

F.A.S. PUBLIC INTEREST REPORT

Journal of the Federation of American Scientists (FAS)

ANTHRAX
OUTBREAK IN
SVERDLOVSK

Volume 41, No. 7

September 1988

A NEW APPROACH TO COMPLIANCE WITH THE CBW TREATIES

The US government continues to charge the Soviet Union with violating chemical and biological weapons treaties, even though the evidence presented to support the allegations is largely discredited. The "Yellow Rain" allegations of toxin warfare in Afghanistan and Southeast Asia and the US version of the Sverdlovsk anthrax outbreak are mechanically repeated year after year with no genuine attempt to confront the evidence that they are wrong. Such lack of accountability is disreputable in itself and ill serves our national

interest in maintaining high standards of accuracy in the information provided to policy makers and to the public. We call on the next Administration, whether Democrat or Republican, to subject these matters at long last to thorough and objective review. And we call upon both the Soviet Union and the US to take the next step toward verifying each other's compliance with the ban on biological weapons by opening their recently declared medical/biological defense facilities to reciprocal scientific exchange.

THE BIOLOGICAL WEAPONS CONVENTION AND THE SVERDLOVSK ANTHRAX OUTBREAK OF 1979

Matthew S. Meselson

The Sverdlovsk controversy. In April and May 1979, a major outbreak of anthrax occurred in the city of Sverdlovsk, 900 miles east of Moscow. The first published report that correctly identified its place and time appeared in January 1980 in *Possev*, a Russian-language magazine based in Frankfurt. The report was datelined Sverdlovsk, November 1979, and was attributed to an anonymous source. Its author prefaced his account by saying that rumors about the event gradually became more detailed, producing a picture of what had happened. According to this reconstruction, there was an outbreak of a disease thought to be anthrax; the outbreak was attributed to a cloud of bacteria produced by an explosion early in April at a military facility at the southwest edge of Sverdlovsk; the first victims were hospitalized on April 4 and died a few hours afterwards; military medical personnel replaced civilians in the unit of the Sverdlovsk city hospital set aside for the patients; an average of 30-40 new cases per day were brought in for a month and the number of deaths was estimated to be roughly a thousand. A month after the *Possev* article, the mass-circulation West German tabloid *Bild Zeitung* published an essentially similar account, adding that "a Western intelligence agency" had determined that the alleged explosion occurred in a factory for bacteriological bombs.

Then as now, any development or production of biological weapons would be a gross violation of the Biological Weapons Convention of 1972, a treaty to which both the US and the USSR are parties. In mid-March 1980, the US Embassy in Moscow asked the Soviet Foreign Ministry for an explanation of what had happened in Sverdlovsk. The Soviets replied, in a note delivered to the Embassy a few days later, that there had been a natural outbreak of anthrax among livestock in March and April 1979, and that people had contracted intestinal anthrax as a result of

eating the meat of animals marketed in violation of veterinary regulations. Even before the Soviet response was received, however, leaks from the White House generated immediate world-wide publicity and accusations of Soviet treaty violations. In the opinion of some, this pre-empted any possibility there may have been for resolving the issue in diplomatic channels. Ever since that time, the US government has rejected the Soviet explanation and has maintained that it possesses evidence that the outbreak resulted from an accidental release of anthrax spores into the air at a biological weapons facility, in violation of the Biological Weapons Convention. Even before 1979 there had been reports in the US press of suspect biological weapons facilities in several Soviet cities, including Sverdlovsk. One may well ask how solid the US case really is, but both the evidence and its evaluation remain largely classified. What is clear, however, is that the controversy still exerts an important influence on western attitudes toward arms control and biological defense programs.

Information published by the Soviets in 1980. Until recently, the Soviets provided only rudimentary information about the Sverdlovsk anthrax outbreak. An article by two
(Continued on page 2)

Matthew S. Meselson, Thomas Dudley Cabot Professor of Natural Sciences, Professor of Biochemistry and Molecular Biology at Harvard University, is the just-past Chairman of FAS. A distinguished molecular biologist, he has long been America's best informed investigator of public policy issues involving biological and chemical warfare. He received the FAS Public Service Award in 1972. In 1980, Matthew Meselson served as an independent consultant to the US government interagency working group that investigated the Sverdlovsk outbreak.

(Continued from page 1)

prominent Moscow physicians, I.S. Bezdenezhnykh, an epidemiologist, and V.N. Nikiforov, an infectious disease specialist, appeared in the May 1980 issue of the Soviet journal *Microbiology, Epidemiology and Immunology*. It stated that cases of human cutaneous and intestinal anthrax in Sverdlovsk were preceded by an outbreak of anthrax among privately owned farm animals probably caused by contaminated feed. Anthrax bacteria were found in meat in two households in which there were human cases. The meat was purchased from private sellers at makeshift markets. Humans and animals in the affected areas of the city and in nearby villages were vaccinated, suspect meat was confiscated and sites of suspected contamination were disinfected. The article did not give the number of persons affected and made no mention of deaths. A second publication, describing the prosecution and sentencing of two individuals who slaughtered sick cattle and sheep and sold the meat in violation of veterinary regulations, appeared the following September in the Soviet journal *Man and the Law*.

On several occasions since 1980, Americans and others, both official and unofficial, sought additional information from Soviet officials, without success. What was particularly lacking was the provision of knowledgeable Soviet experts authorized to discuss the outbreak with their professional counterparts abroad. It could be asked in retrospect why no one tried to contact the two authors of the published epidemiological report, whose professional addresses in Moscow appeared in their article. But the matter was seen as an issue of high-level East-West policy during a time of tense US-Soviet relations, and this may have kept even private scientists concerned with the matter from thinking of so collegial an approach. Nor is it clear that it would have succeeded. For years, it had been Soviet policy not to release even ordinary health statistics. Since Gorbachev, however, detailed health statistics are published on a regular basis.

New information since Gorbachev. Encouraged by the new openness, in June 1986, I renewed earlier requests to Soviet officials to arrange scientific discussions of the Sverdlovsk outbreak. My request was made via Dr. Martin Kaplan, Secretary-General of the Pugwash Conferences on Science and International Affairs in Geneva. This was successful and on August 27-30, I met in Moscow with Dr. P.N. Burgasov, Deputy Minister of Health, Dr. V.N. Nikiforov, Head of the Department of Infectious Diseases at the Central Postgraduate Institute, Dr. I.S. Bezdenezhnykh, Chief Epidemiologist of the Russian Federation, and Dr. O.V. Yampolskaya, assistant to Nikiforov. Bezdenezhnykh and Nikiforov were the authors of the May 1980 article referred to above. The discussions took place mainly in the office of Dr. Nikiforov and in an adjacent classroom at the famous old Botkina Hospital. We also met over meals at the nearby hotel where I stayed. On the third day, I briefed officials at the US Embassy on what the Soviet physicians had said and on plans for further communication. One of the steps agreed upon was a scientific

(Continued on page 3)

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The FAS Public Interest Report (USPS 188-100) is published monthly except July and August at 307 Mass. Ave., NE, Washington, D.C. 20002. Annual subscription \$25/year. Copyright © 1988 by the Federation of American Scientists.

POSTMASTER: Send address changes to FAS, 307 Massachusetts Avenue, NE, Washington, D.C. 20002.

SVERDLOVSK AND THE BIOLOGY OF ANTHRAX

Anthrax occurs widely as a disease of livestock. *Bacillus anthracis*, the infectious agent of anthrax, is a bacterium capable of existence in two different forms. Cells of the vegetative form multiply in the infected animal, producing potentially lethal anthrax toxin as they do so. If vegetative cells from an infected carcass are exposed to air, they can transform themselves into thick-walled spores that do not multiply but which can remain viable in the soil for many years. Upon subsequent infection of a new host animal, the spores return to the vegetative form, re-initiating the cycle.

Although greatly reduced by modern practices of animal husbandry and immunization, anthrax outbreaks among cattle, sheep and other livestock continue to occur in many countries. Thirty European nations, including the USSR, report the number of outbreaks of anthrax in livestock each year to the Office International des Epizooties in Paris. For the decade 1971-1980, a total of 13,068 outbreaks were reported to the O.I.E., including 2607 in the USSR. The most recent large anthrax outbreak reported in the US occurred in 1976 in Texas, resulting in the death of some 160 cattle and horses. Several epizootics in Europe and the US have been traced to contaminated bone-meal used as a livestock food supplement. In 1952, for example, hundreds of swine in Ohio and neighboring states contracted anthrax traced to a single 100 ton lot of imported bonemeal that had been inadequately sterilized.

In the USSR, there are several regions endemic for

animal anthrax. One of these is Sverdlovsk oblast, an area of approximately 195,000 square kilometers on the eastern side of the Ural mountains, including the city of Sverdlovsk (population 1.2 million). A 1974 publication recorded 35 outbreaks in the Sverdlovsk oblast for the period 1956-1968.

In human beings, anthrax generally results from handling or eating products from animals stricken with the disease or from inhaling spores from contaminated hides, hair and other materials. Infections of the external skin form sores that usually remain localized and then heal. In contrast, untreated systemic infection, as may be initiated by inhalation or ingestion, is usually fatal.

Air-borne and food-borne systemic anthrax are difficult or impossible to distinguish on the basis of clinical symptoms alone. Presumably, this is because the principal clinical symptoms in both cases are caused by the toxin that is released from the bacterial cells and quickly becomes distributed throughout the body.

Before the Sverdlovsk outbreak, the largest outbreak of fatal human anthrax in the Soviet Union described in the medical literature occurred in 1927 in the city of Yaroslavl, 150 miles northeast of Moscow. In that case, 27 persons fell ill with a diagnosis of intestinal anthrax and all of them died. The probable source of infection was reported to be cooked sausage. As in Sverdlovsk, it appeared that many more persons ate the contaminated meat than the number who fell ill, presumably reflecting variations in dose and in individual susceptibility.

(Continued from page 2)
lecture tour in the US.

On April 10-17 of this year, Drs. Burgasov and Nikiforov and Dr. V.P. Sergiev, newly appointed Director of the Institute of Medical Parasitology and Tropical Medicine in Moscow, gave formal presentations and took part in informal discussions about the Sverdlovsk outbreak at the US National Academy of Sciences in Washington, the Johns Hopkins School of Hygiene and Public Health in Baltimore and the American Academy of Arts and Sciences in Cambridge. Dr. Alexander Langmuir, former Director of Epidemiology at the USPHS Centers for Disease Control in Atlanta was moderator for the formal presentations and a panel of US experts acted as discussants. The host in Baltimore was Dr. D.A. Henderson, Dean of the Johns Hopkins School of Hygiene and Public Health. The American Academy was the overall host and support was provided by the MacArthur Foundation. The audiences and discussants included more than 200 private and government medical scientists and arms-control specialists.

What emerged from these presentations and informal discussions was a detailed elaboration of the original Soviet account. It is plausible and consistent with what is known from previous outbreaks of human and animal anthrax in the USSR and elsewhere, including the US In

addition, participants in the discussions agreed to collaborate in the further study and documentation of the Sverdlovsk outbreak. The projects contemplated include review and publication of the large amount of patho-anatomical and histological data from the outbreak, medical examination and interview of survivors, and a detailed compilation of epidemiological data.

Although sizeable outbreaks continue to occur in parts of Africa and Asia, the world scientific literature on human intestinal anthrax is scanty and in important respects inconsistent. Some of the attendant uncertainties definitely impeded the efforts of US government officials to interpret the information available to them in 1980. International cooperation in the further study of the Sverdlovsk outbreak presents an unprecedented opportunity both to learn more about the disease and to clarify further the actual events that occurred.

Summary of the account of the Soviet physicians. During the course of the outbreak, all five of the Soviet physicians, on whose account this summary is based, went from their posts in Moscow to deal with various aspects of the situation in Sverdlovsk. Dr. Burgasov, as Deputy Minister of Health, was in overall charge. Dr. Nikiforov set up a special unit to screen and treat the patients at city hospital

(Continued on page 4)



At the Botkina Hospital in Moscow, August 1986. Left to right: Dr. P.N. Burgasov, Dr. O.V. Yampolskaya, Dr. V.N. Nikiforov and Dr. I.S. Bezdenezhnykh. All four went from Moscow to Sverdlovsk in April 1979 to deal with the outbreak of anthrax. (Photo: M. Meselson)

(Continued from page 3)

number 40, where he was assisted by Dr. Yampolskaya and others from Moscow, including a son of Dr. Burgasov. Dr. Bezdenezhnykh and later Dr. Sergiev investigated the epidemiology of the animal and human cases. Nikiforov organized and Sergiev took part in the mass vaccination of persons thought to be at risk.

The first patients were hospitalized on April 4 and the last was hospitalized on May 19. The number of cases presenting each day through April 19 was 5, 5, 5, 7, 7, 6, 10, 9, 7, 5, 4, 4, 1, 0, 0, and 1. Twenty additional cases were hospitalized after that, no two on the same day. Altogether, 96 people were diagnosed with anthrax. Despite intensive antibiotic and anthracic globulin therapy, 64 died. It was the largest outbreak of human anthrax ever to occur in the Soviet Union.

During the course of the epidemic, more than a thousand patients with suspicious symptoms such as fever or stomach pain were taken to hospital number 40 to be screened for anthrax infection. In all, there were 17 cases of cutaneous anthrax and 79 of the intestinal form. All of the patients with cutaneous anthrax survived, although 6 of them had toxemia. Except for one 6-year old girl who survived, all the patients were adults, about two-thirds of them men. About 70 percent of the patients resided in southern Sverdlovsk and nearby suburbs, the others in other parts of the city.

The symptoms of intestinal anthrax observed at Sverdlovsk and also known from earlier cases are diverse and variable. They include very sudden onset, chills, headache, high fever, vomiting, diarrhea, stomach pain, rapid and then failing pulse, loss of blood pressure, cyanosis, gasping, poor blood clotting and death. The gastro-intestinal symptoms are often not present until later stages. In fatal cases, death occurs within 48 hours of onset. Reliable diagnosis of intestinal anthrax requires examination at autopsy and bacteriological tests. All of the fatal cases were autopsied. Dr. Nikiforov projected a series of color photographs

taken at autopsy. There was one photograph of the entire body cavity of a male victim. It showed numerous large discrete hemorrhagic lesions of the intestinal surface. Other photographs showed closer views of affected tissues and histologic sections from this and other victims. There was a wide distribution in the number of discrete intestinal lesions, ranging from hundreds, in some victims, to only one. In other cases no discrete lesion was found but the intestinal wall exhibited a diffuse hemorrhagic appearance. Lymph nodes draining the intestines had hemorrhagic necrosis and contained anthrax bacilli. There was edema but no inflammation of the lungs. In victims who died after a relatively prolonged course, hemorrhage was seen over a much wider area, including the brain. The concentration of anthrax bacilli in the blood reached values up to 500,000 per milliliter. Each of the dead was placed in a wooden coffin with chlorinated lime and buried in a city cemetery where records of each burial are kept. No sequelae were seen 1-2 years later in patients who survived.

Infected meat products were suspected, but the pathogen was not found in meat sampled from food factories, restaurants and canteens that provide meat inspected by the veterinary service. One contaminated sample was obtained by police at a check point set up to confiscate uninspected meat coming into the city. Contaminated samples were also found in the refrigerators of some of the anthrax patients. These had been obtained from private sources. Field investigation revealed that in late March and April there had been an anthrax epizootic among cattle, sheep and pigs in at least 8 different villages and settlements in the area south of the city. Cases of cutaneous anthrax appeared among those who had slaughtered and butchered the sick animals.

It is thought that hundreds or even a few thousand persons ate contaminated meat. Common cooking methods

(Continued on page 5)



At the Johns Hopkins School of Hygiene and Public Health, Baltimore, Maryland, April 14, 1988. Left to right, Dr. V.P. Sergiev, Dr. P. N. Burgasov and Dr. V.N. Nikiforov. (Photo: Peter C. Howard)

СИБИРСКАЯ ЯЗВА

Сибирская язва — острозаразное, тяжелое заболевание человека и животных. Наиболее восприимчивы к сибирской язве овцы, коровы, лошади, козы, олени. Менее восприимчивы собаки, свиньи. Заражение животных происходит главным образом через корм и питьевую воду, загрязненные спорами сибирской язви. Хищные животные и собаки могут заразиться, поедая трупы животных, больных сибирской язвой. Заражение животных происходит и через укусы мух-жигалок, клещей, сленней, которые переносят инфекцию от больных животных.

Больные животные выделяют микробов сибирской язви во внешнюю среду с испражнениями, мочой, слюной и молоком.

Пути заражения человека сибирской язвой разнообразны. Главным путем заражения происходит непосредственно от трупа павшего животного при снятии с него шкуры, при разделке туш вынужденно убитых животных и зараженного животного сырья, при уходе за больными животными, через почву или предметы, загрязненные зараженной почвой, через пищевые продукты, изготовленные из необезвреженного сырья.

У человека заболевание сибирской язвой появляется в кожной, кишечной и легочных формах. Инкубационный (скрытый период) у человека при сибирской язве продолжается от нескольких часов до 6—8 дней (чаще 2—3 дня).

Кожная форма болезни возникает в случае проникновения возбудителя через царапины, ссадины, мелкие порезы кожи, а кишечная форма при употреблении в пищу зараженного мяса, мясных и молочных продуктов, не подвергшихся достаточной термической обработке.

Все больные сибирской язвой и подозрительные на нее подлежат немедленной госпитализации.

Чтобы предупредить заболевание сибирской язвой, делайте следующее:

при уходе за больными животными соблюдайте правила личной гигиены. Запрещается убой скота в индивидуальных хозяйствах. Разделку туш и реализацию мяса надо проводить только с разрешения ветеринарного надзора. Не вскрывайте туши при подозрении на сибирскую язву. Не покупайте от частных лиц мясо, мясopодукты, шерсть, шкуры, кожи, волос, шетину животных. Молоко коров, подозрительных на заболевание сибирской язви, не употребляйте в пищу и уничтожайте.

Товарищи! Принимте активное участие в наведении порядка во дворах, на улицах, подъездах.

Защипайте детям играть с бродячими собаками и кошками.

В случае выявления подозрения на заболевание сибирской язвой немедленно обращайтесь за медицинской помощью.

СЭС Орджоникидзевского района
Главный врач — ЧЕКМЕНЕВА

НС 29564 18/IV-1979 г. Тип. з-да «УЭТМ». Заказ 618. Тираж 20.000

Leaflet dated April 18, 1979, warning residents of the Ordzhonikidze district of Sverdlovsk about the danger of contracting anthrax from infected animals and uninspected meat and other animal products.

(Continued from page 4)

do not adequately inactivate anthrax spores. Usually the cases were sporadic but there were at least three clusters. The largest, accounting for almost one-third of the intestinal cases, was among workers at a large ceramics factory in southern Sverdlovsk. On April 8, the factory received a number of cattle carcasses and the meat was put on sale. At least one of the carcasses was infected. In another case, two men and a woman who butchered an infected sheep developed cutaneous anthrax. In another, a woman and her male friend ate contaminated meat and both died. The fact that only one child (who survived) had intestinal anthrax was attributed to the custom of reserving available meat for the adult family member doing the heaviest labor and to the fact that children have their main meals in schools that serve only inspected meat.

The epizootic was traced to contaminated bone meal used as a feed supplement. This came from a single 29 ton lot of bone meal produced at a meat processing plant at Aramil, a town 15 km southeast of Sverdlovsk. It was put on sale March 25. The first known associated case of animal anthrax appeared March 29. In the winter of 1979 supplies of fodder were low and meat was scarce. In order to boost production it was decided to make available to private owners of meat animals a bone meal feed supplement. This consists of bones and other slaughterhouse

ANTHRAX

Anthrax is a highly infectious, serious illness of man and animals. The most susceptible are sheep, cows, horses, goats and deer. The least susceptible are dogs and pigs. Animals are infected primarily through feed and drinking water, contaminated with anthrax spores. Predators and dogs can become infected while eating the carcasses of animals with anthrax. Animals can also become infected through the bites of mosquitoes, ticks and horseflies which carry infection from sick animals.

Sick animals excrete anthrax microbes into the environment through feces, urine, saliva and milk.

Man can become infected in a variety of ways. The principal path of infection is through direct contact with the carcass of a dead animal while removing its skin, cutting of the carcass of a slaughtered animal and infected animal raw material, and caring for sick animals and through the soil or objects contaminated with infected soil, and food prepared from contaminated raw material.

In man anthrax can be manifested as skin, intestinal and pulmonary forms. The incubation (latent period) in man with anthrax can last between several hours to 6-8 days (most often 2-3 days).

The skin form of the disease arises when the pathogene penetrates through scratches, abrasions or small cuts, while the intestinal form can occur when using contaminated meat or meat and dairy products which had not been properly processed thermally.

All patients with anthrax and those suspected of it must be hospitalized immediately.

To prevent anthrax, do the following: In caring for sick animals observe personal hygiene. The slaughter of cattle at individual farms is forbidden. Dissection of carcasses and cutting of meat can be done only by permission of the veterinarian. Carcasses should not be dissected if anthrax is suspected. Do not buy from private individuals meat, meat products, fur, skins, leather, hair or bristle of animals. The milk of cows suspected of having anthrax should not be used in food and should be destroyed.

Comrades! Take active part in bringing order to households, streets and entrances.

Do not allow children to play with stray dogs and cats.

Should symptoms of anthrax be suspected, immediately seek medical help.

SES of the Ordzhonikidze district

Chief physician—

Chekmeneva

N.S. 29564, 4/18/79. Printed by "UETM," Order 618, 20,000 printed

waste mixed with grain. It is autoclaved to inactivate anthrax spores and other infectious organisms. Procedures at the Aramil facility violated the established technical regulations. Autoclave pressure readings were not taken, records of sterilization times were not kept, the raw material and the autoclaved material were handled in the same area and transported in the same wheelbarrows, and microbiological analysis was not carried out.

Bacillus anthracis was isolated from patients, from samples of infected meat, from carcasses of diseased animals and from the Aramil powder. All of these isolates were judged to be of the same strain on the basis of elementary bacteriological tests.

Road-blocks were set up to prevent uninspected meat from entering the city. Contaminated meat and feed were destroyed by open air burning. There were a few cases of anthrax among stray dogs: consequently approximately 300 strays were destroyed. About 30 buildings where possibly infected animals were slaughtered and butchered were doused with gasoline and burned. Burning sites were typically left as is, not covered over with asphalt or such. Refrigerators and other surfaces suspected of contamination were disinfected with chloramine solution. As prophylaxis, members of patients' families were given antibiotics. Warnings against consuming meat from private sources, citing the risk

(Continued on page 6)

(Continued from page 5)

of anthrax, were broadcast on the radio, published in newspapers, and distributed in posters and leaflets.

Several foreigners were present in Sverdlovsk during the outbreak. One of these was Professor Donald Ellis of Northwestern University in Evanston, Illinois. He was a US National Academy of Sciences exchange scientist who came with his family and worked at the Institute of Chemistry and Physics from mid-April to mid-May. In mid-June, the Ellises returned to Sverdlovsk and stayed until the end of July. (Ellis has told journalists that he was not aware of the outbreak until he returned to the United States.)

Contrary to the US government version of the event, there was no evidence of inhalatory anthrax. All epidemiological, clinical and patho-anatomical evidence supported the diagnosis of intestinal and cutaneous anthrax. Also contrary to the US version, there were no anthrax cases among military personnel, military medical personnel never took over from civilians at hospital number 40, and there was no aerial spraying of disinfectant. There is indeed a military facility in Sverdlovsk that studies infectious diseases. The existence and location of this facility were published last year in the declarations submitted by the Soviet government to the World Health Organization, in accord with an agreement among the parties to the Biological Weapons Convention. When asked the purpose of the military facility in Sverdlovsk, Dr. Burgasov responded that the question should be addressed to the Defense Ministry. (According to the Soviet declaration, the facility studies mechanisms of the spread of diseases significant for the military but has no pathogens.)

The overall conclusion presented by the Soviets is that the outbreak was caused by (i) improper procedures in the production of bone meal at the Aramil facility; (ii) the failure of private animal owners to observe regulations requiring official veterinary approval for slaughter of sick animals; (iii) the illegal sale of meat from such animals; and (iv) inadequate supervision by the veterinary services.

Next steps. It is already clear that the US version of the Sverdlovsk anthrax outbreak is in need of careful and ob-



At the American Academy of Arts and Sciences in Cambridge, Massachusetts, April 15, 1988. From left to right, Dr. Alexander Langmuir, Dr. V.P. Sergiev, Dr. P.N. Burgasov and Dr. V.N. Nikiforov. (Photo: John Guillemin)

US ADMINISTRATION DENIES PLAUSIBILITY OF STORY

The Soviet physicians' detailed account of the Sverdlovsk outbreak is plausible and consistent with what is known about human and animal anthrax. However, in December 1987, after the first informal discussions with Soviet physicians had taken place, President Reagan reported to the Congress that the Administration still found the Soviet account "inconsistent with information available to us and, in many aspects, . . . not consistent with a contaminated meat explanation." In the same report, however, he welcomed the provision of new information and the opportunity to discuss the issue. Clearly, a thorough and objective review of the original US interpretation of the outbreak is now called for and merits priority on the intelligence agenda of the next administration.

jective review. Continued Soviet willingness to provide information and documentation regarding the outbreak has the potential of removing any remaining reasonable doubt that the outbreak was a natural occurrence. Beyond that, there is the question of the military biological facility in southwest Sverdlovsk. Now that the facility has been declared under the provisions agreed upon in 1986 by the parties to the Biological Weapons Convention, it may be possible, on a reciprocal basis, for the Soviets to open the facility and to allow its personnel to meet freely with scientists from other countries. If so, concern about its present mission should be laid to rest. Depending on what is learned, controversy over its work in past years may or may not also be dispelled. Of course, the value of such opening and the Soviet incentive for undertaking it depends in part on the willingness of the US government to conduct a truly objective review of its own previous positions. What is clear is that the best way to protect the mutual interest of the US and the USSR in maintaining and strengthening world-wide restraints against the hostile use of biology is to foster a policy of open laboratories and free communication among biological scientists. ■

CHEMICAL WEAPONS CONVENTION BULLETIN

As announced in the April 1988 PIR, the FAS Fund has initiated publication of a quarterly summary of information relevant to the Convention. The CWC Bulletin contains a digest and summary analyses of noteworthy events, a calendar of coming events such as hearings, conferences, decision dates, and negotiating sessions, selected US and foreign press reports, excerpts of important documents, and a bibliography of other materials. The purpose is to build the level of public information and foster informed discussion and analysis of the CWC. Please write to Gordon Burck at FAS if you or your colleagues are interested in receiving the Bulletin. The first issue will also be sent to new recipients.