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# South Africa's SAFARI

## From nuclear weapons to nuclear medicine

*Since the verification of the termination of its nuclear weapons programme and the dismantling of its nuclear devices and facilities, South Africa has succeeded in converting its defensive nuclear posture to the employment of nuclear energy for peaceful uses, such as power generation and nuclear medicine. In respect of the latter, South Africa has skilfully crafted a global niche for itself. Building on its nuclear expertise, South Africa has become one of the world's leading producers of medical isotopes – an under-researched area in South Africa's nuclear and economic diplomacy – which are used in a variety of medical diagnostic and therapeutic procedures.*

*Moreover, South Africa has succeeded in producing these isotopes from low-enriched, rather than highly enriched uranium; adding further credence to its nuclear non-proliferation commitments. By converting its nuclear reactor, SAFARI-1, to produce and supply medical isotopes, South Africa has gained numerous material and non-material gains, ranging from foreign exchange to status and prestige.*

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In Africa, South Africa is the first country to own and operate a nuclear reactor and a nuclear power station. It is also the first African country to acquire a nuclear weapons programme that produced nuclear devices. The South African government owns and operates three nuclear reactors, namely, a research reactor SAFARI-1 and two nuclear power reactors, Koeberg 1 and Koeberg 2. The latter have been operational since 1984 and 1985 respectively. More recently, South Africa has become Africa's leader in nuclear medicine and the use of radioactive material to, inter alia, protect the continent's water resources and food safety. How and why did this nuclear defensive country change its focus from nuclear weapons to the peaceful use of nuclear energy?

The termination and dismantlement of South Africa's nuclear weapons and weapons installations was verified as complete by the International Atomic Energy Agency (IAEA) in 1993. This brought an end to decades of denial by the South African government of the existence and extent of the nuclear weapons programme. Coinciding with the end of the Cold War proxy wars in Southern Africa and South Africa's internal democratic transition, the termination of the nuclear weapons

programme occurred at a significant period in South Africa's history, that is, a period of a commitment to the non-proliferation of nuclear weapons, nuclear disarmament and the peaceful uses of nuclear energy as enshrined in the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) which South Africa acceded to in 1991.

With its stated commitment to the peaceful uses of nuclear energy, South Africa realigned its nuclear infrastructure, and nuclear diplomacy, accordingly. One area in which post-apartheid and post-nuclear weapons South Africa succeeded significantly, is in the field of nuclear medicine. In this medical field, radioactive material, in particular medical isotopes, is used for diagnostic and therapeutic purposes, to image the heart, brain and skeleton, and to diagnose and treat medical conditions such as cancer, arthritis, liver, tumours and lung conditions.<sup>1</sup> The isotope Molybdenum-99 (Mo-99 or <sup>99</sup>Mo) is the most commonly used isotope of approximately 1 800 radioisotopes. Of these 1 800, up to 200 radioisotopes are used regularly and most must be produced artificially. With a half-life of only 66 hours, Mo-99 is used as the 'parent' in a generator to produce another medical isotope, technetium-99m.

The importance of nuclear medicine to global human health and, thus, human development is illustrated by the extent of its application. In the United States (US), for example, 18 million nuclear medicine procedures are conducted on 311 million people annually. In Europe, about 10 million procedures among 500 million people are conducted annually. With the use of radiopharmaceuticals in diagnosis growing at over 10% annually and a recent global isotope shortage, the supply and demand of these resources have become a major trading commodity between countries; especially in the case of South Africa.<sup>2</sup> Above all, the Mo-99 market is worth

about US\$5 billion per year.<sup>3</sup> During the 2009 to 2010 isotope supply crisis, South Africa was able to supply 25 per cent of the global supply of Mo-99.<sup>4</sup> Therefore, the purpose of this article is to focus on a particular – and under-researched – aspect of South Africa's post-apartheid nuclear and diplomacy, that is, the country's position in the international political economy of medical isotopes until 2012. The aim is also to establish South Africa's commitment to nuclear non-proliferation and the peaceful uses of nuclear energy as envisaged in the NPT.

## Origins and Development of Nuclear Science in South Africa

The origins of South Africa's atomic and nuclear science and diplomacy date back to the period prior to the outbreak of the Second World War when the prime minister of the United Kingdom (UK), Winston Churchill, requested the then South African prime minister, Jan Smuts, to conduct a geological survey of South Africa's uranium resources in order for the UK to secure uranium for its own nuclear programme. Donald Sole, a South African diplomat at the time, explained in his memoirs that the 'genesis of South Africa's atomic energy policy' could be traced back to a meeting in May 1944 between South Africa's prime minister, General Jan Smuts, and the Danish nuclear scientist Niels Bohr.<sup>5</sup> After the end of the Second World War, South Africa became a founding member of the multilateral IAEA created under the auspices of the United Nations (UN). In 1948, South Africa established the Atomic Energy Board (AEB), the forerunner of the Atomic Energy Corporation (AEC), currently known as the Nuclear Energy Corporation of South Africa (NECSA).

The origins of nuclear medicine in South Africa can be traced back to 27 July 1948

when the country first imported radioisotopes. This was followed in 1952 when the Pretoria General Hospital (now the Steve Biko Academic Hospital) bought a sodium iodide counter. The National Conference on Nuclear Energy: Application of Isotopes and Radiation, which took place in Pretoria in 1963, provided additional impetus for the development of radiotherapy as an established medical discipline in South Africa.<sup>6</sup> This was followed by the installation of the first rectilinear scanner at the Council for Scientific and Industrial Research (CSIR) in 1964. Another milestone was the commissioning of SAFARI-1 in 1965 which introduced the country's radioisotope production programme (which was expanded into the Isotope Production Centre on 18 March 1981). In 1969, a gamma camera was installed at the Pretoria General Hospital. This resulted in the development of nuclear medicine as a specialisation separate from radiology. The South African Society of Nuclear Medicine (SASNMM), which was established in 1974, is the oldest such institution in Africa. Currently, seven of the country's teaching hospitals have a Department of Nuclear Medicine and the specialisation is practised in private hospitals.<sup>7</sup>

In 1957, South Africa's nuclear science and nuclear diplomacy developed under the aegis of the IAEA's Atoms for Peace programme. This was the result of the South African government's bilateral nuclear collaboration agreement with the US, the US–South African Agreement for Co-operation. This resulted in South Africa's acquisition of a nuclear research reactor, the South African Fundamental Atomic Research Installation (SAFARI-1), and an assured supply of highly enriched uranium (HEU) fuel for the reactor.<sup>8</sup>

Between 1969 and 1979, all research and development on South African nuclear explosive devices was undertaken by the AEB. In

1979, this responsibility was transferred to the Armaments Corporation of South Africa (Armcor), which operated from its so-called Circle facilities, 15 kilometres from Pelindaba (west of Pretoria) where the AEC was located. The AEC, however, remained responsible for the production and supply of HEU and for theoretical and development studies on nuclear weapons technology.<sup>9</sup>

Initiated in 1960 as a 20 megawatt (MW) tank-in-pool type light water reactor and inaugurated by Prime Minister Hendrik Verwoerd in 1965, the SAFARI-1 nuclear reactor was the first nuclear reactor on the African continent. By the 1970s, South Africa's international isolation and domestic instability increased due to the global condemnation of and domestic opposition to its policy of apartheid.<sup>10</sup> As a result the country's nuclear diplomacy entered a new stage. This included UN sanctions against South Africa, its suspension from the IAEA Board of Governors and secret nuclear-related bilateral relations with declared nuclear weapons states (NWS), including the US, the UK, France and Israel. In 1976 an international embargo was instituted against the supply of nuclear fuel to SAFARI-1. This did not deter the South African government from using SAFARI-1 to commence with uranium enrichment, inter alia, for its nuclear weapons programme.<sup>11</sup>

Although South Africa's nuclear explosives programme was 'officially still aimed at peaceful uses until about 1977 ... the emphasis changed officially to a strategic deterrent capability'.<sup>12</sup> As an adjunct of this shift, in April 1978 Prime Minister John Vorster approved a three-phase nuclear deterrent strategy for South Africa. More pertinent were the results of the South African nuclear weapons programme that underpinned the deterrent strategy. The first South African 'device' was completed in 1978 with more 'devices' completed at an

'orderly pace of less than one per year'.<sup>13</sup> The first aircraft-deliverable vehicle was completed in 1982. Eventually, six 'nuclear devices' were produced.<sup>14</sup> By the end of the 1980s, the Cold War had ended and, with it, the Soviet Union's involvement in African conflicts and support of national liberation movements on the continent. Consequently, efforts to find a lasting solution to the conflicts in Southern and South Africa increased.

## Atoms and the South African Transition

Subsequent to his election as South African president on 14 September 1989, FW de Klerk 'instructed that an investigation be carried out to dismantle the nuclear deterrent completely with the aim of acceding to the NPT as a state without a nuclear weapons capability'.<sup>15</sup> A first report on the matter was submitted to President De Klerk in November 1989 and he subsequently appointed an Experts Committee under the chairmanship of Professor Wynand Mouton, a nuclear physicist, to outline procedures for dismantling and destroying South Africa's 'nuclear devices'.<sup>16</sup> These developments paved the way for a new phase in South Africa's nuclear diplomacy and for South Africa's greater involvement in nuclear export regimes.

In early 1990, the De Klerk government decided that

... all the nuclear devices should be dismantled and destroyed; all the nuclear material in Armscor's possession be recast and returned to the AEC where it should be stored according to internationally accepted measures; Armscor's facilities should be decontaminated and be used only for non-nuclear commercial purposes; after which South Africa should accede to

the Non-Proliferation Treaty, thereby submitting all its nuclear materials and facilities to international safeguards.<sup>17</sup>

An immediate task of the South African government after the 1989 decision to terminate the nuclear weapons programme was to decommission several nuclear weapons facilities in preparation for inspections by the IAEA whilst maintaining the safety and security of the country's nuclear weapons equipment and stocks of HEU. More importantly, South Africa had to convince the international community of the sincerity of its intentions regarding nuclear non-proliferation. Apart from these developments, South Africa was also in the early phases of its political transition to democratic rule.

On 2 February 1990, President De Klerk announced that his government had unbanned the African National Congress (ANC) and other liberation movements, and would release Nelson Mandela (on 12 February 1990) and other political prisoners. These events ushered in a new political and diplomatic era for the country. Of particular importance was De Klerk's announcement that South Africa would suspend its nuclear weapons programme which paved the way for the country's accession to the NPT in 1991.

On 24 March 1993, President FW de Klerk announced the extent of South Africa's nuclear weapons programme to the South African Parliament. The decision set in motion not only speculation about the 'voluntary' nature of South Africa's intention to dismantle its nuclear weapons programme, but also the public announcement of the scope of this nuclear weapons programme. Barely a month later 26 South African parties established the Multi-party Negotiating Forum which subsequently adopted the constitutional principles that formed

the foundation of the South African Interim Constitution and initiated the Transitional Executive Council (TEC) to prepare the country for its first inclusive democratic elections in April 1994. This resulted in the establishment of a Government of National Unity (GNU) under the leadership of Nelson Mandela, the President of the ANC.<sup>18</sup> Apart from including the dismantling of its nuclear weapons programme, the post-1990 period has been most dynamic in terms of South Africa's international relations and diplomacy. During this period it established numerous bilateral relations; acceded to the NPT in 1991; and joined or re-joined several nuclear-related organisations, including the IAEA. These developments resulted in the termination of sanctions and embargoes against South Africa, ended the country's global isolation and resulted in changes in its nuclear-related relations. In the so-called 'Completeness Report' by the Director General of the IAEA to the Agency's General Conference (GC) on 9 September 1993, the Agency referred to the 'destruction of equipment used in the development and making of the nuclear weapons' and to the 'termination of the programme'.<sup>19</sup>

In 1993, prior to the 1994 democratic elections the South African government commenced the alignment of the country's international nuclear non-proliferation position with its domestic legislation. The promulgation of the Non-Proliferation of Weapons of Mass Destruction Act 87 of 1993, as amended in 1995 and 1996, on 23 June 1993 was not only one of the last nuclear-related policy actions of the NP government under President FW de Klerk but, in its amended form, was one of the first nuclear-related policy actions of the President Nelson Mandela-led GNU in South Africa. South Africa thus became one of a few countries to have terminated its nuclear weapons programme – others being Brazil and Libya.

## Atoms and the ANC

Prior to 1990, an active pro-ANC anti-nuclear civil society movement operated outside the country, especially in the UK and at the UN under the leadership of Abdul Minty, who later became South Africa's diplomatic representative at the IAEA.<sup>20</sup>

The development of domestic nuclear non-proliferation export controls in South Africa has occurred in tandem with South Africa's diplomatic initiatives and legal commitments to nuclear non-proliferation since 1990. Writing prior to the institution of the GNU in his now oft-quoted article in *Foreign Affairs*, Nelson Mandela outlined the 'pillars' of South Africa's post-1994 foreign policy, which included human rights; the promotion of democracy worldwide; global peace 'including effective arms-control regimes'; a focus on Africa; and economic development based on international cooperation.<sup>21</sup>

Speaking at the Conference on Nuclear Policy for a Democratic South Africa in February 1994 (a few months prior to the ANC's accession to power), Trevor Manuel stated:

We [the ANC] need to state unambiguously that the African National Congress does not want a nuclear weapons capability in South Africa. We have endorsed the OAU [Organisation of African Unity] declaration calling for the African continent to be a nuclear weapon-free-zone. The ANC has also endorsed the Nuclear Non-Proliferation Treaty.<sup>22</sup>

Years later, Manuel's view was confirmed by South Africa's second post-1994 Minister of Foreign Affairs, Nkosazana Dlamini-Zuma, who admitted that the ANC government

at that early stage [1994] already adopted a policy whereby South Africa should be an

active participant in the various non-proliferation regimes and suppliers groups; adopt positions publicly supporting the non-proliferation of weapons of mass destruction with the goal of promoting international peace and security; and use its position as a member of the suppliers' regimes and of the Africa Group and the Non-aligned Movement to promote the importance of non-proliferation and to ensure that these controls do not become the means whereby developing countries are denied access to advanced technologies required for their development.<sup>23</sup>

Once the ANC came to power after the country's first ever democratic elections in April 1994, international sanctions and embargoes against South Africa were lifted. Diplomatically, the country returned to multilateral organisations and established numerous new bilateral relations. One of the areas in which post-apartheid South Africa gained global status and prestige relates to its termination of its nuclear weapons programme as well as the ANC-led government's position on nuclear disarmament and nuclear non-proliferation.<sup>24</sup>

Apart from adopting a human rights-based foreign policy, the ANC-led South African government reiterated that a 'primary goal' of South Africa's foreign policy is to 'reinforce and promote it as a responsible producer, possessor and trader of defence-related products and advanced technologies in the nuclear, biological, chemical and missile fields'.<sup>25</sup> Moreover, it is South Africa's 'declared national interest in conjunction with its international obligations and commitments, particularly as these relate to non-proliferation, disarmament and arms control, and the implementation of international humanitarian law, to exercise due restraint in the transfer and trade in weapons and related materials, equipment, technology and services'.<sup>26</sup>

The government's argument was that South Africa, in this way, 'promotes the benefits which non-proliferation, disarmament and arms control hold for international peace and security, particularly to countries in Africa and the Non-Aligned Movement (NAM)'.<sup>27</sup> The South African government also acknowledged the competitive nature of the international nuclear-related market and that it wants to be regarded as a 'responsible and reliable supplier of weapons and related materials, equipment, technology, aid and services'.<sup>28</sup>

## Nuclear Energy and Policy in Post-apartheid South Africa

The Nuclear Energy Act 46 of 1999 provides, inter alia, for the establishment of NECSA as the successor of the NP-era's AEC. State-owned NECSA is the owner-operator of SAFARI-1. NECSA also has two commercial subsidiaries, namely, NTP Radioisotopes SOC Limited (NTP), which sells radiation-based products and services, and Pelchem SOC Limited (Pelchem), which supplies fluorine and fluorine-based products. With customers in 60 countries, the NTP Group consists of a number of subsidiaries, including AEC-Amersham SOC Limited (100 per cent owned by NTP), NTP Logistics SOC Limited (51 per cent shareholding), and Gammatec NDT Supplies SOC Limited (55 per cent shareholding). NTP's products and services include:

- Radiopharmaceuticals, which are used for diagnostic and therapeutic purposes in nuclear medicine. NTP's products include NovaTec-P generator, fluorodeoxyglucose (FDG) for Positron Emission Tomography (PET), cold kits and Iodine-131 (I-131) capsules and solutions.
- Irradiation services such as the neutron transmutation doping of silicon ingots

performed to customer specification in the SAFARI-1 reactor.

- Radiochemicals, which are produced in bulk and used by NTP and its customers for the manufacturing of radiopharmaceutical products.
- Radioactive sealed sources for industry, such as the isotopes Iridium-192 (Ir-192), Cobalt-60 (Co-60) and Cesium-137 (Cs-137), which are used in non-destructive testing, industrial gauging and process control applications.<sup>29</sup>

In terms of section 33(1) of the Nuclear Energy Act 46 of 1999, the Minister of Energy is responsible for the implementation of the country's Safeguards Agreement and Additional Protocols. The Ministry of Energy has delegated this function to NECSA. NECSA, therefore, also executes South Africa's international obligations in terms of the Zangger Committee, a voluntary multilateral nuclear control organisation. In addition to this, the main functions of NECSA are to 'undertake and promote research and development in the field of nuclear energy and radiation sciences and technology; to process source material, special nuclear material and restricted material; and to cooperate with persons in matters falling within these functions'.<sup>30</sup>

The South African government also expressed its intention to develop its nuclear industry in its National Nuclear Energy Policy (2008) and in its Ten Year Plan for Science and Technology (2007).<sup>31</sup> In 2008, the Minister for Minerals and Energy stated that the National Nuclear Energy Policy 'represents the Government's vision for the development of an extensive nuclear energy programme' in order to develop a national nuclear architectural capability to 'supply nuclear equipment and nuclear reactors' as well as the 'ability to design, manufacture, and market, commercialise,

sell and export nuclear energy systems and services'.<sup>32</sup>

## The SAFARI-1 Conversion

By the time the ANC came to power as the first democratically elected governing party after the April 1994 elections, South Africa no longer possessed nuclear weapons and a nuclear weapons programme. However, the country maintained some of its nuclear-related capabilities through the operation of the country's research reactor, SAFARI-1. However, the international community was not at ease with South Africa's nuclear intentions. These concerns were amplified when the international community realised that the post-1994 South African government was slow in its efforts to convert the country's nuclear research reactor (SAFARI-1) at Pelindaba from using HEU (which can be used for nuclear weapons) to using low-enriched uranium (LEU). This conversion was only achieved by 2009 considering that the conversion process began as early as 1994.<sup>33</sup>

Following the post-1994 developments, the diplomatic focus between South Africa and the IAEA also shifted to the conversion of SAFARI-1 from HEU to LEU, as some IAEA members remained cautious of South Africa's nuclear intentions. By 1993, SAFARI-1's operations shifted from military purposes to commercial applications, especially producing medical isotopes, using weapons-grade HEU from South Africa's inventory verified by the IAEA.<sup>34</sup> However, the IAEA demanded the conversion of the nuclear reactor; an issue South Africa was hesitant to address as SAFARI-1's HEU-based operations provided South Africa with considerable scientific status and prestige; valuable income from its isotope production; and even some deterrent status. Subsequent to

the diplomatic efforts of the IAEA, the South African government authorised the conversion of SAFARI-1 in July 2005 and financed the conversion to the amount of R12 million per annum for three years.<sup>35</sup>

The original conversion process was to be completed over three to four years in two main phases, namely, the establishment of a local LEU manufacturing capability, which NECSA manufactured, and the conversion of the SAFARI-1 core from HEU to LEU fuel.<sup>36</sup> By 2010, the latter phase had already resulted in NECSA producing 83 LEU fuel elements and 18 control rods.<sup>37</sup>

By 2008, NECSA reported that 'good progress' had been made with the conversion of SAFARI-1 through a cooperation agreement with AREVA-CERCA, a French state-owned nuclear power utility which provided NECSA with LEU fuel plates.<sup>38</sup> On 25 June 2009, SAFARI-1 used LEU for the first time since it went critical on 18 March 1965.<sup>39</sup> Announcing the successful conversion, NECSA stated that the conversion was 'in line with international norms to reduce proliferation risks' and that it would 'enable' South Africa to promote South African products as 'non-proliferation compliant' and enable 'preferential treatment' in key markets such as the US, and in other international joint ventures.<sup>40</sup> This statement correlates with Colby's observation that states base the conversion of their nuclear reactors on economic, political, military and technical considerations.<sup>41</sup>

## The Economic and Diplomatic Gains of the Conversion Process and Isotope Production

### Averting the 'world's worst medical crisis'

From the end of 2007, a series of unscheduled shut-downs and outage extensions of nuclear reactors disrupted the global Mo-99 supply.<sup>42</sup> The

medical radioactive isotope Mo-99 is used in diagnostic tests for illnesses such as cancer and heart disease. According to the IAEA, this created a 'worldwide Mo-99 supply crisis'.<sup>43</sup> NECSA called it the 'world's worst medical crisis in decades'. An unscheduled closure of Canada's NRU research reactor in May 2009 exacerbated the crisis, which continued well into 2010.

Unaffected by shut downs and outages, SAFARI-1 was able to continue its operations. This enabled NTP to produce isotopes and expand its global reach.<sup>44</sup> Moreover, since SAFARI-1's conversion to using LEU, South Africa has become the only country to produce Mo-99 on an industrial scale based on LEU.<sup>45</sup> In 2010, the IAEA acknowledged that subsequent to the conversion of SAFARI-1, South Africa has become the world's 'first large scale' producer of Mo-99, whereas it was only the world's third largest isotope producer in 2007.<sup>46</sup> Moreover, in 2010, the IAEA recognised SAFARI-1 as one of the world's major five isotope producers.<sup>47</sup>

In 2010, South Africa (NTP), Canada (MDS Nordion), Belgium (Institut National des Radioéléments), France (Osiris) and The Netherlands (Covidien) produced 95 per cent of the medical isotope Molybdenum-99 (Mo-99). These reactors are all more than 40 years old. Other Mo-99 producing countries include Australia, Argentina, China, Malaysia, Brazil, Russia, Poland, France, India, Kazakhstan and Uzbekistan.<sup>48</sup>

### Earning foreign exchange

From 2009 to 2010, NECSA's subsidiary, NTP Radioisotopes (Property) Limited (NTP), earned South Africa considerable foreign exchange amounting to R623 million, exceeding its sales target for the period by 21 per cent.<sup>49</sup> Moreover, the NECSA statement is indicative of the strategies of cooperation and partnership, especially as they relate to South Africa's relations with the

IAEA.<sup>50</sup> More important than the aforesaid considerations are the diplomatic considerations of, and diplomatic 'returns' on, the conversion.<sup>51</sup>

With Mo-99 and Iodine-131 as its main products, NTP is NECSA's main source of external revenue. In 2010, the NTP Group's sales amounted to R795 million. This was 46 per cent more than its estimated sales and resulted in the Group becoming the world leader in the supply of medical isotopes.<sup>52</sup> This success continued into 2011 when the Group's sales amounted to R869 million.<sup>53</sup> In 2012, NTP's sales dropped to R842 million as other reactors started production.<sup>54</sup> NECSA ascribed this drop to 'an aggressive effort by competitors' to regain market share following their extended absence due to the 18-month long unscheduled shut down of the NRU reactor. This was further aggravated by the decline in the global demand for Mo-99 and the global financial crisis.<sup>55</sup>

### Status and prestige

For South Africa, the successful conversion was beneficial in non-material terms. Not only did it receive international recognition from the IAEA, but its status and prestige were advanced by the scientific expertise, as well as by the moral authority, associated with the conversion. By April 2010, during President Obama's Nuclear Security Summit (NSS) in Washington, South Africa announced that it 'quite ambitiously, had not only adopted a national policy of HEU-free production of medical isotopes – that is, using only LEU for both fuel and targets – but it also had developed the technology to carry it out'.<sup>56</sup> In 2010, NECSA announced that its subsidiary, NPT Radioisotopes, had become the first and only company in the world producing the medical isotope Mo-99 on a commercial scale using LEU-based technology.<sup>57</sup>

The South African Minister of Energy also observed that South Africa 'will be the first

radioisotope producing country to have completed this conversion process, which is a requirement for supplying radioisotopes into certain key markets'.<sup>58</sup> Reporting on South Africa's activities to the 54th Session of the IAEA General Conference, Ambassador Minty announced that, since July 2010, South Africa had been the world's largest supplier of Mo-99 based on LEU.<sup>59</sup> Subsequently, the IAEA recognised South Africa's conversion of SAFARI-1 to LEU as the 'first step' towards LEU target conversion by a 'major' <sup>99</sup>Mo producer.<sup>60</sup>

### Norm entrepreneurship and leadership

Through SAFARI-1's conversion, South Africa has contributed to a redefinition of the term 'nuclear symbolism', which previously referred to the idea that a state's nuclear weapons capability 'symbolizes a strong, independent and modern state'. By referring to the LEU requirements set by some isotope-importing countries with which South Africa now complies, NECSA has added 'nuclear leverage' to South Africa's nuclear diplomacy.<sup>61</sup> Through the conversion, the country also acts as a norm entrepreneur as a state that previously had a HEU-based nuclear weapons programme. In addition to this, it has become a country that produces medical and other isotopes from LEU, thereby illustrating its commitment to nuclear non-proliferation and the peaceful uses of nuclear energy. With this, South Africa has consolidated its identity as a major nuclear power and moral authority in the developing world.

In terms of Young's leadership autonomy, South Africa has displayed at least two out of three types of leadership in the multilateral nuclear export regimes.<sup>62</sup> Young's first type of leadership is structural leadership. This is exhibited when leaders, or a leading country, make decisions about the resources available to them to achieve a multilateral bargain. With regard to

South Africa's role in exposing the Khan network, South Africa cooperated with the IAEA after investigations of a South African connection to the Khan nuclear non-proliferation network.<sup>65</sup> The South African government has admitted that South Africa's experience has 'shown that no control regime, no matter how comprehensive, can fully guarantee against abuse'.<sup>64</sup>

Secondly, entrepreneurial leadership refers to leaders who are not in a position of power but nonetheless use their diplomatic negotiating and bargaining skills to achieve a particular outcome. South Africa has positioned itself as a norm entrepreneur.<sup>65</sup> Moreover, South Africa has also positioned itself as a 'responsible possessor, producer and trader' in dual-use goods.<sup>66</sup> South Africa's norm construction in its nuclear diplomacy is evident in the South African government's legislation and policies on nuclear non-proliferation, disarmament and arms control that incorporate the obligations of, amongst others, the NSG and the Wassenaar Arrangement (WA). South Africa has incorporated these obligations sometimes prior to its accession to or membership of these conventions or groups.

Finally, intellectual leadership can change the normative or ideational environment to create opportunities for the achievement of a particular objective.<sup>67</sup> South Africa has styled itself to be, and gained global recognition as, a leader in the global nuclear arena. Some global recognition for South Africa's nuclear non-proliferation efforts has occurred. In January 2010, South Africa 'has emerged as a champion of both global nuclear non-proliferation and equal access to peaceful nuclear energy'.<sup>68</sup>

### Niche diplomacy

Typically, states practising niche diplomacy focus on a specifically selected issue, product, service, organisation or activity. South Africa is no exception in this regard. The sources of South

Africa's niche diplomacy are located in the tenets of middle power diplomatic behaviour, which therefore provides a strong normative foundation and emphasises the country's entrepreneurial flair and technical expertise. Other key features of South Africa's niche diplomacy are its focus on consensus and coalition building, cooperation on nuclear issues, and adopting the role of bridge-builder (between Africa and the NWS), mediator, facilitator or catalyst (changing its nuclear posture) in nuclear issues. The latter involves South Africa's planning, convening and hosting meetings, prioritising for future meetings on a particular issue and drawing up declarations and manifestos.

### Nuclear non-proliferation

In the wake of 9/11, international concerns about the threat of nuclear terrorism increased. Through its Nuclear Security Plan 2006–2009, the IAEA and its members cooperated to improve nuclear security worldwide and counter illicit nuclear trafficking.<sup>69</sup> One of these efforts was to shift the use of HEU to LEU in commercial applications through the conversion of nuclear reactors. However, these initiatives were preceded by IAEA diplomatic efforts to influence the South African government to convert South Africa's nuclear research reactor, SAFARI-1, from using HEU to LEU.

### North–South cooperation

On the issue of strengthening North–South cooperation, South Africa has used its position as a member of the IAEA Board to cooperate and form partnerships with traditional diplomatic partners of the North. Addressing the National Assembly on 18 May 1995, Minister of Foreign Affairs Alfred Nzo highlighted some of South Africa's earliest foreign policy dilemmas, namely, balancing relations between the developing and industrialised countries while South Africa

sought to expand its relations with Africa and the developing world.<sup>70</sup> Nzo cautioned that South Africa cannot afford to 'overlook or downgrade the importance of the industrialised countries' to South Africa's national interests. Moreover, South Africa also advocated that IAEA members from developed countries should assist members from developing countries to comply with the IAEA Statute and with other IAEA obligations. However, South Africa's conversion of SAFARI-1 to use LEU provides a very good indicator of North-South cooperation, as well as cooperation and partnerships in the IAEA.

## Conclusion

Whereas South Africa's international isolation was one of the hallmarks of its pre-1990 diplomacy, the country's post-1990 diplomacy signifies a major departure in terms of focus, scope, intensity and diversity. Consequently, the country's nuclear diplomacy was also transformed. Prior to 1990, the 'Janus-faced' nature of South Africa's nuclear diplomacy included, on the one hand, international condemnation and reactions to these condemnations and, on the other hand, secret diplomatic interactions in an effort to either pressurise the South African government to dismantle its nuclear weapons programme, or to bypass bilateral and/or multilateral sanctions against the country. Post-1990, South Africa's nuclear diplomacy was a direct departure from previous practices. As

an instrument of foreign policy, South African diplomacy reflected these changes. One of the illustrations of this departure is South Africa's role and influence in international nuclear and economic bilateral and multilateral diplomacy.

South Africa's nuclear intentions remain in question, especially in view of the South African government's declaration that it is a responsible producer, possessor and trader of nuclear expertise, products and services. In April 2011, the South African government adopted the Integrated Resources Plan (IRP) which paves the way for the expansion of the country's nuclear power generation capacity. South Africa has attempted to construct a 'new conception' of the country's foreign policy identity with the 'other' being its apartheid past, rather than another international actor. Post-1994 South Africa has also managed to construct a nuclear identity through 'positive approximation' by associating or identifying itself with the positive nuclear norms and identities of like-minded states. This nuclear identity has also been achieved through 'negative approximation' by distancing the country from its historical nuclear actions, capabilities and posture. The implications of South Africa's nuclear diplomacy have been wide-ranging. Not only did it contribute to the entry of the African Nuclear Weapons Free Zone Treaty (Pelindaba Treaty) but also to enhance the country's status and prestige. South Africa, which no longer has nuclear weapons, continues to wield considerable soft or normative power on the African continent.

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