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REGULATING THE DISCLOSURE OF CHEMICAL ADDITIVES IN THE HYDRAULIC FRACTURING PROCESS: A COMPARATIVE ANALYSIS BETWEEN CANADIAN AND SOUTH AFRICAN LAW

by
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Executive Summary

Broadly defined, hydraulic fracturing is a stimulation technique used in the oil and gas industry to create additional permeability through creating fractures in an unconventional gas reservoir. Desktop estimates predict that shale deposits beneath the semi-desert Karoo region in South Africa could hold a reserve of up to 450 trillion cubic feet. After initially imposing a moratorium on fracturing throughout South Africa, the South African government has recently changed track and is now intent on pursuing hydraulic fracturing and shale gas extraction in the Karoo.

Arguably one of the main concerns with regards to hydraulic fracturing in the water scarce Karoo is that the fluids used to fracture rock formations can contain chemical additives that could contaminate scarce water resources and pose a risk to human health. In order to be in a better position to protect the environment and their health, members of the public need access to information on what chemical additives are used in fracturing operations.

South Africa's access to information regime is primarily regulated in terms of the Promotion of Access to Information Act, 2000 which gives effect to the right to access to information in section 32 of the Constitution of the Republic of South Africa. There is no guarantee that information on chemical additives will be disclosed or withheld as the Act allows companies to withhold information for a number of reasons, including that the information may constitute a trade secret or confidential commercial or technical information.

In June 2015 South Africa adopted the Final Regulations for petroleum exploration and exploitation in terms of the Mineral and Petroleum Resources Development Act, 2002. The Final Regulations include specific provisions on disclosure on chemical additives. However, the Final Regulations are riddled with uncertainty and loopholes that may seriously impede their ability to protect water resources from the chemical additives contained in fracturing fluids. As currently framed it is unclear whether or not information on chemical additives must be publically disclosed.

Some lessons can be learned from regulatory experience in Canada in Alberta and British Columbia, for example the public disclosure of chemical additives on the website www.fracfocus.ca. However, a number of loopholes have undermined the effectiveness of regulation in Canada. The most prominent loophole is the fact that companies frequently withhold information on the chemicals they use on the basis that this information is a trade secret.

The dissertation concludes that it cannot be said that South Africa's laws that regulate the disclosure of chemical additives will guarantee that fracturing will occur in a manner that is constituent with the right to an environment that is not detrimental to a person's health and wellbeing.

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Chapter 1: Introduction

1.1 Introduction to the problem

Broadly defined, hydraulic fracturing is a stimulation technique used in the oil and gas industry to create additional permeability through creating fractures (fractures are open spaces) in a gas or oil reservoir, which allows gas or oil to flow more readily to the well head at the surface.[1] In the past 15 years, shale gas has become the new fossil fuel resource in the United States and Canada because of recent technological developments in horizontal drilling and the hydraulic fracturing process.[2] These developments have revolutionised hydraulic fracturing and have made it economically feasible to extract unconventional gas that was previously considered inaccessible, such as the shale gas formations that are believed to occur deep underground in the Karoo.[3]

From 1965 to 1975, Soekor (Pty) Ltd, the South African state owned oil and gas exploration company, explored for conventional oil and gas in the Karoo.[4] The company did not find conventional oil and gas but the company thought it found shale gas in the shale formations at depths of 2500 to 4000 metres below the surface of the Karoo.[5] Recent desktop estimates predict that the shale in the Karoo area could be a reserve of up to 450 trillion cubic feet,[6]

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[1] M de Wit 'The great shale debate in the Karoo' (2011) 107 *South African Journal of Science* 3.

[2] Modern drilling techniques allows for the drill to turn corners at depths by making the drill hole extend from the vertical hole along a horizontal track. The ability to extend the drilling hole on the horizontal track enables the harvesting of shale over a much greater area than in a vertical well. See de Wit op cit (note 1) 3 and R Vidic et al 'Impact of Shale Gas Development on Regional Water Quality' (2015) 340 *Science* 827. Modern refinements in hydraulic fracturing technology make it an extremely sophisticated engineering process, able to fracture rock layers at up to 5 km below the surface. See P Leggette et al 'Trade Secrets and the Regulation of Hydraulic Fracturing: Toward a Global Perspective - Pt 1' (2013) 4 *International Energy Law Review* 154.

[3] Vidic et al op cit (note 2) 827.

[4] P Vermeulen 'A South African perspective on shale gas hydraulic fracturing*'* paper delivered at the International Mine Water Association Annual Conference Bunbury, Australia, 2012 at 149.

[5] Ibid.

[6] T Twine 'Karoo Shale Gas Report' (2012) *Report by Econometrix (Pty) Ltd* at 11.

although the upper figure has been recently adjusted downwards to 390 trillion cubic feet.[7] If the upper estimates are accurate this would make the reserve the fifth largest shale gas field in the world.[8] At the time Soekor undertook its exploration, it was not feasible to extract the unconventional shale gas resources that it appeared to have found. Due to recent technological innovations in hydraulic fracturing it has become feasible to extract the unconventional shale gas found in the Karoo.

Although the exact extent of the recoverable reserve is not yet known, the possibility of recovering the shale gas in the Karoo has already divided interest groups into two groups.[9] Proponents of hydraulic fracturing in the Karoo have argued that the extraction of gas in this region could generate economic growth and assist with poverty alleviation.[10] For example, a report prepared by Econometrix in 2012 stated that, assuming that a resource of 50 trillion cubic feet is recoverable, this could generate 355 817 jobs and could drastically increase South Africa's gross domestic product.[11]

Proponents for fracturing in the Karoo also argue that shale gas will provide a new energy source for the country which has been experiencing a power crisis since the initiation of load shedding in 2008.[12] Shale gas presents an opportunity to address our current power crisis while simultaneously diversifying our energy supply away from coal.[13] Shale gas can

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[7] S Hedden et al 'Fracking for shale gas in the Karoo' (2013) *African Futures Paper* at 3.

[8] Twine op cit (note 6) 11.

[9] de Wit op cit (note 1) 1.

[10] Ibid.

[11] Twine op cit (note 6) 11.

[12] A Sebitosi 'Energy efficiency, security of supply and the environment in South Africa: Moving beyond the strategy documents' (2008) 33(11) *Energy* 1591.

[13] de Wit op cit (note 1) 1.

potentially assist South Africa to reduce its carbon emissions as shale gas (methane gas) is alleged to burn almost 50 per cent cleaner than coal.[14] However, this assertion is contested.[15]

Opponents of hydraulic fracturing argue that the true extent of the deposits are unknown and that the economic and employment benefits are exaggerated.[16] Opponents have pointed out that South Africa lacks the infrastructure for gas transportation (pipelines), storage and other activities associated with fracturing since no conventional terrestrial gas fields exist within the country.[17] Opponents also argue that gas will displace investment in the renewable technologies[18] necessary to solve climate problems.[19] Opponents argue further that hydraulic fracturing can have severe adverse impacts on human health and it is uncertain whether the gas can be extracted without damaging the environment.[20]

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[14] Ibid.

[15] This notion is contested as methane, a highly potent greenhouse gas, has been found to leak and vent into the atmosphere throughout the lifecycle of shale gas development. See R Howarth et al 'Methane and the greenhouse-gas footprint of natural gas from shale formations' (2011) 106(4) *Climatic Change* 679-690.

[16] The Econometrix report has been criticised as expectations for job creation may be exaggerated as fracturing is a highly industrialised and high skill industry thus providing limited job opportunities for South Africans as operations will presumably be managed by skilled foreign worker. The long term viability of fracturing is also disputed as from experience in the United States productivity from fracturing wells has a high decline rate in the first two to three years of production, suggesting that productivity from fracturing is very short term, which places doubts on the long term economic viability of fracturing and its associated job creation ability. See S Fakir 'Framework to assess the economic reality of shale gas in South Africa' (2015) *WWF Technical Report*.

[17] G Steyl and G van Tonder 'Hydrochemical and Hydrogeological Impact of Hydraulic Fracturing' in A Bunger *et al* (eds) *Effective and Sustainable Hydraulic Fracturing* 219.

[18] For example, fracturing could undermine investments in projects such as the South African Renewable Energy Independent Power Producer Procurement Programme. This Procurement Programme has been designed so as to contribute towards the target of 3 725 megawatts to South Africa's grid and to contribute towards socio-economic and environmentally sustainable growth, and to start and stimulate the renewable industry in South Africa. See Department of Energy 'Renewable Energy Independent Power Producer Procurement Programme' available at http://www.ipprenewables.co.za/, accessed on 15 June 2015.

[19] H Wiseman 'The Private Role in Public Fracturing Disclosure and Regulation' (2013) 3 *Harvard Business Law Review Online* 49.

[20] A Maule et al 'Disclosure of hydraulic fracturing fluid chemical additives: analysis of regulations' (2013) 23(1) *New Solutions A Journal of Environmental and Occupational Health Policy* 168.

Arguably the biggest concern relating to hydraulic fracturing in the Karoo relates to its impact on both water quality and water quantity. South Africa is a semi-arid, water-deficient and drought prone country.[21] As of February 2016, South Africa is facing its most severe drought in 30 years with more with more than 2.7 million households facing water shortages across the country.[22] It is debatable if a water-deficient country has the water resources to expend of fracturing as based on data from the United States, a typical gas well fracturing operation can use about 15 000m³ of water per well in each operation.[23] As discussed in greater detail in chapter 2 of this dissertation, there are also many concerns around the contamination of ground water as various toxic chemicals are use during the fracturing process.

The merits of either side's arguments are not fully understood because in contrast with conventional gas exploitation that has already been in use for a number of decades, shale gas development is relatively new.[24] Thus, the scientific studies and baseline measurements have not yet been carried out and the full impacts of fracturing are not yet fully understood.[25]

Despite the risks and uncertainties the South African government has sided with the proponents of fracturing in the Karoo with Energy Minister Dipuo Peters having stated in the National Assembly in May 2012 that shale gas in the Karoo is a 'blessing' from God that needs to be exploited for the benefit of the people.[26] More formally, in terms of his State of the Nation address in June 2014 President Jacob Zuma stated that:

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[21] Department of Environmental Affairs and Tourism 'National State of the Environment Report- South Africa (1999)' available at www.environment.gov.za/soer/nsoer/Issues/water/index.htm, accessed 17 April 2010.

[22] A Essa, 'South Africa in midst of epic drought' available at http://www.aljazeera.com/news/2015/11/south-africa-midst-epic-drought-151104070934236.html, accessed 7 November 2015.

[23] Maule et al op cit (note 20) 171.

[24] R Howarth et al 'Natural gas: Should fracking stop?' (2011) 477 *Nature* 271.

[25] Ibid.

[26] News24 'Minister touts shale gas fracking' available at http://www.news24.com/SciTech/News/Shale-gas-a-gift-from-God-minister-20120517, accessed 10 June 2015.

> 'Work needs to be done at a technical level on all forms of energy especially nuclear energy and energy shale gas with regards to funding, safety, exploitation and the local manufacture of components… We will pursue the shale gas option within the framework of our good environmental laws.'[27]

It therefore appears that South Africa will undertake hydraulic fracturing in the Karoo within the framework of our South Africa's 'good environmental laws'.

This dissertation proceeds on the basis that hydraulic fracturing will be pursued in South Africa.[28] Accordingly, our 'good environmental laws' need to be analysed to determine whether or not they can address the specific risks associated with hydraulic fracturing. The focus of this dissertation is solely on risks associated with the chemical additives used to create, and hold open, microscopic fractures in the shale. The key question, elaborated in chapter 1.3 below, is whether or not South Africa's 'good environmental laws' effectively regulate the disclosure of the chemical additives in the fracturing process.

1.2 Relevance of the study

The development of shale gas resources was initiated in late 2009 but was halted due a moratorium in early 2011.[29] This has subsequently been lifted in September 2012 and there are a number of pending applications related to exploration in the Karoo.[30] It is anticipated that hydraulic fracturing exploration will be undertaken in the next couple of years and it is essential

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[27] J Zuma 'State of the Nation Address 2014' available at http://www.gov.za/state-nation-address-his-excellency-jacob-g-zuma-president-republic-south-africa-occasion-june-2014, accessed 15 May 2015.

[28] The viability of shale gas exploitation in South Africa has been put in doubt, at least in the short term, by drop in global oil prices. This is because unconventional gas extraction are characterised by high risk and significant technological challenges and accordingly require good rates of return from high oil and gas prices to make the economics work. See Fakir op cit (note 16) 9. However, considering the more long term oil price scenario where prices will presumably recover, a number of companies, such as Bundu Gas and Oil Exploration, have retained their interest in shale gas resources in the Karoo. See P Naidoo 'Karoo fracking likely to go ahead despite weak oil prices' available at http://www.moneyweb.co.za/news/economy/karoo-fracking-likely-to-go-ahead-despite-weak-oil-prices/, accessed on 25 November 2015.

[29] S Artel 'South Africa Lifts Fracking Moratorium; Citizens Alarmed By U.S. Fracking Examples' available at: http://www.alternet.org/fracking/south-africa-lifts-fracking-moratorium-citizens-alarmed-us-fracking-examples, accessed 1 January 2016.

[30] Ibid.

that South Africa has an effective regulatory regime to address and manage the risks associated with hydraulic fracturing.

Effective regulation and enforcement is essential as the efficacy and utility of shale gas production and fracturing depends on sound governance principles.[31] That is, it can work safer with proper measures in place, when it is comprehensively regulated and enforced in a fully transparent manner with robust measuring and monitoring of environmental impacts and meaningful engagement with local communities.[32]

In June 2015 the Minister of Mineral Resources published the final technical regulations for petroleum exploration and exploitation in terms of the Mineral and Petroleum Resources Development Act (the Final Regulations).[33] These Final Regulations contain provision for the use and disclosure of hydraulic fracturing fluids and are critically assessed at chapter 4.3 below. One of the purposes of this dissertation is to identify any deficiencies in the Final Regulations in the hope that they may be rectified in the future.

As South Africa has delayed the development of its shale gas deposits our regulatory authorities have had more time to consider and adopt better regulations to protect people and the environment.[34] We are in a position to learn and benefit from the experiences of other countries and can potentially avoid some of the problems experienced in other countries.[35]

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[31] B Sovacool 'Cornucopia or curse? Reviewing the costs and benefits of shale gas hydraulic fracturing (fracking)' (2014) 37 *Renewable and Sustainable Energy Reviews* 263.

[32] Ibid.

[33] Department of Mineral Resources 'Gazzeted regulations for Petroleum Exploration and Production' available at http://www.dmr.gov.za/publications/summary/218-hydraulic-fracturing/4820-gazzeted-regulations-for-petroleum-exploration-and-production.html, accessed 15 January 2016.

[34] T Centner and L O'Connell 'Unfinished business in the regulation of shale gas production in the United States' (2014) 476-477 *Science of the Total Environment* 364.

[35] Ibid.

1.3 Key research question

Based on experience abroad the fracturing process has had detrimental impacts on the environment and human health in a number of instances, see chapter 2.3 below. In order to protect the environment and their health, members of the public need access to information on what chemical additives are used in fracturing operations.

Accordingly this dissertation will seek to determine, by looking at the relevant legislation and case law, whether or not South Africa's laws effectively regulate the disclosure of chemical additives used in fracturing fluids. What constitutes effective regulation is elaborated upon in chapter 1.4 below. South Africa's access to information regime is primarily regulated in terms of the Promotion of Access to Information Act (PAIA)[36] which gives effect to the right to access to information in section 32 of the Constitution.

As discussed in greater detail in chapter 4.2.4, non-governmental organisations frequently use the PAIA to attempt to expose both public and private entities that are not complying with South Africa's environmental laws and to compel compliance.

The Final Regulations also contain provisions requiring the disclosure of the chemical additives used in the fracturing process. These provisions will be assessed to determine the extent to which the members of the public can rely on the Final Regulations to compel disclosure.

The dissertation will also assess the regulation of fracturing fluids in two Canadian provinces that have the most regulatory experience with fracturing, Alberta and British Columbia. The dissertation will focus on how these provinces regulate the disclosure and use of hydraulic fracturing fluids to assess whether or not these regimes are effective. Both positive and negative experiences from Canada will be highlighted to identify opportunities for South Africa's regulatory regime to be improved.

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[36] 2 of 2000.

1.4 Theoretical underpinning underlying the thesis

The key research question of whether or not South Africa's laws effectively regulate the disclosure of chemical additives used in the fracturing fluids must be understood in light of the importance and interconnectedness of the right of access to information,[37] the environmental right to an environment that is not detrimental to a person's health and wellbeing[38] and the right to sufficient water.[39] The content of these rights are discussed in greater detail in chapter 4.1.

Access to information is critical to exercising the right to an environment that is not harmful to a person's health or wellbeing contained in section 24 of the Constitution. This is because a person who wishes to exercise his/her environmental right often requires certain information in order to do so effectively. For example, a person whose health or wellbeing is being impacted on by emissions from a factory will require information on the emissions of the factory before he/she can seek to enforce his/her environmental right.[40]

The importance of the right of access to information has been noted by Traverso J in *Aquafund (Pty) Ltd v Premier of the Western Cape* where the court held that:

> '...if it is accepted that every person is entitled to lawful administrative action, it must follow that in a legal culture of accountability and transparency... manifested in the constitution, a person must be entitled to such information as is reasonably required by him to determine whether his right to lawful administrative action has been infringed or not. If a person is not able to establish whether his rights have thus been infringed, he will clearly be prejudiced.'[41]

The Constitutional Court has also pronounced on the importance of the right of access to information in *Brümmer v Minister for Social Development*, where the Court held that the 'the importance of the right of access to information in a country which is founded on values of

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[37] See section 32 of the Constitution.

[38] See section 24 of the Constitution.

[39] See section 27(1)(b) of the Constitution.

[40] M Kidd *Environmental Law* 2 ed (2011) 28.

[41] 1997 (7) BCLR 907 (C) 916E.

accountability, responsiveness and openness, cannot be gainsaid.'[42] The Constitutional Court further held that the Constitution demands that transparency 'must be fostered by providing the public with timely, accessible and accurate information.'[43]

The right is also central to fostering an open and democratic society committed to the principles of openness and accountability.[44] These values are also central to good environmental management, as decision-making needs to be based on available, clear and understandable information that is made available to all relevant stakeholders to allow for informed and justified decisions to be made.[45]

In addition to the rights discussed above the precautionary principle is of great relevance to hydraulic fracturing. At the core of the principle is that where there is a lack of scientific certainty about the impact and/or consequences of a proposed development or similar activity, then caution must be exercised and where necessary, measures must be taken to protect the environment.[46] The uncertainty surrounding fracturing suggests that the application of the precautionary principle is crucial.[47]

The principle has been adopted primarily in the National Environmental Management Act[48] and the principle has received judicial scrutiny in the *Fuel Retailers Association* case,[49] where the

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[42] 2009 (11) BCLR 1075 (CC) para 24.

[43] Ibid para 62.

[44] E Mureinik 'Bridge to Where - Introducing the Interim Bill of Rights' (1994) 10(1) *SAJHR* 43 and *President of the RSA v M & G Media Ltd* 2012 (2) BCLR 181 (CC) para 10.

[45] A du Plessis 'Public participation, good environmental governance and fulfilment of environmental rights' (2008) 11(2) *PER/PELJ* 183.

[46] J Glazewski and L Pilt 'Towards the application of the precautionary principle in South African law' (2015) *Stellenbosch Law Review* 190.

[47] Ibid at 218.

[48] 107 of 1998. See for example section 2 of the National Environmental Management Act where the precautionary principle is reflected in the sub-principle that 'a risk-averse and cautious approach [be] … applied which takes into account the limits of current knowledge about the consequences of decisions and actions.' Importantly, section 2 commences by stating that the principles '…apply throughout the Republic to the actions of all organs of state that may significantly affect the environment.'

Constitutional Court found that the precautionary principle required the environmental authorities, 'to insist on adequate precautionary measures to safeguard against the contamination of underground water'.[50] In so-doing the Court stipulated that the 'principle is applicable where, due to unavailable scientific knowledge, there is uncertainty as to the future impact of the proposed development'; and went on to note that '… water is a precious commodity; it is a natural resource that must be protected for the benefit of present and future generations.'[51]

1.5 Methodology

This dissertation will be a textual analysis of the South African and Canadian jurisdictions (Alberta and British Columbia) conducted through library and desktop based research. It primarily relies on a comprehensive review of existing academic literature, legislation, court judgements and other official documents (government reports) in the two countries. The dissertation also relies on recent media reports in order to get a clear and updated picture of policy developments in respect of hydraulic fracturing in Canada and South Africa.

The dissertation was written while I completed my Master in Laws at the University of Cape Town, South Africa and Queen's University, Canada.

Shale gas has already been exploited in the Canadian provinces of Alberta and British Columbia, see chapter 5 below, and substantial recoverable resources may exist elsewhere in Canada.[52] In an attempt to ensure that the development of shale gas is based on appropriate science-driven, outcome-based regulations with strong performance monitoring, inspection and

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[49] *Fuel Retailers Association of Southern Africa v Director-General: Environmental Management, Department of Agriculture, Conservation and Environment, Mpumalanga Province and Others*2007 (10) BCLR 1059 (CC).

[50] Ibid para 98.

[51] Ibid.

[52] The Council of Canadian Academies 'Environmental Impacts of Shale Gas Extraction in Canada' (2014) *The Council of Canadian Academies Report* at 1.

enforcement, the Canadian government has invested extensive resources to better understand and regulate hydraulic fracturing.[53]

As Canada has more regulatory experience with hydraulic fracturing, South Africa has an opportunity to learn from Canada's successes and failures. Therefore it will be useful to compare our regulation of fracturing fluid use and disclosure against that of the Canadian provinces of Alberta and British Columbia.

1.6 Structure of the dissertation

Having provided a general outline the dissertation proceeds as follows:

Chapter 2: The hydraulic fracturing process

This chapter will explain the hydraulic fracturing process by focusing specifically on the chemicals used in the fracturing process and the associated contamination risk, which has been the focus of public concern both abroad and in South Africa.[54] The chapter will explain why in light of these potential impacts, the disclosure of hydraulic fracturing fluids is important.

Companies are generally opposed to disclosure fearing the release of the chemical composition of fracturing fluids may be a business risk, as the disclosure of information may expose them to having to take remedial measures and also to potential administrative and criminal liability.[55] Companies also oppose disclosure as they invest time and resources into perfecting their fluid technologies, and thus view these chemical recipes as proprietary information that should be protected as trade secrets or confidential commercial or technical information.[56]

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[53] See for example, the Council of Canadian Academies op cit (note 52) 1-262.

[54] Wiseman op cit (note 19) 50.

[55] E Heitmann et al 'Money Talks, Commercial interests and transparency in environmental governance' (2014) *Centre for Environmental Rights Report* at 1.

[56] Maule et al op cit (note 20) 169

The disclosure of chemicals used in fracturing wells is important to persons residing or working near a well, as these people need information on the toxic substances so they can make choices about buying property or living in an area.[57] The public also requires information on the chemical composition of fracturing fluids to ensure that their environmental rights are not being violated.

This chapter will accordingly evaluate how the competing interests of protecting human health and the environment and allowing sufficient protection of fracturing operators' commercial interests can be reconciled.

Chapter 3: Background to hydraulic fracturing in South Africa and Canada

As the theoretical foundation of this thesis is a comparative study between South African and Canadian law this chapter will provide an overview of hydraulic fracturing in South Africa and the Canadian provinces of Alberta and British. South Africa has very little regulatory experience with hydraulic fracturing. Canada has been undertaking hydraulic fracturing in some of provinces for a number of years (such as Alberta and British Columbia) and regulatory experience in these Canadian provinces can provide South Africa with valuable insight into the challenges and risks associated with fracturing.

Chapter 4: Regulation of disclosure of chemical additives used in hydraulic fracturing fluid in South Africa

First, this chapter will set out the constitutional right behind access to information contained in section 32 of the Constitution as elaborated on in PAIA. This chapter will then set out the regulatory framework behind access to information contained in PAIA. The chapter will also review how the courts have interpreted PAIA, focusing especially on the leading decision of the

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[57] T Centner 'Oversight of shale gas production in the United States and the disclosure of toxic substances' (2013) 38 *Resources Policy* 237.

Supreme Court of Appeal in *Company Secretary of ArcelorMittal South Africa and Another v Vaal Environmental Justice Alliance*[58] and other seminal judgements.

The chapter will then critically assess how hydraulic fracturing fluid disclosure is regulated in terms of the Final Regulations to assess whether or not members of the public can obtain information on the chemical additives used through the Final Regulations.

Chapter 5: Regulation of disclosure of chemical additives used in hydraulic fracturing fluid in Canada

This chapter will adopt a comparative approach and assess how the disclosure and use of hydraulic fracturing fluids are regulated in Alberta and British Columbia. The provinces of Alberta and British Columbia require public disclosure of fracturing fluids on the website www.fracfocus.ca. However, trade secrets can be withheld from publication on www.fracfocus.ca which presents a major obstacle for gaining information on fracturing fluids. Both positive and negative experiences from Canada will be highlighted to identify opportunities for South Africa's regulatory regime to be improved.

Chapter 6: Recommendations and conclusion

This chapter will compare South Africa's proposed approach to that of Canada's. This chapter will critically assess the similarities, differences, strengths and weaknesses of the two legal systems. The chapter will furthermore identify what lessons can be learnt from the comparison and will make recommendations in the context of the development of South African environmental law.

The conclusion will summarise the major findings of the dissertation and seek to answer the primary research question. The study concludes by making recommendations in the context of the development of South African environmental law.

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[58] 2015 (1) SA 515 (SCA).

Chapter 2: The hydraulic fracturing process

2.1 What is shale gas?

Shale is a sedimentary rock made up predominantly of consolidated clay and silt sized particles.[59] Shale gas is a natural gas comprised primarily of methane (more than 90 per cent) found in organic rich shale formations.[60] Shale is not homogenous and can vary greatly in mineralogical composition, geochemistry and geomechanical behaviour.[61]

Shale has a very low-permeability, the pores in a shale formulation can be 1000 times smaller than those in conventional sandstone reservoirs.[62] For this reason shale gas is considered to be unconventional.[63] Conventional reservoirs of natural resources are those that typically hold small amounts of high-quality resources and are easy to develop.[64] Unconventional reservoirs contain large volumes of resources but are more difficult to develop.[65] This is because in unconventional reservoirs the reservoir rock does not permit the natural gas to flow into a conventional vertical well at an economic rate.[66] The goal of hydraulic fracturing is to enable such a flow to allow for the extraction of gas from shale deposits.[67]

2.2 Hydraulic fracturing process and the role of chemical additives

The process of hydraulic fracturing in shales has been thoroughly discussed by a number of authors, but the focus of this dissertation is solely on the fluids and chemical additives used to

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[59] The Council of Canadian Academies op cit (note 52) 18.

[60] Ibid.

[61] Ibid.

[62] Ibid.

[63] Ibid.

[64] D Rahm 'Regulating hydraulic fracturing in shale gas plays: the case of Texas' (2011) 39(5) *Energy Policy* 2975.

[65] Ibid.

[66] Ibid.

[67] Ibid.

create, and hold open, microscopic fractures in the shale. The process is to pump a fluid (in present practice almost always water) into a wellbore,[68] consisting of a vertical (approximately 2000-6000 metres deep) and horizontal well (which is approximately a few thousand metres long), at high pressure into the shale formation.[69] The pressurized fluid opens up fractures in the rock. The fluid then flows into the fractures, widening and extending them out from the wellbore.[70] The pumping is stopped and some of the fluid begins to flow back into the wellbore.[71]

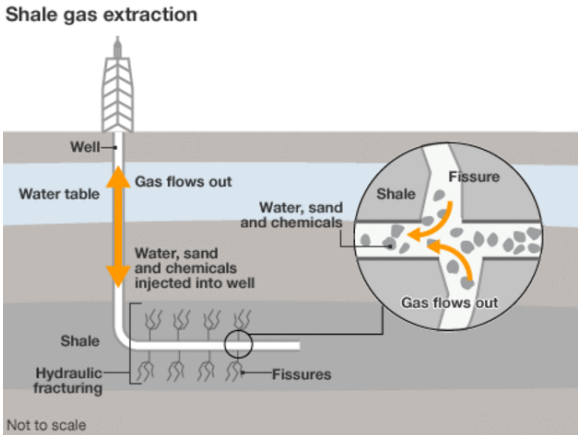

Illustration 1: Hydraulic fracturing basic process.[72]

If the fracturing fluid were simply pure water with no additives, pressure within the shale formation would close the fractures up shortly after the pumping stopped and very little oil or gas could be produced.[73] So the primary additive is one that keeps the fractures from closing up completely and allowing the shale gas to flow back to the surface. The primary additive is

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[68] A wellbore is a hole drilled into the ground to create a well. See G Zuckerman *The Frackers* (2014) 37.

[69] Leggette et al op cit (note 2) 155.

[70] Ibid.

[71] de Wit op cit (note 1) 3.

[72] Source BBC News 'What is fracking and why is it controversial?' available at http://www.bbc.com/news/uk-14432401, accessed 3 December 2015.

[73] Leggette et al op cit (note 2) 155.

called 'proppant,' for it props the fractures open and it is almost always sand.[74] In a typical fracturing operation, 98 to 99 per cent of the fluid and additives are water and sand.[75]

In addition to water and sand other chemical additives[76] need to be added to the mixture to solve particular problems.[77] The most important problem is keeping the sand in the water long enough to make it to the back of the fractures as the sand in the fluid could drop out and clog the bottom of the wellbore, making the operation a failure.[78] To keep the sand suspended in the fracturing fluid, operators either add guar gum[79] to make the water-based fluid more viscous (or thicker), holding the sand in the fluid until it penetrates the fractures.[80] Alternatively operators add synthetic polymers which thicken the fluid less than guar gum does, but reduce the friction the fluid encounters as it is pumped into the well.[81] This second approach is called 'slickwater hydraulic fracturing.'[82]

Another significant problem is the effect of heat in the shale formation on the fluid.[83] The shale is significantly hotter than the atmosphere at the surface.[84] Operators accordingly add borates

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[74] Ibid.

[75] Ground Water Protection Council and ALL Consulting 'Modern Shale Gas Development in the United States: A Primer' (2009) *U.S. Department of Energy Report* at 61.

[76] A typical treatment will use between three and twelve chemical additivities. See J Furlow and R Hays 'Disclosure with protection of trade secrets comes to the hydraulic fracturing revolution' (2012) 7(2) *Texas Journal of Oil, Gas and Energy Law* 303.

[77] Leggette et al op cit (note 2) 155.

[78] Ibid.

[79] Guar gum is made up of ground up guar, which is a bean harvested in northwestern India that acts as a thicken agent. Zuckerman op cit (note 68) 75.

[80] Leggette et al op cit (note 2) 155.

[81] Ibid.

[82] Ibid. Slickwater fracturing requires a greater volume of water to keep the proppant suspended in the fluid. It is anticipated that slickwater hydraulic fracturing will most probably be used in South Africa. R Davis 'Is SA's Water too Precious to Frack with?' available at http://www.ru.ac. za/perspective/perspectivearticles/name,94109,en.html, accessed 20 January 2016 and Department of Mineral Resources "Report on Investigation of Hydraulic Fracturing in the Karoo Basin of South Africa" (2012) *Department of Mineral Resources Report* at 12.

[83] Leggette et al op cit (note 2) 155.

or other compounds to bind the molecules in the fracturing fluid that resist the tendency of the heat to thin the fluid out too much.[85]

Operators use other additives for a variety of other reasons.[86] Iron control agents are used to prevent the degrading of the wellbore.[87] Scale inhibitors prevent mineral deposits from building up inside the wellbore.[88] Acids help clean out tiny entryways into the rock formation.[89] Chemicals kill bacteria in the wellbore that can reduce fracturing performance.[90]

While these conventional chemical technologies can be used routinely with some success, every type of shale is different and the well completion technology used to extract the gas must adapt to these variations.[91] Therefore operators invest time and money into formulating a combination of chemicals that will improve that shale's response to fracturing.[92]

2.3 Impacts of hydraulic fracturing process

Hydraulic fracturing presents a real risk to groundwater as the fluids used to fracture rock formations can contain numerous chemicals that could harm human health and the environment, should they enter drinking water supplies.[93] Some of the chemicals used are

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[84] Ibid.

[85] Ibid.

[86] Ibid.

[87] Ibid.

[88] Ibid.

[89] Ibid.

[90] United States House of Representatives Committee on Energy and Commerce 'Chemicals used in hydraulic fracturing' (2011) *United States House of Representatives Committee on Energy and Commerce Report* at 3.

[91] The Council of Canadian Academies op cit (note 52) 18.

[92] Leggette et al op cit (note 2) 155.

[93] T Colborn et al 'Natural Gas Operations from a Public Health Perspective' (2011) 17(5) *Human and Ecological Risk Assessment: An International Journal* 1046.

common and are generally harmless, such as salt and citric acid.[94] However, some of the identified chemicals have known human health effects.[95] For example, benzene and xylene are often used as chemical additives and benzene is classified by the United States Environment Protection Agency as a carcinogen and xylene is a central nervous system depressant.[96]

In a study of 353 chemicals that the natural gas industry uses in its operations in the United States, the potential health impacts of the chemicals identified found that 75 per cent can affect sensory organs and the respiratory and gastrointestinal systems, 40-50 per cent can affect the nervous, immune and cardiovascular systems as well as kidneys, 37 per cent can affect the endocrine system and 25 per cent can cause cancer or mutations.[97] More than 40 per cent of the chemicals were also found to have ecological effects, indicating that they can harm aquatic and other wildlife which could impact environmental sustainability.[98]

Another recent study, undertaken by the United States House of Representatives Committee on Energy and Commerce, contains the first comprehensive inventory of chemicals used by hydraulic fracturing companies during the drilling process in the United States.[99] Between 2005 and 2009, 14 leading oil and gas service companies used more than 3 billion litres of hydraulic fracturing fluids containing 750 different chemicals and other components.[100] The most commonly used chemicals used in hydraulic fracturing are those given in Table 1.[101]

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[94] United States House of Representatives Committee on Energy and Commerce op cit (note 90) 1.

[95] Maule et al op cit (note 20) 169.

[96] Ibid.

[97] Colborn et al op cit (note 93) 1039.

[98] Ibid at 1046.

[99] See United States House of Representatives Committee on Energy and Commerce op cit (note 90) 1-30.

[100] Ibid at 1.

[101] Ibid.

Table 1: Chemicals used most often in hydraulic fracturing products between 2005 and 2009 in the USA.[102]

Chemical Component	No. of Products Containing Chemical
Methanol (Methyl alcohol)	342
Isopropanol (Isopropyl alcohol, Propan-2-ol)	274
Crystalline silica - quartz (SiO2)	207
Ethylene glycol monobutyl ether (2-butoxyethanol)	126
Ethylene glycol (1,2-ethanediol)	119
Hydrotreated light petroleum distillates	89
Sodium hydroxide (Caustic soda)	80

Table 2 lists a number of chemical components of concern that were found in the same study. The study found that fracturing operators used 29 chemicals that were either known to be carcinogens or were regulated under the United States Safe Water Drinking Act[103] due to their hazardous nature.[104] The study found that some of the chemicals of concern, methanol and ethylene glycol (1,2-ethanediol) are also some of the most often used hydraulic fracturing fluids (see Table 1 above and Table 2 below).[105]

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[102] Source United States House of Representatives Committee on Energy and Commerce op cit (note 90) 6.

[103] 42 U.S.C. § 300f.

[104] United States House of Representatives Committee on Energy and Commerce op cit (note 90) 1.

[105] Ibid at 8.

Table 2: Chemical components of concern.[106]

Chemical Component	Chemical Category	No. of Products
Methanol (Methyl alcohol)	HAP	342
Ethylene glycol (1,2-ethanediol)	HAP	119
Diesel[19]	Carcinogen, SDWA, HAP	51
Naphthalene	Carcinogen, HAP	44
Xylene	SDWA, HAP	44
Hydrogen chloride (Hydrochloric acid)	HAP	42
Toluene	SDWA, HAP	29
Ethylbenzene	SDWA, HAP	28
Diethanolamine (2,2-iminodiethanol)	HAP	14
Formaldehyde	Carcinogen, HAP	12
Sulfuric acid	Carcinogen	9
Thiourea	Carcinogen	9
Benzyl chloride	Carcinogen, HAP	8
Cumene	HAP	6
Nitrilotriacetic acid	Carcinogen	6
Dimethyl formamide	HAP	5
Phenol	HAP	5
Benzene	Carcinogen, SDWA, HAP	3
Di (2-ethylhexyl) phthalate	Carcinogen, SDWA, HAP	3
Acrylamide	Carcinogen, SDWA, HAP	2
Hydrogen fluoride (Hydrofluoric acid)	HAP	2
Phthalic anhydride	HAP	2
Acetaldehyde	Carcinogen, HAP	1
Acetophenone	HAP	1
Copper	SDWA	1
Ethylene oxide	Carcinogen, HAP	1
Lead	Carcinogen, SDWA, HAP	1
Propylene oxide	Carcinogen, HAP	1
p-Xylene	HAP	1
Number of Products Containing a Component of Concern		**652**

Although the chemical additives are a small fraction of the fluid composition, only between 1 and 2 per cent, a typical gas well fracturing operation can use about 15 000 m³ of water per well of fluid used in each operation, this results in approximately 55 000 and 220 000 litres of chemicals used in each well.[107] This presents a significant risk to groundwater as only a small quantity of chemicals used fracturing is needed to contaminate millions of litres of water.[108] For

[106] Ibid.

[107] Maule et al op cit (note 20) 171.

[108] Q Wang et al 'Natural gas from shale formation - The evolution, evidences and challenges of shale gas revolution in the United States' (2014) 30 *Renewable and Sustainable Energy Reviews* 17.

example, benzene present in the petroleum-based products is a known human carcinogen and toxic in water at levels greater than 0.005 ppm.[109]

2.4 Pathways to exposure

It is well understood that some of the chemical additives used in the fracturing process are toxic and exposure to these additives can cause serious harm to human health and the environment. What is less clearly understood, and highly contested, is the probability of these chemical additives contaminating surface and ground water during the fracturing process. The probability of these chemicals contaminating water resources is best understood by looking at the specific pathways for contamination, namely, threats from migration of fracturing fluids from the fracturing zone, threats from well leaks, and threats to surface water from spills.

2.4.1 Migration of fracturing fluids from the fracturing zone

Fracturing of horizontal wells deep underground might present a threat to subsurface aquifers.[110] The low permeability of rock requires that a well be fractured repeatedly; horizontal wells can be fractured up to 10-20 times.[111] Horizontal fracturing is not dissimilar from exploding a massive pipe bomb underground.[112] Because the fractured area in horizontal wells extends over large distances, there are risks of the induced fractures intersecting existing vertical faults or natural fracture systems in the surrounding rocks, permitting gas and fracturing fluids to escape upwards, perhaps into aquifers.[113] The fragility of shallow aquifer systems to

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[109] Ibid.

[110] de Wit op cit (note 1) 4.

[111] Ibid.

[112] Ibid.

[113] Ibid.

possible fugitive gas, fracturing fluids and/or formation water depends primarily on the hydraulic connectivity between deep shale gas formations and the overlying shallow aquifers.[114]

Industry has maintained that the risk of hydraulic fracturing creating vertical conduits that would communicate with, and therefore contaminate, groundwater is extremely small from deep wells.[115] At present there has been little empirical research to fully understand the probability of the migration of fluids from the fracturing zone deep underground.[116] There is also insufficient research to specify at what minimal depth hydraulic fracturing is too risky to undertake.[117] This lack of certainty suggests that the precautionary principle should be adhered to.

2.4.2 Well leaks

More likely is the possibility of gas and fracturing fluid escaping through degraded wellbore casings as a result of rupturing from multiple episodes of fracturing.[118] Overlying aquifers and shallow groundwater systems are vulnerable to such potential leaks since the well will most likely pass through aquifers and shallow groundwater.[119] This risk has been more comprehensively researched.

A number of recent studies have suggested that leaks from drill wells are adversely impacting groundwater. For example, researchers from Duke University examined domestic wells in Pennsylvania to search for evidence of shale gas impacts.[120] They found that the average

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[114] A Vengosh et al 'The effects of shale gas exploration and hydraulic fracturing on the quality of water resources in the United States' (2013) 7 *Procedia Earth and Planetary Science* 865.

[115] The Council of Canadian Academies op cit (note 52) 79.

[116] Ibid.

[117] Ibid.

[118] de Wit op cit (note 1) 4.

[119] Ibid.

[120] See R Jackson et al 'Increased stray gas abundance in a subset of drinking water wells near Marcellus shale gas extraction' (2013) 110(28) *Proceedings of the National Academy of Sciences* 11250-11255.

concentration of methane in groundwater from wells, within one kilometre of shale gas production, was six times higher than that of wells father away, suggesting that the wells are leaking methane into ground water.[121] The researchers' findings have been contested.[122]

Furthermore, an analysis of drinking water sampled from three homes in Bradford County, Pennsylvania, revealed traces of a compound (2-n-butoxyethanol) commonly found in fracturing and drilling fluids.[123] The analysis concluded that the contamination appears to have stemmed from a lack of integrity in the vertical wells and not from the actual fracturing process far below.[124]

Contamination can also occur due to human error as the process is riddled with opportunities for accidents.[125] In *Ernst v. Alberta (Energy Resources Conservation Board)* landowner Jessica Ernst launched a lawsuit against Encana Corporation, Alberta Environment and the Energy Resources Conservation Board over contamination of her well water.[126] In terms of the claim Ernst alleged that the oil company EnCana broke multiple provincial laws and regulations and contaminated a shallow aquifer used by a rural community with natural gas and toxic industry-related chemicals.[127] The shallow aquifer was contaminated due to the accidental injection of hydraulic fracturing fluids directly into sandstone at a depth of 136 metres when the

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[121] Ibid at 11250.

[122] A study by Molosky et al of 1 701 wells in the same area, also testing the impacts of hydraulic fracturing on subsurface water, concluded that gas concentrations were best correlated with topography and groundwater geochemistry, and not shale gas extraction. See L Molofsky et al 'Evaluation of Methane Sources in Groundwater in Northeastern Pennsylvania' (2013) 51(3) *Groundwater* 333-349. In response the Duke University researchers followed up their study with a more comprehensive suite of indicator parameters that supported their previous interpretation. See A Vengosh et al 'The effects of shale gas exploration and hydraulic fracturing on the quality of water resources in the United States' (2013) 7 *Procedia Earth and Planetary Science* 863-866.

[123] G Llewellyn et al 'Evaluating a groundwater supply contamination incident attributed to Marcellus Shale gas development' (2015) 112(20) *Proceedings of the National Academy of Sciences* 6325.

[124] Ibid.

[125] J Gerken 'What the frack shale we do? A proposed environmental regulatory scheme for hydraulic fracturing' (2013) *Capital University Law Review* 95.

[126] *Ernst v Alberta (Energy Resources Conservation Board)* 2014 ABCA 285.

[127] Ibid at para 2.

operators believed they were fracturing at about 1.5 km.[128] The matter is before the Supreme Court of Canada and they are expected to hand down judgement during 2016.[129] Ernst's is one of the clearest examples of groundwater being contaminated by fracturing fluids.

2.4.3 Surface spills

Surface water can also be contaminated by contaminated water used during the fracturing process that returns to the surface, ie flowback[130] and produced water.[131] Between 10 per cent to 90 per cent of the fracturing fluid is returned to the surface during well completion and subsequent production.[132]

Flowback and produced water can contain hazardous fracturing fluids and also salts, chemicals and naturally occurring radioactive material.[133] The composition of flowback and produced water varies widely according to the geology of the fracturing operation, the nature of the chemicals used in the fracturing operation, as well as the chemical characteristics of the water supply used.[134]

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[128] The Council of Canadian Academies op cit (note 52) 8.

[129] In granting leave to appeal, the Supreme Court of Canada has indicated that it will only address the issue of whether or to what extent a legislative provision protecting the regulator from civil actions and remedies is constitutional if the provision purports to limit remedies under the landowner's right to freedom of expression under the Canadian Charter of Rights and Freedoms for breach of Charter rights. Ernst's allegation is that the Alberta Energy Resources Conservation Board breached her Charter right to freedom of expression in terms of section 24 of the Canadian Charter of Rights and Freedoms by failing to accept further communications from her. See *Ernst v Alberta* op cit (note 126).

[130] The fracking fluid is injected into the well at high pressure (100 MPa), and allowed to remain in the well for between 3 and 10 days. The 'flowback water' that literally flows back during the fracturing process. See O Olsson et al 'Hydraulic fracturing wastewater in Germany: composition, treatment, concerns' (2013) 70(8) *Environmental Earth Sciences* 3896.

[131] Initially, the flowback water is almost entirely that of the hydraulic fracking fluid but, over time, its composition gradually changes to that of the water that is naturally found within the shale. This is called 'produced water'. See Olsson et al op cit (note 130) 3896.

[132] Colborn et al op cit (note 93) 1040.

[133] Maule et al op cit (note 20) 169.

[134] E Barbot et al 'Spatial and temporal correlation of water quality parameters of produced waters from Devonian-age shale following hydraulic fracturing' (2013) 47(6) *Environmental Science and Technology* 2562-2569.

From practice abroad flowback and produced water is usually temporarily pumped into wastewater ponds and then moved off-site, where it is either re-injected into the ground,[135] which poses the risk of groundwater water contamination, or transferred to wastewater treatment facilities for treatment and disposal.[136] Treated water from the wastewater treatment facilities is discharged into sewers or surface water bodies, but may still contain high levels of salts, bromides and other pollutants.[137]

2.5 Limitations to understanding the risks

As intense development in most shale gas reservoirs have been taking place for less than 20 years, questions about long term cumulative impacts cannot yet be definitively answered.[138] Fracturing fluid is injected thousands of feet below the surface of the earth, significantly below aquifers and drinking water wells but we do not fully understand whether the fluid left behind in the rock formations may over time migrate upwards towards the surface.[139] Experience from other types of contamination shows that impacts on groundwater typically take decades to manifest.[140] Similarly many chemicals used during the fracturing and drilling stages of gas operations may have long-term health impacts that are not immediately expressed, for example the formation of various forms of cancer.[141]

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[135] In terms of regulation 124(4) of the Final Regulations disposal of flowback or produced water underground, including the use of re-injection disposal wells, is prohibited. In terms of regulation 124(3) liquid waste must be disposed of at an approved waste treatment facility in accordance with relevant legislation and disposal of liquid waste at domestic waste water treatment facilities must only take place after prior consultation with the department responsible for water affairs.

[136] Maule et al op cit (note 20) 169.

[137] Ibid.

[138] The Council of Canadian Academies op cit (note 52) 68.

[139] Gerken op cit (note 125) 98.

[140] Ibid.

[141] Colborn et al op cit (note 93) 1049.

There has also been a general lack of transparency surrounding fracturing which has limited our understanding of its impacts. In the United States, many private land owners who have claimed that shale gas operators contaminated their wells have had their claims settled.[142] These settled claims are subject to confidentiality requirements and therefore the actual or perceived nature of water impacts have not been assessed by government agencies or academics in order to gauge the magnitude and characteristics of impacts on water resources.[143]

Furthermore, the rate of development and the limited funding for research are substantial impediments to research into environmental impacts.[144] Therefore there is only minimal peer reviewed literature that assesses the potential of various chemicals in hydraulic fracturing fluids to persist, migrate, and impact the various types of subsurface systems or to discharge to surface waters.[145]

For the reasons set out above our knowledge of the impacts of hydraulic fracturing are limited and there are presently many unknowns. Our knowledge of the risks posed from the migration of fracturing fluids to potable underground water sources are the subject of much debate. There are, however, a number of examples from experience in Canada and the United States of water contamination from well leaks, accidents and surface spills.[146]

The risks and uncertainty surrounding fracturing suggests that the application of the precautionary principle is crucial.[147] Given that there is a lack of scientific certainty about the

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[142] The Council of Canadian Academies op cit (note 52) 67.

[143] Ibid.

[144] Vidic et al op cit (note 2) 826.

[145] The Council of Canadian Academies op cit (note 52) 77.

[146] P King 'Regulating fracking in South Africa' available at http://www.snslaw.co.za/updates/regulating_fracking.php, accessed 12 November 2015.

[147] Glazewski and Pilt op cit (note 46) 218.

impact and/or consequences of a fracturing, then caution must be exercised and where necessary, measures must be taken to protect the environment.[148]

2.6 Disclosure versus commercial interests

Considering the potential risks to human health and the environment, a lack of disclosure prevents the public from understanding possible health and environmental impacts associated with hydraulic fracturing and the use of fracturing fluids, as well as preventing proper monitoring of chemical contamination as a result of hydraulic fracturing operations.[149]

However, considerable research and investment often accompany the development and selection of a unique chemical formula for a given well.[150] The composition of the fracturing fluid is chosen by using data and experiences that will maximise gas production and meet other goals.[151] Since companies invest time and resources into perfecting their fluid technologies, industry views chemical recipes as commercial information that should be protected as trade secrets or confidential commercial or technical information.[152] Experience in the United States shows that operators decline to disclose information on all chemicals in about two-thirds of the reports submitted under state law[153] and the industry is generally opposed to the disclosure of toxic chemicals.[154]

Despite the industry's arguments for keeping fracturing fluid formulas confidential, there are strong benefits supporting the disclosure of fracturing chemicals.[155] The disclosure of

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[148] Ibid at 190.

[149] Maule et al op cit (note 20) 171.

[150] Centner op cit (note 57) 236.

[151] Ibid.

[152] Maule et al op cit (note 20) 169.

[153] Centner op cit (note 57) 237.

[154] Ibid.

[155] H Wiseman 'Trade secrets, disclosure, and dissent in a fracturing energy revolution' (2011) 111 *Columbia Law Review* 10.

chemicals used in fracturing wells is important to persons residing or working near a well, as these people need information on the toxic substances so they can make choices about buying property or living in an area.[156] Better information could also help to verify or negate claims of contamination and could assist medical professionals to locate the cause of symptoms if a worker or other person were exposed to the chemicals.[157] Furthermore, better information could support clean-up efforts where fracturing fluid spills occur.[158]

If companies are allowed to hide behind the trade secret status (see chapter 4.2.3 below on the nature of trade secrets in terms of PAIA), this decreases the incentive to stop using hazardous substances and to innovate and seek less hazardous fracturing fluids.[159] Disclosure might also have long-term benefits for the industry by facilitating environmental safety, encouraging the development of more environmentally-friendly fracturing fluids, encouraging re-use of fracturing fluids and improving the public's perception of fracturing.[160]

When fracturing has the potential to impact such a large number of people, it is unfair to give the industry the complete benefit of the doubt and allow for complete non-disclosure of the chemicals used and trade secret protection.[161] Although the economic interests of oil and gas companies need to be protected this cannot happen when there are real risks to human health and the environment that the public should be fully aware of.[162]

As discussed in greater detail in chapter 4.1, failure to provide such information would place local communities in a position where they would be unable to protect their right to an

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[156] Centner op cit (note 57) 237.

[157] Wiseman op cit (note 155) 10.

[158] Ibid.

[159] Wiseman op cit (note 19) 63.

[160] Centner op cit (note 57) 236.

[161] J Craven 'Fracking Secrets: The Limitations of Trade Secret Protection in Hydraulic Fracturing' (2014) 16 *Vanderbilt Journal of Entertainment and Technology Law* 414.

[162] Ibid.

environment that is not detrimental to their health and wellbeing and also to right to access to sufficient water.[163] This is undesirable and it is accordingly submitted that complete public disclosure of all information on the fracturing fluids used must be required.

Having discussed the risks associated with the use of fracturing fluids and the need for public disclosure of the chemical additives used in fracturing fluids; the next chapters will discuss the history of hydraulic fracturing in South Africa and the Canadian provinces of Alberta and British Columbia.

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[163] See sections 24 and 27(1)(b) of the Constitution of the Republic of South Africa, 1996.

3. Background to hydraulic fracturing in South Africa and Canada

3.1 South Africa

3.1.1 History of fracturing in South Africa

As mentioned in chapter 1.1 above, from 1965 to 1975 Soekor (Pty) Ltd thought it found shale gas in the unconventional shale formations at depths of 2500 to 4000 m below the surface of the Karoo.[164] At the time Soekor undertook its exploration, it was not feasible to attempt to extract the unconventional shale gas resources that appeared to have been identified. Due to recent technological innovations in hydraulic fracturing it has become feasible to extract the shale gas found in the Karoo and accordingly a number of companies have shown interest in exploiting this reserve.

In or around 2011, three foreign registered multi-national companies as well as a South African international corporation lodged applications under the Minerals and Petroleum Resources Development Act[165] for shale gas exploration licenses to undertake fracturing in the Karoo with the Department of Mineral Resources.[166] The largest of these companies is the multinational oil company, Shell Exploration Company B.V.[167]

This resulted in the nongovernment organisation, the Treasure the Karoo Action Group,[168] commissioning a report in April 2011 entitled 'A critical review of the application for a gas exploration right by Shell Exploration Company B.V.'[169] The report raised a number of

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[164] Vermeulen op cit (note 4) 149.

[165] 28 of 2002. The Act is the central statute regulating mineral and petroleum exploration and exploitation.

[166] L Havemann et al 'A critical review of the application for a Karoo gas exploration right by Shell Exploration Company B.V 2011' available at http://cer.org.za/hot-topics/karoo-fracking, accessed on 12 May 2015, at 3.

[167] Ibid.

[168] The Treasure the Karoo Action Group is a non-profit organisation striving to promote awareness, public participation, transparency, accountability and fairness around the issue of shale gas in South Africa. See Treasure the Karoo Action Group 'About us' available at http://www.treasurethekaroo.co.za/about, accessed on 12 May 2015.

[169] See Havemann et al op cit (note 166) 78.

concerns surrounding fracturing in the Karoo and resulted in a three year moratorium being imposed in early 2011.[170]

Many of the concerns surrounding fracturing in the Karoo relate to the fact that the Karoo is a mainly arid ecosystem that extends across a significant portion of South Africa and access to water is a key constraint on human activity.[171] Given the arid nature of the Karoo, where the potential evaporation far exceeds the mean annual rainfall, water (and in particular groundwater) is the 'life blood' of the region and any deterioration in quality or reduction in quantity of water poses a significant threat to the resilience of the socio-economy and ecosystems of the Karoo.[172]

During the imposition of the moratorium the Working Group of the Task Team on Shale Gas and Hydraulic Fracturing was formed to investigate the matter before any decisions on whether exploration activities would be allowed.[173] The Task Team produced a report entitled the 'Investigation of Hydrological Fracturing in the Karoo Basin of South Africa.'[174] The report recommended that normal exploration activities (excluding the actual hydraulic fracturing), such as geological field mapping and other data gathering activities (for example hydrological studies), continue as normal subject to the existing regulatory framework.[175]

The report further recommended that the existing regulatory framework be augmented to meet the specific needs posed by the fracturing process and that the appropriate regulations, controls and co-ordination systems be established.[176] This process was expected to take 6-12

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[170] Ibid.

[171] Ibid.

[172] Ibid.

[173] Department of Mineral Resources op cit (note 82) 1.

[174] Ibid.

[175] Ibid at 68.

[176] Ibid at 69.

months.[177] Once the appropriate regulations are in place, it was recommended that hydraulic fracturing be authorised under strict supervision.[178] In the event of any unacceptable outcomes, the process may be halted.[179]

Subject to the recommendations in the Task Team's report the moratorium was lifted after being imposed for 14 months, and South Africa became the first country to reverse a moratorium on fracturing.[180] Controversially, the lifting of the moratorium was given based on the recommendations of the Task Team whose members consisted of representatives of the mineral resources, energy, trade and industry, science and technology and economic governmental bodies, but with no representation from either the agriculture, water, environmental, health or tourism ministries.[181]

Pursuant to the recommendations contained in the Task Team's report, the Minister of Mineral Resources published the Final Regulations. The purpose of the Regulations is to prescribe standards and practices that must ensure the safe exploration and production of shale gas in the Karoo.[182] The Final Regulations are discussed in detail in chapter 4.3 below.

The Department of Environmental Affairs during May 2015 announced that they would be undertaking a strategic environmental assessment into hydraulic fracturing in the area depicted in Map 1 below.[183] The aim of the strategic environmental assessment is to provide an integrated assessment and decision-making framework to enable South Africa to establish

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[177] Ibid.

[178] Ibid.

[179] Ibid.

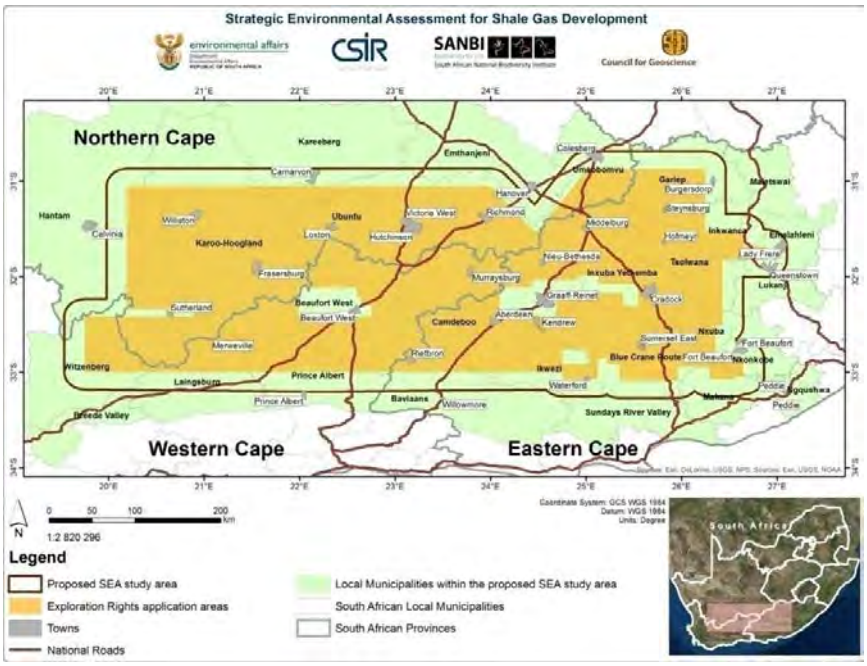
[180] Artel op cit (note 29).

[181] J Franco et al 'Old Story, New Threat: Fracking and the global land grab' (2013) *TNI Agrarian Justice Programme Report* at 7.

[182] Regulation 85.

[183] Department of Environmental Affairs 'Launch of the Strategic Environmental Assessment of shale gas development' available at https://www.environment.gov.za/mediarelease/molewa_tolaunchsea, accessed on 1 June 2015.

effective policy, legislation and sustainability conditions under which shale gas development can occur.[184] The strategic environmental assessment for shale gas development was formally commissioned in February 2015 and will be 24 months in duration.[185]



Map 1: Geographic location illustrating the proposed strategic environmental assessment study area.[186]

The strategic environmental assessment process will not impact on the process of exploration and exploration will continue in terms of the recently published Final Regulations.[187] The Final Regulations should be based on sound scientific information and it makes little sense to undertake a strategic environmental assessment after Final Regulations have already been

[184] Council for Scientific and Industrial Research 'Official website for the Strategic Environmental Assessment (SEA) for Shale Gas Development in South Africa' available at http://seasgd.csir.co.za/, accessed on 30 July 2015.

[185] Ibid.

[186] Source Council for Scientific and Industrial Research op cit (note 186).

[187] A Modise 'Minister Edna Molewa to launch Strategic Environmental Assessment of shale gas development, joined by the Departments of Mineral Resources, Science & Technology, Water Affairs & Sanitation, and Energy' available at https://www.environment.gov.za/mediarelease/molewa_tolaunchsea, accessed on 1 June 2015.

adopted. However, the Minister of Environmental Affairs Minister Edna Molewa has stated that the findings of the strategic environmental assessment might require amendments to the Final Regulations.[188] Therefore one of the purposes of this dissertation is to identify any deficiencies in the Final Regulations in the hope that they may be rectified in the future.

3.1.2 Shale gas resource in the Karoo

It is thought that primarily dry-gas[189] shale gas formations occur at an approximate depth of 2500-4000 m below the surface of the Karoo.[190] Recent desktop estimates predict that the shale in the Karoo area could be a reserve between 32 to 390 trillion cubic feet.[191] It is, however, not known with any degree of certainty how much gas is actually beneath the Karoo and how much of this gas can be recovered.[192] Until such time as prospecting for shale gas begins the true extent of the reserve remains unknown.

3.1.3 Concerns surrounding fracturing in the Karoo

Within the Karoo, hydraulic fracturing poses a number of key issues and concerns, including impacts related to groundwater and other water resources, social-ecological sustainability, livelihoods and rural development, public health, heritage, astronomy and biodiversity.[193] As mentioned in chapter 2.3, this dissertation will focus specifically on the impacts associated with the use of chemical additives in fracturing fluids.

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[188] T Kahn 'Environmental assessment may affect rules of fracking' available at http://www.bdlive.co.za/national/science/2015/05/12/environmental-assessment-may-affect-rules-of-fracking, accessed on 1 June 2015.

[189] Shale gas areas are usually divided into 'dry' gas and 'wet' gas, depending on the hydrocarbon content. Dry gas is almost totally methane with relatively little higher molecular weight product. Wet gas is also predominantly methane but contains a larger percentage of higher molecular weight compounds (crude oil or condensate), including benzene, toluene, ethylbenzene and xylene. See B Goldstein et al 'The Role of Toxicological Science in Meeting the Challenges and Opportunities of Hydraulic Fracturing' (2014) 139(2) *Toxicological Sciences* 274.

[190] Steyl and van Tonder op cit (note 17) 214.

[191] Twine op cit (note 6) 11 and Hedden et al op cit (note 7) 3.

[192] de Wit op cit (note 1) 1.

[193] Havemann et al op cit (note 166) 78.

Any potential impacts on water will be amplified as the Karoo is an arid ecosystem and access to water is a key constraint on human activity.[194] Due to a lack of precipitation groundwater in the Karoo is mainly relied upon for domestic, livestock watering and occasional irrigation purposes.[195] The quality of groundwater is generally good, making it an important source of potable water for the Karoo communities.[196] Much of the groundwater occurs within 50-100 m of the surface.[197] The contamination of groundwater would significantly increase the vulnerability of the rural population's access to water and increase the region's susceptibility to drought, while simultaneously causing ecological degradation.[198]

Within the Karoo the presence of dolerite intrusions may present a unique problem as the possibility exists that the dolerite intrusions connect ground water resources with the shale gas deposits which will be fractured.[199] Dolerite intrusions can be regarded as a preferential pathway for the movement of the fracturing fluids to groundwater aquifers[200] and these intrusions may make the Karoo more prone to the movements of fracturing fluids.[201]

Considering that water is a key constraint on human activity and the unique geology of the Karoo the complete public disclosure of all information on the chemical additives used in the fracturing process must be required.

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[194] Franco et al op cit (note 181) 7.

[195] Havemann et al op cit (note 166) 80.

[196] Ibid.

[197] Ibid.

[198] Hedden et al op cit (note 7) 4.

[199] Vermeulen op cit (note 4) 149.

[200] G van Tonder et al 'Potential impacts of fracking on groundwater in the Karoo basin of South Africa' (2013) *Institute for Groundwater Studies Report* at 3.

[201] Ibid.

3.2 Canada

In Canada fracturing has largely occurred in the western provinces of British Columbia and Alberta.[202] These provinces accordingly have greater regulatory experience with hydraulic fracturing.[203] Substantial recoverable resources may exist elsewhere in Canada.[204] Other provinces with identified shale gas potential include Saskatchewan, Ontario, Quebec, New Brunswick, Nova Scotia, Newfoundland and Labrador.[205] In these provinces, the identification of significant shale gas reserves, often in close proximity to population centres including Aboriginal communities, has raised serious questions about the application of hydraulic fracturing.[206]

The federal and the provincial legislatures are subject to the division of powers created in the Constitution Act, 1867.[207] In 1982 the Constitution Act, 1867 was amendment giving provinces greater control over non-renewable natural resources.[208] In terms of the 1982 amendment the regulation of natural resources, including oil and natural gas, is generally a provincial responsibility.[209] There has been a broad range of approaches to the regulation of hydraulic fracturing in Canada, ranging from relatively permissive regulation, in the western provinces of British Columbia and Alberta, to some provinces imposing a moratorium, such as Quebec.[210]

As the majority of fracturing has occurred in the western provinces of British Columbia and Alberta and as these provinces have greater regulatory experience, this dissertation will focus

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[202] Canadian Water Network '2015 Water and Hydraulic Fracturing' (2015) *Canadian Water Network Report* at 19.

[203] Ibid.

[204] The Council of Canadian Academies op cit (note 52) 1.

[205] Ibid.

[206] Canadian Water Network op cit (note 202) 19.

[207] See sections 91 and 92.

[208] Section 92A.

[209] Ibid.

[210] Canadian Water Network op cit (note 202) 19.

on regulation in these provinces. However, it is not assumed that the other Canadian provinces' approaches should not be considered in South Africa. Considering water scarcity and the country's vulnerability to drought and also our relative lack of expertise and lack of infrastructure for shale gas extraction imposing a moratorium may be a prudent decision, at least until the risks are fully understood.[211] This approach may be more in line with the precautionary principle as detailed at chapter 1.4 above.

Below is a brief summary of hydraulic fracturing undertaken in British Columbia and Alberta to date.

3.2.1 British Columbia

Shale gas production is geographical concentrated in British Columbia, where shale gas reserves are all located in the northeast corner of the province.[212] In the province 7 300 wells have been fractured since 2005, and between 500 to 1 000 new wells are being permitted each year.[213] According to optimistic projections from the Canadian Association of Petroleum Producers, shale gas from British Columbia's two current major shale gas zones, the Horn River and Montney Basins, could account for fully 22 per cent of all of North American shale gas production by 2020.[214]

Fracturing has had numerous economic benefits.[215] The British Columbia government, trusted with protecting the public interest, has a major stake in increased extraction, as resource revenues contribute a significant and growing share of government fiscal capacity.[216] By 2008, British Columbia's oil and gas industry provided the single largest source of resource revenue

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[211] See Havemann et al op cit (note 166) and Glazewski and Pilt op cit (note 46) 190-219.

[212] The Council of Canadians 'Fracking Across Canada' (2014) *A Fractivist's Toolkit Report* at 7.

[213] Ibid.

[214] Ibid.

[215] Ibid.

[216] Ibid.

to the provincial government, $4.09 billion, up from about $75 million in 1992 and $1 billion dollars in 2001.[217]

In an attempt to maximize these benefits, the British Columbia government has reduced oversight of the oil and gas industry in the past 17 years, thus enabling rapid expansion.[218] The fundamental change came in 1998, when British Columbia established the Oil and Gas Commission as a single regulatory body for the oil and gas industry to fast track the permitting process for oil and gas projects.[219]

This fundamental shift in industry oversight was followed in 2003 by the British Columbia Oil and Gas Development Strategy, which included road infrastructure credits, royalty reductions, and regulatory 'streamlining' and subsidies that saved the industry hundreds of millions of dollars and thus encouraged shale gas extraction in the Province.[220]

Currently, falling oil and gas prices have slowed the pace of development.[221] While it is difficult to predict the long-term trajectory for the industry as a whole, continued development of unconventional reserves in Canada is expected in the future.[222]

The rapid development of shale gas in a deregulated environment has raised many environmental and social concerns.[223] Development has created much discontent in northeast

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[217] Canadian Energy Research Institute 'Economic Impacts of Drilling, Completing and Operation of Gas Wells in Western Canada (2010-2035)' available at http://www.ceri.ca/images/stories/CERI_IO_Natural_Gas_Report_June_2011.pdf, accessed on 15 November 2015.

[218] B Pariff 'Fracking Up Our Water, Hydro Power and Climate: BC's Reckless Pursuit of Shale Gas' (2011) *Climate Justice Project Report* at 8.

[219] Ibid.

[220] Ibid.

[221] Canadian Water Network op cit (note 202) 57.

[222] Ibid

[223] See for example C Arsenault *Loud bangs and quiet Canadians: power, property relations and anti-Encana sabotage in northeastern British Columbia* (unpublished MA thesis, the University of British Columbia, 2011).

British Columbia and local landowners have argued that by bearing the negative consequences of energy production, rural people are 'subsidizing natural gas production for consumers in the United States and Ontario by shouldering all the pollution costs.'[224]

To attempt to address some of these environmental and social impacts, the British Columbia government has recently amended its fracturing regulations. To address the concerns surrounding the use of chemical additives in fracturing fluids, British Columbia now requires public disclosure of fracturing fluids on the website www.fracfocus.ca.[225] This development will be discussed in greater detail in chapter 5 below.

3.2.2 Alberta

The vast majority of Canada's proven oil and gas reserves and production facilities are located within the province of Alberta.[226] Discoveries of oil and gas in Alberta have made Alberta the largest producing region in North America.[227] The Alberta Energy Regulator states that 171 000 wells have been fractured since the 1950s, however, multi-stage, horizontal fracturing is relatively new in Alberta.[228]

According to the Alberta Geological Survey, there are 15 prospective shale gas formations in the province.[229] The Alberta Geological Survey estimates that five of these formations

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[224] Ibid at 9.

[225] British Columbia Ministry of Energy and Mines 'Canada's first hydraulic fracturing registry now online' available at https://news.gov.bc.ca/stories/canadas-first-hydraulic-fracturing-registry-now-online, accessed on 25 September 2015.

[226] R Deyholos and D Cuschier 'Canada' in D Peaks (ed) *Oil & gas: A comparative guide to the regulation of oil and gas projects* (2012) 31.

[227] Ibid.

[228] The Council of Canadians op cit (note 212) 13.

[229] C Rokosh et al 'Summary of Alberta's Shale- and Siltstone-Hosted Hydrocarbons' (2012) *Energy Resources Conservation Board File Report* at 1.

(Duvernay, Muskwa, Basal Banff/Exshaw, North Nordegg, and the Wilrich) may contain up to 1 291 trillion cubic feet of shale gas.[230]

Shale gas extraction is primarily regulated by the Alberta Energy Regulator.[231] The Board's mandate is to ensure that the discovery, development, and delivery of Alberta's energy resources take place in a manner that is fair, responsible, and in the public interest.[232] Alberta Environment and Sustainable Resources Development is a provincial ministry responsible for overseeing the environmental protection of Alberta's land, air and water.[233] The Alberta Energy Regulator is supposed to work in conjunction with Alberta Environment and Sustainable Resources Development to regulate the environmental impacts on shale gas extraction.[234]

Like in British Columbia, Alberta has attempted to attract investment in the oil and gas industry by reducing the regulatory burden on oil and gas companies.[235] This deregulation has resulted in reduced environmental regulations and there has been opposition to fracturing as farmers and landowners have claimed that fracturing is having an adverse impact on their drinking water, crops and farms.[236] Landowner Jessica Ernst launched a lawsuit against Encana Corporation, Alberta Environment and the Energy Resources Conservation Board over contamination of her well water.[237]

In terms of the claim Ernst alleged that the oil company EnCana had contaminated a shallow aquifer used by a rural community with natural gas and toxic industry related chemicals.[238] In

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[230] Ibid.

[231] *Ernst v Alberta* op cit (note 126) at para 16.

[232] Ibid at para 18.

[233] Government Gazette Act, R.S.A 2000, c. G-10.

[234] *Ernst v Alberta* op cit (note 126) at para 2.

[235] The Council of Canadians op cit (note 212) 7.

[236] Ibid.

[237] *Ernst v Alberta* op cit (note 126) at para 285.

[238] Ibid.

or around 2011, EnCana allegedly broke several laws, regulations and requirements that were intended to protect drinking water supplies and accidentally injected hydraulic fracturing fluids, consisting of methane and other fluids, directly into sandstone at a depth of 136 m when the operators believed they were fracturing at about 1.5 km.[239]

Alberta has also recently adopted regulations that attempt to protect the environment, human health and water resources. Like British Columbia, Alberta requires that companies disclose their fracturing fluids publically on www.fracfoucs.ca. The regulation of hydraulic fracturing fluids in Alberta is discussed in greater detail in chapter 5.4 below.

[239] The Council of Canadian Academies op cit (note 52) 8.

Chapter 4: Regulation of disclosure of chemical additives used in hydraulic fracturing fluids in South Africa

4.1 The Constitution

The right to access information is contained in section 32 of the Constitution. In terms of the Constitution everyone is entitled to information held by the State and information that is held by another person (legal or juristic person).[240]

The right to access to information is critical to fostering a culture of justification in South African society.[241] Our courts have found the right to be, amongst other things, a 'necessary adjunct to an open and democratic society committed to the principles of openness and accountability.'[242] These values are also central to good environmental management, as decision-making needs to be based on available, clear and understandable information that is made available to all relevant stakeholders to allow for informed and justified decisions to be made.[243]

Access to information is critical to upholding of the environmental right contained in the Constitution.[244] In terms of the environmental right everyone has the right to an environment that is not harmful to their health or wellbeing.[245] A person who wishes to exercise his/her environmental right often requires evidence and information before any environmental measures (whether administrative, civil or criminal in nature) can be instituted.[246] For example, a person whose health or wellbeing is being impacted on by emissions from a factory will require information on the emissions of the factory before he/she can seek to enforce his/her environmental right.[247]

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[240] Ibid.

[241] Mureinik op cit (note 44) 43.

[242] *Qozeleni v Minister of Law and Order and Another* 1994 (3) SA 625 (EC) at 642E-G.

[243] du Plessis op cit (note 45) 183.

[244] Section 24.

[245] Ibid.

[246] W du Plessis 'Chapter 8: Access to information' in A Paterson and L Kotzé (eds) *Environmental Compliance and Enforcement in South Africa* 2 ed (2009) 198.

[247] Kidd op cit (note 40) 28.

Furthermore, access to information is critical to upholding a number of other rights, including the right to sufficient water in terms of the Constitution.[248] As water is the 'lifeblood'[249] of the Karoo region any adverse impact on scarce ground and surface water could essentially prevent local residents from accessing sufficient water.[250] It is accordingly critical that local residents have access to all information that may adverse effect their ability to access sufficient water.

One of the most unique and potentially powerful features of the right to access to information is the provision for access to information held by private bodies.[251] The right expressly recognises the horizontal application of the right to access to information from juristic persons.[252] However, the horizontal application of the right is qualified, only entitling the claimant to a right of access to information held by private entities if the information is required to exercise or protect a right.[253] Within the context of requesting access to information on what chemical additives are used in a fracturing operation, communities should be able to rely on the right to an environment that is not harmful to a person's health or wellbeing contained or the right to access to sufficient water in the Constitution. This issue is discussed in greater detail in chapter 4.2.1 below.

The Constitution requires national legislation to be enacted to give effect to the right of access to information.[254] Pursuant to this requirement PAIA was enacted. Our courts[255] have found

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[248] Section 27(1)(b).

[249] Havemann et al op cit (note 166) 80.

[250] The right to access to sufficient water is amplified in the National Water Act. Among other things the Act lays down stringent water licensing criteria as well as providing for a 'Reserve'. The section 27(1)(b) right to sufficient water, more specifically what constituted sufficient water, was the subject of protracted litigation culminating in the Constitutional Court in *Mazibuko v City of Johannesburg (Centre for Housing Rights as Amicus Curiae)* 2010 (4) SA 1 (CC) where in the context of the Phiri residents in Soweto the court dismissed the argument that 25 litres of water per person per day was insufficient to meet their basic needs.

[251] D McKinley 'The State of Access to Information in South Africa' Prepared for the Centre for the Study of Violence and Reconciliation (2004) *Centre for the Study of Violence and Reconciliation Report* at 32.

[252] Section 32 of the Constitution of the Republic of South Africa, 1996.

[253] Ibid section 32(1)(b).

[254] Ibid section 32(2).

that a cause of action based on the right of access to information cannot normally be brought in terms of the Constitution but should rather be brought through the national legislation enacted to give effect to the right, namely PAIA.[256] Accordingly PAIA is discussed below.

4.2 The Promotion of Access to Information Act (PAIA)

PAIA aims to foster a culture of transparency and accountability in both public and private bodies by giving effect to the right to access to information.[257] PAIA also seeks to actively promote a society in which the people of South Africa have effective access to information to enable them to exercise and protect all rights more fully, including the environmental right.[258] PAIA enables access to information from both private and public bodies through a formal procedure.

PAIA allows both private individuals and the State to request records from private companies.[259] Disclosure of information held by private companies is justified by the public nature of the activities of some corporations and the risks to the public that are inherent in the capital investment process.[260] Similarly, and of specific relevance to hydraulic fracturing, greater transparency can be justifiably demanded of private entities that produce toxic emissions or other pollutants that can have a severe impact on the public.[261]

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[255] See *Institute for a Democratic Society and Others v African National Congress* 2005 (5) SA 39 (C) para 17.

[256] The right can only have direct application in the case of a challenge to the constitutionality of a provision of PAIA itself, when other legislation or conduct beyond the reach of PAIA is challenged as an infringement of section 32 or when litigation seeking access to information that is not covered by PAIA. PAIA does not replace the Constitutional right, but rather gives effect to it and therefore the right and PAIA act independently. See I Currie 'South Africa's Promotion of Access to Information Act' (2003) 9 *European Public Law* 66.

[257] du Plessis op cit (note 45) 183.

[258] Ibid.

[259] I Currie and J Klaaren *The Promotion of Access to Information Act Commentary* (2002) 20.

[260] Ibid.

[261] Ibid.

In terms of PAIA members of the public can request access to records from private bodies.[262] In terms of section 1 of PAIA records are defined very broadly and mean any recorded information, regardless of form or medium of a private or public body, regardless of when the record came into existence.[263] *Prima facie* any records containing the content of the chemical additives used in fracturing fluids will be regarded as records in terms of PAIA.

Section 1 of PAIA defines private bodies as business entities, juristic persons and natural persons acting in their business or professional capacities. *Prima facie* fracturing companies will qualify as private bodies in terms of PAIA as they are companies acting in a private capacity for purely commercial purposes.

As explained by Hoexter, section 50 of PAIA imposes three requirements that need to be satisfied before a requestor will be entitled access to a record of a private body.[264] Firstly, the record must be required for the exercise and protection of a right.[265] Secondly, the requestor must have complied with all the procedural requirements of PAIA.[266] Thirdly, the record is not refused on a justifiable ground of refusal set out in PAIA.[267] Each of these thresholds will be analysed below in the context of requesting information on hydraulic fracturing fluids.

4.2.1 Record required for the exercise and protection of a right

There has been considerable debate in cases as to what sort of 'rights' are intended and in what sense the information must be 'required' for their protection.[268] Within the hydraulic

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[262] Section 9(d) of PAIA.

[263] C Hoexter *Administrative Law in South Africa* 2 ed (2012) 97.

[264] Ibid at 100.

[265] Ibid.

[266] Ibid.

[267] Ibid.

[268] Ibid.

fracturing context, the right that a potential claimant could rely upon is the right to an environment that is not detrimental to their health or wellbeing contained in the Constitution.[269]

Included in this right is the entitlement to the prevention of pollution, as well as the securing of ecological sustainable development.[270] The Bill of Rights binds both the State and all natural and juristic individuals and accordingly hydraulic fracturing companies have the obligation to not utilise the environment in a manner that would render the environment detrimental to another's health and wellbeing.[271] Therefore, the environmental right in the Constitution imposes a positive obligation on all private and public actors to not give effect to circumstances that could result in the environment becoming detrimental to the health and wellbeing of others.

In *Company Secretary of ArcelorMittal South Africa v Vaal Environmental Justice Alliance* the Supreme Court of Appeal held that a requester can also asserts its rights in terms of statutes that were enacted to give effect to the environmental right.[272] The Court made specific reference to rights contained in National Environmental Management Act,[273] the National Water Act[274] and the National Environmental Management: Waste Act.[275] For instance, the Court held that a requestor could rely on the right to participate in environmental governance contained in the National Environmental Management Act,[276] and the right to ensure that the nation's water resources are protected, used and managed in ways which take account of the

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[269] Alternatively they could seek to rely upon the right to access to sufficient water.

[270] Section 24 of the Constitution of the Republic of South Africa, 1996.

[271] Ibid.

[272] 2015 (1) SA 515 (SCA) at para 60.

[273] 107 of 1998. See for example section 2 of the National Environmental Management Act where the precautionary principle is reflected in the sub-principle that 'a risk-averse and cautious approach [be] … applied which takes into account the limits of current knowledge about the consequences of decisions and actions.' Importantly, section 2 commences by stating that the principles '…apply throughout the Republic to the actions of all organs of state that may significantly affect the environment.'

[274] 36 of 1998.

[275] 59 of 2008.

[276] 107 of 1998. See section 2(4)(f).

need to meet basic human needs of present and future generations in terms of National Water Act.[277] These are examples of other rights which the public could rely upon when requesting records from a fracturing operator.

As to the meaning of 'required'[278] as used in PAIA the courts have held that, generally speaking, the question whether a particular record is 'required' for the exercise or protection of a particular right is inextricably bound up with the facts of that matter.[279] Courts have expressed a number of varying opinions on what PAIA entails when it states that information is 'required' for the protection of the abovementioned right, ranging from the information being 'essential', to information that is only 'relevant' to the protection of the right.[280]

In *Clutchco (Pty) Ltd v Davis* after extensive evaluation of the case law, the Supreme Court of Appeal held that the threshold is 'reasonably required' and not of necessity or dire necessity.[281] The Court further held that 'reasonably required' is 'about as precise a formulation as can be achieved, provided that it is understood to connote a substantial advantage or an element of need.'[282] The substantial advantage may be that the information contained in a record would be decisive for the enforcement of a right, or that information would bring a decisive end to the dispute concerning the enforcement of a right.[283]

Within the context of requesting records on hydraulic fracturing fluids, the threshold requirement that would result in a violation of section 24 of the Constitution, is not the

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[277] Section 2 of the National Water Act 36 of 1998 and *Company Secretary of ArcelorMittal South Africa v Vaal Environmental Justice Alliance* 2015 (1) SA 515 (SCA) at paras 64 and 69.

[278] Section 50(1)(a).

[279] *Unitas Hospital v Van Wyk* 2006 (4) SA 436 (SCA) at para 6 and *Company Secretary of ArcelorMittal South Africa v Vaal Environmental Justice Alliance* 2015 (1) SA 515 (SCA) at para 49.

[280] Hoexter op cit (note 262) 101.

[281] 2005 (3) 486 (SCA) at para 11-13.

[282] Ibid at para 13.

[283] *Claase v Information Officer of South African Airways (Pty) Ltd* [2006] SCA 163 (RSA) at para 9 and *Unitas Hospital v Van Wyk and Another* [2006] SCA 32 (RSA) at para 54.

occurrence of a death or disease, but merely the prevailing environmental circumstance, created by the conduct of the third party, that could bring about these events.[284] As pointed out by Du Bois and Glazewski, as a result of the wording of the Constitution[285] any epidemiological or toxicological evidence indicating that the environment has been detrimental to a claimant's health and wellbeing is enough evidence to indicate that an infringement of environmental right has taken place.[286] This, the authors continue, takes place irrespective of whether there is any proof of actual injury to an individual, or whether the element of causation has been established.[287] The authors interpret the threshold as a loss of capacity of the environment to support life, which unquestionably would be the outcome, should any toxic fracturing chemicals enter groundwater resources.[288]

The recent judgement of the Supreme Court of Appeal in *Vaal Environmental Justice Alliance v Appeal Company Secretary, ArcelorMittal SA*, discussed below in greater detail in chapter 4.2.4 below, confirms Du Bois and Glazewski's interpretation that courts will require disclosure of records in circumstances where merely the prevailing environmental circumstance, created by the conduct of a private company, could potentially result in circumstance that could bring about these events.[289] On the facts of the case no proof of actual injury was established and the information requested was required to verify the Vaal Environmental Justice Alliance's claims.[290] In essence the Court held that the mere release of toxic chemicals was enough to require disclosure.

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[284] F Du Bois and J Glazewski 'The Environment and the Bill of Rights' in Y Mokgoro and P Tlakula (eds) *Bill of Rights Compendium* issue 27 (2012) 2B.

[285] Section 24(a).

[286] Du Bois and Glazewski op cit (note 283) 2B.

[287] Ibid.

[288] Ibid.

[289] 2015 (1) SA 515 (SCA).

[290] Ibid at 81.

Accordingly in the context of hydraulic fracturing, requestors will not have to prove actual harm but that merely the release of hydraulic fracturing fluids into the environment could result in harm being caused. This should not be an insurmountable task for requestors to overcome as recent research is painting a clearer picture of the risks associated with hydraulic fracturing.

For example, a study published in the Proceedings of the National Academy of Sciences found that drinking water sampled from three homes in Bradford County, Pennsylvania, revealed traces of a compound (2-n-butoxyethanol), which is known to have carcinogenic properties, commonly found in Marcellus Shale fracturing and drilling fluids.[291] The study indicates that hydraulic fracturing can, on occasion, pose a real threat to underground drinking water and indicates that shallow groundwater can be contaminated.

4.2.2 PAIA's procedural requirements

This requirement is not problematic in the context of hydraulic fracturing. PAIA states that a request for access to a record of private body must be made in the prescribed form (ie Form C) and must identify the right the requester is seeking to protect and provide an explanation of why the requested record is required for the exercise or protection of that right.[292]

4.2.3 Lawful grounds for refusal

Chapter 4 of PAIA sets out two categories of commercially valuable information protected from disclosure by PAIA.[293] The first is third-party commercial information in the hands of a private body that belongs to or relates to someone other than that body.[294] In terms of PAIA a private body must refuse a request for access to a record if the record contains trade secrets of a third party or commercial, financial scientific or technical information, other than a trade secret of a

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[291] Llewellyn et al op cit (note 123) 6326.

[292] Section 53 read with section 50(1)(a).

[293] Ibid.

[294] Ibid.

third party, and the disclosure of which would be likely to cause harm to the commercial or financial interests of that third party.[295]

From experience abroad many fracturing operators purchase their chemical products 'off the shelf' from chemical suppliers.[296] The composition of these chemical products is the proprietary information of third party suppliers and in terms of PAIA any requests for such information must be refused. In this instance the refusal is mandatory.[297]

The second category is that PAIA protects commercial information belonging to or relating to the body that is the recipient of the request.[298] In terms of PAIA a private body may refuse a request for access to a record that constitutes its own trade secret or its own commercial, financial, scientific or technical information, other than a trade secret of a third party, and the disclosure of which would be likely to cause harm to the commercial or financial interests of that private body.[299] Therefore, if fracturing operators develop their own fracturing fluid products they have discretion to refuse to disclose such information.

PAIA does not define what a trade secret is. In our law a trade secret is defined as confidential business or industrial information having particular economic value and the disclosure of which falls exclusively within the competency of the secret's proprietor.[300] Our courts generally look for three requirements to establish information as a trade secret: the information must relate to and be capable of application in trade or industry, it must be secret or confidential, and it must be of economic value to the proprietor.[301] Our courts have held that information on confidential

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[295] Section 64(1).

[296] United States House of Representatives Committee on Energy and Commerce op cit (note 90) 2.

[297] Du Bois and Glazewski op cit (note 283) 2B.

[298] Currie and Klaaren op cit (note 258) 134.

[299] Section 68.

[300] H Klopper et al *Law of Intellectual Property in South Africa* (2011) 61.

[301] H Van Heerden-Neethling *Unlawful Competition* 2 ed (2008) 215 and O Dean and A Dyer *Introduction to Intellectual Property Law* (2014) 195.

technical processes can be regarded as trade secrets.[302] On this basis, a trade secret would *prima facie* include the chemical composition of hydraulic fracturing fluid.[303]

From experience abroad, fracturing companies view the chemical composition of fracturing fluids as confidential commercial information that should be protected as trade secrets or confidential technical information.[304] Companies may also view the release of information, such as the chemical composition of fracturing fluids, as a business risk, as the disclosure of information may expose them to having to take remedial measures and also to potential administrative and criminal liability.[305] On this basis fracturing companies will presumably refuse requests from the public for records on fracturing fluids on the basis that the information is either their own or a third party's trade secret or commercially valuable technical information.

To overcome the discretionary refusal PAIA provides that a record may not be refused insofar as it contains information about the result of any product or environmental testing supplied by or carried out by the private body and its disclosure would reveal a serious public safety or environmental risk.[306] The information must be 'the results of any product or environmental testing or other investigation.'[307] It is doubtful that the mere description of chemical additives used in fracturing fluids would fall within this definition. However, any product or environmental testing on the chemical additives would fall within the scope of the definition.

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[302] See *Harvey Tiling Co (Pty) Ltd v Rodomac (Pty) Ltd and Another* [1977] 1 All SA 481 (T) at 486, *Aercrete South Africa (Pty) Ltd and Another v Skema Engineering Co (Pty) Ltd and Others* [1984] 2 All SA 26 (D) at 27 and *Meter Systems Holdings Ltd v Venter and Another* [1993] 3 All SA 574 (W) at 592.

[303] Currie and Klaaren op cit (note 258) 138.

[304] Maule et al op cit (note 20) 169.

[305] Heitmann et al op cit (note 55) 1.

[306] Section 68(2). S Raddatz *Access to Information - the International Perspective and a Comparative Review of South African and German Law in the Context of Nuclear Energy Development* (unpublished LLM thesis, UCT, 2007) 48.

[307] Section 70(a) of PAIA. As for this first aspect, the results of any such product or environmental testing or other investigations do not include the results of preliminary testing or other investigation conducted for the purpose of developing methods of testing or other investigation.

Furthermore, PAIA provides a trump to both the mandatory and discretionary refusals in that a record may not be refused insofar as it contains information that would reveal a substantial contravention of, or failure to comply with, the law, or an imminent and serious public safety or environmental risk.[308] This trump sets a very high threshold.[309] The override is confined to three public interest aspects; breach of the law, risk to public safety and environmental risk.[310] Mere evidence which establishes the risks is not sufficient as a balancing act must take place and the benefit to the public interest must clearly outweigh any harm of disclosure.[311] This override clause is therefore qualified and restricted in its application and is infrequently used.[312]

Whether or not requestors will be able to successfully invoke the trumps in terms of PAIA is a matter to be decided on facts and will be resolved on a case by case basis. PAIA places an evidentiary burden on the party who refuses a request.[313] Accordingly a fracturing company will only be able to validly refuse access to records if they are capable of adducing sufficient evidence to prove on a balance of probabilities that their refusal is justifiable in terms of PAIA.[314]

4.2.4 Limitations with PAIA requests

There has been a worrying trend in South Africa of a culture of secrecy and unresponsiveness developing in the corporate sector.[315] Private companies often view the release of such information as a business risk, as the disclosure of information may expose them to having to

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[308] Raddatz op cit (note 305) 48.

[309] J Glazewski *Environmental Law in South Africa* 3 ed (2010) 47.

[310] Ibid.

[311] Ibid.

[312] Ibid.

[313] Section 81(3).

[314] Ibid.

[315] *Vaal Environmental Justice Alliance v Appeal Company Secretary, ArcelorMittal SA* 2015 (1) SA 515 (SCA) at para 1.

take remedial measures and also to potential administrative and criminal liability.[316] Accordingly private companies are generally inclined to refuse PAIA requests for environmental records.[317]

The case of *ArcelorMittal South Africa and Another v Vaal Environmental Justice Alliance*,[318] which was referred to in chapter 4.2.1 above, is indicative of the struggles of a community to gain environmental records from a company that was releasing pollution into the environment. The Vaal Environmental Justice Alliance (VEJA), sought for a number of years to access environmental records relating to ArcelorMittal's Vanderbijlpark steel mill and ArcelorMittal's Vaal hazardous waste disposal site in the Vaal Triangle.[319] ArcelorMittal is regarded as a major, if not the major, polluter in the area and VEJA alleged that the pollution caused by ArcellorMittal has harmed the environment and also caused health impacts to its members.[320]

VEJA submitted its requests in terms of in the private-body request form 'Form C' as prescribed by PAIA.[321] In the forms, VEJA set out its credentials as an advocate for environmental justice and further indicated that the requested documents were necessary for the protection of the environmental right set out in the Constitution and were requested in the public interest.[322] VEJA also sought the information to ensure that the operations of ArcellorMittal are conducted in accordance with the law, that pollution is prevented, and that

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[316] Heitmann et al op cit (note 55) 1.

[317] Ibid.

[318] 2015 (1) SA 515 (SCA).

[319] Ibid at para 52. The Vaal Triangle is highly industrialised housing numerous large industrial operations, a coal fired power station, and various smaller industrial and commercial activities in addition to a few collieries and quarries. This concentration of industry generates a significant amount of air and water pollution and also generates substantial volumes of hazardous wastes. See Department of Environmental Affairs and Tourism 'Vaal Triangle Air-Shed Priority Area Air Quality Management Plan' (2008) *Department of Environmental Affairs and Tourism Plan* at 5.

[320] Ibid at para 52.

[321] Ibid at para 9.

[322] Ibid.

remediation of pollution is properly planned for and correctly and timeously implemented.[323] These requests were refused and this resulted in VEJA instituting legal proceedings against ArcellorMittal.[324] The matter eventually ended up in the Supreme Court of Appeal.[325] The Court found in favour of VEJA and compelled ArcellorMittal to disclose the requested information.

In coming to its decision the Supreme Court of Appeal stated that international trends, constitutional values and norms and the relevant environmental legislation (ie the National Environmental Management Act,[326] National Water Act[327] and NEMWA) all support the importance of consultation and interaction with the public.[328] As environmental degradation affects, to different degrees, all members of society, the Court promoted the notion of collaborative corporate governance in relation to the environment.[329] The Court acknowledged that a balance must be struck between industrial activity and its significance to the country's economic development and concerns about the preservation of the environment for the benefit of future and present generations.[330]

The Court's pronouncements clearly indicate it will enforce compliance with PAIA's obligations and are prepared to force corporations to release records. The decision is a clear indication that our judiciary supports the values of transparency and openness. Notwithstanding these pronouncements, the recent stance of private companies to releasing environmental

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[323] Ibid.

[324] Ibid.

[325] Ibid.

[326] 107 of 1998. See section 2(4)(f).

[327] 36 of 1998.

[328] Ibid at para 71.

[329] Ibid at para 71.

[330] Ibid.

information has hardened to the extent that only instituting often expensive and lengthy legal proceedings can compel disclosure.[331]

Seeking recourse from our courts is by no means an ideal for local communities as, first, litigation is very expensive, especially for under resourced and disempowered local communities, as they may have to fight well-resourced private corporations who have the time and money to take the matters to court. Second, it is debatable as to whether or not the information can still protect people's constitutional right to an environment that is not detrimental to their health and wellbeing. This is because court proceedings are lengthy and by the time information is received it may be a number of years after the initial request was made which may be too late if the harm to human health or the environment has already occurred.[332] It is accordingly preferable to require companies to automatically disclose what fracturing fluids they are using.

The Final Regulations contain disclosure provisions that regulate the disclosure of chemical additives in fracturing fluids. These provisions will be assessed below to determine whether or not they will assist members of the public with obtaining information on what fracturing fluids are being used in specific fracturing operations and thus whether the problematic PAIA request procedure can be avoided.

4.3 The final regulations for Petroleum Exploration and Production, 2015 (Final Regulations)

Draft regulations[333] on petroleum exploration and exploitation were published in October 2013 and the Final Regulations were published in June 2015.[334] The purpose of the Final Regulations is to prescribe standards and practices that must ensure the safe exploration and

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[331] Centre for Environmental Rights 'Barricading the Doors' (2013) *Centre for Environmental Rights Report* at 1.

[332] J Dugard and A Alcaro 'Let's work together: Environmental and socio-economic rights in the courts' (2013) 29(1) *South African Journal of Human Rights* 29.

[333] GN 1032 GG 36938 of 15 October 2013.

[334] GN 466 GG 38855 of 3 June 2015.

production of shale gas in the Karoo.[335] Final Regulations regulate *inter alia* the disclosure and use of hydraulic fracturing fluids.

4.3.1 Disclosure of fracturing fluids

In terms of the Final Regulations an applicant, as part of the impact assessment, must submit the following information relating to the competent authority (ie the Minister responsible for mineral resources or MEC concerned):[336]

> (a) fluids and their status as hazardous/non-hazardous substances;
>
> (b) material safety data sheet information;
>
> (c) volumes of fracturing fluid, including proppant, base carrier fluid and each chemical additive;
>
> (d) the trade name of each additive and its general purposed in the fracturing process;
>
> (e) each chemical intentionally added to the base fluid, including each chemical, the chemical abstracts service number, if applicable and the actual concentration, in per cent by mass;
>
> (f) possible alternatives;
>
> (g) possible risk of the above on the environment and water resources; and
>
> (h) remediation required if a pollution incident were to occur.

The Final Regulations requires full disclosure of fracturing fluid composition. The Final Regulations requires information of all of the chemicals and concentrations in a fracturing fluid and this information will allow the competent authority to fully understand the risk associated with the use of fracturing fluids.

The Final Regulations also requires possible alternatives to be disclosed.[337] In terms of the Final Regulations operators must, to the extent technically feasible, maximise the use of

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[335] Regulation 85.

[336] Regulation 113(2).

[337] Regulation 113(2)(f).

environmentally friendly additives.[338] Although the Final Regulations are not clear on this point, it appears that if more environmentally friendly alternatives can be identified, the competent authority has a discretion to require that the more environmentally friendly alternatives be used, to the extent that this is technically feasible.

The Final Regulations also requires a risk assessment of the fracturing fluids describing their potential impact on the environment and the water resources and also a description of what remediation measures would be required in the evident of a pollution incident occurring.[339] As discussed in chapter 5 below, these disclosure requirements go further than disclosure requirements in British Columbia and Alberta, which just require disclosure of what chemicals will be used.[340] However, the Final Regulations are vague and provide little guidance on the content of the risk assessment and remediation required to be disclosed.[341]

There are three major shortcomings with the Final Regulations insofar as they regulate the disclosure of fracturing fluids. First, unlike in British Columbia and Alberta (see chapter 5 below), the Final Regulations do not expressly allow for companies to refuse to disclose on the basis that it constitutes a trade secret. It appears that the information is requested as part of the impact assessment that must be undertaken to obtain an environmental authorisation in terms of the National Environmental Management Act.[342] In terms of Act, read with the Environmental Impact Assessment Regulations, 2014 [343] companies must provide the competent authority with all information that reasonably has or may have the potential of influencing any decision with regard to an application.[344] It is an offence to fail to provide

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[338] Regulation 115(3).

[339] Regulation 114(1).

[340] Regulation 113(2).

[341] Regulations 113(2)(g) and (h).

[342] 107 of 1998. See section 2(4)(f).

[343] GN R982 GG 38282 of 4 December 2014.

[344] Regulation 10(c). See J van Wyk 'Fracking in the Karoo: approvals required?' (2014) *Stellenbosch Law Review* 34-54 which summaries the main authorisations that are required to undertake fracturing in the Karoo.

information that may have an influence on the outcome of a decision of a competent authority.[345]

However, PAIA applies to the exclusion of other legislation that is materially inconsistent with the object, or specific provision, of PAIA.[346] In terms of PAIA, when information is requested, such information must generally be provided, unless some valid ground exists for refusing to do so.[347] As discussed in greater detail in chapter 4.2.3 above, PAIA allows for protection of trade secrets and other commercial and technical information from disclosure. Accordingly companies may seek to withhold information on their chemical additives on the basis that they constitute a trade secret or commercial or technical information that may be protected in terms of PAIA. There are, however, some interesting trumps that can be utilised to overcome the protection afforded to confidential information under PAIA which may be of use to persons seeking to obtain information on the fracturing fluids, see chapter 4.2.3 for a more detailed discussion of these trumps.[348]

Second, the disclosure in terms of the Final Regulations is required in terms of the impact assessment of an entire fracturing operation. The fracturing operation will presumably consist of multiple wells that could be spread out over a large area and the geological composition of these different wells could be varied. As every type of shale is different the well completion technology used to extract the gas must adapt to these variations.[349] Therefore operators may need to formulate different combinations and concentrations of chemicals for each well to

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The main authorisations are a technical co-operation permit, reconnaissance permit, exploration right or production right in terms of the MPRDA; an environmental authorisation for a listed activity in terms of the National Environmental Management Act; a water use licence/authorisation in terms of the National Water Act; a disposal licence in terms of the National Environmental Management: Waste Act; and a land use right in terms of provincial planning legislation. The article also provides a summary of the specific procedures for public participation for each authorisation.

[345] Regulation 48(1)(a).

[346] Section 5 of PAIA

[347] du Plessis op cit (note 245) 205.

[348] Ibid at 211.

[349] The Council of Canadian Academies op cit (note 52) 18.

maximize that shale's response to fracturing.[350] Accordingly, disclosure of fracturing fluids ought to be made on a well by well basis and cannot be made on a project basis, as required by the Final Regulations. As discussed in chapters 5.2 and 5.3, in British Columbia and Alberta, operators are required to disclose the chemical composition and concentrations of fracturing fluids per well.

Third, the Final Regulations requires disclosure of fracturing fluids to the competent authority, being the Minister responsible for mineral resources or MEC concerned.[351] However, the Final Regulations do not expressly require disclosure to the public. It is unclear whether this information is intended to be disclosed to the public during the environmental impact assessment procedure.[352] In British Columbia and Alberta the fracturing fluid composition is published online and all the information is publically available as the public can search for the reports on each well.[353]

People residing or working near a well, need information to know what are the associated risks so they can make choices about buying property or living in an area.[354] However, the Final Regulations are not clear on whether or not this information must be disclosed to the public. In the absence of an expression provision it is assumed that companies will be reluctant to

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[350] Leggette et al op cit (note 2) 155.

[351] Regulation 84 of the Final Regulations.

[352] A number of regulations in the Environmental Impact Assessment Regulations in GN R982 GG 38282 of 4 December 2014 imply that the details of the fracturing fluid composition may be disclosed publically, or at least to registered interested and affected parties, during the environmental assessment process. In terms of regulation 13(1)(f) the project's environmental assessment practitioner must disclose to registered interested and affected parties all material information that reasonably has or may have the potential of influencing any decision to be taken with respect to the application for an environmental authorisation by the competent authority. Furthermore, in terms of regulation 40(2) the public participation must occur during the environmental assessment process and must provide access to all information that reasonably has or may have the potential to influence any decision with regard to an application to all potential, or, where relevant, registered interested and affected parties. However, these regulations are qualified that such disclosure is required unless access to that information is protected by law. As discussed in greater detail in chapter 4.2.3 above, the composition of fracturing fluids may be regarded as a trade secret or commercial or technical information that may be protected in terms of PAIA.

[353] FracFocus 'FracFocus Chemical Disclosure Registry Canada' available at http://www.fracfocus.ca/, accessed on 25 November 2015.

[354] Centner op cit (note 57) 237.

publically disclose what chemicals additives they are using. Members of the public may therefore have to make an access to information request in terms of PAIA to obtain information on the fracturing fluids used in a specific fracturing operation. The Final Regulations accordingly do little to assist the public with obtaining information of the fracturing fluids used in a fracturing operation.

4.3.2 Prohibition against the use of certain chemical additives

The substances listed in the schedule 1 of the Final Regulations are prohibited from use as chemical additives in the fracturing process.[355] Schedule 1 contains a list of 49 chemicals that are prohibited from the fracturing process.[356] The Final Regulations essentially prohibits the use of all of the chemicals of concern identified by the Committee on Energy and Commerce of the U.S. House of Representative (see table 2 in chapter 2.3 above) from being used as chemical additives in the hydraulic fracturing process in South Africa.

This prohibition will have serious implications on hydraulic fracturing operators as they will be prohibited from using commonly used chemical additives. For example, methanol and ethylene glycol (1, 2 ethanediol)) which are prohibited in terms of Schedule 1 are two of the most often used in hydraulic fracturing products between 2005 and 2009 in the USA, see Table 1 in chapter 2.3 above.[357]

While the prohibition appears to be aimed at protecting water quality, a number of points arise. Firstly, other hazardous alternatives that do not appear in Schedule 1 could still be used in hydraulic fracturing process. Accordingly, the Final Regulations only prohibits the use of the

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[355] Regulation 113(1).

[356] The entire list consists of the following chemicals; methanol (methyl), ethylene glycol (1, 2), diesel, naphthalene, xylene, hydrogen chloride, toluene, ethylbenzene, diethanolamine (2,2-iminodiethanol), formaldehyde, sulphuric acid, thoreau, benzyl chloride, cumene, nitrilotriacetic acid, dimethyl formamide, phenol, benzene, di (2-ethyhexyl) phthalate, acrylamide, hydrogen fluoride (hydrofluoric), phthalic anhydride, acetaldehyde, acetophenone, copper, ethylene oxide, lead, propylene oxide, p-xylene, 1-methylnaphthalene, 2-butanone, aniline, 2-methylphenol, 3-methylphenol, 4-methylphenol, acetonitrile, phenol, thiophene, pyrrole, 2-methylnaphthalene, benzidine, isophorone, chloroethane, 2-pyrrolidone, vinyl chloride, bromomethane, 4-methylphenol, acetone and 2-hexanone.

[357] United States House of Representatives Committee on Energy and Commerce op cit (note 90) 1.

hazardous chemicals contained in Schedule 1 and is not an absolute prohibition on the use of hazardous and toxic chemicals in the fracturing process as such.

It ought to be pointed out that in terms of the Final Regulations operators must, to the extent technically feasible, maximise the use of environmentally friendly additives and minimise the amount and number of additives.[358] The phrase 'to the extent technically feasible' is not defined in the Final Regulations and presumably gives companies some leeway to still use toxic substances if the use of non-harmful substances is not technically feasible.

The use of toxic and hazardous fracturing fluids is further implicitly discouraged in terms of the Final Regulations. Operators must, prior to and during all the phases of drilling and hydraulic fracturing operations, ensure that the operation does not pollute a water resource or reduce such a resource.[359] Where such an incident occurs, an operator must implement the necessary remedial measures to ensure that the operation does not cause an adverse impact to water quality in the catchment area and the rights of existing water users are protected. The Final Regulations unfortunately do not further elaborate on how these objectives are to be achieved. The Final Regulations also do not refer to the National Water Act[360] which is the primary legislation regulating the protection of water resources.

The prohibition on the use of chemicals listed in Schedule 1 illustrate that the Final Regulations seek to ensure the protection of water quality in the Karoo.[361] From this perspective the Final Regulations are novel as, for example, the upstream oil and gas industry in the United States is

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[358] Regulation 115(3).

[359] Regulation 122(1).

[360] 36 of 1998.

[361] The Final Regulations contain a number of other provisions that seek to protect water quality in the Karoo. Regulation 122(2) seeks to protect water resources by prescribing minimum distances from water resources where hydraulic fracturing cannot occur. In terms of regulation 122(2) a well site where hydraulic fracturing operations are proposed or planned, must not be located within 5 kilometres, measured horizontally, from the surface location of an existing municipal water well field and identified future well fields and sources. Directional drilling may not be, measured horizontally, within 2.5 kilometres of municipals well field or within 500 metres of a water borehole or from the edge of a riparian area or within 1:100 year flood line of a watercourse. Furthermore, in terms of regulation 122(3) a well may not be drilled within 1 kilometre of a wetland.

not subject to regulations regulating groundwater contamination and, in 2005, received exemption from proposed regulations under the U.S. Safe Drinking Water Act covering hydraulic fracturing (except for diesel fuel).[362]

Whether or not the prohibition will be enforced in practice remains to be seen. Public interest groups have welcomed the prohibition, but have pointed out that as many of these substances are released from rock formations during drilling and fracturing as well and would pose a risk, it will be difficult to monitor the prohibition to ensure that companies comply.[363]

There are doubts whether the Department of Mineral Resources and Energy, who will be responsible for monitoring compliance with the prohibition, possesses the necessary capacity and staff or the political will[364] to ensure the proper enforcement of environmental laws in the hydraulic fracturing context.[365] If the regulator fails to enforce the prohibition there is little in terms of the Final Regulations the public can do to determine whether or not the prohibition is being complied with. This is because, as discussed in greater detail in chapter 4.3.1 above, the Final Regulations do not make any express provision for the public disclosure of the chemical additives used in a specific fracturing operation.

Having examined the regulation of the disclosure and use of hydraulic fracturing fluids in South Africa, the next chapter will assess how the disclosure and use of fracturing fluids is regulated in the Canadian provinces of Alberta and British Columbia.

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[362] The Council of Canadian Academies op cit (note 52) 157.

[363] Treasure the Karoo 'Initial Review of the Regulations for Petroleum Exploration and Production June 2015' available at http://www.treasurethekaroo.co.za/pdf/TKAG's%20preliminary%20review%20of%20the%20fracking%20regulations.pdf, accessed 20 November 2015.

[364] The mandate of the Department of Mineral Resources is to optimise the exploitation of minerals and to regulate energy matters and not to protect the environment for future generations. W du Plessis 'Legal mechanisms for cooperative governance in South Africa: successes and failures' (2008) 23 *South African Public Law* 87 and T Le Quesne 'The Divorce of Environmental and Economic Policy under the First ANC Government, 1994-1999' (2000) 1 *South African Journal of Environmental Law and Policy* 13.

[365] du Plessis op cit (note 363) 87.

Chapter 5: Regulation of disclosure of chemical additives used in hydraulic fracturing fluids in Canada

5.1 Background

In Canada, being a federal state, provinces manage and generally own their oil and gas resources, and are the custodians of surface water and groundwater.[366] The regulation of natural resources, including oil and natural gas, is generally a provincial responsibility.[367] However, the federal government also retains some jurisdiction over environmental matters in the provinces.[368]

In Canada fracturing has largely occurred in the western provinces of British Columbia and Alberta, where there is a more significant history of oil and gas production and greater regulatory experience.[369] Accordingly this chapter will focus on regulation of chemical additives in these two provinces.

This chapter will explore how the chemical additives are regulated both at a federal level and also at a provincial level in the Canadian provinces of Alberta and British Columbia

5.2 Federal regulation

The National Pollutant Release Inventory (NPRI) is Canada's legislated, publicly accessible inventory of pollutant releases (to air, water and land), disposals and transfers for recycling.[370] It is used for identifying pollution prevention priorities, supporting the assessment and risk

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[366] The Council of Canadians op cit (note 212) 1.

[367] Ibid. See section 92 of the British North America Act of 1867.

[368] C Rivard et al 'An overview of Canadian shale gas production and environmental concerns' (2014) *International Journal of Coal Geology* at 9. The federal government responsibilities also include inter-provincial and international energy trade, cross-jurisdiction pipelines, exports/imports as well as natural resource regulation powers in Aboriginal lands.

[369] Canadian Water Network op cit (note 202) 19.

[370] Environment Canada 'The National Pollutant Release Inventory Oil and Gas Sector Review' available at https://www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=02C767B3-1, accessed on 21 November 2015.

management of chemicals, helping develop targeted regulations for reducing releases of toxic substances, encouraging actions to reduce the release of pollutants into the environment and improving public understanding of the risks associated with pollutants released into the environment.[371] It captures data on over 300 substances of concern, including many substances declared toxic under the Canadian Environmental Protection Act, 1999[372] from a wide variety of industrial sectors.[373] All of the captured information is available on a publicly accessible database that discloses the toxic substances that are released into the environment.[374] The database is updated annually by Environment Canada.[375]

Exploration and drilling activities in the oil and gas sector are exempt from reporting to the NPRI.[376] There has been some controversy surrounding whether or not the hydraulic fracturing process falls within the definition of exploration and drilling, but Environment Canada has interpreted that hydraulic fracturing falls within the scope of the exemption.[377] Environment Canada is currently undertaking a review of NPRI reporting requirements for oil and gas

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[371] Ibid.

[372] S.C. 1999, c. 33. The Canadian Environmental Protection Act grants both the Minister of the Environment and the Minister of Health the authority to develop a list of substances to be assessed in determining whether a substance is, or has the potential to become 'toxic'. Once a substance is added to the list, known as the Priority Substances List (PSL), an assessment regarding the toxicity of the substance must be made within five years. The overall objective of this phase is to characterize the type and magnitude of adverse ecological effects, direct or indirect, that could occur following exposure to a substance (or a degradation product of the substance) in the environment. See Environment Canada 'Overview of the Ecological Assessment of Substances under the Canadian Environmental Protection Act, 1999' available at https://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=2EA5D840-1&offset=2&toc=show, access on 21 November 2015.

[373] Environment Canada op cit (note 369).

[374] A Diredzic, 'What lies beneath? Access to Environmental Information in Alberta' (2014) *Environmental Law Centre Report* at 12.

[375] Ibid.

[376] Environment Canada op cit (note 371).

[377] A Gage 'Canadians have a right to know about fracking, tar sands chemicals' available at http://wcel.org/resources/environmental-law-alert/canadians-have-right-know-about-fracking-tar-sands-chemicals, accessed on 21 November 2015.

facilities, including hydraulic fracturing operations, which may change the federal reporting requirements in the future.[378]

Accordingly, due to this exemption, fracturing fluids are not currently required to be reported federally to the NPRI because facilities used for oil and gas exploration or the drilling of oil or gas wells are exempt from NPRI reporting requirements.[379] In the absence of federal regulation the provinces have developed their own reporting and disclosure requirements.

5.3 British Columbia

In British Columbia, the regulation of natural resources, including oil and natural gas, is a provincial responsibility.[380] In 1998, the Province established the British Columbia Oil and Gas Commission as a single regulatory body for the oil and gas industry.[381] The reason for the new Oil and Gas Commission was created in 1998 was to streamline the permitting process by creating a 'single window' regulator, which could grant approvals for new projects.[382]

The Commission has the mandate to both encourage growth and investment in shale gas extraction and also to address and regulate environmental and social considerations.[383] The Commission regulates all oil and gas activities and pipelines in British Columbia, including environmental impacts and water use authorisations.[384] The Commission also regulates the use and disclosure of fracturing fluids.

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[378] Environment Canada op cit (note 369).

[379] P Gass et al 'Attaining Sustainable Development of Oil and Gas in North America Appendix: Canada Policy Briefs' (2014) *Resources for the Future Report* at 5.

[380] Section 92 of the British North America Act of 1867.

[381] British Columbia Oil and Gas Commission 'About us' available at https://www.bcogc.ca/about-us, accessed 20 January 2016.

[382] Pariff et al op cit (note 218) 8.

[383] Ernst and Young 'Review of British Columbia's hydraulic fracturing regulatory framework March' (2015) *Ernst and Young Report* 6.

[384] Pariff et al op cit (note 218) 8.

To parallel the publically available United States' hydraulic fracturing chemical registry FracFocus, which provides information related to chemical additives used in the fracturing process, British Colombia has implemented the website 'www.fracfocus.ca'.[385] It did this by entering into a license agreement with FracFocus to create a Canadian version of FracFocus.[386] As of 1 January 2012, disclosure of used additives on this website is required by the British Columbia Oil and Gas Commission.[387]

Under regulations created under British Columbia's Oil and Gas Activities Act,[388] each operator must submit the following information to the Commission: fracture date, the location of the well, total water used, trade name of each chemical, the supplier of each chemical, the purpose of each chemical, the name of each ingredient, the maximum additive concentration of each ingredient and the maximum fluid concentration of each ingredient.[389]

The information must be submitted within thirty days of the completion of operations at a well.[390] Being provided the information 30 days after the operation has been completed means that the public can only react to fracturing operations.

The Commission, upon receipt, will post the information on the website www.fracfocus.ca.[391] All the information posted on the website is publically available as the public can search for the reports on each well at www.fracfocus.ca and they are made available in pdf format.[392] Unlike

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[385] P Leggette et al 'Trade secrets and the regulation of hydraulic fracturing' (2013) *Norton Rose Fulbright Report* at 21.

[386] Ibid.

[387] Rivard et al op cit (note 367) 5.

[388] SBC 2008, c.36.

[389] British Columbia Oil and Gas Commission 'Fracture Fluid Report Upload Manual Version 1.1' (2012) *British Columbia Oil and Gas Commission Report* 15.

[390] Ibid.

[391] Ibid.

[392] Ibid.

in South Africa, information about the fracturing fluids used in each well is made available to the public.

However, the Commission allows natural gas companies to apply to the federal government's Hazardous Materials Information Review Commission in terms of the Hazardous Material Information Review Act[393] to keep substances they consider to be trade secrets off of the database.[394] The Review Commission was established to provide an independent mechanism to evaluate both the validity of trade secret claims for exemption to the disclosure requirements and the compliance of material safety data sheets and labels for these products.[395]

In terms of the Hazardous Material Information Review Act, an applicant may file a claim for exemption from providing the chemical ingredient, its concentration and the name of any toxicological study that identifies the ingredient.[396] Companies who obtain a registration for their trade secret information will be provided with a registry number from the Hazardous Materials Information Review Commission (the responsibilities of Review Commission were transferred to Health Canada on 1 April 2013).[397] This registry number will be submitted onto www.fracfocus.ca instead of the actual chemical identity, concentration and toxicological study.[398] Accordingly the chemical identity, concentration and toxicological study of the additive will not be disclosed to the public.

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[393] RSC 1985, c 24.

[394] British Columbia Oil and Gas Commission op cit (note 388) 16.

[395] Leggette et al op cit (note 394) 30.

[396] RSC 1985, c 24.

[397] Gass et al op cit (note 378) 5.

[398] British Columbia Oil and Gas Commission op cit (note 388).

Obtaining a Hazardous Materials Information Review Commission registry number for a trade secret is relatively easy.[399] If the claim is accepted, a notice of the decision is then published in the federal government's official publication, the Canada Gazette.[400]

Any affected party may then appeal the decision and ask that the trade secret information be made public.[401] However, an affected party is not just anyone however.[402] The party must be either a supplier of the controlled product, an employee or employer of the workplace where the product is being used, or a health and safety professional at the workplace where the product is being used.[403] Accordingly members of the general public who are affected by a fracturing operation generally lack standing to appeal decisions about trade secrets. Certain government officials and medical professionals are able to access information on trade secrets, using the Hazardous Materials Information Review Commission number, under specific circumstances.[404]

From experience in the United States, that also utilizes FracFocus, the United States Environmental Protection Agency conducted an analysis of more than 39 000 FracFocus[405] disclosures over the period 1 January 2013 to 1 March 2013 and found that more than 70 per cent of disclosures contained at least one chemical designated as a trade secret or other proprietary business information.[406] Accordingly, in 70 per cent of wells surveyed the public

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[399] Leggette et al op cit (note 394) 20.

[400] Ibid.

[401] Ibid.

[402] Ibid.

[403] Ibid.

[404] Gass et al op cit (note 378) 5.

[405] Like in British Columbia and Alberta, a number of states in America allow for disclosure of chemical additives via the FracFocus website.

[406] United States Environmental Protection Agency 'Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources' (2015) *United States Environmental Protection Agency Report* at 197.

would not have information on all of the chemical additives used in the fracturing process.[407] By utilizing the trade secret exemption fracturing companies can relatively easily withhold information on the chemical additives they use.

5.4 Alberta

In Alberta two provincial government departments regulate hydraulic fracturing and its associated environmental impacts; the Alberta Energy Regulator and Alberta Environment and Sustainable Resources Development.[408] The Alberta Energy Regulator is Alberta's primary energy regulator.[409] The Alberta Energy Regulator's mandate is to ensure that the discovery, development, and delivery of Alberta's energy resources take place in a manner that is fair, responsible, and in the public interest.[410] While having a mandate to protect Alberta's water, the Alberta Energy Regulator, is also mandated to seek to avoid imposing unnecessary regulatory burden on industry.[411]

Alberta Environment and Sustainable Resources Development is a provincial ministry responsible for overseeing the environmental protection of Alberta's land, air and water.[412] Alberta Environment and Sustainable Resources Development has a mandate to establish policies related to the protection and sustainable use of all water by all industry and the

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[407] Furthermore, according to data compiled by Bloomberg, energy companies failed to list information for more than two of every five fractured wells in eight United States in 2011. See B Elgin et al 'Fracking Hazards Obscured in Failure to Disclose Wells' *Bloomberg* 14 August 2012, available at http://www.bloomberg.com/news/articles/2012-08-14/fracking-hazards-obscured-in-failure-to-disclose-wells, accessed on 21 November 2015.

[408] *Ernst v Alberta* op cit (note 126) at para 18.

[409] The Government Gazette Act, R.S.A 2000, c. G-10.

[410] *Ernst v Alberta* op cit (note 126) at para 18.

[411] Ibid.

[412] Ibid at para 21.

public.[413] The two agencies are supposed to work together to ensure the protection and proper management of Alberta's water resources in the face of oil and gas activities.[414]

Like British Columbia, the Alberta Energy Regulator requires that fracturing companies disclose the composition of their fracturing fluids on the website www.fracfocus.ca.[415] Operators must submit summary electronic fracture fluid composition and fracture fluid water source data to the Alberta Energy Regulator within 30 calendar days from the conclusion of an operation.[416] Operators must submit the following: fracture fluid composition data per fracture record; fracture scenario (ie details of the type of fracturing operation to be undertaken); details of the company that will undertake the fracture; details of the carrier fluids, proppants, and additives of the fracture fluid and details of the each ingredients used in the fluid, including the name and maximum concentration of all ingredients.[417]

Like in British Columbia, companies can file a claim in terms of the Hazardous Material Information Review Act for exemption of providing the chemical ingredient, its concentration and the name of any toxicological study that identifies the ingredient.[418] The Alberta Energy Regulator may in its discretion at any time require a company to provide additional information about component ingredients regardless of whether such information is a trade secret.[419] If trade secret information is provided in response to such a request, it may be protected from public disclosure under Alberta's Freedom of Information and Protection of Privacy Act.[420]

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[413] Energy Resources and Conservation Board 'A Discussion Paper: Regulating Unconventional Oil and Gas in Alberta' (2012) *Energy Resources Conservation Board Report* at 2.

[414] Ibid.

[415] Alberta Energy Regulator 'Well Drilling and Completion Data Filing Requirements' (2012) *Directive 059* at 5.

[416] Ibid.

[417] Ibid.

[418] Ibid.

[419] Leggette et al op cit (note 394) 21.

[420] RSA 2000, c F-25.

Like in British Columbia, there is concern that companies are frequently utilizing the legal loophole of having their fracturing fluids declared as exempt from disclosure as they are trade secrets. Like in British Columbia the public lack legal standing to challenge the Hazardous Materials Information Review Commission's decision to declare fracturing fluids trade secrets.[421] Accordingly in many instances the public cannot find out what chemicals are being inserted into the fracturing wells.

5.5 Access to information requests

This dissertation will not review in any detail Alberta and British Columbia's laws regulating access to information requests. This is because first requiring the public to rely on access to information requests is not ideal as the requests take a long time to process and can be expensive, especially if litigation is required to compel disclosure. Furthermore, there is no guarantee that information will be disclosed or withheld.[422]

Secondly, although a great deal of the wording of PAIA has been drawn from Canadian freedom of information and privacy legislation, the countries' legislation are fundamentally different in respect of requesting information from private entities.[423] Unlike PAIA provincial[424] and federal[425] access to information laws in Canada have very limited horizontal application and generally limit the public's ability to request information from private entities.[426] While Canada has enacted legislative regulation of information disclosure by private entities, PAIA is

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[421] Leggette et al op cit (note 394) 20.

[422] Diredzic op cit (note 373) 13.

[423] The Task Team on Open Democracy and the Parliamentary Ad Hoc Joint Committee on the Open Democracy Bill consulted Canada's federal legislation, the Access to Information Act RS 1985, c A-1, and Ontario's provincial legislation, the Freedom of Information and Protection of Privacy Act RSO 1990, c F31, when drafting PAIA. See Currie and Klaaren op cit (note 258) 24.

[424] In Alberta access to information requests are regulated in terms of the Freedom of Information and Protection of Privacy Act R.S.O. 1990, c. F.31, s. 1. In British Columbia access to information requests are regulated in terms of the Freedom of Information and Protection of Privacy Act 1992 [1993 in force] (R.S.B.C. 1996, c.165.).

[425] Access to Information Act R.S., 1985, c. A-1.

[426] Currie and Klaaren op cit (note 258) 24.

far more progressive in this regard.[427] The utility of analyzing Canadian federal and provincial regulation of access to information requests is accordingly limited as South Africa's regulation is more progressive.

[427] Ibid.

Chapter 6: Conclusion and recommendations

6.1 Introduction

On the one hand, shale gas production, done properly, can bring wide-ranging benefits including the enhancement of energy security, lower natural gas prices, a lower carbon footprint than some other fossil fuels[428] and economic development.[429] On the other hand, done poorly, it can be prone to accidents and leakage, contribute to environmental degradation and water contamination and, when externalities are accounted for, produce more net economic costs than benefits.[430]

The efficacy and utility of shale gas production and fracturing significantly depends on sound governance principles and regulation.[431] In turn regulation usually depends for its effectiveness on enforcement and implementation by the regulators.[432] Accordingly enforcing effective regulations is necessary to minimize risk to the environment and human health.[433]

Chapters 4 and 5 above discussed the strengths and weaknesses of how fracturing is proposed to be regulated in South Africa and how fracturing is regulated in Canada. This chapter will identify what lessons can be learnt from the comparison and, where applicable, will make recommendations in the context of the development of South African law.

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[428] Although as noted above at footnote 15 above this claim is heavily disputed.

[429] Sovacool op cit (note 31) 250.

[430] Ibid.

[431] Ibid.

[432] M Kidd 'Chapter 10: Criminal measures' in Paterson A and Kotzé LJ (eds) *Environmental Compliance and Enforcement in South Africa* 2 ed (2009) 266.

[433] Sovacool op cit (note 31) 263.

6.2 Critique of South African law

6.2.1 Disclosure

The Final Regulations require information of all of the chemicals and concentrations in a fracturing fluid and this information will allow the competent authority to fully understand the risk associated with the use of chemical additives. However, a major shortcoming of the Final Regulations is that it does not expressly require disclosure to the public or any individuals that will potentially be impacted upon by hydraulic fracturing. It is unclear whether this information is intended to be disclosed to the public during the environmental impact assessment procedure.

Another important problem with the Final Regulations insofar as they regulate the disclosure of chemical additives is that disclosure is not required on a well by well basis. Providing information of the chemical additives used in each well is essential as operators may need to formulate a different combination and concentration of chemicals for each well to maximize that shale's response to fracturing.[434]

In the absence of a provision that requires the chemical additives to be disclosed publically, the public will have to rely on making access to information requests in terms of PAIA to obtain information on the composition of the fracturing fluids used in a specific fracturing operation. Requiring the public to obtain information through access to information requests in terms of PAIA is far from ideal. There is no guarantee that information will be disclosed or withheld as PAIA allows companies to withhold information for a number of reasons, including that the information may constitute a trade secret or confidential commercial or technical information. From experience abroad companies have frequently sought to withhold information on chemical additives on the basis that they constitute trade secrets or confidential commercial or technical information.

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[434] Leggette et al op cit (note 2) 155.

The above survey has shown that in South Africa companies tend to withhold environmental information and communities are forced to go to court to compel disclosure, as is illustrated by the landmark decision of *Company Secretary of ArcelorMittal South Africa and Another v Vaal Environmental Justice Alliance*[435] dealt with in chapter 4.2.4 above. This is taxing on local communities as they have to fight often well-resourced private companies in lengthy court battles. If the information is not automatically provided to local communities they will effectively be excluded from the decision-making process which directly impacts on their lives, as they will lack available, clear and understandable information on what chemicals are being put into ground as part of the fracturing process.[436]

6.2.2 Prohibition

In terms of protecting water quality, the prohibition in terms of the Final Regulations is novel.[437] From experience in Canada and the United States, regulations have not sought to prohibit the use of toxic chemicals in the fracturing process and in fact have exempted the use of toxic chemicals from regulation. For example, exploration and drilling activities, including the process of fracturing, in the oil and gas sector are exempt from reporting to the NPRI.[438] Furthermore, in 2005 hydraulic fracturing received exemption from proposed regulations under the United States Safe Drinking Water Act covering hydraulic fracturing (except for diesel fuel).[439]

The Final Regulations do not prohibit other hazardous alternatives that do not appear in schedule 1 from being used in the hydraulic fracturing process. Accordingly, the Final Regulations only prohibits the use of the hazardous chemicals contained in schedule 1 and is not an absolute prohibition on the use of hazardous and toxic chemicals in the fracturing

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[435] 2015 (1) SA 515 (SCA).

[436] du Plessis op cit (note 45) 183.

[437] Regulation 113(1).

[438] Environment Canada op cit (note 369).

[439] The Council of Canadian Academies op cit (note 52) 157.

process as such. However, in terms of the Final Regulations operators must, to the extent technically feasible, maximise the use of environmentally friendly additives and minimise the amount and number of additives.[440] The phrase 'to the extent technically feasible' is not defined in the Final Regulations and is problematic as it gives companies some leeway to still use toxic substances.

As discussed in greater detail in chapter 4.3.1 above, the Final Regulations do not make any express provision for the public disclosure of the chemical additives used in a specific fracturing operation. If the information is not provided to local communities they will effectively be excluded from the decision-making process, as they will lack available, clear and understandable information to determine whether or not the prohibition is being complied with.[441] In the absence of public involvement it is questionable whether the Department of Mineral Resources and Energy, who will be responsible for monitoring compliance with the prohibition, possesses the necessary capacity and staff or the political will to ensure the proper enforcement of the prohibition.[442]

6.3 Lessons for South Africa from Canada

In British Columbia and Alberta the fracturing fluid composition is published on online on the website www.fracfouc.ca and all the information is publically available as the public can search for the reports on each well.[443] The approach in British Columbia and Alberta theoretically allows for the public to easily access information on what fracturing fluids are being used in a specific well. South Africa could benefit from adopting a similar system and should consider entering into an agreement with FracFocus or alternatively developing its own website.

However, there a number of major shortcomings with regards to disclosure in British Columbia and Alberta which South Africa should not replicate. First, the information on the chemical

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[440] Regulation 115(3).

[441] du Plessis op cit (note 45) 183.

[442] du Plessis op cit (note 363) 87.

[443] FracFocus op cit (note 352).

additives used in each well must be submitted within 30 days of finishing operations at a well.[444] This *ex post facto* approach to disclosure means that the public can only react to the fracturing process. Preferably the information must provide before a fracturing operation commences to allow the public to proactively respond to hydraulic fracturing.

Second, companies are allowed to, and frequently, refuse to disclose on fracfocus on the basis that the composition of their fracturing fluids is a trade secret. This loophole has seriously limited the availability of information on fracturing fluids in Canada. Considering the potential risks to human health and the environment, and the specific sensitivities of the Karoo, including the relative lack of water resources, a lack of disclosure prevents the public from understanding possible health and environmental impacts associated with hydraulic fracturing and the use of chemical additives, as well as preventing proper monitoring of chemical contamination as a result of hydraulic fracturing operations.[445]

Accordingly companies in South Africa should not be permitted to use the trade secret exemption as the risks associated with fracturing in a largely arid environment are simply too high. Adopting this approach would be in line with the precautionary principle discussed in chapter 1.4 which requires that where there is a lack of scientific certainty about the impact and/or consequences of a proposed development then caution must be exercised and the public should be fully aware of the risks associated with a fracturing operation.[446]

This approach would be in line with the right of access to information which demands that transparency 'must be fostered by providing the public with timely, accessible and accurate information.'[447] This approach would also be in line with PAIA, which requires that trade secrets and confidential commercial or technical information cannot be withheld in circumstances where disclosure would reveal a serious public safety or environmental risk. In

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[444] British Columbia Oil and Gas Commission op cit (note 388).

[445] Maule et al op cit (note 20) 171.

[446] Glazewski and Pilt op cit (note 46) 194.

[447] 2009 (11) BCLR 1075 (CC) para 62.

the arid Karoo the release of chemical additives into the ground always proposes a serious public safety or environmental risk and therefore disclosure of the composition of fracturing fluids to the public should automatically be required.

6.4 Conclusion

The Final Regulations contain regulations that are aimed at protecting water resources. However, they are riddled with uncertainty and loopholes that may seriously impede their ability to protect water resources from the chemical additives contained in fracturing fluids. As currently framed it is unclear whether or not information on chemical additives must be publically disclosed.

From experience abroad companies have frequently sought to withhold information on chemical additives on the basis that they constitute trade secrets. In the absence of a provision that requires the fracturing fluids to be disclosed publically, companies will in all likelihood refuse to disclose such information on the basis that it is a trade secret or confidential commercial or technical information.

The public will have to rely on making access to information requests in terms of PAIA to obtain information on the fracturing fluids used in a specific fracturing operation. Requiring the public to obtain information through access to information requests in terms of PAIA is far from ideal. There is no guarantee that information will be disclosed or withheld as PAIA allows companies to withhold information for a number of reasons, including that the information may constitute a trade secret or confidential commercial or technical information.

The Canadian provinces of Alberta and British Columbia require public disclosure of chemical additives used in the fracturing process. Although some lessons can be learned from regulatory experience in Canada, regulation in Alberta and British Columbia has also been problematic due to a number of loopholes in Canadian regulation. The most prominent loophole is the fact that companies frequently withhold information on the chemicals they use on the basis that this information is a trade secret.

President Zuma in his State of the Nation addressed stated that South Africa 'will pursue the shale gas option within the framework of our good environmental laws.'[448] Having reviewed the laws that regulate the use and disclosure of chemical additives in fracturing fluids, it cannot be said with any certainty that our current laws will guarantee that fracturing will occur in a manner that is constituent with the right to an environment that is not detrimental to a person's health and wellbeing.

The Supreme Court of Appeal *Company Secretary of ArcelorMittal South Africa and Another v Vaal Environmental Justice Alliance*[449] gave a general warning to corporations operating in South Africa:

> 'Corporations operating within our borders, whether local or international, must be left in no doubt that in relation to the environment in circumstances such as those under discussion, there is no room for secrecy and that constitutional values will be enforced.'[450]

As our law currently stands there appears to be much scope to keep chemical additives secret from the public which may result in the right to the environment not being upheld in the context of hydraulic fracturing.

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[448]Zuma op cit (note 27).

[449] 2015 (1) SA 515 (SCA).

[450] Ibid at para 82.

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