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## Synchronising Nuclear Governance in SADC Member States Through Regional Cooperation

KAMEN VELICHKOV

African perspectives  
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# Abstract

SADC member states have adopted different approaches to nuclear energy and radioactive applications. However, all of them need to improve their regulatory frameworks and policies to allow, for example, the safe and secure transportation of nuclear material within and out of the region. SADC may provide a platform for nuclear governance synchronisation by encouraging those of its member states that have advanced nuclear programmes to engage in greater cooperation, while leaving the door open for others to join at a later stage. Initial steps may take place on a pilot basis within Pillar II (Infrastructure development in support of regional integration) of the SADC Regional Indicative Strategic Development Plan 2020–2030 (RISDP), in concert with both energy- and transport-related objectives. This may also facilitate the implementation of the Africa Mining Vision and contribute to the preparedness of regional radiological emergency responses. This paper gives a brief overview of nuclear resources, legal and regulatory frameworks, and facilities in the 16 SADC states. It also examines existing nuclear regulation mechanisms in SADC, including the SADC Nuclear Regulators Network, RISDP, Information Tracking System and African Association of Competent Authorities.

## Introduction

The 16 countries that belong to SADC differ considerably in size, economic and human resources, and development strategies: ‘Southern Africa is a region of great contrasts ... with income inequality in the Southern African states among the highest in the world.’<sup>1</sup> Half of SADC member states have uranium deposits and intend to use them for export revenues. As of January 2019, on the condition of a market price range of \$80–130/kg, SADC countries could access the following uranium deposits (in tonnes): Botswana – 87 200; Malawi – 6 200; Namibia – 448 300; South Africa – 320 900; Tanzania – 58 200; and Zambia – 31 000. At a uranium price range above \$130/kg, the Democratic Republic of Congo (DRC) and Zimbabwe could join the group with 2 700 tonnes and 1 400 tonnes, respectively.<sup>2</sup> Moreover, Namibia is among the world’s largest producers, with 10.2 % of the global uranium supply in 2019 coming from its open pit mines. South Africa and Namibia are currently involved in production, the DRC and Malawi have been producers in the recent past, and exploration and mine development is proceeding in SADC countries that have not hitherto supplied uranium, namely Botswana, Tanzania, Zambia and Zimbabwe.<sup>3</sup> The World Nuclear Association predicts that the new mines that will go into production

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1 Adriana Lins de Albuquerque and Cecilia Hull Wiklund, “Challenges to Peace and Security in Southern Africa: The Role of SADC” (FOI Memo 5594, Studies in African Studies, Swedish Defence Research Agency, Kista, December 2015), 1.

2 Nuclear Energy Agency and International Atomic Energy Agency, *Uranium 2020: Resources, Production and Demand*, Joint Report (Paris: OECD Publishing, 2020), 20.

3 Gabi Schneider, “Uranium in Africa: Current Situation, Prospects and Challenges” (Presentation, AFCONE-ISTC webinar “Uranium Resources in Africa: Exploration, Exploitation and Cooperation Opportunities”, September 10, 2020).

in Southern Africa include Husab in Namibia, Kayelekera in Malawi, and Mkuju River in Tanzania.<sup>4</sup>

In Africa uranium resources are mainly treated as a mineral commodity, with little recognition of their contribution as a fuel in affordable and low-carbon electricity production. However, there has been a gradual acknowledgement of nuclear energy's ability to reduce or displace carbon emissions. South Africa is the only African state to operate a nuclear power plant (NPP), although some other SADC states, including Tanzania, Zambia and Zimbabwe, contemplate adopting nuclear energy within the next decade to meet their energy supply needs. South Africa is also investigating the possibility of upgrading existing reactors and building a new reactor. Nuclear applications are found throughout Southern Africa in various industries, including construction, agriculture and healthcare. Medical radiography is also welcomed by communities, as illustrated, for instance, by the success of the Malawian Cancer Programme.<sup>5</sup>

The Africa Mining Vision (AMV), put forward by the AU Commission (AUC), calls for a resource-based African industrialisation and development strategy, underlining that uranium mining can be used to develop partnerships in the improvement of economic infrastructure.<sup>6</sup> In line with the AMV, the AU Commodity Strategy views Africa's uranium resources as a driver for economic development and the creation of a competitive African financial and capital market associated with the uranium-nuclear energy value chain.<sup>7</sup>

On the other hand, there are rising public concerns over the use of nuclear energy in Southern Africa. Mining and refining uranium can create environmental and health problems, including huge tailing and mine waste exposed on the surface, as well as mine, transportation and mill workers' exposure to uranium. The advent of more sophisticated equipment makes training safety personnel more difficult and emergency responses more problematic. Disposal of spent radioactive sources remains a challenge, while the transport of nuclear material continues to be subject to vulnerabilities. The safety and security of nuclear power and uranium mining often seem complex and opaque to many stakeholders. However, governments are beginning to acknowledge the need for a higher degree of nuclear safety and security culture in the broader sense, and various forms of stakeholder engagement are ubiquitous.

Radioactive sources are widely used in many SADC countries and their licencing is controlled. However, the regulations applicable to their use, handling and enforcement differ across countries. At the same time, radioactive sources are of growing interest to terrorist groups for potential use in malicious acts. The management and control of radioactive sources approaching the end of their economic lifetimes is sometimes

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4 World Nuclear Association, "Uranium in Africa".

5 University of North Carolina School of Medicine, Institute for Global Health and Infection Diseases, "UNC Project Malawi Cancer Program".

6 AU, "Africa Mining Vision".

7 New Partnership for Africa's Development, "African Commodity Strategy".

unclear, resulting in the risk that such sources may escape regulatory monitoring. This situation encompasses cross-border safety and security issues, and therefore necessitates strengthened international cooperation.

Article 27 of the SADC Protocol on Health states that ‘States Parties shall co-operate in the control of ionising radiation and radioactive material’.<sup>8</sup> In addition, SADC countries such as Namibia, Zambia, Malawi and Tanzania are developing national registers of all radioactive sources. In this regard, correct safety procedures for the protection of front-line officers and the public must be followed. Dedicated instruments, well-established procedures and communication channels are essential, and training and exercises are of utmost importance.

African countries have a legal obligation under several treaties and international or regional instruments to ensure effective regulation of uranium production and export. This is crucial for good governance and for maintaining public confidence in the security and safety of the nuclear industry. It is also pertinent that the existing and emerging producers join the Nuclear Suppliers Group (NSG), the international regime set up to ensure that the production of uranium does not lead to uncontrolled proliferation. At present, countries such as Namibia remain outside the NSG. However, the non-proliferation regimes have no mechanisms to intervene in more complex justice questions arising from nuclear waste or ecological concerns.

## All SADC countries are signatories to the African Nuclear-Weapon-Free-Zone Treaty

All SADC countries are signatories to the African Nuclear-Weapon-Free-Zone Treaty (Pelindaba Treaty), which requires all nuclear material, facilities and equipment on the continent to be used exclusively for peaceful purposes and prohibits the dumping of radioactive waste or attacks against nuclear installations in Africa.<sup>9</sup> For several countries, the export of uranium ore concentrate (UOC) requires cross-border transport through their neighbours’ territories, making it a regional issue. Border-crossing points are possible nodes on routes for the illicit trafficking of nuclear and other radioactive materials. Modern detection equipment and appropriate training can help to deter and counteract such trafficking.

This paper seeks to provide an overview of nuclear regulation at national level in SADC countries, and to discuss existing regional instruments and how they could be developed

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<sup>8</sup> SADC, ‘Protocol on Health’.

<sup>9</sup> AU, ‘The African Nuclear-Weapon-Free Zone Treaty (Pelindaba Treaty)’.

further. The next section provides a brief summary of nuclear resources, legal and regulatory frameworks, and facilities in the 16 SADC states. Where relevant and where information is available, it also discusses nuclear authorities and future nuclear energy plans. In addition, it lists membership status in the African Regional Cooperation Agreement for Research, Development, and Training Related to Nuclear Science and Technology (AFRA) and the Forum of Nuclear Regulatory Bodies in Africa (FNRBA). This section is followed by analyses of existing mechanisms for cooperation and synchronisation of nuclear regulation in SADC, including the SADC Nuclear Regulators' Network (SADC NRN), Regional Indicative Strategic Development Plan (RISDP), Information Tracking System (ITS) and the African Association of Competent Authorities (AACCA), as well as the transport of nuclear materials. It concludes with recommendations on the way forward.

## Nuclear governance in SADC: Resources, legal and regulatory framework and facilities

SADC countries could be classified into three groups for the purposes of nuclear analysis:

- the stand-alone South Africa with its well-developed nuclear industry;
- the 10 countries that have declared their interest and have been developing nuclear regulatory frameworks (at various stages) – Angola, Botswana, DRC, Madagascar, Malawi, Mozambique, Namibia, Tanzania, Zambia and Zimbabwe; and
- the five smaller countries and island states whose interest is limited to applications – Comoros, Eswatini, Lesotho, Mauritius and Seychelles.

### South Africa

South Africa has an advanced nuclear sector and comprehensive nuclear governance system that other SADC countries could theoretically tap as a reservoir of knowledge, skill, scientific and research excellence, and innovation. However, because of its long and incremental formation, other SADC states may find it difficult to directly imitate or internalise the South African nuclear architecture.

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South Africa is among the top countries globally in terms of uranium reserves (around 7%).<sup>10</sup> Uranium is produced mainly as a by-product of gold mining. The Nuclear Fuels Corporation of South Africa ensures that all measures necessary for the safe transportation of yellowcake are implemented, as prescribed by the National Nuclear Regulator (NNR) in its authorisation licence.

Safe storage of low- and intermediate-level nuclear waste takes place at the Vaalputs National Radioactive Waste Disposal Facility. This is a well-regulated and coordinated process. The volume of spent fuel generated by the Koeberg NPP is small by industrial standards. In the absence of a permanent repository for spent fuel, as required by the 2005 Radioactive Waste Management Policy and Strategy, spent fuel is kept onsite.<sup>11</sup>

South Africa has two operable nuclear power reactors, with a combined capacity of 1 860 MWe, generating approximately 5% of its electricity market under the control of state utility Eskom. South Africa is part of the Southern African Power Pool (SAPP), with extensive interconnections and total installed generating capacity of about 67 GWe, of which over 80% is South African.<sup>12</sup>

The South African government has been planning to expand its nuclear capacity since 2006, by building another power plant. Agreements with nuclear vendors from China, France, Russia, South Korea and the US were signed from 2014 onwards.<sup>13</sup> In 2017, however, following a court case against the nuclear programme brought forward by civil society organisations, the Western Cape High Court ruled that the South African government had not complied with constitutional provisions when it signed nuclear agreements with Russia, the US and South Korea.<sup>14</sup> A change in the presidential administration in 2018 put a further halt to the country's nuclear plans. Yet nuclear energy remained on the agenda and in 2019 the government outlined plans to complete the procurement of 2 500 MW of new nuclear capacity by 2024, build 1 GW of new nuclear capacity by 2030 and extend the operating lifetime of the Koeberg nuclear power plant by 20 years, until 2044.<sup>15</sup> In 2020 a formal Request for Information was issued for 'The South African Nuclear New Build', indicating a cautious approach, as it was an information-gathering and market-testing exercise rather than a competitive tender.<sup>16</sup> In late 2020 and early 2021 public comments were accepted on the government's expansion plans, followed by public hearings in mid-2021. The South African nuclear sector employs about 2 700 people, hence commitments to the future of power plants remain very strong.<sup>17</sup>

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10 World Nuclear Association, "Nuclear Power in South Africa".

11 South Africa, Department of Minerals and Energy, "Radioactive Waste Management Policy and Strategy for the Republic of South Africa" (2005).

12 World Nuclear Association, "Nuclear Power in South Africa".

13 Anthonie Cilliers, "History of Nuclear in South Africa", *ESI Africa*, February 18, 2019.

14 "Earthlife Africa (ELA) and the Southern African Faith Communities' Environment Institute (SAFCEI) v Minister of Energy and Others", High Court of South Africa (Western Cape Division), Judgement, Case No 19529/2016, April 26, 2017.

15 South Africa, Department of Energy, "Integrated Resource Plan (IRP2019)", *Government Gazette* 42778 (October 18, 2019).

16 South Africa, Department of Mineral Resources and Energy, "Request for Information (RFI) in Respect of the Nuclear New Build Power Procurement Programme", June 2020.

17 South Africa, Department of Energy, "Nuclear Energy Background".

An IAEA Integrated Nuclear Infrastructure Review (INIR) mission to South Africa in 2013 evaluated the status of the country's nuclear infrastructure.

The regulatory framework of South Africa is anchored on two laws adopted in 1999: the Nuclear Energy Act 46 and the National Nuclear Regulator Act 47, alongside several other relevant pieces of legislation on financing, environment, disaster management, etc. The institutional infrastructure has its national specificity. The regulator and the nuclear energy programme implementing organisation were separated long ago and functioned independently for many years. The autonomous Council for Nuclear Safety served as a model for the establishment and competences of the National Nuclear Regulator (NNR).

The Nuclear Energy Act gives the minister of minerals and energy the responsibility for nuclear power generation, the management of radioactive waste, and the country's international nuclear commitments. The Nuclear Energy Corporation of South Africa (NECSA), a state corporation established under the same act, is in charge of most nuclear energy matters, including handling waste and safeguards, but not power generation. NECSA's functions also include promoting research in the field of nuclear energy and radiation sciences. It serves South Africa's nuclear-related needs in areas such as industrial applications, medical diagnostics and therapy, nuclear waste treatment, non-proliferation of nuclear materials, and clean energy. In 2008 NECSA converted the SAFARI-1 research reactor to low enriched uranium. However, the continuous existence of a large quantity of highly enriched uranium in South Africa remains a source of concern for external observers.<sup>18</sup>

## South Africa is the only SADC state that renders assistance in nuclear safety and security to other African countries

South Africa is a unique case in terms of its international commitments. It is the only SADC state that renders assistance in nuclear safety and security to other African countries. However, no actual and fixed programme has been confirmed, and in practice South Africa co-hosts training programmes and courses with external non-African actors.<sup>19</sup>

Besides former Soviet republics Kazakhstan and Ukraine, South Africa is the only country in the world to have built nuclear weapons and then voluntarily dismantled them. In 1991 the country acceded to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), and, in 1996, to the Pelindaba Treaty. In 2002 it signed an additional protocol in relation to its safeguards agreements with the International Atomic Energy Agency (IAEA). However,

<sup>18</sup> Nuclear Threat Initiative, "Civilian HEU: South Africa", July 1, 2019.

<sup>19</sup> Annie DuPre and Nicolas Kasprzyk, "CBRN Assistance and Capacity-Building Programmes for African States" (Institute for Security Studies, Pretoria, 2016), 40.

South Africa has not yet ratified the Amended Convention on Physical Protection of Nuclear Material (CPPNM), most likely for bureaucratic reasons. It is a member of the Nuclear Suppliers Group, and the country's dual-use capabilities are regulated by the South African Council for the Non-Proliferation of Weapons of Mass Destruction, presided over by the minister of trade, industry and competition.<sup>20</sup>

With the Pelindaba Treaty's entry into force in July 2009, South Africa hosted the treaty's compliance body – the African Commission on Nuclear Energy (AFCONE). South Africa's nuclear diplomacy with the rest of the continent entered a new phase. It is an active member of AFRA. It supported two AFRA projects on the continent and hosted the 1995 AFRA annual meeting. However, it has yet to sign and ratify the new AFRA Agreement, which came into force in 2020. South Africa is a leading member of the FNRBA.

When South Africa acceded to the SADC Treaty in 1994, it produced, in August 1996, a foreign policy document titled 'Framework for Co-operation in Southern Africa'. Basic transport infrastructure in the region did fall in the areas of interest, but safety on roads, including uranium transport, remained unaddressed.<sup>21</sup>

## Namibia

The Namibian economy is heavily dependent on the extraction and processing of natural resources such as uranium. Commercial uranium mining began in 1976 under favourable market conditions. In 2021 Namibia's uranium resources were estimated by the World Nuclear Association to constitute about 10% of global uranium resources.<sup>22</sup> It is the fourth largest producer of uranium after Kazakhstan, Canada and Australia.<sup>23</sup> The country's uranium deposits are mined in open pits, which is the most cost-effective technology. Milling takes place on site, and the ore is transported in the form of yellowcake. In March 2020 Namibia's largest mining facility, at Rössing, suspended normal operations because of the COVID-19 pandemic.

Namibia provides transportation access to seaports for landlocked SADC countries such as Botswana, Malawi and Zambia, and has a well-established road infrastructure.<sup>24</sup> Four transport corridors link it to SADC countries: the Trans-Kalahari, via Botswana; the Trans-Cunene, via Angola to the DRC; the Trans-Oranje, via South Africa; and the Trans-Caprivi, via Zambia. The latter is used to transport uranium ore to the port of Walvis Bay. In April

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20 Jo-Ansie van Wyk, "No nukes in Africa: South Africa, the Denuclearisation of Africa and the Pelindaba Treaty", *Historia* 57, no. 2 (December 2011): 263-297, December 2011.

21 South Africa, Department of International Relations and Cooperation, "Southern African Development Community (SADC) History and Present Status", 2004.

22 World Nuclear Association, "Uranium in Namibia".

23 World Nuclear Association, "World Uranium Mining Production".

24 Jeremiah Kebwaro, "Nuclear Safety, Security and Safeguards in the Mining and Transport of Uranium Ore Concentrate in Namibia" (Presentation, EU Project MC 5.01 15B Support to Southern African States in Nuclear Safety and Safeguards, ISTC webinar series, March 24, 2021).



2021 the government of Namibia ratified the tripartite agreement on the Walvis Bay-Ndola-Lubumbashi Development Corridor (Walvis-Copperbelt corridor).<sup>25</sup>

## Namibia provides transportation access to seaports for landlocked SADC countries such as Botswana, Malawi and Zambia

The Namibian uranium industry is subject to the provisions of a number of legal instruments, including the Minerals Act 1992 (Act 33 of 1992); the Atomic Energy and Radiation Protection Act 2005 (Act No 5 of 2005) and its regulations; the Environmental Management Act 2007 (Act 7 of 2007, EMA); and the Customs and Excise Act (Act 20 of 1998).<sup>26</sup>

The Atomic Energy and Radiation Protection Act explicitly places the responsibility for safety and security on the operator. Facilities handling uranium products are required to establish physical and administrative security measures, and to develop a radiation management plan.<sup>27</sup> The Minerals Act provides for export control on trade in minerals, including uranium ore. It also defines royalty rates and penalties for any infractions and sets mine closure requirements. The Environmental Management Act and the Environmental Impact Assessment Regulations govern the issuing of environmental clearance certificates. The Environmental Management Act is supplemented by the 2002 Minerals Policy, which obligates operators to minimise environmental impacts and ensure meaningful community involvement.<sup>28</sup>

The 1998 Customs and Excise Act mandates customs officials to verify documents and seal shipments submitted for import or export. Uranium products are transported from the mine to the harbour by licenced companies. The consignments are escorted by the mine's security personnel and radiation safety officer.<sup>29</sup> Truck convoys deliver consignments from Namibia's neighbouring countries to Walvis Bay port. The longest route they follow – about 5 000km – is from the Kayelekera mines in Malawi, through Zambia, and along the Caprivi corridor in Namibia. Containers are supposed to be sealed with company's seals endorsed on the manifest from the country of origin. The national police in each state is responsible for escorting the trucks through their territory.<sup>30</sup> Although mining companies reportedly conduct incident preparedness drills, the inclusion of other stakeholders in the respective emergency response plans may increase the efficiency of such exercises.

25 Eugene Goddard, "Namibia Forges Ahead with Walvis-Copperbelt Corridor", *Southern Africa's Freight News*, April 8, 2021.

26 Namibian Uranium Association, *Annual Report 2020* (Swakopmund: NUA, 2021).

27 D von Oertzen et al., *Trekopje Mine Radiation Management Plan*, Report (VO Consulting and Orano Mining Namibia, 2012).

28 Namibia, Ministry of Mines and Energy, "Minerals Policy of Namibia".

29 Namibian Parliament, "Customs and Excise Act 20 of 1998".

30 Kebwaro, "Nuclear Safety, Security and Safeguards".

Large-scale uranium mining and the accompanying radiation hazards inform not only Namibia's government policy but also its regulatory infrastructure. The Ministry of Health and Social Services houses the core policymaking body – the Atomic Energy Board (AEB), comprising members of the line ministries for foreign affairs; health; mines and energy; labour; and environmental affairs.<sup>31</sup>

The National Radiation Protection Authority (NRPA) is an independent regulatory body. The main duties of the NRPA are to maintain an inventory, and to regulate and enforce activities involving radioactive and nuclear material. However, it does not have administrative autonomy and is an entity within the Ministry of Health and Social Services. According to the health minister, 'the lack of sufficient local radiation safety inspectors' is of concern.<sup>32</sup>

Namibia is a state party to major international agreements such as the CPPNM, the NPT, the IAEA Safeguards Agreement, the Pelindaba Treaty and the Comprehensive Nuclear Test-Ban Treaty (CTBT). The country applied to join the NSG in 2016 but its membership remains an open issue. Namibia was a member of AFRA prior to 2020, when the revised agreement entered into force. It has not signed or ratified it. It is also a member of the FNRBA, although it has not yet endorsed its charter.

## Tanzania

In Tanzania uranium exploration evolved through the use of airborne radiometric surveying that identified seven major blocks of uranium deposits.<sup>33</sup> Exploration activities ceased when uranium prices dropped, but resumed in 2007. Tanzania's reserves of uranium oxide are believed to be sufficient to make it the eighth-largest uranium producer globally and the third-largest in Africa, if fully exploited.<sup>34</sup> Only one uranium company, Mantra Tanzania Ltd, an African subsidiary of Russia's Uranium One (an international mining company of the Russian State Nuclear Energy Corporation), has received a licence out of 70 locally and internationally registered prospecting companies. However, owing to declining international uranium prices, the mining project has been suspended.<sup>35</sup>

Although Tanzania is currently not mining uranium, it has made regulatory and institutional arrangements for nuclear safety, security and safeguards, in anticipation of a boom in the

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31 Namibia, "Atomic Energy and Radiation Protection Act, 2005", *Government Gazette* 3429 (May 16, 2005).

32 Kalumbi Shangula, "Regulatory Authority Infrastructure for Namibia", International Nuclear Information System.

33 Firmi P Banzi, Peter Msaki, and Najat Mohammed, "Challenging Issues in Regulating Uranium Mining in Tanzania" (Presentation, International Seventh Conference on Uranium Mining and Hydrogeology, Freiberg, September 15-21, 2014). The sites are: Mkuju, Madaba; Isuna, Bahi, Makutupora; Ndala, Igombe, Kigoma Ugalla River, Mpanda; Minjingu, Gallapo; Monduli, Tarosero; Chimala, Panda, Njombe; Bukoba, Biharamulo.

34 Dennis Mwalongo, "Reporting Uranium Resource and Project Activities for 2012-2013" (Presentation, IAEA-CYTED-UNECE Workshop on UNFC-2009 Applications in Uranium and Thorium Resources: Focus on Comprehensive Extraction, Santiago, July 9-12, 2013).

35 "Uranium Mining in the United Republic of Tanzania: Current Status, Challenges and Opportunities" (Poster contribution, International Symposium on Uranium Raw Material for the Nuclear Fuel Cycle, June 27, 2018).

sector.<sup>36</sup> The existing normative framework also caters for the growing number of registered radiation facilities in the country – from 22 in 1985 to 436 in 2008. Of these, 70% were associated with medical applications, 11% with industry and construction applications, 5% with research and education, and 14% with other applications.<sup>37</sup>

Although Tanzania is currently not mining uranium, it has made regulatory and institutional arrangements for nuclear safety, security and safeguards, in anticipation of a boom in the sector

In Tanzania the regulatory infrastructure preceded mining. Initially, it was created to control nuclear applications, mostly in medicine. The National Radiation Commission (NRC) came into existence through the 1983 Protection from Radiation Act. The NRC was later changed to the Tanzania Atomic Energy Commission (TAEC) through the Atomic Energy Act 7 of 2003. The TAEC was vested with all the powers needed to control the safe and peaceful use of nuclear technology. At the same time, it was tasked with promoting nuclear applications.<sup>38</sup>

Legislation relevant to nuclear governance comprises the National Environment Management Council Act of 1983, the Environmental Management Act of 2004, the Mining Act of 2010, the Occupational Health Safety Act of 2003 and the Atomic Energy Act of 2003. The Atomic Energy Act plays a central role, particularly in terms of underpinning a comprehensive set of implementing regulations. These cover radiation safeties in mining and processing radioactive ores; the packing and transporting of radioactive materials; environmental impact assessments; minerals and mineral concentrates trading; etc. A notable feature of the normative framework in Tanzania is the periodic update of regulations to reflect changing realities.

Institutionally, the TAEC interacts mostly with the Ministry of Health, Community Development, Gender, Elderly and Children; the National Environment Management Council; the Ministry of Minerals; the Ministry of Works, Transportation and Communication; and the Occupational Safety and Health Authority.

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36 Abdalah Abdulrahman Kileo, "Strengthening Institutional and Legal Frameworks towards Nuclear Safety, Security, and Safeguard in Tanzania" (Presentation, EU Project MC 5.01 15B Support to Southern African States in Nuclear Safety and Safeguards, ISTC webinar series, February 2021).

37 JE Ngaile, WK Mompome and LH Meza, "The Current Status of Radiological Protection Infrastructure in Tanzania" (Presentation, International Congress of the International Radiation Protection Association, Buenos Aires, October 19–24, 2008).

38 Tanzania Atomic Energy Commission, "[About Us](#)".

A uranium mining licence is granted after the operator satisfies the requirements for environmental certification by presenting a radiation protection plan, a radioactive waste management plan, a transport and storage of radioactive ores plan, a safety assessment report, and corporate social responsibility measures.<sup>39</sup>

In Tanzania, radioactive minerals are transported via roads, railways and three seaports – Dar es Salaam, Tanga and Mtwara – serving seven African countries. To make the seaports more suitable for the shipment of uranium, radiation portal monitors to scan cargo have been installed at Dar es Salaam Port gates 3, 4 and 8.

Tanzania is a state party to the NPT. It signed the Agreement and Additional Protocol with IAEA for the Application of Safeguards, and has ratified the Convention on Physical Protection of Nuclear Material and the Pelindaba Treaty. The country is a member of the FNRBA, although it has not yet endorsed its charter.

Although the country is not yet a member of AFRA, the government pays special attention to stakeholder engagement, particularly among the youth and academia. In line with Tanzania's National Development Vision 2025, the TAEC launched the first Nuclear Science and Technology conference and exhibition in 2020, designed to bring together researchers and innovators from the public and private sectors.

## Malawi

Although the Malawian government has identified uranium as a key national resource, it is explored and exploited by Australian operators: Paladin Energy Ltd., Resource Star Ltd. and Globe Metals and Mining. A total of 4 222 tonnes of uranium ore was produced and exported between 2009 and 2014, when production stalled due to low prices.<sup>40</sup>

The National Energy Policy (2018) envisages the construction of an NPP by 2035.<sup>41</sup> Malawi has a single comprehensive policy and law that covers all radioactive materials, activities and facilities, while regulations are usually specific to the type of activity, such as transport, waste management, naturally occurring radioactive materials, etc.<sup>42</sup>

The regulatory framework is based on the Atomic Energy Act of 2011 and the independent and empowered Atomic Energy Regulatory Authority (AERA). Certain aspects of the regulatory body are still not fully operationalised, however. For example, the country has introduced specific regulations on the transport of radioactive material, but there is no system for licensing transporters.

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39 Environmental Justice Atlas, "Mkuju River Uranium Mine, Tanzania".

40 Jim Green, "Paladin Energy Puts Second African Uranium Mine into Care-and-Maintenance", *Nuclear Monitor* 862, no. 4726 (2018).

41 Government of Malawi, "National Energy Policy", 2018.

42 Master Simoni, "Strengthening Frameworks for Safety, Security, and Safeguards of Uranium Ore Concentrate in Malawi" (Presentation, EU Project MC 5.01 15B Support to Southern African States in Nuclear Safety and Safeguards, ISTC webinar series, November 2020).

As per the National Transport Master Plan (2018), the Nacala Railway Corridor project is central to transport infrastructure in Malawi. It allows Tanzania, Malawi, Zambia, Mozambique and Zimbabwe to increase their international trade and safely transport strategic commodities.

The AERA's capacity for safety and security inspections is also limited. It interacts and shares capacity-building programmes with other relevant agencies, including the Mines Department, the Department of Energy Affairs, the Ministry of Health, and the University of Malawi. Since the AERA falls under the Ministry of Environment, it cooperates closely with another entity similar in origin – the Malawi Environmental Protection Authority, created under the Environmental Management Act of 2017.

In terms of managing transport-related emergencies, Malawi has a draft National Nuclear and Radiological Emergency Preparedness and Response Plan. However, the inadequate skills and technical equipment of key institutions and local authorities may impede the efficiency of Malawi's emergency response. It has signed but not yet ratified the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency. In terms of physical protection measures, it has been a party to the CPPNM since December 2013, but not yet to its amendment. The country has an Integrated Nuclear Security Support Plan in place.

**The inadequate skills and technical equipment of key institutions and local authorities may impede the efficiency of Malawi's emergency response**

Malawi has undertaken a number of commitments regarding nuclear safeguards. The country has signed and ratified the NPT (3 September 1992), the Pelindaba Treaty (23 April 2009), the IAEA Comprehensive Safeguards Agreement (CSA, 3 August 1992) and Access Protocol (26 July 2007), and the Small Quantities Protocol (29 February 2008). Collaboration between the various relevant institutions leaves room for improvement, which may be partially achieved through the introduction of documented standard processes and procedures for safeguards inspections, verification and reporting. Malawi is a member of the FNRBA, although it has not yet endorsed its charter. It is not a member of AFRA.

## Democratic Republic of Congo

The DRC has a long record of activities related to nuclear and radioactive materials. Uranium was mined at the Shinkolobwe mine prior to 1942. Attempts to resume production through contracts with Brinkley (UK) in 2007 and Areva (France) in 2009 did

not materialise.<sup>43</sup> Uranium mines, many of them in Katanga province, have been officially closed.

Several hundred radioactive sources are in use in the DRC, mainly in the industrial and medical sectors, and for education and research purposes. One research reactor, TRIGA MK1, was dismantled in 1970, and a second one, TRIGA MK2, has been closed since 2004. There are temporary storage facilities for disused sources at the General Atomic Energy Commission and at former mines.

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The main statutory framework for nuclear safety and security in the DRC is provided through Law No. 017/2002 of 16 October 2002, which deals with protection against the dangers of ionising radiation and the physical protection of nuclear materials and installations. This law stipulates the establishment of the Comité national de protection contre les rayonnements ionisants (National Committee for Protection Against Ionising Radiation, CNPRI) as the sole and autonomous regulatory body under the direct authority of the president of the DRC and under the oversight of the minister in charge of scientific research and technology. The same law establishes the Institut National de Radioprotection (National Institute of Radiation Protection) as the technical support organisation to the CNPRI.<sup>44</sup>

The DRC has an Organisation de la Réponse de Sécurité Civile (Organisation for a Civil Security Response) plan and a 24/7 operational crisis centre, based on an all-hazards emergency preparedness principle. In addition, a draft chemical, biological, radiological and nuclear (CBRN) emergency response plan is in preparation. The need for specialised equipment is acute, as the country has a vast territory and 35 major border-crossing points on notoriously porous borders.

The DRC has taken on the relevant international commitments. It ratified the NPT (1970) and concluded a CSA (1972) and Additional Protocol (2003) with the IAEA. The country has acceded to the CPPNM (2004) but not yet to its amendment. There are also informal protocols on the exchange of information on the import and export of radioactive and nuclear materials with neighbouring countries, eg, between the DRC and Zambia.

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43 François Kazadi Kabuya and Lukusa Mukengabantu, "Uranium and Thorium Resources in the Democratic Republic of the Congo: Historical and Current Status" (Presentation, IAEA-CYTED-UNECE Workshop on Recent Developments in Evaluation of Uranium and Thorium Resources, Lisbon, October 15-18, 2012).

44 Pontien Nzereka Mbayitiraki, "Regulatory Nuclear Framework of the DRC" (Presentation, Professional Training Course on Nuclear Safety for Members of the Arab Network of Nuclear Regulators, Global Nuclear Safety and Security Network/IAEA, Tunis, May 14-15, 2015).



The country was a member of AFRA prior to 2020, but has not signed or ratified the revised agreement. It is a member of the FNRBA.

## Zambia

The government of Zambia has developed the seventh National Development Plan (2017–2021) aimed at sustained growth and socio-economic transformation, partially driven by the mining sector.<sup>45</sup> At the same time, the 2020 National Nuclear Policy (NNP) provides a framework for the use of nuclear technology in sectors such as industry, agriculture, energy, health, mining, education and environment. Once it has been explored and mined, the sale of uranium will give the country much-needed foreign exchange reserves. President Edgar Lungu has announced that the administration will pursue nuclear technology as part of a diversified, sustainable energy mix to power Zambia's economy.<sup>46</sup> Within the next 10–15 years Zambia needs at least 2GW of electricity, and it must ensure the production of isotopes for cancer treatment and the irradiation of food.

The NNP does not set out a legal framework for uranium transportation. While its 2019 National Transport Policy states that Zambia has to take a lead in the development of corridors and position itself as a hub of inter-regional trade, as all key transport corridors in SADC transverse the country,<sup>47</sup> it still needs domesticated legislation to regulate the transportation of dangerous goods.

Several uranium ore deposits have been discovered in Zambia in two geological environments: the Karoo System and the Katanga System. Lumwana Mining Company (LMC), owned by Barrick Gold Corporation, has an open-pit mine, excavating mainly copper.<sup>48</sup> In 2008, Lumwana was given authorisation to stockpile uranium and construct a processing plant.<sup>49</sup> However, the project did not materialise due to the economic downturn and the effect of the Fukushima accident on the nuclear industry. As of 2020, the Mutanga uranium project is being undertaken by GoviEx Uranium (Canada).<sup>50</sup>

There are persistent issues surrounding transit deliveries. Between 2009 and 2014 its Radiation Protection Authority issued one-year licences to transport UOC from the Keyelekera mine to Walvis Bay to consignees that also had Malawian and Namibian licences.

In Zambia the regulatory framework is based on the Ionising Radiation Protection Act No. 16 of 2005, amended in 2011. Statutory Instrument (SI) No. 98 of 2011 sets out the safety and security requirements. It also imposes the use of international standards

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45 Melody Mwewa, "The Legal Framework for Zambia in Relation to Nuclear Safety, Security and Safeguards and Transportation of Uranium Ore Concentrates" (Presentation, EU Project MC 5.01 15B Support to Southern African States in Nuclear Safety and Safeguards, ISTC webinar series, April 2021).

46 Simon Allison, "Nuclear Deal(s): What Zambia Can Learn from South Africa", *Daily Maverick*, December 8, 2016.

47 Zambia, Ministry of Transport and Communications, "National Transport Policy", 2019.

48 Barrick Gold Corporation, "Lumwana Zambia".

49 World Nuclear Association, "Uranium in Africa".

50 Newsfile.com, "GoviEx Announces Drill Program on Mutanga Project, Zambia", May 28, 2021.

domestically wherever Zambia has no explicit national standards. With the multiplication of actors in the nuclear safety field, the need for synchronised licencing, inspection and enforcement systems becomes even more acute.<sup>51</sup> Regulation 46 of SI No. 98 places general responsibility for security on the licensee.<sup>52</sup> The Mines and Minerals Development Regulations of 2008 and SI No. 85 of 2008 apply the same approach to transportation.

The 2020 NNP paves the way for the development of a nuclear act (currently being drafted) to provide for the development, coordination and implementation of a nuclear programme in Zambia, and for the establishment of the Zambia Nuclear Agency and a Nuclear Safety and Radiation Protection Act to provide for the regulation and management of the peaceful use of nuclear and radioactive materials. The Zambia Atomic Energy Agency may play an important role in the synchronisation of internal regulations and the governance structure. Zambia is on the verge of procuring a research reactor through Russia's Rosatom.<sup>53</sup>

In Zambia special attention is paid to the movement of radioactive sources, which is considered to be more hazardous than the transport of uranium ore. At present, a transport consignee has to have permission from four institutions, and an environmental impact assessment. The nuclear act being prepared might consolidate all licences into one, issued by the regulator, and would most likely remain under the Ministry of Health. Currently, its Radiation Protection Authority is acting in the capacity of regulator. At the same time, there is also the Nuclear Energy Programme Implementing Organisation at the Ministry of Higher Education.

Special attention is paid to the movement of radioactive sources, which is considered to be more hazardous than the transport of uranium ore

Zambia is a state party to many international treaties – the NPT, CTBT, Pelindaba Treaty and the CPPNM (but not yet its amendment). It has signed a CSA, Small Quantities Protocol and Additional Protocol with the IAEA, the latter awaiting ratification. The country recently expressed an interest in complying with the Code of Conduct on the Safety and Security of Research Reactors. Zambia was a member of AFRA prior to 2020, when the revised agreement entered into force. It has not signed or ratified it yet. It is a member of the FNRBA.

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51 Nsama Kwendeni, "Gaps of the Legal Framework of Zambia in Relation to Nuclear Safety, Security and Safeguards and Transportation of Uranium Ore Concentrates" (Presentation, Virtual Meeting of Legal Experts to Review Zambia's Legal Framework Convened under EU Project MC 5.01 15B, February 16, 2021).

52 Misozi Banda Kapeya, "Zambia's Legal Framework on Nuclear Safety, Security and Safeguards" (Presentation, Virtual Meeting of Legal Experts to Review Zambia's Legal Framework, Convened under EU Project MC 5.01 15B, February 16, 2021).

53 Rosatom, "Nuclear is the Technology of Zambia's Future – Msiska", August 6, 2019.

## Zimbabwe

In 1980 the German company Saarberg Interplan Uran GmbH discovered about 3 000 tonnes of uranium resources in the Kanyemba area of Zimbabwe, but the project was abandoned due to low uranium prices. In 2007 the president granted Special Grant 4886 to the Geological Survey of Zimbabwe to explore the site in partnership with the China Nuclear International Uranium Corporation.<sup>54</sup>

The German company Saarberg Interplan Uran GmbH discovered about 3 000 tonnes of uranium resources in the Kanyemba area of Zimbabwe

A draft Nuclear Energy Minerals policy is currently under review. It defines the government's position on exploration, mining, ore processing, waste management, health and safety issues, decommissioning, rehabilitation and long-term management of closed mines and processing sites, as well as associated activities such as transportation, handling, possession, transfers, storage, power generation, and import and export of uranium. The mining of all minerals in Zimbabwe is governed by the Mines and Minerals Act of 1961. The Mines and Minerals Amendment Bill of 2017 recognises uranium as a designated strategic mineral with special importance for the economic, social, industrial and security development of the country.<sup>55</sup>

National policies on the safe use, storage and transportation of radioactive hazards are mainly addressed in the Radiation Protection Act of 2004, which established the Radiation Protection Authority of Zimbabwe as the national regulator. The draft National Nuclear Security Detection Strategy and draft Capability Development Plan await final approval by the government.

The Zimbabwean government approved the Integrated Nuclear Security Support Plan in 2013, reviewed in 2018, which is coordinated by the Office of the President and Cabinet. The plan sets out six key focus areas, ranging from prevention to sustainability, and involves in its implementation – in addition to the Radiation Protection Authority – the ministries of justice, legal and parliamentary affairs and of state security.

In 2009 the government accepted the recommendations of an IAEA advisory mission and established a national committee to oversee nuclear safety and security matters. The

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54 Sindiso Ncube, "Exploratory Case Study on Zimbabwe" (Presentation, EU Project MC 5.01 15B, Support to Southern African States in Nuclear Safety and Safeguards, ISTC webinar series, November 2020).

55 Rosatom, "Nuclear is the Technology".

committee, chaired by the deputy chief secretary in the Office of the President, comprises senior level representation from key line ministries.

In 2013 the Transport Policy was launched, containing provisions on the transportation of dangerous goods. Zimbabwe also adopted the IAEA Regulations for the Safe Transport of Radioactive Material embedded in SI 62 of 2011 on Radiation Protection Regulations.<sup>56</sup>

The country became a member of the IAEA in 1986. While it signed a CSA with the agency, uranium mining is not included in its scope. It also has still to accede to the IAEA Additional Protocol. A revised Small Quantities Protocol was signed in 1995. Zimbabwe is a state party to the Pelindaba Treaty and the CTBT. The ratification of the CPPNM and its Amendment is currently under consideration.

Regionally, Zimbabwe is a member of the FNRBA and participates in the forum's 10 technical working groups. It took part in a number of AFRA regional projects such as building competent authority effectiveness on regulating the transport of radioactive material. In 2014 it joined Namibia and Malawi in a transport safety peer review under the IAEA's regional project on strengthening compliance assurance for the transport of radioactive material.

Zimbabwe was a member of AFRA prior to 2020, when the revised agreement entered into force. It has not signed or ratified it.

## Mozambique

Uranium is not mined in Mozambique, although in the 1960s one mine functioned in the northern Tete province. Its two shafts continue to cause lingering contamination.

Mozambique uses sealed radioactive sources in medical practices; industrial radiography and well logging; and container and security scanners. Its National Atomic Energy Agency (ANEA), created in 2009, leads efforts towards full national compliance with international standards. The relevant legal and normative framework is based on the Atomic Energy Law (2017) and comprises several decrees adopted in 2018, including the Radiation Protection Regulation, the Radioactive Waste Management Regulation and the Radioactive Material Transport Regulation.

Mozambique uses sealed radioactive sources in medical practices; industrial radiography and well logging; and container and security scanners

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<sup>56</sup> Vertic, "Zimbabwe Radiation Protection Act".

The Organic Statute of ANEA dates from 2019, and its Internal Regulations from 2020. Mozambique has received technical assistance related to personal dosimetry, environmental monitoring and calibration of equipment.<sup>57</sup> External support in capacity-building implies an improved accreditation process for foreign qualifications.

Several other pieces of legislature complement the nuclear regulatory framework: the Minerals Act No. 20 of 2014 governs the use of radioactive materials in extraction; the Environmental Management Act No. 83 of 2014 deals with the management of hazardous residues; and the Customs Act No. 4 of 2011 controls the trade in relevant equipment and technologies.

Mozambique ratified the Pelindaba Treaty in March 2008 and signed a CSA with the IAEA in 2010. It also signed the Treaty on the Prohibition of Nuclear Weapons on 18 August 2020. It is a member of the FNRBA, although it has not as yet endorsed its charter. It is not a member of AFRA.

## Angola

Angola has no uranium mines or research reactors, but has sources with low radioactive output that are mainly used in the industrial and medical sectors.

Angola has no uranium mines or research reactors, but has sources with low radioactive output that are mainly used in the industrial and medical sectors

Specific legislation places the onus on the government to establish mechanisms for the safety and security of nuclear materials and radioactive sources in the country. The Atomic Energy Law (2007) provides for the implementation of nuclear safety and security requirements. The 'Regulation on Radioprotection' presidential decree addresses licencing issues and procedures required to grant authorisation for the import, export, transfer and transport of radioactive material. The Organic Statute of the Atomic Energy Regulatory Authority (AREA, 2014) presidential decree establishes the AREA as the body in charge of overseeing the application of the law and its regulations.<sup>58</sup> AREA has to ensure that only properly licensed users can import, export or transfer nuclear or radioactive material.

57 Mauro Grande Oliveira, "Mapping of Mozambique's Nuclear Safety and Security Including Uranium Transportation and Management Policies" (Presentation, EU Project MC 5.01 15B Support to Southern African States in Nuclear Safety and Safeguards, ISTC webinar series, March 2021).

58 Luis Filipe Cardoso, "Nuclear Governance in Angola" (Presentation, Third Joint Meeting of the SADC Nuclear Regulators Network, Nkopola Lodge, Malawi, October 10-11, 2019).

Angola joined IAEA in 1999 and concluded a Comprehensive Safeguards Agreement with the agency. The country has acceded to and/or ratified the Pelindaba Treaty, the amended CPPNM, the two conventions on nuclear or radiological accidents, the Convention on Nuclear Safety, and the Code of Conduct on the Safety and Security of Radioactive Sources. It is a member of the FNRBA, although it has not as yet endorsed its charter. It was a member of AFRA prior to 2020, when the revised agreement entered into force. It has not signed or ratified the new agreement.

## Botswana

Botswana has one of the largest undeveloped uranium deposits in the world. The government has granted only one uranium exploration licence, to the Australian exploration company A-Cap Energy on the Letlhakane project, a low-risk, shallow open-pit mine.<sup>59</sup> In 2020 Jiandong He, a Chinese engineering tycoon, tried to gain control of A-Cap Energy.<sup>60</sup>

Botswana has one of the largest undeveloped uranium deposits in the world

The potential export of yellowcake is related to two railway projects – the Trans-Kalahari Railway (TKR) and/or the Ponta Techobanine Project (PTP). The TKR project entails the construction of a 1 500km-long line from Botswana to Walvis Bay, Namibia. The PTP project entails the construction a 1 100km line and the construction of a deep-water port at a coastal village south of Maputo, Mozambique.

Botswana has radioactive sources both in use and crossing its borders from neighbouring states.<sup>61</sup> There is an authorisation programme in place whereby any person who possesses or transports radioactive material has to have a licence. For import or export additional permits are needed, issued on the basis of confirmation from the exporting country. There is a fixed portal monitor at one of the points of entry into Botswana.

As of October 2017, there were 308 registered licensees in Botswana that used radiation sources mainly in health, agriculture, mining, academic and research institutions, manufacturing and construction.<sup>62</sup>

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59 Nadine James, "Botswana's Uranium, Coal Reserves Could Breathe New Life into Mining Sector", *Creamer's Media Mining Weekly*, July 8, 2016.

60 WISE Uranium Project, "Botswana".

61 Tshegofatso Zwikula, "Presentation on Behalf of the Radiation Protection Inspectorate of Botswana" (Presentation, Joint Fourth Meeting of the SADC Nuclear Regulators Network and the Steering Committee of Project MC 5.01 15B MC, Gaborone, November 27-28, 2019).

62 Republic of Botswana, "First National Report on Implementation of the Obligations under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management", 2017.



Botswana has a Radiation Protection Act (2006) and Radiation Protection Regulations (2008). The act establishes the national independent regulatory system, ie, the Radiation Protection Board and the Radiation Protection Inspectorate (RPI). The RPI is a public office under the Ministry of Tertiary Education, Research, Science and Technology. There is a draft bill to amend the Radiation Protection Act to reflect the construction of a national storage facility and to increase the effectiveness of the RPI, in line with recommendations by the Integrated Regulatory Review Service mission, conducted by the IAEA in 2017.

Currently, Botswana has an Integrated Nuclear Security Support Plan, and the Nuclear Security Committee addresses security issues.

Botswana has accumulated some experience in bilateral cooperation on nuclear matters with South Africa, Zambia and Namibia. In terms of international commitments, it has ratified the NPT, additional protocols and safeguards agreements, the amended CPPNM, the Treaty on the Prohibition of Nuclear Weapons, and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

The country was a member of AFRA prior to 2020, when the revised agreement entered into force. It has not signed or ratified it. It is a member of the FNRBA, although it has not as yet endorsed its charter.

## Madagascar

Currently, Madagascar has no confirmed uranium resources, although exploration in the Makay and Ambakaka areas is encouraged by the Office of National Mines and Strategic Industries.<sup>63</sup> Nuclear applications are largely found in the medicine and industrial sectors.

Law No. 97-041 on protection against harmful radiation and radioactive waste management is the foundation of the relevant legislative framework, with general provisions on the transportation of radioactive materials.<sup>64</sup> Currently, a draft nuclear law that addresses safety, security and safeguards is in preparation. Based on Law No. 97, four decrees of implementation have been enacted, as well as nine orders, including Order No. 2735/94 on the transport of radioactive materials.<sup>65</sup>

Madagascar has no confirmed uranium resources, although exploration in the Makay and Ambakaka areas is encouraged

63 NEA and IAEA, *Uranium 2020*, 277.

64 Joseph Lucien R Zafimanjato, "Presentation on Behalf of Madagascar" (Presentation, African Regional Workshop on the Amended Convention on the Physical Protection of Nuclear Material (A/CPPNM), organized by NTI and AFRICISIS, online, April 14, 2021).

65 Heritsoa Emilien Radofa, "Nuclear Safety and Security in Madagascar" (Presentation, EU Project MC 501 15B, ISTC webinar series, 2021).

In 2019 Madagascar received the first IAEA International Physical Protection Advisory Service (IPPAS) mission, which concluded that the country has established a regulatory framework to secure radioactive sources and facilities, including during transport, that is in line with the IAEA's guidance.<sup>66</sup> The governance infrastructure was established in 2015, comprising the Autorité Nationale de Protection et de Sûreté Radiologique (National Authority for Radiological Protection and Safety) and the Directorate of Radiological Safety and Nuclear Security of the Institut National des Sciences et Techniques Nucléaires (National Institute of Nuclear Sciences and Techniques, INSTN).

Madagascar is a convenient location to conduct electronic monitoring of maritime transport. The island hosts the regional Maritime Information Fusion Centre (Centre de Fusion et d'Information Maritime) of the Indian Ocean Regional Information Platform (IORIS). Several outreach and advocacy efforts are carried out with the goal of demystifying the nuclear sector and engaging stakeholders, including annual 'nuclear days' organised by the INSTN.

Madagascar has signed and ratified most of the relevant international conventions, including the NPT, CPPNM and the Pelindaba Treaty. It is a member of the FNRBA, although it has not as yet endorsed its charter. It was a member of AFRA prior to 2020, when the revised agreement entered into force. It has not yet signed or ratified it.

## Seychelles

Seychelles has only a small number of radioactive sources, used by construction companies, public authorities, port and aviation services, and medical facilities. Its Radiation Safety and Security Act (2014) led to the drafting of regulations focused on the authorisation and inspection of industrial and medical facilities, as well as the enforcement of directives.<sup>67</sup> To ensure its effectiveness, the regulatory body – the Radiation Safety and Security Department – falls under the Ministry of Employment, Immigration and Civil Status. This is a government agency with no stake in nuclear matters and whose impartiality can therefore be relied upon.

Seychelles has only a small number of radioactive sources, used by construction companies, public authorities, port and aviation services, and medical facilities

66 IAEA, "IAEA Completes Nuclear Security Advisory Mission in Madagascar", August 23, 2019.

67 Keven Aglae, "Nuclear Safety and Security of the Seychelles" (Presentation, Third Joint Meeting of the SADC Nuclear Regulators Network and the Steering Committee of project MC 5.01 15B MC, Nkopola Lodge, Malawi, October 10-11, 2019).

The Department of Risk and Disaster Management is the main actor involved in emergency preparedness and response. The national CBRN team in Seychelles comprises the line ministries for justice; agriculture; environment, energy and climate change; health; and foreign affairs and transport. Stakeholders also include the Public Utilities Corporation, the Bureau of Standards, the People's Defence Forces, the Port Authority, the Postal Services and Customs. A draft all-hazards response plan is under consideration.

Like Madagascar, Seychelles hosts an IORIS information exchange centre.

Its relevant international commitments comprise its accession to the NPT (1985), ratification of the IAEA CSA and Additional Protocol (2004), signature of the Small Quantities Protocol (2006), and accession to the CPPNM (2003) and its amendment (2006).<sup>68</sup>

Seychelles is a member of the FNRBA, although it has not as yet endorsed its charter. It was a member of AFRA prior to 2020, when the revised agreement entered into force. It has not signed or ratified it.

## Comoros

Comoros uses nuclear technologies in medicine and industry, and an oncology service has recently been installed in in the El Marouf Hospital on Grand Comore.

### Comoros uses nuclear technologies in medicine and industry

As a newcomer to the field, Comoros has the opportunity to reflect international best practices and experiences in its domestic regulations. The country has developed relevant national legal instruments on the basis of the 1997 Framework Law No. 94-018 relating to environmental protection. Examples of legislation under preparation include a law on radiation protection, nuclear safety and the creation of regulatory authority; a code of conduct for Moroni Port, a regulation on radiation protection, radioactive waste and sources; and the statute of the Radiation and Nuclear Safety Authority.

The Comoros' IAEA membership was approved by the IAEA General Conference in 2014.<sup>69</sup> Two years later the country managed to finalise its Integrated Nuclear Security Support Plan. In 2017 Comoros University became a member of the International Nuclear Security

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68 IAEA, "IAEA Completes Nuclear Security".

69 Abdou Ali Soumail, "Statement on Behalf of the Comoros" (Presentation, Third Joint Meeting of the SADC Nuclear Regulators Network and the Steering Committee of project MC 5.01 15B MC, online, October 10-11, 2019).

Education Network. In 2019 the country joined the IAEA's [Incident and Trafficking Database](#) and, in 2021, the [International Network for Nuclear Security Training and Support Centres](#).

The Comoros is not a member of AFRA or the FNRBA.

## Eswatini

In Eswatini, nuclear applications can be found in the areas of diagnostic medicine; agriculture for sustainable food security (through the use of irradiators); industrial radiography; and education and research.

For almost 50 years the only piece of legislation that dealt with radioactive sources was the Control of Radioactive Sources Act (1964), but it was never instituted. To remedy the situation, a national committee for radioactive sources was tasked to develop a comprehensive database and establish a national radiation safety infrastructure in 2017. The committee drafted the National Nuclear Regulatory Act (2018). This is a comprehensive law that addresses various regulatory aspects and establishes an independent regulatory body – the Nuclear Regulatory Department of the Ministry of Tourism and Environment Affairs (MTEA). The mandate of the regulator comprises radiation protection; the safety and security of radioactive sources; emergency preparedness and response; intra-governmental coordination; transport of radioactive material; radioactive waste and safeguards; and export and import controls.<sup>70</sup>

The implementation of the act has to take place in sync with the Mines and Minerals Act (2011), the Environment Management Act No. 5 (2002), the Disaster Management Act No. 1 (2006) and the Occupational Safety and Health Act No. 9 (2001). Environment authorisations are issued by the Eswatini Environment Authority at the MTEA. However, existing facilities such as radiology departments in hospitals do not need authorisation as they were established prior to the act's entry into force. On the other hand, the Minerals Management Board under the Minerals and Mines Ministry issues licences for reconnaissance, prospecting and mining. The authorisation and licencing procedures have to take place with the concurrence of the nuclear regulator.

In terms of policymaking, Eswatini has a special organ – the Public Policy Coordinating Unit (PPCU) – to ensure cohesion in the Cabinet's performance. The unit helped to formulate Vision 2022 and the National Development Strategy. It must enable non-governmental organisations to participate in policymaking processes and channel contributions by the donor community.

The kingdom is a signatory to a number of international instruments in the field of nuclear safety and security. The country, which has been a member of IAEA since 2013, has signed

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70 Cebisile Dlamini, "Assessment of the National Legal, Regulatory and Institutional Infrastructure for the Kingdom of Eswatini" (Presentation, EU Project MC 5.01 15B Support to Southern African States in Nuclear Safety and Safeguards, ISTC webinar series, January 2021).

two CSAs. It ratified the Pelindaba Treaty in 2000, the CTBT in 2016, and the CPPNM in 2003. Eswatini was a member of AFRA prior to 2020, when the revised agreement entered into force. It has not signed or ratified it. It is not a member of the FNRBA.

The kingdom is a signatory to a number of international instruments in the field of nuclear safety and security

## Lesotho

Lesotho is a modest user of nuclear applications. The IAEA has successfully carried out a review on the physical protection of radioactive material in its territory.<sup>71</sup> The relevant legislative framework was initially established in 2008. Ten years later, the Radiation Protection Act was adopted, creating a regulatory authority. The Ministry of Environment is responsible for licencing related to radioactive material.

The country is a state party to the International Convention for the Suppression of Acts of Nuclear Terrorism, the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, and the Convention on Assistance in the Case of Nuclear Accident or Radiological Emergency.<sup>72</sup>

Lesotho was a member of AFRA prior to 2020, when the revised agreement entered into force. It has not signed or ratified it. It is not a member of the FNRBA.

## Mauritius

Radioactive materials in Mauritius are mainly used in applications in the medical, industrial and research fields. Legislation on radiation protection was passed in 2003. The Radiation Protection Authority was established in 2006, operating under the aegis of the Ministry of Energy and Public Utilities. The Radiation Protection Authority is administered and managed by the Radiation Protection Council, which comprises a chairperson and eight other members who represent line ministries and other relevant organisations.<sup>73</sup>

Mauritius is a signatory to a number of international instruments, including the NPT, the Pelindaba Treaty and the CTBT. The country is a member of both the FNRBA and AFRA.

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71 Moeti Nyane Stephen, "Remarks on the State of Radiation Protection in Lesotho" (Presentation, Third Joint Meeting of the SADC Nuclear Regulators Network and the Steering Committee of project MC 5.01 15B, Nkopola Lodge, Malawi October 10-11, 2019).

72 NTI, "Nuclear Security Index".

73 Mauritius, Ministry of Energy and Public Utilities, *Second National Report on Compliance with Obligations under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*, 2017.

# Intra-SADC nuclear cooperation

## SADC Nuclear Regulators' Network

Regional organisations in Africa such as SADC can provide an appropriate platform for sharing experiences in nuclear safety and the effective coordination of a rollout of best practices. One such attempt was the initiative to establish a specialised cooperative mechanism of SADC member states – the SADC NRN.

The SADC NRN was founded in 2011 by a voluntary Memorandum of Cooperative Agreement (MCA). Initially, 12 SADC countries signed the MCA, with the remaining members invited as observers. The underlying concept was based on several assumptions. At its annual meetings, the NRN Assembly, consisting of the heads of national regulators, was expected to formulate, by consensus, strategic approaches to nuclear and radiological safety and security. The executive arm of the network, the NRN Secretariat, was to be chaired by a member of the FNRBA, while the FNRBA chairpersons in SADC countries were to be ex-officio members. Areas of interest were expected to include transport, import and export control, uranium mining, nuclear security, radioactive waste management, and legal and regulatory infrastructures.<sup>74</sup>

The SADC Protocol on Nuclear and Radiation Safety was drafted with the intention to establish a Council of Ministers, as well as the NRN Assembly and Secretariat. The protocol aimed to promote the interdependence and integration of regional nuclear regulatory institutions for the sake of harmonisation and standardisation. It sought to boost recognition of the importance of a comprehensive regional strategy and action plan for the further development of nuclear regulatory governance.

With time it became evident that the NRN should reflect nuclear safety stakeholders better and take into account the emergence of regulators in several SADC member states that were not involved in 2010, not least because they lacked national nuclear regulators. Gradually, four main priority areas of the NRN found broad support: legal and regulatory frameworks; uranium mining and milling legacy issues; transportation safety; and information management.

In 2014, at an EU regional seminar on 'Strengthening Peaceful Use of Nuclear Energy', the Southern African countries called on relevant international organisations to provide regional support programmes that address needs or gaps at the national, regional or continental level. This led to a follow-up regional seminar on uranium mining, milling and transport involving Tanzania, Malawi, Namibia and Zambia, and to the launch of the EU

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<sup>74</sup> Happy Mutanga, "Southern African Development Community Nuclear Regulators Network" (Presentation, Second Joint Meeting of SADC Nuclear Regulators Network and Steering Committee of project MC 5.01 15B, Arusha, May 1, 2018).



project ‘Support to Southern African States in Nuclear Safety and Safeguards’ (Project MC 5.01/15B).<sup>75</sup>

The project aims to reinforce the capacity of Southern African countries to develop an effective regulatory framework for domestic uranium production, including methods for the effective accounting, control and security of uranium products. The project has funded the elaboration of country-specific case studies and recommendations for both licencing and control of uranium-mining activities and transport. A regional study focuses on transport that involves border crossings and information exchange for the transfer of responsibilities. It identifies discrepancies and makes recommendations for harmonisation. The project has identified and addressed training needs, and provides an Internet-based communication system for tracking the movement of nuclear materials and preventing incidents.

## Regional Indicative Strategic Development Plan

The RISDP provides an overarching strategic framework to improve performance. Its purpose is to strengthen regional integration and facilitate the medium-term implementation of SADC’s socio-economic policies. As existing policy documents near the end of their lifetime, any updates or renewals are expected to reflect the opportunities and challenges that present themselves.

‘Infrastructure support for regional integration’ is the most complex sectoral intervention area of the RISDP.<sup>76</sup> It aims to coordinate and promote the integrated management of trans-boundary transport and communication, and energy resources, and to facilitate cross-border movements.

**‘Infrastructure support for regional integration’ is the most complex sectoral intervention area of the RISDP**

This makes infrastructure sectoral governance the most likely host for radioactive material safety measures. Being the custodian of both the energy and the transport protocols, the Infrastructure and Services Directorate at the SADC Secretariat is well positioned to promote nuclear safety guidelines.

The dynamism of the RISDP implies flexibility and adaptability in line with prevailing challenges. SADC countries have to comply with international regulations and advance

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75 International Science and Technology Center, “Support to Southern African States in Nuclear Safety and Safeguards”, *Newsletter* 3, April 2020.

76 SADC, “Summary of the Regional Indicative Strategic Development Plan”.

their legal and regulatory frameworks accordingly, against the background of a developing mining sector and an expected increase in demand for the transportation of UOC and other radioactive material. The growing need for greater cross-border and regional cooperation calls for synchronised governance at the national and regional level. The harmonisation of the mining industry in the region is already an enabling environment for investment and competitiveness. Uniform policies across the region in uranium mining and transport would complement and strengthen such gradual harmonisation.

The minerals industry has been a growth nucleus for many towns and cities in the subregion. Most rail and road infrastructure was developed to serve the movement of material inputs and outputs from mines to local, regional and external markets. Similarly, since the mining sector uses substantial amounts of electric power, many generating units were constructed to service the sector.<sup>77</sup>

There is no institutional mechanism for the coordination of nuclear safety and security policies at the SADC regional level. It is necessary to create an appropriate SADC organ using the model of the SADC/Southern African Regional Police Chiefs Co-operation Organisation, supervised by the Chiefs of Police Sub-Committee of the Inter-State Defence and Security Committee.

Moreover, the SADC Secretariat may decide to participate more intensively in EU Project MC 5.01/15B, acting as a coordinating node. It may help find solutions on how to host the server for the web-based ITS, developed and installed under Project MC 5.01 15B in several SADC countries. This in turn may encourage SADC member states to share, via the system, the necessary information for UOC or other radioactive material shipments.

## Information Tracking System

Project MC 5.01 15B provides for the ITS in order to prevent incidents and ensure an exchange of relevant data in a fast, continuous, comprehensive and consistent manner. It has been deployed in eight SADC countries. To meet the needs of the four island-state members of SADC, the developer, Software Company Ltd., is envisaging an interface between the ITS and the IORIS.

The ITS training and support website contains general information, accessible to everyone, about the training conducted so far in Tanzania and Zambia. These training sessions include a Train-the-Trainer course and a real-time simulation of a shipment lifecycle – from its initial creation to its completion. An exam is administered at the end of the training. A passing grade earns certification to use the ITS.

The ITS is a project output that requires maintenance to ensure sustainability. The necessary equipment was procured by the project, and the main server was installed at the South

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<sup>77</sup> UN Economic Commission for Africa, Southern Africa Office, "Harmonization of Mining Policies, Standards, Legislative and Regulatory Frameworks in Southern Africa" (ECA/SA/TPub/Mining/2004/03, UNECA, Lusaka, 2004), 3.

African NNR premises, with a second backup server at the TAEC in Tanzania. However, running costs such as electricity supply and Internet connection, as well as maintenance and upgrade costs, will have to be taken over by the beneficiary countries after the formal expiration of the project.

The ITS is a project output that requires maintenance to ensure sustainability

In terms of the future use of the ITS, the SADC Secretariat indicated that its IT Unit may not be able to house the server due to insufficient technical and manpower capacity. As a result, it may designate respective organisations in one or more of its member states to act on its behalf.

## Transport

The transport of nuclear and other radioactive material is a regulated activity that occurs in the public domain outside of fixed facilities and potentially involves in-transit stops, trans-shipment points and changes in the mode of transport. Several different stakeholders, such as shippers, carriers, receivers, regulatory authorities and law enforcement agencies, are involved. This calls for a comprehensive legal framework with clearly defined roles and responsibilities, as well as effective planning, coordination and cooperation between all stakeholders, to ensure appropriate security during transportation.<sup>78</sup>

International transport is a major driving force for the synchronisation of regulations and policies. This is an important area where states need to share information to provide the required assurances that duty holders are complying with transport regulations, and hence achieving the requisite levels of safety.

International transport is a major driving force for the synchronisation of regulations and policies

Border controls detect issues regarding transport documentation, driver training, placarding, and package marking and labelling. However, issues relating to packaging

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<sup>78</sup> IAEA, "Division for Nuclear Security".

manufacture, the appropriateness of permitted self-certification of package designs, packaging maintenance, package configuration management, repairs and correct filling cannot be detected by means of border inspections alone.

Furthermore, providing a forum and network for African countries to exchange information will enable each state to understand what compliance checks are being carried out by other states en route. This will avoid any unnecessary duplication and allow additional inspections to be carried out to cover any gaps in knowledge about the duty holder or the package being transported.

In this regard, SADC countries' study visit to Finland and workshops with Kazakhstan were useful. Such visits, organised through European projects, may contain not only country specific but also regional perspectives from the Nordic Council and Eurasia, respectively.

Driven by necessity, Southern African countries have concluded bilateral agreements on information exchanges regarding the transportation of radioactive materials. One notable example is the Memorandum of Understanding between the DRC's CNPRI and Zambia's Radiation Protection Authority.

## **African Association of Competent Authorities**

One possible way ahead in providing greater opportunities for interaction among SADC member states and others is the African Association of Competent Authorities (AACA), which is currently being set up. Conceived within the FNRBA, at the Working Group on Transportation, the aim of the AACA will be to develop and promote a common regulatory approach to the safe transport of radioactive material within participating African member states. This highly specialised grouping, akin to a community of practitioners, may produce several desirable outcomes, such as a common understanding; common positions, statements and approaches on emergency transportation-related preparedness; the monitoring and control of occupational radiation doses in the transportation process; and the justification of certain professional practices.

The association, should it comprise at least the core group of interested SADC member states, can be expected to contribute to a high level of transport regulation throughout Southern Africa. First, it can set up a comprehensive network of radioactive transport safety regulators in (Southern) Africa, which the SADC NRN has so far failed to achieve. Second, it may facilitate learning from each other's best practices and the elaboration of a consensus on important transport regulatory issues. Third, it may have an impact on the practice of radioactive materials transportation through the voluntary implementation of outcomes from its work. Finally, it may create the conditions for further partnerships, including with institutions such as the European Association of Competent Authorities.

# Conclusion and recommendations

This paper looked at the situation in 16 SADC countries in terms of their existing nuclear facilities and regulatory frameworks. It also examined available regional networks, plans and systems that have the potential to synchronise SADC's nuclear regulations. These topics are pertinent because many SADC member governments are planning to increase uranium mining and the peaceful use of nuclear applications, which are projected to drive growth in the region. In addition to South Africa, several other countries are considering adding NPPs to their energy generation mix to help meet rising electricity demand. This requires at least partial synchronisation of existing and emerging regulatory frameworks, better networking of the SADC nuclear regulators, the development of human resources, and the introduction of information technologies. Nuclear energy is highly regulated, with good reason. It is necessary to ensure the safe and secure handling of the nuclear material, plants, reactors and waste disposal of all existing and new nuclear programmes in SADC.<sup>79</sup> Among the many aspects and areas of nuclear safety and security, the transport of nuclear material and radioactive material is crucial, as it requires a comprehensive approach and joint action by neighbouring states. There is certainly potential for cooperation and further synchronisation going forward. SADC constitutes a subregional group in AFCONE and has representatives in the FNRBA and AFRA. It may assist those of its member states that can and are willing to engage in enhanced cooperation in the harmonisation of legal and institutional frameworks for radiation safety, while keeping the format open for other SADC countries to join at a later stage.

In this regard, the following recommendations should be considered:

- Examine the positions of member states on the elaboration of transportation safety guidelines to gain a better understanding of current progress and outstanding priorities in key areas.
- Provide technical support for the elaboration of appropriate normative recommendations on proficiency in the regulation of the transport of radioactive material and related inspections.
- Recommend that member states install and implement the ITS, and designate countries and institutions with the relevant technical capacity that may host the server(s) on behalf of the SADC Secretariat.
- As part of Pillar II (Infrastructure development in support of regional integration) of the RISDP 2020-2030, consider establishing an open-ended informal group of stakeholders on the safe and secure transportation of radioactive material.

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<sup>79</sup> South African Institute of International Affairs, "Atoms for Development Advocacy Campaign".

- Support the implementation of the results from existing enhanced forms of cooperation among like-minded member states, including through regional information-exchange arrangements that could be anchored in the SADC Secretariat for technical support.
- Encourage member states to join the AACA in order to jointly search for practical and harmonised national-level solutions to important transport regulatory issues.
- Keep relevant stakeholders informed about the activities of the SADC regulators' network and be prepared to consider requests from them for advice on radiological protection and regulatory matters.
- Set up a mechanism for AFCONE-SADC cooperation on nuclear matters, including the safety and security of transportation of radioactive material.
- Create a quartet cooperative mechanism between AFRA, AFCONE, the FNRBA and SADC.
- Establish a SADC Office on Nuclear Energy and Regulation.

# Author

## Kamen Velichkov

is Senior Program Manager and Diplomatic Advisor at the International Science and Technology Center, where he oversees EU-funded projects on non-proliferation in Africa and Central Asia. Previously he served as Ambassador of Bulgaria to the Netherlands; Permanent Representative to the OPCW; Ambassador to Thailand; and Head of the Political Section at the EU delegation to Kazakhstan. He was also a visiting lecturer on foreign policy at universities in Kazakhstan, Belgium, Bulgaria and the Netherlands.

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# About SAIIA

SAIIA is an independent, non-government think tank whose key strategic objectives are to make effective input into public policy, and to encourage wider and more informed debate on international affairs, with particular emphasis on African issues and concerns.

SAIIA's occasional papers present topical, incisive analyses, offering a variety of perspectives on key policy issues in Africa and beyond.

## Cover image

Inside India's highly secure and rarely visited uranium processing facility at Turamdih Uranium Mill the yellow substance is called Yellow Cake or Urania and is an intermediate form of uranium after it has been mined. It is mostly triuranium octoxide or  $U_3O_8$ , it is usually not very radioactive. Uranium is usually found in small quantities in the ore and complex processing extracts the ore. The Uranium can then be used to make electricity in nuclear power plants or enriched and then used to make nuclear weapons or atom bombs (Pallava Bagla/Corbis via Getty Images)

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Jan Smuts House, East Campus, University of the Witwatersrand  
PO Box 31596, Braamfontein 2017, Johannesburg, South Africa  
Tel +27 (0)11 339-2021 · Fax +27 (0)11 339-2154  
[www.saiia.org.za](http://www.saiia.org.za) · [info@saiia.org.za](mailto:info@saiia.org.za)