

UNIVERSITY OF CAPE TOWN

INSTITUTE OF MARINE & ENVIRONMENTAL LAW (IMEL)

**A Critical Analysis of the Role of the Permitting System as a Legal Tool for
Preventing and Controlling Water Pollution by Proposed Hydraulic
Fracturing in South Africa**

By

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Research dissertation presented for the approval of Senate in partial fulfilment of the requirements for the LL.M. degree in approved courses and a minor dissertation. The other part of the requirement for this qualification was the completion of a programme of courses.

I hereby declare that I have read and understood the regulations governing the submission of LL.M. dissertations, including those relating to length and plagiarism, as contained in the rules of this University, and that this dissertation conforms to those regulations.

Cape Town, _____ 2013

Tankiso Mohobo

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Abstract

This study provides a critical analysis of the role of the permitting system as a legal tool for preventing and controlling water pollution by proposed hydraulic fracturing which is intended to take place in the Karoo South Africa. The research endeavours to establish how the permitting requirements under the current South African environmental laws respond to the potential risk of contamination of water resources during the different stages of production of shale gas using the hydraulic fracturing technique. The paper identifies and analyses relevant permitting requirements under various environmental laws of South Africa which are triggered by the HF process. The applicable authorisations which have been discussed include requirement of environmental authorisation, environmental management programme, production right, water and waste management licences and closure certificate. In general the study finds that the environmental permitting regime of South Africa is satisfactory in addressing the challenges of the HF process however, the weakness lies on the capacity and appropriateness of some of the authorities charged with power to manage the permitting process and the gaps and confusions created by repeal and suspension of some of the provisions.

List of Acronyms

DEA	Department of Environmental Affairs
DME	Department of Minerals and Energy
DWA	Department of Water Affairs
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EPA	Environmental Protection Agency
HF	Hydraulic Fracturing
IAP	Interested and Affected Persons
IWMP	Industry Waste Management Plan
MPRDA	Mineral and Petroleum Resource Development Act
NEMA	National Environmental Management Act
NEMWA	National Environmental Management Waste Act
NORM	Naturally Occurring Radioactive Material
NWA	National Water Act
PAIA	Promotion of Access to Information
PASA	Petroleum Agency South Africa
SA	South Africa
TDS	Total Dissolved Solids
USA	United States of America

CHAPTER ONE

1.1 Introduction and Background

This study focuses on the proposed implementation of the hydraulic fracturing (HF) technique (commonly known as fracking) in extracting shale gas deep underground in the Karoo region in South Africa. Shale gas is proclaimed as having the potential to contribute massively to the economic development of SA¹ and also to provide answers to the current energy crisis the country is facing.² At the same time, it is argued that the method of extracting shale gas by HF has potential to impact negatively on the environment and human health.³ HF technology seems to be surrounded by controversies. One of the controversies is that the technology has detrimental effect on water resources. The argument of negative impact on water resources is twofold. Firstly, the HF process is water intensive and secondly there is concern about its potential to contaminate surface and groundwater resources.⁴ SA is considered to be a naturally ‘water-scarce’ country⁵ and, moreover, the intended development would take place in a semi-desert area of Karoo.⁶ More than half of the population of SA depends on groundwater for their daily consumption of water hence the issue of protection and conservation of water resources is of paramount importance in SA.⁷ Pollution of water resources is the most worrying issue when one thinks of the HF process.⁸

¹ Department of Mineral Resources South Africa *Report on Investigation of the Hydraulic Fracturing in the Karoo South Africa* 18 September 2012 70, available at <http://www.dmr.gov.za/publications/finish/182-report-on-hydraulic-fracturing/854-annexures-full-report-on-investigation-of-hydraulic-fracturing-in-the-karoo-basin-of-south-africa-18-september-2012/0.pdf>, accessed on 05 June 2013.

² Environmental Monitoring Group ‘Water and Climate Change Research Series Report 6: Water and Fracking in South Africa’, September 2012, 7, available at http://www.emg.org.za/images/stories/water_cl_ch/fracking%20and%20water%20in%20sa_tp%20print.pdf, accessed on 05 June 2013.

³ H Hatzenbuehler and TJ Centner ‘Regulation of Water Pollution from Hydraulic Fracturing in horizontally drilled well in Marcellus Shale Region, USA’ (2012) 4 *Water* 984.

⁴ D Fig ‘Extraction and Displacement: The potential social and environmental impacts of hydraulic fracturing in South Africa’ 11-12 paper presented at the International Conference on Global Land Grabbing II October 17-19 2012, available at <http://www.cornell-landproject.org/download/landgrab2012papers/Fig.pdf>, accessed on 17 March 2013.

⁵ Department of Water Affairs *National Water Act 36 of 1998 Review of the National Water Resource Strategy 2* GN 845 GG 36736 of 16 August 2013 8.

⁶ M Jorritsma ‘Don’t Frack with Our Karoo’: Water, Landscape, and Congregational Song in Kroonvale, South Africa’ (2012) 13 *The Journal of South African and American Studies* 373

⁷ J Nel et al ‘Benefit and Implementation of Groundwater Protection Zoning in South Africa’ (2009)23 *Water Resource Manage* 2895 at 2896-2897.

⁸ G Steyl and GJ van Tonder ‘Hydrochemical and Hydrogeological Impact of Hydraulic Fracturing in the Karoo, South Africa’ *INTEC* (2013) 19, available at <http://cdn.intechopen.com/pdfs/44641/InTech->

The scope of this paper will, however, be limited to the risks of contamination of water resources during different stages of the HF process such as drilling of a well, fracturing of a well and handling of flowback or HF wastewater. The study will, therefore, reveal that the process of HF needs careful monitoring and strict regulations, from the start to the completion of the project, in order to prevent and control fresh water pollution.

A permitting system is one of the crucial regulatory tools used for environmental protection and pollution control.⁹ Permitting also plays a critical role in ensuring environmental compliance by industries.¹⁰ Thus, it is the main purpose of the paper to analyse current SA's permitting regime as a tool for facilitating prevention and control of water pollution in SA by HF activities. This exercise will seek to gauge how SA's permitting requirements measure up or respond to the risks of water contamination challenges posed by HF. Lastly, there will be a determination as to whether SA's permitting regime would need to be improved to effectively address the environmental challenges associated with HF.

1.2 Rationale

The extraction of shale gas by HF technique would be a new project to be implemented in SA. As it has been pointed out above, HF is an activity which raises number of environmental issues, especially water pollution. This research is, therefore, undertaken to investigate the capability of the current SA environmental permitting regime in regulating water pollution concerns associated with HF technique. Further, the research seeks to determine whether there are any deficiencies in South African permitting framework which need to be improved before the implementation of HF technology.

1.3 Methodology

This dissertation will be developed by conducting a desktop research which involves analysis of relevant statutes, policy documents, books, journals, articles, reports and internet materials. In particular, the study will be undertaken by critically analysing the current South African

Hydrochemical_and_hydrogeological_impact_of_hydraulic_fracturing_in_the_karoo_south_africa.pdf
accessed on 04 June 2013.

⁹ LJ Kotze and C Bosman op cit 'A Legal Analysis of the Proposed Waste Discharge System in Terms of South African Environmental and Water Law Framework' (2006) 27 1 *Obiter* 131.

¹⁰ N Hankasalo et al 'Environmental Permitting as a Driver for Eco-Efficiency in the Dairy Industry: A closer look at the IPPC Directive' (2005) 13 *Journal of Cleaner Production* 1049.

environmental permitting regime in regulating possible water pollution during HF. The critical analysis will be carried out by examining diverse array of literature and legislation from other jurisdictions which are already practising HF technique.

1.4 Structure of the Paper

This paper has four chapters in total. Chapter Two will commence by giving a brief overview of the geographic information and background of the Karoo area planned for shale gas extraction. The chapter will further define the technology of the HF and elaborate on all the stages involved in extracting natural gas by this method. Furthermore, in outlining the different stages of HF, Chapter Two will also discuss possible water pollution risks of HF during its different stages.

Chapter Three will be divided into three sections or parts. Part A will describe and discuss an overarching environmental requirements set out under the NEMA which are triggered by the production of shale gas. Part B on the other hand will give a description and analysis of mining and production related permitting requirements as set out in the MPRDA which apply to the extraction of shale gas by HF technique. The last section of Chapter Three will describe and analyse permitting requirements related to water pollution which can be caused by the production of shale gas using the HF process. The general legal requirements for producing shale gas are covered in legislation such as National Environmental Management Act¹¹ (NEMA), Mineral and Petroleum Resource Development Act¹² (MPRDA), National Water Act¹³ (NWA) and National Environmental Management Waste Act¹⁴ (NEMWA). The critical analysis of these permitting requirements under these legislation would be aimed at determining their capacity to prevent and control water pollution during the different stages of the HF. In essence, the stages of HF which have been outlined in Chapter Two will form the basis for legislative discussion in Chapter Three.

Chapter Four will serve as a concluding chapter wrapping up the issues and critiques raised from the preceding chapter. This chapter will also contain recommendations to the issues which have been canvassed in this paper when answering the main and subsidiary research questions.

¹¹ Act 107 of 1998.

¹² Act 28 of 2002.

¹³ Act 36 of 1998.

¹⁴ Act 59 of 2008.

CHAPTER TWO

2.1 Proposed Hydraulic Fracturing in the Karoo South Africa

The Karoo is an extremely dry area which forms two-thirds of the entire South African land.¹⁵ Karoo is a 'Khoisan' word which means 'dry or thirstland.'¹⁶ The majority of people who are living in the Karoo rely largely on underground water as the source of their domestic water while surface water is only accessed by few at some parts of the Karoo.¹⁷ It is common cause that there is an extreme shortage of rainfall in the Karoo. Generally, SA is one of the driest countries and it is estimated that more than 280 towns and settlements in SA get their water from underground¹⁸ and the demand for water is rapidly increasing while supply is very limited.¹⁹

Current studies point out that the Karoo basin in SA has a potential to produce a substantial quantity of an extractable natural gas resource²⁰ owing to the permeable rocks which are embedded underneath the Karoo region. Ever since the 1960's there have been attempts to search for the existence of natural gas in SA, which could be tapped for commercial purposes, but to no avail.²¹ However, with the introduction of the horizontal drilling technology, the quest to engage in commercial exploitation of natural gas in SA has been revived. It is estimated that an area of about 155 000 square kilometres at Whitehill and Prince Albert Formations in the Karoo basin could be viable for commercial production of shale gas.²² However, it has not yet been established with absolute precision the quantity of shale gas resource embedded beneath the Karoo.²³ The current research has estimated that the Karoo shales have capacity to produce an extractible gas of up to 485 trillion cubic feet.²⁴

¹⁵ Wikipedia, available at <http://en.wikipedia.org/wiki/Karoo>, accessed on 04 June 2013.

¹⁶ Jorritsma M "Don't Frack with Our Karoo": Water, Landscape, and Congregational Song in Kroonvale, South Africa' (2012) 13 3-4 *Safundi: The Journal of South African and American Studies* 373 at 383

¹⁷ Environmental Monitoring Group op cit (n2).

¹⁸ Strydom H A and King N D *Environmental Management in South Africa* (2009) 433.

¹⁹ Glazewski J *Environmental Law in South Africa* 2ed (2005) 427.

²⁰ Department of Mineral Resources South Africa op cit (n1) 11.

²¹ G Steyl and GJ van Tonder op cit (n8) 2.

²² Department of Mineral Resources South Africa op cit (n1) at 9.

²³ MJ de Wit 'The great shale debate in the Karoo' (2011) 107 7/8 *South Africa Journal of Science* 1.

²⁴ G Steyl and GJ van Tonder op cit (n8) 2.

2.2 Hydraulic Fracturing Technique

HF is defined as the process of ‘injecting fluids into the target formation at a force exceeding the parting pressure of the rock, thus inducing a network of fractures through which oil or natural gas can flow to the wellbore.’²⁵ Natural gas is ‘held inside the rock formation, similar to how sponge holds water.’²⁶ The fluids which are injected into the underground rock formations are called fracturing fluids. It is mixture of water, sand and unknown chemicals or additives. It is estimated that more than 90% of fracturing fluids are made up of water²⁷ and the rest are other added substances, though the composition of the fracturing fluids would vary depending on the distinct character of the well.²⁸ This is the kind of technology which is now applied to extract unconventional shale gas which used to be difficult to extract in the past using the conventional vertical drilling because it is embedded in a rock which does not allow the gas to be released out easily.²⁹ The existence of underground shale gas resource has been discovered a long time ago. However, it could not be utilised as a reliable source of energy since it was very expensive to engage in its development and it was not easy to tap it in large volumes³⁰ due to the nature of the formations it is embedded in. Therefore, the birth of unconventional extraction technique has altered the *status quo* since now the production of natural gas is thriving in the United States of America (USA).³¹

2.2.1 Stages of Hydraulic Fracturing Process

2.2.1.1 Drilling and Construction of a Wellbore

Before fracturing fluids can be injected into the underground formation, there has to be drilling and construction of a wellbore. The HF technique first requires drilling a vertical well

²⁵ Spellman FR *Environmental Impacts of Hydraulic Fracturing* (2012) 11.

²⁶ H Sprohge et al ‘Lower Carbon Energy: The Case of Hydraulic Fracturing for Natural Gas’ (eds) L Kreiser et al *Carbon Pricing, Growth and the Environment* (2012) 87 at 88-89.

²⁷ USA EPA Study on the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources December 2012, available at <http://www2.epa.gov/sites/production/files/documents/hf-report20121214.pdf>, accessed on 13 April 2013.

²⁸ RJ Reser ‘State and Federal Statutory and Regulatory Treatment of Hydraulic Fracturing’ (2013) January *Defence Counsel Journal* 90 at 94.

²⁹ World Energy Outlook *Special Report on Unconventional Gas* November 2012 18 available at http://www.worldenergyoutlook.org/media/weowebiste/2012/goldenrules/WEO2012_GoldenRulesReport.pdf accessed on 05 June 2013.

³⁰ SL Sakmar ‘The Global Shale Gas Initiative: Will the United States be the Role Model for the Development of Shale Gas Around the World’ (2010-2011) 33 2 *Houston Journal of International Law* 369 at 370.

³¹ JR Clark ‘Hydraulic Fracturing and "Spotty" Regulation: Why the Federal Government Should Let States Control Unconventional Onshore Drilling’ (2011) *Brigham Young University Law Reform* 1743.

until it reaches a shale gas formation and, thereafter, drilling horizontally through shale rock in order for the drill-hole to penetrate the required distance of the shale reservoir.³² Shale rock formations are located deep down underground, and to reach them it is estimated that one needs to drill vertically a distance of about 1.2 kilometres to 3.5 kilometres.³³ On the other hand, it is estimated that horizontal drilling of the shale rock formation could go as far as 600 meters³⁴ or up to a mile.³⁵

The wellbore or drill-hole will need to be tightly cased or surrounded with multiple steel pipes and cemented for it to remain sealed and firm during drilling of the well up to the last stage of production of the shale gas.³⁶ The purpose of the steel casings is to protect and separate fresh water aquifers from the wellbore.³⁷ It has been established that the location of fresh water aquifers could be about 100 to 1000 metres from the surface.³⁸ Hence, one of the main reasons for tightly sealing the wellbore with steel casings and cement is to prevent groundwater contamination by leakage of drilling fluids, waste drilling mud, HF fluids and wastewater, and methane ('main component of natural gas'³⁹) and other contaminants.

Waste is always generated during drilling of a well. Waste which is generated during this process is made up of water, oil, clay, chemical compounds or additives found in drilling fluid⁴⁰ and underground rock cuttings.⁴¹ Furthermore, the drilling mud which has been used for drilling a well is often composed of toxic materials emanating from the underground rock

³² SL Sakmar op cit (n30) at 377.

³³ D Rahm 'Regulating hydraulic fracturing in shale gas plays: The case of Texas' (2011) 39 *Energy Policy* 2974 at 2975.

³⁴ Ibid.

³⁵ H Sprohge et al op cit (n26) 90.

³⁶ TE Kuth, MJ Mazzone, MS Mendoza and CS Kulander 'American Law and Jurisprudence on Fracing' (2011) 7-8, available at <http://haynesboone.com/files/Publication/e3fb4761-330e-466d-a65f-8967b231823d/Presentation/PublicationAttachment/0bee3622-30b1-47fa-8aaa-8b9949bc1e22/FrackingStudyUpdated.pdf>, accessed on 05 June 2013 (NB: Original version of this paper was published by the Rocky Mountain Mineral Law Foundation in the Rocky Mountain Mineral Law Foundation Journal 2010(47) 2 277).

³⁷ JR Clark op cit (n31) 1766.

³⁸ TE Kuth 'American Law and Jurisprudence on Fracing' (2010) 47 2 *Rocky Mountain Mineral Law Foundation in the Rocky Mountain Mineral Law Foundation Journal* 277 at 282.

³⁹ RD Vidic et al 'Impact of Shale Gas Development on Regional Water Quality' (2013) 340 *Science* 1235009-1, available at <http://www.marcellus.psu.edu/news/PDFs/scienceArticleMay2013.pdf>, accessed on 19 June 2013.

⁴⁰ TE Kuth op cit (n38) at 280.

⁴¹ World Energy Outlook op cit (n29) at 23.

formations.⁴² As a result, drilling waste would have to be handled and managed appropriately in terms of the law to avoid water pollution.

2.2.1.2 Injection of Fracturing Fluids to Fracture a Well

After the completion of the drilling and construction of a well the next stage would be the injection of the fracturing fluids into the well. As it has been indicated earlier, the HF fluids are made up of large quantities of water mixed with different chemicals and ‘proppants’.⁴³ This HF mixture would be injected into the well at an extremely high pressure which will cause the shale rock formation to crack, allowing the fluids to penetrate through the rock formation to further widen or extend the fractures on the formation.⁴⁴ Thus, it is essential for the wellbore to be tightly fixed and sealed in order to withstand the tremendous pressure applied during injection of the fracturing mixture.

The amount of water needed to be used would depend on the size of the well which has been drilled and the nature of the shale rock formation to be fractured.⁴⁵ It is estimated that on average, a Marcellus shale formation in the US would need five and half millions gallons (about 20 million litres) of water for fracturing⁴⁶ and the well could be fractured more than once. It is evident that fracturing process is really water intensive and water plays an indispensable part in the process of shale gas exploitation.⁴⁷

On the other hand, the purpose of proppants or grains is to remain into the cracked shale rock, and to leave a space which will allow shale gas to be released out of the shale rock.⁴⁸ If proppants were not used to get in between the cracks on the shale rock formation the cracks would close once the fracturing fluids are retrieved out of the split formation and

⁴² JW Adams et al ‘Emerging Centrifugal Technology in Shale Hydraulic Fracturing Waste Management A U.S.-France-China Selected Environmental Comparative Analysis’ (2011-2012) 34 3 *Houston Journal of International Law* 561 at 591.

⁴³ USA EPA Study on the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources op cit (n27) 15.

⁴⁴ H Wiseman ‘Fracturing Regulation Applied’(2012) 22 *Duke Environmental Law & Policy Forum* 361 at 363.

⁴⁵ Ibid.

⁴⁶ SL Sakmar op cit (n30) 402.

⁴⁷ J Hayes ‘Protecting Pennsylvania Three Rivers Water Resources from Shale Gas Development Impacts’ (2011-2012) 22 *Duke Environmental Law & Policy Forum* 385.

⁴⁸ DC Stickley ‘Expanding Good Practices: The Conundrum of Hydraulic Fracturing’ (2012)12 2 *Wyoming Law Review* 321 at 323-324.

the shale gas would remain trapped in the rock.⁴⁹ One supposes that the quantity of solid particles used as proppants would also depend on the size and nature of the shale rock formation to be cracked.

The chemicals mixed with water to form fracturing fluids are not always the same but their composition would depend on the geological nature of a particular formation to be fractured.⁵⁰ Studies which were conducted in the USA between the periods of 2005-2009 reveal that around 750 chemical additives were used in a fracturing fluid concoction. Although most of the additives were non-toxic, there were still some few harmful substances present in the mixture.⁵¹ Some of the hazardous chemicals include diesel fuel, kerosene, benzene, toluene, xylene, and formaldehyde.⁵² The purpose of these chemicals is to optimise the performance of the fracturing fluids.⁵³

Even though the chemicals added to the fracturing fluids are estimated to constitute about 0.5% to 2% of the fracturing mixture, they can have harmful impact on water resources,⁵⁴ and again pose a serious threat to human health and surrounding environment.⁵⁵ Moreover, there is a risk that fracturing fluids may spill onto the earth's surface during the time when they are injected in the wellbore, either through a well casing failure or improper handling.⁵⁶ It is, therefore, obvious that water resources which are situated at or adjacent to the fracturing site are likely to be contaminated by these fluids during the process of fracturing a well.⁵⁷ Another concern is that some of the HF fluids and chemicals remain underground after the fracturing process, and they could contaminate underground freshwater

⁴⁹ TE Kurth et al 'Understanding Hydraulic Fracturing: Issues, Challenges and Regulatory Regime' *Practical Law Company* 2012, available at

<http://haynesboone.com/files/Uploads/Documents/Attorney%20Publications/Understanding-Hydraulic-Fracturing-Issues-Challenges-and-Regulatory-Regime.pdf>, accessed on the 16 March 2013.

⁵⁰ H Wiseman 'Untested Waters: The Rise of Hydraulic Fracturing in Oil and Gas Production and the Need to Revisit Regulation' (2009-2010) XX *Fordham Environmental Law Review* 115 at 120.

⁵¹ RD Vidic et al op cit (n39) 827.

⁵² D Rahm op cit (n33) 2976.

⁵³ RD Vidic et al op cit (n39) 827.

⁵⁴ I Abayev 'Hydraulic Fracturing Wastewater: Making the Case for Treating Environmentally Condemned' (2013) 24 *Fordham Environmental Law Review* 275 at 280-281.

⁵⁵ BD Lutz et al 'Generation, Transport, and Disposal of Wastewater Associated with Marcellus Shale Gas Development' *Water Research Resource* (2013) 49 647.

⁵⁶ G Aitken et al 'Shale gas: Unconventional and unwanted-The case against shale gas' *Friends of the Earth Europe*, September 2012 12, available at http://www.foeeurope.org/sites/default/files/publications/foee_shale_gas_unconventional_and_unwanted_0.pdf, accessed on 17 June 2013.

⁵⁷ AC Cupas 'The Not-So-Safe Drinking Water Act: Why we must Regulate Hydraulic Fracturing at Federal Level' (2008-2009) 33 *William and Mary Environmental Law and Policy Review* 605 at 608.

resources⁵⁸ because the fractures may not be confined to the shale rock reservoir, but they may spread to the aquifers enabling methane and other contaminants to enter groundwater resources.⁵⁹

2.2.1.3 Flowback Process

After fracturing of the well has been carried out successfully, the fracturing fluids would return to the surface. Roughly 25% to 50% of the fracturing fluid would return to the surface as waste,⁶⁰ while the rest would remain underground. A used fracturing fluid which has reverted back to the surface is referred to as flowback.⁶¹ In addition to the HF chemicals which are contained in the flowback, it has been argued that:

‘...fracking fluid also picks up naturally occurring radioactive materials (NORMs) such as uranium, and total dissolved solids (TDS), which is a mixture of salt and other minerals that lie deep underground. ... “[S]hales, more than any other kind of rock, selectively trap heavy metals such as lead, arsenic, barium, strontium, and chromium.” This means that even if no chemicals are used in the fracking fluid, the water that is pumped underground becomes infused with radioactive and toxic elements that had previously been locked safely underground for millions of years.’⁶²

The greatest environmental threat of flowback relates to possible contamination of fresh water resources because of the toxic substances it is carrying. Water which is contaminated by TDS poses danger to freshwater ecosystem and is not suitable for human consumption due to high salinity.⁶³ On the other hand NORMs which are found in fracturing wastewater are normally linked to the cause of cancer in humans.⁶⁴ Often, spent HF fluid which has returned from underground is stored on the well site, either retained in tanks or deposited into excavated open-pits.⁶⁵ Accordingly, it can be gathered that the spent HF fluid is composed of highly toxic and harmful substances and this raises environmental concerns regarding how it is handled and disposed of once it reaches the surface environment.

⁵⁸ DC Stickley op cit (n48) at 324-325.

⁵⁹ M Zoback et al ‘Addressing the Environmental Risks from Shale Gas Development’ July 2010 *World Watch Institute* 11, available at <http://efdsystems.org/Portals/25/Hydraulic%20Fracturing%20Paper%20-%20World%20Watch.pdf>, accessed on 16 March 2013.

⁶⁰ J Hayes op cit (n47) 390.

⁶¹ Spellman op cit (n25) 11.

⁶² LZ Lees ‘Anticipated Harm, Precautionary Regulation and Hydraulic Fracturing’ (2012) 13 *Vermont Journal of Environmental Law* 575 at 580.

⁶³ I Abayev op cit (n54) 281-282.

⁶⁴ I Abayev op cit (n54) 284.

⁶⁵ USA EPA Study on the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources op cit (n27) 18.

2.2.1.4 Production of Natural Gas

Subsequent to the withdrawal of the HF fluid from underground, the sand particles (proppants) would remain trapped in the cracked shale rock formation leaving space for the shale gas to move and pour out into the well and flow up to the surface.⁶⁶ This would be the harvesting stage of the shale gas. During the production of the natural gas, it would flow out of the well along with produced water and the HF fluids which had remained into the well after fracturing had stopped.⁶⁷ These fluids are referred to as ‘produced water.’⁶⁸ Produced water will continue to flow out with the shale gas during the entire period the well is put on production. However, the quantity of produced water normally subsides at later stage depending on the nature of the particular well.⁶⁹ Upon arrival on the surface, natural gas would have to be processed in order to be separated from the produced water,⁷⁰ and the remaining produced water would constitute a waste. In USA the common practice is that once natural gas has been collected from the well and separated from the impurities, it can be channelled through pipelines to the refinery and to the final destination where it would be used.⁷¹

Materials contained in produced water would depend on the geological characteristics of the particular formation, but normally it is composed of substances such as fracturing fluids, salts, NORMs, TDS, dissolved oil, gas, mineral and chemical compounds.⁷² It has been claimed that produced water from gas wells is 14 times saltier than seawater.⁷³ It is noteworthy that produced water and flowback are normally stored together in open pit, ponds or tanks and they are together referred to as HF wastewater.⁷⁴ A leakage or spill of the untreated HF wastewater to the soil could lead to contamination of the nearest surface water and shallow aquifers during rainfall runoff.⁷⁵ The wastewater could normally spill during

⁶⁶ H Sprohge et al op cit (n26) 90.

⁶⁷ RM Cady ‘Drilling into the Issues: A Critical Analysis of Urban Drilling’s Legal, Environmental and Regulatory Implications’ (2009-2010) 16 *Texas Wesleyan Law Review* 127 at 140.

⁶⁸ R Spellman op cit (n25) 15.

⁶⁹ H Rebecca & J VanBriesen ‘In Fracking’s Wake: New Rules are Needed to Protect Our Health and Environment from Contaminated Wastewater’ *Natural Resources Defense Council* (2012) May 11, available at <http://www.nrdc.org/energy/files/Fracking-Wastewater-FullReport.pdf>, accessed on 15 June 2013.

⁷⁰ Ahmadun FR et al ‘Review of Technologies for Oil and Gas Produced Water Treatment’ (2009) 170 *Journal of Hazardous Materials* 530 at 532.

⁷¹ D Rahm op cit (n33) 2976.

⁷² Ahmadun FR et al op cit (n70) 533.

⁷³ Ahmadun FR et al op cit (n70) 534.

⁷⁴ USA EPA Study on the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources op cit (n27)

18.

⁷⁵ Ibid.

heavy rains which can cause pits or ponds holding fracturing wastewater to outpour the contents to the ground leading to the polluted storm water.⁷⁶

Apart from that, opponents of the HF technique maintain that there is a high risk of contamination of groundwater by methane during the production of natural gas. An example of groundwater contamination by methane gas has been captured in documentary film entitled *Gasland*⁷⁷ which purports to reveal the impact of the HF on the water wells of residents staying closest to the HF drilling sites in some parts of USA. Residents interviewed in the documentary disclosed how their water changed colour, taste and started bubbling because of natural gas caused by the HF companies in their location. One of the shocking scenes in the documentary is tap water which goes on flames upon being lit. Nevertheless, there are differing opinions about the HF causing water pollution. Some have claimed that the chances of water contamination through shale rock formation fractures are minimal because in most cases shale gas wells are based far below the water formations⁷⁸ and there are several layers of rocks in between which could prevent the methane to access the aquifers.⁷⁹ However, Steyl and van Tonder contend that due to the uniqueness of the geology of the Karoo which is characterised by ‘presence of dolerite formations and thermal springs . . . there might be a possible upward migration pathway for contamination’ of groundwater during the production or lifetime of the well.⁸⁰

2.2.1.5 Well Closure

After the well has been drained of all the shale gas or has stopped producing shale gas anymore, before it can be deserted, it would have to be plugged⁸¹ by filling the borehole tightly with the cement or any other material which can provide a long lasting blockage of the well to prevent migration of any substances occurring from the well.⁸² All the structures

⁷⁶ M Zoback et al op cit (n59) 7.

⁷⁷ Documentary Film written and directed by James Fox 2010, available at <http://www.youtube.com/watch?v=kJyZhZcQOLI>.

⁷⁸ JR Clark op cit (n31) 1768.

⁷⁹ M Zoback et al op cit (59) 7.

⁸⁰ G Steyl and GJ van Tonder op cit (n8) 20.

⁸¹ R Wood et al ‘Shale Gas: A Provisional Assessment of Climate Change and Environmental Impacts’ *Tyndall Centre for Climate Change Research University of Manchester* (2011) 25, available at http://www.tyndall.ac.uk/sites/default/files/tyndall-coop_shale_gas_report_final.pdf, accessed on 16 June 2013.

⁸² US Department of Energy ‘State Oil and Natural Gas Regulations Designed to Protect Water Resources’ (2009) 26, available at

which had been used during drilling and production of shale gas would have to be removed and the site be rehabilitated to its original status.⁸³ Plugging of a well is meant to protect ground water resources from contamination by toxic substances produced from the well.⁸⁴ Abandoned wells can be an environmental hazard, if they have been poorly plugged after their closure, in that methane gas or contaminants can easily seep through and reach the aquifers formations.⁸⁵ Apart from that, the cement which has been used to plug the wellbore could naturally lose its strength with time and start to crack thereby opening a channel for the natural gas and contaminants to move to the underground drinking water.⁸⁶

2.3 Conclusion

The purpose of this chapter was to give a full and clear picture of the stages involved in production of shale gas by using the HF process, and to identify the possible risks of contamination of surface and ground water resources during the HF process. Identification of the possible risks and dangers of the HF lay a basis for discussion of the current permitting system under environmental laws of SA, which will follow in the subsequent Chapter, and test how they respond to the specific environmental risks of the HF. At the moment, certain causes of water pollution by the HF can be attributed to well failure, poor construction of wells, leakage and overflow of waste dams or pits, and accidents during storing or handling of the fracturing fluids and waste. It is evident that there is still no watertight proof that the HF technique causes contamination of groundwater by migration of methane or the HF fluids; however, the literature establish that it is a possibility which should not be ignored.

http://www.gwpc.org/sites/default/files/state_oil_and_gas_regulations_designed_to_protect_water_resources_0.pdf, accessed on 16.June 2013.

⁸³ World Energy Outlook op cit (n29) 28.

⁸⁴ R Wood et al op cit (n81) 25.

⁸⁵ EL Hagström & JM Adams 'Hydraulic Fracturing: Identifying and Managing the Risks' (2012) 24 2 *Environmental Claims Journal* 93 at 107.

⁸⁶ L Greeff 'You can't have your gas and drink your water: Hydraulic Fracturing in the Context of South Africa's Looming Water Crisis' *Environmental Monitoring Group*, September 2012, 15-16, available at http://www.emg.org.za/images/stories/water_cl_ch/fracking%20and%20water%20in%20sa_tp%20print.pdf, accessed on 20.0613.

CHAPTER THREE

Legal Requirements to Produce Shale Gas in South Africa

3.1 Introduction

The preceding chapter of this paper has attempted to give an overview of how the process of the HF poses a significant danger to the quality of water resources. The risks of water pollution raised in that chapter are the likely affects which the HF could cause to the water resources in the Karoo should the government eventually grant a go ahead to embark on the extraction of shale gas thereat. However, SA already has in place an array of environmental legislative measures and policy documents which are meant for protection of the environment and natural resources conservation against activities or developments which pose significant danger to the environment. In fact, even the supreme law of the country⁸⁷ guarantees every citizen, among others, a right to an environment that is not harmful to their health or wellbeing, and to have the environment protected through reasonable measures that prevent pollution and promote sustainable use of natural resources.⁸⁸

The enactment of NEMA as an overarching legislation on all environment related matters has been a direct response to the government's constitutional obligation as contained in section 24 of the constitution. In addition, there are other sectoral environmental laws which have been enacted in order to realise the objectives of section 24 of the constitution and NEMA. The sectoral laws which have been enacted thus far to protect environment and promote sustainable use of natural resources include NWA, MPRDA and NEMWA and others. All these laws have been enacted with the aim of ensuring that natural resources are used in an environmentally friendly manner and the development is achieved in a sustainable fashion as per the national environmental management principles.⁸⁹

This chapter will be divided into three sections viz. Part A, Part B and Part C. Part A will describe and analyse overarching environmental as set out in the NEMA. Similarly Part B will describe and at the same time analyse the mining related permitting requirements as set out in the MPRDA. The last section will give a description and discussion of the permitting requirements related to water pollution in terms of the NWA and NEMWA. The discussion of the permitting requirements under these laws would be aimed at finding out

⁸⁷ Constitution of the Republic of South Africa No 108 of 1996.

⁸⁸ Section 24, Constitution of South Africa of 1996.

⁸⁹ Section 2 of NEMA.

how they respond to the possible risk of contamination of water resources during the production of shale gas by HF. Moreover, the aim of the analysis is to determine whether this permitting regime can facilitate achievement of protection of water resources against HF technique.

Part A

3.2 Overarching Environmental Requirements as Set Out in NEMA

As pointed out in Chapter Two the main concern about the process of producing shale gas by HF has the likelihood of causing serious harm to both groundwater and surface water. Substances which have been identified as posing danger to water quality during production of shale gas are drilling waste, fracturing chemicals, flowback, produced water and methane (natural gas). NEMA as the principal environmental legislation defines pollution in general terms as:

‘any change in the environment caused by substance . . . emitted from any activity, including storage or treatment of waste or substances . . . whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystem . . . or will have such an effect in the future.’

Thus, before any development or production of shale gas can take place in SA, there are certain legal requirements which would have to be complied with by any company proposing to produce shale gas. The general environmental requirements to conduct mining or exploitation activities are contained in NEMA⁹⁰ and NEMA EIA Regulations of 2010.⁹¹ NEMA is the principal legislation regulating every activity which has potential to cause significant harm to the environment and natural resources. NEMA EIA Regulations of 2010 contain a list of activities which a developer or operator may not undertake in the absence of an Environmental Authorisation (EA) from the relevant authority. EA has been defined as a ‘written order, document or certificate that may be issued by a competent authority . . . to an applicant to grant the applicant permission to perform certain acts or activities that may have an impact on the environment.’⁹² Likewise, in terms of NEMA an EA is defined as ‘the authorisation by a competent authority of a listed activity or specified activity in terms of this Act (NEMA), and includes a similar authorisation contemplated in a specific environmental management Act’.⁹³

⁹⁰ Section 24 of NEMA.

⁹¹ GN R543 to 546 of 18 June 2010.

⁹² LJ Kotze & C Bosman op cit (n9) 131.

⁹³ Definitions under Section 1 of NEMA.

Normally an EA is granted after conducting an Environmental Impact Assessment (EIA) in terms of NEMA EIA Regulations of 2010. Environmental Impact Assessment is defined as a ‘systematic process of identifying, assessing and reporting environmental impacts associated with an activity . . .’⁹⁴ The EIA process does not only investigate the negative effects of the proposed development on the environment but it is a tool which is also used to explore positive consequences and how they can be optimised. Furthermore the EIA can be utilised to examine possible alternatives which can help to minimise negative impacts of the activity in order to achieve sustainable development.

For one to know whether an EA would be required, one has to first look at the listed activities under NEMA (EIA) Regulations of 2010. It is under these EIA regulations that one would be able to determine whether the activity would require a full EIA or a basic EIA in order for the EA to be issued, and to identify a competent authority which the application has to be lodged to. Therefore, any company which proposes to engage in production of shale gas would have to submit an application for EA to the Minister of Minerals and Energy for the activities related to shale gas production, which are listed activities under the NEMA EIA regulations.

There are certain activities linked with shale gas development which would trigger listed activities under the NEMA EIA regulations and, hence, require an EA before commencement of shale gas production. They are as follows:

GN R.545: Activity Number 3: ‘The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.’ The mixture of chemicals contained in drilling fluids and the HF fluids stored at the well site may be classified as dangerous goods in terms of the NEMA EIA regulations of 2010.

GN R.545: Activity Number 4: ‘The construction of facilities or infrastructure for the refining, extraction or processing of gas, oil or petroleum products with an installed capacity of 50 cubic meters or more, excluding facilities for the refining, extraction or processing of gas from landfill sites.’ It is obvious that production of shale gas involves a construction of facilities and basic structures at the well-site which would be used for extracting and processing the natural gas by separating it from the impurities when it reaches the surface

⁹⁴ Regulation 1 GN R543.

from the underground. Examples of infrastructures constructed at the well site for extraction of natural gas are the drilling rigs and wellbores.

GN R.545: Activity Number 6: ‘The construction of facilities or infrastructure for the bulk transportation of dangerous goods- (i) in gas form, outside an industrial complex, using pipelines, exceeding 1000 meters in length with a throughput capacity of more than 700 tons per day.’ Similarly, construction of facilities for transmitting shale gas through pipelines exceeding 1000 meters would qualify as a listed activity as per activity number 6 under GN R.545.

GN R.545: Activity 22: Any activity which requires production right or renewal in terms of the provisions under MPRDA. Accordingly, in terms of section 83 of MPRDA, shale gas production requires production right or its renewal in order to take place.

It is, therefore, evident from the identification of the above activities that the proposed development of shale gas resource in the Karoo would not commence before an EA has been obtained from the Department of Minerals and Energy (DME). It also follows that an EA is a prerequisite for construction of facilities or infrastructure for the storage of dangerous HF chemicals, and extraction or processing of gas or petroleum products as contemplated by listed Activities 3 and 4 of GN R.545 EIA Regulations respectively. One can argue that construction of a wellbore and assembling of drilling rigs at the well-site for the purpose of extracting and processing shale gas is tantamount to construction of facilities or infrastructure for the extraction or processing of petroleum products as contemplated by listed Activity 4 under GN R.545. Construction of a well and drilling structures are the facilities which would be used for injections of mixture of fracturing chemicals to extract natural gas or petroleum product (shale gas) beneath the ground until it reaches the surface for processing.

Even if one can attempt to argue that drilling and fracturing of a well do not require an EA because there is nowhere EIA Regulations refer to ‘drilling or fracturing of a well’, that argument would fail simply because the drilling and fracturing of a well are activities incidental to shale gas production which require an exploration right or production right as per listed Activities 21 and 22 of GN R.545 EIA Regulations of 2010.

In short, it is clear from the above reasoning that any drilling and fracturing of a well for the purpose of extracting shale gas would not be allowed before the operator has been issued with an EA by the Minister of Minerals and Energy in terms of NEMA. This also means that

a full EIA would have to be conducted as part of an EA application. It is through the process of an EIA that the potential consequences or impacts of the drilling and fracturing of well on the water resources can be known in advance in order to put in place measures to prevent or mitigate the negative effects of drilling and fracturing activity.

3.2.1 Procedure for Applying for Environmental Authorisation Under NEMA

As indicated above, a formal application for an EA would have to be made on an official form directed to the Minister of Minerals and Energy, accompanied by an application fee, and it must be filed together with a proof of service of notice to the owner or person in control of land on which the activity is proposed to be undertaken at.⁹⁵ In situation where an applicant for the EA is not the owner or occupier of the land intended to be used for the proposed activity, the applicant would have to provide the landowner or occupier with a written notice advising him or her to take part in the public participation process.⁹⁶ NEMA EIA Regulations are silent on the time frame within which the owner of the land or occupier must be notified of the proposed activity and the public participation process, but in terms of section 5A(c) of the MPRDA it has to be not less than 21 days written notice.

It is noteworthy that it is not a legal requirement for a landowner or occupier whose land is the subject of the development of shale gas to consent to the proposed activity on his or her land. This is because in terms of the MPRDA mineral and petroleum resources embedded underneath a private property belong to the South African nation and the State exercises custodianship over those resources on behalf of the nation.⁹⁷ This position has recently been affirmed by the Constitutional Court of SA in *Agri South Africa v Minister of Minerals and Energy and Other*⁹⁸ when dismissing a claim for compensation which was based on the ground that ‘the commencement of the MPRDA had the effect of expropriating of the mineral rights conferred on holders by the Minerals Act.’⁹⁹ Landowners or occupiers, therefore, only have a right to participate in the public participation process through which they can object to the granting of the EA if they have valid reasons to show that the activities of the HF on their lands would result in contamination of their water resources or serious environmental degradation.

⁹⁵ Regulation 12 GN R 543.

⁹⁶ Regulation 15(1) GN R 543.

⁹⁷ Section 3(1).

⁹⁸ 2013(4) SA 1 (CC).

⁹⁹ *Agri SA v Minister of Minerals and Energy* op cit (n98) at 8.

Moreover, since shale gas development requires a full EIA to be undertaken before its implementation, an EAP would have to compile a scoping report and plan of study for EIA and submit them to the Minister of Minerals and Energy. In order to compile a scoping report an EAP is required, among others, to conduct a preliminary public participation process, keep register of interested and affected persons (IAP), attend to the comments and representations raised by the IAP during their participation, and identify potential environmental impacts and alternatives of the activity.¹⁰⁰ The EAP would also have to afford all IAP an opportunity to comment on the scoping report before it could be submitted to the authorities.¹⁰¹ In essence, the scoping report serves as a mini EIA by setting out initial assessment of the impacts of the activity and it also provides a roadmap for the full EIA. Once the competent authority has accepted and approved scoping report together with the plan of study for the EIA, a full and detailed EIA would have to be conducted in line with the approved plan of study.

When conducting the full investigations and assessment of the potential risks of the activity, the applicant would still have to engage participation of the public and IAP, and provide them with all relevant information.¹⁰² Public participation or involvement of IAP in the application process is one of the crucial requirements of the EIA process. This requirement is meant to involve persons who are likely to substantially suffer or whose rights are likely to be negatively affected by the proposed activity of drilling and fracturing of the well. Normally these people would be those who are resident adjacent to the drilling site, landowners, occupiers, municipality of that jurisdiction and organs of state dealing with that particular activity.¹⁰³ These are the persons whose opinions and inputs would have to be considered and addressed before an EIA can be issued. Since the majority of Karoo residents rely on ground water, they have a vested right to be consulted and informed about any proposed activity which has potential to infringe their right to clean water. During the EIA process, the residents are entitled to all relevant and material information about the proposed HF operation. It is through the EIA that IAP can, for example, request information on composition of the HF chemicals which are going to be used to fracture a well. If applicant refuses to disclose information about composition of chemicals IAP have a remedy under Promotion of Access to Information Act (PAIA).¹⁰⁴ IAP, the residents and landowners in the Karoo would have a right to object to the granting of an EA for the proposed drilling and

¹⁰⁰ Regulation 27 GN R 543.

¹⁰¹ Regulation 27(g) GN R 543.

¹⁰² Section 24(4)(a)(v).

¹⁰³ Regulation 54 GN R 543 in GG 33306 of 18 June 2010.

¹⁰⁴ Act 2 of 2000.

fracturing if hazardous or toxic chemicals which have potential to pollute their water resources would be used in the HF process. At least there is a fair and open process afforded to IAP in application for an EA though the final decision rests on the Minister of Minerals and Energy.

Furthermore Section 24(4) (a) of NEMA stipulates, among others, that in investigating, assessing and communicating the potential environmental effects of the proposed activity during an EA application process, there has to be coordination and cooperation between relevant organs of state that have a direct interest over the proposed activity. Organs of state which could have jurisdiction over the proposed activity are the Department of Environmental Affairs (DEA), Department of Water Affairs (DWA), Municipality of the area and the Catchment Management Agency of that area. Because of the particular nature of the HF process, it would be mandatory that the Minister of Water Affairs, as the protector and public trustee of SA's water be consulted about the proposed HF activities since it has potential to negatively affect water resources. In addition to this, the recommendations advanced by the affected organs of state have to be considered when making a decision.¹⁰⁵ Even though NEMA requires the DME to take into account recommendations of DWA and DEA when making decision on EA and EMPr, the DME is not bound to follow those recommendations. This is an awkward situation because the DME is not a suitable organ of state to make decisions on applications for the EAs. Its primary responsibility is not to protect the environment and water resources, but to promote a thriving environment for exploitation of minerals and petroleum resources. This means that the DME would not be able to make an objective decision and assessment on the feasibility and practicability of the measures proposed to prevent or mitigate water pollution by the HF activities.

Furthermore, an applicant for an EA must clearly describe the environment which is at risk of being adversely affected by the activity and the degree of the impact on the environment.¹⁰⁶ It has been pointed out in Chapter Two that pollution of water resources, by methane and HF chemicals, is the major concern which is likely to result from extraction of shale gas. An EIA is the permitting tool which will be used to investigate, evaluate and communicate all the potential effects which HF fluids and methane could cause to the underground water. This means that the operator would be bound by law to appoint a

¹⁰⁵ Section 24(4)(a)(ii).

¹⁰⁶ Section 24(4)(a)(iii) and (iv).

qualified person to carry out specialised study¹⁰⁷ on the depth of the groundwater formation and the depth of the shale gas formation at the site that is proposed to be fractured in order to know the distance between the two.¹⁰⁸ This investigation would enable the competent authority to appreciate the chances of the HF fluids and methane migrating from the well to the aquifers. If the distance between shale formation and aquifers is too close, the Minister of Minerals and Energy would reject the application for an EA because the chances of contamination would be too high. Moreover, even if the location of the ground water can be judged to be too isolated from shale gas formation, it would still have to be established through an EIA whether there is a possibility of the HF fluids and methane reaching ground water location. If there is a possibility of migration, the specialised report would have to indicate preventive measures proposed to be implemented to debar the migration of HF fluids and methane to the water resources.

The information about the depth of the groundwater and shale gas formation is also necessary for purposes of drilling and constructing an HF well. Chapter 2 has shown that there is link between drilling an HF well and migration of methane and HF fluids to the groundwater resources, since a poorly constructed well could leak methane or HF fluids into the aquifers. Thus, in Pennsylvania USA, any person who wishes to drill a well must first have a permit to drill a well,¹⁰⁹ and the Code also requires him or her to prepare and maintain casing and cementing plan which will have to indicate, among others, the location of the aquifers.¹¹⁰ Even in Ohio, an applicant for permit to drill must take samples of the water wells situated adjacent to the drilling site.¹¹¹ There are no similar explicit requirements under the NEMA, MPRDA or their respective regulations in respect of application for authorisations. In order to adequately address risks of water pollution by migration of the HF pollutants, it would be ideal if the NEMA or EIA Regulations could explicitly stipulate that an applicant for an EA should also prepare and submit casing and cementing plan as part of the EA application.

In terms of the NEMA, every application for an EA must include a thorough investigation of the potential effect of the alternatives to the activity on the environment and

¹⁰⁷ Regulation 32 GN R 543.

¹⁰⁸ L Greeff op cit (n86) 18.

¹⁰⁹ Section 78.11 of 25 Pa. Code.

¹¹⁰ Section 78.83a of 25 Pa. Code.

¹¹¹ Section 1509.06(A)(8)(c) R.C.

also assess the degree of impact on the environment.¹¹² Moreover, the applicant should also include the consideration of the option of not implementing the activity at all.¹¹³ The applicant is also required to include investigation of the mitigation measures to the identified negative consequences or impacts on the environment.¹¹⁴ The applicant should also reveal any lack of knowledge or uncertainties about some other kind of information he had been required to compile and submit. In some cases, the applicant cannot determine with certainty the potential consequences and impact of the activity he is planning to undertake. The application should furthermore disclose how he or she intends to monitor and manage the effects or impacts on the environment and the effectiveness of the measures he is planning to apply.¹¹⁵ Finally, the application should also contain a provision for the compliance with the requirements of the specific environmental management Act applicable to the listed activity in question.¹¹⁶

When a full and detailed EIA has been undertaken, the developer would have to submit an EIA report to the Minister of Minerals and Energy, as the competent authority, who will consider it and either accept it as it is or refer parts of it to the specialist for re-evaluation.¹¹⁷ It is noteworthy that there is also a need for public engagement even when the report has been referred to the specialist for study. Since HF industry would be new in SA, there is a high possibility that the DME lacks necessary expertise and technical know-how about assessing and making decisions on EIA reports submitted by the HF companies. Therefore, it would be prudent if the EIA reports could be referred to specialist who could evaluate the report and advise the DME accordingly.

In addition, the authorities may direct a developer to submit an environmental management programme (EMPr) before an application for EA may be considered or granted.¹¹⁸ EMPr is applicable to mining and production activities regulated under MPRDA. It has to contain information on how the identified environmental effects would be minimised and dealt with in regard to planning and design, pre-construction and construction stage, operation phase, rehabilitation and closure stage.¹¹⁹

¹¹² Section 24(4)(b)(i) NEMA.

¹¹³ Ibid.

¹¹⁴ Section 24(4)(b)(ii) NEMA.

¹¹⁵ Section 24(4)(b)(v).

¹¹⁶ Section 24(4)(b)(vii).

¹¹⁷ Regulation 34 GN R 543.

¹¹⁸ Section 24N(1) NEMA.

¹¹⁹ Regulation 33(b) GN R 543.

Moreover, an EMPr should identify persons who will undertake the implementation of the measures contained in Regulation 33(b) and the mechanisms which would be utilised for the effective monitoring and reporting compliance with the conditions of the EMPr.¹²⁰ Most importantly, the EMPr should also indicate how the developer intends to take care of any activity which causes pollution or migration of pollutants or environmental harm, and how he or she would comply with environmental management standards, applicable laws on closure stage and financial provision for rehabilitation of the damaged environment.¹²¹ Since an EMPr could play a vital role in preventing or controlling the potential risk of groundwater contamination by the HF fluids and methane, it should also contain a plan on groundwater protection which should form part of the EMPr. The plan would specifically address the potential problem of methane and HF fluids migration. The plan on groundwater protection would further focus, in more details, on measures which can be implemented to curb movement of underground contaminants to fresh underground water resources. In terms of Regulation 12(6) (a) of GN 704, a person in control of a mine is required to submit plans, specifications and design reports approved by an independent engineer to the DWA not later than 60 days after commencement of the operations. Considering the potential harm which methane and HF fluids pose to groundwater resources, it would be sensible if the DWA could request submission of such a plan as part of EMPr before commencement of HF operations. Thus, preparation of plans for protection of underground water would be in terms of Regulation 12(6) (a). The EMPr should also contain an environmental awareness plan on how the employees would be sensitised about any environmental risk associated with their work and how they must deal with the risks to avoid pollution and environmental harm.¹²²

In short, the EMPr must contain a description of how a developer would comply with the duty of care and remediation of environmental damage as contemplated by Section 28¹²³ of NEMA. It is evident that an EMPr is the road map on how the mining or production activity would be conducted from the beginning to the end of the operation. Nonetheless, when making a decision on application for the EA, the Minister of Minerals and Energy is obliged to consider a number of factors such as environmental effects of granting or rejecting

¹²⁰ Regulation 33(d) and (e) GN R 543.

¹²¹ Regulation 33(g) GN R 543.

¹²² Regulation 33(j) GN R 543.

¹²³ Section 28 of NEMA imposes a legal duty on any person who engages in an activity which causes or likely to cause significant pollution or environmental degradation to take reasonable measures to prevent that pollution or environmental harm from happening, continuing or repeating itself and even if such pollution or degradation has been sanctioned by law he or she has to take measures to, among others, investigate, prevent, lessen, control, modify and remedy the impact of that pollution or environmental harm.

the application all together,¹²⁴ capacity of applicant to meet the proposed measures and conditions to be attached,¹²⁵ comments and objections of organs of the government having interest in the application.¹²⁶ Prior to being granted the EA, the applicant must advance a financial security for ‘the rehabilitation, management and closure’ of the proposed activity.¹²⁷ The operator would remain environmentally liable for financial security until he or she has being issued with a closure certificate.¹²⁸ The closure process is regulated by the MPRDA and it has been thoroughly dealt with in the subsequent section of this chapter. Lastly, it is an offence for a developer to fail to comply with the conditions applicable to any EA for a listed activity and an approved EMPr.¹²⁹

It is clear from the above outline that the requirement of preparing and compiling an EMPr as part of application for an EA would play a crucial role in addressing some of the environmental concerns identified in the EIA report. An EMPr is of major importance in that it can address some of the specific environmental issues involved in drilling and construction of the well. An EMPr could prescribe the way construction or setting up of drilling structures has to be done, prescribe how erection of impounding dams for drilling waste would be done, outlining how water resources would be protected during drilling of a well, and how drilling waste would be contained to prevent or minimise harm to nearby water resources. It also follows that an EMPr can only be approved if competent authorities are satisfied that it would adequately and feasibly aid the operator to deal with the water pollution threats associated with drilling activities. Before an EMPr can be approved by the authorities, it also has to be subjected to public participation process so that IAP can have an opportunity to scrutinise it, comment or object to its contents.

It has been alluded above that the DME is the competent authority entrusted with power to consider applications for EA. Moreover, it is the same body which approves the EMPr prepared as a condition for issuing or considering an EA application in terms of the NEMA. This state of affairs could be a major weakness which affects the effectiveness of the EMPr and EA in regulating water pollution issues linked to drilling and fracturing of the HF well. It has been succinctly argued that:

¹²⁴ Section 24O(b)(i).

¹²⁵ Section 24O(b)(iii.).

¹²⁶ Section 24O(1)(b)viii) and (2).

¹²⁷ Section 24P(1).

¹²⁸ Section 24(P)(5).

¹²⁹ Section 24F (2) (c) and (e) NEMA.

‘ . . . the DMR has little or no expertise or capacity - and will not have this expertise or capacity for many years to come, even with the best intentions - adequately to assess environmental impacts, issue appropriate and lawful EA, monitor compliance and take enforcement action in the case of violation . . . It is difficult to ignore the consequences of that unfulfilled responsibility when one considers the cost of acid mine drainage (which cost will continue for decades, if not centuries, to come) to the national fiscus...’¹³⁰

From the above quote, one can argue that failure to effectively deal with the challenge of acid mine drainage (AMD) in SA is a testimony that the DME lacks adequate capacity and resources in environmental management; thus, it would also fail to regulate environmental risks of the HF industry and this will come at a high cost to water resources in the Karoo. One of the ways to remedy this situation at the moment could be to improve cooperation and coordination between the DME, DWA and DME during the processes of application for EA and development of EMPr. In Germany, for example, the issue of water protection has to be dealt with in the main authorisation application and mining authorities could refuse to issue the authorisation if ‘water civil servants’ fail to support that authorisation.¹³¹ Thus, in SA the environment and water resources could be adequately protected against the HF activities if the DME can attach more weight to the comments and recommendations raised by the DWA and DME in terms of Section 24O(1)(b)(vii) of NEMA. The DME should in fact refuse to issue an EA or approve EMPr if the DWA and DME have recommended for their rejections, or approve them on conditions suggested by the DWA and DME. The rationale is that, the DWA and DME are the competent authorities whose principal responsibilities is the protection of water resources and environment respectively; thus, they have relatively adequate technical capacity and expertise on water pollution and environmental issues.

¹³⁰ Centre for Environmental Rights ‘Another Day, another Legislative Calamity: Time for a Simpler Regime for the Environmental Regulation of Mining’, 19 June 2013, available at <http://cer.org.za/news/another-day-another-legislative-calamity>, accessed on 19 June 2013.

¹³¹ European Union ‘Final Report on Unconventional Gas in Europe’ 8 November 2011 79, available at http://ec.europa.eu/energy/studies/doc/2012_unconventional_gas_in_europe.pdf, accessed on 09 February 2013.

Part B

3.3 Mining Related Permitting Requirements as Set Out in the MPRDA

The MPRDA regulates mining, prospecting, exploration, production and other incidental activities. One of the objects of the MPRDA is to give effect to Section 24 of the Constitution of SA by ensuring that the nation's minerals and petroleum resources are developed in line with the principle of sustainable development.¹³² In terms of the MPRDA shale gas would be treated as petroleum resource, which is defined as

‘any liquid, solid hydrocarbon or combustible gas existing in a natural condition in the earth's crust and includes any such liquid or solid hydrocarbon or combustible gas, which gas has in any manner been returned to such natural condition, but does not include coal, bituminous shale or other stratified deposits from which oil can be obtained by destructive distillation or gas arising from a marsh or other surface deposit.’

In order for one to engage in shale gas development, he or she has to apply for a production right in terms of Section 83 of the MPRDA. An application for a production right would follow after an applicant has established, through an exploration process, the quantity of shale gas available. The Minister of Minerals and Energy is the competent authority who grants production rights at the recommendation of the designated agency.¹³³ Section 71 of MPRDA outlines the mandate of the PASA and it includes the promotion of exploration and production of oil and gas resources of SA, evaluation of applications related to petroleum development and to make recommendations to the Minister; monitor and report compliance with permits or rights to the Minister, review and make recommendations to the Minister with regard to the acceptance of environmental reports and the conditions of the EA and amendments thereto.

The fact that PASA is the designated body charged with power to promote, regulate and oversee the industry of oil and gas resources in South Africa could be a major setback in the regulation of the HF activities. There seems to be a material conflict of interest¹³⁴ in that on the one hand PASA's vision is to create a ‘vibrant upstream petroleum industry in South Africa’ by, among others, ‘increasing exploration and sustainable development of oil and gas in South Africa.’¹³⁵ On the other hand, PASA has to review and advance recommendations to

¹³² Section 2(h) of MPRDA.

¹³³ At the moment the Petroleum Agency South Africa (PASA) is the designated agency which applications for production rights have to be directed to.

¹³⁴ L Greeff op cit (n86) at 5.

¹³⁵ PASA Profile, available at http://www.petroleumagencyrsa.com/About_Us/company_profile.aspx, accessed on 28 July 2013.

the Minister concerning approval of environmental reports and conditions of the EA and their amendments.¹³⁶ It is, therefore, clear that the main goal of PASA is to promote a thriving commercial development of petroleum resources in SA, while the protection of the environment against negative effects of exploration and production activities is its secondary function. This is a serious anomaly contained in the Act. Thus, one could argue that the potential threats of serious water pollution by the HF would not be given due weight when making decisions and recommendations by the PASA in regard to the applications for production rights for shale gas resource because its main interest is to promote exploration and exploitation of petroleum resources as opposed to protection of the environment and water resources.

It has been rightly suggested that this deficiency could be remedied by amending the relevant provisions of the law in order to separate these conflicting powers.¹³⁷ It is noteworthy that the process to rectify this shortcoming was initiated in 2008 when NEMA and MPRDA were amended¹³⁸ in an endeavour to bring coordination between these two legislation when it comes to environmental requirements ‘by providing for the use of one environmental system’ and providing for other matters related to mining and exploitation activities.¹³⁹ The ultimate aim of the amendments is to transfer environmental regulatory powers in regard to mineral and petroleum activities to the Minister of Environmental Affairs commencing on the 7th June 2016.¹⁴⁰

The PASA has power to accept or reject the application depending on whether it had complied with the necessary administrative requirements under Section 83 of the MPRDA. If the application is accepted, the PASA can direct the applicant to notify and consult IAP, conduct an EIA and submit an EMPr for approval within 180 days in terms of Section 39 of MPRDA.¹⁴¹ Moreover, the competent authority cannot issue a production right if it can be established that the drilling and fracturing of the well for the purpose of shale gas production would result in significant pollution and environmental degradation. It is, however, common cause that every stage of mining or production operation has a direct impact on the environment, but usually a huge environmental degradation happens during mining or

¹³⁶ Section 71 (i) MPRDA.

¹³⁷ D Fig op cit (n4) 15.

¹³⁸ National Environment Management Amendment Act 62 of 2008 and Mineral and Petroleum Resources Development Act 49 of 2008.

¹³⁹ Per Preamble of National Environment Management Amendment Act 62 of 2008.

¹⁴⁰ Section 13 of National Environment Management Amendment Act 62 of 2008.

¹⁴¹ Section 83(4) MPRDA.

production stage of the resource.¹⁴² The competent authority will only be able to know the environmental effects of the production operations if the operator has undertaken an EIA and submitted an EMPr as required by Section 83(4) (b) of the MPRDA. In *Bengwenyama Minerals (Pty) Ltd and Others v Genorah Resources (Pty) Ltd and Others*, the Constitutional Court rejected respondent's argument 'that environmental satisfaction was not a prerequisite or jurisdictional fact for the granting of a prospecting right' and held that 'approval of the prospecting operation is dependent on an assessment that the operation will not result in unacceptable pollution, ecological degradation or damage to the environment.'¹⁴³

Likewise, it follows that a production right would not be issued unless the environmental concerns about drilling and fracturing of a well are investigated and adequately addressed in the EMPr which will have to be approved by the competent authority. Drilling and construction of a well is a critical stage in preparing for injection of HF fluids in order to produce shale gas. There have been numerous reports or incidents of water pollution in the USA which have been caused by well failure due to poor well construction and design.¹⁴⁴ In Ohio USA, any person who wishes to drill a well must first apply and obtain a permit to drill from the competent authority.¹⁴⁵ The application for a permit to drill a well must contain, among others, names and address of the operator,¹⁴⁶ location of the well,¹⁴⁷ geological formation to be used and total depth of the well,¹⁴⁸ identification of the geological formation to be used as the injection zone and the composition of the injection liquid.¹⁴⁹ In addition to that, R.C of Ohio requires any person who applies for a permit to drill a new horizontal well which is within urbanised area, to take samples of water wells located within 1500 feet of the proposed well before drilling activities could begin.¹⁵⁰ Moreover, the applicant is enjoined by R.C of Ohio to give a formal notice to every

¹⁴² Department of Environmental Affairs *Mining and Biodiversity Guideline: Mainstreaming Biodiversity into the Mining Sector* (2013) 70, available at https://www.environment.gov.za/sites/default/files/legislations/miningbiodiversity_guidelines2013.pdf, accessed on 26 June 2013.

¹⁴³ 2011 (4) SA 113 at 143 para 77.

¹⁴⁴ C Clark et al 'Hydraulic Fracturing and Shale Gas Production: Technology, Impacts, and Policy' *Argonne National Laboratory*, 10 September 2012, available at http://www.gliccc.org/wp-content/uploads/2012/10/Hydraulic-Fracturing-and-Shale-Gas-Production-Technology_Impacts_Policy.pdf, accessed on 16 March 2013.

¹⁴⁵ Section 1509.5 Ohio Revised Code (R.C).

¹⁴⁶ Section 1509.06 (A)(1) R.C.

¹⁴⁷ Section 1509.06 (A)(4) R.C.

¹⁴⁸ Section 1509.06(A)(6)(a) R.C.

¹⁴⁹ Section 1509.06(A)(6)(b) R.C.

¹⁵⁰ Section 1509.06(A)(8)(c) R.C.

owner of the real property situated within 500 feet of the well and to the municipal authorities.¹⁵¹

Another example is Pennsylvania State in USA where an operator is required under Section 78.83a of 25 Pa. Code to prepare and maintain a casing and cementing plan about how the well is going to be drilled from the beginning to the end. The casing and cementing plan has to provide details about the type of casing and cement which are going to be used to construct the well, and the location of the ‘anticipated fresh groundwater zones’.¹⁵² The operator of the well could be requested by the Department to submit the plan for review and approval.¹⁵³ One may assume that if the Department does not approve the casing and cementing plan, then the operator cannot be issued a permit to drill a well. The rationale for the casing and cementing requirements is to prevent methane gas and other substances, such as HF fluids, escaping and causing pollution to the fresh groundwater resources.¹⁵⁴

One can learn from the examples of Ohio and Pennsylvania that their permitting requirements are more detailed when it comes to regulation of drilling and fracturing of a well. In as much as an EA and EMPr could play a central role in regulating drilling and injection of the HF fluids, there is a need to introduce a requirement of a drilling or well permit, supported by casing and cementing plan, for the prospective HF industry in SA. The requirement of a permit to drill a well could play a pivotal role in achieving protection of the environment and water resources in that the authorities would be able to scrutinise the drilling and construction work at the well site before it becomes operational.¹⁵⁵ Furthermore, it is through an application for a permit to drill that the operator can disclose the composition of the chemicals he or she intends to use in fracturing a well. This would enable the authorities to regulate the use of the toxic chemicals proposed to be used. The regulation of drilling of a well by way of permit would enable the regulating authorities to monitor and seek reports on the compliance with the permit conditions in regard to protection of groundwater resources. Specifically, this would enable the regulating authorities to satisfy themselves that the wellbore has been properly cased and cemented according to the approved casing and cementing plan to prevent ground water contamination during fracturing of a well.

¹⁵¹ Section 1509.06(A)(9) R.C.

¹⁵² Section 78.83a 25 Pa. Code.

¹⁵³ Section 78.83a(c) Pa. Code.

¹⁵⁴ Section 78.81 Pa. Code.

¹⁵⁵ H Wiseman op cit (n44) at 382.

It is noteworthy that though Section 83(4) of the MPRDA still makes reference to Section 39 of MPDRA, it has been repealed by Section 33 of MPRDA Amendment 49 of 2008. On the other hand, Section 83(4) has also been substituted by Section 61 (d) of the MPRDA Amendment¹⁵⁶, a provision which will become effective on the 7th December 2014. The repeal of Section 39 and amendment of Section 83(4) by a provision which will be operative on the 7th December 2014 have left a lacuna on the requirement of preparation and submission of EMPr for approval before production right can be granted. Furthermore, the repeal and amendment have created confusion in that Section 84(c) of MPRDA still empowers the Minister to grant production right ‘if the production will not result in unacceptable pollution, ecological degradation or damage to the environment.’ Then the question that remains is how the Minister would make an environmental determination in the absence of an EIA report and an EMPr. The confusion does not end there; even the MPRDA regulations remain unchanged in regard to the requirement of the EIA report and preparation of EMPr in applications for mining or production right.

Furthermore, Section 39 of the MPRDA has been repealed despite the crucial role an EMPr plays in environmental management of mineral and petroleum activities. The repeal effectively dispenses with the requirement of the EMPr before granting of a production right. Dispensing with the need for approval of the EMPr before commencing mineral or petroleum activities under the MPRDA is in sharp contrast with the provisions of Section 24 of the Constitution of SA and it could clearly lead to serious environmental ramifications.¹⁵⁷ This means that production right for shale gas could be granted by DME without even assessing and evaluating the impact it would have on the environment and water resources. Moreover, an applicant for production right would not even have to satisfy the competent authority on the measures he or she intends to put in place to prevent or mitigate possible environmental harm by the HF process.

Likewise, Section 40 of the MPRDA has also been repealed, meaning that it is no longer a legal requirement for the Minister to consult and liaise with any State department

¹⁵⁶ Section 61(d) of MPRDA Amendment reads as thus “(4) If the designated agency accept the application, the designated agency must, within 14 days of the receipt of the application, notify the applicant in writing to- (a) consult in the prescribed manner with the landowner, lawful occupier and any interested and affected party and include the result of the consultation in the relevant environmental reports as required in terms of Chapter 5 of the National Environmental Management Act, 1998; and (b) submit relevant environmental reports required in terms of Chapter 5 of the National Environmental Management Act, 1998, within 180 days from the date of the notice.”

¹⁵⁷ Centre for Environmental Rights op cit (n188).

having an interest on environmental matters before making a decision whether to approve or disapprove EMPr. The importance of EMPr as an environmental regulatory tool for mining and production activities cannot be disputed, and similarly the significance of consultation and coordination between State departments administering environmental matters cannot be over-emphasised. Consultation is crucial because the Minister of Environmental and Water Affairs can influence or object the granting of a licence if it would detrimentally affect water resources, or suggest appropriate conditions which should be attached in order to guard against water pollution during drilling and construction stage. The DEA and DWA are the bodies best suited to advise the DME on the appropriateness of the application because they have the capacity and expertise on environmental aspects. Failure to garner comments and opinions from the DEA and DWA would lead to uninformed and disastrous decisions being made by the Minister of Mineral Resources which would jeopardise the environment and scarce water resources in the Karoo. This would simply amount to bad cooperative environmental governance which is in direct conflict with one of the principles of NEMA that states that there should be intergovernmental co-ordination and harmonisation of actions relating to the environment.¹⁵⁸

Be that as it may, there are a number of requirements listed under Section 84 of the MPRDA which an applicant has to meet in order for the application for a production right to be granted by the Minister. Amongst others, the Minister should grant the production right if the applicant would be able to secure financial resources and has the technical capacity to engage in the production of shale gas in a viable and best possible way.¹⁵⁹ It, therefore, follows that the prospective producer of shale gas would have to satisfy the competent authority that he or she has a financial and technical capacity to, amongst others, drill and fracture a well for production of a shale gas in a successful manner. The production operation cannot be launched unless the person who has been issued with the right can provide a financial guarantee, to the satisfaction of the designated agency, of the adequate financial capacity to enable him to carry out the production work programme.¹⁶⁰ Incidentally, the MPRDA does not define 'production work programme' but one assumes that it carries the same connotation as 'mining work programme'¹⁶¹ when applied in the context of production

¹⁵⁸ NEMA Section 2(4)(l).

¹⁵⁹ Section 84(1) (a) to (b) MPRDA.

¹⁶⁰ Section 89 MPRDA.

¹⁶¹ Mining Work Programme is defined under Section 1 as the 'plan to be followed in order to mine a mineral resource optimally'.

of petroleum. The production work programme would form part of the production right¹⁶² and would play a vital role in production of a shale gas as it would be a detailed plan guiding the process of producing shale gas. Nevertheless, and most importantly, the Minister would grant the production right if the production of shale gas would not cause a serious pollution and severe environmental damage.¹⁶³ Financial and technical capacity is not only required for optimal and viable production of shale gas but it is also necessary for implementing measures to prevent and mitigate environmental harm resulting from shale gas production.

Furthermore, Section 84 of the MPRDA provides that a production right would be issued if the operation would be done in accordance with the MPRDA, relevant provisions of the Mine Health and Safety Act¹⁶⁴ and also in conformity with a prescribed social and labour plan. One understands that in essence, Section 84 demands that the Minister shall only grant the production right of shale gas if he or she is satisfied that the production of shale gas would be socially, economically and environmentally sustainable. In addition, in terms of Section 5A of the MPRDA, no person is allowed to produce any mineral or petroleum, or commence any work related thereto without an EA,¹⁶⁵ a production right and written notice to the landowner or lawful occupier. The EA envisaged in terms of Section 5A (a) would be issued by the Minister of Mineral Resources after an EIA has been undertaken in terms of the NEMA. It is worth reiterating that it is peculiar and confusing that the legislature has repealed Section 39 of the MPRDA and at the same time suspending the operation of Section 5A (a) which prohibits commencement of mining and production activities without an EA. Surely the environment and water resources in the Karoo cannot be adequately protected while this confusion on the legal requirements under the MPRDA still exists.

Nonetheless, any person who has been issued with a production right has rights and obligations ensuing from the production right. A holder of the production right has an obligation to comply with the terms and conditions of the right, relevant provisions of the MPRDA and any other law.¹⁶⁶ 'Any other law' could be understood to include NEMA, NWA, NEMWA and other environmental legislation promoting the protection of the environment and prevention of pollution as per Section 24 of the Constitution of SA. For example, 'any other law' could also include complying with requirements under Regulations

¹⁶² Regulation 36(2) GN R527.

¹⁶³ Section 84(c) MPRDA.

¹⁶⁴ Act 29 of 1996.

¹⁶⁵ This provision would be ineffective until the 7th December 2014.

¹⁶⁶ Section 86 (2) (c).

on use of Water for Mining and Related Activities aimed at Protection of Water Resources (GN 704).¹⁶⁷ Lastly, the holder of the production right has a duty to see to it that his or her operations are in line with the requirements of the approved EMPr.¹⁶⁸

When the production operations for natural gas finally come to an end, the mine or the well site would have to be closed in accordance with Section 43 of the MPRDA. In some cases the operator of a mine would describe in the EMPr how he or she would comply with the applicable laws on closure of the well site, and financial provision for rehabilitation of the affected environment. Section 43(3) provides that:

‘The holder of prospecting right, mining right, retention permit, mining permit, or previous holder of an old order right or previous owner of works that has ceased to exist, or the person contemplated in subsection (2), as the case may be, must apply for a closure certificate upon-

- (a) the lapsing, abandonment or cancellation of the right or permit in question;
- (b) cessation of the prospecting or mining operation;
- (c) the relinquishment of any portion of the prospecting of the land to which a right, permit or permission relate; or
- (d) completion of the prescribed closing plan to which a right, permit or permission relate.’

It is noteworthy that this provision does not make mention of the holder of exploration or production right being required to apply for closure certificate once the operation ceases. However, it could not have been the intention of the legislature to exempt exploration and production operations from the requirement of closure certificate because petroleum activities, most invariably, result in environmental degradation or pollution just like mining activities. Moreover, the EMPr which would be approved by the Minister before commencement of the production activities must contain a description of environmental objectives and specific goals for mine closure.¹⁶⁹ A contrary interpretation would be absurd and unreasonable as it would not promote and give effect to Section 24 of the Constitution.

Nevertheless, an application for closure certificate must be directed to the Regional Manager within 180 days when the right or activities come to an end and it must be supported by prescribed environmental risk report.¹⁷⁰ The environmental risk report plays a pivotal role in informing an application for a mine closure since it identifies and assesses all possible environmental risks which can be classified in terms of their level of risk such as potential significant risk, uncertain risk or insignificant risk.¹⁷¹ The environmental risk report must also

¹⁶⁷ GN 704 in GG 20119 of 4 June 1999.

¹⁶⁸ Section 86(2)(d) NB: Commencing on the 7 December 2014 holders of production right would be obliged to comply with the conditions of the environmental authorisation as per section 64 (b) of the MPRDA Amendment 49 of 2008.

¹⁶⁹ Regulation 51(a)(i) GN R527.

¹⁷⁰ Section 43(4) NB: This provision will come into operation on 7 December 2014.

¹⁷¹ Regulation 60(a) GN R527.

set out plans which would be applied to prevent or manage the identified potential significant risks¹⁷² which must include-

- (i) a description of the management measures to be applied;
- (ii) a predicted long-term result of the applied management measures;
- (ii)(sic) the residual and latent impact after successful implementation of the management measures;
- (iii) time frames and schedule for the implementation of the management measures;
- (iv) responsibilities for implementation and long-term maintenance of the management measures;
- (v) financial provision for long-term maintenance; and
- (vi) monitoring programme to be implemented.¹⁷³

The fact that commencement of Section 43 (4) of the MPRDA has been deferred until the 7th December 2014 means that until then mine operators are not bound to submit an environmental risk report in support of their applications for closure certificate. Again this is an abnormal state of affairs which exists under the MPRDA because in effect mines would be abandoned without identifying and assessing the level of risk they pose to the environment, and there will be no prevention or monitoring measures developed to deal with the potential risks. It has been averred in Chapter Two that upon abandonment of the well site, it is feared that methane and the HF fluids which had remained underground would move up to the ground water location through the artificial fractures.¹⁷⁴ If Section 43(4) could still be suspended when the exploitation of shale gas by the HF is finally taking place, this would mean that the level of risk of water pollution by methane and the HF chemicals which remain underground after well closure would not be identified and assessed. There will further be no plans or strategies created during well closure to prevent migration of the HF pollutants to the aquifers. As a result, the environment and water resources in the Karoo could suffer a significant pollution. It is, therefore, imperative that Section 43(4) should be operative before the HF could be allowed to take place in the Karoo as this would obligate well operators to prepare environmental risk reports which include strategies for the prevention of potential water pollution by HF pollutants after cessation of shale gas production.

The Minister would issue the certificate if the Chief Inspector and other government bodies having interest in matters affecting the environment have affirmed that there have been compliance with regulations on health and safety, control of water resources pollution, treatment of extraneous water and conditions of EA.¹⁷⁵ Apart from that, when issuing the

¹⁷² Regulation 60(f) GN R 527.

¹⁷³ Regulation 60 (g) GN R 527.

¹⁷⁴ M Zoback et al op cit (n59) 7.

¹⁷⁵ Section 43(5).

certificate the Minister may decide to give back some portion of the financial security to the operator and retain the other share for environmental impacts which are likely to emerge from the closed mine in the future.¹⁷⁶ Lastly, but important in as far as shale gas production is concerned, the Minister may not issue the closure certificate unless ‘the complete and correct records, borehole core data or core-log data . . . or the complete and correct surface and . . . underground geological plans have been lodged with the Council for Geoscience.’¹⁷⁷ Surface and underground geological plans could be instrumental in the management and prevention of potential risks posed by methane and the HF chemicals remaining underground after the HF operations.

In terms of Section 43 (1) of the MPRDA the operator of the well site would remain liable for any environmental harm or pollution caused by the well site until he or she has been issued with a closure certificate. Chapter 2 outlined that in the US when an operator of a well site has finished harvesting the gas, he or she is required to properly plug the well with the cement before deserting it to prevent methane and HF fluids moving up the well. Greeff is of the opinion that cement which is used to plug the wellbore would ultimately wear out in about 100 years’ time and this would allow methane and HF fluids to flow up to groundwater location.¹⁷⁸ This is indicative that even a properly plugged HF well needs a long term monitoring because groundwater would be constantly in danger of being polluted should the plugging fail. In this regard, the HF well operators should not be relinquished of environmental liability to monitor and maintain the plugged well. Put differently, the HF well operators should not be eligible for closure certificate after ceasing operations because the HF has long term effects. If the HF operators are not eligible for closure certificate, it would mean that the requirement of financial security would not be discharged and it could be used anytime in the future should pollution to groundwater erupt. This would simply be in line with principle of NEMA that:

‘the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment.’¹⁷⁹

If the HF well operators could be granted closure certificate, then the aftermath of the HF might resemble AMD and the taxpayers’ coffers would have to be used to control the migration of methane and HF fluids.

¹⁷⁶ Section 43(6) NB: This provision would also remain inoperative until the 7th December 2014.

¹⁷⁷ Section 43(13) (b) and (c).

¹⁷⁸ L Greeff Op cit (n86) 30.

¹⁷⁹ Section 2(4) p.

Part C

3.4 Permitting Requirements Related to Water Pollution

It has already been revealed that the HF process generates tons of waste from the drilling stage until the production stage. As mentioned above, this waste is normally stored in pits or dams at the well site before it can be treated or disposed of. As a result, this triggers water use and waste management licences as the two regulatory tools which become relevant to the issue of waste. The primary purpose of regulation by water use and waste management licences is to prevent and control occurrence of water pollution resulting from the drilling and HF waste. This is in line with one of the principles of environmental management under NEMA which provides that sustainable development requires that waste should be avoided or, where it cannot be avoided, it should at least be minimised and re-used or recycled if possible, or else be disposed of in a responsible manner.¹⁸⁰ With the use of best management practices and technology, waste discharge and disposal could be carried out sustainably and thus avoiding water pollution.¹⁸¹

3.4.1 Requirements Under the National Water Act

Being in possession of a mining right or production right with an approved EMP does not necessarily entitle an operator to commence operating.¹⁸² The developer of a shale gas in SA would have to satisfy the legal requirements pertaining to water use and licencing under the NWA. It is common cause that the HF process is water intensive and it also has potential to contaminate fresh water resources. For these reasons, the NWA becomes relevant in the regulation of shale gas production. Generally, the main purposes of the NWA is to, inter alia, ensure that SA's water resources are protected by reducing and preventing pollution and degradation of water resources.¹⁸³ Thus the NWA defines water pollution as:

- ‘the direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it-
- (a) less fit for any beneficial purpose for which it may reasonably be expected to be used;
 - (b) harmful or potentially harmful-
 - (aa) to the welfare, health or safety of human being;
 - (bb) to any aquatic or non-aquatic organisms;
 - (cc) to the resource quality; or

¹⁸⁰ Section 2(4)(a)(v) NEMA.

¹⁸¹ C Bosman & M Kidd ‘Water Pollution’ in H A Strydom & N D King (eds) *Environmental Management in South Africa* 2ed (2009) 654.

¹⁸² Endangered Wildlife Trust ‘Mining Impacts: Water and Mining’, available at http://www.miningtoolkit.ewt.org.za/mining_impacts_water.html, accessed on 09 August 2013.

¹⁸³ Section 2(h) of NWA.

(dd) to property.’

Governance of the use of water falls under Chapter 4 of the NWA and as a general principle water use must be licenced. In terms of Section 21 of the NWA water use is defined to include taking water from a water resource, storing water, impeding or diverting the flow of water, engaging in a controlled activity, discharging waste into a water resource from a certain source, disposing of waste in a manner which may detrimentally impact on a water resource etc. Definition of water use under Section 21 of the NWA covers a very wide scope. It is noteworthy that discharging or disposing of waste in a manner which is likely to cause pollution to water resources would amount to water use requiring water licence. These are activities which Kidd and Bosman describe as ‘non-consumptive water use.’¹⁸⁴ As a result their likely impacts on the water resources would also have been thoroughly addressed in the application for water use licence. It follows that disposal or discharge of drilling waste and the HF wastewater would require a water licence because it is constituted of highly toxic substances which are likely to impact negatively on water resources.

Furthermore storing, recycling and reusing of drilling waste and HF wastewater are activities which have potential to pollute water resources and as a result they amount to water use in terms of the NWA, and a water licence would, therefore, be required before their commencement. In addition, before a water use licence can be issued, the DWA would have to satisfy itself that the proposed activities of storing, recycling and reusing of the HF waste would be conducted in accordance with provisions of the GN 704. GN 704 provides in details the requirements which have to be met before commencement of the mining activity which is likely to cause pollution to water resources. In terms of Regulation 2(1) of GN 704, before the operator could erect a pit for holding or storing drilling waste, he or she would have to notify the DWA 14 days before the erection commences. It would be an offence for the operator to go ahead with the activity without providing necessary notice to the DWA. The rationale for notifying the DWA in advance is to allow the DWA to visit the well site to inspect whether the proposed pit or dam meets the requirements of the law. After the inspection the DWA can determine whether to issue a water use licence or not.

The application for use of water in relation to shale gas production would have to be made in terms of the provisions of Part 7 of the NWA. Normally the responsible authority is the Minister of Water Affairs or catchment management agency if assigned by the

¹⁸⁴ C Bosman & M Kidd op cit (n181) 654.

Minister.¹⁸⁵ In addition, the responsible authority has power to direct the applicant to submit further information or an assessment report prepared by a qualified person on the impact of the proposed licence on the water resource; and the authorities can also order the applicant to engage an expert who will conduct an independent review of the assessment report.¹⁸⁶ The submission of the information and assessment report is very useful to enable the decision maker to evaluate the application and make a well informed decision on whether to grant the application or reject it. It is evident that the kind of assessment and investigation of the likely impact of the proposed licence on the quality of the water resource can be equated to an EIA. Responsible authorities should ask for investigation and assessment by a specialist in the application of the water use for the HF because information on the degree of impacts on water resources is still lacking or unknown; therefore, specialised investigation would be necessary. A decision on the application for water use licence would be based on whether the water use would constitute an ‘optimum beneficial use’ or sustainable water use.¹⁸⁷ Furthermore, the relevant authority may conduct its own investigation on the potential impact of the proposed licence on, among others, the protection, management and control of the water resource and may also engage participation of relevant state departments and interested parties before a decision on application for water use licence can be made.¹⁸⁸

Like any other authorisation, a water use licence may come with conditions stipulated on it by the responsible authority. It is also an offence to contravene any condition attached to a water use licence.¹⁸⁹ In terms of Section 29 of the NWA, a responsible authority may attach conditions relating to water protection,¹⁹⁰ return flow and discharge or disposal of waste, by:

- ‘(i) specifying a water resource to which it must be returned or other manner in which it must be disposed of;
- (ii) specifying permissible levels for some or all of its chemical and physical components;
- (iii) specifying treatment to which it must be subjected, before it is discharged; and
- (iv) specifying the volume which may be returned;’¹⁹¹

Since drilling waste and HF wastewater contain toxic chemicals, the water licence would have strict conditions on how drilling waste and HF wastewater should be disposed, the level of chemical components of the waste, and the kind of treatment it should be subjected to in order to protect the nearest water bodies.

¹⁸⁵ Section 1NWA.

¹⁸⁶ Section 41(2) (a).

¹⁸⁷ C Bosman & M Kidd op cit (n181) 683.

¹⁸⁸ Section 41 (2) (a) and (b).

¹⁸⁹ Section 151(1)(c)

¹⁹⁰ Section 29(1) (a) (i).

¹⁹¹ Section 29(1) (c).

Moreover, there is an intention to declare the HF one of the controlled activities and at the moment that process is still in commenting stage.¹⁹² Thus, should the HF be declared a controlled activity, an authorisation under the NWA would be required before any drilling or activities incidental to the HF could commence. Controlled activities are those which the Minister of Water Affairs may identify and declare as having a detrimental impact on water resources.¹⁹³ In the case of a controlled activity, a responsible authority may attach conditions on the licence or general authorisation specifying the waste treatment, pollution control and monitoring equipment to be installed, maintained and operated; and the management practices to be followed to prevent the pollution of any water resource.¹⁹⁴

Before a responsible authority can issue a licence, it may request an applicant to provide security which would be accepted by the responsible authority, if that security would enable the applicant to discharge his or her licence obligations towards protection of water resource.¹⁹⁵ The provision of security is crucial especially if the prospective licence holder is going to engage in a water use which has the potential to cause significant degradation or pollution to the water resource. Again, once the licence has been issued, the licensee has a legal obligation to comply with the licence conditions and provisions of the NWA, or otherwise the responsible authority has power to take appropriate action against him or her.¹⁹⁶ The security operates as an undertaking by the well operator that he or she would comply with the water use licence conditions during the life cycle of the HF. This means that if underground water pollution is detected during or after the production of shale gas, the operator would forfeit the security and it would be used to rehabilitate the harm to underground water. The fixing of security can be a powerful tool used to prevent, mitigate or rehabilitate pollution of water resource by the actions of licence holder or it can also compel the licensee to religiously comply with the conditions of the licence or the provisions of the NWA. Provision of security is the effective way of ensuring compliance with the law and conditions of a licence, but it would amount to unnecessary duplication and parallel regulation if an operator of a well site could be required to provide financial security when

¹⁹² Department of Water Affairs *National Water Act 36 of 1998 Proposed Declaration of the Exploration for and or Production of Onshore Unconventional Oil or Gas Resources and any Activities Incidental thereto including but not limited to Hydraulic Fracturing as a Controlled Activity* GN 863 in GG 36760 of 23 August 2013.

¹⁹³ Section 38 of NWA.

¹⁹⁴ Section 29(1) (d).

¹⁹⁵ Section 30 NWA.

¹⁹⁶ Section 53-55 of NWA Responsible authority may order rectification of contravention, suspend or withdraw the water use licence.

applying for an EA and also in an application for water licence. This parallel governance could be cured by coordination and cooperation between the DWA and DME during application process of the EA or water use licence as envisaged by Section 24L of NEMA discussed below.

In addition, the DWA is currently facing a huge backlog of the water use licence applications to the extent that there are water users operating without water licences.¹⁹⁷ This means that there is a high chance for the HF to take place in the absence of water use licence and, as a result, the DWA would not be able to regulate its activities affecting water resources. Furthermore, it has been stated that effective monitoring of groundwater quality or status is highly demanding in terms of expertise, technology and resources which are currently lacking within the DWA or DME. The government of SA is in dire need of qualified and experienced hydro-geologists who can monitor the status of underground water;¹⁹⁸ as a result, this will hinder effective protection of groundwater against possible migration of methane and HF fluids.

One of the important aspects of the GN 704 which can aid to prevent or control drilling and HF waste from causing water pollution is the requirement of submission of plans, specifications and design reports approved by a qualified engineer to the DWA 60 days before construction of surface pit or dam.¹⁹⁹ The submission of this kind of information to the authorities is critical in enabling them to make an informed assessment and evaluation on the proposed location of the dam, nature of materials proposed to be used for construction, capacity of the dam, security for the dam and any other measure proposed for prevention of water pollution. The operator cannot begin the activity of constructing the surface dam or pit unless the submitted plans and specifications of the dam or pit are approved by the DWA. For example, the DWA can disapprove the plan if the location of the dam or pit would be within the 1:100 year flood-line or within horizontal distance of 100 metres from any water resource.²⁰⁰

¹⁹⁷ Department of Water Affairs op cit (n5) 25.

¹⁹⁸ Department of Water Affairs *Groundwater Strategy* 2010 14, available at http://www.dwaf.gov.za/Groundwater/Documents/GSDocument%20FINAL%202010_MedRes.pdf, accessed on 12 September 2013.

¹⁹⁹ Regulation 12(6) (a) GN 704.

²⁰⁰ As per Regulation 4(a).

3.4.2 Requirements Under the Regulations on Use of Water for Mining and Related Activities Aimed at Protection of Water Resources

First and foremost, it is noteworthy that GN 704 governs environmental management within the mining industry with the aim of protecting water resources. It only makes explicit reference to the use of water for mining and related activities but it is silent about petroleum activities. One supposes this is the case because the GN 704 was promulgated during the existence of the Minerals Act No 50 of 1991²⁰¹ which did not distinguish between petroleum and mineral resources. It is further noteworthy that during operation of the Minerals Act the authorities were only issuing a ‘mining authorisation’ as opposed to mining and production right as per the MPRDA. Thus, one can argue that reference to mining activities in the regulations should also include production of petroleum activities. In addition, the GN 704 is germane to the shale gas industry because shale gas production and related activities do pose danger to the water resources like mining industry does, and they are both extractive industries now regulated by one statute viz. the MPRDA. Therefore, the HF activities would have to be in compliance with the requirements of the GN 704. Those requirements relate, amongst others, to the restrictions on locality of a mine or activity,²⁰² protection of water resources,²⁰³ security at the mining site²⁰⁴ and cessation of mine activity.²⁰⁵

As for the restriction on locality of the mine, an operator of a mine is restricted from putting any residue deposit, dam or any associated structure at an area which is prone to flooding or within a horizontal distance of 100 metres from any water resource.²⁰⁶ Furthermore, the person in control of a mine is prohibited from undertaking underground mining or any related operation within the 1 in 50 year flood-line or within 100 metres from any water resource.²⁰⁷ These restrictions on locality of the mine are more or less akin to the requirements of application for a permit to drill an HF well in Ohio, USA in terms of the R.C. of Ohio which have been discussed in Part B of this chapter. It would be through an EIA process that a prospective operator of the HF well would be able to establish the flood-line of the area and the presence of the water resources within the area in which he or she intends to drill the HF well. Furthermore, the owner of the mine is restricted from disposing of any

²⁰¹ Now repealed by the MPRDA.

²⁰² Regulation 4.

²⁰³ Regulation 7.

²⁰⁴ Regulation 8.

²⁰⁵ Regulation 9.

²⁰⁶ Regulation 4(a).

²⁰⁷ Regulation 4(b).

waste substances from the mine which cause or have potential to contaminate water resources.²⁰⁸

Regulation 2(1) of the GN 704 requires any person who intends to operate a new mine or conduct any new activity to provide 14 day notice to the DWA prior to commencement and closure of a mining activity. This is crucial because the DWA has a legal mandate to see to it that the nation's water resources are conserved and protected against pollution. It, therefore, follows that an operator of a shale gas company would have to give 14 days' notice to the DWA before drilling and construction activities could commence at the well site. Giving the DWA a notice would enable it to discharge its mandate by ensuring that the commencement of drilling and fracturing of a well does not cause significant water pollution, and that it is carried out in accordance with the NWA and GN 704. The purpose of the notice is to enable the DWA to inspect and satisfy itself that the intended drilling and well construction would be carried out in compliance with requirements of the GN 704. The DWA would have to monitor compliance in regard to the location of the drilling site, the location and design of the drilling waste dam, measures put in place to prevent water pollution during the drilling operation and the fracturing of a well, and security and access control of the dams storing harmful chemicals and waste.

If the mine is already operational, the operator is required to submit a copy of its amended EMPr to the DWA and must furnish a 14 day written notice to the DWA before temporary or permanent closure of the mining or related activity.²⁰⁹ The requirement of submission of a copy of amended EMPr to the DWA in terms of Regulation 2(a) of the GN 704 makes it evident that the DWA recognises and approves the role of EMPr in protecting water resources against mining activities, thereby promoting cooperative governance and harmonisation between DWA and the DME as per the regulations' explanatory note. Approval of the amended EMPr by the DWA could mean that it has satisfactorily met the requirements of the GN 704 and, hence, the concerned mining company would be exempted from the requirements of the regulations.²¹⁰ It is noteworthy that the DWA is one of the organs of state which have to be consulted for comments before an EMPr could be approved by the DME during the main application for an EA in terms of NEMA. In the same vein, the

²⁰⁸ Regulation 4(c).

²⁰⁹ Regulation 2(2)(a) and (b).

²¹⁰ Department of Water Affairs and Forestry *Guideline Document for the Implementation of Regulations on use of Water for Mining and Related Activities aimed at the Protection of Water Resources* GN 704 Operational Guide M6.1 2ed May 2000, available at http://www.dwaf.gov.za/Dir_WQM/docs/Pol_GuideImplemRegul.DOC, accessed on 04 August 2013.

DWA would also have to be consulted during an application for amendment of EMPr.²¹¹ However, the final decision on approval of EMPr and its amendments rests on the DME and it is not bound by the recommendations of the DWA. The GN 704 was introduced to supplement the EMPr requirements because EMPr process was not effective enough to promote the objectives of NWA.²¹² Maybe this is the reason why the DWA would need to have the amended EMPr in order to align it with the requirements of the NWA and GN 704 should there be a need. One can, therefore, argue that even if the DME approves an EMPr which does not adequately protect water resources against the HF activities, the DWA can utilise the provisions of GN 704 to remedy that deficiency.

Regulation 7 of the GN 704, on the other hand, requires the operator of a mine to apply all due diligence in preventing waste substances from contaminating water resources either through seepage, leakage or natural flow, and to contain all waste substances in holding dams in a manner which will prevent erosion into the water resource during storm-water runoff. The erosion of wastewater into the water resources has could have the potential to pollute downstream water resources and pose health risk to people who rely on that water. In regard to the security measures, Regulation 8 of the GN 704 requires that a mining operator should see to it that there is strict security and access control at the dams storing any harmful substances by erecting fences round the dams and placing notices warning people of the harmful contents therein. These measures are meant to ensure that any dams or impoundment holding waste substances at the site are not accessed by intruders who might damage the equipment or structures and lead to the cause of pollution to the water resource.

It has been explained in Chapter 2 that during the process of drilling and fracturing of a well, the toxic drilling waste and HF wastewater which have been generated have to be kept in open pits or dams at the well site. The storing of the HF waste in the open pits or dams as a measure to avoid damage to fresh water resources triggers applicability of Regulation 12(6) of the GN 704. In particular, Regulation 12 (6) provides that before an operator erects pits or dams, he or she must clearly describe the nature of the impounding dams by preparing plans, specifications and designs which would have to be certified by a qualified person and submitted to the DWA before implementation of the activity. The rationale of submitting this

²¹¹ In terms of Regulation 46(4)(a)(iii) and (5)(a) GN R.543.

²¹² Gauteng Department of Agriculture, Environment and Conservation *Mining and Environmental Impact Guide* (2008) 9-36, available at <http://www.gdard.gpg.gov.za/DocumentsandForms/Documents/MiningandEnvironmentalImpactGuide.pdf>, accessed on 12 September 2013.

kind of information about the impounding dams to the DWA is to allow the regulating authorities to determine in advance whether proposed waste dams meet the requirements of NWA and GN 704, and would not cause harm to water resources. Thus the DWA would not permit the erection of the dam for impounding HF waste if its plan and design would result in severe water pollution, and no measures have been put in place to avert that pollution.

The GN 704 also provides for the temporary or permanent closure of a mine. It requires that operator of mine has to put in place all pollution control measures and remedy affected water resource when ceasing to operate the mine.²¹³ One can argue that the closure of mine in terms of Regulation 9 of the GN 704 should be in line with the provisions of Section 43 under the MPRDA as has been discussed above in Part B.

It is clear from above outline of the requirements of the GN 704 that its objective is to protect water resources from being polluted or diminished by the mining activities. The GN 704 seems to be more elaborate and specific on the requirements for protecting water resources against mining and related activities in SA. As stated above, these requirements bind any person who is the holder of a mining authorisation, now called mining right or production. The holder of a production right of shale gas would also be bound to abide by the GN 704 legal requirements when carrying out production operations from the drilling stage up to the closing stage. Most importantly, administration and enforcement of the GN 704 falls under the DWA whose main responsibility is to ensure that SA's water resources are protected against pollution.

3.4.3 National Environmental Management Waste Act

It has been established in Chapter 2 that a large quantity of waste is generated during the process of producing shale gas. This, therefore, justifies the applicability of the NEMWA in shale gas development. One of the aims of the NEMWA is to protect human health and the environment against pollution by providing measures for waste management and handling.²¹⁴ There are legal requirements which would have to be complied with under the NEMWA for one to engage in management of waste generated during shale gas production. Essentially, the NEMWA provides that a waste licence would be required for listed waste management activities that have, or are likely to have, a detrimental effect on the environment.²¹⁵ Waste

²¹³ Regulation 9.

²¹⁴ Section 2 of NEMWA.

²¹⁵ section 20.

management activities include undertaking any activity that is likely to generate waste, storage, collection, handling, re-use, recycle, treatment, transfer or disposal of waste.²¹⁶ As a result, a waste management licence would be required before undertaking management of waste produced during shale gas process.

An application for a waste management licence would have to be made in terms of Section 45 of the NEMWA by submitting the application to the licencing authority. The licencing authorities can either be the Minister of Environment or the MEC of the relevant province, depending on the nature of the waste activity in question.²¹⁷ The applicant would have to conduct either a basic assessment process or a full EIA in terms of the NEMA EIA Regulations as part of a waste management licence application if the activity proposed to be undertaken is listed under category A or B of the list²¹⁸ respectively. In short, the application for waste licence would have to show the likely effect of the waste management activity on the environment, any alternatives, and prevention or mitigation strategies considered or intended to be applied.

If the production of shale gas would involve the treatment of effluent or wastewater with an annual throughput capacity of more than 2 000 cubic metres but less than 15 000 cubic metres, then a basic assessment would have to be carried out as part of licence application.²¹⁹ However, if the throughput of the effluent or wastewater exceeds 15 000, a full EIA would have to be undertaken before waste licence can be issued.²²⁰ In the USA, recycling of HF waste is regarded as one of the optimum means of minimising the negative impacts of HF waste.²²¹ There are two benefits of recycling HF wastewater: firstly, the recycled waste could be reused to fracture another well thereby reducing the use of fresh water and secondly, recycling helps to cut down the volume of final HF waste which would be disposed.²²² There is a link between recycling of waste and storing of waste in that for waste to be recycled, it would first have to be stored or contained in some impoundment for treatment. In the same manner, the activity of recycling and reusing of HF waste as a hazardous waste is regulated under GN 718 as a listed activity requiring a waste licence

²¹⁶ Section 1 of NEMWA Definitions.

²¹⁷ Section 43 of NEMWA.

²¹⁸ List of Waste Management Activities that have or are likely to have a Detrimental Effect on the Environment GN 718 in GG 32368 of 3 July 2009.

²¹⁹ Activity 11 under Category A of GN 718.

²²⁰ Activity 7 under Category B of GN 718.

²²¹ DC Stickley op cit (n48) 333.

²²² C Clark et al op cit (n144) 9.

before being undertaken. This activity would similarly need a full EIA process as part of application for waste licence. During EIA process prospective well operator must demonstrate, when applying for waste licence, effective and efficient technical and financial capacity to treat and recycle HF wastewater. In some parts of USA gas companies tend to opt for underground injection as disposal of HF wastewater because it is financially and technically costly to recycle HF wastewater.²²³ This kind of practice is not permitted in SA under the GN 704 in that an operator of a mine is not allowed to 'place or dispose of any residue or substance which causes or is likely to cause pollution of a water resource, in the workings of any underground or opencast mine excavation, prospecting diggings, pit or any other excavation.'²²⁴

Furthermore, if the production of shale gas would result in the storage or treatment of hazardous waste in lagoons,²²⁵ re-use and recycling of hazardous waste²²⁶ and construction of structures associated with any of the activities under Category B,²²⁷ a full EIA would have to be conducted as part of the waste licence application. I did discuss in Chapter Two that the waste that is generated at the well site is drilling waste, flowback and produced water which would have to be carefully handled and managed to prevent water pollution. This drilling waste and HF wastewater which return to the surface contain harmful drilling chemicals, HF chemicals and toxic materials extracted from underground; as such, it should qualify as hazardous waste which needs a full EIA process. In Wyoming, USA, well operators are required by law to reveal information on the composition of the chemicals used in HF mixture subject to the exception of proprietary information or trade secrets.²²⁸ In SA disclosure of information is regulated by the PAIA but operators or developers are not obliged by any specific permitting requirements to disclose chemical composition of the chemicals they use in their activities. It is during the process of full EIA that IAP could require the operators to disclose composition of the HF chemicals and the potential effect they could have to the human health and water resources. Thus, a specific requirement for disclosure of the HF chemicals could be useful in controlling the use of toxic chemicals which yield hazardous wastewater which has potential to cause serious damage to water resources.

²²³ BJ Smith *Fracing the Environment?: An Examination of the Effects and Regulation of Hydraulic Fracturing* *Texas Wesleyan Law Review* (2011-2012) 18 129 at 139.

²²⁴ Regulation 4(c).

²²⁵ Activity 1 and 6 under Category B of GN 718.

²²⁶ Activity 2 under Category B of GN 718.

²²⁷ Activity 18 under Category B of GN 718.

²²⁸ C Clark et al op cit (n211) 10.

In the US, Chapter 78 of Oil and Gas Pennsylvania Code requires the operator of a well site to contain HF waste in a pit or tank constructed or installed at the well site.²²⁹ Furthermore, to prevent or minimise waste overflow, the pit or tank constructed at the well site shall be designed to have at least 2 feet of freeboard remaining all the times.²³⁰ The pit shall also be placed '20 inches above the seasonal high groundwater table'²³¹ and have an impermeable liner or layer with strong and thick texture to hold HF waste and prevent it from seepage or leakage beneath the pit.²³²

This activity of managing the HF waste by storing it in impermeable pits or tanks at the well site would amount to a listed waste management activity that has or is likely to have detrimental effect on the environment in terms of GN 718. Therefore, as a general rule, an operator of a well site would need to obtain a waste management licence before implementing this pollution control or prevention measure. The well operator would, in that event, have to undertake a full EIA as a prerequisite for obtaining waste management licence. A full EIA would have to be conducted for the following reasons. Firstly, storing of HF waste in pits is tantamount to 'storage of hazardous waste in lagoons' which falls under category B of GN 718. Further, GN 718 defines 'lagoons' as 'the containment of waste in excavations and includes evaporation dams. . .' Therefore, one can argue that 'pit' qualifies as an 'excavation' because a pit is constructed by excavating the earth. The second reason for conducting a full EIA or scoping report as part of application for waste licence is that, as mentioned earlier, the HF waste could be classified as hazardous waste because it is composed of toxic drilling chemicals, drilling cuttings, HF chemicals, flowback, produced water and other toxic substances naturally occurring underground. The other reason is that HF technique is new in South Africa and its environmental impacts are unknown; thus, every activity related to it would need a cautious approach in line with the principles of environmental management²³³ before it can commence.

In essence, a full EIA is the best tool if the 'potential scope and extent of environmental impacts is not well understood, or is likely to be significant.'²³⁴ It is common

²²⁹ Section 78.56(a).

²³⁰ Section 78.56(a) (2) The Pennsylvania Code.

²³¹ Section 78.56(a) (2) and (4)(iii) The Pennsylvania Code.

²³² Section 78.56(a) (2) and (4)(i) The Pennsylvania Code.

²³³ Section 2(4)(a)(vii) provides that 'a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions'.

²³⁴ Department of Water Affairs *National Environmental Management: Waste Act 59 of 2008: National Waste Management Strategy* GN 344 GG 35306 of 4 May 2012 43 para 3.4.2.

cause, as pointed out before, that the purpose of EIA is to determine possible negative effects of the proposed activity on the environment.²³⁵ It is noteworthy that most of the water pollution issues resulting from storing, treating, recycling and reusing the HF waste would have been covered in the initial EIA which had been conducted for the main EA and EMP in terms of NEMA. All the material information about the impacts of the HF waste on the water resources and the mitigatory measures proposed to be implemented during the lifespan of the activity would have been indicated in the EIA report and EMP. As a result, Section 44 of NEMWA comes into play in that for a waste management licence to be issued,

‘licencing authority must . . . co-ordinate or consolidate the application and decision making process contemplated in this Chapter with the decision-making process in Chapter 5 of the National Environmental Management Act and other legislation administered by other organs of state, without whose authorisation or approval or consent the activity may not commence, or be undertaken or conducted.’²³⁶

Likewise, Section 24L of NEMA demands integration and harmonious operation between government authorities regulating activity which triggers other specific environmental legislation. Exercising their powers in consultation with one another, the authorities can decide to issue separate authorisations or an integrated environmental authorisation in respect of that activity.²³⁷ It, therefore, follows that if Section 24L of NEMA and Section 44 of NEMWA can be adhered to, the application and decision making process for the HF waste management licence, water use licence and EA under NEMA would not run parallel to each other but would form part of a single process. However, these authorisations for the HF activity would only be issued after consultation or approval of DEA, DWA and other interested and affected organs of state, avoiding conflicting decisions or governance on the HF activity.

When granting a waste management licence, the licencing authority would attach conditions and requirements to the licence which would have to be complied with by the licence holder. Crucially, the conditions and requirements attached to the licence would, amongst others, be aimed at protection of the environment and natural resources against waste management activities, mitigation and remediation measures to be utilised to address the harmful effects of the activities.²³⁸ It goes without saying that the licence holder should also have the financial and technical capacity to comply with the requirements or obligations

²³⁵ J Glazewski *Environmental Law in South Africa* 5ed (2005) 229.

²³⁶ Section 44(1) of NEMWA.

²³⁷ Section 24L(1)(a) and (b) NEMA.

²³⁸ Section 51(2) (e) (g) and (h).

stipulated in the waste management licence. In regard to technical capacity, the licence holder could be required to appoint a waste management control officer who will be charged with developing and implementing all the strategies and measures meant for the minimisation of waste and compliance with licence requirements.²³⁹ The conditions attached are akin to the general duty in respect of waste management per Part 2 of the NEMWA.

In addition, the licence could also specify how the licence holder would carry out monitoring and reporting on the compliance with licence conditions.²⁴⁰ Monitoring and enforcement of licence requirements play a central role in an endeavour to achieve environmental protection.²⁴¹ For that reason, Environmental Management Inspectors' (EMIs) duty is very critical in prevention and control of water pollution resulting from the drilling and HF wastewater through monitoring of compliance with the terms and conditions of the licence by the well operator. The EMIs have authority to order the well operator to prepare and submit reports on the extent of compliance and non-compliance with the conditions and requirements of waste licence and any measures implemented by the well operator to avoid or minimise non-compliance.²⁴² In addition, if the EIMs could suspect that the well operator has violated the Act and licence conditions to an extent that the drilling waste might cause serious harm to the water resources and surrounding environment, the EIMs could direct the operator to submit waste impact report in terms of Section 66 of NEMWA. For example, if the EMI suspects that the dam storing drilling waste is leaking, overflowing or there has been accidental spill of drilling waste on the well site then he or she can invoke the provisions of Sections 51(2) (g) and 66 of NEMWA. It is through the compliance report and waste impact report that the authorities could determine whether the activity should be allowed to continue and on what conditions in order to rehabilitate the harm to water resources; or whether the licence should be suspended or revoked.

In order to guard against false and inaccurate reporting on the impact of management of drilling waste on water resources, the operator could be directed to engage the services of an independent qualified person, at the operator's costs, who will compile the waste impact report on behalf of the operator in terms of Section 66(5) of NEMWA. However, engagement of an independent person is not an absolute guarantee that he or she would be unbiased and objective when compiling and submitting waste impact report of the drilling waste on behalf

²³⁹ Section 58.

²⁴⁰ Section 51 (k).

²⁴¹ Department of Water Affairs op cit (n234) 42 para 3.4.

²⁴² Section 51(2)(g) NEMWA.

of the operator, the reason being that the operator of the well would be the one who appoints and pays the fees of the independent person; as thus, it is probable that independent person could compile the report which would favour the interest of his or her client viz. the well operator. Naturally, independent reporter could doctor the report if there has been serious violation of the law or non-compliance with licence conditions by the operator which led to significant pollution of water resources. This flaw could be remedied by providing, necessary resources, technical training and capacity to the EMIs in order for them to be able to effectively conduct onsite investigations and compile waste impacts reports of the waste management activities threatening fresh water resources.

Lack of resources and technical capacity within the regulating authorities to discharge their enforcement duties efficaciously seems to be the biggest challenge on monitoring and enforcement of the Act and licence conditions in SA.²⁴³ For example, the monitoring of groundwater pollution requires expensive technical resources and competence in the absence of which prevention of ground water resources would be unsuccessful.²⁴⁴ At the moment SA has no 'independent expertise' which could be used to monitor the effect of HF industry on water resources.²⁴⁵ As a result, there is a particular need to increase technical capacity and skill of the EMIs on investigating cases of water pollution, especially groundwater, by HF activities.

3.5 Conclusion

To sum up, permitting system is one of the crucial regulatory tools used for environmental protection and pollution control.²⁴⁶ There are various environmental permitting requirements which have to be met before production or exploitation of shale gas in SA. Firstly, an EA in terms of Section 24 of NEMA would have to be obtained in regard to the listed activities which are related to shale gas production. An EMP may need to be submitted for approval before production can commence. Secondly, a production right would have to be applied for and granted in terms of MPRDA before the operator can start producing shale gas. Thirdly, a water licence would have to be obtained because HF is a water intensive process and because it may be declared a controlled activity and it is also an activity which is likely to cause

²⁴³ Department of Water Affairs op cit (n5) 96.

²⁴⁴ K Mechlem 'Thematic Paper 6: Legal and Institutional Frameworks' *Groundwater Governance* June 2012 13, available at www.zaragoza.es/contenidos/medioambiente/onu/968-eng-v6.pdf, accessed on 11 August 2013.

²⁴⁵ D Fig op cit (n4) 15.

²⁴⁶ LJ Kotze and C Bosman op cit (n9) at 131.

significant pollution to water resources. In order to ensure appropriate compliance with the NWA, the HF activities would also be regulated under GN 704. Fourthly, a waste management licence would be required for managing and handling waste generated during the HF operations. Lastly, the well operator would require a closure certificate after he or she has completed shale gas production or when the right to produce natural gas has expired or terminated. Every permit or licence comes with conditions and legal duties which have to be complied with by the permit or licence holder, breach of which attract administrative measures as well as criminal sanctions.²⁴⁷

University of Cape Town

²⁴⁷ J Glasewski *Environmental Law in South Africa* 2013 LexisNexis Durban 26-5.

CHAPTER FOUR

4.1 Conclusion

4.1.1 Evaluation

This paper has shown that the process of extracting shale gas takes place in different stages. The first stage is the drilling of the land for the creation of the wellbore. The second stage is the fracturing of the well with the pressurised injection of HF fluids. The third stage is the return of the HF fluids (flowback) which would be followed by production of gas as the fourth stage. The last stage is the closing or plugging of the well. I identified that each stage comes with some environmental issues mostly related to possible contamination of surface and ground water.

The paper discussed the permitting legal requirements applicable to production of shale gas in SA. The analysis has established that shale gas development in SA is governed by general environmental legislation. In fact, currently there is no single law which is designated to specially regulate permitting requirements for the natural gas exploration and production. In the same vein, it has been revealed that there are fragmented permits or authorisations required under different environmental laws; the situation which Section 24L²⁴⁸ of NEMA has endeavoured to remedy. As a result, prospective producers of shale gas in SA would have to apply for various authorisations under different environmental laws. The paper has furthermore established that the process of EIA in terms of NEMA regulations is a prerequisite for most of the environmental activities under various legislation.

In regard to the drilling and fracturing, the research has established that these activities could not take place at the well site without first obtaining an EA which will have to be preceded by an EIA process. Thus, an EIA plays a central role in investigating and assessing the impact of drilling and fracturing on water resources. In addition, since drilling and fracturing are activities regulated under the MPRDA, an EMPr would have to be developed in support of application for an EA. However, the paper has found that EMPr is not enough, on its own, to address the specifics of drilling and fracturing of a well. Drilling and fracturing of a well can best be regulated by a specific well permit which will have to be

²⁴⁸ It enables competent authorities under different environmental laws to exercise their powers jointly when issuing EA for listed activities regulated under other environmental laws.

supported by casing and cementing plan on how the well will be built and what would be the composition of the HF fluids to be used in injecting a well.

The paper has also discussed the requirement of closure certificate under the MPRDA. It has been shown that the deferment of requirement for environmental risk report in support of application for closure certificate until the 7th December 2014 would mean that HF wells could be abandoned without investigating into and assessing the level of potential risks that would follow thereafter.

Moreover, it is expected that the activities of drilling and fracturing would trigger requirement of water licence once the HF is declared a controlled activity and it would not commence without prior authorisation from the DWA. The proposal to declare the HF a controlled activity is an indication that the authorities appreciate the detrimental effects it could have on the water resources in the Karoo if it is not carefully regulated. It has, however, been revealed that there are currently water use activities which are taking place in the absence of water licence due to the DWA failure to issue licences on time. There is, therefore, a high possibility that the production of shale gas could commence without water licence from the DWA because of the prevailing situation of backlog of applications for water licence. Water licence is the only way in which the DWA can regulate water use activities. It could be a disaster if the HF could proceed with its water use activities without being regulated by DWA.

The paper has established that GN 704 could play a crucial role in protecting water resources against the HF activities in that it can address some of the specific challenges of drilling a well by, for instance, imposing restrictions on location of the drilling site to avoid water pollution during fracturing of a well. The GN 704 could be very useful in preventing and controlling water pollution resulting from drilling and fracturing of a well since the administration and enforcement of the GN 704 falls under the DWA which is responsible for protecting water resources in SA. The GN 704 gives the DWA authority to regulate HF activities if the EMPr inadequately addresses water pollution resulting from the production of shale gas.

There are various permitting requirements for the regulation of possible contamination of water resources by the drilling waste and HF wastewater. The activity of managing or handling the HF waste is fairly regulated to prevent and control water pollution by the HF waste. The management of waste is regulated by water use and waste management

licences. The process of application for water use and waste management licences would still require full EIA process. Moreover, declaring the HF a controlled activity would possibly help to prevent unacceptable pollution because the authorities would impose strict conditions for the protection of water resources when authorising the HF activity. In addition, GN 704 specifically regulates the design and location of the impounding dams for drilling waste and HF wastewater. The requirements under GN 704 could be used to supplement EMPr in regard to prevention and control of water pollution which could be caused by storing large quantities of the HF waste at the well site.

One of the salient aspects of the permitting system of environmental legislation of SA is the requirement of provision of financial security by the well operator under the NWA and NEMA before being authorised to commence HF activities. This requirement could impel shale gas developers to religiously comply with the laws and permit conditions because non-compliance would result in security being forfeited and used to remedy the harm caused by non-compliance.

The paper has further noted that the repeal of Section 39 of MPRDA and amendment of Section 83(4), respectively, have abolished environmental requirements in application for a production right. This effectively implies that an applicant for a production right for shale gas would no longer have to satisfy PASA that the activity would not result in pollution to water resources and ecological degradation. The repeal and amendment could have adverse results on the environment because of notoriety of mining and production activities to cause severe damage to water resources and the environment. This gap could cause the HF activities to be granted production right without satisfying environmental requirements. Moreover, this confusion has further been intensified by the suspension of operation of Section 5A (a) of the MPRDA.

Currently it seems that it would be difficult for the underground water to be protected from possible contamination by methane and HF fluids. The problem is not an inadequacy of the permitting requirements, but it lies with the capacity of the DWA to effectively take action against underground water pollution. The paper has found that there is a lack of technical capacity and skill to monitor the effect of methane and the HF fluids on underground water; as a result, underground water pollution could go unnoticed without being remedied or stopped. Furthermore, the paper has also recognised the vital role played by the EMIs in the monitoring and enforcement of waste and water permitting requirements.

It is believed that there is a limited skill and expertise within the EIM personnel to deal with cases of the HF environmental impacts. There is, therefore, a need to provide them with necessary technical training and capacity to investigate cases of water groundwater pollution caused by the migration of methane and other HF pollutants.

Overall, one can gather from this research that SA has a satisfactory permitting regime which can be used to prevent and control water pollution which is likely to be caused by the HF technique. There are no major deficiencies on the permitting provisions which could enable water pollution to thrive when implementing the HF. There is, however, an apparent confusion and lacuna which have been occasioned by the repeal and suspension of some of the environmental requirements in the MPRDA. The other weakness seems to be on the capacity of the regulating entities charged with the responsibility to administer these permitting requirements. For example, the DME has been given responsibility to make decisions on applications for the EAs and approval of EMPs though it lacks adequate technical capacity and resources to discharge that duty effectively. As for production right, the paper has revealed that there is also a material conflict of interest in that, PASA as the authority designated for promoting exploration or production of shale gas, is also mandated to make decisions on environmental applications. On the other hand, the DWA lacks adequate capacity and resources to process applications for water licences within a short period of time and to effectively monitor changes on the status of groundwater resources. It is, thus, clear that the main weakness is in regard to effective implementation of the law.

4.1.2 Recommendations

In order to achieve proper compliance with the permitting requirements for shale gas production in SA the DME should cease to be the competent authority which administers an EIA process for the EA applications and approval of EMPs. The relevant laws should be amended and put into operation to stop this apparent conflict of interest. On the other hand, if DME continues to regulate environmental matters then the law has to change to allow an improved coordination and consultation when processing applications for EA or EMP. DME should not only have to take the recommendations of DEA and DWA into account but it should be bound by them.

In the similar manner, Sections 39 and 83(4) of the MPRDA should be restored or it should be substituted by a provision which requires an EMP to be prepared and submitted in

terms of Section 24N of NEMA or EIA regulations before application for a production right is granted. If the current situation is not changed negative environmental effects of the HF would not be determined beforehand and this would lead to environmental disasters. There seems to be a lot of confusion and gaps of the legal requirements in the MPRDA which should be sorted out before implementation of the HF.

It has been revealed that EMPr cannot be enough on its own to regulate water pollution challenges raised by the HF because each and every stage of the HF poses threat to water resources. Therefore, it is suggested that in addition to EMPr the MPRDA should introduce the requirement of drilling or well permit which will have to be supported by plan on cementing and casing of the well to protect underground water from the HF fluids, waste and methane.

The paper has also urged the introduction of specific requirement in the SA permitting regime compelling the prospective well operators to disclose composition of the HF chemical fluids before water use and waste management licences could be issued. Disclosure of the toxic chemicals would enable the authorities to make well advised decisions on whether to issue water use and waste management licences. Furthermore, when the authorities have knowledge of the chemicals used, this will enable them to take appropriate measures in controlling those chemicals which pose greatest risk to the water resources unlike when the HF chemicals are unknown.

Since pollution of groundwater could happen long time after the closure of the HF well site, the operator should not be issued with closure certificate so that he or she could remain liable for ground water pollution by methane migration which could surface after many years. This will require amendment of Section 43 of MPRDA to exclude the HF industries from being entitled to closure certificate after cessation of the HF activities.

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