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The Impact of UNSCR 1540

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*Motivations and Means:
Scientists in Apartheid South Africa's
Nuclear, Biological, and Chemical Weapons
Programs and Relevance for UNSCR 1540*

For more than a decade the South African apartheid government developed its nuclear, biological, and chemical (NBC) weapons programs in secret. Only those who worked directly on the programs or oversaw their strategic direction, including at least the state president and the minister of defense, knew the details of their existence. In 1993 President F. W. de Klerk announced publicly that South Africa had pursued a program to develop nuclear warheads; until then rumors of it had been unsubstantiated. It was even later, in 1996, that details of the country's chemical and biological weapons programs, referred to as Project Coast, its apartheid-era code name, became public.

By 2005, a fairly detailed record of the evolution, history, and dismantlement of South Africa's NBC programs existed.¹ It showed that the factor most influential in motivating the decision to develop them was the perception that the apartheid state was existentially threatened by internal and external forces. Other factors, such as the availability of technical and scientific expertise, access to raw materials and equipment, and the willingness of scientists to cooperate, also played an important role in creating the conditions in which the decision to proliferate could be made. The policy response to this threat analysis identified the importance of a nuclear deterrent capability and the need to be able to respond to a chemical weapons attack and to improve the means for crowd control within South Africa. Although military and political leaders were motivated by the need to counter the threat to the state, the programs were driven more immediately by the motivations of individuals to test the limits of science and resourcefulness in a country increasingly isolated from the rest of the world.

This chapter focuses on the role of scientists in the establishment and development of apartheid South Africa's NBC programs. It attempts to understand the factors that influenced the decisionmaking process in relation to the initiation and development of those programs and the role that scientists played. The conclusions it reaches suggest how international measures such as United Nations Security Council Resolution (UNSCR) 1540 of April 28, 2004, and the existing international treaty framework covering nuclear, chemical, and biological weapons can contribute to preventing the further proliferation of these weapons, and they also point to those measures' limitations. The chapter briefly sets out the history of the South African nuclear weapons program and the chemical and biological weapons programs, which followed significantly different courses during their establishment and dismantlement. The common denominator is the role of scientists and other skilled professionals, who were able to manipulate the programs to suit their interests and who developed the knowledge and skills necessary to establish and run them. The chapter concludes by identifying lessons from the South African experience for other countries engaged in activities that may skirt the limits of acceptability under international non-proliferation and disarmament regimes. These lessons also apply to countries in which proliferation activities are outside the purview of national regimes, which nonetheless now face having to implement UNSCR 1540.

South Africa during Apartheid

During the 1970s threats, whether real or perceived, to the existence of the apartheid state increased dramatically. Before 1974 South Africa had been buffered from the rest of the continent by its neighbors, which were still under colonial rule. But this changed when in that year the Portuguese government fell in a coup. In 1975 Mozambique and Angola gained independence, and the South African armed forces invaded Angola but were forced to withdraw. Their response was to rearm and reorganize the National Union for the Total Independence of Angola and thereby destabilize the government of the Popular Movement for the Liberation of Angola (MPLA).

The change in the external threat to the apartheid state was mirrored by a simultaneous increase in the internal resistance to apartheid, and by the late 1970s the South African government and military viewed these threats as a "total onslaught" against the country. According to the defense minister Magnus Malan in 1977, this onslaught "involves so many different fronts, unknown to the South African experience, that it has gained the telling but horrifying name of total war. This different but all-encompassing war has

brought with it new methods and new techniques which in turn have to be met by countermeasures.”²

In 1976, when students took to the streets of Soweto to protest against the use of Afrikaans as the primary language of education, the police responded with live ammunition, killing and injuring protestors. The incident focused international attention on Pretoria and its consistent violations of human rights. The government and military were aware that incidents of this kind could not be repeated because they would not be tolerated by the international community. This prompted the military to seek new crowd control measures, the Holy Grail being a chemical agent that could be used to calm crowds. Both General Lothar Neethling, a former South African police forensics chief, and General Constand Viljoen, a former chief of the South African Defence Force (SADF), recalled the military’s interest in such agents. Neethling explained to the Truth Commission that “when the riots started in 1976, the South African Police were caught unawares. They had nothing apart from guns, shotguns, and sharp point ammunition. Nobody wanted to use that and that’s why there was a surge for various techniques to be applied. . . . I went overseas three times to Germany, England, Israel, America to find the best techniques available.”³

These considerations prompted the SADF to decide to develop a chemical program that concentrated on creating irritants and incapacitants for crowd control and external operational use and also on making equipment and clothing to protect against the use of chemical weapons, particularly in Angola. The biological weapons program, on the other hand, focused on devising covert assassination weapons for the operational units of the SADF. The development and use of these weapons to eliminate key figures in the liberation movement was in line with the counterinsurgency warfare approach of the military.

During the 1980s, at the height of the cold war, the SADF continued to wage a high-intensity conventional war in Angola against Soviet-backed MPLA and Cuban forces. It occupied large parts of southern Angola almost continuously from 1980 to 1988.⁴ Internally opposition to apartheid grew in intensity. The African National Congress (ANC) and the Pan-African Congress received international support from, among others, the Soviet Union and China. Compounding these threats to the state was the international ostracism of the government as a result of its apartheid policies. South Africa faced sanctions from the United Nations and what has been termed a “near-excommunication from Western nuclear suppliers, markets and scientific forums” with which it had cooperated and benefited since 1957, when it had signed a 50-year agreement with the United States under the Atoms for Peace program.⁵ But successive American (and British) administrations also adopted

opportunistic policies toward the apartheid government. Indeed, the failure, particularly by the United States, to apply sanctions strictly, may have contributed to making the South African government confident that it would not be called to account for its chemical and biological warfare program even if the West came to know that it existed.

In 1977, some twenty years after South Africa had begun its nuclear enrichment and explosives research under the international Peaceful Uses of Nuclear Energy (PNE) banner, there was clear evidence of its militarization.⁶ And in 1978, when P. W. Botha succeeded John Vorster as prime minister, he established a high-level committee on nuclear weapons policy. This committee included the prime minister, the ministers of defense, foreign affairs, minerals and energy, and finance and also the chiefs of Armscor (the state's weapons procurement company), the Atomic Energy Board (AEB), and the SADF.⁷ By 1979 it had recommended building "deliverable nuclear weapons to acquire a 'credible deterrent capability' and shifting overall responsibility for the program to Armscor."⁸ As Botha recalled later, a nuclear arsenal was developed as a "diplomatic weapon to defend South Africa."⁹ The decision to build a nuclear weapons capability was taken at the highest level: Prime Minister Vorster is credited with taking the final decision.¹⁰

Recruiting the Scientists

The nuclear weapons program grew out of existing capabilities. South Africa had a cadre of skilled scientists and engineers who had benefited from international exchanges and shared technology since the 1950s and 1960s. Working for the AEB (as of 1985 the Atomic Energy Committee), they formed the backbone of the nuclear weapons program near Pretoria. The scientists were drawn from earlier programs, including the PNE efforts and a program, subsequently canceled, that drew together approximately two dozen scientists to build a nuclear reactor. Those recognized as the drivers of the South African nuclear weapons program included the head of the AEB/AEC, Ampie Roux, sometimes referred to as the "godfather" of South Africa's nuclear weapons. However, the decision to pursue a weapons-focused nuclear program meant that control of it moved from the AEC to Armscor, where a mix of politicians, scientists, and technocrats became responsible for advancing the program.

Relative to those in the United States and the Soviet Union, only a small number of scientists and engineers worked on South Africa's nuclear weapons program. According to Albright, "by the early 1980s the program employed about 100 people, of which only about 40 were directly involved in the

weapons program and only 20 actually built the devices. . . . By the time the program was cancelled in 1989, the work force had risen to 300, with about half directly involved in weapons work.”¹¹ All those working on the program required top secret security clearances, available only to home-born South Africans. As the country relied increasingly on self-sufficiency, the weapons were created from a technological can-do mentality that coincided with its increasing international isolation in the 1970s and 1980s.¹²

Under Armscor’s guidance the nuclear program’s focus was on developing and manufacturing weapons that met the same military standards as other weapons systems. The first fully weaponized and aircraft-deliverable production model was completed in June 1988. By the time the program was terminated, there were six devices: one completed in 1979, one upgraded pre-production model, and four production models. Nuclear material was available for a seventh device that was never assembled. The devices were gun-type, designed to operate without neutron initiators, and had a calculated explosive yield of ten kilotons. “One of the things that surprised United Nations inspectors who visited South African nuclear plants was that much of the equipment was low-tech. For example, 2-axis machine tools normally used for simple manufacturing were reportedly adapted to create complex 3-dimensional shapes for South Africa’s gun-type nuclear device.”¹³ Although these seven devices were low-tech, more sophisticated concepts had been investigated, in part to maintain the interest of the scientists and engineers involved in the project.

During the course of the program, scientists took part in both its strategic and operational areas. André Buys, a scientist on the AEB explosives team in the 1970s and the general manager of Armscor’s nuclear weapons plant Circle by 1983, recalled that “he and other scientists worried that ‘nobody actually sat down and worked out a proper strategy for what they wanted to do with [the bombs] . . .’”¹⁴ For this reason he established a working group in 1983 that developed a more specific, three-phase strategy emphasizing “deterrence and diplomatic leverage.”¹⁵ Thus the scientists’ role changed from being simply providers of technical expertise, the initial requirement of them, to involvement at the strategic level, at their own initiative. Their strategy was subsequently endorsed by President Botha.

However, it was a group of technocrats, largely engineers, rather than scientists that drove the design of the nuclear program as it developed toward a realizable weapons program. These engineers, mainly from Armscor, mixed their knowledge of nuclear weapons with a broader understanding of weapons production and delivery. This resulted in the modification of the program to produce deliverable weapons. Horton argues that although the influence of scientists was particularly high during the earliest phases of the

program (up to 1977), during the course of weaponization (from 1977) their influence diminished relative to that of the technocrats and politicians, who alone took the decision to dismantle the program.¹⁶

In pursuing a chemical weapons program, the first place to which the military turned to find a scientist willing to develop the concept was the Council for Scientific and Industrial Research's (CSIR) Applied Chemistry Unit. The head of the unit, Dr. J. P. De Villiers, had given thought in the 1970s to issues of chemical warfare, particularly to how the SADF could protect itself against the use of chemical weapons in Angola. He was aware too of the potential benefits of using chemical weapons in unconventional warfare. Dr. Wouter Basson, a young military doctor who had close ties with the surgeon general, was tasked with approaching the CSIR chemist, Dr. Vernon Joynt (who worked under De Villiers), to take on the job of leading the program. Joynt was not attracted to the idea of doing secret military work and turned the offer down, leaving the ambitious Basson to step into his place. Basson's own interest in the possibilities that chemical and biological weapons could offer the military, his scientific qualifications, and his ability to impress high-ranking officers with his knowledge played a role in their giving him the freedom to determine the nature and direction of the program.

In 1981, the decision was taken to give the program to the SADF's Medical Services (SAMS). According to Purkitt and Burgess, "the SAMS had ties with Special Forces and was also trained to protect the SADF from all types of attacks, including CBW [chemical and biological weapons]. . . . The connection between SAMS and covert Special Forces provided a secret and loosely managed organizational context for the new CBW program," which had consequences for the management and research direction of the program.¹⁷

The biological weapons program developed from the relationship between Basson and Dr. Daan Goosen, a veterinarian. Basson tasked Goosen with the establishment of a specialized facility called Roodeplaat Research Laboratories (RRL), where research could be done on biological warfare agents and where the chemical agents produced at its sister company, Delta G, could be tested using animal models. Both were front companies distanced from the military by appearing to be commercial entities. Together Goosen and Basson recruited scientists to RRL, predominantly from the conservative University of Pretoria. The combination of attractive financial benefits and the opportunity for scientists to work in well-equipped laboratories where they could spend part of their time doing their own work was sufficient incentive for most of those who came to work at the laboratory. Few were initially motivated by patriotism.

The veterinarian Dr. André Immelman was the scientist recruited to RRL next after Goosen, and the responsibility for carrying out military contracts

fell to him. He was one of the few scientists who confessed to having been, at least to some extent, politically motivated to join the company. He stated in an affidavit to the Truth and Reconciliation Commission (TRC) that he thought he could “make a contribution towards the protection of the South African population.”¹⁸ Immelman was ordered to see to the military’s requirements and to be the single point of contact between the military and the front company. Although he maintained that the work he was doing was for defensive application, he did admit that after a while he began to be concerned about the legitimacy of his work. When he took this worry to Basson, he was brushed off with the assurance that he would not be personally involved, or bear any responsibility, if the poisons he was making available were misused.¹⁹

Another scientist, the veterinarian and microbiologist Dr. Mike Odendaal, testified at the TRC and during the criminal trial of Wouter Basson in 1999–2002 that as head of the Department of Microbiology at RRL he had been required to develop some of the biological assassination weapons. He spoke of infecting cigarettes and chocolates with anthrax spores, sugar with salmonella, and chocolates with botulinum. There was no doubt in his mind that these were intended for operational use.²⁰ In interviews Odendaal initially justified his involvement in the development of assassination weapons by saying that he had done “good” work too, and pointed to the example of an antelope vaccine he had developed at RRL.

In addition, Odendaal oversaw what was probably the most sophisticated work done at the facility. This was carried out by Adriaan Botha, a junior scientist, and the result was genetically modified *E. coli*. He explained that this research was motivated by his personal interest in developing a recombinant vaccine against enterotoxemia in sheep. And, he claimed, in order to get his proposal passed by the management of RRL he referred to its potential military application, despite having no intention of developing a usable weapon.²¹

As noted by Purkitt and Burgess, “Basson was a highly charismatic and effective recruiter, who was apt at identifying and enlisting some of the most promising and highly skilled medical researchers from the military and from the larger civilian scientific community.”²² Although most of the senior scientists and managers recruited to RRL were aware they were employed in front companies whose primary purpose was to attend to the chemical and biological warfare needs of the military, this was not made clear to the more junior staff members. Indeed some of them have claimed they were never aware of being part of a CBW program. Purkitt and Burgess have argued that it was the combination of the career opportunities offered by the front companies and the knowledge that their work was furthering a political agenda

most of the scientists supported that led to their recruitment and their decision to stick with the work. "Many of these researchers and scientists joined the program because . . . the intellectual challenges and opportunities to participate in path-breaking research in one of several related disciplines, for example chemistry, anatomy and virology, intrigued them. Almost all were Afrikaaner South Africans who shared a sense of patriotic duty, a nationalistic zeal for the importance of the work and a sense that their research was critical for maintaining national security."²³ Interviews with the junior-level scientists revealed that political motivations were less significant factors in their decision to work at RRL and Delta G than the attraction of the research itself. The political context may have provided a useful justification later on. This was less true for those in positions of authority.

Although the military withdrew fully from the CBW program only as late as 1993, the process of closing down the program began much earlier as it became clear that some kind of negotiated settlement with the African National Congress was inevitable. However, documents from the biological warfare program show that biological assassination weapons were made available to the covert units of the security forces until at least 1989 and that up to this time RRL had considered expanding its facilities. By 1990 it was clear that the facilities would be privatized. The closure of the chemical front company was given impetus by the Chemical Weapons Convention, which opened for signature in 1993.

Motivations and Means

The political landscape of South Africa between 1960 and 1990 profoundly influenced the motivations for the creation and development of the country's NBC programs and also the motivations of the individuals who worked for them. Some scientists, especially senior ones in the CBW program, both shared a common political ideology and were influenced by the political situation at the time. The more junior scientists were, as indicated above, not informed about the true nature of the CBW program. Scientists have spoken of the attraction of having sufficient funds and physical resources to pursue cutting-edge research in the chemical, biological, and nuclear areas; and specifically in the nuclear field they worked to keep up with nuclear technology and to maintain scientific prominence.

The above are universal motivations, which would apply to scientists anywhere in the world. But the inevitable secrecy of illicit weapons programs meant that the scientists did not talk about what they were doing with colleagues outside the program or even with their closest family members. They

had only each other with whom to share their justifications for involvement. Thus they were shielded from questions or considerations about the morality of their work. A separate moral economy was inevitable in which the offensive weapons–related work could be weighed in their minds against other work, for example developing vaccines for wildlife, or against the value of scientific advancement.

Together with the motivations of the scientists were the means, provided largely by the state, to enable these programs to flourish. From the 1970s to 1988–89 the political will to support South Africa’s NBC programs did not falter, and money, in the form of high salaries, new laboratories, and research facilities with modern equipment, flowed freely. The programs also ran under fairly loose management: those with a clear interest in them determined their direction and output. As a case in point, weak management of RRL from the mid-1980s meant that scientists justified research into areas that interested them by adding the words “may have military application” to their research proposals.

A similar observation was made about the nuclear weapons program: “According to participants and Western government experts, the [plant’s] success depended principally on the skill and initiative of its scientists and technicians. They went through years of trial and error before producing significant quantities of enriched uranium. Behind this talent was the government’s willingness to provide adequate funding to solve complicated problems.”²⁴

Thus the motivations of the scientists and engineers who worked on South Africa’s NBC programs differed little from those of any individual who finds an interesting field of work. The most significant difference is that in some instances they were violating South Africa’s treaty obligations under the Biological and Toxin Weapons Convention (BTWC) and were following a clear lead from Pretoria to ignore the Nuclear Non-Proliferation Treaty (NPT).²⁵

In the context of the CBW program, treaty obligations were consistently underplayed or not addressed at all by Basson. His reports frequently conflated chemical and biological weapons and placed emphasis on issues relating to chemical agents. By avoiding a discussion of the international implications of biological weapons development, he gave himself the space to pursue an agenda that would have gained him the approval of at least the head of Special Forces, General A. J. (Kat) Liebenberg. A document written by Basson in the 1990s indicates that he believed there was little adherence to the BTWC anyway. “It is also often a problem for the scientists of RRL (who are not trained to think strategically),” he said, “to keep perspective in the light of the renewal of Western attempts to ban chemical and biological weapons. It appears to them that South Africa should abide by these calls. *The fact that no*

country involved is really weighing up the possibility of moving away from biological weapons is not clear to them"²⁶ (emphasis in original).

Although a philosophy was developed with regard to the use of chemical weapons both inside and outside South Africa, there is as yet no document made public that indicates a similar doctrine was developed for the use of biological weapons. Because the focus of the biological program was on the development of weapons for covert assassination, it is extremely unlikely that such a document exists. A document by Basson provides some insight into why this may have been the case. He argues that the SADF's philosophy about using chemical weapons "does not cover any aspects of Biological warfare. Because of the more controlled nature of Biological Warfare [sic] there are many more international control measures. The production of Biological weapons is not allowed anywhere in the world."²⁷ This suggests that there may have been a policy for the development of biological weapons but that given the nature of the ban on biological warfare, it remained unwritten. This is consistent with the way in which the South African security forces operated under apartheid.

As noted by Purkitt and Burgess, it is not unusual for countries operating under a militaristic regime to place national interests ahead of international obligations. It was only in the early 1990s, as a democratic transition became inevitable in South Africa, that the Department of Foreign Affairs took responsibility for international treaty obligations and was able to provide the required reassurance to the international community and ensure that South Africa was no longer considered a proliferator of NBC weapons technology.²⁸

Scientists and the Modern World

One of the challenges of the modern security environment is to try to learn the lessons of history so that measures to prevent proliferation can be put in place. The desire to learn from South Africa's NBC programs is no different. However, as has been noted by others, each state's path in acquiring proliferation technology is unique and often entails the involvement of non-state actors. But as the world is faced with a handful of states remaining outside international non-proliferation and disarmament regimes and as there is an increasing focus on non-state groups that attempt to access weapons of mass destruction material and technology, it seems relevant to attempt to identify examples of past experience that may be relevant to current non-proliferation efforts.

At the level of the state, it is clear that national legislation will not stop states from proliferating if that is their intent. Thus the means that are available to the international community to prevent, combat, and eradicate such

tendencies become a delicate interplay of coercion and threat, with the stakes high that either approach could push a country closer to the brink of proliferation. Analyses of South Africa's decision-making process in deciding to pursue a nuclear program have not yielded any conclusive arguments that one theoretical argument trumped others during the process of deciding to develop nuclear weapons.²⁹ In fact, it has been noted that the "political leadership took advantage of its scientists' eagerness to demonstrate South Africa's technical prowess at a time when the military had no rational operational requirement" to develop a nuclear deterrent.³⁰ A lack of apparent rational decisionmaking would further complicate efforts to engage with states on these issues.

At least within the context of international peace and security, there is a framework within which to operate for those states that willingly participate in international control regimes. But the tendency to want to push states out of these regimes for non-compliance (or not to actively try to keep them in a regime when they are intent on leaving) can make it very difficult to find channels for negotiation. In the case of South Africa, Horton observes that "U.S. policy to minimise proliferation by punishing South Africa for not joining the NPT backfired and resulted in a greater, not reduced proliferation risk."³¹ Waldo Stumpf, who oversaw the dismantlement of the country's nuclear program, makes a similar assertion: "although international political isolation may be an instrument to contain individual cases of nuclear proliferation, a point in such an isolation campaign may be reached where it actually becomes counter-productive and really pushes the would-be proliferators towards full proliferation."³² He argues that this stage was reached in South Africa when the United States cut off its supplies of fuel to the two nuclear reactors in South Africa in the 1970s. "The little leverage the U.S. had over the South African nuclear program was lost."³³ On the other hand, effective means to address suspected or proved violators of agreements are extremely important. States observing the agreements have to ensure that they are effective and that support for them is clearly demonstrated. Otherwise, the argument that "no-one else takes them seriously" becomes an easy justification for non-compliance.

The isolation of South Africa played to its advantage as its programs became more advanced. There were rumors that weapons programs were being pursued, but without confirmation from Pretoria, although individual scientists are known to have spoken to non-South Africans about the programs.

Visitors to South Africa during the 1970s report the AEC scientists were proud of their efforts and privately revealed their nuclear research. They

found the scientists to be well trained and pursuing their work with an attitude of “wanting to show the world what South Africa can do.” Many during this early stage had studied abroad but in later years the opportunities for overseas training and contact through international conferences were severely reduced. This likely contributed to a highly parochial worldview on their part but does not appear to have impeded their technical skills. . . .³⁴

Such isolation also reinforces perceptions of insecurity and external and internal threat. The resulting national security assessments are often what tips the balance toward proliferation. In contrast a change in such assessments toward a more secure environment (whether real or perceived) can mean the reversal or cancellation of weapons programs. But Stumpf also notes that the “roll-back option” South Africa followed for threshold non-nuclear-weapon states “is not an easy path to follow as the NPT and its associated instruments were not designed to deal with such an eventuality.”³⁵

At the level of individuals, the motivations discussed above remain relevant to countries other than South Africa. Their calculation may be based on financial inducements, prestige, and career advancement or on a strong belief in a political cause. Whatever the reason, if the individual perceives that the benefit ultimately outweighs the cost, then proliferation of technology and knowledge may be the result.

To elaborate all the possible responses to such a wide range of challenges is beyond the scope of this chapter. Nonetheless, one very clear lesson can be drawn from South Africa's experience. This is the need for strong, mutually reinforcing NBC regimes and approaches that combine oversight and enforcement with international cooperation and technical assistance, which in turn encourage states to pursue a peaceful path of nuclear technology and commercial-only chemical and biotechnology industries. These regimes should be entrenched at national, bilateral, regional, and multilateral levels so that the options for negotiation and acquiescence are greater. UNSCR 1540 has such an approach because its effectiveness depends on national and international enforcement and also on other means of cooperation in trying to stem possible proliferating activities by non-state actors.

Conclusion

The South African experience of WMD development, while small-scale, illustrates that states will pursue policy options that are in their best security

interests. In this example, it was not only South Africa that set aside its international commitments in order to develop weapons programs for its security needs but also Western nations that put their security concerns ahead of the need to uphold these obligations.

The international security environment has set unprecedented challenges for controlling the spread of weapons, especially NBC programs. At one level, countries concentrate on the need to prevent the spread of technology and equipment that may assist in the manufacture of WMD while they ignore or find too difficult the need to deal with knowledge and its transfer by individuals. There remain countries, and actors within countries, who are focused on attaining illicit weapons at any cost and by any means. But, as seen in the case of South Africa, it is also important to concentrate on those who conceptualize and implement the programs, that is, the scientists and the engineers. With the universal and mandatory requirements of UNSCR 1540, states not willing to comply with the Resolution are now under increasing pressure to explain actions that might be seen to involve proliferating activities by members or groups on their territory.

South Africa remains unique in its renunciation of all three of its WMD programs in the early 1990s. The programs were halted and dismantled, and the scientists and engineers were left to go into private business or to find new lines of work. They were not retrained and reemployed in order to ensure that their knowledge and expertise were not used for illegal purposes in the future. This was due to a range of factors, including national political sensitivities. The post-1994 ANC government was lampooned by the national press when it was discovered that Wouter Basson had been reemployed by the military. The fact that his reemployment was at the request of the American and British governments, which were concerned about his potential role in assisting proliferation in Libya, was not taken into consideration in the court of public opinion. What South Africans saw was that the post-apartheid government was prepared to employ and pay a man believed to have been responsible for gross human rights violations. The large-scale reemployment of scientists from the NBC programs would have found little support from ANC supporters and would have been very difficult for the ruling party to justify to the electorate.

There is no single factor, be it an international treaty, national legislation, or a code of conduct for scientists, that will be sufficient to deter a country or group intent upon proliferation from pursuing an option that it believes is in its or its country's best security interests. The primary lesson for disarmament from the South African experience is that deterrents on many levels are

required in order to increase sufficiently the disincentive for individuals as well as states to seek weapons of mass destruction.

Notes

1. See, for example, Lt. Col. Roy E. Horton III, "Out of (South) Africa: Pretoria's Nuclear Weapons Experience," USAF Institute for National Security Studies, Occasional Paper 27, August 1999; D. Albright, "South Africa's Secret Nuclear Weapons," ISIS Report, May 1994; Waldo Stumpf, "Birth and Death of the South African Nuclear Weapons Programme," paper presented at the conference "50 Years after Hiroshima," September 28–October 2, 1995, Unione Scienziati per il Disarmo, at www.fas.org/nuke/guide/rsa/nuke/stumpf.htm; Peter Liberman, "The Rise and Fall of the South African Bomb," *International Security*, Vol. 26, No. 2 (Fall 2001), pp. 45–86; and Chandré Gould and Peter Folb, *Project Coast: Apartheid's Chemical and Biological Warfare Programme*, UNIDIR, 2002.

2. Quoted in Jacklyn Cock and Laurie Nathan (eds.), *War and Society: The Militarisation of South Africa* (Cape Town: David Philip, 1989), p. xiii.

3. Testimony of General Lothar Neethling in the transcript of the Truth and Reconciliation Commission hearing into chemical and biological warfare, Cape Town, June 11, 1998.

4. Jeremy Grest, "The South African Defence Force in Angola," in Cock and Nathan (eds.), *War and Society*, p. 116.

5. NTI, South Africa profile, at www.nti.org/e_research/profiles/SAfrica/Nuclear/index_2153.html.

6. Liberman, "The Rise and Fall of the South African Bomb," fn. 1, p. 49. In 1977 it was suspected that South Africa was planning an underground cold test. In response to strong protests by the United States, the Soviet Union, and France, the government canceled the test. The resulting sanctions and the cancellation of U.S. cooperation pushed South Africa from a "peaceful nuclear explosives" approach to a more aggressive, weapons-focused research and development program, initially under the Atomic Energy Board and then Armscor, the state weapons agency.

7. As quoted in Liberman, "The Rise and Fall of the South African Bomb," p. 53.

8. *Idem*.

9. *Ibid.*, p. 59.

10. *Ibid.*, p. 52.

11. David Albright, "South Africa's Secret Nuclear Weapons," ISIS Report, May 1994, p. 9, at www.isis-online.org/publications/southafrica/ir0594.html.

12. *Ibid.*, p. 1.

13. "South Africa's Nuclear Autopsy," *The Risk Report*, Vol. 2, No. 1 (January–February 1996), Wisconsin Project on Nuclear Arms Control, at www.wisconsinproject.org/countries/safrica/autopsy.html.

14. Correspondence with A. Buys, December 10, 1999, as quoted in Liberman, "The Rise and Fall of the South African Bomb," p. 55.

15. *Ibid.*, p. 56.

16. In September 1988 South Africa sent a letter to the then director general of the International Atomic Energy Agency (IAEA), Hans Blix, expressing its willingness to accede to the Nuclear Non-Proliferation Treaty if certain conditions were met, primarily that South Africa be allowed to market its uranium subject to IAEA safeguards. The dismantlement of the program quickly followed, and was completed two years before President de Klerk announced in 1993 that South Africa had had a nuclear weapons program.

17. Helen Purkitt and Stephen Burgess, "Paths to Disarmament: The Rollback of South Africa's Chemical-Biological Warfare and Nuclear Weapons Programs," paper presented at the 2001 annual meeting of the International Studies Association, p. 7, at www.isanet.org/archive/disarm.html.

18. Affidavit of Dr. André Immelman to the Truth and Reconciliation Commission, Pretoria, June 4, 1998.

19. *Idem.*

20. Chandré Gould and Marlene Burger, *Secrets and Lies: Wouter Basson and South Africa's Chemical and Biological Warfare Programme* (Cape Town: Zebra Press, 2002), pp. 36–37.

21. All RRL research proposals had to be authorized by the departmental head and the head of research (in this case Mike Odendaal and Schalk Van Rensburg).

22. Purkitt and Burgess, "Paths to Disarmament," p. 7.

23. Dr. Ian Phillips, African National Congress defense expert, quoted in *ibid.*, p. 7.

24. *Ibid.*, p. 4.

25. South Africa signed the Nuclear Non-Proliferation Treaty only in 1991, but it had been a party to the treaty negotiations and had held a seat on the International Atomic Energy Agency's board of governors until 1977–78, when it was suspended owing to its nuclear ambitions. It was later barred from participating in the IAEA's general conference. South Africa signed the BTWC in April 1972 and ratified it in November 1975, well before it initiated the biological weapons program.

26. Wouter Basson, *Authorisation for the Sale of Assets: Project Coast*, document written for the purpose of securing the authorization of the minister of defense, Magnus Malan, for the privatization of RRL (HSF/UG/302/6/C123), SADF Top Secret document, August 19, 1991.

27. Wouter Basson, "Presentation to the Reduced Defence Command Council: Proposed Philosophy for Secret Chemical Warfare for the South African Defence Force—Principles and Feedback on Current Status in the SA Defence Force," October 3, 1990, South African History Archives.

28. Purkitt and Burgess, "Paths to Disarmament," p. 16. It has also been noted that the negotiation of the Chemical Weapons Convention, with a strict compliance regime, convinced South Africa that it would not be able to sustain a clandestine chemical weapons production capacity, thus hastening that program's closure.

29. For discussion, see, for example, Liberman, "The Rise and Fall of the South African Bomb," and Purkitt and Burgess, "Paths to Disarmament."

30. Horton, "Out of (South) Africa," p. 15.
31. *Ibid.*, p. 14.
32. Stumpf, "Birth and Death of the South African Nuclear Weapons Programme."
33. *Ibid.*
34. Horton, "Out of (South) Africa," p. 5.
35. Stumpf, "Birth and Death of the South African Nuclear Weapons Programme."