

## GOVERNMENT NOTICE

---

### DEPARTMENT OF MINERAL RESOURCES

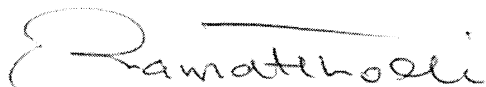
No. R. 466

3 June 2015

#### MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (ACT No.28 OF 2002)

#### REGULATIONS FOR PETROLEUM EXPLORATION AND PRODUCTION

The Minister of Mineral Resources, under section 107 of the Mineral and Petroleum Resources Development Act, 2002, (Act No. 28 of 2002), read with the provisions of section 14 of the Interpretation Act, 1957 (Act No. 33 of 1957) made the regulations as arranged in the Schedule.



ADV. NGOAKO ABEL RAMATLHODI

MINISTER OF MINERAL RESOURCES

---

## **SCHEDULE**

---

1. In these regulations, regulations means the regulations published under GN R1288 of 29 October 2004, as amended by GN R1203 of 30 November 2006 and GN R349 of 18 April 2011.
2. The regulations is hereby amended by the addition of the following regulations after regulations 83.

## **PART IV**

### **PETROLEUM EXPLORATION AND PRODUCTION**

#### **CHAPTER 6**

##### **GENERAL PROVISIONS**

84. Definitions
85. Purpose and application of Regulations

#### **CHAPTER 7**

##### **ENVIRONMENTAL IMPACT ASSESSMENT**

86. Environmental Impact Assessment
87. Assessment of Conditions Below Ground
88. Water Resource Monitoring
89. Assessment of Related Seismicity
90. Site Preparation
91. Site Containment

##### **Protection of Astronomy Activities**

92. Radio Astronomy
93. Optical Astronomy

**CHAPTER 8****WELL DESIGN AND CONSTRUCTION**

- 94. Well Risk Identification and Assessment
- 95. Well Design
- 96. Well Construction Standards
- 97. Conductor Casing
- 98. Surface Casing
- 99. Intermediate Casing
- 100. Production Casing
- 101. Centralisers
- 102. Cement Requirements and Compressive Tests
- 103. Casing String Tests
- 104. Formation Pressure Integrity Tests
- 105. Blowout Prevention
- 106. Pressure Testing of the Blowout Prevention Equipment
- 107. Well Examination

**CHAPTER 9****OPERATIONS AND MANAGEMENT**

- 108. Management of Operations
- 109. Drilling Fluids
- Management of Operations
- 110. General
- 111. Hydraulic Fracturing Equipment
- 112. Mechanical Integrity Tests and Monitoring
- 113. Hydraulic Fracturing Fluid Disclosure
- 114. Fracture and Fracturing Fluid Containment

- 115. Fracturing Fluids Management
- 116. Management of Flowback and Produced Fluids
- 117. Transportation of Fluids
- 118. Fluids Storage
- 119. Hydraulic Fracturing Operations
- 120. Post Hydraulic Fracturing Report

#### Management of Water

- 121. Water Balances
- 122. Protection of Water Resources
- 123. Water Use

#### Management of Waste

- 124. General
- 125. Waste Management

#### Management of Pollution Incidents

- 126. Management of Spillage

#### Management of Air Quality

- 127. Fugitive Emissions
- 128. Fugitive Dust
- 129. Noise Control

### CHAPTER 10

#### WELL SUSPENSION AND DECOMMISSIONING

- 130. Well Suspension
- 131. Suspended Well Integrity Management
- 132. Well Decommissioning and Closure
- 133. Short title



## CHAPTER 6

### GENERAL PROVISIONS

#### 84. Definitions

In these Regulations a word or expression to which a meaning has been assigned in the Act, bears that meaning and, unless the context otherwise indicates—

“API standards” means relevant American Petroleum Institute Standards;

“applicant” means a person who intends to make an application for an exploration right or production right in terms of the Act;

“aquifer” has the meaning assigned to it in section 1(1) of the National Water Act, 1998 (Act No.36 of 1998);

“base fluid” means the continuous phase fluid type, including, but not limited to water used in hydraulic fracturing operations;

“casing” means piping positioned in a wellbore and cemented in place to prevent soil or rock from caving and isolates fluids from the surrounding geological formations;

“competent authority” has the meaning assigned to it in section 1(1) of the National Environmental Management Act;

“competent person” has the meaning assigned to it in the Mineral and Petroleum Resources Development Regulations;

“EMPr” has the meaning assigned to it in the Environmental Impact Assessment Regulations;

“environmental authorisation” has the meaning assigned to it in section 1(1) of the National Environmental Management Act;

“Environmental Impact Assessment Regulations” means the Environmental Impact Assessment Regulations, 2014, published in Government Notice No. R982 Government Gazette No. 38282 of 4 December 2014;

“exploration well” means a well drilled for the purpose of obtaining specific geological and geophysical information to prove, define and assess the existence and commerciality of petroleum by conducting any type of pressure tests;

“flare” means a thermal oxidation system using an open, enclosed, or semi-enclosed flame;

“fresh water” means surface and subsurface water in its natural state that–

(a) is suitable for human consumption, domestic livestock, irrigation, industrial, municipal and recreational purposes;

(b) is capable of supporting aquatic life in line with South African water quality guidelines; and

(c) contains less than 1000 mg/l Total Dissolved Solids;

“gas” means natural gas, including casinghead gas, coal bed methane and shale gas;

“geohazard” means a geological state such as dolerites, kimberlite such as groundwater pathways, possible fault reactivation, zones of brecciated rock, proximity of hot springs, abnormal water temperature or presence of palaeochannels, that may lead to widespread damage or risk;

“groundwater” means water found in the subsurface in the saturated zone below the water table;

“holder” means a holder of an exploration or production right granted in terms of sections 80 and 84 of the Act, respectively;

“horizontal well” means a well where the wellbore is drilled vertically to a kick-off depth beyond which the wellbore is deviated to run parallel to the target formation;

“hydraulic fracturing” means injecting fracturing fluids into the target formation at a pressure exceeding the parting pressure of the rock to induce fractures through which petroleum can flow to the wellbore;

“hydraulic fracturing additive” means a chemical substance or combination of substances, including, but not limited to a chemical and proppant that is added to a base fluid for the purposes of preparing hydraulic fracturing fluid;

“hydraulic fracturing flowback” means hydraulic fracturing fluid and other fluids that return to the surface after hydraulic fracturing has been completed and prior to the well being placed in production;

“hydraulic fracturing fluid” means the mixture of the base fluid and the hydraulic fracturing additives used to perform hydraulic fracturing;

“hydraulic fracturing string” means a pipe or casing string used for the transport of hydraulic fracturing fluids;

“inactive well” means a well that has not been active for six (6) consecutive months;

“micro-seismic monitoring” means the monitoring of seismic activity less than or equal to magnitude 3 using a network of calibrated seismological equipment in order to produce readings on magnitude, depth, location, error and time of each seismic event;

“Mineral and Petroleum Resources Development Regulations” means the Mineral and Petroleum Resources Development Regulations published in Government Notice No.R.527 dated 23 April 2004;

“naturally occurring radioactive material” means radioactive material that naturally exists in natural materials;

“National Environmental Management Act” means the National Environmental Management Act, 1998 (Act No. 107 of 1998);

“oil” means natural crude oil or petroleum and other hydrocarbons, regardless of gravity, which are produced at the well in liquid form and which are not the result of condensation of gas after it leaves the underground reservoir;

“production well” means a well drilled for the purpose of producing petroleum;

“produced water” means water, regardless of chloride and total dissolved solids content, that is produced in conjunction with oil or natural gas production or natural gas storage operations, but does not include hydraulic fracturing flowback;

“proppant” means sand or a natural or man-made material that is used during hydraulic fracturing operations to prop open the artificially created or enhanced fractures;

“release” means spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment;

“saturated zone” means the subsurface zone below the water table where interstices are filled with water under pressure greater than that of the atmosphere;

“seismic monitoring” means the monitoring of seismic activity using a network of calibrated seismological equipment in order to produce readings on magnitude, depth, location, error and time of each seismic event;

“specific environmental management Act” has the meaning assigned to it in section 1(1) of the National Environmental Management Act;

“South African Waste Information System” or “SAWIS” means a national waste information system established in terms of section 60 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008);

“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 a well;

“the Act” means the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)

“pollution” has the meaning assigned to it in section 1(1) of the National Environmental Management Act;

“water resources” has the meaning assigned to it in section 1(1) of the National Water Act, 1998;

“watercourse” has the meaning assigned to it in section 1(1) of the National Water Act, 1998;

“well” means a drilled hole used for the purpose of exploration and production of petroleum resources;

“well integrity” means the application of technical, operational and organisational solutions to reduce the risk of uncontrolled release of formation fluids throughout the life cycle of a well;

“well examination scheme” means arrangements for an examination of the well conducted by an independent and competent person that are—

(a) recorded in writing; and

(b) suitable for ensuring, together with the assistance of any other measures the holder may take, that the well is designed, constructed, operated, maintained, modified, suspended, and decommissioned so that—

(i) there can be no escape of fluids from the well; and

(ii) risks to the health and safety of persons from the well or anything in it, or from strata, to which the well is connected, have been assessed and are within acceptable levels.

“well site” means the surface area, including a well, occupied by equipment or facilities necessary for or incidental to drilling, hydraulic fracturing, production, or plugging a well.

**85. Purpose and application of Regulations**

- (1) The purpose of these Regulations is to augment the Mineral and Petroleum Resources Development Regulations, so as to prescribe standards and practices that must ensure the safe exploration and production of petroleum.
- (2) These Regulations apply to onshore exploration and production operations and must be read with the Act, the Mineral and Petroleum Resources Development Regulations and any other relevant legislation.

**CHAPTER 7****ENVIRONMENTAL IMPACT ASSESSMENT****86. Environmental Impact Assessment**

- (1) The exploration and production activities related to petroleum are subject to the requirements of the National Environmental Management Act and any relevant specific environmental management Act.
- (2) Before exploration and production activities related to petroleum may commence, the holder must be in possession of an Environmental Authorisation issued in terms of the Environmental Impact Assessment Regulations, 2014.
- (3) When submitting an application in terms of the Environmental Impact Assessment Regulations an applicant must comply with the minimum information requirement, guidance document or decision support tool as identified by the competent authority.
- (4) The designated agency, the Council of Geosciences and the Council for Scientific Research must be identified as interested and affected parties for the purposes of the public participation to be undertaken as part of the Environmental Impact Assessment process.

**87. Assessment of conditions below ground**

- (1) An applicant or holder must assess the geology and geohydrology of the affected area prior to well design and submit a geological overview report to the designated agency for approval.
- (2) The report contemplated in sub-regulation (1) must be submitted, for consideration, to the competent authority as part of the application for

Environmental Authorisation. The report must at least include the following information:

- (a) A geological map of the area (that can encompass several hydraulic fracturing sites) at the appropriate scale and with details that must allow understanding of the potential structural aspects;
- (b) an analysis of available geological information such as published and unpublished map sheets, satellite imagery and published and unpublished scientific papers;
- (c) stratigraphic exploration boreholes to understand the regional stratigraphy and possible structural complexity as well as proposed depth(s) to the top and the bottom of the formation into which well fracturing fluids are proposed to be injected;
- (d) borehole analysis including core logging, downhole geophysics, camera, water strikes, hydrogeochemical character and injection tests in fractures or formations;
- (e) the physical and chemical properties of the stratigraphic formations such as porosity, permeability, naturally occurring fissures and fractures, total organic carbon, clay and mineralogy;
- (f) cross sections of the study area based on surface geology, exploration borehole and geophysical profiling showing the stratigraphy, including the presence and morphology of dolerite, kimberlite and tectonic structures;
- (g) groundwater monitoring (area covered, duration of monitoring, watercourse) and deep groundwater investigation to be specified when independent preliminary research has been completed;
- (h) a model of fluid migration in the geological formation; and
- (i) geohazards associated with geological formation and structural features and possible solutions to overcome them.

#### **88. Water resource monitoring**

- (1) An applicant or holder must appoint an independent specialist to conduct a hydrocensus fulfilling the standard requirements of the department responsible for water affairs which indicates potentially affected water resources, on at least, a 3 kilometres radius from the furthest point of potential horizontal drilling, as well as identify priority water source areas and domestic groundwater supplies indicated on relevant geohydrological maps.
- (2) An applicant or holder must prepare and submit, together with the water use licence application, to the department responsible for water affairs, a proposed water resource monitoring plan, for approval. The plan must at least identify-

- (a) the sampling methodology;
  - (b) the monitoring points;
  - (c) the monitoring parameters;
  - (d) the monitoring frequency; and
  - (e) the reporting frequency.
- (3) The monitoring plan contemplated in sub-regulation (2) must be submitted to the competent authority for consideration, as part of the application for Environmental Authorisation.
- (4) Water samples collected as part of the monitoring plan contemplated in sub-regulation (2) must be analysed by an accredited laboratory and the holder must submit the results and their interpretation to the designated agency and the department responsible for water affairs within 7 days after receipt thereof.
- (5) The results must at least include a detailed description of the sampling and testing conducted, including duplicate samples, the chain of custody of the samples and quality control of the testing.
- (6) A full water monitoring report must be included in the EMPr required in terms of the Environmental Impact Assessment Regulations, 2014.
- (7) A holder must, after conducting a baseline water quality assessment, continue with monitoring in accordance with the approved plan and must-
  - (a) have the water resources subjected to sampling, analysis and interpretation of water quality and changes in water levels by an independent specialist approved by the designated agency in accordance with the approved plan contemplated in sub-regulation (2);
  - (b) submit the results of the analysis and interpretation to the designated agency and the department responsible for water affairs within 7 days of receipt of the analysis and interpretation; and
  - (c) submit the monitoring assessment reports in accordance with the approved monitoring plan contemplated in sub-regulation (2).
- (8)
  - (a) The designated agency, Council for Geoscience, Council for Scientific and Industrial Research, designated local authorities or the department responsible for water affairs, may collect samples of fluids encountered in the exploration or production area (water or hydrocarbons, at depth or at the surface) for their own analysis and interpretation.
  - (b) The holder must allow site access to the authorities mentioned in paragraph (a) for the purpose of collecting the samples.

- (9) Data collected as contemplated in this regulation must be published except where it may be shown to directly relate to the availability of petroleum and commercial value of the holder's acreage.
- (10) Groundwater aspects must be recorded and reported according to the department responsible for water affairs' Standard Descriptors for Geosites.
- (11) The holder must capture the water resource data generated into the relevant department responsible for water affairs' databases.

#### **89. Assessment of related seismicity**

- (1) An applicant or holder must, prior to conducting hydraulic fracturing, assess the risk of potential hydraulic fracturing related seismicity and submit a risk assessment report and the proposed mitigation measures to the designated agency for approval and recommendation by the Council for Geoscience and the risk assessment report must, as a minimum, identify—
  - (a) stressed faults which must be avoided in the fracturing process;
  - (b) fracture behaviour of targeted formations; and
  - (c) the site-specific seismic monitoring to be undertaken pre-fracturing, during operation and post fracturing including the monitoring and reporting frequency.
- (2) An applicant or holder must carry out site-specific surveys prior to hydraulic fracturing to characterise local stress regimes and identify proximal faults and the site characterisations must at least include—
  - (a) desktop studies of existing geological maps;
  - (b) seismic reflection and refraction data where available;
  - (c) available background seismicity data;
  - (d) stress data from proximal boreholes where available; and
  - (e) other relevant available geophysical data, such as gravity.
- (3) The risk assessment report contemplated in sub-regulation (1) and the site-specific surveys contemplated in sub-regulation (2) must be submitted to the competent authority, for consideration, as part of the application for Environmental Authorisation.
- (4) The assessment of the orientation and slip tendency of faults and bedding planes may be done once faults have been identified and geological stress regimes characterised.
- (5) The holder must mitigate risks of fault movement by identifying stressed faults by preventing fracturing fluids from entering stressed faults.



- (6) The holder must test fracture a targeted formation in a given well by using small pre-fracturing injection tests with micro-seismic monitoring.
- (7) A holder must, following pre-fracturing injection tests contemplated in sub-regulation (6), investigate whether seismic activity occurs and then modify subsequent hydraulic fracturing operations.
- (8) The holder must undertake seismic monitoring at the site for a period of 3 years after hydraulic fracturing activities have ceased and include the results of the seismic monitoring in the monitoring report contemplated in sub-regulation (1)(c).

**90. Site preparation**

The area in respect of which an exploration or production right is granted must be prepared in accordance with the Environmental Authorisation and the approved EMPr.

**91. Site containment**

A holder must at all times, prevent the contamination of the environment by providing a suitably designed impermeable site underlay system and making site drainage arrangements.

**Protection of astronomy activities**

**92. Radio astronomy**

- (1) The Minister of Mineral Resources must, as part of issuing an exploration and a production right, ensure that the holder of such a right complies with the declarations made, and regulations promulgated, in terms of the Astronomy Geographic Advantage Act, 2007 (Act No. 21 of 2007), for the protection of astronomy advantage areas declared for radio astronomy purposes.
- (2) Where an authorisation is required by a declaration made, or a regulation promulgated, in terms of the Astronomy Geographic Advantage Act, 2007, the authorisation must be obtained prior to the issuing of an exploration and a production right.

- (3) Compliance with a declaration made, and a regulation promulgated, in terms of the Astronomy Geographic Advantage Act, 2007, must be a condition of the exploration and production right.

**93. Optical astronomy**

- (1) The Minister of Mineral Resources must, as part of issuing an exploration and production right, ensure that the holder of such a right complies with the declaration made and regulations promulgated, in terms of the Astronomy Geographic Advantage Act, 2007, for the protection of astronomy advantage areas declared for optical astronomy purposes.
- (2) Where an authorisation is required by a declaration made, and regulations promulgated, in terms of the Astronomy Geographic Advantage Act, 2007, the authorisation must be obtained prior to the issuing of an exploration and production right.
- (3) Compliance with a declaration made, and regulations promulgated, in terms of the Astronomy Geographic Advantage Act, 2007, must be a condition of the exploration and production right.

## **CHAPTER 8**

### **WELL DESIGN AND CONSTRUCTION**

**94. Well risk identification and assessment**

- (1) The primary responsibility for identifying, assessing and mitigating well hazards rests with the holder.
- (2) An applicant or holder must ensure that the following specific design and operational risks are considered as part of the well-related risk assessment process:

- (a) Aquifer isolation;
  - (b) permeable zones must be assessed to achieve adequate isolation by casing with cement;
  - (c) the holder must protect potable groundwater and prevent migration of high salinity groundwater into the stimulation well or other aquifers and the final well decommissioning of the stimulation well design must be considered at the well design phase;
  - (d) casing deformation and cement degradation;
  - (e) fracturing containment;
  - (f) seismicity induced by hydraulic fracturing;
  - (g) deformation of aquifers and geological strata due to injection or extraction of fluids or gas; and
  - (h) surface subsidence due to deformation of aquifer and geological during fluid or gas extraction.
- (3) Control measures must–
- (a) be based on well design risk assessments and the environmental risk assessments;
  - (b) be documented in the well's basis of design documentation and well operations programmes or equivalent documents.
- (4) The well design risk assessment contemplated in sub-regulation (2), which includes the proposed control measures contemplated in sub-regulation (3), must be submitted to the competent authority, for consideration, as part of the application for an Environmental Authorisation.

## **95. Well design**

- (1) A holder must ensure that a well design is informed by the risk assessment and is constructed, equipped, commissioned, operated, modified, maintained, suspended and decommissioned in a manner that provides for the control of the well at all times and must prevent–
- (a) the migration of petroleum and other fluids into any other formation except the targeted formation;
  - (b) the pollution of water resources; and
  - (c) risks to health and safety of persons from the well or anything in the well, or in strata to which the well is connected.

- (2) The final well decommissioning design must be considered at the well planning stage and be included as part of the application for Environmental Authorisation for consideration.
- (3) The decommissioning design must at least consider the following:
  - (a) The height of cement in annulus outside casing;
  - (b) permeable formations outside the casing that must be covered by cement;
  - (c) cementing casing overlaps;
  - (d) the need for plugs to cover the full diameter of the hole, with only casing within the cement;
  - (e) the type of fluid in annuli above cement; and
  - (f) the difficulty of injecting cement into the annulus.
- (4) Where technically appropriate and environmentally safe, multi-well pads and horizontal drilling technologies must be considered in order to maximise the spacing between neighbouring wells and to minimise the cumulative surface impact of operations.

#### **96. Well construction standards**

- (1) A well, except a stratigraphic well, must be cased according to current industry standards published by the API "5CT Specification for Casing and Tubing" and the casing thread compound and its use must conform to the current API RP 5A3.
- (2)
  - (a) A casing installed must have a minimum yield pressure designed to withstand at least 1.2 times the maximum pressure to which the casing may be subjected during drilling, production or hydraulic fracturing operations.
  - (b) The minimum yield pressure must be based upon engineering calculations as listed in the API "TR 5C-3 Technical Report on Equations and Calculations for Casings, Tubing and Line Pipe used as Casing and Tubing, and Performance Properties Tables for Casing and Tubing".
- (3) A holder may not use casing–
  - (a) that is pitted, patched, bent, corroded, crimped, or casing
  - (b) the threads of which are worn or damaged; or

- (c) that is reconditioned and that has not passed the approved hydrostatic pressure and drift test pursuant to API "5CT Specification for Testing and Tubing".
- (4) A holder must contact the designated agency at least 2 days prior to setting a casing to enable an authorised person to be present when the test is done.
- (5) A holder may, despite any provision of these Regulations, but subject to sub-regulations (6) and (7), adopt well construction standards for exploration and production wells other than those provided for in these Regulations.
- (6) A holder intending to adopt well construction standards as contemplated in sub-regulation (5) must-
  - (a) submit detailed information about the proposed well construction standards;
  - (b) provide a detailed comparative technical assessment of the proposed well construction standards and the standards prescribed under these regulations from an independent drilling engineer; and
  - (c) show how such well construction standards will enhance higher levels of well integrity as compared with those prescribed under these regulations.
- (7) A holder may proceed to implement well construction standards as contemplated in sub-regulation (5) only after receiving written consent from the designated agency.
- (8) A holder intending to drill stratigraphic wells-
  - (a) must submit, to the designated agency, its proposed well design and construction standards to be adopted to show that well integrity will be maintained; and
  - (b) may only proceed with drilling after receiving written approval from the designated agency.

#### **97. Conductor casing**

Conductor casing must be set and cemented to a surface in order to-

- (a) stabilise unconsolidated sediments;
- (b) isolate shallow aquifers that provide or are capable of providing fresh groundwater for water wells and springs in the vicinity of the well; and
- (c) provide a base for equipment to divert shallow natural gas.

**98. Surface casing**

Surface casing for exploration or production wells must be set to a depth of 60m below the base of the deepest fresh water or at least 100 metres above the top of expected petroleum bearing zones, whichever comes first, and cemented to a surface.

**99. Intermediate casing**

- (1) Intermediate casing for exploration and production wells must be set to protect unexpected fresh water found below the surface casing shoe.
- (2) Intermediate casing used to isolate fresh water must not be used as the production string in the well in which it is installed and must not be perforated for purposes of conducting a hydraulic fracture treatment through it.
- (3) When intermediate casing is installed to protect fresh water, it must be set at least 30 meters below the base of the unexpected deepest fresh water and must be cemented to the surface.
- (4) In instances where intermediate casing is set solely to protect fresh water encountered below the surface casing shoe and cementing to the surface is technically infeasible and may result in lost circulation or both, cement must be brought to a minimum of 180 meters above the shallowest fresh water zone encountered below the surface casing shoe.
- (5) The location and depths of petroleum-bearing zones or fresh water zones that are open to the wellbore above the casing shoe, must be confirmed by coring, electric logs, testing or such data from an offset well on the same well pad and must be reported to the designated agency.

**100. Production casing**

- (1) In cases where intermediate casing is not installed, production casing must be run and be fully cemented to the surface.
- (2) If intermediate casing is in place, production casing must be set and be fully cemented to 150 meters above the top perforated zone.

**101. Centralisers**

- (1) Casing must be centralised in each segment of the wellbore to provide sufficient casing standoff and foster effective circulation of cement to isolate critical zones including aquifers, flow-zones, voids, lost circulation zones and hydrocarbon production zones.
- (2) Surface casing must be centralised at the shoe, above and below a stage collar or diverting tool, and through fresh water zones.
- (3) In non-deviated holes, a pipe centraliser must be placed every fourth joint from the cellar cement shoe to the ground surface or to the bottom of the cellar.
- (4) Centralisers must be in accordance with the standards of-
  - (a) API "10 D, Specification for Bow-Spring Casing Centralizers and all rigid centralizers";
  - (b) API "10 TR 4 Considerations Regarding Selection of Centralizers for Primary Cementing Operations"; and
  - (c) API RP "10D-2, Recommended Practice for Centralizer Placement and Stop Collar Testing".
- (5) The designated agency may require additional centralisation where necessary in order to ensure the adequacy of the integrity of the well design.

**102. Cement requirements and compressive tests**

- (1) A holder must notify the designated agency at least 2 days before commencing with cementing of casing operations to enable an authorised person to be present.
- (2) Cementation of casing must be done by the pump and plug method with a minimum of 25% excess cement and appropriate loss circulation material, unless another amount of excess cement is approved by the designated agency.
- (3) Cement placed into the well bore must be cement that is manufactured to meet the standards of API "10 A Specification for cements and material for well cementing" or ASTM "C150/C150M Standard Specification for Portland Cement" and foamed cement slurry must be prepared to minimise its free water content in accordance with API "RP 10B-4 Recommended Practice On Preparation and Testing of Foamed Cement Slurries at Atmospheric Pressure."

- (4) A holder must conduct tests for cement mixtures for which published performance data is not available on representative samples of the basic mixture of cement and additives used, by using distilled water or potable tap water for preparing the slurry.
- (5) The actual water for preparing the slurry for cement mixtures for which published performance data is not available must be the distilled water or potable tap water used for testing as contemplated in sub-regulation (4).
- (6) Tests contemplated in sub-regulation (4) must be conducted using the equipment and procedures established in the current API "RP 10 B-2 Recommended Practice for Testing Well Cements" and API "RP 10B-4 Recommended Practice on Preparation and Testing of Foamed Cement Slurries at Atmospheric Pressure"
- (7) Test data showing competency of a proposed cement mixture to meet the requirements of the current API "API RP 10 B-2 Recommended Practice for Testing Well cements" must be submitted to the designated agency for approval prior to the cementing operation.
- (8) A holder must perform cement compressive strength tests on casing strings and if it does not conform to standards it must be redone.
- (9) After the cement is placed behind the casing, a holder must wait for the cement to set until the cement achieves a calculated compressive strength of at least 500psi (3447.38 kPa) before the casing is disturbed in any way, including installation of a blow-out preventer.
- (10) The cement must have a compressive strength of at least 1,200 psi (8273.71 kPa), and the free water separation must be no more than 6 millilitres per 250 millilitres of cement, tested in accordance with the current API TR 10TR3.
- (11) A holder must ensure that there is isolation of hydraulic fracturing operations from freshwater and other permeable horizons by ensuring complete cement isolation in each casing annulus.
- (12) A holder must, in co-operation with specialist contractors, prepare suitable programmes for cement placement operations, including monitoring of the effectiveness of placement as part of the operations planning, contingency plans and procedures to cover the possibility of a failure to meet the cementation design objectives.
- (13) The designated agency may, where necessary, require-
  - (a) a specific cement mixture to be used in a well or an area if evidence of local conditions indicates that specific cement is necessary; or



- (b) installation of an additional cemented casing string or strings in the well.
- (14) A holder must run a radial cement bond evaluation log and monitor the annular pressure to verify the cement bond on all casing strings and must carry out remedial cementing if the cement bond is not adequate for drilling ahead.
- (15) A copy of the cement job log for a cemented casing string in the well must be maintained in the well file and be submitted to the designated agency.
- (16) Proposed changes to the cementation programme must be reported to the designated agency for approval before the changes are implemented except in the case of a need to prevent a possible catastrophic consequence.

### **103. Casing string tests**

- (1) After the setting and cementing of a casing string, except the conductor casing, and prior to further drilling, the casing string must be tested with fresh water, mud, or brine to at least the maximum anticipated treatment pressure but no less than 0.22 psi per foot (1.512 kPa per 0.3048 meter) of casing string length or 1,500 psi (10 342.12 kPa), whichever is greater, for at least 30 minutes with less than a 5% pressure loss.
- (2) The pressure test must not exceed 70% of the minimum internal yield and if the pressure declines more than 5%, or if there are other indications of a leak, corrective action must be taken before conducting further drilling and hydraulic fracturing operations.
- (3) A holder must notify the designated agency at least 2 days prior to conducting a pressure test to enable an authorised person to be present when the test is done.
- (4) A record of the pressure test must be submitted to the designated agency prior to conducting hydraulic fracturing operations.
- (5) The actual pressure must not exceed the test pressure at any time during hydraulic fracturing operations.
- (6) A hydraulic fracturing string used in the operations must be either strung into a production liner or run with a packer set at least 30 meters below the deepest cement top and must be tested to not less than the maximum anticipated treating pressure minus the annulus pressure applied between the fracturing string and the production or immediate casing.

- (7) The pressure test must be considered successful if the pressure applied has been held for at least 30 minutes with no more than 5% pressure loss.
- (8) The annulus between the hydraulic fracturing string and casing must be pressurised to at least 250 psi (1723.69 kPa) and monitored.

#### **104. Formation pressure integrity test**

- (1) A holder must, after a successful casing string test contemplated in regulation 103, conduct a formation pressure integrity test below the surface casing and below all intermediate casing.
- (2) A holder must notify the designated agency, at least 2 days prior to conducting a formation pressure integrity test, to enable an authorised person to be present when the test is done.
- (3) A record of the pressure test must be submitted to the designated agency prior to conducting hydraulic fracturing operations.
- (4) The actual hydraulic fracturing treatment pressure must not exceed the casing test pressure at any time during hydraulic fracturing operations.

#### **105. Blowout prevention**

- (1) A holder must install blowout prevention equipment that meets the current API Std 53 for blowout equipment after setting the casing to shut-off a wellhead which must be supported and secured to prevent stresses on all connections.
- (2) A holder may be exempted from installing blowout prevention equipment as contemplated in sub-regulation (1) only if the holder-
  - (a) obtains written approval from the designated agency;
  - (b) shows that the conditions under which it is operating do not require the installation of blowout preventer equipment as contemplated in sub-regulation (1); and
  - (c) provides reliably operating well control equipment it intends to install in order to control kicks, prevent blowouts and to safely carry out all well operations.
- (3) Blowout prevention equipment installed at a well that maybe subject to hydraulic fracturing must include a remote blowout prevention actuator-

- (a) that is powered by a source other than rig hydraulics;
  - (b) that is located at least 20 meters from the well head; and
  - (c) that has an appropriate rated pressure equal to or greater than the induced hydraulic fracture pressure.
- (4) Lines, valves and fittings between the blowout preventer and the remote actuator must be flame resistant and must have a working pressure rating higher than the maximum anticipated well heads surface pressure.
- (5) Blowout prevention equipment must be in good working condition at all times.
- (6) When blowout prevention equipment is installed, tested, or in use, a competent person must be present at the well site and that person must have a current well control certification from an accredited training programme that is acceptable to the designated agency.
- (7) The certification referred to in sub-regulation (6) must be available at the well site and be provided to the designated agency upon request.

**106. Pressure testing of blowout prevention equipment**

- (1) The blowout prevention equipment must be tested to 100% of rated working pressure and the annular-type blowout preventer must be tested to 1,000 psi (6894.76 kPa) at the time of installation in accordance with current API std 53 for blowout equipment.
- (2)
  - (a) Testing of blowout prevention equipment for a drilling or completion operation must take place prior to drilling below the last cemented casing seat.
  - (b) The holder must maintain a record of the pressure tests and submit the record to the designated agency.
- (3) A holder must notify the designated agency at least 2 days prior to conducting a blowout preventer test to enable an authorised person to be present when the test is done.
- (4) Blowout prevention equipment that has failed any pressure test must not be used until it is repaired and passes the pressure test.

**107. Well examination**

- (1) A holder must submit a well examination plan to the designated agency before commencing with drilling or hydraulic fracturing, which plan must include aspects not limited to the following:
  - (a) groundwater and aquifer isolation;
  - (b) fracture containment;
  - (c) related seismicity risks;
  - (d) fracturing and flow-back or testing programmes and operations;  
and
  - (e) independent well examination.
- (2) The designated agency may, at the cost of the holder, appoint an independent and competent person to undertake well examination.
- (3) Well examination must at all times demonstrate that the pressure boundary of the well is controlled throughout the life cycle of the well.

**CHAPTER 9****OPERATIONS AND MANAGEMENT****108. Management of operations**

A holder must appoint competent persons to be responsible for the day to day management of the operations in accordance with relevant legislation, policies and relevant operational procedures.

**109. Drilling fluids**

- (1) A holder must ensure that drilling operations through shallow soils and local aquifers are always undertaken using air, water or water-based mud systems, details of which must be declared through material safety data sheets to the designated agency prior to commencement of drilling operations.
- (2) A holder may only use other forms of drilling fluids below cemented surface casing where it can be shown that the use of drilling fluids contemplated in sub-regulation (1) is technically infeasible and with the prior approval of the designated agency.

**Management of operations****110. General**

- (1) A holder must not commence with drilling operations before obtaining the necessary authorisations, permits and licences in terms of the National Water Act, 1998, the National Environmental Management Act, 1998, and the specific environmental management Act;
- (2) An applicant must submit the following to the designated agency, the department responsible for water affairs and to the competent authority as part of the application for Environmental Authorisation:
  - (a) A well engineering design which must include but not be limited to the-
    - (i) type of rig to be used;
    - (ii) method of drilling;
    - (iii) type and estimated amount of drilling fluids;
    - (iv) different stages of drilling and the size of drill bits;
    - (v) casing programme;
    - (vi) cementation programme; and
    - (vii) perforation design.
  - (b) a hydraulic fracturing programme and procedure that must include-
    - (i) pre-fracturing simulation and modelling;
    - (ii) the proposed depth(s) to the top and the bottom of the formation into which well fracturing fluids are to be injected;
    - (iii) the authorised source and volume of water to be used;
    - (iv) handling, storage, reuse, transportation, treatment and disposal of hydraulic fracturing fluids and flow-back.
    - (v) fracturing fluid compositions, concentrations and estimated total volume to be used;

- (vi) the anticipated surface and downhole treating pressure range;
- (vii) the maximum injection treatment pressure;
- (viii) the annuli and offset well pressure monitoring programme to be performed;
- (ix) a testing and flowback plan;
- (x) equipment rig up and testing, including testing of high pressure equipment;
- (xi) a design of the fracture geometry including fracturing target zones, sealing mechanisms and aquifers;
- (xii) a micro-seismic monitoring programme;
- (xiii) the monitoring of pressure on the production string and well annuli during rig up and testing; and
- (xiv) the monitoring of any adjacent or offset wells for pressure on the production string and other well annuli as required.

#### **111. Hydraulic fracturing equipment**

- (1) Equipment used in hydraulic fracturing operations must be fit for purpose and must meet relevant API standards as prescribed in these Regulations.
- (2) Water transfer systems must be designed to site-specific conditions and must be tested and monitored in accordance with a schedule approved by the designated agency.

#### **112. Mechanical integrity tests and monitoring**

- (1) Before the commencement of hydraulic fracturing-
  - (a) mechanical integrity tests required under these Regulations must be successfully completed;
  - (b) the injection lines and manifold, associated valves, hydraulic fracturing head or tree and any other wellhead component or connection not previously tested must be tested with fresh water, mud, or brine to at least the maximum anticipated treatment pressure for at least 30 minutes with less than a 5% initial pressure loss.

- (2) A holder must notify the designated agency at least 2 days before commencing with the tests contemplated in sub-regulation (1) to enable an authorised person to be present during the testing operations.
- (3) A record of the pressure test must be maintained by a holder and made available to the designated agency.
- (4) The pressure exerted on treating equipment including valves, lines, manifolds, hydraulic fracturing head or tree, casing and hydraulic fracturing string, if used, must not exceed 95% of the working pressure rating of the weakest component.
- (5) A function-tested relief valve and diversion line must be installed and used to divert flow from the hydraulic fracturing string-casing annulus to a covered tank in case of hydraulic fracturing string failure.
- (6) The relief valve must be set to limit the annular pressure to no more than 95% of the working pressure rating of the casings forming the annulus.
- (7) The hydraulic fracturing treatment pressure must not exceed the test pressure of any given component at any time during hydraulic fracturing operations.
- (8)
  - (a) During hydraulic fracturing, annulus pressure, injection pressure and the rate of injection must be continuously monitored and recorded.
  - (b) Micro-seismicity (in real time <5 minute delay) must be monitored by a long array of accelerometers located in an offset monitoring well, situated 100m or more away from well at a comparable depth.
  - (c) Microseismic sensors must be designed for temperatures between 175-200 degrees C.
  - (d) Tiltmeter measurements must be taken with an array of tiltmeters, either located in shallow offset wells (10m) at the site surface or in a more sensitive deep offset well at comparable depth to fracking depth and in fracking well which provides info on fracture orientation and direction (azimuth).
  - (e) Downhole pressure sensors must be used to provide indirect measurements of fracture height, which are to be connected to the production casing as well as outer casings to monitor well integrity.

- (f) Performing temperature and flow logging along the length of the well must correlate with information on fracture growth.
- (g) Proppants must be tagged with radioactive isotopes so that proppant can be analysed to locate where different stages of the proppant went and to locate fractures at depth.
- (h) Chemical tracers must be added to hydraulic fracturing fluid to improve the understanding of fracture fluid loss and flowback.
- (i) Temperature in the well must be measured to trace fluids from shale formations that are at a higher temperature than shallow fluids using fibre-optic sensors to measure temperature, pressure and sound that provides real-time information on fracture locations in the well (fibre-optic sensors are especially valuable for use in downhole high pressure high T situations where electronic gauges fail).
- (j) The following aspects must also be monitored during the stimulation operation and reported to the designated agency on a quarterly basis:
  - (i) type and volumes of water sourced for stimulation operations;
  - (ii) volumes and rates of fracking fluid pumped into the target zone; and
  - (iii) volumes and rates of flowback received during and after each stimulation.
- (9) The holder must maintain monitoring records and submit:
  - (a) the records to the designated agency at any time during the period up to and including 5 years after the well is permanently plugged or decommissioned.
  - (b) Monitoring results must also be included in the Environmental Management Programme Report required in terms of the Environmental Impact Assessment Regulations.
- (10) Hydraulic fracturing operations must be immediately suspended if an anomalous pressure or flow condition or other anticipated pressure or flow condition is occurring in a way that indicates that the mechanical integrity of the well has been compromised and that continued operations pose a risk to the environment.



- (11) A holder must notify the designated agency and the department responsible for water affairs within 1 hour of suspending hydraulic fracturing as a result of circumstances contemplated in sub-regulation(10) relating to the mechanical integrity of the well or the risk to the environment.
- (12) Remedial action must be undertaken immediately and the designated agency must be satisfied with the remedial actions prior to issuing a written consent for the recommencement of operations.
- (13) The designated agency may only issue a written consent for the recommencement of operations as contemplated in sub-regulation (12) after consulting with the department responsible for water affairs.

**113. Hydraulic fracturing fluid disclosure**

- (1) The substances listed in schedule I attached hereto are prohibited from use in the fracturing process.
- (2) A holder or applicant shall, as part of the impact assessment, submit the following information to the competent authority –
  - (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 percent 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.

**114. Fracture and fracturing fluid containment**

- (1) A holder must conduct a risk assessment and submit a risk assessment report to the designated agency and to the competent authority as part of the application for Environmental Authorisation which report must-

- (a) describe the control and mitigation measures for fracture containment; and
  - (b) document the basis for the sealing mechanism and demonstrate that adequate control measures will be implemented.
- (2) Faults and igneous intrusions that may impact the hydraulic fracturing seal mechanism must be researched and assessed and the assessment must be documented and referenced in the Hydraulic Fracturing Programme referred to in regulation 110 (2) (b), in order to demonstrate that the risk of fracturing fluids migrating via faults and intrusions beyond the designated fracture zones has been mitigated.
- (3) Hydraulic fracturing must be monitored and recorded as stipulated in the Hydraulic Fracturing Programme referred to in regulation 110 (2)(b) to ensure that well integrity is maintained.
- (4) Hydraulic fracturing fluid must be confined to the target zone and if the monitoring system contemplated in sub-regulation (3) or the water monitoring programme indicates that hydraulic fracturing fluid or hydraulic fracturing flowback is migrating outside the target zone, the holder must immediately–
  - (a) suspend hydraulic fracturing until remedial action, that prevents the fluid migration, is completed; and
  - (b) notify the designated agency and the Department of Water and Sanitation.
- (5) A holder must obtain the approval of the designated agency prior to resuming hydraulic fracturing operations suspended in terms of sub-regulation (4).
- (6) The designated agency may only issue a written consent for the recommencement of operations as contemplated in sub-regulation (5) after consulting with the department responsible for water affairs.

#### **115. Fracturing fluids management**

- (1) An applicant or holder must assess potential risks and develop a risk management plan for each well to be fractured which plan must address the following aspects:
  - (a) Identification of chemical ingredients and characteristics of each additive;

- (b) identification of volume and concentration of hydraulic fracturing additives in the fracturing fluid;
  - (c) assessment of potential environmental and health risks of fracturing fluids and additives in both diluted and concentrated form; and
  - (d) definition of operational practices and controls for the identified risk.
- (2) A risk management plan referred to in sub-regulation (1) must be submitted–
  - (a) to the competent authority, for consideration and approval, as part of the application for Environmental Authorisation; and
  - (b) to the designated agency before the applicant or holder may commence with hydraulic fracturing operations.
- (3) A holder must–
  - (a) to the extent technically feasible, maximise the use of environmentally friendly additives and minimise the amount and number of additives; and
  - (b) train and develop relevant employees on appropriate procedures in the handling of hydraulic fracturing additives.

**116. Management of flowback and produced fluids**

- (1) A holder must manage flowback and produced fluids in accordance with the approved waste management plan referred to in regulation 125.
- (2) A holder must, within 7 days after it becomes available, disclose to the designated agency and the department responsible for water affairs, the following information regarding flowback and produced fluids:
  - (a) The actual volume of fluids to be recovered during flow-back;
  - (b) the water quality balance of additives not recovered;
  - (c) the actual rates, pressures and temperatures of fluids recovered and produced;
  - (d) the flowback and produced fluids compositional analysis;
  - (e) any identified contamination issues; and
  - (f) any radioactive contaminated fluids.

**117. Transportation of fluids**

- (1) An applicant or holder must develop a fluid transportation management plan that must at least ensure–

- (a) planning to minimise fluid transport movements and distances;
  - (b) the implementation of management procedures to address the risks associated with fluid transport;
  - (c) that natural gas is removed from fluids prior to fluids being transported and a system for checking and recording is implemented;
  - (d) that fluids are transported to and from the hydraulic fracturing treatment site in accordance with relevant legislation and national standards in a manner designed to prevent spillage; and
  - (e) that the general workforce, including drivers, receives appropriate training and is equipped to respond to emergencies and to implement clean up measures.
- (2) A fluid transportation management plan referred to in sub-regulation (1) must be submitted–
  - (a) to the competent authority, for consideration and approval, as part of the application for Environmental Authorisation; and
  - (b) to the designated agency 30 days prior to the commencement of drilling and hydraulic fracturing.
- (3) The transportation of hazardous fluids or materials must be carried out in accordance with applicable South African National Standards, relevant legislation and the Material Safety Data Sheets.
- (4)
  - (a) The fluid transportation management plan referred to in sub-regulation (1) must include a quarterly reporting requirement.
  - (b) Quarterly reports conforming to the approved plan must be submitted to the designated agency and the department responsible for water affairs.
- (5) The quarterly reports must be consolidated into annual reports which must be included in the EMPr.

#### **118. Fluids storage**

- (1) An area where hydraulic fracturing additives, chemicals, oils, fuels are to be stored must have sufficient containment capacity to hold the volume of the largest container stored on site plus 10% to allow for precipitation, unless the container is equipped with individual secondary containment.

- (2) For the purposes of storage at the well site, hydraulic fracturing additives, hydraulic fracturing fluids, hydraulic fracturing flowback, and produced water must be stored in above-ground tanks during the phases of drilling, hydraulic fracturing and production operations until removed for proper disposal.
- (3) For the purposes of centralised storage off site for potential re-use prior to disposal, hydraulic fracturing additives, hydraulic fracturing fluids, hydraulic fracturing flowback, and produced water must be stored in above-ground tanks with lined bund walls.
- (4) Untreated hydraulic fracturing fluids and hydraulic fracturing flowback must be removed from the well site within 60 days after the completion of hydraulic fracturing operations.
- (5) Tanks, piping, and conveyances, including valves of sufficient pressure rating, must be constructed and be able to resist corrosion and be maintained in a leak-free condition.
- (6) Fluids transfer operations from tanks to tanker trucks must be supervised at both ends and along interconnecting piping.
- (7)
  - (a) A sample from every tank that contains hydraulic fracturing flowback or produced water must be tested for volatile organic compounds, semi-volatile organic chemicals, inorganic chemicals, heavy metals, and naturally occurring radioactive material, prior to removal from the site.
  - (b) The results of the test must be—
    - (i) submitted to the waste transportation and disposal operators and the designated agency; and
    - (ii) included in the quarterly waste management report.
- (8)
  - (a) The background level of radioactivity in the ground adjacent to the storage tanks must be measured prior to drilling and prior to site restoration to establish whether there has been any change that may require particular remediation measures.
  - (b) The results of the measurements must be included in the quarterly report to be submitted to the designated agency.
- (9) A holder must make use of tanks to store flow-back fluids on site.
- (10) Storage tanks must comply with applicable corrosion control requirements in accordance with applicable South African National Standards in terms of the Standards Act, 2008 (Act 8 of 2008).

- (11) Storage site locations must be secured at all times.
- (12) Information relating to tank maintenance records, tank cleaning records and off-take waste disposal records must be included in the quarterly report, submitted to the designated agency and included in the EMPr.

#### **119. Hydraulic fracturing operations**

- (1) A holder may only proceed with hydraulic fracturing operations–
  - (a) after the designated agency has approved the plans and well engineering design contemplated in regulation 27; and
  - (b) after all other requirements prescribed by these Regulations have been fully satisfied.
- (2) A holder must notify the designated agency and the department responsible for water affairs, in writing, at least 5 days before commencing with hydraulic fracturing operations.
- (3) During hydraulic fracturing, a holder must–
  - (a) comply with the terms and conditions of the exploration and production right as well as any other authorisations;
  - (b) conduct operations in a manner that does not pose a risk to public health, life, property and the environment;
  - (c) ensure that arrangements to deal with emergencies are in place and are disclosed to the designated agency and relevant departments;
  - (d) ensure that audits by independent and competent persons are made available to the designated agency and are in line with the reporting requirement of plans provided for in these Regulations;
  - (e) ensure that a sufficient number of people, who are adequately trained and experienced to operate fracturing, flow-back or testing equipment, emergency shut-down systems and spill containment equipment, are available;
  - (f) ensure that systems acceptable to the designated agency are in place to monitor the extent of the induced fracture network; and
  - (g) ensure the monitoring of adjacent or offset wells for pressure on the production string and other well annuli, as required.
- (4) An applicant or holder must ensure that–

- (a) risk assessments to eliminate or reduce the risks of dangerous substances being released and the impact of the release on the environment, is carried out; and
  - (b) proposals for the control and mitigation of the risks are provided and submitted to the competent authority, for consideration, as part of the application for Environmental Authorisation.
- (5) The holder must ensure that once approved, the necessary control and mitigation measures are implemented.

**120. Post hydraulic fracturing report**

- (1) A holder must compile and submit, to the designated agency and the department responsible for water affairs, a detailed post hydraulic fracturing operation report, for review and recommendations, which report must include among others–
  - (a) the location of the well, position in co-ordinates and well number;
  - (b) the actual fluid compositions, concentrations and total volumes used;
  - (c) the actual surface and downhole treating pressure range;
  - (d) the maximum injection treating pressure;
  - (e) the actual or calculated fracture geometry;
  - (f) annuli and offset well pressure monitoring records;
  - (g) confirmation that wellbore integrity was maintained throughout the operation;
  - (h) the testing and flow-back results;
  - (i) an explanation of operational variations to the pre-job design;
  - (j) data and information concerning related seismic events, in internationally accepted formats, that have been recorded including the steps taken as a result of such events;
  - (k) plans to continue micro-seismic monitoring; and
  - (l) the induced seismic events that have been recorded including the steps taken as a result of such events.
- (2) A holder must compile an audit report of the detailed post hydraulic fracturing operations for the completed well pad and submit the report to the designated agency and the department responsible for water affairs.

## Management of Water

### 121. Water balance

- (1) A holder in control of operations must compile a water balance that-
  - (a) is based on data collected from installed flow measurement devices, to measure the amount of water abstracted, received, consumed, transported or discharged as required, in order to ensure that the flow of at least 90% of the total water in use is measured, with the remaining 10% or less being calculated;
  - (b) incorporates accurate values determined from suitable measurement or modelling for rainfall, runoff, seepage and evaporation from the facilities where these components of the water balance may potentially come into play;
  - (c) accounts for seasonal changes for the flow values affected by rainfall or evaporation;
  - (d) is computerised so that it can be updated at least monthly with measured and modelled data;
  - (e) accounts for and reflects the possible interconnections between the operations, the surface and ground water resource and how these may be avoided and mitigated;
  - (f) is used by the holder to generate water management reports to assist in the management of the impact of the operations on the water resource; and
  - (g) is submitted to the department responsible for water affairs on a bi-annual basis together with the monitoring data, unless stipulated otherwise in a water use licence.
- (2) A holder in control of operations must ensure that measuring devices used to develop the water balance are easily accessible, properly maintained and in good working order, based on a verifiable programme of checking, calibration, or renewal of measuring devices.

### 122. Protection of water resources

- (1) A holder 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 and where such an incident occurs, a holder must implement the necessary remedial measures;



- (a) the operation does not cause adverse impact to water quality in the catchment area; and
  - (b) the rights of existing water users are protected.
- (2) A well site where hydraulic fracturing operations are proposed or planned, must not be located-
  - (a) within 5 kilometres, measured horizontally, from the surface location of an existing municipal water well field and identified future well fields and sources and directional drilling may not be within 2.5 kilometres of municipals well field;
  - (b) within 500 metres, measured horizontally, from the surface location of an existing water borehole and directional drilling may not be within 500 metres of the borehole; and
  - (c) within 500 metres, measured horizontally, from the edge of a riparian area or within 1:100 year flood-line of a watercourse.
- (3) A well may not be drilled within 1 kilometre of a wetland.
- (4) A holder must undertake regular water quality testing as determined by the department responsible for water affairs.

### **123. Water use**

- (1) A holder must, prior to commencement of hydraulic fracturing, obtain the necessary authorisation for the water uses as required, indicating the supply source, quality and location for the base fluid for each stage of the operation and the water usage volume.
- (2) An applicant or holder must prepare an integrated water management plan and submit it to the designated agency and the department responsible for water affairs with the following components:
  - (a) A master layout plan per well site;
  - (b) hydrocensus;
  - (c) flowcharts and data derived from a dynamic, computerised water balance;
  - (d) a pollution prevention and impact minimisation plan;
  - (e) a stormwater management plan;
  - (f) a water conservation and demand management strategy;
  - (g) post closure water management and monitoring;
  - (h) a water monitoring plan; and
  - (i) water monitoring, analysis and reporting of mineral, metal and chemical constituents.

- (3) A holder must consider re-using hydraulic fracturing fluids and produced water from its operations or neighbouring operations in order to reduce competition with freshwater uses.

### **Management of Waste**

#### **124. General**

- (1) Waste, including solids, liquids, sludges and slurries, must be disposed of in accordance with the applicable legislation.
- (2) Waste containing radioactive materials must be managed in accordance with National Radioactive Waste Disposal Institute Act, 2008 (Act No. 53 of 2008).
- (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.
- (4) Disposal to underground, including the use of re-injection disposal wells, is prohibited.
- (5) Discharge of hydraulic fracturing fluids, hydraulic fracturing flowback, and produced water into a surface watercourse is prohibited.
- (6) Annular disposal of drill cuttings or fluids is prohibited.
- (7) Drill cuttings and waste mud must be temporarily stored in above ground tanks.
- (8) Solid waste generated during operations must be categorised and disposed of accordingly at a licensed landfill site or treatment facility.

#### **125. Waste management**

- (1) An applicant or holder must prepare and submit a comprehensive waste management plan to the competent authority, for consideration and approval, as part of the application for Environmental Authorisation.
- (2) The plan contemplated in sub-regulation (1) must mention the waste to be produced at the site, including drill mud, flow back, produced fluids and radioactive contaminated fluids.

- (3) A holder must, when managing waste generated from its operations, adhere to the waste management plan contemplated in sub-regulation (1) and the relevant legislation.
- (4)
  - (a) The holder must maintain a record of the waste produced and disposed of.
  - (b) The content of the record to be kept must be included in the approved waste management plan contemplated in sub-regulation (1).
- (5)
  - (a) The holder must compile a waste report which must be submitted to the South African Waste Information System (SAWIS).
  - (b) Disposal, recovery or treatment facilities used by the holder must be registered on the South African Waste Information system and waste statistics related to the fracturing operation must be submitted to the system.

### **Management of pollution incidents**

#### **126. Management of spillage**

- (1) A spillage of hydraulic fracturing fluids or hydraulic fracturing flowback in excess of 50 litres must be reported to the designated agency within 24 hours of occurrence.
- (2) A spillage of hydraulic fracturing fluids, hydraulic fracturing additives, or hydraulic fracturing flowback, used or generated during or after hydraulic fracturing operations must be cleaned up immediately.
- (3) An incident involving the spilling of a harmful substance that flows or may flow into a water resource must be dealt with in accordance with sections 19 and 20 of the National Water Act, 1998 and sections 28 and 30 of the National Environmental Management Act, 1998.

### Management of air quality

#### 127. Fugitive emissions

- (1) A holder must minimise the emissions associated with the venting of hydrocarbon fluids and natural gas during hydraulic fracturing operations by-
  - (a) routing the recovered fluids into storage vessels and-
    - (i) routing the recovered gas into a gas gathering line, collection system, or to a generator for onsite energy generation subject to section 20 of the Act; or
    - (ii) using a method other than venting.
  - (b) employing sand traps, surge vessels, separators and tanks as soon as practicable during cleanout operations to safely maximise resource recovery and minimise releases to the environment.
- (2) If a holder establishes that it is technically infeasible to minimise emissions associated with the venting of hydrocarbon fluids and natural gas during hydraulic fracturing using the methods specified in sub-regulation (1), the designated agency must require the holder to capture and direct any natural gas produced during the hydraulic fracturing operations phase to a flare, except in conditions that may result in fire hazards or explosion.
- (3) A flare used as contemplated in sub-regulation (2) must be equipped with a reliable continuous ignition source over the duration of hydraulic fracturing operations and a holder must maintain and operate the flare in accordance with the manufacturer's specifications.
- (4) In order to establish the technical infeasibility contemplated in sub-regulation (2), a holder must demonstrate, for each well site, on an annual basis, that taking the actions listed in sub-regulation (1) is not feasible based on a site-specific analysis.
- (5) A holder that uses a flare during hydraulic fracturing, other than emergency conditions, must file an updated site-specific analysis, annually, with the designated agency.
- (6) The site-specific analysis contemplated in sub-regulation (4) must have details about whether any changes have occurred that alter the technical infeasibility of a holder to reduce the emissions as contemplated in sub-regulation (1).

- (7) A holder must, on a quarterly basis, record and report to the designated agency, the amount of gas flared or vented from each hydraulic fracturing well.

**128. Fugitive dust**

- (1) A holder must comply with the National Environmental Management: Air Quality Act, 2004(Act No.39 of 2004) and the National Dust Control Regulations published in Government Gazette No.36974, Government Notice No. R 827 of 1 November 2013.
- (2) A holder must employ practices for the control of fugitive dust during hydraulic fracturing operations, which must include, but not limited to-
  - (a) the use of speed restrictions;
  - (b) regular road maintenance; and
  - (c) the restriction of construction activity during high-wind days.
- (3) Additional management practices such as road surfacing, wind breaks and barriers or automation of wells, to reduce truck traffic, may also be required by the relevant department if technologically feasible to minimise fugitive dust emissions.

**129. Noise control**

- (1) Site selection, including the identification of traffic routes, must consider the potential effect of noise pollution on the surrounding environment.
- (2) The necessary abatement measures must be considered as part of the planning process for hydraulic fracturing operations.
- (3) A holder must adherence to local by-laws concerning noise control and limits.

## CHAPTER 10

### WELL SUSPENSION AND DECOMMISSIONING

#### 130. Well suspension

- (1) A holder may only suspend a well-
  - (a) after obtaining the approval of the designated agency; and
  - (b) for a period determined by the designated agency.

#### 131. Suspended well integrity management

- (1) A holder must ensure that management standards and procedures are in place for monitoring wells that are in suspension phase following drilling and hydraulic fracturing operations, prior to development phase, including the status of the equipment and any annulus pressure.
- (2) Procedures must take account of the specific circumstances of the well and must include the reporting criteria for any anomaly and a risk assessment of the anomaly.
- (3) The suspension of a well-
  - (a) must be effected in such a way that the well can be re-entered safely and secured using pressure control equipment, without compromising the barriers in place; and
  - (b) may not jeopardise the future final abandonment of the well.

#### 132. Well decommissioning or closure

- (1) A well that is no longer active, or producing, or for which the approved suspension period determined in terms of regulation 130 (b) has passed, must be plugged and decommissioned in accordance with-
  - (a) a decommissioning plan approved by the designated agency; and
  - (b) the relevant provision of the Environmental Impact Assessment Regulations.
- (2) The decommissioning plan must take into account the following factors:

- (a) Current condition and design of the well;
  - (b) height of cement in annulus outside casing;
  - (c) permeable formations outside casing that must be covered by cement;
  - (d) cement casing overlaps;
  - (e) the need for abandonment plugs to cover the full diameter of the hole;
  - (f) the type of fluid in annuli above cement;
  - (g) the difficulties of injecting cement into the annulus;
  - (h) future monitoring of the integrity of the well plug;
  - (i) the depth below surface at which casing must be cut; and
  - (j) related seismic activity risks.
- (3) The surface area of a decommissioned well must be clear of obstructions and equipment and the well bore must be cemented for the full length and diameter of the wellbore to surface.

### 133. Short Title

These Regulations are called Regulations for Petroleum Exploration and Production, 2015.

### Schedule I

#### Hydraulic Fracturing Fluids

- (1) The following substances will not be allowed as additives to fracturing fluids:

Chemicals Components of Concern: Carcinogens, Chemicals regulated under Safe Drinking Water Act and Hazardous Air Pollutants			
Chemical Component	Chemical Category	CAS registry	No. of Products containing chemical
Methanol (Methyl	HAP	67-56-1	342
Ethylene glycol (1,2-	HAP	107-21-1	119
Diesel <sup>1</sup>	Carcinogen, SDWA, HAP	68476-34-6	51

Naphthalene	Carcinogen, HAP	91-20-3	44
Xylene	SDWA, HAP	1330-20-7	44
Hydrogen chloride	HAP	7647-01-	42
Toluene	SDWA,HAP	108-88-3	29
Ethylbenzene	SDWA,HAP	100-41-4	28
Diethanolamine(2,2-iminodiethanol)	HAP	111-42-2	14
Formaldehyde	Carcinogen, HAP	50-00-0	12
Sulphuric acid	Carcinogen	7664-93-9	9
Thoreau	Carcinogen	62-56-6	9
Benzyl chloride	Carcinogen, HAP	100-44-7	8
Cumene	HAP	98-82-8	6
Nitrilotriacetic acid	Carcinogen	139-13-9	6
Dimethyl formamide	HAP	68-12-2	5
Phenol	HAP	108-95-2	5
Benzene	Carcinogen, SDWA,	71-43-2	3
Di (2-	Carcinogen, SDWA,	117-81-7	3
Acrylamide	Carcinogen, SDWA,	79-06-1	2
Hydrogen fluoride(Hydrofluoric	HAP	7664-39-3	2
Phthalic anhydride	HAP	85-44-9	2
Acetaldehyde	Carcinogen, HAP	75-07-0	1
Acetophenone	HAP	98-86-2	1
Copper	SDWA	7440-50-	1
Ethylene oxide	Carcinogen, HAP	75-21-8	1
Lead	Carcinogen, SDWA,	7439-92-1	1
Propylene oxide	Carcinogen,HAP	75-56-9	1
p-Xylene	HAP	106-42-3	1
1-Methylnaphthalene		90-12-0	
2-Butanone		78-93-3	
Aniline		62-53-3	
2-methylphenol		95-48-7	
3- Methylphenol		108-39-4	
4- Methylphenol		106-44-5	
acetonitrile		75-05-8	
Phenol		108-95-2	5
Thiophene		110-02-1	
Pyrrole		109-97-7	
2-Methylnaphthalene		91-57-6	
Benzidine		92-87-5	
Isophorone		78-59-1	
Chloroethane		75-00-3	
2-pyrrolidone		616-45-5	
vinyl chloride		75-01-4	
Bromomethane		74-83-9	
4-methylphenol		106-44-5	
Acetone		67-64-1	3
2-Hexanone		591-78-6	