



Regulating mine rehabilitation as a potential climate change mitigation activity

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Abstract

Climate change has proven to be a destructive global phenomenon with widespread environmental consequences that require urgent mitigation. In response to this urgency, the international community has developed various treaties to mitigate climate change. These treaties include the United Nations Framework Convention on Climate Change, the Kyoto Protocol, and the Paris Agreement. One of the causes of climate change is the emission of various greenhouse gases, and the mining sector is the major contributor to these emissions globally. These emissions are a result of mineral extraction and the processing stages involved in processing such minerals.

In the South African context, the effects of climate change are evident from climate events such as the heavy rainfall in 2022 in KwaZulu-Natal that led to over 400 fatalities. Despite South Africa's commitment to climate change mitigation efforts by means of various laws and policies, there is a significant challenge in the mining sector since the country has over 6 100 unrehabilitated and abandoned mines. This is concerning because these mining sites, especially coal mines, continue to emit methane, a second greenhouse gas after carbon dioxide. This continues to occur even after the mine has ceased to be active.

Although South Africa has put climate change mitigation measures in place, mine rehabilitation is not regulated as a climate change mitigation activity. Despite the requirement under South African law for financial provision to ensure that money is set aside for rehabilitation, thousands of mines remain unrehabilitated. Against this background this study argues that mine rehabilitation, with an emphasis on coal mines, can potentially be a climate change mitigation activity. Rehabilitating these mines will prevent ongoing methane emission, thereby partially contributing to South Africa's broader climate change mitigation efforts. The research was done by adopting a desktop study methodology, supported by quantitative visuals to explore mine rehabilitation as a potential climate change mitigation activity.

Keywords: Mine rehabilitation; Climate change mitigation; Unrehabilitated and abandoned mines; South Africa; Financial provision

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List of Abbreviations

AGSA	Auditor-General of South Africa
AMD	Acid mine drainage
CBDR-RC	Common but differentiated responsibilities and respective capabilities
CGS	Council for Geoscience
CDM	Clean Development Mechanism
Constitution	Constitution of the Republic of South Africa, 1996
DMPR	Department of Mineral and Petroleum Resources
DMR	Department of Mineral Resources
DME	Department of Minerals and Energy
DMRE	Department of Mineral Resources and Energy
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
D and O	Derelict and Ownerless
Earthlife-case	<i>EarthLife Africa Johannesburg v Minister of Environmental Affairs</i>
GHG	Greenhouse gases
IRP	Integrated resource plan
IET	International Emissions Trading Mechanism
JI	Joint Implementation Mechanism

KP	Kyoto Protocol
MTEF	Medium-term expenditure framework
MPR	Minister of Mineral and petroleum resources
MPRDA	Mineral and Petroleum Resources Development Act 28 of 2002
MEC	Member of the Executive Council
NEMA	National Environmental Management Act 107 of 1998
NEMAQA	National Environmental Management Air Quality Act 39 of 2004
NWA	National Water Act
NCCR Green Paper	National Climate Change Response Green Paper
NCCR White Paper	National Climate Change Response White Paper
NDCs	Nationally determined contributions
NCOP	National Council of Provinces
REIPPPP	Renewable energy independent power producer's procurement programme
SET	Sectoral emissions targets
UNFCCC	United Nations Framework Convention on Climate Change

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Chapter 1 Introduction

1.1 Background

One of the most current pressing global environmental issues is climate change, which is partially a consequence of the Industrial Revolution in the 18th century.¹ Global temperature began to rise at this time and it is continuing to do so.² It has been reported that the global average temperature has risen by approximately 1°C since the 19th century, and most of this increase happened over the last five decades.³ The effects of climate change as a result of anthropogenic activities are therefore much worse than they were half a century ago. Anthropogenic activities, including those of the mining sector, partly contribute to this rising temperature. Greenhouse gas (hereafter GHG) emissions such as carbon dioxide, methane, nitrous oxide, and synthetic gases like chlorofluorocarbons and hydrofluorocarbons have significantly contributed to climate change.⁴

The consequences of climate change are continuously growing and widely impactful; it threatens humanity. These consequences include heat waves, droughts, flooding, rising sea levels and wildfires.⁵ Since climate change is resulting in severe consequences around the world, it has become urgent for countries to act by implementing climate change mitigation strategies. In response to this threat and the urgent need, various countries have come together to sign the Paris Agreement in 2015.⁶ The main aim of the Paris Agreement is to reduce the anthropogenic GHG emissions that contribute to climate change which lead to global warming.⁷ Signatories of the Paris Agreement have committed to keeping the rise of the global average temperature below 2°C, preferably limiting the temperature

¹ See United National date unknown <https://www.un.org/en/climatechange/what-is-climate-change>.

² Ameer *et al* 2022 *Economic Modelling* 2.

³ The Royal Society & US National Academy of Sciences *Climate Change Evidence & Causes* 2.

⁴ Healey Climate Change Crisis 2.

⁵ Intergovernmental Panel on Climate Change *Climate Change 2021: The Physical Science Basis* 310.

⁶ *United Nations FCCC /CP/2015/L.9/Rev.1* (2015).

⁷ See Article (hereafter A) 2 of the Paris Agreement (2015).

increase to 1.5°C.⁸ If this goal is achieved it would significantly reduce the risks and consequences of climate change.⁹ Despite these goals, researchers such as Reisinger *et al* argue that the world is not doing enough to meet these goals and targets.¹⁰ They warn that limited progress with climate change mitigation makes the possibility of exceeding the 1.5°C temperature increase extremely high.¹¹ This study agrees with the arguments put forth by Reisinger *et al*. The call for climate change mitigation is not only a legal duty but also an appeal to humanity's ethical responsibility to protect the current and future generations.¹²

Although the mining sector significantly contributes to climate change, it remains a major employer, employing approximately 477 000 people in South Africa in 2023.¹³ The mining sector is the major contributor to the gross domestic product of South Africa. It therefore plays a major economic role, despite its environmental impact. Historically, coal and other minerals were mined in South Africa without mine rehabilitation practices in place¹⁴, contributing to GHG emissions and climate change. This is because unrehabilitated coal mines continue to emit methane.¹⁵

The mining sector in South Africa is one of the main contributors to GHG emissions, thereby partially contributing to climate change. This was stated in the case of *EarthLife Africa Johannesburg v Minister of Environmental Affairs and others* (hereafter *Earthlife case*) where the court highlighted South Africa's impact on global GHG emissions.¹⁶ This contribution to GHG is due to the extensive mining and mineral processing activities that form part of the South Africa's economy,

⁸ A 2(1)(a) of the Paris Agreement (2015).

⁹ A 2(1)(a) of the Paris Agreement (2015).

¹⁰ Reisinger et al 2025 *Annual Review of Environment and Resources* 2.

¹¹ Reisinger et al 2025 *Annual Review of Environment and Resources* 2.

¹² Murombo "South Africa's Energy Mix - Towards a Low-Carbon Economy" 18-26.

¹³ Stoddard 2024 <https://www.dailymaverick.co.za/article/2024-02-05-sa-mining-employment-rises-in-2023-while-exports-slide-on-eskom-and-transnet-crisis/>.

¹⁴ Ndzimande & Chauke 2012 *Journal of the Southern African Institute of Mining and Metallurgy* 135.

¹⁵ See Global Methane Initiative *Methane Emissions from Abandoned Coal Mines in China* 2.

¹⁶ *EarthLife Africa Johannesburg v Minister of Environmental Affairs and others* 2017 2 All SA 519 (GP) Para 25 (hereafter *Earthlife case*).

including the high reliance on coal to produce energy, which then partly causes climate change.¹⁷

Beyond contributing to GHG emissions, traditional mining severely degrades land.¹⁸ Land use changes as a result of mining further exacerbate GHG emissions since the removal of vegetation and disturbance of soil releases carbon dioxide into the atmosphere.¹⁹ In South Africa, mines that extract gold and uranium, in areas such as Witwatersrand, have destroyed wetlands, reduced biodiversity, and degraded soil, water and air quality.

These effects partly exacerbate climate change challenges. Without any urgent action for climate change mitigation, local communities are likely to experience poverty and be vulnerable to these impacts. The link between mining and climate change should be an indication that mine rehabilitation is needed. This in turn will offer lasting social and economic benefits, especially after mine closures.²⁰ Mine rehabilitation, which is the process of restoring the land that has been degraded to the state it was before the mining activity, is important for climate change mitigation, sustainable growth, biodiversity preservation, and ecological stability.²¹

Mining companies have operated without sufficient consideration for environmental restoration, leaving behind excavated landscapes and improperly closed mines.²² One of the contributing factors is that prior to the promulgation of the *National Environmental Management Act* 107 of 1998 (hereafter *NEMA*) and the current *Mineral and Petroleum Resources Development Act* 28 of 2002 (hereafter *MPRDA*), previous legislation such as the *Mines and Works Act*, 27 of 1956 just required the

¹⁷ *EarthLife* case 2017 2 All SA 519 (GP) Para 25.

¹⁸ Shackleton 2020 *Land Use Policy* 1.

¹⁹ Witchalls 2022 <https://earth.org/environmental-problems-caused-by-mining/>.

²⁰ Federation for a Sustainable Environment *Rehabilitation of mine contaminated eco-systems A contribution to a just transition to a low carbon economy to combat unemployment and climate change* 5.

²¹ Pan African Resource 2024 <https://www.panafricanresources.com/mine-site-rehabilitation/>.

²² Ndzimande & Chauke 2012 *Journal of the Southern African Institute of Mining and Metallurgy* 135.

mining site to be fenced and dangerous openings to be secured.²³ Similarly, mining rights granted in terms of the *Mining Rights Act* 20 of 1967 did not impose explicit environmental management or mine rehabilitation obligations.²⁴ The lack of strict environmental laws for sectors like mining in the past has had long-term environmental consequences²⁵ that are felt to this day.

However, there has been a shift in the regulation of mine rehabilitation. Sustainable mining laws and policies that prioritise the environment and the rehabilitation of mines have been adopted. For example, legislation such as *NEMA* require avoidance, minimisation, and mitigation of environmental degradation²⁶, with mine rehabilitation serving as a key mitigation activity. Mine closure planning is an important part of the mining life cycle, “which includes exploration, pre-feasibility studies, development through operations and finally closure” and most importantly rehabilitation of the mine.²⁷ The *MPRDA* requires that the holder of a mining right or permit applies for a closure certificate when mining operations cease²⁸ and the closure certificate can only be granted after the mine has been properly rehabilitated.

NEMA imposes a duty of care on any individual or entity responsible for causing or potentially causing environmental degradation to remediate the environmental damage.²⁹ The remedy includes mine rehabilitation in cases involving mining activities. Section 2 of *NEMA* includes the polluter-pays principle, which states that the party responsible for harming or degrading the environment must cover the costs for the damage caused.³⁰ The polluter-pays principle requires the

²³ Department of Mineral Resources (hereafter DMR) *The National Strategy for the Management of Derelict and Ownerless Mines in South Africa* 7.

²⁴ DMR *The National Strategy for the Management of Derelict and Ownerless Mines in South Africa* 7.

²⁵ Ndzimande & Chauke 2012 *Journal of the Southern African Institute of Mining and Metallurgy* 135.

²⁶ Section 2(4)(a)(ii) of *National Environmental Management Act* (hereafter *NEMA*) 107 of 1998.

²⁷ Mpanza, Adam & Moolla 2021 *Journal for Transdisciplinary Research in Southern Africa* 5.

²⁸ Section 43(3)(b) of *Mineral and Petroleum Resources Development Act* (hereafter *MPRDA*) 28 of 2002.

²⁹ Section 28 of *NEMA* 107 1998.

³⁰ Section 2(4)(p) of *NEMA* 107 1998.

rehabilitation of mines when they reach the end of life or if they have been abandoned.³¹

Furthermore, *NEMA* includes a financial provision that requires mining companies to set aside funds to cover the costs of rehabilitating the mine once it is no longer active and for post-closure activities.³² This financial provision ensures that once a mine is inactive or has reached the end of its life, there is financial security or money to use to cover the costs of mine rehabilitation. The goal is to bring the land where the mine activities were conducted back to its original state or close to where it was. The inclusion of a financial provision shows that mine rehabilitation is a legal responsibility. As much as there has been a shift that aims to regulate unrehabilitated and abandoned mines, it appears that the aforementioned laws are not implemented.³³

The *Constitution of the Republic of South Africa*, 1996 (hereafter *the Constitution*) guarantees the right to an environment that is not harmful to health or well-being.³⁴ The *Constitution* imposes a duty on the state to protect this environmental right, not only for the present generation but also for future generations.³⁵ The laws that require mining companies to rehabilitate mines after mining operation have ceased, align with the constitutional right to a protected environment. When these mines are rehabilitated, which can include reforestation to sequester carbon, it can reduce the country's GHG emissions.

Currently, there are no policies and measures that address methane emissions from coal mines and that promote carbon sequestration during mine rehabilitation process.³⁶ This study aims to address this regulatory gap by arguing that the implementation of effective mine rehabilitation strategies can play a significant role

³¹ See section 2(4)(p) of *NEMA* 107 1998.

³² Section 24P of *NEMA* 107 1998.

³³ See Kuipa & Lekudze 2024 *Journal of the Southern African Institute of Mining and Metallurgy* 552.

³⁴ Section 24(a) of the *Constitution of the Republic of South Africa*, 1996.

³⁵ Section 24(b) of the *Constitution of the Republic of South Africa*, 1996.

³⁶ DFFE *Sectoral Emissions Targets 2025 to 2030* 24.

in preventing methane emissions from post mining sites, supporting broader climate change mitigation objectives.

1.2 Problem statement

Unrehabilitated and abandoned mines, especially coal mines, contribute to climate change as these mining sites continue to emit methane³⁷ and these mines leave behind degraded land that loses its ability to sequester carbon, contributing to GHG emissions. Despite South African laws now requiring mines to be rehabilitated once they have reached the end of their life, South Africa has 6 100 abandoned mines that remain unrehabilitated.³⁸ In 2022 the Auditor-General released a report on the follow-up performance audit conducted on the Department of Mineral Resources and Energy (hereafter DMRE) regarding the rehabilitation of abandoned mines.³⁹ The report indicated that South Africa has 6 100 abandoned mines, of which 379 are coal mines.⁴⁰ The audit found only minimal progress with the department's rehabilitation programme over the past 12 years.⁴¹ The average number of rehabilitated mines per year increased from 1.67 mines in 2009 to only 2.25 mines in 2021.⁴² Despite this increase, the majority of mines in South Africa remain unrehabilitated. The report indicated that no high-risk commodity mines, which include coal mines, were rehabilitated, with the exception of asbestos mines.⁴³ These sites further cause acid mine drainage (hereafter AMD)⁴⁴, air pollution from

³⁷ See Global Methane Initiative *Methane Emissions from Abandoned Coal Mines in China*, which is a study highlighting ongoing methane emissions from abandoned coal mines in China, which contributes to climate change.

³⁸ See Auditor General of South Africa (hereafter AGSA) *Follow-up performance audit at the Department of Mineral Resources and Energy (hereafter DMRE) on the rehabilitation of derelict and ownerless mines*.

³⁹ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines*.

⁴⁰ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 17.

⁴¹ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 8.

⁴² AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 8.

⁴³ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 27.

⁴⁴ Watson *et al* "Terrestrial and Deep Seabed Mining" 878.

mines that are not active⁴⁵, spontaneous combustion,⁴⁶ land subsidence⁴⁷ and they sustain illegal mining activities.⁴⁸

The existence of over 6 000 abandoned mines in South Africa where rehabilitation is happening at a very slow rate⁴⁹ indicates the shortcomings in rehabilitation practices. These shortcomings are caused by the lack of enforcement, implementation, and insufficient funding for mine rehabilitation.⁵⁰ The extent of GHG emission as a result of unrehabilitated mines can be easily overlooked. However, a study done in China revealed that 44 abandoned coal mines in Shanxi province were estimated to emit over 500 million cubic meters of methane every year, which is equivalent to the global warming potential of 7 million tonnes of carbon dioxide.⁵¹ This highlights the significant climate impact of methane emissions from just a small number of abandoned coal mines, a pressing issue given that South Africa has over 300 unrehabilitated coal mines.

The nexus between climate change and unrehabilitated mines presents a significant and urgent research problem. This is especially important within the context of climate change mitigation, given the ongoing methane emissions from abandoned and unrehabilitated coal mining sites. Despite mining activities having broader environmental consequences, there is a gap in the understanding of how the enforcement of mining rehabilitation requirements or practices can serve as a potential climate change mitigation activity. This is due to the limited number of studies examining mine rehabilitation as a climate change mitigation activity. There is also a gap in understanding to what extent South Africa's laws regulate or support

⁴⁵ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 22-23.

⁴⁶ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 24.

⁴⁷ Davydenko, Tahmaseb & Shokri 2024 *Geophysical Research Letters* 1 & Galloway; Burbey 2011 *Hydrogeology Journal* 1459.

⁴⁸ Mhlomo & Amponsah-Dacosta 2015 *Taylor & Francis* 1-2.

⁴⁹ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 8.

⁵⁰ See Van Wyk & Haagner 2025 *Journal of the Southern African Institute of Mining and Metallurgy* 213.

⁵¹ Global Methane Initiative *Methane Emissions from Abandoned Coal Mines in China* 2.

mine rehabilitation as a climate change mitigation activity. Therefore, this study aims to fill these gaps and contribute to the efforts to address climate change in alignment with the climate change objectives of South Africa.

Mine rehabilitation is typically viewed as a way of mitigating the environmental consequences after the mining activities. However, this study aims to argue that mine rehabilitation could also serve as a climate change mitigation activity.

1.3 Research question

To what extent does South Africa's legislation regulate mine rehabilitation as a climate change mitigation activity, through methane emission reduction at post-mining sites?

1.4 Research aim and objectives

The primary aim of this study is to evaluate the extent to which South Africa's legislation regulate or support the rehabilitation of abandoned mines as a climate change mitigation activity, with specific focus on reducing methane emissions in post-mining sites.

In pursuit of this aim, the objectives of this study are to:

- (a) provide a contextual background to the study by briefly discussing the key issue that has to be researched and addressed;
- (b) provide a brief overview of South Africa's international climate change mitigation mandate and examine the objectives and mechanisms for climate change mitigation in South Africa;
- (c) analyse the South African legal framework governing mine rehabilitation to highlight that there is a legal responsibility to rehabilitate the mines once they have reached the end of their life;

- (d) critically examine the current state of mine rehabilitation practices in South Africa by discussing what has been happening on the ground to mitigate or alleviate the consequences of unrehabilitated and abandoned mines; and to
- (e) propose recommendations aimed at addressing methane emissions from unrehabilitated and abandoned mines in South Africa, with emphasis on coal mines.

1.5 Research methodology

The study made use of a desktop study methodology by primarily relying on a literature review. This involved analysing primary and secondary sources such as books, chapters of books, journal articles, legislation, case law, international treaties, government policy documents and reliable electronic sources. Important international treaties such as the *United Nations Framework Convention on Climate Change* (hereafter UNFCCC) and Kyoto Protocol (hereafter KP) are discussed. Domestically, legislation such as *NEMA* and some of the sector-specific environmental laws are analysed. In addition to the written literature review, the study includes graphs, maps and statistical data in relation to mine rehabilitation to support the literature review. These quantitative visuals are used as a way of highlighting the extent of unrehabilitated and abandoned mines in South Africa. By analysing these sources, the aim is to gather information that is relevant to mine rehabilitation and climate change mitigation.

Chapter 2 Pinning down South Africa's climate change mitigation mandate, objectives, and proposed mechanisms

2.1 Introduction

Climate change mitigation entails actions which aims to reduce or prevent the emission of GHGs, which trap heat in the atmosphere.⁵² By minimising sources of GHG emissions, such as the burning of fossil fuels for energy production, the impact of human beings on the climate system will be lowered.⁵³ As climate change emerged as a significant global issue that has to be mitigated, international treaties and instruments such as UNFCCC and KP were adopted in the 1990s to address its consequences, and later the Paris Agreement. At the heart of these international treaties lies the core objective of mitigating climate change. These treaties have guided countries to start climate change mitigation efforts including South Africa.

Section 231 of the *Constitution* regulates the approval and domestication of international agreements, stating that such agreements bind the Republic only once approved by the legislature.⁵⁴ In the South African context the *Constitution* protects everyone's right to an environment that is not detrimental to their health or wellbeing, and this right must be protected through reasonable legislative and other measures.⁵⁵ Climate change is one of the factors that infringes environmental rights, and South Africa is not an exception to the effects of climate change as was seen during the 2022 heavy rainfall experienced in KwaZulu-Natal, which led to the death of over 400 people and the displacement of over 40 000 people.⁵⁶ The KwaZulu-Natal 2022 flood has been proven to have been exacerbated by climate change.⁵⁷

⁵² Ilango "Significance of artificial intelligence to develop mitigation strategies against climate change in accordance with sustainable development goal" 380 & Ssekamatte 2018 *African Evaluation Journal* 4.

⁵³ Ilango "Significance of artificial intelligence to develop mitigation strategies against climate change in accordance with sustainable development goal" 380-381.

⁵⁴ Section 231 of the *Constitution of the Republic of South Africa*, 1996.

⁵⁵ Section 24 of the *Constitution of the Republic of South Africa*, 1996.

⁵⁶ See report by Centre for Environmental Rights *The direct and indirect climate change impacts, loss and damages in selected at-risk communities in Durban as a result of the April 2022 floods* 17-21.

⁵⁷ See Engelbrecht *et al* 2025 *Journal Communications Earth & Environment*.

The rainfall during the event was between 40% and 107% higher than it would have been with cooler temperatures.⁵⁸

In response to the international mandate to mitigate climate change and protect environmental rights, South Africa, specifically the Department of Forestry, Fisheries and the Environment (hereafter DFFE), formerly known as the Department of Environmental Affairs, developed the *National Climate Change Response Green Paper* (hereafter *NCCR Green Paper*) and the *National Climate Change Response White Paper* (hereafter *NCCR White Paper*) in 2010 and 2011 respectively as South Africa's starting point to address climate change. Finally in 2024 the long-awaited *Climate Change Bill* was signed into law.⁵⁹ The *NCCR Green* and *White paper* and the *Climate Change Act* include two main objectives, namely climate change mitigation and climate change adaptation.⁶⁰ However, for this study the focus is on climate change mitigation.

This chapter has two primary objectives. Firstly, it provides an overview of the international mandate, objectives, and mechanisms for climate change mitigation. This is the starting point in understanding South Africa's climate change mitigation approach. Understanding the international context is important because South Africa's climate change mitigation response and mandate are influenced by international treaties such as UNFCCC, KP and the Paris Agreement, which establish the obligation to mitigate climate change and guide domestic actions. Secondly, this chapter delves into the South African context by examining South Africa's climate change mitigation response through national objectives and mechanisms. The chapter is structured as follows: It begins by briefly exploring the evolution of the international climate change mitigation mandate and commitments. It then discusses the national climate change mitigation objectives by referencing key policies and laws such as the *NCCR Green Paper*, the *NCCR White Paper*, and the

⁵⁸ Engelbrecht *et al* 2025 *Journal Communications Earth & Environment* 8.

⁵⁹ Proc 251 in GG 52319 of 17 March 2025.

⁶⁰ *National Climate Change Response Green Paper* (hereafter *NCCR Green Paper*) (2010) Para 2, *National Climate Change Response White Paper* (hereafter *NCCR White paper*) (2011) Para 2 & Section 2 of *Climate Change Act* 22 of 2024.

Climate Change Act. Finally, the chapter examines the mechanisms that South Africa has put in place to achieve these objectives.

2.2 South Africa's international mitigation mandate

South Africa's climate change mitigation mandate has been developed from its international obligations and commitment to mitigate climate change. The foundation of this mandate began with the adoption of the UNFCCC in 1992, to which South Africa became a signatory as a non-annex 1 country.⁶¹ According to the UNFCCC, the objective is:

"To achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner."⁶²

The UNFCCC acknowledged that most of the historical and current GHG emissions are emitted by developed countries.⁶³ This then led to the establishment of the principle of common but differentiated responsibilities and respective capabilities (hereafter CBDR-RC).⁶⁴ Under this principle, Non-annex 1 countries like South Africa were not obligated to mandatory commitment, as the primary burden was placed on Annex 1 countries.⁶⁵ However, Non-annex 1 countries were encouraged to participate in climate change mitigation efforts, provided that they receive financial support from the developed countries or Annex 1 countries.⁶⁶ Therefore, as a participant in climate change negotiations under the UNFCCC, South Africa has an

⁶¹ Steenkamp & Naudé 2018 *African Journal of Business Ethics* 71.

⁶² A 2 of the United Nations Framework Convention on Climate Change (hereafter UNFCCC) (1992).

⁶³ Preamble of the UNFCCC (1992).

⁶⁴ A 3(1) of the UNFCCC (1992).

⁶⁵ See A 3(1) of the UNFCCC (1992).

⁶⁶ A 3 of the UNFCCC (1992).

international obligation as a developing country to take part in mitigation efforts, especially considering that South Africa is the leading GHG emitter in Africa.⁶⁷

The UNFCCC did not set specific GHG emission reduction targets, it merely required member states to take steps to limit anthropogenic GHGs.⁶⁸ This then led to the adoption of the KP in 1997. The KP, which incorporates the CBDR-RC principle,⁶⁹ came into force in February 2005,⁷⁰ aimed at giving effect to the objectives and implementation of the UNFCCC by setting binding emissions targets for industrialised (Annex I) countries.⁷¹ The first commitment period of the KP lasted for four years from 2008 to 2012,⁷² during which countries under Annex 1 had a binding obligation to:

“Ensure that their aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A do not exceed their assigned amounts, calculated pursuant to their quantified emission limitation and reduction commitments inscribed in Annex B and in accordance with the provisions of this Article, with a view to reducing their overall emissions of such gases by at least 5 per cent below 1990 levels in the commitment period 2008 to 2012.”⁷³

However, during the second commitment period, new targets were introduced for Annex 1 countries.⁷⁴ This second period is known as the Doha amendment.⁷⁵ Annex 1 countries were obligated to reduce GHG emissions by at least 18% below 1990 levels.⁷⁶ This period ran for eight years from 2013 to 2020.⁷⁷ These obligations were binding only for Annex 1 countries.⁷⁸

⁶⁷ Rumble, Gilder & Parker “Carbon Pricing in South Africa” 20-4.

⁶⁸ Kidd *Environmental Law* 64.

⁶⁹ Carter and Barnard “Demystifying the global climate change regime” 9.

⁷⁰ Kyoto Protocol (hereafter KP) (1997).

⁷¹ Kidd *Environmental Law* 64.

⁷² Böhringer 2003 *Oxford Review of Economic Policy* 451.

⁷³ A 3(1) of the KP (1997).

⁷⁴ See UNFCCC *Doha amendment to the KP on to the UNFCCC* 1.

⁷⁵ UNFCCC *Doha amendment to the KP on to the UNFCCC*.

⁷⁶ UNFCCC *Doha amendment to the KP on to the UNFCCC* 1.

⁷⁷ UNFCCC *Doha amendment to the KP on to the UNFCCC* 1.

⁷⁸ UNFCCC *Doha amendment to the KP on to the UNFCCC* 1.

While the obligations under the UNFCCC and the KP were primarily compulsory for Annex 1 countries, the Paris Agreement, which was adopted in 2015, changed this. All signatories of the Paris Agreement, including developing countries like South Africa, are required to address climate change, and this is compulsory.⁷⁹ The Paris Agreement mandates that signatories must prepare, communicate, and maintain successive nationally determined contributions (hereafter NDCs), where they outline the mitigation actions they aim to achieve through domestic measures.⁸⁰ Therefore, mine rehabilitation as a potential climate change mitigation activity can be integrated into South Africa's NDCs. This will strengthen the country's international climate change mitigation commitments while simultaneously addressing domestic challenges associated with unrehabilitated and abandoned mines.

As a signatory to the UNFCCC, KP, and the Paris Agreement, South Africa has committed to implementing climate change mitigation actions. In December 2009, at the UNFCCC COP 15 in Copenhagen

"South Africa committed at Copenhagen to reduce its GHG emissions by 34% by 2020 and 42% by 2025 below business as usual."⁸¹

The Climate Action Tracker estimate suggested that South Africa's 2020 commitment made in December 2009, at the UNFCCC COP 15 in Copenhagen was met.⁸² However, there is no report yet suggesting whether the 2025 commitment has been met. South Africa's GHG emissions trajectory is projected to peak between 2020 and 2025, within the range of 398 to 614 megatonnes of carbon dioxide equivalent.⁸³ Following the peak, emissions are expected to stabilise for up to a decade before gradually declining from 2036, reaching between 212 and 428 megatonnes by 2050.⁸⁴

⁷⁹ See A 3 of the Paris Agreement (2015).

⁸⁰ A 4(2) of the Paris Agreement (2015).

⁸¹ *NCCR Green Paper* (2010) Para 5.4.

⁸² Climate Action Tracker 2021 South Africa - Assessment - 29/10/2021 | Climate Action Tracker.

⁸³ *NCCR White paper* (2011) Para 6.4.2.

⁸⁴ *NCCR White paper* (2011) Para 6.4.2.

2.3 South Africa's climate change mitigation objectives

South Africa's climate change mitigation objectives are rooted in its domestic laws and policies, as well as international commitments. A common obligation across these laws and policies is the stabilisation of GHG concentrations in the atmosphere at a level that prevents dangerous human interference with the climate system.

2.3.1 National Climate Change Response Green Paper

In 2010, the DFFE published the *NCCR Green Paper*. Its climate change mitigation objective is to fairly contribute to the achievement of stabilisation of GHG concentrations in the atmosphere at the level that prevents dangerous human interference with the climate system.⁸⁵ The *NCCR Green Paper* for climate change mitigation has specific focus areas or industries, namely energy, industry and transport.⁸⁶ The *NCCR Green Paper* acknowledges that the mining sector emits methane, especially from coal mines.⁸⁷ To address this South Africa planned that by 2015, it would

"compile and initiate the implementation of a strategy and action plan to reduce fugitive emissions of methane by 42% from the business as usual by 2025".⁸⁸

However, the *NCCR Green Paper* did not explicitly address emissions from unrehabilitated coal mines that continue to emit methane even after mining operation has ceased. This omission is concerning, as over 300 abandoned coal mines in South Africa remained unrehabilitated as of 2021, which is the main focus of this study.

⁸⁵ *NCCR Green Paper* (2010) Para 2.

⁸⁶ *NCCR Green Paper* (2010) Para 5.

⁸⁷ See *NCCR Green Paper* (2010) Pg 18.

⁸⁸ *NCCR Green Paper* (2010) Para 5.5.8.

2.3.2 National Climate Change Response White Paper

The *NCCR White Paper* published in 2011 was influenced by the *Constitution*, *NEMA*, the Millennium Declaration, and the UNFCCC.⁸⁹ The climate change mitigation objective of the white paper is to:

“Make a fair contribution to the global effort to stabilise GHG concentrations in the atmosphere at a level that avoids dangerous anthropogenic interference with the climate system within a timeframe that enables economic, social and environmental development to proceed in a sustainable manner”.⁹⁰

NCCR White Paper lists focus areas to reduce emissions. This includes the energy sector by promoting energy efficiency and with the introduction of renewable energy.⁹¹ Other focus areas are transport, waste management and carbon capture.⁹²

South Africa relies heavily on coal for energy, as over 80% of energy in South Africa is produced from coal.⁹³ Coal mining supports this energy production, and some of the coal mines in South Africa have reached their end of life and have been left unrehabilitated and abandoned. These mines continue to emit methane. If they are rehabilitated, the climate change mitigation objectives of the *NCCR White Paper* will be partially achieved.

2.3.3 Climate Change Act

South Africa made significant progress when the President of the Republic of South Africa signed the *Climate Change Bill*, which has been a bill since 2018, into law in 2024.⁹⁴ The *Climate Change Act* aims to ensure the

“development of an effective climate change response and a long-term, just transition to a low-carbon and climate-resilient

⁸⁹ Madondo & Nkwana 2021 *Administratio Publica* 193.

⁹⁰ *NCCR White paper* (2011) Para 2.

⁹¹ *NCCR White paper* (2011) Para 8.3-8.4.

⁹² See *NCCR White paper* (2011) Para 8-8.7.

⁹³ DMRE The South African Energy Sector Report 2023 14.

⁹⁴ South African Government 2024 <https://share.google/g9o8lkyTIWf3K05ST>.

economy and society for South Africa in the context of sustainable development”.⁹⁵

The climate change mitigation objective of the *Climate Change Act* is to contribute fairly to the stabilisation of GHG concentrations in the atmosphere at a level that prevents dangerous human interference with the climate system.⁹⁶ This objective aligns with the climate change mitigation objectives stated in the *NCCR Green* and the *White Paper*. However, the difference between the *Climate Change Act* and the *NCCR Green* and *White Paper* is the approach in achieving climate change mitigation. *NCCR Green* and *White Paper* list the focus areas whereas the *Climate Change Act* does not specify focus areas for mitigation efforts. Instead, it provides a broader framework for achieving the stated objectives.

2.4 International prescribed mitigation mechanisms under the Kyoto Protocol

The KP primarily outlines internationally prescribed mechanisms that will allow signatories to meet GHG emission reduction commitments under Article 3. These mechanisms are referred to as flexible mechanisms that aim to help Annex 1 countries to meet their GHG emission reduction commitments.⁹⁷ These primary mechanisms are the international emissions trading mechanism (hereafter IET), the joint implementation mechanism (hereafter JI) and the clean development mechanism (hereafter CDM).

2.4.1 International emissions trading mechanism

The IET mechanism allows Annex 1 countries to trade emission reduction units with each other.⁹⁸ Annex 1 countries often use IET mechanisms to reduce costs associated with emissions reductions since IET allows Annex 1 countries to buy another Annex 1 country's emission budget.⁹⁹

⁹⁵ *Climate Change Act* 22 of 2024.

⁹⁶ Section 2(c) of *Climate Change Act* 22 of 2024.

⁹⁷ Du Toit and Glazewski "International Climate Change Law" 12

⁹⁸ A 6, 12(3)(a)-(3)(b)(5) & 17 of the Kyoto Protocol (1997).

⁹⁹ Du Toit and Glazewski "International Climate Change Law" 14.

2.4.2 Joint implementation mechanism

The JI mechanism, which also applies to Annex 1 countries, allows these countries to transfer or acquire emission reduction units from another Annex 1 country. As stated, that:

“any Party included in Annex 1 may transfer to, or acquire from, any other such Party emission reduction units resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks of greenhouse gases in any sector of the economy”.¹⁰⁰

2.4.3 The clean development mechanism

Lastly, the CDM applies to Annexed 1 and Non-annex 1 countries, including South Africa. The objective of this mechanism is to assist Non-annex 1 countries to achieve sustainable development, to contribute to the objective of the Convention, and to assist Annex 1 countries to ensure that they comply with their quantified emission limitation and reduction commitments.¹⁰¹ The CDM assists Non-annex 1 countries to achieve sustainable development by allowing Annex 1 countries or entity to undertake environmental projects and invest in Non-annex 1 countries.¹⁰² As a result, this simultaneously contributes to the objective of the CDM in terms of the KP and also assist Annex 1 countries to comply with their commitment of emission reduction.¹⁰³

2.5 South Africa's mechanisms for achieving climate change mitigation

objectives

In an effort to ensure that the objectives of climate change mitigation are achieved and to implement the internationally prescribed CDM, South Africa has implemented

¹⁰⁰ A 6(1) of Kyoto Protocol (1997) & See Du Toit and Glazewski "International Climate Change Law" 14.

¹⁰¹ A 12(2) of the Kyoto Protocol (1997).

¹⁰² Legora *A legal analysis of South Africa's international climate change mitigation obligations in the renewable energy sector* 25 & See Rumble, Gilder & Parker "Carbon Pricing in South Africa" 20-16.

¹⁰³ See A 12(3)(a-b) of the Kyoto Protocol (1997).

a range of mechanisms. These mechanisms aim to reduce GHG emissions, promote renewable energy, and ensure that the country achieves a just transition to a low carbon economy. This would also give effect to section 24 of the *Constitution*. These mechanisms include:

2.5.1 Carbon pricing and taxation

Carbon pricing is used as a mechanism to incentivise behaviour change as an effort to mitigate climate change.¹⁰⁴ It is suggested that the most effective way to transition to a low carbon economy is carbon pricing.¹⁰⁵ Carbon pricing has the potential to ensure that companies are held financially liable for the damage their emissions cause to society by internalising the costs.¹⁰⁶ This prevents what is called “economic externality” where the broader public pays for the costs that arise from climate change, such as costs associated with damaged crops and health.¹⁰⁷ One of the ways in which carbon pricing can be implemented is through carbon tax.¹⁰⁸

The carbon pricing mechanism in South Africa is the *Carbon Tax Act*, enacted in 2019, which serves as an incentive to mitigate climate change. The enactment of the *Carbon Tax Act* is one of the efforts of the South African government to contribute to the global effort to stabilise GHG concentrations in the atmosphere at a level that would prevent dangerous human interference with the climate system.¹⁰⁹ *Carbon Tax Act* imposes taxes on various activities that releases large amounts of GHGs¹¹⁰ by setting “a price on each unit of pollution, namely on each tonne of carbon dioxide equivalent”.¹¹¹ These activities include energy, transport, industrial and coal mining.¹¹²

¹⁰⁴ Lehmann K “South Africa’s Climate Change Commitments and Regulatory Response Potential”¹⁰.

¹⁰⁵ National Development Plan 2030 *Ensuring environmental sustainability and an equitable transition to a low carbon economy* 207.

¹⁰⁶ Rumble, Gilder & Parker “Carbon Pricing in South Africa” 20-2.

¹⁰⁷ Rumble, Gilder & Parker “Carbon Pricing in South Africa” 20-5.

¹⁰⁸ Rumble, Gilder & Parker “Carbon Pricing in South Africa” 20-3.

¹⁰⁹ Zireva 2020 *Sabinet African Journals* 1.

¹¹⁰ Zireva 2020 *Sabinet African Journals* 2.

¹¹¹ Rumble, Gilder & Parker “Carbon Pricing in South Africa” 20-12.

¹¹² For detailed list of activities see Schedule 2 of the *Carbon Tax Act* 15 of 2019.

The *Carbon Tax Act* gives effect to the polluter-pays principle, which requires that the costs to address the environmental damage must be borne by those responsible for the environmental damage.¹¹³ The *Carbon Tax Act* encourages companies to adopt cleaner technologies to avoid tax for equalling or exceeding the threshold listed under schedule 2 on the specific activity, and to develop and adopt low carbon technologies.¹¹⁴ It is suggested that the revenue generated from carbon tax has to be directed at climate change mitigation and adaptation activities to give effect to section 24 of the *Constitution*.

2.5.2 Renewable energy policies and programmes

South Africa is the seventh largest producer of coal in the world,¹¹⁵ with over 80% of South Africa's electricity being generated from coal.¹¹⁶ One of the reasons for this is that the country's economy is energy intensive.¹¹⁷ However, electricity that is generated from coal extracted through coal mining, contributes to climate change. This impact can be mitigated with the implementation of renewable energy to achieve a just energy transition. GHG emissions from the energy industry can only be mitigated with a transition to renewable energy sources.¹¹⁸ In response to this, the South African government, the Department of Energy and the National Energy Regulator of South Africa have developed policies and projects to procure and implement renewable energy and support the transition to a low-carbon economy. One of the renewable energy programmes is the Renewable Energy Independent Power Producers Procurement Programme (hereafter REIPPPP), which is a tender

¹¹³ Section 2(4)(P) of *NEMA* 107 of 1998 & See Rumble, Gilder & Parker "Carbon Pricing in South Africa" 20-5.

¹¹⁴ Lehmann K "South Africa's Climate Change Commitments and Regulatory Response Potential" 11.

¹¹⁵ Steyn & Minnitt 2010 *The Journal of The Southern African Institute of Mining and Metallurgy* 593.

¹¹⁶ DMRE *The South African Energy Sector Report 2023* 14.

¹¹⁷ DMRE *The South African Energy Sector Report 2023* 14.

¹¹⁸ *National Energy Efficiency Strategy of the Republic of South Africa* (2008) Para 3.3 & See Murombo "South Africa's Energy Mix - Towards a Low-Carbon Economy" 18-3.

process that facilitates investment from the private sector into national grid-connected renewable energy generation in South Africa.¹¹⁹

A possible positive approach is the repurposing of rehabilitated mines for renewable energy projects. Mining sites that are no longer in operation offer large expanses of land and infrastructure that is already available that can be transformed into renewable energy.¹²⁰ Integrating renewable energy projects into the mine rehabilitation process can potentially be a good solution, as this initiative can potentially lead to a low-carbon economy and contribute to climate change mitigation efforts. This approach reduces decommissioning costs, contributes to energy security and creates economic opportunities for the post-mining communities.¹²¹ An experience can be taken from the repurposing of the Matra Power Plant in Hungary, where a former coal mining site was transformed into a renewable energy hub, generating solar and wind power.¹²²

2.5.3 Integrated resource plan (IRP) 2019

The Integrated Resource Plan (hereafter IRP) is a long-term energy planning document that outlines how South Africa will produce energy in the coming years.¹²³ The aim is to reduce the country's reliance on coal for energy production by introducing more renewable energy projects¹²⁴, which supports climate change mitigation efforts.

Figure 1 below presents the projected installed energy capacities and decommissioning schedule by energy source for the period 2019–2030. According to IRP 2019, by 2030 the South African energy supply will be coming from the various sources. The country's reliance on coal will drop but it will still be a dominant source that will contribute 43% of the energy mix.¹²⁵ However, when it comes to

¹¹⁹ Eberhard & Naude 2016 *Journal of Energy in Southern Africa* 1.

¹²⁰ European Commission Toolkit *Environmental rehabilitation and repurposing* 18.

¹²¹ European Commission Toolkit *Environmental rehabilitation and repurposing* 18.

¹²² European Commission Toolkit *Environmental rehabilitation and repurposing* 18.

¹²³ Mohammed Thameezuddeen *Pestel analysis on major countries* 193.

¹²⁴ See DMRE *Integrated Resource Plan (IRP2019)* 42.

¹²⁵ DMRE *Integrated Resource Plan (IRP2019)* 42.

renewable energy there would be a significant increase, with wind planned to contribute 22.5%, Photovoltaic 10.5%, and concentrated solar power 0.76%.¹²⁶ Gas and hydro are planned to provide 8.1% and 6.2% of the energy mix respectively, while storage is planned to contribute 6.35%.¹²⁷ Nuclear energy will contribute 2.36% of the energy supply, while other sources such as biomass and landfill, will contribute 0.5%.¹²⁸ On paper this energy mix reflects an important shift from coal energy production to cleaner energy sources, which is in line with climate change mitigation efforts.

Table 5: IRP 2019

	Coal	Coal (Decommissioning)	Nuclear	Hydro	Storage	PV	Wind	CSP	Gas & Diesel	Other (Distributed Generation, CoGen, Biomass, Landfill)
Current Base	37 149		1 860	2 100	2 912	1 474	1 980	300	3 830	499
2019	2 155	2373					244	300		Allocation to the extent of the short term capacity and energy gap.
2020	1 433	-557				114	300			
2021	1 433	-1403				300	818			
2022	711	-844			513	400	1000	1600		
2023	750	-555				1000	1600			
2024			1860				1600		1000	500
2025						1000	1600			500
2026		-1219					1600			500
2027	750	-847					1 600		2000	500
2028		-475				1000	1 600			500
2029		-1694			1575	1000	1 600			500
2030		-1050		2 500		1 000	1 600			500
TOTAL INSTALLED CAPACITY by 2030 (MW)	33364		1860	4600	5000	8288	17742	600	6380	
% Total Installed Capacity (% of MW)	43		2.36	5.84	6.35	10.52	22.53	0.76	8.1	
% Annual Energy Contribution (% of MWh)	58.8		4.5	8.4	1.2*	6.3	17.8	0.6	1.3	

Installed Capacity
 Committed / Already Contracted Capacity
 Capacity Decommissioned
 New Additional Capacity
 Extension of Koeberg Plant Design Life
 Includes Distributed Generation Capacity for own use

- 2030 Coal Installed Capacity is less capacity decommissioned between years 2020 and 2030
- Koeberg power station rated / installed capacity will revert to 1926 MW (original design capacity) following design life extension work.
- Other / Distributed generation includes all generation facilities in circumstances in which the facility is operated solely to supply electricity to an end-use customer within the same property with the facility
- Short term capacity gap is estimated at 2000 MW

Figure 1: Projected Installed Energy Capacities and Decommissioning Schedule by Energy Source (2019–2030) in terms of South Africa's IRP 2019¹²⁹

¹²⁶ DMRE *Integrated Resource Plan (IRP2019)* 42.

¹²⁷ DMRE *Integrated Resource Plan (IRP2019)* 42.

¹²⁸ DMRE *Integrated Resource Plan (IRP2019)* 42.

¹²⁹ DMRE *Integrated Resource Plan (IRP2019)* 42.

However, the 2022 statistics of the Council for Scientific and Industrial Research indicated that over 80% of South Africa's energy still comes from coal,¹³⁰ which indicates that South Africa is still far from achieving the IRP 2019 target of reducing coal reliance to 43% by 2030. With the Cabinet's approval of the IRP 2025, which aims to mobilise R2.2 trillion in investment to accelerate the diversification of South Africa's energy mix towards cleaner energy sources, the dominance of coal as a primary source of electricity is expected to decline.¹³¹

2.5.4 Sectoral emissions targets

The *Climate Change Act* define sectoral emissions targets (hereafter SETs) as "quantitative or qualitative" goals that are informed by sector-specific policies and measures that are aimed at reducing GHG emissions over a specific period.¹³² The *Climate Change Act* requires the Minister to publish a list of GHG-emitting sectors with the national GHG profile goals within one year of the *Climate Change Act* coming into effect.¹³³ SETs must incorporate "quantitative and qualitative" GHG emission reduction goals for the first five years, and thereafter for a period of 5–10 years and 10–15 years.¹³⁴ Although the *Climate Change Act* is currently in force, certain provisions, such as section 25(4)(c), have not yet come into effect, because the DFFE must first consult with other relevant departments.¹³⁵

In response to this legislative requirement, DFFE published a draft SET document for public comments in 2024.¹³⁶ The draft lists key sectors that emit GHGs including mining, agriculture, human settlements, trade and industry, transport, energy, and

¹³⁰ See Council for Scientific and Industrial Research *Statistics of utility-scale power generation in South Africa 2*.

¹³¹ Department of Electricity and Energy *Integrated Resource Plan October 2025* viii.

¹³² Section 1 of *Climate Change Act 22 of 2024*.

¹³³ Section 25(1) of *Climate Change Act 22 of 2024*.

¹³⁴ Section 25(4)(c) of *Climate Change Act 22 of 2024*.

¹³⁵ Proc 251 in GG 52319 of 17 March 2025.

¹³⁶ Department of Forestry, Fisheries and the Environment (hereafter DFFE) *Sectoral Emissions Targets 2025 to 2030*.

environment and forestry.¹³⁷ However, the mining sector is the main focus of this study and the other sectors are not discussed.

The mining sector is one of the greatest contributors to GHG emissions, emitting carbon dioxide, methane, and nitrous oxide emissions.¹³⁸ These emissions originate from fuel combustion for the operation of the mine, the release of methane from coal mines, and changes to the land that affect potential carbon sequestration.¹³⁹ Emission reduction in this sector requires several measures.¹⁴⁰ These include reducing the use of fuel and transitioning to non-GHG-emitting energy sources.¹⁴¹ It also involves reducing methane from coal mines and minimising the disturbance of carbon sinks during mining operations.¹⁴² In addition, enhancing carbon sequestration through effective mine rehabilitation strategies can contribute to overall emissions reductions.¹⁴³

Despite these climate change mitigation activities, the draft document indicates a significant regulatory gap when it comes to emissions from the mining sector. The draft indicates that mine rehabilitation can be a potential climate change mitigation activity.¹⁴⁴ Currently, South Africa does not have policies and measures that specifically aim to address fugitive methane emissions emanating from coal mines and the promotion of carbon sequestration during the mine rehabilitation process.¹⁴⁵

2.5.5 Carbon budget

The *Climate Change Act* introduced carbon budgets as one of the key emission mitigation activities to reduce the total GHG emissions that can be emitted by a facility within a defined period.¹⁴⁶ The *Climate Change Act* mandates the Minister to

¹³⁷ See DFFE *Sectoral Emissions Targets 2025 to 2030* 24-29.

¹³⁸ DFFE *Sectoral Emissions Targets 2025 to 2030* 24.

¹³⁹ DFFE *Sectoral Emissions Targets 2025 to 2030* 24.

¹⁴⁰ DFFE *Sectoral Emissions Targets 2025 to 2030* 24.

¹⁴¹ DFFE *Sectoral Emissions Targets 2025 to 2030* 24.

¹⁴² DFFE *Sectoral Emissions Targets 2025 to 2030* 24.

¹⁴³ See DFFE *Sectoral Emissions Targets 2025 to 2030* 24.

¹⁴⁴ DFFE *Sectoral Emissions Targets 2025 to 2030* 24.

¹⁴⁵ DFFE *Sectoral Emissions Targets 2025 to 2030* 24.

¹⁴⁶ Section 27 of *Climate Change Act* 22 of 2024.

allocate carbon budgets to entities that are involved in GHG emission activities,¹⁴⁷ this include the mining sector. The GHGs that are considered for carbon budgets are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and nitrogen trifluoride.¹⁴⁸ The duration of the carbon budget must be at least three successive five-year periods, with the first five-year period specifying the maximum allowable emissions.¹⁴⁹

It is important to note that the first phase of carbon budgets from January 2016 to December 2020, with an extension to December 2022, was discretionary.¹⁵⁰ Entities that submitted carbon budgets during the first phase received five percent allowance on their carbon tax liability as an incentive for participation.¹⁵¹ However, with the *Climate Change Act* signed into law, carbon budgets will be compulsory.

The *Climate Change Act* also mandates that entities subjected to carbon budgets submit a GHG mitigation plan to the Minister for approval.¹⁵² The plan must outline the mitigation measures that will be implemented to comply with the allocated carbon budget.¹⁵³ The introduction of mandatory carbon budgets indicate that South Africa is taking a positive step to address climate change. It also reflects efforts to hold high emitting sectors like mining accountable for their contribution to climate change. However, section 27 of the *Climate Change Act* is not yet in effect because the DFFE has to firstly comply with section 30 of the *Climate Change Act* by developing detailed regulations that will address the implementation of section 27.¹⁵⁴

2.5.6 Just Energy Transition Investment Plan

¹⁴⁷ Section 27(1) of *Climate Change Act* 22 of 2024.

¹⁴⁸ DFFE *Carbon budget methodology document* 7.

¹⁴⁹ Section 27(3) of *Climate Change Act* 22 of 2024.

¹⁵⁰ DFFE *Carbon budget methodology document* 5.

¹⁵¹ DFFE *Carbon budget methodology document* 5.

¹⁵² Section 27(4)(a) of *Climate Change Act* 22 of 2024.

¹⁵³ Section 27(4)(b)(i) of *Climate Change Act* 22 of 2024.

¹⁵⁴ Proc 251 in GG 52319 of 17 March 2025 & See section 30 of *Climate Change Act* 22 of 2024.

South Africa's Just Energy Transition Investment Plan prioritises electricity decarbonisation, demand-side management, and private-sector emissions reductions, while allocating targeted funding to coal-affected regions facing plant and mine closures.¹⁵⁵ These interventions are intended to support South Africa in achieving its 2030 NDC target range of 350–375 MtCO₂-eq.¹⁵⁶ Mpumalanga has been identified as a primary focus due to the province hosting many coal mines.

2.6 Conclusion

The objective of this chapter was to provide an overview of South Africa's international climate change mitigation mandate, objectives, international and domestic mechanisms to achieve climate change mitigation. It discussed the evolution of international climate change mitigation efforts, which began with the UNFCCC, the KP and later the Paris Agreement. The chapter highlighted South Africa's commitment under these international treaties as a signatory. South Africa's mitigation objectives were discussed in relation to key policy documents such as the *NCCR Green* and *White Papers* and the *Climate Change Act* as the key legislation. These policies and the *Climate Change Act* emphasise the need for GHG concentrations to be stabilised to ensure that dangerous human interference with the climate system is prevented.

This chapter also discussed the international prescribed mechanism for climate change mitigation, which allows Party States to meet GHG emission reduction commitments under Article 3 of the KP. These international prescribed mechanisms include IET, JI and the CDM. Among these mechanisms, the CDM is relevant to South Africa. To give effect to CDM and to contribute to the objective of climate change mitigation, domestic mechanisms and strategies have been identified. These include carbon pricing and taxation, renewable energy policies and programmes,

¹⁵⁵ National Development Plan 2030 *South Africa's just energy transition investment plan (JET IP) for the initial period 2023–2027* 9.

¹⁵⁶ National Development Plan 2030 *South Africa's just energy transition investment plan (JET IP) for the initial period 2023–2027* 9.

the IRP 2019, sectoral emissions targets, carbon budgets and just energy transition investment plan.

While South Africa's climate change mitigation efforts have evolved, there is a regulatory gap when it comes to addressing critical issues such as the emission of methane from the unrehabilitated coal mines. The next chapter therefore analyses the South African legal framework governing mine rehabilitation. It focuses on key pieces of legislation such as *NEMA*, *MPRDA*, *National Water Act* (hereafter *NWA*), and *National Environmental Management Air Quality Act* (hereafter *NEMAQA*). In addition, the chapter discusses the financial provision that is the key mechanism to ensure that mining companies set aside sufficient funds to finance the rehabilitation of mines once they reach their end of life.

Chapter 3 South African legal framework for mine rehabilitation and financial provision

3.1 Introduction

Mining activities have raised significant concern due to their immediate and long-term physical impacts on the land.¹⁵⁷ Mining is a temporary activity that substantially changes the landscape and leaves behind lasting evidence of past activity.¹⁵⁸ In South Africa this is evident from thousands of mines that have been left unrehabilitated and abandoned. The environmental consequences of mining activities are wide. Coal mining, for instance, either opencast or underground, has a significant effect on abiotic elements such as air, water and soil.¹⁵⁹ Additionally, mining poses risks to biodiversity and affects soil by degrading its quality¹⁶⁰ and this continues to occur if the mines are left unrehabilitated.

These impacts have to be mitigated, and one of the measure to mitigate them is mine rehabilitation, which involves restoring the mine to a sustainable state or position prior to the mining activity.¹⁶¹ Repealed pieces of legislation that regulate the mining sector, such as the *Mines and Works Act* 27 of 1956 and the *Mining Rights Act* 20 of 1967 did not strictly require proper mine rehabilitation practices.¹⁶² Currently, South Africa does not have legislation that specifically seeks to address and regulate mine rehabilitation. However, there are specific provisions in various existing pieces of legislation and regulations that generally seek to address mine rehabilitation, but not as a climate change mitigation activity.

The main objective of this chapter is to analyse the South African legal framework governing mine rehabilitation, with a focus on the legal and regulatory aspects of mine rehabilitation rather than the entire process of mine rehabilitation. The chapter

¹⁵⁷ Sengupta *Environmental Impacts of Mining: Monitoring, Restoration and Control* 1.

¹⁵⁸ Sengupta *Environmental Impacts of Mining: Monitoring, Restoration and Control* 1.

¹⁵⁹ Strydom & Cairncross "Energy" 465.

¹⁶⁰ See Sengupta *Environmental Impacts of Mining: Monitoring, Restoration and Control* 25.

¹⁶¹ Chamber of Mines of South Africa/Coaltech *Guidelines for the rehabilitation of mined land* 4.

¹⁶² DMR *The National Strategy for the Management of Derelict and Ownerless Mines in South Africa* 7.

is structured as follows: It begins by discussing environmental rights as stated and protected in section 24 of the *Constitution*, because this constitutional right is the foundational legal basis for mine rehabilitation obligations. This constitutional environmental right is important because it mandates the state to regulate mining activities in a manner that ensures that the environment is protected sustainably.

This chapter then analyses key environmental laws governing mine rehabilitation, which includes the *NEMA*, *MPRDA*, *NWA*, and *NEMAQA*. The *NEMA* as an umbrella for other environmental laws, sets out environmental principles that must be implemented for any activity that will or may cause environmental degradation. The *MPRDA*, which specifically governs and regulate the mining sector, set out specific legal obligations that must be complied by the mining rights holders. As mining activities tend to pollute water resources, the *NWA* regulates the protection of water resources affected by mining and other activities. The *NEMAQA* addresses air quality concerns caused by mining operations such as dust. Finally, this chapter analyses financial provisions that serve as a key mechanism designed to ensure that mining companies set aside sufficient funds to cover the costs of mine rehabilitation, thereby preventing the issue of abandoned mines and environmental degradation.

3.2 Constitutional mandate

The mining sector has a duty to adhere to the constitutional mandate by ensuring that the mining activities are conducted with due diligence and care for the protection of the rights of others.¹⁶³ These rights include environmental rights enshrined in section 24 of the *Constitution*, which stipulates that:¹⁶⁴

“Everyone has the right: -

(a) to an environment that is not harmful to their health or wellbeing;
and

¹⁶³ Swart 2003 *The Journal of The South African Institute of Mining and Metallurgy* 490.

¹⁶⁴ Section 24 of the *Constitution of the Republic of South Africa*, 1996.

(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that: -

i. prevent pollution and ecological degradation;

ii. promote conservation; and

iii. secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.”

The state has a duty to “respect, protect, promote and fulfil” this environmental right as per the *Constitution*.¹⁶⁵ The state must therefore prevent public and private conduct that would be contrary to the environmental right.¹⁶⁶

Pollution and ecological degradation are one of the negative consequences of mining.¹⁶⁷ In response, the state has a constitutional duty as stated in section 24 of the *Constitution*. This duty is to prevent pollution and ecological degradation, and to promote conservation through reasonable legislative and other measures.¹⁶⁸ One of the ways to comply with this obligation in the mining context is through the rehabilitation of mines that have reached their end of life or are no longer active. As stated in the *NEMA*, mine rehabilitation is one of the measures that can be used to remedy and mitigate the environmental harm caused by mining activities.¹⁶⁹ This approach aligns with the constitutional environmental mandate in section 24 of the *Constitution*, which requires the prevention of pollution and ecological degradation and the promotion of conservation by ensuring that mining operations do not leave lasting environmental harm.

¹⁶⁵ Section 7(2) of the *Constitution of the Republic of South Africa*, 1996.

¹⁶⁶ Du Plessis 2011 *South African Journal on Human Rights* 299.

¹⁶⁷ See Watson *et al* “Terrestrial and Deep Seabed Mining” 877-879.

¹⁶⁸ Section 24(b) of the *Constitution of the Republic of South Africa*, 1996.

¹⁶⁹ See Section 4(a)(ii) & 24PA(1)(f) of *NEMA* 107 of 1998.

3.3 Key legislative instruments

3.3.1 National Environmental Management Act 107 of 1998

The *NEMA* serves as the umbrella for the South African environmental legal framework. The *NEMA* is the general framework that guides environmental management and implementation plans.¹⁷⁰ Section 2 of the *NEMA* outlines the principles of sustainable development, emphasising that pollution and degradation to the environment should be avoided and where avoidance is not possible, the impacts should be minimised and remedied.¹⁷¹ Additionally, negative consequences for the environment and people's environmental rights should be anticipated and prevented, and where prevention is impossible, the effects should be minimised and remedied.¹⁷²

A precautionary approach should always be taken¹⁷³ in mining activities. The polluter-pays principle requires that the costs of remedying the pollution and environmental degradation and the costs of prevention must be borne by those responsible for the environmental damage.¹⁷⁴ The polluter-pays principle includes the costs associated with preventing environmental harm and the costs to address the consequences of pollution that have already occurred.¹⁷⁵

Furthermore, environmental health and safety responsibilities during mining operations must be observed throughout all stages of the mine's existence, meaning this must not stop at any phase of mine operation.¹⁷⁶ The responsibility lasts from planning and operation to closure and rehabilitation of the mine, which aligns with

¹⁷⁰ Section 2(1)(b) of *NEMA* 107 of 1998.

¹⁷¹ Section 2(4)(1)(a)(ii) of *NEMA* 107 of 1998.

¹⁷² Section 2(4)(1)(a)(viii) of *NEMA* 107 of 1998.

¹⁷³ Section 2(4)(1)(a)(vii) of *NEMA* 107 of 1998.

¹⁷⁴ Section 2(4)(p) of *NEMA* 107 of 1998.

¹⁷⁵ Kidd *Environmental Law* 8-9.

¹⁷⁶ See Section 2(4)(e) of *NEMA* 107 of 1998.

the cradle-to-grave principle.¹⁷⁷ Upholding these principles play an important role in protecting and managing the environment.¹⁷⁸

Prior to mining activities, an environmental authorisation is required.¹⁷⁹ The *NEMA* stipulates that the holder of the environmental authorisation to undertake mining activity bears any

“environmental liability, pollution or ecological degradation, the pumping and treatment of polluted or extraneous water, the management and sustainable closure thereof notwithstanding the issuing of a closure certificate by the Minister responsible for mineral resources in terms of the *Mineral and Petroleum Resources Development Act*, 2002, to the holder”.¹⁸⁰

Therefore, the holder of the environmental authorisation for the mining activity must plan, manage and implement procedures and requirements for the closure of a mine as may be prescribed.¹⁸¹ This must include mine rehabilitation practices.

Section 28 of the *NEMA* establishes a duty of care for the environment. Under this provision duty of care requires that anyone carrying out mining activities that cause, have caused, or will cause significant pollution or degradation to the environment must undertake measures aimed at preventing such harm from occurring.¹⁸² Where such harm cannot be avoided, the responsible party must take measures to minimise and remedy the pollution or degradation.¹⁸³ These remedial measures may include actions to remedy the effects of pollution or environmental degradation¹⁸⁴ as a result of mining operations through mine rehabilitation. This will ensure that there is restoration of the affected environment to the state it was prior to the mining activity or close to it.

¹⁷⁷ See Section 2(4)(e) of *NEMA* 107 of 1998

¹⁷⁸ *Fuel Retailers Association of SA (Pty) Ltd v Director General, Environmental Management Mpumalanga* 2007 2 SA 163 (SCA) para 67.

¹⁷⁹ See Section 24 of *NEMA* 107 of 1998.

¹⁸⁰ Section 24R(1) of *NEMA* 107 of 1998.

¹⁸¹ Section 24R(3) of *NEMA* 107 of 1998.

¹⁸² See Section 28(1) of *NEMA* 107 of 1998.

¹⁸³ Section 28(1) of *NEMA* 107 of 1998.

¹⁸⁴ Section 28(3)(f) of *NEMA* 107 of 1998.

This duty of care to address pollution even applies to past pollution that occurred prior to the enactment of the *NEMA*.¹⁸⁵ The duty of care is applied retrospectively, which is positive considering that some of the unrehabilitated and abandoned mines were abandoned prior to the commencement of the *NEMA* and the current *MPRDA*. This requires that pollution from the historical abandoned mines should be addressed so that environmental justice is achieved. However, the burden largely falls on the State because some of the former holders of these mines have either passed away, liquidated or have become untraceable.¹⁸⁶

3.3.2 Minerals and Petroleum Resources Development Act 28 of 2002

The *MPRDA* is the main legislation that regulates the mining sector in South Africa. The objective of the *MPRDA* is to ensure that there is equal accessibility to and sustainable development of the republic's mineral and petroleum resources.¹⁸⁷ The *MPRDA* stipulates that unless the Minister of Minerals and Petroleum Resources (hereafter MPR) issues a closure certificate, liability remains with the permit or right holder.¹⁸⁸ This applies to the

"holder of a prospecting right, mining right, retention permit, mining permit, or previous holder of an old right".¹⁸⁹

They remain responsible for any environmental damage caused by mining activities.¹⁹⁰ This includes pollution, the "pumping and treatment of extraneous water", as well as the management and sustainable closure of the mine.¹⁹¹

In *Ezulwini Mining Company (Pty) Ltd v Minister of Mineral Resources and Energy and Others* 2023 (5) SA 112 (SCA), the Supreme Court of Appeal upheld the decision

¹⁸⁵ Section 28(1A)(a) of *NEMA* 107 of 1998 & See Kidd *Environmental Law* 152.

¹⁸⁶ See Swart 2003 *The Journal of The South African Institute of Mining and Metallurgy* 489.

¹⁸⁷ Section 2(c) of *MPRDA* 28 of 2002; Section 2(c) of *Upstream Petroleum Resources Development Act* 23 of 2024.

¹⁸⁸ Section 43(1) of *MPRDA* 28 of 2002.

¹⁸⁹ Section 43(1) of *MPRDA* 28 of 2002.

¹⁹⁰ Section 43(1) of *MPRDA* 28 of 2002.

¹⁹¹ Section 43(1) of *MPRDA* 28 of 2002.

of the High Court in Pretoria.¹⁹² The court stated that Ezulwini Mining Company is obligated by law to continue pumping and treating extraneous water from its underground workings.¹⁹³ This obligation remains in place until a closure certificate is issued by the Minister of Mineral Resources and Energy, as per section 43 of the *MPRDA*.¹⁹⁴

A mine closure certificate is a formal document that confirms that the environmental damage caused by the mining activities has been remedied.¹⁹⁵ According to the *MPRDA*, a mine closure certificate can only be issued once certain conditions have been met. The Chief inspector and each relevant government department responsible for environmental matters must confirm in writing that all requirements have been addressed.¹⁹⁶ These include compliance with health and safety provisions, the management of pollution affecting water resources, and the effective pumping and treatment of extraneous water.¹⁹⁷ In addition, all conditions set out in the environmental authorisation must have been met.¹⁹⁸

In South Africa, one of the reasons why some unrehabilitated and abandoned mines remain unaddressed is that their former holders are untraceable, deceased, or have undergone liquidation.¹⁹⁹ Therefore, to address this the *MPRDA* stipulates that the state will bear the responsibility of rehabilitating the abandoned mines in cases where the owner of the mine is deceased, untraceable and or has undergone the liquidation process.²⁰⁰ The costs of rehabilitation should first be covered by the financial provision set aside by the owner, but if there is no financial provision or

¹⁹² *Ezulwini Mining Company Pty Ltd v Minister of Mineral Resources and Energy and others* 2023 (5) SA 112 (SCA) para 48.

¹⁹³ *Ezulwini Mining Company Pty Ltd v Minister of Mineral Resources and Energy and others* 2023 (5) SA 112 (SCA) para 48.

¹⁹⁴ *Ezulwini Mining Company Pty Ltd v Minister of Mineral Resources and Energy and others* 2023 (5) SA 112 (SCA) para 48.

¹⁹⁵ See Watson & Olalde 2019 *Journal of the Southern African Institute of Mining and Metallurgy* 640-641.

¹⁹⁶ Section 43(5) of *MPRDA* 28 of 2002.

¹⁹⁷ Section 43(5) of *MPRDA* 28 of 2002.

¹⁹⁸ Section 43(5) of *MPRDA* 28 of 2002.

¹⁹⁹ See Swart 2003 *The Journal of The South African Institute of Mining and Metallurgy* 489.

²⁰⁰ Section 46(1) of *MPRDA* 28 of 2002.

insufficient funds, the costs or remaining costs should be borne by the state.²⁰¹ Therefore, there are some abandoned mines that must be rehabilitated by the State using taxpayers' money, which contradicts the *White Paper a Minerals and Mining Policy for South Africa*.²⁰² The policy explicitly states that the government has to ensure that the costs associated with the environmental impact as a result of the mining activity are not borne by the community, which prevents "economic externality".²⁰³

The *MPRDA* further stipulates that the environmental management principles as per the *NEMA* should be applied to mining activities.²⁰⁴ For instance, the polluter-pays principle requires rehabilitation of the mine in order to remedy the pollution caused by mining activities.²⁰⁵ This ensures that the land where the mine operates is rehabilitated either to its natural state prior to the commencement of the mining activity or to an acceptable standard.

3.3.3 National Water Act 36 of 1998

The *NWA* gives effect to section 27(1)(b) of the *Constitution*, which protects everyone's right of access to sufficient water,²⁰⁶ as well as section 24 of the *Constitution*, which protects the environment for the benefit of current and future generations.²⁰⁷ This includes water resources, such as ground water.²⁰⁸ One of the key objectives of the *NWA* is to protect, use, develop, conserve, manage and control the Republic's water resources in a manner that will prevent pollution and the degradation of water resources.²⁰⁹ Mining in general consumes large quantities of water for the operation of the mine; it also pollutes the water resources. In South Africa, the mining sector is accountable for approximately 3% of the country's water

²⁰¹ Section 46(2) of *MPRDA* 28 of 2002.

²⁰² See *White Paper A Minerals and Mining Policy for South Africa* (1998) Para 4.1(v) October 1998.

²⁰³ *White Paper A Minerals and Mining Policy for South Africa* (1998) Para 4.1(v) October 1998; Rumble, Gilder & Parker "Carbon Pricing in South Africa" 20-5.

²⁰⁴ Section 37(1)(a) of *MPRDA* 28 of 2002.

²⁰⁵ Section 2(4)(p) of *NEMA* 107 1998.

²⁰⁶ Section 27(1)(b) of the *Constitution of the Republic of South Africa*, 1996.

²⁰⁷ Section 24(b) of the *Constitution of the Republic of South Africa*, 1996.

²⁰⁸ Viljoen & Bosman 2022 *Potchefstroom Electronic Law Journal* 9-10.

²⁰⁹ Section 2(h) of *NWA* 36 of 1998.

consumption.²¹⁰ Coal mines have an effect on South Africa's water resources throughout their entire lifespans.²¹¹ Coal ash for example plays a significant role in contaminating the ground water²¹², and this continues to happen if coal mines are left unrehabilitated.

Considering that South Africa is a water-scarce country,²¹³ the *NWA* mandates specific obligations to address this issue. It mandates that any landowner, person in control of the land, or occupant who undertakes an activity that causes or is likely to cause pollution to a water resource to take reasonable measures that will prevent such pollution.²¹⁴ Such preventative measures may include to "eliminate any source of the pollution and remedy the effects of the pollution",²¹⁵ which can be achieved through effective mine rehabilitation, for example by preventing coal ash from polluting ground water. However, in the case of *Harmony Gold Mining Company Limited v Regional Director: Free State Department of Water Affairs and Forestry*, the court confirmed a broad interpretation of section 19(1) of the *NWA*, stating that the duty to take reasonable measures to prevent pollution on the water resources extends beyond a person's own land, to land owned, controlled, or used by others.²¹⁶

Further, the *NWA* empowers the Minister of Water and Sanitation to make regulations in relation to water management.²¹⁷ The mining regulations in GN 704 in GG 20119 of 4 June 1999 require that at the cessation of the operation of the mine, the person responsible for the mine must put in place pollution control measures.²¹⁸ These measures must comply with the environmental regulations to prevent pollution in relation to the contamination of water resources.²¹⁹ In instances

²¹⁰ Centre for Environmental Rights *Water impacts and externalities of coal power* 3.

²¹¹ Centre for Environmental Rights *Water impacts and externalities of coal power* 3.

²¹² Centre for Environmental Rights *Water impacts and externalities of coal power* 4.

²¹³ Matimolane & Mathivha 2025 *Frontiers in Environmental Science* 2.

²¹⁴ Section 19(1) of *NWA* 36 of 1998.

²¹⁵ Section 19(2)(d-e) of *NWA* 36 of 1998.

²¹⁶ *Harmony Gold Mining Company Limited v Regional Director: Free State Department of Water Affairs and Forestry* 2006 (SCA) para 32; see Viljoen, Rantlo & Du Plessis 2022 *Obiter* 879.

²¹⁷ See Section 26 (1) of *NWA* 36 of 1998.

²¹⁸ Reg 9(1) in GN 704 in GG 20119 of 4 June 1999.

²¹⁹ Reg 9(1) in GN 704 in GG 20119 of 4 June 1999.

where the operation of the mine affected or altered the water resource, the party responsible must remedy the effects.²²⁰ This remedy may be achieved through mine rehabilitation.

3.3.4 National Environmental Management Air Quality Act 39 of 2004

It has been argued that unrehabilitated and abandoned coal mines continue to release methane.²²¹ Although methane is not typically considered an air pollutant since air pollution is considered to be substances that are harmful to human health, methane does still contribute to air pollution²²² and partially contributes to climate change. The *NEMAQA* aims to regulate the air pollution with one of the key objectives being the prevention of air pollution and ecological degradation.²²³ It gives effect to section 24(b) of the *Constitution* to ensure that the quality of air is not detrimental to the health and wellbeing of everyone.²²⁴

The *NEMAQA* requires that if it is determined that the mine will likely cease within the next five years based on its known ore reserves, a written notification must be submitted to the Minister.²²⁵ The notification must outline the likelihood of the cessation of the mine, and most importantly, about the plans put in place to rehabilitate the mine.²²⁶ It must also address measures to prevent air pollution from dust after the cessation of mining operation,²²⁷ considering that coal mining does release dust.²²⁸ Therefore *NEMAQA* explicitly requires the rehabilitation of mines upon closure to prevent air pollution and to minimise environmental harm.

²²⁰ Reg 9(2) in GN 704 in GG 20119 of 4 June 1999.

²²¹ Global Methane Initiative *Methane Emissions from Abandoned Coal Mines in China 2*.

²²² See Mar *et al* 2022 *Environmental Science and Policy* 129-130 for detail discussion.

²²³ Section 2(a)(ii) of *NEMAQA* 39 of 2004.

²²⁴ Section 2(a)(ii) & (b) of *NEMAQA* 39 of 2004.

²²⁵ Section 33 of *NEMAQA* 39 of 2004.

²²⁶ Section 33 of *NEMAQA* 39 of 2004.

²²⁷ Section 33 of *NEMAQA* 39 of 2004.

²²⁸ See Liu & Liu 2020 *Environmental Research* 1-15.

3.4 Financial provision in terms of the National Environmental Management Act

Mine rehabilitation is a costly process, requiring investment amounting to millions and in some cases billions of rands to ensure that mines are properly rehabilitated. To address this, the *NEMA* includes a financial provision mine holders have to comply with to ensure that on the cessation of the mine, the mine is rehabilitated, protecting the state from bearing the costs of rehabilitating the mine.²²⁹ The *NEMA* defines financial provision as:

“The amount which is to be provided in terms of this act by a holder, holder of an old order right or applicant, guaranteeing the availability of funds to fulfil the obligation to undertake progressive rehabilitation, decommissioning, closure and post closure activities including the pumping and treatment of polluted or extraneous water to ensure that the state does not become liable for those costs which should be covered, by a holder, holder of an order right or applicant”.²³⁰

The *NEMA* states that in instances where the Minister prescribes that financial provision should be set aside, the applicant of the environmental authorisation must determine the required financial provision.²³¹ This financial provision must cover costs for progressive rehabilitation, decommissioning, closure and post-closure activities that must include the pumping and treatment of extraneous and polluted water.²³²

In instances where environmental authorisation has already been granted, the holder of the environmental authorisation, holder or holder of an old order right must provide a financial provision.²³³ This will ensure that the costs for progressive rehabilitation, mitigation, decommissioning, closure and post-closure activities, which include the pumping and the treatment of extraneous and polluted water, are

²²⁹ See Section 24P of *NEMA* 107 of 1998.

²³⁰ Section 1 of *NEMA* 107 of 1998.

²³¹ Section 24P(3) of *NEMA* 107 of 1998.

²³² Section 24P(3) of *NEMA* 107 of 1998.

²³³ Section 24P(4) of *NEMA* 107 of 1998.

covered.²³⁴ This ensures that the adverse environmental impacts and latent environmental consequences are mitigated and rehabilitated.²³⁵

The *NEMA* further lists the acceptable avenues for the financial provision.²³⁶ These include cash deposited into the account under the administration of the relevant Minister of the mineral resource, insurance policies in terms of specific sector legislation, or a

“financial guarantee from an institution that is registered in terms of the applicable financial sector legislation”.²³⁷

Other acceptable mechanisms include a trust fund that is established specifically for ensuring that subsection 4 is realised, or any other financial provision avenue.²³⁸

The *NEMA* empowers the Minister of MPR and the Minister of Water and Sanitation or a Member of the Executive Council (hereafter MEC) to intervene in instances where the holder of environmental authorisation, holder, or holder of an old order fails to mitigate, remedy and rehabilitate the adverse environmental impacts of mining activities.²³⁹ In such cases these Ministers or the MEC must notify the holder and may use all or part of the financial provision to address the environmental impacts through mitigation, remediation and rehabilitation.²⁴⁰ Most importantly, the financial provision must be used specifically for progressive rehabilitation, decommissioning, closure, and post-closure to ensure that the adverse environmental effects are mitigated, remedied and rehabilitated, and not for any other purpose.²⁴¹

Concerning the financial provision specifically for mining activity, the holder of the environmental authorisation, holder or holder of an old order right must ensure that the financial provision is maintained and retained when the closure certificate is

²³⁴ Section 24P(4) of *NEMA* 107 of 1998.

²³⁵ Section 24P(4) of *NEMA* 107 of 1998.

²³⁶ See section 24P of *NEMA* 107 of 1998.

²³⁷ Section 24P of *NEMA* 107 of 1998.

²³⁸ Section 24P of *NEMA* 107 of 1998.

²³⁹ Section 24P(9) of *NEMA* 107 of 1998 & Section 24PA(5) of *NEMA* 107.

²⁴⁰ Section 24P(9) of *NEMA* 107 of 1998 & Section 24PA(5) of *NEMA* 107.

²⁴¹ Section 24P(10) of *NEMA* 107 of 1998.

issued by the Minister responsible for the mineral resource in terms of the *MPRDA*.²⁴² This gives effect to the cradle-to-grave principle.²⁴³ The holder must also review and adjust the environmental liability and ensure that mitigation and rehabilitation measures are initiated each and every year.²⁴⁴ The financial provision, which has to address latent environmental impacts or residual environmental impacts, which include

“the pumping and treatment of extraneous and polluted water, must be transferred to the Minister responsible for mineral resources upon the issuing of a closure certificate”.²⁴⁵

If insurance is used as the financial provision vehicle for latent or residual environmental impacts, the relevant Minister must have access to the funds once the closure certificate is issued.²⁴⁶

However, in reality it appears that some mine holders do not comply with the financial provision, and this is supported by the findings of the Centre for Environmental Rights, where eleven mining companies were analysed in relation to compliance with the financial provision for rehabilitation.²⁴⁷ The Centre for Environmental Rights found there was inconsistency, unclearness and unreliable information in mining companies’ disclosure on rehabilitation.²⁴⁸ As a result it is difficult to know if these companies complied with financial provision or know whether the estimates for rehabilitation were accurate.²⁴⁹ This problem is exacerbated by the fact that the compliance, monitoring and enforcement systems of DMRs are ineffective.²⁵⁰

²⁴² Section 24PA(1)(a) of *NEMA* 107 of 1998.

²⁴³ See Section 2(4)(e) of *NEMA* 107 of 1998.

²⁴⁴ Section 24PA(1)(b & f) of *NEMA* 107 of 1998.

²⁴⁵ Section 24PA(3) of *NEMA* 107 of 1998.

²⁴⁶ Section 24PA(4) of *NEMA* 107 of 1998.

²⁴⁷ Centre for Environmental Rights *The truth about mining rehabilitation in South Africa Full disclosure 1*.

²⁴⁸ Centre for Environmental Rights *The truth about mining rehabilitation in South Africa Full disclosure 2*.

²⁴⁹ Centre for Environmental Rights *The truth about mining rehabilitation in South Africa Full disclosure 2*.

²⁵⁰ Centre for Environmental Right *The truth about mining rehabilitation in South Africa Full disclosure 1*.

3.4.1 Financial provision regulations

The *NEMA* empowers the Minister to make regulations that are in alignment with subsection 4 of the Act outlining the procedure to be followed in relation to financial provision.²⁵¹ In response, the Minister of DFFE, previously known as the MEA, published regulations GN R1147 in GG 39425 of 20 November 2015 addressing financial provision. The purpose of this regulation is to address financial provision in relation to costs to deal with the management, rehabilitation and remediation of the environmental impacts from mining activities over the lifespan of the mine operation and “latent or residual environmental impacts that may be known in future”.²⁵²

This regulation reiterates what is stated in the *NEMA*, which is that the applicant or holder of a right must determine and make financial provision to ensure that sufficient funds are available to cover the costs of rehabilitating and remedying the adverse environmental impacts caused by mining activities.²⁵³ The financial provision must specifically cover the costs for rehabilitation, remedying, decommissioning, closure activities, as well as the management of latent or residual environmental impacts that might emerge in future, including the pumping and treatment of polluted or extraneous water.²⁵⁴

The financial provision must be determined by the applicant who is required to list all the activities and costs separately.²⁵⁵ These costs must be calculated based on the actual expenses involved in the implementation of measures for annual rehabilitation, final rehabilitation, decommissioning, and closure of the prospecting, exploration, mining following the closure of operations.²⁵⁶ Additionally, it must account for remedying any latent or residual environmental impacts that may be identified in the future, including the pumping and treatment of polluted or

²⁵¹ Section 24(5)(b)(ix) of *NEMA* 107 of 1998.

²⁵² Reg 2 in GN R1147 in GG 39425 of 20 November 2015.

²⁵³ Reg 4 in GN R1147 in GG 39425 of 20 November 2015.

²⁵⁴ Reg 5 in GN R1147 in GG 39425 of 20 November 2015.

²⁵⁵ Reg 6 in GN R1147 in GG 39425 of 20 November 2015.

²⁵⁶ Reg 6(a-b) in GN R1147 in GG 39425 of 20 November 2015.

extraneous water.²⁵⁷ Although key regulatory legislation such as the *NEMA* and *MPRDA* require mine rehabilitation, some of the unrehabilitated mines were abandoned prior to the enactment of the *MPRDA*.²⁵⁸ As a result, the rehabilitation of these mines became the responsibility of the state. This is because in cases where no financial provision is made or if existing financial provision is insufficient, the government must cover the costs of mine rehabilitation.²⁵⁹

The history of the South African regulatory framework on mine rehabilitation shows that rehabilitation and financial provision for mine rehabilitation was introduced in the *Minerals Act* 50 of 1991. Previous pieces of legislation such as the *Mines and Works Act*, 27 of 1956 and the *Mining Rights Act* 20 of 1967 lacked comprehensive environmental management and rehabilitation requirements.²⁶⁰ Therefore, what can be drawn from this is that most of the mines that were abandoned prior to the enactment of the *MPRDA* and the *NEMA* did not set aside financial provisions for rehabilitation, shifting the financial burden and rehabilitation obligation to the state. Given that over 6 000 mines remain unrehabilitated, it is clear that the government is not prioritising mine rehabilitation.

It is important to note that the amendment of the transitional arrangements in the financial provisioning regulations, 2015 allow the holders of mining rights to continue operating under the financial provisioning arrangements approved in terms of the *MPRDA* until a future compliance date is formally published in the Government Gazette.²⁶¹ Until then, affected right holders are deemed to be compliant with the Financial Provisioning Regulations, provided they comply with the financial provisioning conditions attached to their existing rights or permits.²⁶²

²⁵⁷ Reg 6(c) in GN R1147 in GG 39425 of 20 November 2015.

²⁵⁸ AGSA *Report of the Auditor-General to Parliament on a performance audit of the rehabilitation of abandoned mines at the Department of Minerals and Energy* 3.

²⁵⁹ Section 46(2) of *MPRDA* 28 of 2002.

²⁶⁰ DMR *The National Strategy for the Management of Derelict and Ownerless Mines in South Africa* 7.

²⁶¹ GN 4296 in GG 50059 of 1 February 2024.

²⁶² See GN 4296 in GG 50059 of 1 February 2024.

3.5 Conclusion

The main objective of this chapter was to analyse the South African legal framework that governs mine rehabilitation. This chapter analysed the environmental right enriched in section 24 of the *Constitution*, and the legislative and regulatory provisions that obligate the mining sector to rehabilitate mines to ensure that the environmental harm is rehabilitated. These analyses indicated that the environmental right as protected by section 24 of the *Constitution* establishes a foundation for the environmental protection by guaranteeing that everyone has a right to an environment that is not detrimental to their health or wellbeing. These measures mandate sustainable environmental practices, and mine rehabilitation plays a significant role in giving effect to section 24 of the *Constitution*.

Moreover, key legislative instruments such as the *NEMA*, *MPRDA*, *NWA* and *NEMAQA*, were found to be the existing laws that address mine rehabilitation. The *NEMA* provides comprehensive environmental management principles, which include a duty of care and the polluter-pays principle, which requires that mining companies prevent and remedy environmental degradation through mine rehabilitation practices. Additionally, the *NEMA* and regulation GN R1147 in GG 39425 of 20 November 2015 require financial provision to ensure that there are sufficient funds to finance the costs associated with mine rehabilitation. The *MPRDA* reinforces these obligations by ensuring that mine closure is properly regulated.

The *NWA* and *NEMAQA* further regulate the protection of water and air quality respectively by requiring that preventative and remedial measures be undertaken to address water and air pollution as a result of mining activities. One of the ways to remedy such pollution is mine rehabilitation. Despite these laws, challenges remain, particularly in relation to unrehabilitated and abandoned mines, where the financial burden of mine rehabilitation is shifted to the state. The aforementioned legislations and regulations do regulate mine rehabilitation, however these laws fall short of supporting or regulating mine rehabilitation as a climate change mitigation

activity. The next chapter therefore examines the current state of mine rehabilitation practices, discussing the extent of unrehabilitated mines in South Africa.

Chapter 4 The current state of mine rehabilitation practices in South Africa

4.1 Introduction

Mine rehabilitation is one of the most significant aspects of environmental management in the mining sector, given that mining activities have dire consequences for the environment. Although the legal framework exists to regulate mine rehabilitation as discussed in Chapter 3 of this study, the reality on the ground indicates that there is a huge gap in compliance and the implementation of the legal requirement that mines must be rehabilitated once they reach the end of their life cycle. This gap can be seen from the reports released by the Auditor-General to the Parliament on a performance audit of the rehabilitation of abandoned mines at the DME and follow-up performance audit at the DMRE in 2009 and 2021 respectively.²⁶³ The 2009 audit revealed that as of May 2008, South Africa had 5 906 abandoned mines,²⁶⁴ and the 2021 audit revealed that this number had increased to 6 100.²⁶⁵ These abandoned mines pose a serious risk to the communities and the environment, including but not limited to AMD, air pollution, spontaneous combustion, land subsidence, water pollution, and illegal mining activities. This exacerbates climate change, especially coal mines, because abandoned coal mines continue to emit methane,²⁶⁶ the second most dominant GHG emission after carbon dioxide, which is central to this study.

The main objective of this chapter is to critically analyse mine rehabilitation practices in South Africa by specifically relying on the Auditor-General's findings of the 2021 audit. In doing so, the chapter contributes to the aim of this study, which is

²⁶³ See AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines*; AGSA *Report of the Auditor-General to Parliament on a performance audit of the rehabilitation of abandoned mines at the Department of Minerals and Energy* (hereafter DME).

²⁶⁴ AGSA *Report of the Auditor-General to Parliament on a performance audit of the rehabilitation of abandoned mines at the DME* 3.

²⁶⁵ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 15.

²⁶⁶ See Global Methane Initiative *Methane Emissions from Abandoned Coal Mines in China*.

evaluating the extent to which South African legislation regulate or support the rehabilitation of abandoned mines as a climate change mitigation activity, with specific focus on reducing methane emissions. While there is limited evidence in South Africa that mine rehabilitation practices have partially mitigated GHG,s this practice have the potential to contribute to climate change mitigation by preventing ongoing methane emission from abandoned coal mines.

The previous chapter made it clear that South African law does require mining companies to rehabilitate mines once they are no longer active or have reached their end of life. The focus now shifts to what has been happening on the ground by relying on the reports from the Auditor General and Mintek. While the chapter analyses Gold and Asbestos mines to illustrate systemic rehabilitation failures, the main focus is on coal mining.

The chapter is structured as follows: It begins by discussing the environmental and socio-economic effects of unrehabilitated and abandoned mines, emphasising that there is an urgent need to rehabilitate these mines for the sake of protecting ecosystems, the communities close to these mines and to partially contribute to climate change mitigation efforts. By discussing these consequences first, the aim is to provide a clear reason why these mines have to be urgently rehabilitated. The discussion then turns to what has been happening on the ground to alleviate these impacts so far. To highlight the severity of the issue, key aspects such as the extent of unrehabilitated and abandoned mines are analysed by looking at the statistical data, establishing the scale of the issue. The financial costs to rehabilitate current unrehabilitated and abandoned mines are considered, followed by an examination of the mine rehabilitation progress from 2022 to present to identify the gaps in rehabilitation efforts.

4.2 The environmental and socio-economic impacts of unrehabilitated and abandoned mines

Unrehabilitated and abandoned mines are not always isolated.²⁶⁷ Some of these mines are located close to communities, plants and animals.²⁶⁸ As a result of their close proximity, the surrounding communities and the natural habitats are directly affected by these mining sites. These consequences include but are not limited to AMD, air pollution from inactive and unrehabilitated mines, spontaneous combustion, land subsidence, and illegal mining activities. These consequences impacts the health of people, thereby infringing on section 24(a) of the *Constitution*, which guarantees everyone's right to an environment that is not harmful to their health and wellbeing.²⁶⁹ Below followed a detailed discussion of these consequences.

4.2.1 The environmental and health impacts of acid mine drainage

AMD contaminates soil, groundwater and surface water.²⁷⁰ Although AMD can occur naturally, it is partially exacerbated by mining activities, contributing to air, soil and water pollution, and degrading surrounding ecosystems.²⁷¹ AMD is caused by sulphide minerals, primarily iron pyrite, when exposed to air or water, leading to their oxidation.²⁷² This oxidation is of environmental concern, particularly in the gold and coal mining sectors.²⁷³ This chemical reaction then generates acidic water, either naturally or due to anthropogenic activities such as mining and construction.²⁷⁴ AMD often carries heavy metals and substances that are toxic,

²⁶⁷ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 8.

²⁶⁸ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 6.

²⁶⁹ Section 24(a) of the *Constitution of the Republic of South Africa*, 1996.

²⁷⁰ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 22.

²⁷¹ Reclamation Research Group *Acid Mine Drainage and Effects on Fish Health and Ecology: A Review* 1.

²⁷² Reclamation Research Group *Acid Mine Drainage and Effects on Fish Health and Ecology: A Review* 1.

²⁷³ Watson *et al* "Terrestrial and Deep Seabed Mining" 878.

²⁷⁴ Reclamation Research Group *Acid Mine Drainage and Effects on Fish Health and Ecology: A Review* 1.

which in turn affect aquatic ecosystems and human health.²⁷⁵ Often, once the mine ceases to operate, water fills into mine voids, creating conditions that lead to the formation of AMD,²⁷⁶ which indicates that mine rehabilitation is necessary to address AMD.

In South Africa, AMD has had, devastating effects in areas such as the Witwatersrand gold fields, the North West, Free State, Mpumalanga and KwaZulu-Natal coal areas, as well as the O’Kiep copper district.²⁷⁷ An example of what AMD can do is the contamination of Boesmanspruit Dam near Carolina in Mpumalanga, where heavy rainfall caused overflow from coal facilities, causing AMD to pollute the dam that supplied water to Carolina and the Silobela township.²⁷⁸ As a result of this residents were without safe drinking water for seven months.²⁷⁹ Beyond water contamination, nearby communities that are exposed to AMD face health risks due to toxic dust and polluted water.²⁸⁰ It contributes to diseases such as tuberculosis and cancer.²⁸¹ The effect that AMD has on the environment and human health can persist for a very long time.²⁸²

4.2.2 Air pollution from inactive and unrehabilitated mines

Mines, whether active or inactive, still continue to have effects on the air quality of the surrounding areas and often the impact is comparable to that of a mine that is still active.²⁸³ When mining waste is left unmonitored, it releases potential toxic

²⁷⁵ Roche & Mudd “An Overview of Mining and the Environment in Western Australia” 185.

²⁷⁶ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 22.

²⁷⁷ See South African Human Rights Commission *Acid Mine Drainage and Human Rights* 4.

²⁷⁸ Centre for Environmental Rights *Zero Hour: Poor Governance of Mining and the Violation of Environmental Rights in Mpumalanga* 5.

²⁷⁹ Centre for Environmental Rights *Zero Hour: Poor Governance of Mining and the Violation of Environmental Rights in Mpumalanga* 5.

²⁸⁰ Centre for Environmental Rights *Zero Hour: Poor Governance of Mining and the Violation of Environmental Rights in Mpumalanga* 4-5.

²⁸¹ Africanews 2024 <https://www.africanews.com/2017/03/21/south-africa-s-acid-mine-water-pollution-risks-lives/>.

²⁸² Watson *et al* “Terrestrial and Deep Seabed Mining” 901.

²⁸³ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 22-23.

waste into the air through dust fall,²⁸⁴ which happens even when the mine is no longer active and left unrehabilitated. Inhaling dust fall from these unrehabilitated mines will most likely lead to people suffering from respiratory infections, chronic cardiopulmonary diseases, and lung cancer.²⁸⁵ Communities that are close to inactive mines or partially rehabilitated or unrehabilitated asbestos waste dumps, are at the greater risks of these diseases.²⁸⁶ Proper rehabilitation of these mines is important to prevent these greater health risks and protecting the communities.

4.2.3 Spontaneous combustion of unrehabilitated and abandoned coal mines

South Africa has over 300 unrehabilitated and abandoned coal mines²⁸⁷, some of which might still contain low quality fine coal. This may cause spontaneous combustion,²⁸⁸ posing environmental and health risks to nearby communities. Spontaneous combustion refers to an oxidation reaction that generates heat internally without any external heat source.²⁸⁹ This oxidation reaction changes the internal heat balance of the material, which can be coal, causing the temperature to increase so that the material catches fire and burns.²⁹⁰ One of the sites that was identified to be at risk from the derelict and ownerless (hereafter D and O) database was the abandoned Transvaal and Delagoa Bay Colliery coal mine near Witbank.²⁹¹ This coal mine partially collapsed, creating large sinkholes near the informal

²⁸⁴ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 23.

²⁸⁵ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 23.

²⁸⁶ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 23.

²⁸⁷ See AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 17 figure 4.

²⁸⁸ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 24.

²⁸⁹ Coaltech Research Association *Prevention and Control of Spontaneous Combustion Best Practice Guidelines for Surface Coal Mines in South Africa* 1.

²⁹⁰ Coaltech Research Association *Prevention and Control of Spontaneous Combustion Best Practice Guidelines for Surface Coal Mines in South Africa* 1.

²⁹¹ Environmental Monitoring Group *The Social and Environmental Consequences of Coal Mining in South Africa a Case Study* 8.

settlements.²⁹² The coal that is still underground continues to burn, which leads to physical hazards and air pollution in surrounding areas.²⁹³

Discarded coal dumps can cause spontaneous combustion. People who live close to these unrehabilitated and abandoned coal mines often go to these mines to take out coal under conditions that are not safe.²⁹⁴ When spontaneous combustion occurs, it releases dangerous pollutants into the atmosphere.²⁹⁵ This includes sulphur, mercury and arsenic.²⁹⁶ These pollutants do partially contribute to carbon dioxide, which in turn contributes to climate change and worsening global warming.²⁹⁷ These pollutants further degrade the air quality and seriously poses risks to public health.²⁹⁸

4.2.4 Land subsidence

Land subsidence, which is the sinking of the earth's surface, is one of the major geohazards that threaten the infrastructure, natural resources such as water, and the built environment.²⁹⁹ This destruction occurs around the globe, causing infrastructure damage, flood risks and a reduction in aquifer storage capacity.³⁰⁰ Land subsidence occurs because of natural factors such as volcanic or seismic activity, the collapse of underground cavities, as well as human activities such as

²⁹² Environmental Monitoring Group *The Social and Environmental Consequences of Coal Mining in South Africa a Case Study* 8.

²⁹³ Environmental Monitoring Group *The Social and Environmental Consequences of Coal Mining in South Africa a Case Study* 8.

²⁹⁴ Segar 2025 <https://www.spotlightnsp.co.za/2025/08/04/battle-to-breathe-how-air-pollution-in-emalahleni-is-affecting-peoples-health/>.

²⁹⁵ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 24.

²⁹⁶ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 24.

²⁹⁷ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 24.

²⁹⁸ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 24.

²⁹⁹ Davydzenska, Tahmaseb & Shokri 2024 *Geophysical Research Letters* 1.

³⁰⁰ Davydzenska, Tahmaseb & Shokri 2024 *Geophysical Research Letters* 1.

excessive ground water extraction, mining activities.³⁰¹ Unrehabilitated and abandoned mines also contribute to this issue.

The consequences of land subsidence extend beyond physical damage. It affects water management systems by changing the gradients of streams and drainage systems.³⁰² In the mining sector, land subsidence is one of the pressing issues. The surface sinking that is caused by underground mining endangers public safety and properties in the area where such a mine is operating and this potentially leads to geological hazards and ecological degradation.³⁰³ Moreover, ground water that moves through mining voids often becomes contaminated and results in the pollution of wetlands, rivers and dams.³⁰⁴ The adverse impacts of land subsidence can include injuries and fatalities for both humans and animals, land deformation, and damage to infrastructure such as homes, buildings, railways and roads.³⁰⁵

4.2.5 *Illegal mining crisis*

Unrehabilitated and abandoned mines contribute to the issue of illegal mining in South Africa.³⁰⁶ With 6 100 unrehabilitated and abandoned mines across the country³⁰⁷, these mines become easy targets for illegal miners who want to extract mineral resources such as gold, coal, platinum and other minerals.³⁰⁸ Slow and costly rehabilitation programmes leave a huge opportunity for illegal mining operations.³⁰⁹ These miners, also known as *zama-zamas*, illegally exploit sealed-off abandoned mines and exploit mines that are active.³¹⁰

³⁰¹ Davydzenka, Tahmaseb & Shokri 2024 *Geophysical Research Letters* 1 & Galloway & Burbey 2011 *Hydrogeology Journal* 1459.

³⁰² Davydzenka, Tahmaseb & Shokri 2024 *Geophysical Research Letters* 1.

³⁰³ Li et al 2024 *Applied Sciences* 2.

³⁰⁴ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 24.

³⁰⁵ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 24.

³⁰⁶ Mhlongo & Amponsah-Dacosta 2015 *Taylor & Francis* 1-2.

³⁰⁷ See AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines*.

³⁰⁸ Ojajorotu 2024 *Journal of China University of Mining and Technology* 335; Geldenhuys 2024 *Servamus* 11.

³⁰⁹ Geldenhuys 2024 *Servamus* 11.

³¹⁰ Geldenhuys 2024 *Servamus* 11.

Illegal mining can have severe health risks such as chemical radiation exposure from mining activities, especially when involving gold and uranium.³¹¹ Further, illegal mining contributes to security threats.³¹² The continuous failure to rehabilitate these mines effectively and quickly sustains illegal mining, making it a continuous challenge that threatens the environment and socio-economic stability of affected regions. The high unemployment rate in South Africa also contributes to this.

In August 2024, efforts were initiated to address illegal mining at the Buffelsfontein gold mine located outside Stilfontein as part of operational *Vala Umgodi*, which means close the hole.³¹³ Since then, about 2 000 illegal miners have been arrested, with over 90% reportedly from other neighbouring African countries.³¹⁴ Additionally, 93 bodies were recovered from the Buffelsfontein mine.³¹⁵ The rescue operations undertaken by the community members and mine rescue services cost tax payers R3.5 million.³¹⁶ This reveals the severe consequences of illegal mining, which has long-term health risks and results in fatalities and injuries. If these mines are properly rehabilitated, illegal mining and its consequences can be avoided.

4.3 The extent of unrehabilitated and abandoned mines in South Africa

The majority of unrehabilitated and abandoned mines are situated in Gauteng and Western Cape, particularly in areas with a population density exceeding 380 people

³¹¹ Ojakorotu 2024 *Journal of China University of Mining and Technology* 335.

³¹² Ojakorotu 2024 *Journal of China University of Mining and Technology* 335.

³¹³ Mutsila 2025 <https://www.dailymaverick.co.za/article/2025-01-16-stilfontein-mine-rescue-ends-with-78-dead-246-rescued-and-ringleaders-in-custody/>.

³¹⁴ Mutsila 2025 <https://www.dailymaverick.co.za/article/2025-01-16-stilfontein-mine-rescue-ends-with-78-dead-246-rescued-and-ringleaders-in-custody/>.

³¹⁵ Portfolio Committee on Minerals and Petroleum Resources 2025 <https://www.parliament.gov.za/press-releases/media-statement-minerals-and-petroleum-resources-police-committees-welcome-presentations-derelict-mines-and-operation-vala-umgodi>.

³¹⁶ Portfolio Committee on Minerals and Petroleum Resources 2025 <https://www.parliament.gov.za/press-releases/media-statement-minerals-and-petroleum-resources-police-committees-welcome-presentations-derelict-mines-and-operation-vala-umgodi>.

per square kilometre.³¹⁷ This increases the potential risks associated with unrehabilitated mine sites.

Figure 2 below shows the geographical distribution and the extent of abandoned mines scattered across South Africa. It further highlights the scale of the issue, the potential environmental, social and economic impacts, including the effects on the surrounding communities.³¹⁸

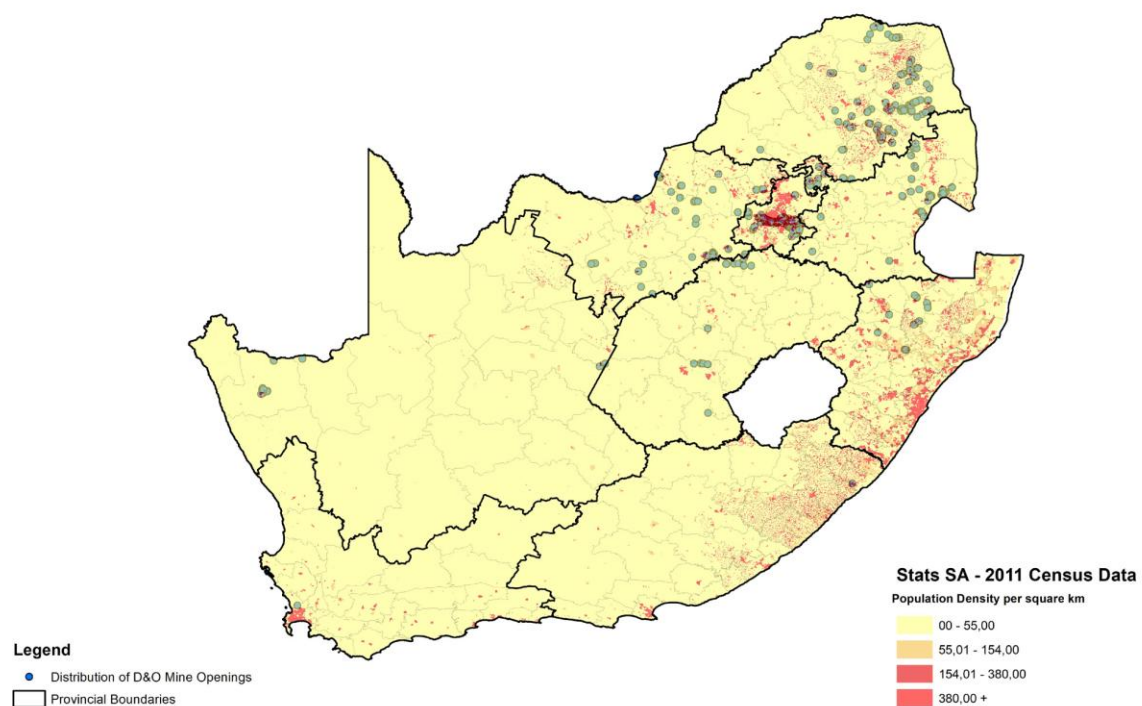


Figure 2: Geographic distribution of abandoned mines in South Africa (CGS, 2021)³¹⁹

4.3.1 Statistical data on unrehabilitated and abandoned mines

Unrehabilitated and abandoned mines are categorised as high, medium or low, with some mines not requiring rehabilitation.³²⁰ According to the D and O mines

³¹⁷ AGSA Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines 16 & 18.

³¹⁸ Fredua A Comparative Legal Approach to Mining Rehabilitation Funding Schemes in South Africa and Western Australia 17.

³¹⁹ AGSA Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines 16.

³²⁰ AGSA Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines 15.

database, out of 6 100 unrehabilitated and abandoned mines, 2 568 have been identified to be high risk due to their adverse environmental impact and their proximity to the surrounding communities.³²¹ Among these unrehabilitated and abandoned high-risk mines, a large number were found to be from four mining commodities, namely gold, coal, asbestos and copper.³²² Gold mine is the highest, followed by coal, asbestos and lastly copper.³²³

Figure 3 below shows the distribution of abandoned mines in South Africa by commodities. Gold accounts for the largest percentage, with 717 sites (46%) reflecting its historical and lasting environmental impact. Coal follows with 379 sites (25%), highlighting its environmental concerns like methane emissions. Asbestos, with 246 sites (16%), poses a major health risk due to its hazardous substances. Copper has the smallest percentage with 200 abandoned mining sites (13%).

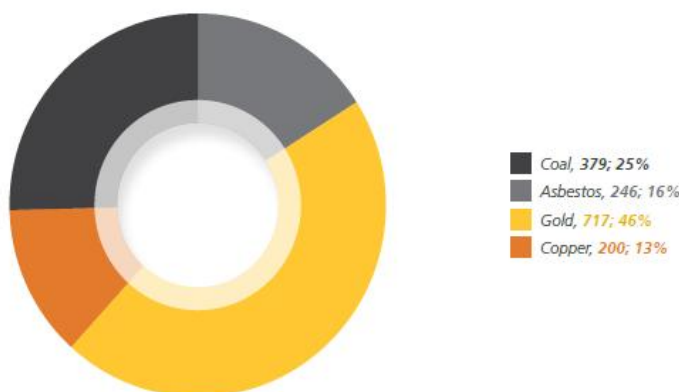


Figure 3: High-risk unrehabilitated abandoned mines by commodity (D and O database, 2021)³²⁴

³²¹ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 17.

³²² AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 17.

³²³ See AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 17 figure 4.

³²⁴ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 17.

However, there are discrepancies when comparing the D and O mines database on asbestos mines with the valuation report.³²⁵ The department itself could not explain these discrepancies.³²⁶ The 2021 audit report acknowledged that it identified errors in the data recorded in the D and O mines database.³²⁷ This is because the valuation report identified 261 abandoned asbestos mines compared to 246 abandoned asbestos mines recorded in the D and O mines database.³²⁸

4.3.2 Unrehabilitated and abandoned coal mines in South Africa

Historically, coal and other minerals have been exploited in South Africa without land or mine rehabilitation practices.³²⁹ As stated, the 2021 audit report revealed that there are 6 100 unrehabilitated and abandoned mines, of which 379 are coal mines.³³⁰ According to the report, coal mines are classified as a high-risk commodity and none of them are rehabilitated.³³¹ This lack of rehabilitation of coal mines partially contributes to climate change because these sites continue to emit methane. The extent of unrehabilitated coal mines in South Africa should not be overlooked. A study conducted in China found that 44 abandoned coal mines in Shanxi Province emit over 500 million cubic meters of methane every year.³³² In 2024 methane emissions from abandoned coal mines in China was estimated to be 2 761 kilotonnes.³³³

³²⁵ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 27.

³²⁶ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 27.

³²⁷ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 8.

³²⁸ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 28.

³²⁹ Ndzimande & Chauke 2012 *Journal of the Southern African Institute of Mining and Metallurgy* 135.

³³⁰ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 17.

³³¹ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 17.

³³² Global Methane Initiative *Methane Emissions from Abandoned Coal Mines in China* 2.

³³³ Global Methane Tracker 2025 Understanding methane emissions – Global Methane Tracker 2025 – Analysis - IEA.

Considering that South Africa has 379 unrehabilitated coal mines,³³⁴ these mines could potentially be releasing methane into the atmosphere, much more than the 44 abandoned mines in China, exacerbating climate change each and every day. Therefore, the proper rehabilitation of these mines will partially contribute to South Africa's climate change mitigation efforts.

4.4 Costs to rehabilitate abandoned mines in South Africa

Rehabilitating mines is a costly process, with total costs depending on certain factors such as the size of the mine and the extent of the environmental damage. According to the 2009 audit, the Council for Geoscience (hereafter CGS) estimated that to rehabilitate the 5 906 abandoned mines that were identified at the time would cost R30 billion.³³⁵ However, this estimation did not include the long-term management of AMD and expenses associated with building and operating plants.³³⁶ In relation to the construction of these plants, CGS estimated that it could cost up to R5 billion, with costs associated with ongoing operation being estimated to be hundreds of millions of rand per year.³³⁷ From the R30 billion estimation, R28.5 billion was estimated to be the cost of rehabilitating 1 730 high-risk unrehabilitated and abandoned mines³³⁸ due to their adverse environmental impact.

However, with 6 100 unrehabilitated and abandoned mines in South Africa currently, the costs to rehabilitate all of these mines far exceeds the R30 billion estimated by the CGS. On 8 September 2022, Gwede Mantashe, the Minister of Mineral Resource and Energy then, now Minister of MPR, stated that the estimation for the rehabilitation of 6 100 D and O mines would exceed R49 billion.³³⁹ The DMRE

³³⁴ See AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 17 figure 4.

³³⁵ AGSA *Report of the Auditor-General to Parliament on a performance audit of the rehabilitation of abandoned mines at the DME* 5.

³³⁶ AGSA *Report of the Auditor-General to Parliament on a performance audit of the rehabilitation of abandoned mines at the DME* 5.

³³⁷ AGSA *Report of the Auditor-General to Parliament on a performance audit of the rehabilitation of abandoned mines at the DME* 5.

³³⁸ AGSA *Report of the Auditor-General to Parliament on a performance audit of the rehabilitation of abandoned mines at the DME* 5.

³³⁹ DMRE 2022 <https://www.dmre.gov.za/news-room/post/1990> & See Gilliland 2019 <https://mg.co.za/article/2019-12-06-00-r49bn-to-rehabilitate-6000-mines/>.

focused on rehabilitating abandoned asbestos mines due to their health risks for human beings, which include lung cancer, mesothelioma, increased risk of cancer of the larynx or gastro-intestinal tract, scarring of the respiratory system.³⁴⁰ While it is understandable that the department would prioritise the rehabilitation of abandoned asbestos mines, not prioritising rehabilitation of abandoned coal mines which continue to emit methane partially contributing to climate change is a concern. This is because climate change is an environmental issue that has to be urgently mitigated.

The national treasury allocated insufficient annual funds for the rehabilitation of all abandoned mines by 2038.³⁴¹ The medium-term expenditure framework (hereafter MTEF) only allocated funds for rehabilitating abandoned asbestos mines and holings programmes, and excluded the other 2 322 high risk abandoned mines, including the coal mines.³⁴² The March 2021 valuation report indicated that out of 261 asbestos abandoned mines, only 32 had been rehabilitated since the beginning of the rehabilitation programme in 2006–2007.³⁴³

The valuation report estimated that rehabilitating the remaining 229 abandoned asbestos mines by 2033 would require R3.86 billion.³⁴⁴ However, based on the current funding, the MTEF would only allocate 44% of this amount, which is R1.69 billion by 2033, further delaying the full rehabilitation of these asbestos mines by 2043.³⁴⁵ Although mine rehabilitation funding was reported to be R140 million in 2019, and it was increased during the 2024 financial year to R310,8 million, this

³⁴⁰ AGSA *Report of the Auditor-General to Parliament on a performance audit of the rehabilitation of abandoned mines at the DME* 5.

³⁴¹ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 9 & 28.

³⁴² AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 28.

³⁴³ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 27.

³⁴⁴ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 28.

³⁴⁵ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 28.

funding remains insufficient to meet the rehabilitation target within the planned time frame.³⁴⁶

4.5 Mine rehabilitation progress according to the Auditor-General's findings (up to 2021)

The Auditor General's findings indicate that out of 6 100 unrehabilitated and abandoned mines as of 31 March 2021, none of the identified 2 322 high risk commodity mines have been rehabilitated.³⁴⁷ Out of 1 170 identified holdings, only 507 have been closed, with 663 still open.³⁴⁸ Since the beginning of the mine rehabilitation programme in 2006–2007, only 32 out of 261 asbestos mines have been rehabilitated.³⁴⁹ The average annual rehabilitation rate slightly increased from 1.67 mines to 2.25 mines in 2009 and 2021 respectively.³⁵⁰

The implementation plan of South Africa's national mineral research organisation Mintek indicated that 10 asbestos mines were planned to be completely rehabilitated within a three-year period from 2019 to 2022, which is about 3.33 projects per year.³⁵¹ At this rate it would then take about 69 years to rehabilitate the remaining 229 asbestos mines, with all the asbestos mines completed by 2090.³⁵² With an average annual rate of 2.25 mines per year, the reality is that asbestos mines will be rehabilitated by the year 2123.³⁵³ As these mines remain unrehabilitated, communities continuously feel the consequences. Therefore, at this rate it then

³⁴⁶ See DMRE 2022 <https://www.dmre.gov.za/news-room/post/1990> & DMRE 2024 <https://www.dmre.gov.za/news-room/post/2689>.

³⁴⁷ See Figure 9 AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 27.

³⁴⁸ See Figure 9 AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 27.

³⁴⁹ See Figure 9 AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 27.

³⁵⁰ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 8 & 27.

³⁵¹ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 28; See Mintek *Annual Integrated Report 2019/2020* 46.

³⁵² AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 28.

³⁵³ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 28.

becomes impossible to achieve the 2033 target for rehabilitating the remaining 229 asbestos mines.

Figure 4 below shows the rehabilitation status of asbestos mines, holings, and high-risk commodity mines in South Africa, with many sites remaining unrehabilitated or improperly closed. Over 80% of asbestos mines (229 sites) are still unrehabilitated, with limited progress made. For holings, 57% (663 sites) remain unrehabilitated, while 43% are closed. All high-risk commodity mines (2,322 sites) remain unrehabilitated, which is concerning.

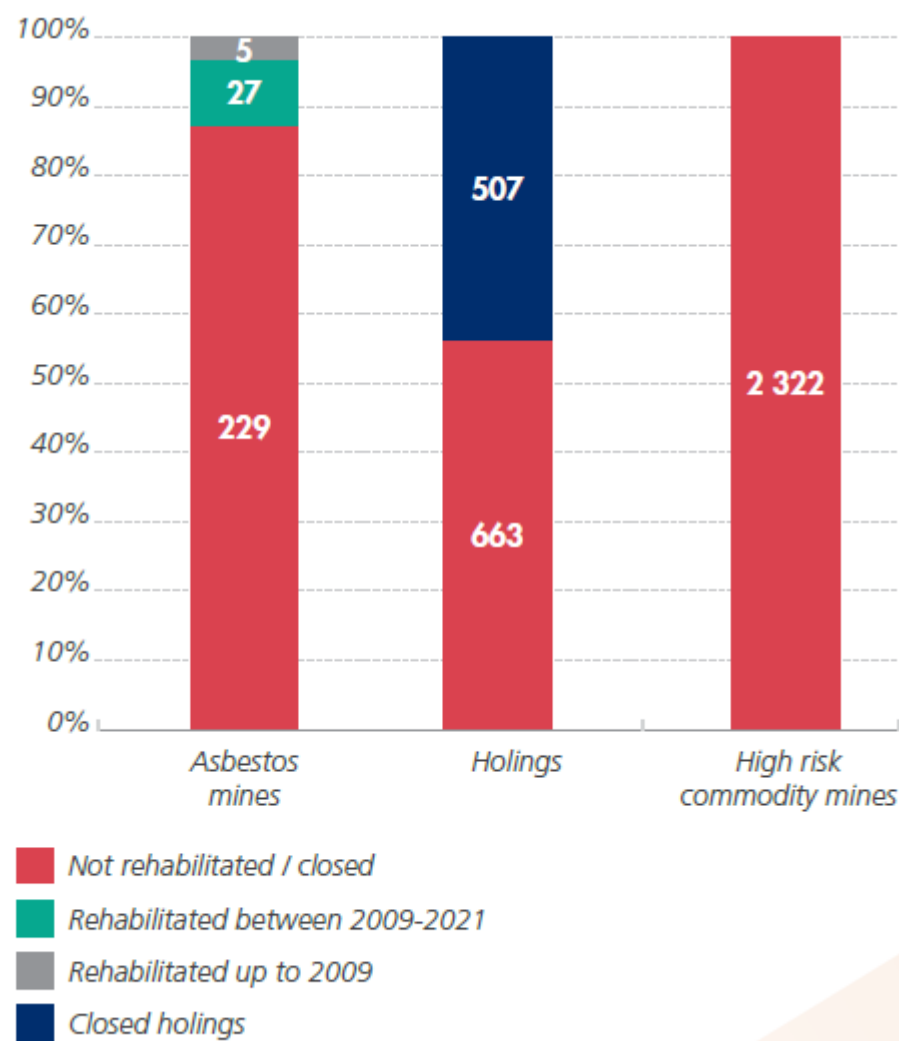


Figure 4: Progress of mine rehabilitation efforts up to 31 March 2021³⁵⁴

Figure 5 below shows that at the current annual rate of asbestos mine rehabilitation, full completion will only be achieved by 2123, which is almost a century from now.

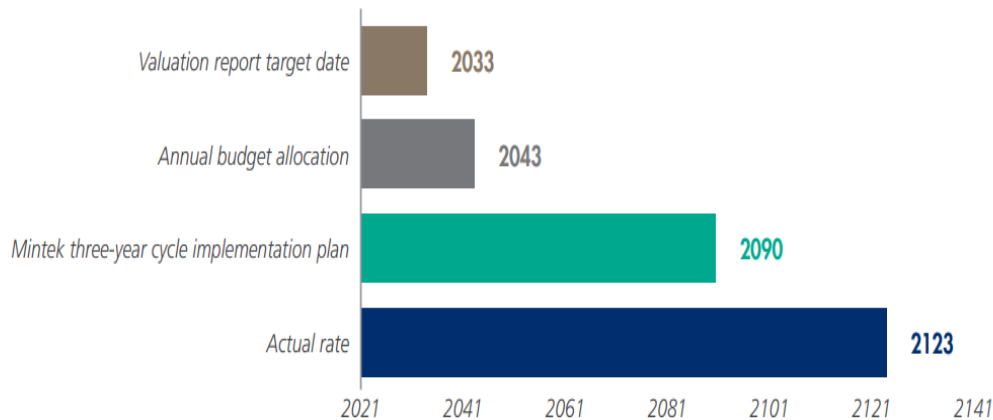


Figure 5: Estimated timeframe for rehabilitation of asbestos mines³⁵⁵

4.6 Progress made from 2022 to the present

After the Auditor-General published its findings on the follow-up performance audit of the DMRE in 2022. The expectation was that DMRE would try to implement the recommendations of the Auditor-General. In the Mintek Annual Corporate Plan 2022/23, it was reported that two asbestos mines in Penge Village in Limpopo were rehabilitated in the previous year.³⁵⁶ Further, 41 gold mine holings in Gauteng were sealed and construction work was underway to seal 14 more holings.³⁵⁷ The Mintek annual integrated report of 2022/23 reported that in the 2023 financial year, 95

³⁵⁴ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 27.

³⁵⁵ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 27.

³⁵⁶ Mintek *Annual Corporate Plan 2022/23* 51.

³⁵⁷ Mintek *Annual Corporate Plan 2022/23* 52.

holings were sealed in the West Rand and Ekurhuleni, and two asbestos mines in Limpopo and Northern Cape were fully rehabilitated.³⁵⁸

In the 2024 financial year, it was reported that 44 holings were closed in the West Rand, Riverlea and Ekurhuleni, and two asbestos rehabilitation projects were completed in Limpopo.³⁵⁹ Mintek Annual Integrated Report 2023/24 further reported that as per the directives from the DMRE, 24 shafts from the 44 holings were sealed and closed as an emergency intervention to address the national emergency pertaining to illegal mining activities in Riverlea, Johannesburg.³⁶⁰ The deputy Minister of MPR, Judith Nemadzinga, stated on 25 July 2024 to the National Council of Provinces (hereafter NCOP), that two additional D and O mines were currently undergoing rehabilitation, with five more still in the design and planning phase.³⁶¹ Further, with additional funding being allocated for the 2024 financial year, the DMRE aimed to rehabilitate three more mines and close 40 holings.³⁶²

Despite these efforts, the general overall rate of mine rehabilitation is insufficient, considering that South Africa has thousands of unrehabilitated and abandoned mines and nothing much has been done on the ground to alleviate the effects discussed in this chapter. Based on what has been reported by Mintek up until the end of 2024, there is rate of two high-risk commodity mines being rehabilitated per year. Of these high-risk commodity mines, only asbestos mines have been rehabilitated, the rest of the high commodity mines including coal mines are not being rehabilitated. Therefore, this clearly indicates that the slight annual increased rate on the rehabilitation from 1.67 in 2009 to 2.25 in 2021 reported by Auditor-General³⁶³ has slightly decreased to 2. To meet the long-term targets, which includes the 2033 goal for rehabilitating all asbestos mines and the 2038 target for rehabilitating all high-risk commodity mines, is almost impossible.

³⁵⁸ Mintek *Annual Integrated Report 2022/23* 35.

³⁵⁹ Mintek *Annual Integrated Report 2023/24* 47.

³⁶⁰ Mintek *Annual Integrated Report 2023/24* 55.

³⁶¹ DMRE 2024 <https://www.dmre.gov.za/news-room/post/2689>.

³⁶² DMRE 2024 <https://www.dmre.gov.za/news-room/post/2689>.

³⁶³ AGSA *Follow-up performance audit at the DMRE on the rehabilitation of derelict and ownerless mines* 8 & 27.

4.7 Conclusion

The main objective of this chapter was to critically analyse the mine rehabilitation practices in South Africa based on the findings of the 2021 audit and mintek. The 2021 audit revealed that South Africa has 6 100 unrehabilitated and abandoned mines, an increase from 5 906 unrehabilitated and abandoned mines identified in the 2009 audit. The DMRE prioritised the rehabilitation of asbestos mines due to their adverse health effects on human beings. Asbestos mines are classified as high-risk mines that require immediate attention. However, other high-risk abandoned mines such as coal, gold and copper are not prioritised. Among 261 asbestos mines identified, only 32 have been rehabilitated, with no rehabilitation for the remaining of other high risk mines. This is a significant concern considering that unrehabilitated coal mines continue to emit methane, into the atmosphere partially contributing to climate change.

What has been happening on the ground with thousands of unrehabilitated mines has a significant effect on the health of people and the environment. Some of these effects discussed include AMD, which can be partially exacerbated by mining activities, contributing to air, soil and water pollution. This then leads to health complications because of water contamination and the degradation of surrounding ecosystems. Air pollution from inactive mines continue to occur, especially if waste from these mines is left unmonitored. Unrehabilitated and abandoned mines also contribute to spontaneous combustion. Additionally, land subsidence, which is the sinking of earth surface, occurs because of excessive ground water extraction, mining activities, and unrehabilitated and abandoned mines, leading to destruction of infrastructure. Lastly, abandoned unrehabilitated mines sustain the illegal mining activities in South Africa. Therefore, proper rehabilitation of these mines would mitigate all of the aforementioned impacts. The next chapter concludes the study by summarising the main points and coming up with recommendations that will address the issue identified in Chapter 1, namely that unrehabilitated and abandoned mines, particularly coal mines, partially contribute to climate change by continuing to emit methane.

Chapter 5 Conclusion and recommendations

5.1 Conclusion

The primary aim of this study was to evaluate the extent to which South Africa's legislation regulate or support mine rehabilitation as a climate change mitigation activity, with specific focus on reducing methane emissions in post-mining sites. This was done by primarily relying on the desktop study methodology.³⁶⁴ It is clear that although South Africa has committed to mitigate climate change to the extent of enacting legal framework and policies, there is a significant enforcement gap, especially pertaining to post-mining activities. It is evident that anthropogenic activities such as mining have played a significant role in global warming, with the earth's average temperature increasing by 1°C since early 20th century, with much of the increase occurring over the past five decades.³⁶⁵

Chapter 1 of this study began by highlighting and introducing the issue and the critical gap that has to be addressed. It highlighted the scale of unrehabilitated mining sites in South Africa. South Africa had 6 100 unrehabilitated and abandoned mines as of 31 March 2021, 379 being coal mines.³⁶⁶ These unrehabilitated coal mining sites continue to emit methane. This is evident from studies such as those conducted in China published in 2012, which found that 44 abandoned coal mines in Shanxi province was estimated to emit over 500 million cubic meters of methane annually.³⁶⁷ The study conducted in China reveals the likelihood that South Africa's unrehabilitated and abandoned coal mines could be contributing a similar severe methane emissions.³⁶⁸ This then defeats the main objective of the Paris Agreement, which South Africa is signatory to, which aims to decrease the emission of GHGs by keeping the rise of the global temperature below 2°C.³⁶⁹

³⁶⁴ See para 1.4 & 1.5 above.

³⁶⁵ See para 1.1 above.

³⁶⁶ See para 1.2 above.

³⁶⁷ See para 1.2 above.

³⁶⁸ See para 1.2 above.

³⁶⁹ See para 1.2 above.

In addition to methane emissions, land degradation as a result of these unrehabilitated and abandoned mines loses the ability to capture carbon.³⁷⁰ Therefore, this supports the recommendation that when the mine rehabilitation process integrates reforestation, it supports climate change mitigation initiatives.³⁷¹ The aforementioned issues were acknowledged in South Africa's draft SETs, acknowledging the lack of regulatory measures and practical implementation in relation to methane emission.³⁷²

Furthermore, the study provided an overview of where South Africa's mitigation mandate stems from, and discussed the objectives and the mechanisms put in place to mitigate climate change. It was highlighted that the mandate to mitigate climate change stems from international obligations and commitments, specifically under the UNFCCC, KP and the Paris Agreement.³⁷³ One of the general objectives of these conventions being climate change mitigation.³⁷⁴ This mitigation mandate has been incorporated in domestic laws and policies. It is reflected under the objectives of the *NCCR Green and White Papers*, as well as the *Climate Change Act*.³⁷⁵

Although there are shortcomings in mine rehabilitation practices, South Africa has introduced mechanisms to achieve climate change mitigation objectives. These mechanisms include carbon pricing and taxation, which are regulated by the *Carbon Tax Act*.³⁷⁶ Moreover, policies such as renewable energy policies and programmes have been introduced to promote renewable energy for the achievement of a just energy transition, considering that South Africa relies on coal to generate over 80% of the country's electricity and coal being extracted through coal mining.³⁷⁷ This

³⁷⁰ See para 1.3 above.

³⁷¹ See para 1.2 above.

³⁷² See para 2.5.4 above.

³⁷³ See para 2.2 above.

³⁷⁴ See para 2.2 above.

³⁷⁵ See para 2.3 above.

³⁷⁶ See para 2.5 above.

³⁷⁷ See para 2.5.2 above.

transition to renewable energy is being pursued through programmes such as REIPPPP.³⁷⁸

With the enactment of the *Climate Change Act*, two climate change mechanisms were introduced, although not yet in operation.³⁷⁹ These climate change mechanisms are SETs and carbon budgets. SETs aim to reduce GHGs that are applicable to a specific sector for a specific period, while carbon budgets aim to reduce the total GHG emissions that can be emitted by the facility over a defined period.³⁸⁰

In Chapter 3, the study argued that although South Africa does not have legislation that specifically aims to address the mine rehabilitation crisis especially within the context of climate change mitigation. There are specific sections and regulations that explicitly and implicitly require the mines to be rehabilitated once they reach the end of their lives or cease to operate. As a foundational legal basis, the interpretation of section 24 of the *Constitution*, which requires the prevention of pollution and ecological degradation, and the promotion of conservation through reasonable legislative and other measures, does require mine rehabilitation considering that mining activities have dire consequence for the environment.³⁸¹

The *NEMA* serves as an umbrella for the South African environmental laws.³⁸² The *NEMA* includes principles of sustainable development, such as the precautionary principle, the polluter-pays principles and duty of care to prevent, minimise and remedy the harm caused on the environment.³⁸³ These principles are important to ensure that mine rehabilitation is not treated as post-mining activity, but rather as a fundamental obligation included in every phase of the mining operation.³⁸⁴

³⁷⁸ See para 2.5.2 above.

³⁷⁹ See para 2.5.4 & 2.4.5 above.

³⁸⁰ See para 2.5.4 & 2.5.5 above.

³⁸¹ See para 3.2 above.

³⁸² See para 3.3.1 above.

³⁸³ See para 3.3.1 above.

³⁸⁴ See para 3.3.1 above.

Complementing the *NEMA*, the *MPRDA* ties environmental responsibilities to mining rights, requiring that the holders of the mining right fulfil rehabilitation duties once the mine ceases operation.³⁸⁵ This obligation is only fulfilled once the closure certificate is issued.³⁸⁶ The financial provision mechanism is also in place to ensure that the mine rehabilitation process is funded, even if companies become insolvent or mine holders are deceased or untraceable.³⁸⁷ Furthermore, sector-specific legislation such as the *NWA* and national environmental management legislation such as the *NEMAQA* recognise the effects of mining activities. These laws mandate the prevention of pollution and mine rehabilitation requirements to address the contamination of water resources and the pollution of air quality, respectively.³⁸⁸

Considering that South Africa has 6 100 unrehabilitated and abandoned mines according to the 2021 Auditor General findings, it is clear that the mine rehabilitation obligations as required by the aforementioned legislations and regulations are not being complied with.³⁸⁹ The continuous lack of rehabilitation and abandonment of these mines have ongoing environmental and socio-economic impacts. These impacts include AMD,³⁹⁰ air pollution from inactive mines,³⁹¹ the risk of spontaneous combustion,³⁹² land subsidence,³⁹³ and illegal mining activities.³⁹⁴

The continued existence of these 6 100 unrehabilitated and abandoned mines is also a result of the costs associated with their rehabilitation, which has been reported to be exceeding R49 billion.³⁹⁵ The current budget allocated to rehabilitate these mines is insufficient, resulting in the slow progress with the rehabilitation of these mines, making it unlikely that the DMPR will achieve its long-term targets by

³⁸⁵ See para 3.3.2 above.

³⁸⁶ See para 3.3.2 above.

³⁸⁷ See para 3.3.2 above.

³⁸⁸ See para 3.3.3 & 3.3.4 above.

³⁸⁹ See para 4.1 above.

³⁹⁰ See para 4.2.1 above.

³⁹¹ See para 4.2.2 above.

³⁹² See para 4.2.3 above.

³⁹³ See para 4.2.4 above.

³⁹⁴ See para 4.2.5 above.

³⁹⁵ See para 4.4 above.

2033.³⁹⁶ The target is to rehabilitate all asbestos mines by 2033 and the 2038 target is to rehabilitate all high-risk commodity mines, which includes coal mines.³⁹⁷ The lack of priority assigned to coal mines is particularly concerning, considering that unrehabilitated and abandoned coal mines continue to emit methane, partially contributing to climate change leading to global warming.³⁹⁸

5.2 Recommendations

This study centred on the issue that unrehabilitated coal mines continue to emit methane, thereby partially contributing to climate change and leading to global warming. Climate change is currently one of the pressing environmental challenges the world must mitigate as a matter of urgency. If these unrehabilitated coal mines are rehabilitated that will serve as a climate change mitigation activity. Therefore, in an attempt to answer the stated research question, the study recommends the following:

- Regulations in terms of section 30 of *Climate Change Act* should be drafted and developed to directly address methane emission from unrehabilitated abandoned coal mines.
- The revenue generated from taxing emissions in the mining sector in terms of *Carbon Tax Act*, should not be transferred into the national revenue fund or into a general pool of funds. Instead, a separate fund should be established and this fund should specifically be used for climate change mitigation and adaptation initiatives. A portion of the fund should be allocated to rehabilitate coal mines and other high-risk commodity mines.
- The DMPR should collaborate with the private sector on research and investigation to explore the possibility of transforming unrehabilitated and abandoned mines into viable business by integrating renewable energy projects into the mine rehabilitation process. This approach will potentially

³⁹⁶ See para 4.5 above.

³⁹⁷ See para 4.5 above.

³⁹⁸ See para 4.4 above.

incentivise the private sector to invest in mine rehabilitation partnering with the DMRE, considering that South Africa wants to transition from coal-intensive energy to renewable energy.

- The DMPR should also prioritise the rehabilitation of abandoned coal mines as a matter of urgency, just as it prioritises asbestos mines.
- The rate of mine rehabilitation should increase every year.
- The DMPR should develop new short and long-term action plans and goals for the rehabilitation of abandoned mines. In the short term, goals and plans the primarily focus should be on the rehabilitation of high-risk mines which includes coal mines, while the long-term goals and plans should focus on the rehabilitation of all abandoned mines. The current goals will most likely not be achieved. These goals and plans must be supported by implementation and enforcement strategies.

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