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A PROJECT LIFE-CYCLE APPROACH?**

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## REGULATION OF HYDRAULIC FRACTURING IN SOUTH AFRICA: A PROJECT LIFE-CYCLE APPROACH?

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### 1 Introduction

Hydraulic fracturing is a reality in South Africa and the promulgation of the *Regulations for Petroleum Exploration and Production* on 3 June 2015 is a step forward in the regulation of this new phenomenon.<sup>1</sup> The pre-June 2015 legal framework did not specifically provide for hydraulic fracturing and the regulators were initially caught off guard by the speed with which the Department of Mineral Resources allocated exploration rights to international companies.<sup>2</sup> The regulators used the *Mineral and Petroleum Resources Development Act 28 of 2002* (MPRDA), which provides for reconnaissance, technical cooperation, exploration and production rights for petroleum. The definition of "petroleum" in the Act referred to gas, making the Act directly applicable to gas exploration activities.<sup>3</sup> The Act had been written with off-shore exploration in mind, however. The exploration and production of onshore gas had not really been regarded as economically viable options at the time of the writing of the MPRDA.<sup>4</sup>

The Department of Mineral Resources granted exploration rights for shale gas in one of the driest parts of the country, namely the Karoo, which also has a variety of

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<sup>1</sup> GN R466 in GG 38855 of 3 June 2015 – hereinafter referred to as GN R466.

<sup>2</sup> Also see Kotzé and Goosen 2014 *Litnet Akademies* 149-197.

<sup>3</sup> Section 1 *Mineral and Petroleum Resources Development Act 28 of 2002* (MPRDA).

<sup>4</sup> Petroleum Agency SA 2013 <http://www.petroleumagency.com/index.php/petroleum-geology-resources/exploration-history>.

endemic plant and animal species.<sup>5</sup> It consists mostly of (fragile) agricultural areas.<sup>6</sup> The agricultural section of the Karoo community vehemently opposes the possibility of shale gas exploration in this area, while another section of the community celebrates the possibility of the creation of job opportunities and the alleviation of poverty.<sup>7</sup>

In 2012 the South African Department of Mineral Resources appointed a task team to investigate the possible environmental risks of the exploitation of shale gas, as well as the negative social and economic impacts that such activities may have in the Karoo.<sup>8</sup> The task team raised various concerns, such as the disposal of contaminated water, the possible contamination of groundwater, and the fact that a vast amount of water would have to be transported to the area over long distances.<sup>9</sup> The existence of kimberlite and dolerite dykes was also a concern, and it was suggested that major hydrological and geological studies would be necessitated to determine the impact of shale gas exploration on the agricultural activities in the area.<sup>10</sup> The team also indicated that the activities might impact on the astronomical activities that were to be undertaken in the area.<sup>11</sup> The positive outcomes of shale gas exploration would be job creation, revenue income for the country, and the lessening of South Africa's dependency on other forms of fossil fuels.<sup>12</sup> According to the Report, existing mining, water and environmental laws would have to be applied when applications for permission to explore for shale gas are received.<sup>13</sup>

On 15 October 2013 the Minister of Mineral Resources published for comment draft regulations prescribing "standards and practices that will ensure safe exploration and

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<sup>5</sup> Petroleum Agency SA 2013 <http://www.petroileumagencysa.com/index.php/home-14/shale-gas>.

<sup>6</sup> In this regard see the Environmental Management Programme Reports (EMPr) drafted by two of the applicants for exploration rights - Bundu Gas and Oil Exploration 2015 [http://www.golder.com/af/en/modules.php?name=Pages&sp\\_id=1793](http://www.golder.com/af/en/modules.php?name=Pages&sp_id=1793) para 4; Falcon Oil & Gas 2015 <http://www.srk.co.za/en/za-falcon-seismic-empr>.

<sup>7</sup> See eg Treasure Karoo Action Group Date Unkown <http://www.treasurethekaroo.co.za/about>; Botha and Yelland 2011 <http://www.ee.co.za/article/on-fracking-in-the-karoo-open-forums-and-the-power-of-public-opinion-3.html>.

<sup>8</sup> DMR *Report on Investigation of Hydraulic Fracturing*.

<sup>9</sup> DMR *Report on Investigation of Hydraulic Fracturing* para 2.4.3.

<sup>10</sup> DMR *Report on Investigation of Hydraulic Fracturing* para 2.4.3.2.

<sup>11</sup> DMR *Report on Investigation of Hydraulic Fracturing* para 2.8.

<sup>12</sup> DMR *Report on Investigation of Hydraulic Fracturing* para 2.3.

<sup>13</sup> DMR *Report on Investigation of Hydraulic Fracturing* para 2.5.

exploitations of petroleum" applicable to onshore and offshore operations.<sup>14</sup> The regulations made explicit reference to natural gas, coal-bed methane and shale gas. The drafting of the regulations was informed by comments received during a public participation process on the issue of shale gas exploration and production.

In February 2014 (following on previous moratoria)<sup>15</sup> the Minister of Mineral Resources placed a moratorium on the issuing of new shale gas exploration permits. It seems, however, that government is going to allow at least some exploration in the Karoo area, based on previously issued permits.<sup>16</sup> There seems to be no consensus within government with regard to the idea of hydraulic fracturing. The cabinet ministers and the President have voiced different opinions, with the President<sup>17</sup> and the Minister of Mineral Resources favouring hydraulic fracturing as a possible driver of the economy and job creation vis-à-vis the Ministers of Water and Sanitation and Environmental Affairs, who are trying to enforce their mandates as custodians of South Africa's environment and water resources.<sup>18</sup> To address the concerns of the ministers, an interdepartmental task team has been appointed to discuss matters pertaining to shale gas. In May 2015 the Portfolio Committee on Mineral Resources requested an additional report on hydraulic fracturing as well as on the applicable legislation to enable informed decisions to be made in this regard.<sup>19</sup> The CSIR, SANBI and the Council of Geoscience were appointed to compile a strategic impact assessment for the Karoo basin; this report will be available only in 2017.<sup>20</sup> As indicated above, on 3

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<sup>14</sup> Gen N 1032 in GG 36938 of 15 October 2013.

<sup>15</sup> GN 54 in GG 33988 of 1 February 2011; GN 922 in GG 38218 of 31 October 2014; intention declared to restrict and comments invited: Gen N 932 in GG 35866 of 16 November 2012.

<sup>16</sup> GN 71 in GG 37294 of 3 February 2014; in the Free State also see: GN 922 in GG 38218 of 31 October 2014.

<sup>17</sup> President Zuma stated in his State of Nation Address of 17 June 2014 that "We will pursue the shale gas option within the framework of our good environmental laws." Zuma 2014 <http://www.gov.za/state-nation-address-his-excellency-jacob-g-zuma-president-republic-south-africa-occasion-joint-0>.

<sup>18</sup> Section 2(4)(o) *National Environmental Management Act* 107 of 1998 (NEMA); s 3 *National Water Act* 36 of 1998. See eg Mokonyane 2015 <http://www.gov.za/speeches/address-minister-water-and-sanitation-ms-nomvula-mokonyane-occasion-budget-vote-201516-21>; Shabangu 2015 <http://www.gov.za/statement-mineral-resources-minister-ms-susan-shabangump-gazetting-technical-regulations-petroleum>; Molewa 2013 <http://www.gov.za/statement-minister-water-and-environmental-affairs-mrs-edna-molewa-media-briefing-gcis-offices>.

<sup>19</sup> Parliament of South Africa 2015 <http://www.gov.za/speeches/committee-needs-information-hydrolic-fracturing-28-may-2015-0000>.

<sup>20</sup> Pandor 2015 <http://www.gov.za/speeches/statement-ministers-environmental-affairs-mrs-edna-molewa-science-and-technology-naledi>; Wild *Mail&Guardian* 16.

June 2015 GN R466 was published to prescribe standards and practices for the onshore exploration and production of petroleum (including gas, although this is not specified in the draft regulations).<sup>21</sup> GN R466 includes measures dealing with the different phases of petroleum exploration and production – from planning to closure.

Since 2008, the then Department of Mineral Resources and the Department of Water and Environmental Affairs have attempted to align their environmental application processes. The MPRDA and the *National Environmental Management Act* 107 of 1998 (NEMA) (as well as several other pieces of legislation)<sup>22</sup> have been amended to create a so-called "one environmental system".<sup>23</sup> In June 2015 the Gauteng High Court declared unconstitutional the notice putting the *National Environmental Laws Amendment Act* 25 of 2014 into operation.<sup>24</sup> If the Constitutional Court confirms the invalidity of this order, this may create a legal vacuum in the issuing of environmental and waste authorisations relating to mining, petroleum and gas exploration and production. This may delay the process even further.<sup>25</sup> The only measures that will pertain to hydraulic fracturing will be GN R466.

This note will address the regulation of petroleum exploration and production from a project life-cycle approach with specific reference to the new regulations pertaining to hydraulic fracturing in South Africa. Legislation does not necessarily address the project life cycle of a specific project and environmental regulation during this project

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<sup>21</sup> Reg 85(1)-(2) of GN R466.

<sup>22</sup> Eg *National Environmental Management: Waste Act* 59 of 2008 (NEMWA).

<sup>23</sup> *Mineral and Petroleum Resources Development Amendment Act* 49 of 2008 (MPRDAA); the *National Environmental Management Amendment Act* 62 of 2008 (NEMAA); the *National Environmental Management Laws Second Amendment Act* 30 of 2013; the *National Environmental Management Laws Amendment Act* 25 of 2014 (NEMLA); the *Minerals and Petroleum Resources Development Bill* [B15B-2013]. The *Mineral and Petroleum Resources Development Bill* was approved by Parliament. The President, however, referred the Bill back to Parliament due to the possible unconstitutionality of some of its clauses.

<sup>24</sup> *Aquarius Platinum SA (Pty) Ltd v Minister of Water and Sanitation* (High Court of South Africa Gauteng Division) unreported case number 76522/2014 of 27 May 2015.

<sup>25</sup> Subsequent to the writing of the note, the Department of Environmental Affairs has issued regulations pertaining to residue stockpiles and residue deposits which may influence the outcome of a future decision of the Constitutional Court as the rationale for the original decision no longer exists – see GN R632 in 39020 of 24 July 2015. However, it must be kept in mind that when *Aquarius* was decided the regulations were only in draft format.

life cycle is fragmented between different pieces of legislation, line ministries and spheres of government.<sup>26</sup>

The aim is to present an appraisal of the 2015 regulations (GN R466), wherein both strengths and potential shortfalls within the project life cycle of a hydraulic fracturing project, namely during the exploration, production and closure phases of hydraulic fracturing, are identified. The note is not a discussion of the merits of hydraulic fracturing,<sup>27</sup> nor does it address all the challenges arising from the so-called "one environmental system".<sup>28</sup> The focus is on the 2015 regulations and what they set out to achieve within the project life cycle of a hydraulic fracturing project.

In this note a brief historical background will be provided relating to the regulation of environmental and mining matters and the introduction of the so-called one environmental system, then GN R466 will be discussed from a project life cycle approach, commencing with the pre-commencement phase, the design and authorisation phase, the testing phase, the operational phase and the decommissioning or closure phase, and this will be followed by a few comments on the new regulations.

## **2 A historical background**

There are currently three main departments that will have responsibilities with regard to hydraulic fracturing in terms of national legislation. The departments are the Department of Mineral Resources, the Department of Environmental Affairs and the Department of Water and Sanitation.<sup>29</sup> The Department of Mineral Resources has the responsibility to act in terms of the MPRDA, the NEMA and the *National Environmental*

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<sup>26</sup> Nel and Kotzé "Environmental Management" 14-15. They identify various phases including the planning phase, the implementation phase, the operational phase and the closure or decommissioning phase. Each of these phases has sub-phases. Also see Nel and Du Plessis 2004 *SAPL* 181-190.

<sup>27</sup> In this regard, see Centre for Environmental Rights 2012 <http://cer.org.za/news/position-statement-on-protection-of-environmental-rights-in-decisions-around-fracking-for-shale-gas>; De Wit 2011 *SAJS* 1-9; Van Wyk 2014 *Stell LR* 34-54; Glazewski and Plit 2015 *Stell LR* 190-219. Also see the recent study of the United States Environmental Protection Agency 2015 <http://www2.epa.gov/hfstudy/hydraulic-fracturing-study-draft-assessment-2015>.

<sup>28</sup> In this regard, see Centre for Environmental Rights 2015 <http://cer.org.za/news/as-new-environmental-laws-for-mines-start-coming-into-effect-confusion-reigns>.

<sup>29</sup> There are also other national, provincial and local authorities involved in the issuing of other authorisations, but they will not be discussed in this note.

*Management: Waste Act* 59 of 2008 (NEMWA), while the Department of Environmental Affairs also has responsibilities in terms of the NEMA, the NEMWA and the *National Environmental Management: Air Quality Act* 39 of 2004 (NEMAQA). The Department of Water and Sanitation has jurisdiction over the *National Water Act* 36 of 1998. The seeming overlap between the jurisdictions of the different departments has a long history.

In 2008 the MPRDA and the NEMA were amended. All the sections dealing with environmental issues in the MPRDA were repealed and reinserted in a slightly amended format into the NEMA. The idea was that the Minister responsible for mineral resources would make all decisions with regard to mineral and petroleum issues, while the Minister responsible for environmental affairs would make decisions on all environment-related issues. The amendments of the NEMA would come into effect only once the *Mineral and Petroleum Resources Development Amendment Act* 49 of 2008 (MPRDAA) had come into effect. The NEMA amendments came into effect on 8 December 2014. The procedure to apply for water use licences would also have to be aligned.<sup>30</sup> The *National Environmental Laws Amendment Act* 25 of 2014 (NEMLA), amongst other things, transferred all decision-making with regard to mining-related environmental matters to the Minister of Mineral Resources (excluding water and air quality),<sup>31</sup> introduced a mineral resource inspectorate,<sup>32</sup> provided for an appeal to the Minister of Environmental Affairs on any environmental decision taken by the Minister of Mineral Resources,<sup>33</sup> and transferred all decision-making with regard to residue-stockpiles and residue deposits (to be regulated in terms of the NEMWA<sup>34</sup>) to the Minister of Mineral Resources.<sup>35</sup> The NEMLA also influenced the date of the coming into force of the "one environmental management system", ie 8 December 2014.<sup>36</sup>

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<sup>30</sup> Section 163A *National Water Amendment Act* 27 of 2014.

<sup>31</sup> Section 24C(2A) of NEMA.

<sup>32</sup> Section 31BB of NEMA.

<sup>33</sup> Section 43 of NEMA.

<sup>34</sup> In this regard see Hartzler and Du Plessis 2014 *SAPL* 469-493. Also see GN R632 in GG 39020 of 24 July 2015.

<sup>35</sup> Sections 1, 43(1A), 43A, 69(1)(iA) of NEMWA.

<sup>36</sup> Section 28 of NEMLA.

The position at present is therefore that the Minister of Mineral Resources is the decision-maker with regard to all environment-related matters pertaining to gas regulation. The Minister of Environmental Affairs is the appeal authority. All applications for hydraulic gas exploration and production are to be approved by the Minister of Mineral Resources,<sup>37</sup> but the applications for environmental authorisations will have to be completed in terms of the NEMA<sup>38</sup> and its regulations.<sup>39</sup> An environmental management programme report (EMPr) will have to be completed in terms of section 24N of the NEMA as well as the EIA regulations.<sup>40</sup> Financial provision for closure has to be provided in terms of section 24P of the NEMA.<sup>41</sup> The *Mineral and Petroleum Resources Development Bill* of 2015 alluded to above provides, amongst other things, for a 20% free carried interest in favour of the state in the case of the performance of any gas or petroleum exploration activities.

As stated above, before the issuing of GN R466 the South African legislative framework did not formally provide for the regulation of onshore gas exploration and production (such as hydraulic fracturing) other than by way of the granting of exploration and production rights in terms of the MPRDA. The then Ministers of Environmental Affairs and Water Affairs reacted in different ways when confronted by the possible introduction of hydraulic fracturing. When the Department of Mineral Resources commenced with the issuing of exploration rights to various companies, the then Minister of Water and Environmental Affairs reacted first by issuing a notice that she was going to declare "the exploration for and or the production of onshore unconventional oil or gas resources (and any activities incidental thereto) including but not limited to hydraulic fracturing" as a controlled activity in terms of the *National Water Act* 36 of 1998.<sup>42</sup> Such a declaration implies that the activity may not be

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<sup>37</sup> Sections 79 and 83 of MPRDA.

<sup>38</sup> Section 24 of NEMA.

<sup>39</sup> Items 18, 20 and 22 of GN R984, read with GN R982 in GG 38282 of 4 December 2014 (hereinafter referred to as GN R982 and GN R984).

<sup>40</sup> GN R982; read with GN R527 in GG 26275 of 22 April 2004 issued in terms of the MPRDA (hereinafter referred to as GN R527) (previously an exploration work programme and a production work programme had to be compiled).

<sup>41</sup> The regulations with regard to the financial provision in terms of NEMA are still draft regulations (GN 940 in GG 38145 of 31 October 2014); GN R527 of the MPRDA will have to be used in the meantime.

<sup>42</sup> Gen N 863 in GG 36760 of 23 August 2013.



undertaken or may not commence unless authorised in terms of the *National Water Act*.<sup>43</sup> In her 2015 budget speech in Parliament the then Minister of Water and Sanitation indicated that she would formally gazette a notice declaring hydraulic fracturing as a controlled activity in the next budget year.<sup>44</sup> On 16 October 2015 she declared "the exploration and/or production of onshore naturally occurring hydrocarbons that require stimulation, including but not limited to hydraulic fracturing and/or underground gasification, to extract, and any activity incidental thereto that may impact detrimentally on the water resource as a controlled activity" in terms of the *National Water Act*,<sup>45</sup> with the consequences as set out above.

On 14 March 2014 the Minister of Environmental Affairs declared her intention to declare greenhouse gases (including methane gas, which may be released during hydraulic fracturing operations) as priority air pollutants in terms of the NEMAQA.<sup>46</sup> Once a greenhouse gas is declared a priority pollutant, persons with activities falling in specified categories must prepare pollution prevention plans.<sup>47</sup> In June 2015 she also issued draft reporting regulations for greenhouse gas emissions *inter alia* from gas exploration and production activities.<sup>48</sup> The regulations remain draft regulations and by the time of writing of this note, they have not been finalised.

As indicated above, the Minister of Mineral Resources had in 2013 published for comment draft regulations for the onshore and offshore exploration and production of natural gas, coal-bed methane and shale gas. The regulations provide, amongst other things, for environmental impact assessments determining the impact of the activities on natural resources and sensitive areas during the full life-cycle of the operations. The holder was responsible for indicating the fluids that were going to be used as well as their hazardous or non-hazardous specifications. The risks of these fluids to the environment and water resources had to be indicated as well as the mitigation

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<sup>43</sup> Section 37 *National Water Act* 36 of 1998.

<sup>44</sup> Mokonyane 2015 <http://www.gov.za/speeches/address-minister-water-and-sanitation-ms-nomvula-mokonyane-occasion-budget-vote-201516-21>.

<sup>45</sup> GN 999 in GG 39299 of 16 October 2015.

<sup>46</sup> Gen N 172 in GG 37421 of 14 March 2014 issued in terms of s 29 of NEMAQA. See Department of Environmental Affairs 2013 [http://www.gov.za/sites/www.gov.za/files/greenhousegas\\_inventory\\_southafrica\\_a.pdf](http://www.gov.za/sites/www.gov.za/files/greenhousegas_inventory_southafrica_a.pdf).

<sup>47</sup> Sections 24-25 of NEMAQA.

<sup>48</sup> Gen N 541 in GG 38857 of 5 June 2015.

measures that had to be undertaken should pollution occur. The holder of the right had further to assess the geology and geohydrology of the affected area as well as the risk of seismicity and indicate that all radio and optical astronomy advantage areas would be protected. Water resources assessments and studies had to be undertaken. Specific measures were prescribed for the construction, production and closure phases. All of these measures were aimed at reducing or limiting the pollution that might emanate during the life-cycle of the project. GN R466 contains similar provisions, leading to criticism from activists that the regulations are a mere reproduction of regulations from the United States<sup>49</sup> and that there had not been enough public consultation.<sup>50</sup>

### **3 GN R466: A life-cycle approach**

The project life of hydraulic fracturing as set out in GN R466 appears to be analysable into the following phases: the pre-commencement phase, the design and authorisation phase, site preparation, testing, the operational phase, and the decommissioning and closure phase. The regulations will be discussed according to these phases. Although GN R466 distinguishes some of these phases, the specific regulations pertaining to these phases have not necessarily been described under that specific phase. The reader of GN R466 therefore still has to determine which regulation or sub-regulation will apply to a specific phase or phases within the project life cycle.

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<sup>49</sup> The Department of Interior Bureau of Land Management of the United States Federal Government issued the *Oil and Gas; Hydraulic Fracturing on Federal and Indian Lands; Final Rule* 43 CFR 3160 on 26 March 2015. The Rule includes measures pertaining to the life cycle but does not address hydraulic fracturing from a life-cycle point of view. The Rule followed a public participation and public commentary process. It should be noted that hydraulic fracturing has occurred in the US for more than 30 years and was regulated either by the American Petroleum Institute (API) Standards, environmental and water legislation or by state regulation. Also see Brady and Crannell 2014 *Vt J Envtl L* 40-70. For a summary of the API standards, see API 2012 <http://www.api.org/policy-and-issues/policy-items/hf/hydraulic-fracturing-best-practices> accessed.

<sup>50</sup> Anon 2015 *Legalbrief Environmental*. The regulations were published on 15 October and the public could comment until 14 November 2013 – no extensions were allowed. The draft regulations were compiled after a workshop where all stakeholders could have attended. See comments from groups that the period for comment was too short – Treasure Karoo Action Group Date Unkown <http://www.treasurethekaroo.co.za/fracking-regulations>; Centre for Environmental Rights 2013 <http://cer.org.za/news/minister-mineral-resources-publishes-draft-regulations-fracking-comment>. GN R466 was published in June 2015.

### **3.1 Pre-commencement phase**

The pre-commencement phase can also be described as the planning phase.<sup>51</sup> GN R466 prescribes several measures that an applicant needs to comply with before any exploration can take place.<sup>52</sup> It is clearly stated that an applicant must obtain an environmental authorisation in terms of section 24 of the NEMA before any exploration or production right may be issued.<sup>53</sup> In addition to the NEMA EIA Regulations,<sup>54</sup> GN R466 prescribes additional assessments that have to be undertaken as part of the EIA process. These assessments include an assessment of the geology and geohydrology of the area, a hydrocensus of the "potentially affected water resources within a 3 kilometres radius from the furthest point of potential horizontal drilling," and an assessment of potential seismicity.<sup>55</sup>

The geology and geohydrology study have to include a map of the area that is of such a scale that it allows one to understand the potential structural aspects of the area. This must include the physical and chemical properties of the stratigraphic formations and their composition.<sup>56</sup> The study should also include an analysis of published and unpublished map sheets as well as published and unpublished papers on the subject. The applicant must conduct stratigraphic exploration boreholes to determine the

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<sup>51</sup> Nel and Kotzé "Environmental Management" 15 distinguish the identification of a project, exploration and the decision to proceed as part of the planning phase. As illustrated by them, several plans may have to be drafted during this phase. The applicant will also have to ensure that his design of the project and technology complies with the prescribed measures – the project could have a conceptual design and later a detailed design that may need to be revised if necessary. It may also be necessary at this stage to comply with tender specifications, to obtain goods from contractors, and to conclude specific contracts with contractors. In this phase the applicant must ensure that he or she and the contractors comply or will comply with all the prescribed legal measures.

<sup>52</sup> Reg 86(1) GN R466. These measures will have to be undertaken in addition to the measures prescribed in GN R982, ie a scoping report and an EIA that have to be prepared (read with item 18 GN R984) and any other measures prescribed in the NEMA, the MPRDA or any of the specific environmental management acts.

<sup>53</sup> Regs 86(2) and 110(1) GN R466. Reg 110(1) states that no drilling may commence without all the NEMA and specific environmental authorisations. Also see ss 79(4) and 83(4) of the MPRDA. In terms of the MPRDA the applicant has to submit the environmental reports – it is not a condition that the environmental authorisation needs to be obtained prior to the submission of the application.

<sup>54</sup> The applicant must comply with the minimum requirements set in GN R982 – reg 86(3) GN R466. The Council of Geosciences and the Council for Scientific Research are specifically indicated as interested and affected parties – reg 86(4) GN R466.

<sup>55</sup> Regs 87-89 GN R466.

<sup>56</sup> Reg 87(2)(e)-(f).

regional stratigraphy as well as the structural complexity of the area. The report must indicate the "proposed depth(s) to the top and the bottom of the formation into which well fracturing fluids are proposed to be injected".<sup>57</sup> A model of "fluid migration in the geological formation" and the "geohazards associated with the geological formation and structural features" must be included. The study must also indicate solutions to overcome the possible geohazards.<sup>58</sup>

The hydrocensus must be conducted by an independent specialist. The specialist must conduct a study of the affected water resources within a 3 kilometre radius of the furthest point of potential horizontal drilling. The study must also indicate priority water resources and domestic groundwater supplies on geohydrological maps.<sup>59</sup> A baseline water quality assessment must be undertaken to determine the water quality before any hydraulic fracturing is undertaken.<sup>60</sup> The applicant must also indicate how it will conduct groundwater monitoring and deep groundwater investigations after the preliminary research has been undertaken.<sup>61</sup> An accredited laboratory must analyse the samples and the results must be sent to the designated agency and the Department of Water Affairs within seven days after receipt of the results.<sup>62</sup>

In addition to these reports, the applicant must submit information with regard to the fluids that he or she is going to use.<sup>63</sup> The applicant must as far as possible and "to the extent it is technically feasible, maximise the use of environmentally friendly additives and minimise the amount and number of additives".<sup>64</sup> The report must indicate which fluids are hazardous or non-hazardous and must include their material safety data sheets. The applicant must indicate "the volumes of fluids, proppants, base carrier fluids and each chemical additive" that are going to be used in the process. The trade name and the purpose of each chemical during the process must be

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<sup>57</sup> Reg 87(2)(a)-(c). The borehole analysis must include information on "core logging, downhole geophysics, camera, water strikes, hydrogeochemical character and injection tests or formations" – reg 87(2)(d).

<sup>58</sup> Reg 87(h)-(i).

<sup>59</sup> Reg 88(1).

<sup>60</sup> Reg 88(4).

<sup>61</sup> Reg 87(2)(g).

<sup>62</sup> Reg 88(7).

<sup>63</sup> Reg 113(2).

<sup>64</sup> Reg 115(3)(a).

described. The risk of these chemicals to the environment and water resources must be described in a risk assessment report<sup>65</sup> as well as how remediation will be effected should any pollution incident occur. The report must also refer to possible alternatives that could be used.<sup>66</sup>

The applicant must also apply for a water use licence in terms of the *National Water Act* 36 of 1998.<sup>67</sup> He or she must indicate the "supply source, quality and location for the base fluid of each stage of the operation and the water usage volume". The applicant or holder of an authorisation must submit, with its water use application, environmental authorisation application and as part of its EMPr, a water resource monitoring plan and an integrated water management plan.<sup>68</sup> The water resource monitoring plan must specify, amongst other things, the sampling methodology, the monitoring points, parameters, frequency and reporting frequency.<sup>69</sup>

The applicant must further submit for approval a report on the risk assessment of the potential of hydraulic fracturing on seismicity and this report must accompany the application for an environmental authorisation.<sup>70</sup> The report must also include mitigation measures and a recommendation from the Council of Geoscience. The risk assessment must indicate the stress faults and fracture behaviour of the targeted formations and the monitoring that will be undertaken before fracturing. The study may include desktop studies of existing geological maps and the use of existing seismicity and geophysical data.<sup>71</sup>

An additional risk assessment must be done with regard to fracture containment.<sup>72</sup> The assessment must indicate what the risk is of "fracturing fluids migrating via faults

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<sup>65</sup> Reg 114.

<sup>66</sup> Reg 113(2)(a)-(h).

<sup>67</sup> Water uses are listed in s 21 *National Water Act* 36 of 1998 – see also reg 123(1).

<sup>68</sup> Regs 88(2), (3) and (6), and 123(2).

<sup>69</sup> Reg 88(2)(a)-(e).

<sup>70</sup> Reg 89(1) and 89(3).

<sup>71</sup> Reg 89(2).

<sup>72</sup> Reg 114(1).

and intrusions beyond the designated fracture zones."<sup>73</sup> The risk management plan must be submitted as part of the environmental authorisation application.<sup>74</sup>

### **3.2 Design and authorisation phase**

GN R466 sets comprehensive prescriptions on well design. The well design must prevent the migration of fluids, the pollution of water resources and "risks to the health and safety of persons from the well or anything in the well, or in strata to which the well is connected".<sup>75</sup> It places the primary responsibility on the holder of the authorisation to conduct well design risk assessments and environmental risk assessments to identify, assess and mitigate all possible well hazards, including aquifer isolation, the isolation of permeable zones, the protection of groundwater, the degradation of cement, fracturing containment, the deformation of aquifers, and surface subsidence.<sup>76</sup> The well design control measures must be documented. The risk assessments and well design must be included in the environmental authorisation application.<sup>77</sup> The holder must consider using multi-well pads and horizontal drilling technologies to ensure that there is enough space between neighbouring wells and to minimise the cumulative surface impact of the wells.<sup>78</sup> The design must already make provision for decommissioning.<sup>79</sup>

The design of the water transfer systems must be site-specific.<sup>80</sup> During this phase the site selection should further take into account the volume of traffic that will be created and the possible noise pollution of the environment.<sup>81</sup> The design should include abatement measures.<sup>82</sup> The holder must, if need be, obtain an authorisation in terms of the *Astronomy Geographic Advantage Act* 21 of 2007 for possible

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<sup>73</sup> Regs 114(2) and 119(4).

<sup>74</sup> Reg 115(2).

<sup>75</sup> Reg 95(1).

<sup>76</sup> Regs 94(1)-(3).

<sup>77</sup> Regs 94(4) and 95(2).

<sup>78</sup> Reg 95(4). These technologies should be considered only if they are "technologically appropriate and environmentally safe".

<sup>79</sup> Reg 95(3). Also see para 3.6 below.

<sup>80</sup> Reg 111(2).

<sup>81</sup> Reg 129(1).

<sup>82</sup> Reg 129(2).

interference in radio astronomy and optical astronomy. These authorisations will be a precondition to the issuing of an exploration or production right.<sup>83</sup>

The drilling operations may commence only if the holder has obtained all the necessary authorisations in terms of the NEMA and specific environmental management acts.<sup>84</sup>

### **3.3 Site preparation and construction phase**

The construction phase is usually regarded as part of the operational phase. However, for the purposes of this note it is discussed as a separate phase in the hydraulic fracturing operations. During the construction phase the site is usually prepared for construction in terms of the conditions set out in the authorisations. During this phase the construction workers should be trained to comply with these conditions. The holder should ensure that the construction is done in accordance with the original approved design and that the prescribed materials of the right quality and quantity are used during construction. He or she may during this phase already make use of instruments such as an audit. He or she may also commence with the training of the future employees that will commission the project.<sup>85</sup> In the case of hydraulic fracturing, the commissioning will first be preceded by a testing phase.

As set out in GN R466, the holder must prepare the site where hydraulic fracturing will occur in terms of the conditions set out in the environmental authorisation and the EMPr.<sup>86</sup> During the construction phase the well must be cased in accordance with the API or other agreed-to standards, and no inferior or damaged casing may be used; all materials must be tested in accordance with approved tests.<sup>87</sup> An official must be

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<sup>83</sup> Regs 92-93.

<sup>84</sup> Reg 110(1).

<sup>85</sup> See Nel and Kotzé "Environmental Management" 15.

<sup>86</sup> Reg 90.

<sup>87</sup> Regs 96(1)-(3, (5). If other standards are used, the holder must submit detailed information with regard to the standards, indicating how these standards will ensure better well integrity. An independent drilling engineer must submit a comparative technical assessment of the proposed standard and the prescribed standard – regs 96(6)-(7). In the case of stratigraphic wells the well design and construction standards must be submitted; written approval must be obtained – reg 96(8). A "stratigraphic well" means a "well or hole drilled only for the purpose of obtaining information pertaining to specific geological, structural and stratigraphic information that might lead towards the discovery of petroleum with no intent to produce from such well" – reg 1.

present when the casing is performed.<sup>88</sup>

There are specific requirements for conductor, surface, intermediate and production casings.<sup>89</sup> These requirements relate to the protection of shallow groundwater, subterranean fresh water and the stabilisation of sediments. There are specific requirements with regard to the cementing of the different casings,<sup>90</sup> as well as how the casing should be centralised.<sup>91</sup> The centralisers must comply with API standards, but the designated agency may require additional centralisation during the design phase.<sup>92</sup> An official must be present when the cementing is done.<sup>93</sup>

Blowout prevention equipment must also be installed except if the holder has obtained a written exception.<sup>94</sup> This equipment must also comply with the API standards and must have a "remote blowout prevention actuator that is powered by a source other than rig hydraulics." The actuator must be situated 20 meters from the nearest well head.<sup>95</sup>

During construction the holder must ensure that dust control measures are in place and if need be he or she must manage the road surfaces and erect wind breaks and barriers. The holder and construction workers must comply with the dust control measures in NEMAQA and its regulations.<sup>96</sup>

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<sup>88</sup> Reg 96(4).

<sup>89</sup> Regs 97-100.

<sup>90</sup> See eg regs 98, 100, 102(2)-(16). During the cementing process tests must be undertaken to ensure, amongst other things, that the cement mixture is the correct strength and that distilled water or potable tap water is used during the testing, to ensure that there is complete isolation from water resources. The holder must "run a radial cement bond evaluation log and monitor the annular pressure to verify the cement bond on all casing strings" and if necessary effect remedial measures if the cement is not adequate for the drilling process. The holder must report the changes and record them in a log book – regs 102(15)-(16).

<sup>91</sup> Reg 101.

<sup>92</sup> Regs 101(4)-(5).

<sup>93</sup> Reg 102(1).

<sup>94</sup> Regs 105(1)-(2).

<sup>95</sup> Reg 105(3). The equipment must be flame resistant and in good working order. The installation, testing and use of the equipment must be done by a competent person in possession of an accredited training certificate – regs 105(6)-(7). The certificate must be available at the well site and must be sent to the designated agency.

<sup>96</sup> Regs 128(1)-(3). Also see the dust regulations issued in terms of NEMAQA: GN R827 in GG 36974 of 1 November 2013.



The holder must also prepare various plans and programmes before he or she can commence with hydraulic fracturing, such as a well examination plan,<sup>97</sup> a water monitoring plan,<sup>98</sup> a testing and flowback plan,<sup>99</sup> a micro-seismic monitoring programme,<sup>100</sup> a risk management plan for each well,<sup>101</sup> a waste management plan,<sup>102</sup> a fluid transportation management plan,<sup>103</sup> an integrated water management plan,<sup>104</sup> a waste management plan<sup>105</sup> and a decommissioning plan.<sup>106</sup>

The well examination plan must, for example, deal with groundwater and aquifer isolation, seismicity risks and fracture containment. An independent person must conduct the well examination.<sup>107</sup> The waste management plan must refer, amongst other things, to the drill mud, produced fluids and radioactive contaminated fluids.<sup>108</sup> The integrated water management plan must include, amongst other things, the hydrocensus, flowcharts, a pollution prevention and impact minimisation plan, a stormwater management plan, a water conservation and demand management strategy, and a water monitoring plan.<sup>109</sup>

The equipment must comply with the prescribed standards, mostly the API standards, except if the holder agreed with the designated agency to use other equipment or if the designated agency prescribed other requirements.<sup>110</sup>

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<sup>97</sup> Reg 107.

<sup>98</sup> Reg 88.

<sup>99</sup> Reg 110(2)(b)(ix).

<sup>100</sup> Reg 89.

<sup>101</sup> Reg 115(1). The plan must refer to the chemicals and their composition, the volume of additives, the assessment of the environmental and health risks of these fluids and the "operational practices and controls for the identified risk" – regs 115(1)(a)-(d).

<sup>102</sup> Reg 116.

<sup>103</sup> Reg 117. The plan must provide for quarterly reports to the designated agency and the Department of Water and Sanitation. These reports must be consolidated into annual reports – regs 117(4)-(5).

<sup>104</sup> Reg 123(2).

<sup>105</sup> Reg 125(1).

<sup>106</sup> Reg 132(1)(a) to be approved by the designated agency.

<sup>107</sup> Regs 107(1)-(2).

<sup>108</sup> Reg 125(2).

<sup>109</sup> Regs 123(2)(a)-(i).

<sup>110</sup> See eg reg 111(1).

Before any drilling can take place, the holder must measure the background level of radioactivity in the ground adjacent to any storage tanks. These results must be provided to the designated agency on a quarterly basis.<sup>111</sup>

### **3.4 Testing phase**

Before hydraulic fracturing commences, the holder must conduct various tests. For example, he or she must test the wells by making use of small pre-fracturing injection tests with micro-seismic monitoring. If seismic activity occurs, the holder must modify his or her subsequent operations.<sup>112</sup>

After the well has been cemented, the holder must first conduct casing string tests with fresh water, mud or brine against a prescribed pressure within the presence of an authorised person.<sup>113</sup> These tests are followed by formation pressure integrity tests below the surface and intermediate casings, again in the presence of an authorised person.<sup>114</sup> The blowout prevention equipment must also be tested in accordance with the API standards and also in the presence of an authorised person.<sup>115</sup> The testing must be done before any drilling may commence below the "last cemented casing seat".<sup>116</sup> Similarly the water transfer systems must be tested.<sup>117</sup> Whenever it is possible that wells may contaminate fresh water, tests must be undertaken and the results must be reported to the designated agency.<sup>118</sup>

The holder must conduct mechanical integrity tests with fresh water, mud or brine, again in the presence of a designated official.<sup>119</sup> During the testing the holder must take different measures relating, amongst other things, to seismicity, temperatures, the flowpath, and the loss and flowback of proppants and fluids.<sup>120</sup> This information

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<sup>111</sup> Reg 118(8).

<sup>112</sup> Regs 89(7)-(8).

<sup>113</sup> Regs 103(1)-(3), (5)-(6). A record of the test must be submitted – reg 103(4).

<sup>114</sup> Regs 104(1)-(3). The holder must submit a record of the pressure tests to the designated agency – reg 104(3).

<sup>115</sup> Reg 106.

<sup>116</sup> Reg 106(2). The holder must keep records of the pressure tests and send them to the designated agency – reg 106(2)(b).

<sup>117</sup> Reg 111(2).

<sup>118</sup> Reg 99(5);

<sup>119</sup> Reg 112(1). Records must be kept and sent to the designated agency – reg 112(3).

<sup>120</sup> Reg 112(8).

must inform the EMPr.<sup>121</sup> If there is any mechanical failure, the operations must be suspended and the designated agency informed. Remedial action must be taken.<sup>122</sup>

### **3.5 Operational phase**

The site is prepared, the wells are constructed and tested and now the operations must be commissioned. Again the employees usually receive induction training on how to use the equipment and how to react in emergency situations. During this phase the holder of the authorisation must comply with all the conditions in the authorisations and must manage these operations in accordance with the prescribed plans and legislation, which may include the obligation to comply with norms and standards, SANS standards, the appointment of qualified personnel, regular monitoring, reporting and auditing, communication with interested and affected parties, or establishing public forums, amongst other obligations.<sup>123</sup>

In the case of hydraulic fracturing operations, GN R466 places general obligations on the holder of an authorisation to ensure that the environment is not contaminated by "providing a suitably designed impermeable site underlay system and making site drainage arrangements" and to ensure that the operation "does not pose a risk to public health, life, property and the environment".<sup>124</sup> The holder must ensure that a water resource is not polluted or reduced, that the water quality in the catchment area is not impaired and that the rights of water users are protected. The holder must take remedial measures should such an incident occur.<sup>125</sup>

In addition to the general requirements, specific measures are prescribed. For example, a well site may not be within 5 km of an existing municipal water well field, within 500 metres of an existing water borehole, within 500 metres of the edge of a riparian area, within a 1:100 year flood-line of a watercourse, or within 1 km of a wetland. The regulations define "watercourse" to have the meaning assigned to it

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<sup>121</sup> Reg 112(9)(b).

<sup>122</sup> Regs 112(10)-(13). Operations may commence only with approval from the designated agency.

<sup>123</sup> See Nel and Kotzé "Environmental Management" 15; Nel, Du Plessis and Du Plessis "Instrumentation for Local Environmental Governance" 106.

<sup>124</sup> Regs 91 and 119(3)(b).

<sup>125</sup> Reg 122(1).

section 1 of the *National Water Act* 36 of 1998. A "watercourse" is thus defined as "(a) a river or spring; (b) a natural channel in which water flows regularly or intermittently; (c) a wetland, lake or dam into which, or from which, water flows; and (d) any collection of water which the Minister may, by notice in the *Gazette* declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks". A wetland is not defined in the regulations and GN R466 does not refer to the *National Water Act* in this regard. However, section 1 of the *National Water Act* defines a "wetland" as "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil." The definitions of "watercourse" and "wetland" are quite wide and in terms of the Karoo this may include vast areas of land, depending on whether a narrow or a wider interpretation will be given to the two definitions. This sub-regulation may ensure that hydraulic fracturing will take place in limited areas only.

The holder must appoint competent persons to manage the hydraulic fracturing operations in terms of the legislation, policies and operational procedures.<sup>126</sup> There is also an obligation on the holder to submit various documents to the Department of Water and Sanitation, the Department of Environmental Affairs and the designated agency.<sup>127</sup> These documents refer for example to the well engineering design and the type of rig that is going to be used and the hydraulic fracturing programme and its applicable procedures. The holder must, amongst other things, indicate the proposed depth of the drilling, the authorised source and volumes of water that are going to be used, and the storage, reuse, transportation and disposal of fracturing fluids as well as the composition thereof.<sup>128</sup> Schedule 1 of GN R522 lists substances that may not be used in the hydraulic fracturing process.<sup>129</sup> The holder must also institute various

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<sup>126</sup> Reg 108.

<sup>127</sup> Reg 110(2).

<sup>128</sup> Regs 110(2)(a)-(b).

<sup>129</sup> Reg 113(1).

monitoring programmes.<sup>130</sup>

The holder may proceed with his or her hydraulic fracturing operations only once the designated agency has approved all the plans and if all the requirements of GN R466 have been complied with. The holder must inform the designated agency when the operations will commence.<sup>131</sup>

During the operational phase the holder must act in accordance with the conditions of the authorisations and all the plans that he or she had to compile.<sup>132</sup> For example, water monitoring must take place in accordance with the water monitoring plan and water samples must be submitted to an accredited laboratory for analysis. The results as well as the interpretation thereof have to be submitted to the Department of Water Affairs within seven days of the receipt thereof.<sup>133</sup> The holder must also record and report groundwater data in accordance with the Department of Water Affairs' Standard Descriptors for Geosites.<sup>134</sup> The holder is responsible for capturing all data into the Department of Water Affairs' databases.<sup>135</sup> The water balance must be determined and the equipment used for this purpose must be in good working order.<sup>136</sup>

During the life cycle of the well, well examinations must be conducted to ensure that the pressure boundary of the well is controlled.<sup>137</sup> The holder may use only air, water and water-based mud systems to drill through shallow soils and local aquifers. The holder must provide material safety data sheets to the designated agency before commencing its operations.<sup>138</sup> The holder may use other drilling fluids only if it is "technically infeasible" to use other methods and if the fluids have been approved by the designated agency.<sup>139</sup> The fluids must be stored in accordance with the

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<sup>130</sup> Regs 110(2)(b)(xii)-(xiv) (hydraulic fracturing programme), 111(2) (water transfer systems), 112(9) (mechanical integrity and fluids); 114(3) hydraulic fracturing programme in terms of fracture containment), 123(2)(i) (water monitoring). See also regs 119(3)(f)-(g).

<sup>131</sup> Regs 119(1)-(3).

<sup>132</sup> See eg reg 119(3)(a).

<sup>133</sup> Regs 88(4)-(5). The report must also include, amongst other things, a description of the sampling and testing, the chain of custody and the quality of testing.

<sup>134</sup> Reg 88(10).

<sup>135</sup> Reg 88(11).

<sup>136</sup> Regs 121(1)-(2).

<sup>137</sup> Reg 107(3).

<sup>138</sup> Reg 109(1).

<sup>139</sup> Reg 109(2).

prescriptions set out in regulation 118. Provision is made for the onsite and offsite storage of fluids. The transfer of fluids from tanks to tanker trucks is to be supervised.<sup>140</sup>

The hydraulic fracturing fluids must be confined to the hydraulic fracturing site or target zone. If the fluids migrate outside the zone, operations must be suspended immediately and remedial measures undertaken. The Department of Water and Sanitation must be notified. Operations may recommence only if the designated agency after consultation with the Department of Water and Sanitation gives written consent.<sup>141</sup> The flowback and fluids must be managed in terms of the waste management plan and must be stored in tanks that comply with SANS standards.<sup>142</sup> The transportation of fluids is managed in terms of the fluid transportation management plan and the fluids must be transported in accordance with SANS standards and the material safety data sheets.<sup>143</sup> The holder must test samples from each tank that contains hydraulic fracturing flowback or produced water to determine whether any volatile or semi-volatile organic compounds or chemicals, heavy metals and naturally occurring radioactive material are present before the tanks can be removed from the site.<sup>144</sup>

The holder must manage waste in accordance with the waste management plan and dispose of waste as set out in the authorisations.<sup>145</sup> Radioactive waste must be disposed of in terms of the *National Radioactive Waste Disposal Institute Act 53 of 2008*.<sup>146</sup> Liquid waste must be disposed of at an approved waste treatment facility. Domestic treatment facilities may be used only if the Department of Water and

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<sup>140</sup> Reg 118(6).

<sup>141</sup> Regs 114(4)-(6).

<sup>142</sup> Regs 116(1) and 118(10). The holder must provide certain information regarding the flowback and fluids within 7 days after it becomes available – reg 116(2). "Tank maintenance records, tank cleaning records and off-take waste disposal records" must be included in a quarterly report to be submitted to the designated agency and EMPr – reg 118(12).

<sup>143</sup> Regs 117(1)(a)-(e) and (3)d. For example, natural gas must be removed from fluids before they can be transported, and the fluids must be transported in terms of the relevant legislation and standards.

<sup>144</sup> Reg 118(7). The results must be provided to the transporters, the disposal operators and the designated agency. They must also be reported.

<sup>145</sup> Regs 125(3) and 124(1).

<sup>146</sup> Reg 124(2).

Sanitation approves the use thereof.<sup>147</sup> The waste may not be re-injected into the disposal wells and the discharge of hydraulic fracturing fluids, flowback and produced water into a surface watercourse is prohibited.<sup>148</sup> Drill cuttings and fluids may not be disposed annular and must be stored temporarily in tanks above ground.<sup>149</sup> Solid waste must be disposed of at a licenced waste and treatment facility.<sup>150</sup> The holder must keep a record of the waste generated and disposed of, and must submit the information to the South African Waste Information System (SAWIS).<sup>151</sup>

The draft hydraulic fracturing regulations provided specific measures for the removal and storage of top soil that were not repeated in the final regulations.<sup>152</sup> These issues will have to be addressed in the EMPr or dealt with in terms of the regulations relating to residue stockpiles and residue deposits.<sup>153</sup>

The Department of Geoscience and the Department of Water Affairs may at any time access hydraulic fracturing sites "to collect samples of fluids encountered in the exploration or production area (water or hydrocarbons, at depth or at the surface)" and analyse them.<sup>154</sup> The data must be published, except if the data relate to "the availability of petroleum or the commercial value of the holder's acreage".<sup>155</sup>

The holder must undertake site-specific seismic monitoring during the operational phase and must report any seismic activity to the designated agency and the Council of Geosciences.<sup>156</sup> Once faults have been identified, the holder must assess "the orientation and slip tendency of faults and bedding planes" and must mitigate the risks associate by fault movement, *inter alia* to prevent fracturing fluids from entering stressed faults.<sup>157</sup>

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<sup>147</sup> Reg 124(3).

<sup>148</sup> Regs 123(4)-(5).

<sup>149</sup> Regs 123(6)-(7). Annular disposal is the disposal of material between two casing strings – see Anon date unknown <http://web.ead.anl.gov/dwm/techdesc/slurry/index.cfm>.

<sup>150</sup> Reg 124(8).

<sup>151</sup> Regs 125(4) and 125(5). The holder may use only facilities that are registered on the South African Waste Information system.

<sup>152</sup> Reg 7 Gen N 1032 in GG 36938 of 15 October 2013.

<sup>153</sup> Issued in terms of NEMWA - GN R632 in GG 39020 of 24 July 2015.

<sup>154</sup> Reg 88(8).

<sup>155</sup> Reg 88(9).

<sup>156</sup> Reg 89(1).

<sup>157</sup> Regs 89(4)-(5).

The holder must ensure that there are arrangements in place for emergencies and inform the designated agency and relevant government departments of these plans.<sup>158</sup> Spillages of hydraulic fracturing fluids or flowbacks in excess of 50 litres must be cleaned up immediately and reported to the designated agency within 24 hours. If the spillage threatens or may harm a water resource, the holder must act in terms of section 19 of the *National Water Act* 36 of 1998 and sections 28 and 30 of the NEMA. The employees must be trained how to react in emergency situations and how to implement clean-up and mitigation operations.<sup>159</sup> They must also be trained to use the equipment, to understand and apply the procedures set out in the plans, and to handle the hydraulic fracturing additives.<sup>160</sup>

If a well is to be suspended during operations, the holder must obtain permission from the designated agency. The well may be suspended for a specific period only. The well must be monitored and risk assessments must be undertaken if any anomaly occurs. The well must be suspended in such a manner that it can be reused and that GN R466 also makes provision for the control of fugitive emissions, dust control and noise control.<sup>161</sup> The holder must as far as possible capture any emissions or natural gas that may escape as a result of the hydraulic fracturing. This may be done for example by way of storage vessels, routing the gas into a gas line or to a generator, or employing sand traps and surge vessels. The holder may only in exceptional circumstances make use of flaring, and then only if it will not create a fire hazard or result in an explosion.<sup>162</sup> The holder must comply with the dust control measures set in the NEMAQA and its regulations, which measures deal mostly with the managing of trucks which may cause dust.<sup>163</sup> It is specifically stated that the holder must comply with the local government bylaws on noise pollution.<sup>164</sup>

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<sup>158</sup> Reg 119(3)(c).

<sup>159</sup> Regs 117(1)(e), 119(3)(e) and 119(5).

<sup>160</sup> See eg 115(3).

<sup>161</sup> Regs 127-129.

<sup>162</sup> Regs 127(1)-(2). If flaring is to be used, specific measures are prescribed – regs 127(3)-(7).

<sup>163</sup> Regs 128(1)-(3).

<sup>164</sup> Reg 129(3).



Audits must be undertaken by an independent and competent person and the reports must be made available to the designated agency.<sup>165</sup>

### **3.6 Decommissioning and closure phase**

During the decommissioning or closure phase, depending on the conditions in the authorisations and the legislation, the holder of the authorisation must rehabilitate the site, remove equipment and demolish unnecessary buildings as far as possible,<sup>166</sup> and undertake measures to prevent future pollution and environmental degradation. In some instances, brownfield developments may take place.<sup>167</sup> Legislation may require that the holder do an additional basic assessment or EIA before closure.<sup>168</sup>

GN R466 provides measures for decommissioning in chapter 10 and specifically with regard to well suspension. Before the decommissioning can take place, the holder will have to undertake a basic assessment in terms of the EIA Regulations and prepare an EMPr.<sup>169</sup> The designated agency will specify a period during which the well must be suspended. The surface of the well must be cleared, and the "equipment and the well bore must be cemented for the full length and diameter of the wellbore to surface".<sup>170</sup> During this period, risk assessments of anomalies must be undertaken.<sup>171</sup> After the lapsing of this period, the well can be plugged in accordance with the decommissioning plan and the EMPr. During decommissioning various factors must be taken into account, namely "(a) the current condition and design of the well; (b) the height of cement in the annulus outside casing; (c) the permeable formations outside the casing that must be covered by cement; (d) the cement casing overlaps; (e) the need for abandonment plugs to cover the full diameter of the hole; (f) the type of fluid in the annuli above the cement; (g) the difficulties of injecting cement into the annulus; (h)

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<sup>165</sup> Reg 119(3)(d).

<sup>166</sup> If the building is not older than 60 years, in which case the permission of the South African Heritage Council will be needed – s 34 *National Heritage Resources Act* 25 of 1999.

<sup>167</sup> On brownfield development, see Potts and Cloete "Developing Guidelines" 389-400.

<sup>168</sup> See Nel and Kotzé "Environmental Management" 15. See eg reg 11 of GN R321 in GG 29792 of 20 April 2007 (gas pipelines).

<sup>169</sup> Listed activity 22 GN R983 in GG 38282 of 4 December 2014.

<sup>170</sup> Reg 132(3).

<sup>171</sup> Regs 130-131.

future monitoring of the integrity of the well plug; (i) the depth below the surface at which the casing must be cut; and (j) related seismic activity risks".<sup>172</sup>

Any untreated hydraulic fracturing fluids and flowbacks must be removed from the site within 60 days after the completion of the operations.<sup>173</sup> The holder must again measure the background level of radioactivity in the soil in the vicinity of the hydraulic flowback and produced water tanks to determine whether there are any changes and whether remedial measures are necessary.<sup>174</sup>

The holder must submit, to the Department of Water and Sanitation and the designated agency, a post-hydraulic fracturing report.<sup>175</sup> The report must include, amongst other things, the location of the wells, reference to the fluids, the testing and flow-back results, the induced seismic events that have been recorded and any steps taken in this regard.<sup>176</sup> The holder must also ensure that an audit is performed of the hydraulic fracturing operations for the completed well pad. This report must also be submitted to the same departments.<sup>177</sup>

After closure the holder must monitor and report for a period of three months on seismic activity in the area where the hydraulic fracturing took place.<sup>178</sup> He or she must also keep the records of the mechanical integrity of the well equipment for a five-year period after closure.<sup>179</sup> He or she must also monitor and manage the water quality and flow, post closure, in terms of the integrated water management plan.<sup>180</sup>

#### **4 Analyses and conclusions**

It is laudable that South Africa issued regulations pertaining to hydraulic fracturing before large scale-operations in this regard began to take place. The regulations are written as a guideline, however, as no offences are created. The Minister of Mineral

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<sup>172</sup> Regs 132(2)(a)-(j).

<sup>173</sup> Reg 118(4).

<sup>174</sup> Reg 118(8).

<sup>175</sup> Reg 120(1).

<sup>176</sup> Regs 120(1)(a)-(l).

<sup>177</sup> Reg 120(2).

<sup>178</sup> Regs 89(1) and (8).

<sup>179</sup> Reg 112(9)(1).

<sup>180</sup> Reg 123(2)(g).

Resources will still be the decision-maker with regard to all aspects relating to hydraulic fracturing, while the Minister of Environmental Affairs will be only the appeal authority. Whether that will prove sufficient to ensure environmental protection remains to be seen. Where the draft regulations made no reference to other environmental legislation, the final regulations do refer to other environmental legislation and link the regulations to the NEMA and specific environmental management acts. The holder of the right will, for example, still have to comply with the conditions in the EMPr and the exploration and production right and any transgression thereof will lead to criminal liability in terms of the NEMA and the MPRDA.

The regulations do not make any mention of socio-economic issues such as job creation and food security. They do not provide for public participation. One has to assume that these matters will be dealt with during the EIA process. Again it is to be remembered that the EIA process and the approval of the environmental authorisation will be under the control of the Department of Mineral Resources, who may apply criteria different from those that the Department of Environmental Affairs would. The application guidelines and forms on the website of the Petroleum Agency of South Africa (the designated authority) have also not been updated to reflect the new position yet.<sup>181</sup>

The regulations specifically exclude certain substances that may not be used as additives to fracturing fluids. However, GN R466 allows that the holder may apply to the designated agency to add additional additives where it is not technically feasible to make use of some of the existing fluids. Although the use of these fluids must be reported to the designated agency, there is no obligation to make these reports available to the public. The only way in which the public would be able to obtain these records would be to make use of the *Promotion of Access to Information Act 2 of 2000*. If the United States' history is to be applied,<sup>182</sup> the holder could claim that this

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<sup>181</sup> Petroleum Agency of South Africa 2013 <http://www.petroleumagencyrsa.com/index.php/regulations/application-process1>.

<sup>182</sup> Also see the *Emergency Planning and Community Right-To-Know Act* 42 USC § 11023 (2006) where this type of data must be provided to the Environmental Protection Agency or the relevant state where the hydraulic fracturing takes place. Also see Rahm 2011 *Energy Policy* 2974–2981;

was confidential commercial information as a ground for refusal, and this might lead to protracted court proceedings – something that the interested and affected parties in the areas where hydraulic fracturing will take place would not be able to afford.

The regulations state that the API standards must be used for certain technology and cementing, amongst other things. The question is whether the API standards are best practice and whether other countries have developed better practices.<sup>183</sup>

The practical application of the regulations still has to be tested in practice. For example, GN R466 refers to a watercourse and indicates that hydraulic fracturing may not take place within a certain distance of a watercourse or wetland. The definitions of "watercourse" and "wetland" are quite wide, and a wide interpretation of these definitions by the Department of Water and Sanitation may in fact ensure that no hydraulic fracturing could take place anywhere in South Africa. It is clearly stated that the Department of Mineral Resources will not be able to issue an exploration right or production right without a water licence being issued. The MPRDA does not refer to the fact that water use licences need to be obtained. However, if the 2013 Bill is passed in Parliament, then the applicant for an exploration right and production right will have to indicate only that he or she had applied for a water use licence.<sup>184</sup> The regulations will then be in conflict with the eventual Act. The studies relating to water conducted in terms of GN R466 will be assessed by the designated agency and not by the Department of Water and Sanitation. The interplay between these studies and the studies to be undertaken for a water use permit still have to be aligned and the practical implications thereof worked out in future.<sup>185</sup>

The monitoring of seismic activity is fixed at a three-month period and the monitoring of water pollution and quality at a five-year period. There is no indication of what will happen if seismic activity, water pollution or environmental degradation occur after

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McFeeley 2012 <http://www.nrdc.org/energy/files/fracking-disclosure-IB.pdf>.

<sup>183</sup> See, for example, Canada: Precht and Dempster 2012 <https://www.novascotia.ca/nse/pollution-prevention/docs/Consultation.Hydraulic.Fracturing-Jurisdictional.Review.pdf>.

<sup>184</sup> Sections 81 and 83 of the MPRDA, which is to be amended.

<sup>185</sup> The Draft Regulations published in terms of the *National Water Act* 36 of 1998 does not refer to these regulations - Gen N 126 in GG 38465 of 12 February 2015. At the time of the writing of this article the final regulations have not yet been published.

these periods. Section 24R of the NEMA places a continuous liability for pollution and environmental degradation on the holder of a right, while the *Mineral and Petroleum Resources Development Bill* [B15B-2013] also contains a similar provision.<sup>186</sup> The regulations seem to be in conflict with the legislation. On a positive note, GN R466 addresses the full project life cycle of the hydraulic fracturing process. The draft regulations, however, seem to make the distinction between the different phases a bit clearer than the final regulations. One has to read between the lines and combine measures from different regulations to come to this conclusion.

The regulations seem to address both technical and environmental, safety and health aspects. Whenever an activity commences, an official from the designated agency must be present to ensure that the correct procedures are followed. Whether this will be feasible and whether the officials will always be available to ensure that an activity could commence is another question. The question as to who would have to pay for the travel expenses of officials has also not been addressed. The regulations also make provision for emergency measures and are very clear that operations may not commence if any problems occur. The link between these emergency measures and sections 30 of NEMA and section 20 (that also deal with emergency issues) of the *National Water Act* will still have to be dealt with.

GN R466 does not specifically spell out how the safety and health issues of people living outside the hydraulic fracturing site should be addressed, but refers to the NEMA and specific environmental management acts in this regard. The public will have to ensure that these measures are properly addressed in the EMPr, which is a public document. GN R466 further includes various environmental management instruments such as training, reporting, monitoring and auditing.

GN R466 addresses seismic issues and the holder must prepare emergency and remedial measures in this regard. However, there is not a total ban on the use of hydraulic fracturing if seismic activity may occur. South Africa's GN R466 also provides

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<sup>186</sup> Amending s 43 by inserting s 43(1A) into the MPRDA.

for astronomical issues, most probably due to the possible location of the hydraulic fracturing sites near to sites where astronomy may occur.

It may be that these regulations may still be amended once hydraulic fracturing is in place and has been monitored for a while. Whether these regulations will provide enough protection to the safety and health of people and the environment during the entire project life-cycle of hydraulic fracturing operations remains to be seen.

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## LIST OF ABBREVIATIONS

API	American Petroleum Institute
CSIR	Council for Scientific and Industrial Research
DMR	Department of Mineral Resources
EIA	environmental impact assessment
EMPRs	<i>Environmental Management Programme Reports</i>
MPRDA	<i>Mineral and Petroleum Resources Development Act 28 of 2002</i>

MPRDAA	<i>Mineral and Petroleum Resources Development Amendment Act 49 of 2008</i>
NEMA	<i>National Environmental Management Act 107 of 1998</i>
NEMAA	<i>National Environmental Management Amendment Act 62 of 2008</i>
NEMAQA	<i>National Environmental Management: Air Quality Act 39 of 2004</i>
NEMLA	<i>National Environmental Management Laws Amendment Act 25 of 2014</i>
NEMWA	<i>National Environmental Management: Waste Act 59 of 2008</i>
SAJS	South African Journal of Science
SANBI	South African National Biodiversity Institute
SAPL	Southern African Public Law
SAWIS	South African Waste Information System
Stell LR	Stellenbosch Law Review
Vt J Env'tl L	Vermont Journal of Environmental Law