

THE LEITENBERG-ZILINSKAS HISTORY OF THE SOVIET BIOLOGICAL WEAPONS PROGRAMME

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In 1989 I was working in the UK's Foreign and Commonwealth Office's Arms Control and Disarmament Research Unit (ACDRU) on issues related to Chemical Weapons Convention (CWC) negotiations. At that time there seemed to be no prospect of any immediate conclusion of the negotiations – arguments over the level of verification were often at the heart of the problem in the Conference on Disarmament in Geneva. Disputes over what to declare, and how to inspect declared sites, were extensive. When we heard in late 1989 or very early 1990 (I cannot recall now the exact dates with certainty) that there was a highly significant new intelligence source on a major clandestine Soviet offensive biological weapons (BW) programme, it seemed to indicate to many UK officials working on chemical and biological arms control at the time that we needed to place an even greater weight on the necessity for effective verification in the CWC. We could not end up with another weak compliance regime such as the one that was included in the 1972 Biological and Toxin Weapons Convention (BTWC), where investigation through the UN Security Council could be thwarted by the exercise of a Permanent Member's veto. There was also a concern that this new information, if true, could scupper steps towards agreement on a CWC in the Conference on Disarmament negotiations then underway in Geneva; if the Soviet Union were cheating on such an apparently breath-taking scale on the BTWC, was there any point on embarking on a new agreement on chemical weapons? How would this play with Ministers? The UK-USSR exchange of confidence-building visits of experts between the UK's Chemical Defence Establishment (CDE) at Porton Down and the Soviet equivalent at Shikhany in 1988 had not left us with a sense that the Russians were ready to be transparent about their offensive CW programme. Access had been limited, equipment evidently had been moved, and the UK team was denied access to a complete chemical production plant that seemed to be linked to the site. On one occasion the UK Ambassador to the Conference on Disarmament brandished a

¹ This essay reviews the book by Milton Leitenberg and Raymond Zilinskas, *The Soviet Biological Weapons Program: A History* (Harvard University Press, 2012, xvi + 921 pp). The author is acknowledged in the book for assistance during its writing. Dr Walker works in the Arms Control and Disarmament Research Unit, Foreign and Commonwealth Office, King Charles Street, London. The views expressed in this review are the author's own and not necessarily those of the FCO.

LANDSAT satellite image that clearly showed the connections, but even this was not enough to convince the Soviet hosts to grant access.

How would the US react? There might be elements in a Republican administration that would seize on this as grounds for withdrawing altogether from further arms control negotiations with the Russians. And even if they did not withdraw, any treaty negotiated with this background – the story would inevitably leak in Washington – could well struggle to pass the Senate Foreign Relations Committee under Jesse Helms. Things looked bleak. The net result was high level representations to Gorbachev that led ultimately to UK-US visits to suspect sites in 1991, meetings at official level, and an agreement on a Joint Statement on Biological Weapons signed in Moscow in September 1992. This was intended to pave the way to further visits – including to military biological sites – and the establishment of Working Groups to address a range of issues, not all of which were directly related to the Soviet BW programme. The objective, which was clear at least in the UK and US, was to enable the Russian authorities to take steps to reassure us that they had dismantled the offensive programme inherited from the Soviet Union and were now working solely on biodefence, or other peaceful biological activities.

That things did not work out that way is chronicled in the hugely impressive new work by Milton Leitenberg and Raymond Zilinskas – *The Soviet Biological Weapons Program: A History*. The antecedents to the day in late 1989 when Vladimir Pasechnik (Director of one of the BW facilities in Leningrad) chose to defect to the United Kingdom are charted in great detail from the origins of Soviet interest in the hostile uses of biology in 1918 through until the early 1970s when, driven by the charismatic and highly influential scientist, Yury Ovchinnikov of the USSR Academy of Sciences, the Soviet Union embarked on a new large-scale offensive BW programme. This ‘modern program’ – in the authors’ phrase – we now know had a clear aim of exploiting the new developments in genetic engineering that were just beginning to emerge in the West. This programme was approved by the Central Committee of the Communist Party of the Soviet Union and the USSR Council of Ministers at a time (March 1971) when the Soviet Union had recently changed its position and now accepted that there should be a separate Biological and Toxin Weapons Convention, and was negotiating

to finalise the text in Geneva between March and September 1971. The Convention prohibits the development, production, stockpiling and retention of BW.

One of the defining features of this large-scale offensive programme was the very deliberate development of ‘legends’ for the many ostensibly civil facilities and activities in the organisation that ran the offensive programme: Biopreparat. The ‘legends’, or cover stories, were developed in order to keep the true nature of what was being done secret, not just from any prying eyes outwith the Soviet Union, but from personnel working in the programme as well, not to mention Soviet citizens more generally. There were very strict need-to-know provisions, so that comparatively few individuals had a complete overview of what was going on. That these ‘legends’ existed at all was almost proof in its own right that the Soviet Union was violating the Convention. If the work underway was legitimate, then why go to such lengths to hide it? That was certainly a perception in the UK at the time when the details of the programme became apparent from Pasechnik’s de-briefing. Once it became clear to Soviet authorities that there might well be some form of international inspection, a greater emphasis was placed on these cover stories in order to deflect inquisitive eyes and minds from the real story. There is a certain historical irony here in that one of the core arguments in Karl Marx’s *Capital* is that things are not as they appear on the surface and that one should dig down to see the real nature of what is going on.

Leitenberg and Zilinskas take great care to outline and describe the specifics of the BW programme as it evolved through the 1970s and into the 1980s – the main facilities and programmes involving both the Ministry of Defence and Biopreparat are discussed in depth. We learn in great detail, for example, of the work done on engineering the genes that expressed certain peptides (human bioregulators) into bacteria, which would then serve as the delivery means to attack an exposed population. Of particular interest were those peptides produced naturally by the human body in exceedingly small quantities, such as neuropeptides. Any alteration in the delicate balance in the human body would lead to adverse physiological effects and possible death. The potential for misuse of peptides was a UK concern in the CWC negotiations in the late 1980s – early 1990s, and we felt that clearly such materials would be covered by the General Purpose Criterion (the proposed comprehensive definition of toxic chemicals) but we also gave consideration at the time to proposing a

specific example for inclusion on the draft Schedules to serve as a marker in the way that the two toxins – saxitoxin and ricin – were viewed by the negotiators. Substance P (a bioregulator) was therefore selected, and elements for a possible draft Working Paper for the Conference on Disarmament were prepared by Porton Down. However, this was never carried forward as a serious proposition and presented in Geneva, although the idea was discussed in the Western European and Others Group at the time in 1989-90.² We did not feel that such a proposal would gain support in the wider Conference on Disarmament. Looking back on this now it is not clear to me that our interest was driven by some specific intelligence information on Soviet activities of the sort reported by Leitenberg and Zilinskas, or whether it was shaped by a technical appreciation of the potential for misuse based on a careful horizon-scanning hazard assessment. There might have been a bit of both.

The UK had long been an advocate of what, in the early days of post-war disarmament, used to be known as ‘effective control’, and things were no different in the CWC, where practical work on verification procedures was already underway. The revelations brought by the new source – Vladimir Pasechnik – helped elevate the problems of biological weapons to the highest levels of government. For the first time since the late 1960s, when the UK had proposed a separate agreement on BW, the Foreign Secretary and Prime Minister became closely engaged on BTWC issues. Pasechnik’s information could not be ignored: a massive clandestine offensive programme had been underway since the early 1970s and seemed to represent not only a clear and fundamental challenge to the BTWC, but to arms control more generally – and this too against a background of change in the Soviet Union with Gorbachev’s *glasnost* and *perestroika* in full flow. There was clearly a disconnect: could we be certain of Gorbachev’s intentions, given the apparent scale and sophistication of the Soviet offensive BW programme?

Leitenberg and Zilinskas also chart the long and difficult Sverdlovsk saga in detail, including some new material (details of US and UK private diplomatic approaches to the Soviet government in 1980 and later Politburo documents on the matter for instance) and noting some of the mistakes and exaggerations that have

² This was a group of ten Western country members of the Conference on Disarmament that tried to coordinate their positions, resolve internal differences and to exchange views on the issues facing the CWC negotiations. Its members were Australia, Belgium, Canada, France, Germany, Italy, Japan, The Netherlands, UK and US.

circulated about it. The 1979 accident at the Military Technical Scientific Research Institute Sverdlovsk is described in some detail. This plant was being used to produce *Bacillus anthracis* for BW weapons. According to the authors, the accident was caused by a failure to put back two high-efficiency particulate air filters from the exhaust system of the spray dryer that had been removed for efficacy checking. This led to a release of agent into the atmosphere, causing the death of some 70 people outside the plant. By the mid 1990s, this was seen as a litmus test by the UK – lack of candour and transparency demonstrated that the Russians were not interested in addressing our concerns or demonstrating that the offensive BW programme had indeed been truly wound up, and that the facilities and personnel were now redirected onto peaceful uses of biology. The failure to take the simple solution open to them was indicative – they could have stated that what happened then was under the Soviet Union and clearly a breach of the BTWC, but this was now the Russian Federation and they needed to demonstrate their compliance. We wondered why they should not do so: was it because there was intent to preserve the offensive programme? Did the individuals concerned feel guilty in any way about past misdeeds, which they could not bring themselves now to admit, at least not to the UK and US? Were they worried about a change in government and possible retribution from a new hard line administration against anyone betraying Russian secrets? Were they worried about their jobs in an increasingly uncertain age? Could they not bring themselves to admit that their entire professional careers had been engaged in illegal work? Was it down to cultural factors such as an innate sense of secrecy and the Russian distrust of foreigners? Was it a combination of these factors? Were we missing something? At any rate it seemed – not just in relation to the Sverdlovsk incident, but to many other aspects of the Soviet offensive programme – that the Russians were living up to Dostoyevsky's comment in *Crime and Punishment*, 'Nothing in this world is harder than speaking the truth'. Leitenberg and Zilinskas do not dwell in great detail on the detailed rationales of the Russian players, noting just that their core intent was to preserve the basics of the programme.

Revelations from the Soviet programme and the continuing travails facing implementation of the 1992 Joint Statement had an impact on UK approaches to the Ad Hoc Group (AHG). The AHG, created in 1994 at the BTWC States Parties Special Conference, met regularly from 1995 through to 2001, in what turned out to be a forlorn

attempt to negotiate a verification protocol for the Convention. There were two main considerations in these negotiations that were influenced by the lessons emerging from the Soviet programme as well as Russian positions adopted in the negotiations themselves: the need to include what became known as ‘other biological production facilities’ – essentially, pharmaceutical plants using contained fermenters and downstream processing and cell lines – and the question of permitted threshold quantities of listed biological agents and toxins. These were lists of human, animal and plant pathogens and toxins agreed to be of relevance for the Protocol. Arguments over what should be on – or, often, not on – these lists ate up an enormous amount of time in the negotiations. Some delegations such as the US disputed the need for such lists in the first place; others were unsure as to how such lists would be linked to the compliance measures such as declarations that were being developed in negotiations run by a separate Friend of the Chair.

Leitenberg and Zilinskas describe in great detail the huge production factories built for the Soviet BW programme. All of these had massive fermentation capacities and were ostensibly for peaceful purposes. Single cell protein was one of the main products. Key places were the Berdsk Chemical Factory, the Omutninsk Chemical Factory and Plant Progress in Stepnogorsk in Kazakhstan, whose Main Production Facility housed twenty 1000-litre fermenters functioning as pilot plants, and ten 20,000-litre production fermenters. It seemed to the UK that we needed to include facilities with such capabilities in the Protocol’s proposed declarations and inspections regime – but, hardly surprisingly, the Russians rejected this idea, and so too did some Western states such as the US, Germany, France and Japan. A Protocol that did not address the type of facilities which the Soviet BW programme intended to use – and we saw the same in Iraq with the Al Hakam Single Cell Protein plant – would not have passed the laugh test. Our concern was that, given the revelations from the Soviet programme, we could not recommend to Ministers any agreement that excluded many of the types of places where the Soviet Union had so evidently and deliberately constructed for BW production on a massive scale. This was perhaps the main reason for the UK’s persistence in arguing the case for some coverage in the Protocol draft text on declarations of ‘other microbiological production’. In the end we did have some provisions in the Chairman’s 2001 text Article 4 on this, but the scope was much reduced, and the nature of possible on-site activities was limited in the context of

randomly-selected transparency visits that could be held at such facilities. All of this effort was for nought of course as there was no agreement on the Protocol, and negotiations for it collapsed in bitterness and recrimination in August 2001 following US rejection of the Chairman's text at the 24th session of the Ad Hoc Group (AHG). This no doubt suited the Russians privately, but publicly they insisted that a verification protocol was essential: a view maintained down to the present.

A recurring Russian requirement of the Protocol negotiations was to secure agreement on a list of agents and permitted threshold quantities that could be held for each type of agent – a system for working out specific quantities per agent would be based on the effective doses, and one illustrative Russian example came up with a figure of 16.25 kilograms. For the UK, US and others in the negotiations this was a technical nonsense; biological agents could be readily grown from seed stocks and to us it looked very much as if the Russians were seeking to legitimise high quantities of biological materials that would be put beyond any legitimate enquiry by an inspecting team. Such a proposal could also have undermined the Convention's Article I by undermining the General Purpose Criterion. Considerable effort by the AHG's Hungarian Chairman Tibor Tóth, the UK, France and Germany was deployed throughout the negotiations into finding ways of accommodating Russian positions, but in a way that made technical sense and would not undermine the Convention's Article I. In the end we had a complex system of annual and current transparency threshold levels in Article 3 of the draft text of the Protocol covering all listed agents with these levels to be expressed in ranges – six kilos for the annual threshold and four kilos for the current threshold. The Russians seemed content with this outcome at the time.

Leitenberg and Zilinskas say relatively little about the Russian approach to the Protocol negotiations, although they do note the role played by Oleg Ignatiev in the Russian delegation in Geneva. Ignatiev was a key figure in the Military Industrial Commission (VPK). The VPK, as the authors note, was crucial in the existence and maintenance of the Soviet BW programme. Ignatiev was also a central player on the Russian side during the Trilateral Working Group meetings intended to oversee implementation of the September 1992 Joint Statement – Ignatiev led the Russian team that visited the Evans Medical vaccine plant in the Speke district of Liverpool,

during the round of Russian visits to US and UK non-military biological facilities, whilst I led the UK host team of MOD and Porton experts. We took some of the Russians, including Ignatiev, out to a brewery pub one evening and sent out for fish and chips – probably one of the more surreal moments in my career. Here I was swopping pints with a leading player in the Soviet BW programme in a down-market public house in one of the least salubrious parts of Liverpool. Such are the vagaries of a diplomatic existence.

One of the interesting questions about the Russian attitude to BW, and one also raised in the book, is why – when Gorbachev was pressing for rapid progress on nuclear arms control as well as conventional arms reduction – did the BW side of the house lag behind? And, as the authors note, the Russian CW community was in no hurry either to embrace transparency fully on their programmes and capabilities, nor to destroy their stockpiles – something that we were already acutely aware of. It seems that in preparing for a visit by a US delegation to the State Research Institute of Organic Chemistry and Technology (*GosNIIOKhT*) in the early 1990s under the auspices of the 1989 US-USSR Wyoming Memorandum of Understanding, all laboratory equipment that had been purchased in the West was removed from the rooms designated to be visited by the Americans. When the UK team had visited the Shikhany facility in 1988 we found laboratories stripped of equipment; we learned later that everything had been hidden in the basements.

However, whilst there were undoubted issues here in the CW context, they were not as pronounced as those facing the UK and US in getting to the bottom of the BW problem. Was this because Gorbachev, and later Yeltsin, did not feel strong enough politically to take on the entire military industrial complex at the same time as the legion of other issues bedevilling their policies? After all there are just so many hours in the day, and there were other pressing foreign and domestic policy issues vying for attention and action. How much did the leadership actually know? Were they complicit in deciding to cover up and retain some residual capabilities? Leitenberg and Zilinskas observe that one of the most difficult questions to understand is what kind of papers concerning the biological weapons issues went to Gorbachev? What did he see? What did he read? And what did he sign? It was a paradox of the entire period. On the one hand Gorbachev was making great strides in halting and reversing the arms race – the

INF Treaty and the Conventional Forces in Europe Treaty for instance – but BW seemed to be immune from the disarmament imperative. The Biopreparat offensive programme was certainly scaled back – largely driven by a recognition that the UK and US were now well-informed about the programme and would be pressing to inspect the suspect sites. This is one of the book's many highlights, as the authors have made good use of some rare primary source documents to elucidate the role in defence and foreign policy making of the Central Committee of the Communist Party of the Soviet Union, as well as various small ad hoc and permanent bodies charged with decision making, particularly on arms control matters.

The role of Gorbachev and Shevardnadze is crucial in plotting out the nature of the Soviet response to high-level UK and US *démarches* provoked by the defection of Vladimir Pasechnik in 1989. This led to a series of visits to four of the Soviet BW sites in 1990-91 in the opening phase of what became known as the trilateral process. But it proved difficult to address all Western concerns satisfactorily, as the Soviet Union continued to equivocate and failed to provide conclusive evidence that the offensive programme had indeed been fully closed down. There were invariably more questions than answers, and why Gorbachev did not clamp down more authoritatively is still one of the great unanswered questions in this saga. Sir Rodric Braithwaite – British Ambassador in Moscow for much of the time that this was going on – wrote in this memoirs that it was 'an integral part of the conduct of business; junior officials lied to their seniors, the government lied to the public and to foreigners'. This is approvingly cited by the authors in *The Soviet BW Program*.

All of the tortuous UK, US and USSR exchanges and meetings are accurately chronicled in the chapter on the Gorbachev years (Chapter 21 – the longest in the book). So at the end of it all how do the authors assess Gorbachev's role? They come to a balanced view: one that highlights his accomplishments in other aspects of arms control, especially nuclear. Nor should his role in ending the Cold War be overlooked, or the non-intervention in Eastern Europe as the Warsaw Pact states broke away from the Soviet system. The Central Committee papers cited in Chapter 21 suggest that there was some notional attempt to cut back on the offensive BW programme, but the programme's main achievements – as described in great detail elsewhere in the book – actually took place on Gorbachev's watch i.e. between 1985 and 1990: yet another

historical paradox. Leitenberg and Zilinskas believe, on the basis of the evidence, that Gorbachev was being lied to about the nature and extent of the programme by senior military men and by the VPK, and possibly even by some of the Central Committee staff. Other domestic and economic problems were becoming ever more acute as time wore on; grappling with the BW problem effectively was just one problem too many for Gorbachev. This seems a fair assessment.

When the Soviet Union dissolved and the Russian Federation came into being, there seemed to be new hope that we (the UK and US) might at long last get to the bottom of the story and be confident that the offensive programme was finally abandoned and all activities accounted for. Things started promisingly enough under President Yeltsin. How it all unravelled is the subject of the book's Chapter 22. A Joint Statement on BW was signed by the UK, US and Russia in September 1992. This was intended, at least from the UK and US perspective, to set up a process through which the Russians could demonstrate that they had ended the offensive programme – through a series of visits to military and non-military facilities and transparency measures on past programmes. Other issues were part of the programme too, such as conversion, and discussing potential verification measures for the BTWC. Here was a glorious opportunity to make a neat break with the past. We were to be disappointed, although the seeds of the Joint Statement's downfall had already been sown in the provisions that were agreed. This can be summed up in one word: 'equivalence'. The Russians succeeded in treating the three players on the same level, so for instance, whilst there would be visits to Russian facilities, there would be an equivalent number of Russian visits to US and UK sites. At the time the UK was not happy with this outcome as we believed that the spotlight was being shifted away from the real problem – the Russian programme and intentions of current policy makers (many of the same individuals from Soviet days were still in place) – to treating the US as if the Russians had major concerns over US compliance. They did not seem that bothered about the UK. However, at the time the only way to ensure that the Russians signed up to the commitments in the Joint Statement was to commit ourselves to certain concessions. Such is the nature of international – or indeed any – negotiations; the higher priority was to tie the Russians into a programme of transparency and conversion, so we had to hold our noses. The full consequences of these concessions, apparently necessary at the time, were only to become apparent later.

Implementation of the Joint Statement over the next four years was fraught – as Chapter 22 ably recounts. As noted above the core problem was the ‘equivalence’ issue; the Russians kept pushing the spotlight on to the US and away from their own questionable activities. They made unreasonable demands as we tried to thrash out the ‘rules of the road’ document between 1994 and 1996 to govern procedures for visits to military biology sites. The Joint Statement set out no requirement for such things, but this was the obstacle that had to be surmounted if UK and the US experts were to gain access to Russian military sites. The programme of exchange of visits in 1994 had seen four UK/US visits to Russian non-military biological sites, and in return we received three in the US and one in the UK. (We had to spend a good part of 1993 negotiating an agreement with the Russians on the protection of confidential information. They insisted on completion of this before the first visits could begin.) As a result of these visits the Russians insisted that we first must have a set of procedures for the visit to military sites to deal with what they saw as problems that had emerged at the non-military sites – they complained of what they perceived as subjective assessments of Russian capabilities. We now needed, in their view, a definition of BW; a definition of a military biological site; rules for sampling and criteria for determining a site’s compliance with BTWC and agreed definitions of terms. We assumed that much of this was designed deliberately to limit our scope for observing or commenting on questionable activities and infrastructure. The Russians also wanted to go first in the next round of visits, so there were rows over various permutations on the order of visits. We did agree on Common Understandings of some key terms rather than definitions and these included one that made sure that mid spectrum agents such as bioregulators were within the scope of biological weapons. This was important in view of the already mentioned Soviet work on such agents. Negotiations on these rules, however, quickly became bogged down. Although a document was eventually close to agreement by the end of 1995, it ultimately foundered on Russian insistence that US overseas military medical establishments in places such as Egypt and Peru should be included in the definition of military biological sites. The Russians also wanted to use 1 January 1946 as the cut-off date in the definition of such sites – another problem for the US. So in May 1996 when Russian Foreign Minister Yevgeny Primakov wrote to Secretary of State Warren Christopher insisting on access to US overseas sites, that was the last straw and the US refused to respond – a move that effectively put the

Joint Statement into cold storage. It was never formally terminated, the US preferring to pursue aspects of the former Soviet programme through the Nunn-Lugar process. The UK hoped that the BTWC Protocol might eventually plug the gap – we were to be disappointed there as well. So once again, as with Gorbachev, the leading lights of the old offensive BW programme had succeeded in thwarting attempts to close down the programme fully and to require a full and candid account of its nature and extent; and of course in keeping the UK and US out of their military BW sites. For the UK at least, one key turning point in the process came in the Joint Statement Second Working Group meeting in Moscow in October 1994. During a discussion on past programmes the Russians trotted out the old discredited argument that the cause of the outbreak of anthrax in Sverdlovsk was contaminated meat. Such protestations demonstrated conclusively to us that whatever the Russian objective for the trilateral process was, it certainly was not about candour and transparency or addressing our concerns. This entire sorry saga is outlined at length in the book, which concludes entirely reasonably in light of what happened that ‘as far as rest of the world knows, everything remains as it was for Russia’s trilateral partners and the international arms control community – incomplete and unresolved.’

Inevitably for such an ambitious work, some minor errors have crept in. These include dating the first BTWC review conference at 1981 – whereas it took place in 1980; confusing the designations of the two separate UK sites at Porton Down in Wiltshire: CDE and MRE, later CBDE and CAMR and later still Dstl and HPA respectively. The book states that Dr David Kelly was an intelligence officer – but in fact he was Head of the Defence Microbiology Division at CBDE, and was on secondment much later to the Ministry of Defence during UNMOVIC days. There are some minor errors in the rendition of UK National Archive file numbers - the class and piece numbers are not fully cited. It would have helped too, in view of the very many locations mentioned in the book, to have had a map or maps. The figures in Table 23.1 on the total amount of funds spent by the US on biological weapons prevention are also apparently wrong – some double counting crept in during the final preparation of the manuscript. It seems that the true figures are about \$1.1 billion rather than the \$1.5 billion that appears in the book. However, in the great scheme of things these are very minor quibbles indeed and do not detract from the impact overall of what is otherwise a magisterial study.

The authors have taken great care to state the strengths and weaknesses of their sources and what is known and what is not. Fact and interpretation are largely kept separate, which is especially important in any discussion of a BW programme where there are still many black holes in the information available and where there are some highly questionable secondary sources in circulation. For instance, some of Alibekov's claims about the nature of the Soviet programme after his defection to the United States when he was no longer part of it are given a sceptical eye. So too is the idea that the Soviet programme managed to put biological agents into ballistic missile warheads, solved the problems of keeping agent alive during the stresses and strains of atmospheric re-entry and was able to ensure dispersal at the right altitude. In the latter context it is worth noting that re-entry vehicles had been designed to enable the sensitive innards of nuclear warheads to survive re-entry. The book avoids making claims that are not supported by evidence and it candidly notes in places that we just do not know. Exactly what goes on today in the Russian Ministry of Defence's biological facilities is one such gap. Interview evidence is given a fair prominence alongside documentary sources, many of which are primary, including some from Soviet archives. The Central Committee papers are particularly revealing as already noted.

Undoubtedly *The Soviet Biological Weapons Program: A History* will be the standard and definitive reference source on this issue for years to come, until such times as more archival material becomes available in Russia, US, UK and elsewhere which may help flesh out in greater detail some other aspects of this sad story. The book has no rivals. It is a scholarly work in the finest traditions of academic research covering a complex series of events over many decades: a thoroughly impressive achievement by any standard.

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