

Sonia Ben Ouagrham-Gormley
Monterey Institute of International Studies, Center for Nonproliferation Studies, Washington, District of Columbia, USA

The Anti-plague system experienced a dramatic expansion in Soviet times. From the dozen facilities created in the Russian Empire, it grew during the Soviet period to include over 100 facilities engaged in public health activities as well as BW-related work. This article describes how this highly responsive public health system, created to respond to natural outbreaks of dangerous diseases, became a critical adjunct to the Soviet BW program.

Keywords Soviet Biological Weapons Program; Biological Warfare; Biological Weapons; Problem 5; Ferment; Anti-Plague System; Plague; Disease Surveillance; Anthrax; Tularemia; CCHF; Saratov Anti-Plague Institute; Rostov Anti-Plague Institute; Volgograd Anti-Plague Institute

INTRODUCTION

Compared to its predecessor—the AP network of the tsarist empire—the AP system under the Soviet regime was a much larger and more diverse organization, consisting of over 100 facilities, located in 11 republics of the Soviet Union, that not only responded to outbreaks of plague but also dealt with other dangerous bacterial and viral diseases, and prevented their occurrences by means of disease surveillance, research, production, and training activities. By this time, select parts of the AP system also came to support the Soviet BW program. This article will describe how a highly responsive public health system established to cope with natural outbreaks of dangerous diseases became a critical adjunct to the Soviet BW program.

Founded on the legacy of the AP facilities inherited from the Russian empire, the Soviet AP system was a direct descendent of the imperial AP system. Until the mid-1920s, the Soviet AP system was essentially composed of facilities created during the tsarist period with only three new laboratories and one institute created by the Soviet state. During that period, the role of the AP system was to combat the spread of dangerous diseases by responding to the numerous outbreaks of plague and cholera that occurred in various regions of the newly formed Soviet Union. AP specialists worked under trying conditions, largely unprotected against contagion. Necessity being the mother of invention, however, these specialists fashioned a work methodology that would later be improved and uniformly employed throughout the system as it grew in subsequent years.

In the late 1920s, the Soviet AP system entered a new phase in its development that lasted well into the late 1950s. This phase was characterized by a shift from the previously exclusive focus on the containment of outbreaks to the prevention of future outbreaks as well. During this period, the AP system was enlarged to 87 facilities, strategically located throughout the Soviet Union. Instead of housing new AP laboratories in existing institutes or universities, as in the tsarist period and early 1920s, Soviet authorities established large and independent AP stations and institutes on or near the territory of natural disease foci to monitor endemic regions and conduct research on dangerous diseases. Based on the same principle of prevention, they also established a number of AP stations along the borders of the Soviet Union and in cities with important transportation hubs, to prevent the importation of dangerous diseases from neighboring countries and overseas.

At this stage of its development, the AP system was organized as a pyramid under the Soviet Ministry of Health (MOH), with a small number of AP institutes at the top overseeing the work of a larger number of regional AP stations, which in turn supervised an even greater number of field stations. The Saratov institute—the first AP institute created in the Soviet Union—emerged as a leading organization, initiating the unification of the system, defining work methodology, and setting standards for the whole system. This period also saw much scientific progress, primarily in understanding the transmission mechanisms of plague and other dangerous infectious diseases, and in the development of new treatment methods. AP facilities diversified their activities, beyond research and disease monitoring to include the production and testing of medical products and the training of system personnel and those of other public health and military organizations. Work conditions and equipment quality also dramatically improved compared to the first stage of the AP system development.

Received October 2005; accepted 17 November 2005.
Address correspondence to Sonia Ben Ouagrham-Gormley, Monterey Institute of International Studies, Center for Nonproliferation Studies, 1111 19th Street, NW, Washington, DC 20036. E-mail: souagrham@stimson.org

Until the 1960s, the expansion of the AP system was mainly driven by the discovery of—and need to protect the population against—new natural foci of plague and other bacterial diseases, such as anthrax, tularemia, and brucellosis, as well as viral diseases such as Crimean Congo Hemorrhagic Fever (CCHF). In the early 1960s, however, parts of the AP system were incorporated into the Soviet BW program. Initially, the AP system performed tasks for the defensive BW program—known as *Problem 5*—and later in the 1970s for the offensive BW program—known as *Ferment*. These new responsibilities generated additional changes in the structure of the system, including the appearance of military personnel on the staff and management teams of AP facilities. Although only a small number of AP facilities and personnel were directly involved in the BW program, the system's centralized structure allowed the military to benefit from system-wide discoveries and experience.

The remainder of this article is organized into three parts, reviewing the evolution of the AP system in detail. The first part provides an account of the various development stages of the AP system, from the early years of the Soviet state until the dissolution of the USSR in December 1991. The second part describes the structural organization of the Soviet AP system and its reporting and funding mechanisms for civilian and BW-related work. The third part details the main activities of AP facilities during the Soviet era.

I. CREATION OF THE STRUCTURAL ORGANIZATION OF THE ANTI-PLAGUE SYSTEM AND THE EVOLUTION OF ITS RESPONSIBILITIES

The Soviet AP system developed in two distinct phases. The first, which lasted from the creation of the leading organization of the system in 1918 until the late 1950s, saw the development of core system infrastructure, consisting of a network of institutes, regional stations, and field stations. During this first phase, the need to protect the Soviet Union against outbreaks of plague, which occurred frequently and often generated high mortality rates, largely motivated the system's expansion. During the second phase, which began in the late 1950s to early 1960s and lasted until the Soviet Union's dissolution in late 1991, two developments drove the enlargement of the Soviet AP system. On the one hand, the discovery of additional natural plague foci, primarily in Central Asia, led to the establishment of new regional and field AP stations. On the other hand, the AP system was incorporated into the Soviet BW program. As a result, several AP institutes and stations redirected their activities in the early 1960s and 1970s to fulfill tasks ordered by the USSR Ministry of Defense (MOD).

A. Phase One: Creation of the Core Infrastructure and the Shift from Response to Prevention

1918 to 1927: Establishment of the Soviet AP System

During the Soviet Union's early years, plague outbreaks were frequent in many regions, some continuing from the tsarist times. For instance, a plague outbreak in the Trans-Baikal region (called Harbin plague), which started in 1911, continued until the late 1930s, eventually spreading to the Vladivostok region in the Russian Far East, where it converted into the pneumonic form, causing more than 500 deaths. Other outbreaks of plague occurred in the Soviet Socialist Republic (SSR) of Georgia (1920), the SSR of Kazakhstan (1923), and in the European part of Russia, specifically the Astrakhan *oblast* (1922), the Donsk *oblast* (modern day Rostov *oblast*, 1923), near Stalingrad (today's Volgograd), and on the left bank of the Volga River (1923) (Nikolayev 1979, 110–115). Between 1918 and 1927, the Russian Socialist Federated Soviet Republic (RSFSR)—the official designation of Russia as a constituent part of the Soviet Union—reported 1,384 cases of plague, 1,126 of which were fatal (Nikolayev 1979, 110–115); the SSR of Kazakhstan reported 1,369 cases between 1919 and 1929, 1,337 of which were fatal (CNS 2003c). (See Tables 1 and 2.)

TABLE 1
Number of plague outbreaks in the South East of the RSFSR (1918–1927)

	Number of sites	Number of contaminated people	Number of fatal cases	Number of cured people
1918	5	45	45	0
1921	1	23	17	6
1922	7	148	139	9
1923	85	481	442	39
1924	4	25	22	3
1925	38	264	193	71
1926	20	181	166	15
1927	9	112	102	10
Total	178	1279	1126	153

Source: Nikolayev 1979, 110–115.

TABLE 2
Number of plague outbreaks in the Far East of the RSFSR (1919–1927)

	Number of sites	Number of plague cases
1919	2	2
1920	5	17
1921	12	57
1922	3	9
1923	2	3
1924	3	6
1925	3	3
1926	3	3
1927	1	5
Total	34	105

Source: Nikolayev 1979, 110–115.

These outbreaks spurred the Soviet government to create a permanent organization in charge of responding to outbreaks of plague. Before the Bolshevik Revolution, 11 AP laboratories were operative in southeast Russia and one laboratory was located beyond the Baikal region. During the Russian civil war of 1918–21, however, most of these laboratories stopped their operations. For instance, Fort Alexander I—one of the main AP facilities of the Russian empire—was closed in 1917 and temporarily occupied by Bolshevik armed forces, which used the facility as an ammunition storage depot and naval guardhouse (*Northern Fortresses)*. But after the Soviet Union was established, its government acted to restore and then expand the AP system it had inherited.

One of the first steps the Soviet government took was to replace the Fort Alexander I laboratory. After it was closed in 1917, its director—A.I. Berdnikov—was transferred to Saratov University, where he was elected chair of the department of bacteriology (CNS 2003c). In 1918, at the initiative of Berdnikov, Saratov University petitioned the RSFSR People's Commissariat for Healthcare (*Narodniy kommissariat zdravookhraneniya*) to open an AP institute in Saratov that would assume the functions of the defunct Fort Alexander I laboratory. In spite of the dire economic circumstances of the civil war, the RSFSR government found the argument compelling, and on October 18, 1918, the Saratov AP institute—named Regional Institute of Microbiology and Epidemiology—was opened within the Saratov University medical department. The institute was composed of three main departments dealing with vaccines, epidemiology, and plague (Abramova 1989). In 1919, by decree of the RSFSR Commissariat for Healthcare, the institute was renamed the State Regional Institute of Microbiology and Epidemiology of the South East (Mikrob) and was tasked with the production of bacterial preparations, the management of the AP laboratories located in southeast RSFSR, and providing assistance to local public health agencies in implementing epidemic control measures (Nikolayev 1979, 110–115). The same year, Mikrob became independent from Saratov University and moved into a separate building donated by Saratov regional authorities. A plague control commission was created under the RSFSR Commissariat for Healthcare to supervise the work of AP facilities (Nikolayev 1979, 110–115).

The unification of the AP system, however, did not emerge as a priority until Mikrob convened, in May 1920, the first of what would become a series of annual plague-control meetings. Only three representatives of the then-existing 10 AP laboratories attended the meeting. This poor showing prompted Mikrob to revive the network of AP laboratories inherited from the tsarist period. In 1920, the institute started training new personnel for its own staff and other AP laboratories. In 1922, five AP laboratories—Astrakhan, Ural, Tsaritsyn (one of the former names of Volgograd), Urdinsk (now Urda), and Altay—were placed under Mikrob's jurisdiction, creating the embryo of a unified AP system, the overall management of which was transferred to the Department for Especially Dangerous Infections of the Soviet Commissariat for Healthcare (Nikolayev 1979, 110–115). The same year, Mikrob began publishing a journal named *Bulletin of Microbiology*, *Epidemiology and Parasitology*, (Richmond 2002, 34) which furnished AP facilities with a unified source of scientific information.In 1923, the then director of Mikrob—Professor S.M. Nikanorov—was appointed authorized agent of the Soviet Commissariat for Healthcare for plague control throughout the Soviet Union (Nikolayev 1979, 110–115).

During this revival period, AP scientists worked under especially difficult conditions. They had no motor vehicles of their own and had to request local authorities for the means to reach outbreak areas. When motor vehicles could not be assigned, AP specialists commonly traveled on horseback, camels, or even cows. They lacked equipment and chemicals, including common disinfectants. They also encountered difficulties with finding appropriate lodging during fieldwork. If they could not spend the night with local inhabitants, or if they were operating in sparsely inhabited areas, they usually camped under the stars, risking contamination from sick animals roaming the immediate area (Nikolayev 1979, 110–115). At that time, there were no effective means for the treatment of plague (Nikolayev 1979, 110–115) and no reliable protective equipment (Richmond 2002, 75); such work conditions constituted a significant health hazard for AP scientists, many of whom died from accidental exposure to plague and other infectious diseases. In spite of these difficult work conditions, AP specialists succeeded in containing plague outbreaks within the boundaries of natural plague foci. This success was mainly due to the emphasis they placed on rapid response to disease outbreaks to quickly isolate and quarantine the sick, and exterminate rodents living in areas contaminated by pathogens (Nikolayev 1979, 110–115).

In 1924, during the third plague control conference organized by Mikrob, AP specialists emphasized the importance of preventing outbreaks from occurring by inspecting the steppes and deserts to detect epizootic outbreaks at an early stage of development. Fourteen epidemiological teams were created for that purpose, thus initiating the shift that would be formalized a few years later—moving the AP system from the exclusive eradication of outbreaks to the prevention of future outbreaks (Nikolayev 1979, 110–115). In addition, three new laboratories were created, and by 1927, the AP system was comprised of 15 facilities (Nikolayev 1979, 110–115). Two of the three new laboratories established during that period—the AP laboratory of Irkutsk, established in 1923 and the AP laboratory of Stavropol, created in 1925 within the Institute of Bacteriology and Chemistry [*Khimbakinstitut*] would later be transformed into AP institutes (*Stavropol Scientific Research Anti-plague Institute*). The third, newly created facility—the Batumi AP laboratory in Georgia—was established in 1924 (CNS 2003b) in response to repeated outbreaks of plague (in 1836, 1901, 1910, and 1920) in this busy seaport and major transportation hub. At that time, Soviet scientists believed that infected humans or animals traveling by land or sea from Turkey and Middle Eastern countries caused these outbreaks. Therefore, the Batumi AP laboratory was tasked with monitoring the city and the area immediately surrounding the seaport.

1927 to the Late 1950s: The Expansion of the AP System and the Shift from Eradication to Prevention

In the late 1920s, when the Soviet economy started to recover from the civil war, a recovery due in part to Lenin's[1] New Economic Policy (1921–1928), the Soviet government allocated more funding to support the AP system's growth. It had become increasingly clear to AP specialists that outbreak prevention hinged on two requirements. The first was the presence of AP personnel at the sites of the natural foci in order to interrupt the routes of contagion from rodents to man. Equally critical was an understanding of the mechanisms of contagion and infection. To achieve these objectives, in subsequent years new large and independent AP stations and research institutes were established on or near the locations of existing natural plague foci and past outbreaks to monitor endemic regions and conduct research on plague and other dangerous diseases (Nikolayev 1979, 110–115). Thus, the Rostov and Irkutsk AP institutes were established in 1934, the Almaty institute in Kazakhstan (previously a regional AP station under the authority of Mikrob) was founded in 1949, and the Stavropol AP institute was opened in 1952. Mikrob and the four new AP institutes came to constitute the core of the Soviet AP system, which operated as a unified and centralized system under Mikrob's lead (CNS 2003c).

During this period, Mikrob's leading role within the AP system was also reinforced. In 1940, the institute became the USSR's leading methodological center for research and investigations of especially dangerous infections, reporting to the Soviet MOH. Mikrob thus took responsibility for defining work methods and standards for the AP system as a whole. For example, all employees of the AP system were required to undergo a six-month specialization course at the institute prior to assuming their functions in their respective organizations. In 1942, the institute was accredited to organize the defense of doctoral dissertations (Nikolayev 1979, 110–115). Mikrob was also a venue for prominent scientists and over the years produced a large number of members of the USSR Academy of Sciences (Richmond 2002, 36; Abramova 1989).

This period also led to the founding of most of the regional and field AP stations on or near the locations of natural plague foci or along the borders of the Soviet Union to prevent the import of plague and other dangerous diseases (see side bar below). Many of these stations had already existed during the tsarist period in the form of AP laboratories, but were transformed into field

[1] Vladimir Ilyich Lenin (1870–1924) was a Russian revolutionary, the leader of the Bolshevik party that seized power during the Russian revolution of 1917. He became the leader of the USSR after its foundation in 1922.

New AP Facilities Created in the 1930s and 1950s

In Central Asia, the Turkmen AP station, located in Ashkhabad, the capital of Turkmenistan, was created in 1938 from the plague department of the Ashkhabad Institute of Epidemiology and Microbiology. The Kyrgyz AP station was established in 1938 in Frunze (present-day Bishkek, capital of Kyrgyzstan), the Aral Sea AP station (Kazakhstan) in 1946, the Nukus AP station (Uzbekistan) in 1949, the Uzbek AP station, located in the city of Tashkent, was created in 1950, and the Tajik AP station (Dushanbe, Tajikistan) was opened in 1956 (Aikimbayev 1999, 41). The AP stations located in the SSRs of Kazakhstan, Uzbekistan, and Kyrgyzstan were, until the end of 1948, subordinated to Mikrob. But on January 1, 1949, at the request of the Kazakh SSR government, the USSR Council of Ministers transformed the Almaty AP station into an institute named the Central Asia Scientific Research Anti-plague Institute (Aikimbayev 1999, 42). The same year, all AP stations located in Central Asia were put under the authority of the newly created Almaty AP institute, except for the Turkmen AP station, which remained under Mikrob's supervision.

In the Caucasus, the development of the AP system was mainly motivated by a false premise: namely, that plague outbreaks originated in neighboring countries, particularly Iran and Turkey, and were imported into the Soviet Union by air or land. A few years after the creation of the Batumi AP laboratory (1924), a second AP laboratory was created in 1933 within the Tbilisi Bacteriological Institute in Georgia. In 1937, the AP laboratory became independent from the Bacteriological Institute and was organized as an observation AP station to monitor Tbilisi city and its suburbs. In 1956, when plague epizootics occurred in the neighboring republics of Azerbaijan and Armenia, the Tbilisi Observation AP station was transformed into a regional AP station. Its personnel and monitoring responsibilities were expanded, and in 1958, the Batumi AP laboratory was transferred under its authority, thus creating a unified AP system in Georgia (CNS 2003b).

In Azerbaijan, after a plague outbreak in the Hadrut district in 1930 claimed 35 victims, Soviet authorities established a plague department within the Institute of Microbiology in Baku. As AP scientists believed that the disease originated in neighboring Iran, seven AP posts were set up along the border with that country between 1931 and 1935 (later three of them would be shut down.) (Richmond 2002, 36) In 1934, the plague department of the Institute of Microbiology was transformed into the Central Anti-plague Station of Azerbaijan.

In Armenia, the AP system was established in the early 1940s. As Armenia shared borders with Iran and Turkey, the MOH of the Armenian SSR opened a tularemia station in Yerevan in 1941 to reinforce the protection against imported diseases at the SSR's borders. In 1942, the station was reorganized into an AP station by decision of the Soviet MOH, and in 1944, a station subordinated to the Yerevan station was opened in the city of Leninakan (present-day Gyumri) (CNS 2003).

Although several epizootics occurred in Azerbaijan during that period, it is only in 1953 that Soviet scientists identified the source of the outbreaks as domestic natural plague foci. Therefore, starting in 1953, the Azerbaijani AP system was expanded with the creation of three new field stations in the cities of Shamkhor, Mingachevir, and Khachmas (CNS 2003). In Armenia, a second AP station reporting to the Yerevan station was established in 1953 in Kafan close to the border with Azerbaijan.

or regional AP stations under the Soviet system. For instance, the Chita regional AP station, which reported to the Irkutsk AP institute, was originally established in 1913 as an AP bacteriological laboratory but was transformed into a regional AP station in 1940. Similarly, the Central Anti-plague Laboratory of Uralsk was originally established in 1914, but was reorganized into an AP station reporting to Mikrob in 1934.

Further, several regional AP stations were established in cities having major seaports in order to prevent the importation of

FIG. 1. Trainees who completed training on especially dangerous infections at the Kyrgyz anti-plague station during 1969–1987. (Legend at the bottom of map translated from Russian: "From 1969 to 1987; Number of persons who went through training—268; From this number, laboratory assistants from the Kazakh SSR; and Kyrgyz SSR—187 people; Tajik SSR—13; RSFSR—46; Military units—14; Georgian SSR—2; Azerbaijan SSR—6.")

dangerous diseases through the shipping of goods and persons. This was the case, for instance, of the Leningrad (renamed St. Petersburg in July 1991), and Moscow stations, which were created in 1934, and the Odessa station (Ukraine), established in 1935. Generally, plague was not endemic to either seaports and inland transportation hubs or their surrounding regions, but these areas had in the past frequently been the sites of plague outbreaks due to the arrival of infected animals and humans from abroad. (Chart 1 provides a complete organizational chart of the Soviet AP system, including stations that are not mentioned in the narrative.)

As the AP system infrastructure expanded and its personnel grew, major progress was made in understanding the mechanisms of plague outbreaks. Indeed, AP specialists discovered 15 new natural plague foci throughout the USSR and identified their main carriers, which they categorized into primary, secondary, and random carriers. The methodology to prevent epizootics was also developed during this second period and standardized throughout the AP system at Mikrob's initiative (Abramova 1989, 11). This methodology consisted of rodent population control measures, repeated campaigns of rodent and flea extermination (carriers and vectors of plague), and disinfection of rodents' burrows. Different extermination methods were applied according to the type of rodent prevailing at specific foci. For example, insecticide was dusted in susliks' burrows, liquid poisonous bait was used against gray rats, and airdropped solid poisoned bait was used to kill southern gerbils (Abramova 1989, 13). The first large-scale campaign of rodent and flea extermination took place in 1933 in the southeast, central areas, and Far East of the RSFSR. The mapping of natural plague foci became systematic, as well as the study of the mechanisms of the epizootic process (AP scientist 2005).

Scientific studies were also conducted on the microbiology and immunology of plague, particularly to improve understanding of the preservation mechanisms of the plague microbe in nature and to develop new treatments for the disease. Collections of pathogens and fleas were also assembled within AP institutes and stations to support scientific research. For instance, the Stavropol AP institute created its collection of fleas in 1934, and it grew to include over 750 flea types originating from not only the USSR but also from foreign countries such as Afghanistan, Bulgaria, China, Iran, Iraq, Mongolia, and others (*Stavropol Scientific Research Anti-Plague Institute*). The Irkutsk AP institute created its collection of pathogens in 1940 (*Irkutsk State* 1984; Irkutsk

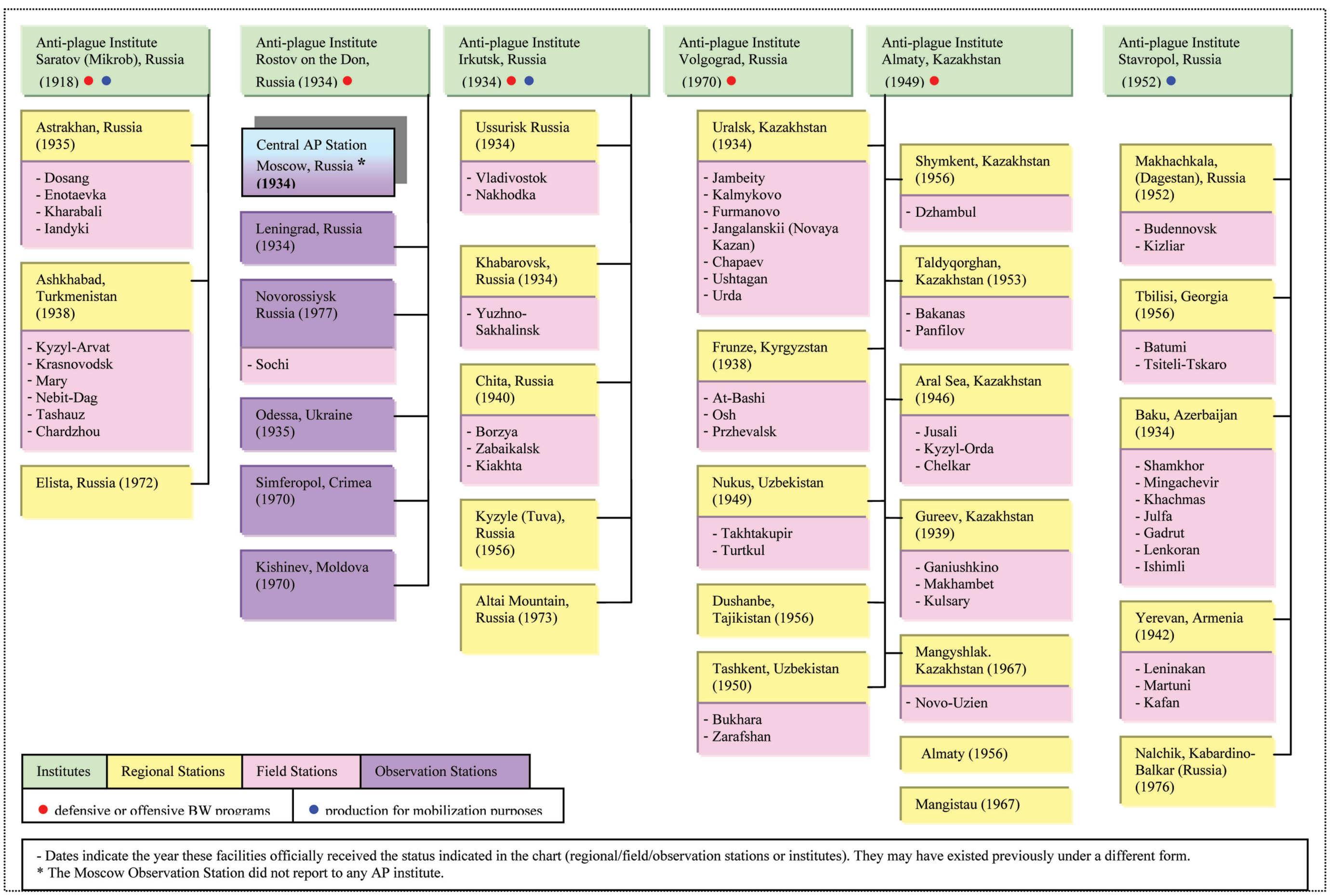

CHART 1. Organizational chart of the Soviet anti-plague system.

Anti-plague Institute), while Mikrob assembled its collection of pathogens in 1950 (Abramova 1989, 110–115).

With Mikrob leading the way, AP facilities started to diversify their activities and added production and testing of medical preparations, such as vaccines and diagnostics, to their portfolio, as well as research on other dangerous diseases. Mikrob, for instance, produced up to 50 biological products, such as cholera vaccine, smallpox lymph, and anti-diphtheria serum. In 1926, due to a shortage of medical equipment, Mikrob also started manufacturing incubators, drying cabinets, and other laboratory equipment of its own design, which were used throughout the AP system (Nikolayev 1979, 110–115; Richmond 2002, 35). Tularemia was discovered in the Volga River delta in 1926 by Mikrob scientists and from then on became an area of study for AP scientists throughout the system. The Stavropol AP institute developed a tularemia vaccine in 1943–44, and started researching ways to treat brucellosis in 1948 (*Stavropol Scientific Research Anti-plague Institute*).

In addition to monitoring natural plague foci, AP facilities also assisted other public health organizations in dealing with infectious diseases such as typhus, cholera, and malaria, among others. During World War II, AP facilities, and, more particularly, Mikrob and the Chita and Stalingrad (today's Volgograd) AP stations, were also actively engaged in protecting troops from dangerous infections (Nikolayev 1979, 110–115) and training civilian and military medical personnel (*Pharmatsevticheskii*).

Thus, by the late 1950s, the AP system had developed into a large hierarchical structure, comprised of leading and subordinate organizations, located on or near natural disease foci or along the borders of the Soviet Union, and operating as a unified and centralized system. By this time, moreover, AP activities had diversified, evolving from the exclusive response to the prevention of disease outbreaks, to include disease surveillance, research, production, and support of other public health organizations on a variety of dangerous diseases.

B. Phase Two: Intensified Development and Involvement in the Soviet BW Program

In the late 1950s and early 1960s, all the trends of the previous four decades were confirmed and reinforced. The development of the AP system was intensified due to the discovery of new natural plague foci and the industrialization of areas where plague and other diseases were endemic (Aikimbayev 1999, 99). During this second phase, working conditions and the scientific equipment of the system were also improved, and AP scientists continued to broaden their areas of expertise. The new element introduced during the second stage, however, was the involvement of the AP system in the Soviet BW program.

Intensified Development

During the second phase, an expansion of the AP system occurred in Central Asia, the Caucasus, and in some parts of Russia due to the discovery of new natural plague foci and the realization that the most active plague foci were located in the Kazakh SSR (Aikimbayev 1999, 99). (See side bar below)

AP Facilities Created in the 1960s

In Kazakhstan, the Taldyqorghan AP station (Kazakhstan), originally established in 1953 and closed in 1962, was reopened in 1963, and the Panfilov and Bakanas field AP stations were placed under its jurisdiction. In 1967, the Mangistau AP station (Kazakhstan) was created from the former field station in the town of Fort Shevchenko (Aikimbayev 1999, 41) Two other regional AP stations were also established in 1956: the Almaty and Shymkent stations.

In Russia, a similar development occurred in the region supervised by the Irkutsk AP institute, which is located in an area with some of Russia's most active natural plague foci. A field AP station located in Kyzyl, in the region of Tuva (Russia), originally established in 1951, was transformed into a regional AP station in 1966; the Gorno-Altai field AP station, originally established in 1953, was transformed into a field AP laboratory in 1966 and upgraded to the status of regional AP station in 1973 (CNS 2003c).

In 1958 and 1962, Soviet scientists discovered the existence of natural plague foci in the regions of Zangezur-Karabakh and Lake Sevan in Armenia. This discovery stimulated the expansion of the AP system of the republic, with the creation in 1972 of a third AP station reporting to the Yerevan station, in the town of Martuni, on the South shore of Lake Sevan (CNS 2003).

In 1970, two new observation AP stations were created in Kishinev (Moldova) and Simferopol (Crimea, Ukraine) to reinforce the network of seaport and border stations responsible for the prevention of dangerous diseases imported from foreign countries. In 1982, a new AP station was also set up in Tsiteli Tskaro, in the eastern part of the Georgian republic (CNS 2003b).

In addition to plague, typhus, cholera, malaria, brucellosis, anthrax, and tularemia, which they started researching in the previous period (Domaradskij & Suchkov 1996), AP scientists also began working on viral diseases such as CCHF and hepatitis. By the 1960s, each of the five existing AP institutes—the Volgograd AP institute was created in 1970—had set up virology laboratories within their infrastructures (CNS 2003c). For example, the Stavropol AP institute opened its virology department in 1956 (Suchkov 1995, 152–187). The trend towards the initiation of production activities at AP institutes was also confirmed during the second phase of the AP system development. For example, in 1958, the Stavropol AP institute created a production facility to manufacture live plague vaccine; and in 1960, the Rostov AP institute started the production of diagnostics and other medical preparations. Similar production activities were launched at the Almaty AP institute in 1970 (CNS 2003c).

A notable feature of this period was the improvement or enlargement of existing AP facility infrastructure. For instance, in the 1960s, two five-story buildings were constructed at Mikrob to house new laboratories and production activities (Abramova 1989, 6). In 1965, Mikrob also established an aerosol laboratory for the study and modeling of pulmonary forms of dangerous diseases. This research allowed the development of an inhalation vaccine against plague, which was widely used in the Soviet public health system (Abramova 1989, 19). Work conditions and equipment used during fieldwork also improved dramatically. Unlike the first phase of development of the AP system, in the 1960s AP facilities were supplied with their own vehicle fleets, medical equipment, and material. AP specialists also had at their disposal a network of so-called "seasonal stations"—buildings with basic equipment, which served as field camp bases during monitoring campaigns. These stations were generally composed of a building to house personnel and a laboratory building, in which AP scientists stored pathogens isolated from nature and performed preliminary work on them. In addition, to reach isolated areas and/or provide supplies to epidemiological teams in the field, AP scientists were given access to small airplanes.

In an effort to further unify working methods throughout the AP system, a database was created in 1960 at Mikrob to gather all monitoring campaign data provided by AP facilities. Standardized data collection was practiced; the territory monitored by AP facilities was divided into primary and subordinate areas, with the first having dimensions of 20 × 20 km and the second 10 × 10 km. All AP facilities reported their monitoring activities each season on standardized forms. Mikrob received over 15,000 documents annually from AP facilities; the data was entered into Mikrob's database and then was analyzed by its specialists to determine the activity level of each natural focus and make predictions on potential outbreaks occurring in the future. These findings were distributed to all AP facilities, as well as to the Soviet MOH (Abramova 1989, 11–12). In 1968, Mikrob also launched a scientific journal entitled *Problems of Highly Dangerous Diseases* (*Problemy osobo opasnykh infektsii*), which published the findings of scientific studies performed at AP facilities. In 1980, this publication was replaced by thematic collections of reports on scientific work performed by AP scientists (Abramova 1989, 25).

Originally established with the intention of protecting the Soviet population against natural infectious diseases, the Soviet AP system by the 1960s had become what appears to have been an efficient organization that possessed unique capabilities related to the study and handling of highly dangerous pathogens. Scientists came to view employment in the AP system as prestigious and rewarding, both in terms of research and remuneration. Its personnel received numerous incentives, such as 10–50 percent higher salaries than those paid by other public health services, early retirement (age 50 for women and age 55 for men), two-month long vacations, and six percent per day bonus pay for work during disease outbreaks. Although these incentives were intended to compensate AP personnel for the risks associated with work on contagious and other dangerous microorganisms, in practice the incentives resulted in more qualified applicants applying for positions with the AP system (AP scientist 2002a). In 1976, the system consisted of 87 organizations, including six main institutes, 27 regional stations, and 54 field stations (AP scientist 2005). In the 1960s and 1970s, the system employed over 14,000 personnel, including about 7,000 scientists (Stavskiy et al. 2002, 37). Annually, the Soviet government allocated more than 40 million rubles to support the AP system, which in the 1960s and 1970s represented a significant budget (CNS 2003c).

Secrecy and Secret Work

As the AP system evolved for public health purposes, parts of it were also incorporated into the Soviet BW program. It is important, however, to distinguish between the generalized secrecy regarding the AP system's public health activities that was maintained for political reasons and secret BW-oriented work conducted within the AP system. Although most of the work performed at AP facilities was considered confidential, only a small number of people in these various facilities actually worked on secret BW-related programs.

The desire to maintain secrecy regarding AP system activities was predominantly motivated by the desire to prevent close scrutiny of the claims made by the Soviet government about its successes in public health. Indeed, starting in 1938, the Soviet government had decided that diseases such as plague and cholera had been eradicated in the Soviet Union. Therefore, information about all outbreaks of these diseases occurring after 1938 was considered a state secret. Information about epizootics—disease outbreaks among carrier animals—was also considered confidential at least until the 1960s (Soldatkin and Feniuk 1995, 183–187). In some cases, secrecy was also imposed by regional authorities, because they feared that the occurrence of these diseases in their republics would expose them to criticism from Soviet central authorities in Moscow. An interesting anecdote illustrating this point occurred in 1965 in Ashkhabad, Turkmenistan. During a cholera epidemic in neighboring Uzbekistan and Afghanistan, a scientist of the Ashkhabad AP station analyzed samples of water collected locally, and isolated 20 different strains of cholera El Tor. Local authorities, denying the existence of cholera locally, accused the scientist of diverting strain samples from the AP station's collection to infect the water. Eventually, analysis of local water samples done by researchers from Mikrob and the Rostov AP institute, who were responding to the outbreaks in Uzbekistan and Afghanistan, concluded that the strains found in the water samples in Ashkhabad were different from those contained in the Turkmen AP station's collection, thus excluding the hypothesis of a voluntary contamination (Suchkov 1996, 83–104; Kuznetsova 1995, 226–232).

In addition, to help maintain secrecy regarding disease outbreaks, Soviet public health and medical officials were required to adhere to a special procedure when reporting on disease events. The procedure involved the use of specifically numbered forms, with each disease assigned a unique number. For example, Form 30 was used for cases of cholera, Form 100 for plague, and

Form 22 for anthrax. Surprisingly, this coding system was not designed by the military or the MOH. Rather, the system was developed by the Soviet Union's Statistics Directorate, which designed reporting forms and indexed them, as a means of concealing information about disease outbreaks. Eventually, all identification using scientific terminology was removed from the forms, leaving only numerical codes and indexes (AP scientist 2002b). The motivation behind this coding system was to prevent unauthorized persons from gaining access to statistical data that were considered confidential and to allow for their manipulation by government officials, which was a common practice during the Soviet period.

Later, when the AP system started working on BW-related programs (see below), a second coding system was developed by the MOD to be used in reports relating to secret work. (see Table 3).

The overall secrecy imposed by the Soviet government had two major negative consequences. First, AP researchers only rarely were permitted to publish reports on their research and disease surveillance work in open scientific literature. This, in turn, created major difficulties when combating epidemics. Indeed, many scientists were not prepared to respond appropriately to epidemics because they believed the disease in question had been eradicated in their country. In addition, efforts to control epidemics were hampered by the fact that the real number of affected persons was kept secret from those who were responsible for responding to these outbreaks (Suchkov 1996, 83–104).

Regarding secret BW-related work, except for Mikrob, which started developing identification and treatment methods under the defensive BW program in the 1950s, the other AP facilities were first drawn into this program in the 1960s. For instance, after a reorganization of the AP system in 1964, the Rostov AP institute refocused its research activities on executing tasks for the defensive BW program, code-named *Problem 5* (CNS 2003c). Although the institute remained involved in public health work and in 1971 was appointed lead institute for work on cholera within the AP system, these activities were sharply decreased. Hence, scientists at the Rostov AP institute were no longer required to conduct disease surveillance on natural foci, and three of the institute's regional stations—in Astrakhan, Makhachkala (Dagestan), and Elista—and the territory they monitored were transferred to Mikrob and the Stavropol AP institute (Suchkov 1995, 152–187). The Rostov AP institute maintained supervisory control only over the Volgograd AP station (until 1970) and the so-called observation AP stations (CNS 2003c). (See Chart 1).

TABLE 3

Indexes and codes used in the AP system for BW-related work during the Soviet period

Name of disease	Form number	Code
Anthrax	23	123
Bolivian Hemorrhagic fever (Machupo)	3	103
Botulism	5	105
Brucellosis	4	104
Cholera	29	129
Crimean-Congo Hemorrhagic fever	11	111
Ebola Hemorrhagic fever	17	117
Glanders	22	122
Korean Hemorrhagic fever	10	110
Malaria	35	135
Marburg Hemorrhagic fever	15	115
Plague	27	127
Smallpox	20	120
Tularemia	26	126

In the early 1970s, the AP system became actively involved in the Soviet offensive BW program, codenamed *Ferment*. Under this program, Mikrob created a large and well-equipped genetics laboratory that was kept secret even from most of those who worked within the system. Then-director of the institute, Dr. P.I. Anissimov, was assigned to head the secret laboratory (CNS 2003c). During the same period, the Volgograd AP station, which was until then supervised by the Rostov AP institute, was transformed into an AP institute to work exclusively on BW programs (Domaradskij & Orent 2003, 144). As a result, from the early 1970s to the break-up of the Soviet Union, the Volgograd, Saratov (Mikrob), and Rostov AP institutes executed tasks pertaining to both the defensive (*Problem 5*) and offensive (*Ferment*) aspects of the Soviet BW program (CNS 2003c).

In the early 1960s, military personnel were also integrated into the AP system's staff and management teams. For instance, in the 1960s, General I.N. Nikolayev was appointed director of Mikrob. Prior to this appointment, Nikolayev served as the director of the Institute of Epidemiology and Hygiene in Kirov (now Vyatka), a military institute controlled by the MOD, and when he moved to Saratov he brought with him some of his associates from Kirov (Domaradskij & Orent 2003, 135). Similarly, after the Volgograd AP institute was created, military personnel previously working at the Rostov AP institute were transferred to Volgograd (Domaradskij & Suchkov 1996, 48–82). For example, Colonel V.S. Suvorov, formerly employed at the Rostov AP institute, became the first director of the Volgograd AP institute (CNS 2003c). In 1973, V.N. Miliutin, a colonel in the Soviet Army reserve, who was formerly employed at the military institute at Zagorsk (present-day Sergiyev Posad), was appointed director of the Rostov AP institute; his deputy, M.T. Titenko, was also a colonel in the reserve (Domaradskij & Suchkov 1996, 48–82).

Military institutes playing central roles in the Soviet BW program also supervised the work of AP facilities. For instance, researchers from the Institute of Epidemiology and Hygiene in Kirov, from Zagorsk, and from Sverdlovsk (now Yekaterinburg), visited the Rostov AP institute annually to discuss the work it performed for the defensive BW program (Domaradskij 1995).

The involvement of AP facilities in the BW program varied from facility to facility: some devoted most of their activities to the BW effort, while others worked exclusively on public health issues. However, the fact that military officers headed the two leading AP institutes—Mikrob and the Rostov AP institute—which oversaw the work of all other AP facilities (see below) implies that scientific findings and achievements of the entire AP system were made available to the military when relevant. Many scientists from the AP system also worked at military institutes (Domaradskij 2003) and served in various AP facilities with greater or lesser involvement in the BW program (Suchkov 1995). This type of personnel exchange also facilitated the transfer of information to the military.

II. STRUCTURAL ORGANIZATION OF THE SOVIET AP SYSTEM

As a result of these two main stages of development, by the early 1970s, the AP system had become a large, hierarchal, dual-purpose organization that reported both to the civilian and military branches of the Soviet government. It retained this character until the Soviet state ceased to exist in December 1991.

A. Hierarchal System

On the eve of the Soviet Union's dissolution, the AP system employed about 10,000 staff members, including 2,000 scientists—a significant number, although below the number employed in the 1960s and 1970s (CNS 2003c). By 1991, the system consisted of six AP institutes (five in Russia and one in Kazakhstan), 29 regional AP stations, and about 53 field AP stations (Popov 1996, 5–9). The number of field AP stations fluctuated in Soviet times, increasing or decreasing according to the changing epidemiological situation. Indeed, although some field AP stations had been established as permanent facilities, others were set up to respond to a particular epizootic and then were closed when the outbreak ended. These temporary field AP stations usually were housed in preexisting buildings that were not necessarily designed for scientific work.

As noted above, the system had a pyramidal structure under which each institute—with the exception of the Volgograd AP institute due to its concentration on BW-related work—had a subordinated network of regional AP stations located in endemic plague areas. Each regional AP station controlled one or more field AP stations, and each field AP station had so-called seasonal stations—buildings used during monitoring campaigns as a base for epidemiological teams, which were sent into the field twice a year to monitor the rodent and flea populations (carriers and vectors of plague).

In addition to regional and field AP stations that conducted disease surveillance on specific territories, the AP system included so-called observation AP stations, which were not located in regions with natural plague foci. Instead, they were mainly sited in port cities or large transportation hubs, such as Leningrad, Moscow, Novorossiysk, and Odessa. Observation AP stations were responsible for preventing the importation of infectious disease agents from abroad.

There were two reasons why AP stations were subordinate to specific institutes: regional proximity and scientific interest. As a rule, AP stations located on territory under the jurisdiction of a specific institute were affiliated with that institute. In some cases, however, the association of an AP station with an institute did not depend on regional proximity, but on the value it provided to the institute's scientists. For instance, the Gureyev (now Atyrau) AP station, in Kazakhstan, was affiliated with Mikrob because it had an animal facility that allowed Mikrob scientists to perform on-site animal testing (AP scientist 2002c).

B. Reporting and Funding Mechanisms

Due to its dual-purpose activity, the AP system had two separate reporting and funding mechanisms: one for civilian, public health work, and the other for BW-related activities.

Reporting and Funding Mechanism for Civilian Work

For their civilian work, AP institutes and regional AP stations reported to the Soviet Union's deputy minister of health—also referred to as chief sanitary physician (Levi 1996, 232–240). Within the USSR MOH, the AP system was subordinate to the Main Sanitary Epidemiological Directorate (MSED). Within this directorate, the Department of Especially Dangerous Infections supervised the work of the AP system until 1971, after which time oversight was transferred to another service of the MSED—the Directorate of Quarantine Infections (DQI) (CNS 2003c). DQI was created in 1971 after a large outbreak of cholera in the Soviet Union, and was tasked with the organization of prophylactic measures to combat plague, cholera, anthrax, tularemia, and other dangerous diseases (Kuznetsova 1995, 226–232) (See Figure 2).

The Moscow observation AP station held a special status within the system. In addition to its observation responsibilities, it had system-wide administrative and management responsibilities. The station supported the Department of Especially Dangerous Infections, which had then only seven employees, and after 1971, it continued to support DQI in such tasks as the review of research plans or research reports sent by other AP stations and institutes (Kuznetsova 1995, 226–232). The Moscow station also procured equipment and material for all AP facilities (Richmond 2002, 37). Due to its administrative responsibilities, the Moscow AP station was not subordinate to any of the Russian AP institutes, but instead reported directly to the Soviet MOH (AP scientist 2002c).

Financially, regional AP stations and AP institutes had the same standing in that they received their funding directly from the USSR MOH. For scientific and methodological matters, however, AP stations were subordinate to AP institutes, which defined the direction and scope of the stations' work. Although AP stations received their funding directly from the USSR MOH, AP institutes indirectly shaped the funding profile of AP stations. Indeed, AP institutes reviewed AP stations' research programs and epidemiological work plans and had to affix their seal of approval before the stations received funding from the

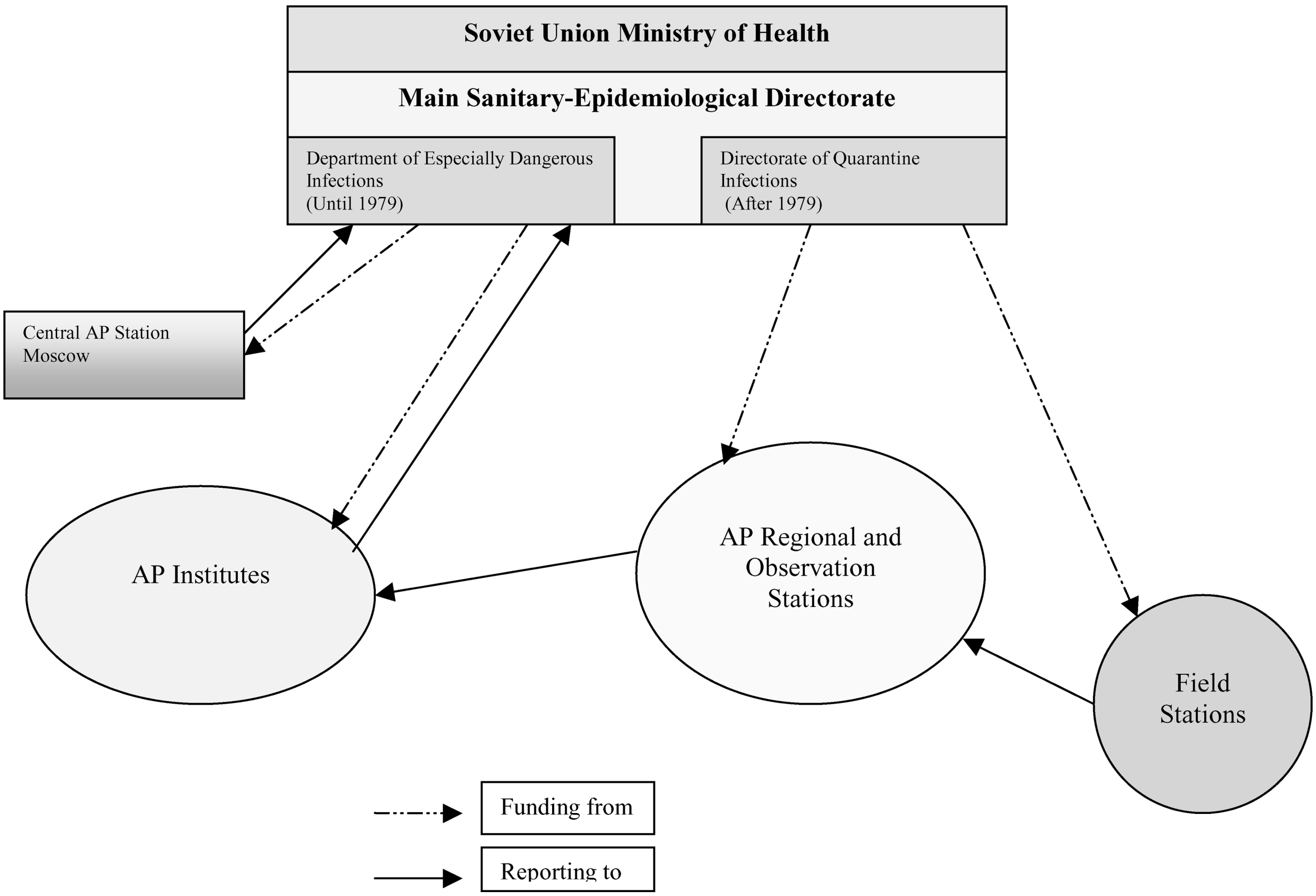

FIG. 2. Reporting and funding mechanisms for civilian work.

USSR MOH (see section III of this article). AP stations also reported to the relevant AP institute on their activities, and their level of performance was a factor in determining their funding amount.

Reporting and Funding Mechanism for BW Work

For their BW-related work, AP facilities received direction from the Civil Defense Headquarters (CDH) of the USSR MOD, via the Second Directorate of the USSR MOH. Within the MOD, CDH was responsible for civil defense in case of chemical, biological, or nuclear incidents. In the biological area, CDH was responsible for ensuring the supply of medical preparations that would be used in case of war. Within the MOH, the Second Directorate was the alter ego of CDH; it organized and oversaw the production of antibiotics and other medical preparations for mobilization purposes, performed by facilities under the authority of the MOH, including those of the AP system (See Figure 3).[2]

Funding for BW work was channeled to AP facilities, via the MOH, from two agencies that managed different parts of the Soviet BW program—Glavmikrobioprom and Biopreparat (see the article by Zilinskas on the anti-plague system and the Soviet biological warfare program). As military programs received funding priority during the Soviet period, AP facilities working on BW programs, such as the Rostov, Volgograd, and Saratov AP institutes, found themselves financially better off than those working mostly on public health issues. They also had larger staffs and newer laboratory equipment, as well as ample supplies of chemicals and laboratory material.

III. MAIN ACTIVITIES OF AP FACILITIES DURING THE SOVIET PERIOD

When it reached its maturity in the late 1960s, the AP system was engaged in a wide array of activities, ranging from disease

[2]Note that another MOH directorate—the 3rd Directorate—ensured epidemiological surveillance on the territory of nuclear test-sites. The 3rd Directorate had its own network of AP stations that was distinct from the AP System described in this report, and which served only the territories of Soviet nuclear test-sites. This directorate also dealt with radiation defense and aerospace issues for the MOH.

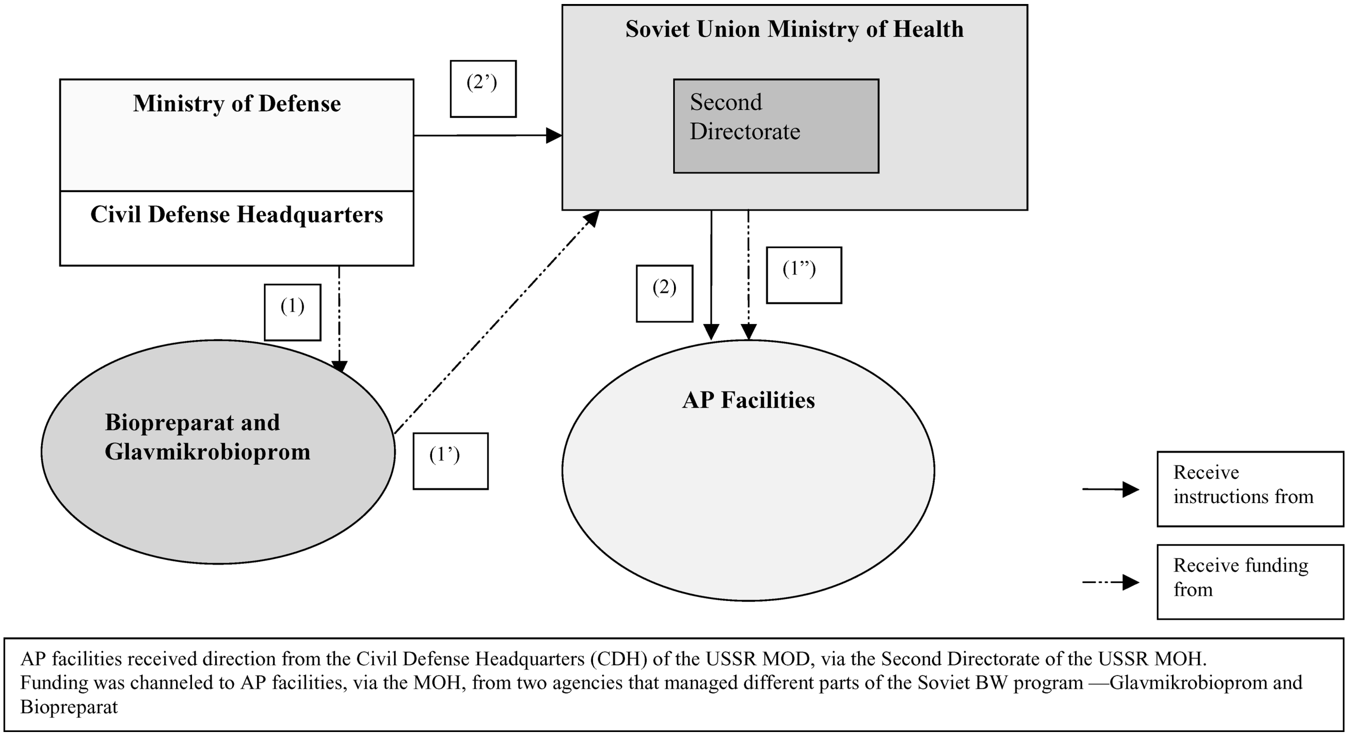

FIG. 3. Funding and reporting mechanisms for BW-related work.

surveillance, research, and production to training. These activities served both public health and military purposes.

A. Disease Surveillance

The main responsibility of the AP system was to conduct surveillance of natural disease foci and entry points to the USSR (especially maritime ports and border crossings) to prevent outbreaks of dangerous diseases endemic to the region or imported from abroad. Practically, this task involved recovering pathogens from the environment (epidemiological teams would trap rodents, collect blood samples from them and comb out the ectoparasites they carried); detecting and mapping disease outbreaks; studying microbe survival mechanisms in vectors and carriers; and undertaking other activities related to the discovery, monitoring, and containment of dangerous infections. AP personnel registered 43 natural plague foci in the Soviet Union, covering a total territory of about 550 million acres (220 million hectares). Annually, AP specialists monitored up to 75 percent of the natural disease foci territory (Popov 1996, 5–9). AP institutes and regional AP stations also carried out scientific research on the genetics, biochemistry, and physiology of pathogens.

Traditionally, the AP system hierarchy defined the range and type of activities of individual AP facilities—field/regional AP stations and AP institutes—and the reason for their establishment. As all AP facilities were originally created to respond to outbreaks of plague and to prevent such outbreaks, all AP facilities studied plague. Over time, most of them also studied tularemia, cholera, anthrax, and brucellosis. Research on other dangerous diseases was added to a facility's portfolio when (1) natural foci of these diseases—other than plague—existed in the region it monitored; and (2) when a scientist or team of scientists had a particular interest in these diseases.

Field AP stations generally conducted disease surveillance on a defined territory and had limited research capabilities that allowed them only to identify microorganisms recovered from natural sources. Regional AP stations conducted disease surveillance on a specific territory, some of which was monitored by field AP stations; they also supervised the work of the field AP stations under their authority. Regional AP stations had the capability to conduct in-depth analysis of strains collected from nature or sent to them by AP institutes for research purposes. Research projects were conducted as agreed upon with their respective supervising institutes. Consequently, AP stations usually housed several research laboratories, supported a collection of pathogens, and employed the corresponding research personnel.

Observation AP stations were responsible for preventing the importation of infectious disease agents from abroad; they usually monitored only a relatively small territory, such as a port or a city. To maintain their knowledge and skills, however, they also sent some of their personnel into the field to conduct disease surveillance on natural plague foci monitored by other AP stations. The Leningrad observation station, for instance, would send its scientists to Kazakhstan to take part in monitoring campaigns in the field (Suchkov 1995, 152–187).

AP institutes, on the other hand, were almost exclusively research, production, and training organizations. Very few of their personnel conducted monitoring activities, which were performed primarily by the AP stations they supervised. The direction of their research depended on the activity level of the natural foci located on their territory and the orders they received from Moscow. For instance, because the natural plague focus located in the Tuva region is the most active on the Russian territory, the Irkutsk AP institute, which oversees the Tuva region, had a strong plague research department.

B. Development and Review of Research Programs

AP institutes and regional AP stations conducted research on dangerous diseases. For example, Mikrob was engaged in research on microbiology, immunology, diagnostics, pathology, and treatment of plague, cholera, and other diseases (Richmond 2002, 36). The Rostov AP institute conducted research on plague and tularemia enzootics, and the development of new drugs to cure plague, tularemia, brucellosis, and anthrax, among other subjects (Suchkov 1995, 152–187).

Typically, directors, in collaboration with the heads of the relevant laboratories, developed annual scientific research proposals for each institute and regional station. These proposals underwent a sequential review by two separate bodies within each institute and station—the Methodological Commission and Scientific Council. Once approved by these in-house bodies, research programs were forwarded to the lead AP institute in the particular subject matter for an additional two-level review. For instance, Mikrob was the lead institute for plague, while the Rostov AP institute was the lead institution for cholera. Research proposals originating from AP institutes and stations were discussed during meetings of the Central Problem Commission of the corresponding lead institute in the presence of the scientists who had submitted the proposals. The decisions of the Central Problem Commission were then reviewed by the Scientific Council of the lead institute in the presence of the directors or deputy directors of the institutes that had submitted the proposals. The final report of the Scientific Council was then sent to the USSR MOH for approval and funding.

The multi-level review process was intended to ensure the scientific soundness of research projects and avoid duplication of activities among AP facilities. A similar review and approval process was applied to the AP facilities' budgets, accounting, and scientific reporting.

For BW-related research, development and reporting mechanisms were similar to those described above for civilian-oriented work. For instance, in the structure of the Soviet BW program, the Gamaleya Institute of Epidemiology and Microbiology in Moscow served as the lead institute for *Problem 5*. Therefore, the Gamaleya Central Problem Commission reviewed the work performed by AP facilities on *Problem 5*. Gamaleya scientists also paid annual visits to the institutions working on *Problem 5* to discuss ongoing projects. These visiting groups included representatives of the USSR MOH's 2nd Directorate and the MOD. The results of these discussions were used to amend existing projects or draw up plans for the following year (AP scientist 2002c).

C. Production

AP institutes produced various dual-purpose medical preparations, such as plague vaccines. When ordered directly by the USSR MOH, these products were used to vaccinate humans living on natural plague foci, and to respond to natural outbreaks. When ordered by the Ministry of Civil Defense Headquarters via the 2nd Directorate of the USSR MOH, they were also used for bio-defense mobilization purposes. For instance, the Irkutsk AP institute produced and stored on site 10 million doses of vaccines each year for use in case of war. Mikrob and the Stavropol AP institute also had mobilization capabilities (AP scientist 2002c).

D. Training

AP institutes were educational organizations that trained infectious disease specialists not only from the AP system but also from other public health organizations, such as the Sanitary Epidemiological Service (SES)[3] and military institutes. Typically, over 200 specialists were trained annually at AP institutes (CNS 2003c).

All new employees of the AP system had to undergo an initial six-month training program at Mikrob. Different courses were offered to scientists, depending on their expertise (epidemiologist, bacteriologists, zoologists, etc.) Thereafter, employees periodically had to maintain and advance their skills by taking three-month training seminars offered at five AP institutes; only the Volgograd AP institute lacked a training center. Mikrob provided methodological guidelines to all AP facilities having a training center (Abramova 1989, 24). Training seminars typically were composed of practical laboratory work and theoretical lectures. Practical work generally involved experiments with the causative agents of brucellosis, tularemia, anthrax, cholera, and plague. Theoretical lectures covered such topics as plague epizootiology and epidemiology (Suchkov 1995, 152–187).

Training in the AP system had a dual purpose. It aimed not only to teach work methods and safety techniques to combat naturally occurring dangerous diseases, but also prepared AP specialists and personnel from other public health and military organizations to respond to biological attacks. For instance, the Rostov AP institute trained a group of scientists from the Leningrad Military Medical Academy every year (AP scientist 2002c).

Regional AP stations also provided some training to laboratory technicians working in the AP system and in other organizations. For instance, the Azerbaijani AP station in Baku conducted regular training sessions for its personnel using its field AP station in Imishli. The training aimed to instruct personnel on how to deploy tent camps with laboratories, isolation wards, and other field installations (AP scientist 2004). In Kazakhstan, the Makhambet field AP station was one of the primary training

[3] See note 3.

grounds for disinfectors and other technical personnel. As a testimony to the quality of the training provided by the Makhambet AP station, many of the disinfectors employed at the Makhambet station were borrowed by the Guriyev regional AP station to conduct disinfection campaigns within the region it monitored (AP scientist 2003).

Regional AP stations also trained personnel from non-AP organizations. For instance, Figure 1 indicates the number and origin of laboratory assistants who completed the training course provided by the Kyrgyz AP station located in Bishkek. Between 1969 and 1987, 14 personnel from military units took the course.

CONCLUSION

As demonstrated in this article, the AP system underwent a dramatic expansion in Soviet times. From the dozen facilities created in the Russian Empire, it grew during the Soviet period to include over 100 facilities, and became a hierarchical but flexible organization, involved in a wide array of activities. In addition, AP facilities in Soviet times actually operated as a *system* under unified rules and standard methodologies, cooperating through personnel and information exchanges under the overall supervision of a lead institute—Mikrob in Saratov. This systematic and unified approach to disease surveillance and prevention also allowed a better flow of information within the system. The accelerated development of the AP system, primarily motivated by the regular occurrence of disease outbreaks in various regions of the Soviet Union, and aided by a continuous flow of funds from the Soviet government, resulted in the expansion of AP personnel's knowledge of and expertise in working with naturally occurring bacterial and viral diseases.

These very characteristics made the AP system attractive to the defense community at a time when Soviet authorities were expanding the BW program: the military saw an opportunity to tap into the experience and knowledge accumulated over several decades by AP specialists on dangerous diseases—many of them caused by microbes and viruses that can be weaponized. Therefore, the involvement of the AP system in the Soviet BW program appears to have come almost as an afterthought. The system was on a strictly public health oriented development path when parts of it were diverted to work on the BW program. The AP system represented indeed a valuable source of ready-to-use information, biomaterial, and expertise.

REFERENCES

Abramova, V.S., ed. 1989. *Mikrob All-Union Order of the Red Banner of Labor Scientific Research Anti-Plague Institute* (*1919–1989*) (in Russian). Saratov, Russia.

Aikimbayev, A.M., ed. 1999. *The Anti-Plague Service of Kazakhstan: History of Its Foundation and Development* (in Russian). Almaty, Kazakhstan.

AP scientist. 2002a. Personal communication.

AP scientist. 2002b. Personal communication.

AP scientist. 2002c. Personal communication.

AP scientist. 2003. Personal communication.

AP scientist. 2004. Personal communication.

AP scientist. 2005. Personal communication.

Center for Nonproliferation Studies (CNS). 2003a. *Anti-Plague Service of Armenia* (in Russian). Monterey: Center for Nonproliferation Studies.

———. 2003b. *Formation and Activity of the Anti-Plague System of Georgia* (in Russian). Tbilisi, Georgia: Center for Nonproliferation Studies.

———. 2003c. *Plague in the European Part of Russia until the XX Century* (in Russian). Moscow: Center for Nonproliferation Studies.

Domaradskij, Igor V. 1995. *Troublemaker, or The Story of an "Inconvenient" Man* (in Russian). Moscow: Privately Published.

Domaradskij, I.V. and Yu.G. Suchkov. 1996. From the Epizootology of Plague to the Genetics of its Causative Agent. In *Noteworthy Accounts on Activities and Prominent Figures of the Anti-Plague System of Russia and the Soviet Union* (in Russian). Vol. 4. Moscow: Informatika.

Domaradskij, Igor V. 2003. Plague in the European Part of Russia (commissioned report, in Russian). Moscow.

Irkutsk Anti-Plague Institute. Available at: http.//www.irkutsk.ru/chumin/history.html.

Irkutsk State Scientific Research Anti-Plague Institute of Siberia and the Far East—1934–1984 (in Russian). (Brochure issued in celebration of the 50th birthday of the Irkutsk Anti-plague Institute, Irkutsk, 1984.)

Kuznetsova, K.A. 1995. Specific Features of the Organization of the AP System. In *Noteworthy Accounts on Activities and Prominent Figures of the Anti-plague System of Russia and the Soviet Union* (in Russian), Vol. 3. Moscow: Informatika.

Levi, M.I. 1996. Vartan Nikitich Ter-Vator, Director of the Stavropol Anti-plague Institute. In *Noteworthy Accounts on Activities and Prominent Figures of the Anti-Plague System of Russia and the Soviet Union* (in Russian), Vol. 4. Moscow: Informatika.

Nikolayev, N.I. 1979. History of Development of Plague Prevention in the USSR (in Russian). *J. Microbiol. Epidemiol. Immunol.* 4, 110–115.

Northern Fortresses No Date. Available at: http://www.nortfort.ru/alexander_e.html.

Popov, V.P. 1996. Anti-Plague System of the USSR. In *Noteworthy Accounts on Activities and Prominent Figures of the Anti-Plague System of Russia and the Soviet Union* (in Russian), Vol. 4. Moscow: Informatika.

Richmond, Jonathan Y. ed. 2002. *BSL-4 Laboratories*. Anthology of Biosafety, vol. 5. Mundelein, IL: American Biological Safety Association.

Soldatkin, I.S. and B.K. Feniuk, 1995. Head Zoologist of the Anti-Plague System. In *Noteworthy Accounts on Activities and Prominent Figures of the Anti-plague System of Russia and the Soviet Union* (in Russian), Vol. 2. Moscow: Informatika.

Stavropol Scientific Research Anti-Plague Institute under the Ministry of Health of Russia. Pharmatsevticheskii Vestnik. (Special report [in Russian]) No Date, Available at: http://farmvestnik.ru/issues/0178/document/0178_021.html.

Stavskiy, E.A., Cherny, N.B., Chepurnov, A.A., and Netesov, S.V. 2002. Anthology of Some Biosafety Aspects in Russia (up to 1960), in Richmond, Jonathan Y., ed. *Anthology of Biosafety: BSL-4 Laboratories*, Vol 5. Mundelein, IL: American Biological Safety Association.

Suchkov, Iu.G. 1995. Student and Colleagues. In *Noteworthy Accounts on Activities and Prominent Figures of the Anti-Plague System of Russia and the Soviet Union* (in Russian), Vol. 2. Moscow: Informatika.

Suchkov, Yu.G. 1996. Foreign Specialist in Afghanistan-65. In *Noteworthy Accounts on Activities and Prominent Figures of the Anti-Plague System of Russia and the Soviet Union* (in Russian), Vol. 4. Moscow: Informatika.