Appendix 4

DRAFT FOR PEC COMMENT – 05 May 2017

Minimum Information Requirements in terms of the National Environmental Management Act (107 of 1998) as part of the application for an Environmental Impact Assessment (EIA) for Environmental Authorisation related to onshore shale gas appraisal activities

Contents

1. Definitions

"**Exploration**", referring specifically to shale gas, means (1) the re-processing of existing seismic data, acquisition and processing of new seismic monitoring data and (2) the drilling of exploration wells or holes only for obtaining information pertaining to specific geological, structural and stratigraphic information that might lead towards the discovery of petroleum with no hydraulic fracturing.

“Appraisal”, referring specifically to shale gas, means further testing including horizontal drilling, pressure testing and hydraulic fracturing to assess the existence and commerciality of petroleum prior to the onset of production.

“Production” means any operation, activity or matter that relates to the development and production of petroleum.

"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.

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

"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;

"Exploration well" means a vertical well drilled for the purpose of obtaining specific geological and geophysical information to prove, define and assess the existence and commerciality of petroleum.

"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.

"**Appraisal work programme**" means the approved appraisal work programme indicating the petroleum operations to be conducted on the exploration area during the validity of the Exploration Right, including the details regarding the exploration activities, phases, equipment to be used and estimated expenditures for the different exploration activities and phases.

2. Context

(a) In terms of the National Environmental Management Act (Act 107 of 1998, as amended) ("NEMA") and the 2014 NEMA Environmental Impact Assessment (EIA) Regulations promulgated in Government Gazette 38282 and Government Notice (GN) R984 on 8 December 2014, no one may commence with an activity identified in terms of Section 24(2)(a) of NEMA unless environmental authorisation in terms of NEMA has been obtained for the activity.

(b) An approval of an Environmental Management Programme ("EMPR") in terms of the Mineral and Petroleum Resources Amendment Act 2008 (Act No. 49 of 2008) ("MPRDA") does not constitute an environmental authorisation in terms of NEMA.

(c) The current applications submitted by shale gas development companies for Exploration Rights in terms of the MPRDA, prior to 8 December 2014, are pending and no application for environmental authorisation in terms of NEMA has been submitted to date. As such, applications for environmental authorisation are required prior to the commencement of any activities listed in the 2014 NEMA EIA Regulations (including Activity 20 of Listing Notice 1 and Activity 18 of Listing Notice 2).

(d) Regulation 10(b) of the Environmental Impact Assessment Regulations, 2014 (as amended) requires that an application for environmental authorisation comply with any protocol or Minimum Information Requirements ("MIRs") relevant to that application as identified by the Minister in a government notice.

(e) The MIRs provide the regulatory framework and process that will apply to applications for environmental authorisation for onshore shale gas appraisal activities in order for the

Competent Authority, to make decisions on the applications in a streamlined and responsible manner.

(f) The MIRs have been drafted in two parts to provide a step-wise regulatory process, accounting for the different phases of shale gas development operations so that baseline monitoring plans and baseline data can be submitted for approval as part of environmental authorisation applications to the Competent Authority. The MIRs provide a framework describing the nature and content of information which must be submitted prior to exploration and appraisal activities being approved as part of an environmental authorisation in terms of the NEMA. In this way, exploration and appraisal are effectively detached from production via continuous Environmental Impact Assessments that account for the environmental and operational baseline data obtained during the preceding activities.

(g) The MIRs apply to shale gas appraisal activities and must be read with Technical Regulations for Petroleum Exploration and Exploitation in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) and any other applicable Acts, regulations or guidelines. MIRs for shale gas appraisal activities will be developed separately.

3. Shale gas appraisal activities

(a) **Exploration** activities are the second stage of the shale gas development cycle. They are typically concentrated 5 years, but are undertaken throughout the entire development cycle to inform the location of additional appraisal and production activities if shale gas is found in suitable concentrations and flow rates. Appraisal activities include 2-D seismics, 3-D seismics, vertical exploration wells, horizontal appraisal wells, hydraulic fracturing, road development, trucks, water management, waste management and potentially flaring.

4. Application for environmental authorisation for exploration

(1) Application

(a) Appraisal activities for shale gas are subject to the requirements of the NEMA and any relevant Specific Environmental Management Acts.

(b) Before appraisal activities related to shale gas may commence, the holder must be in possession of an Environmental Authorisation in terms of the Environmental Impact Assessment Regulations, 2014.

(c) The Competent Authority, with the Departments of Environmental Affairs, Science and Technology, Energy, Water & Sanitation, Agriculture Forestry and Fisheries; along with the relevant Provincial and Local Authorities, must be identified as interested and affected parties for the purposes of public participation to be undertaken as part of the Environmental Impact Assessment process.

(d) The South African National Biodiversity Institute, the Council of Geosciences and the Council for Scientific and Industrial Research must be identified as interested and affected parties for the purposes of public participation to be undertaken as part of the Environmental Impact Assessment process.

(e) An Proponent should, together with an application for environmental authorisation, also submit, for consideration to the Competent Authority, a –

i. Screening site-selection report;
ii. Shale gas appraisal work programme;
iii. Quantitative risk assessment report;
iv. Baseline monitoring programme for production; and
v. Ongoing monitoring programme for appraisal.

(2) **Screening site selection report**

(a) Potential appraisal sites within an area where the Proponent holds an approved Exploration Right should be identified through a thorough screening site selection report which –

i. considers all environmental sensitivities based on existing and up-to-date spatial datasets. Datasets are obtainable from the Department of Environmental Affairs;
ii. considers the sensitivity of the Square Kilometre Array, the regulatory requirements of the Karoo Central Astronomy Advantage Area Astronomy in terms of the Geographic Advantage (AGA) Act, Act No.21 of 2007 and the Southern African Large Telescope in Sutherland, declared in terms of the AGA Act;
iii. considers the availability of existing services, infrastructure, and resources;
iv. identifies and confirms preferred sites, through a detailed site selection process, which includes an impact assessment process inclusive of cumulative impact and a ranking process of all the identified alternatives

focusing on the geographical, physical, biological, social, economic, and cultural aspects of the environment.

(b) The screening site selection report must contain information that is necessary for a proper understanding of the site selection process, informing all preferred alternatives. The scope of the screening site selection report must include –

i. documented public notification and consultation for the sites included in the screening site-selection report; and

ii. maps containing all considered environmental and social sensitivities, buffers, and existing services, infrastructure and resources.

(c) The Competent Authority must consider the screening site selection report and –

i. where needed request additional information or adaptive changes which consider local environmental and social sensitivities;

ii. decide to accept, or reject, all or some of the sites proposed in the screening site selection report to be assessed in the EIA phase;

iii. decide to accept or reject the baseline monitoring programme for production; and

iv. decide to accept or reject the ongoing monitoring programme for appraisal.

(3) **Shale gas appraisal work programme**

(a) A shale gas appraisal work programme must be produced which contains the information that is necessary for a proper understanding of the long-term plans of the appraisal operations, and must include–

i. The proposed locations of seismic surveys, stratigraphic, exploration wells and appraisal wells within the Exploration Right area;

ii. A description of the type of seismic survey to be used;

iii. The well design risk assessment which includes proposed control measures and an early warning monitoring and response system for failures, spills and contamination events;

iv. Precise information on the hydraulic fracturing fluids to be used during the process in terms of volumes, composition and toxicity;

v. Information on the proposed shale gas production scenario over a 10 year period and a preliminary shale gas production site layout including associated infrastructure such as roads, waste and water treatment facilities and transport routes;

vi. well engineering design which must include, but not be limited to the following-

vii. type of rig to be used;

viii. method of drilling;

ix. type and estimated amount of drilling fluids;

x. different stages of drilling and the size of drill bits;

xi. casing programme;

xii. cementation programme; and

xiii. perforation design.

xiv. hydraulic fracturing programme and procedures, which must include-

xv. pre-fracturing simulation and modelling;

xvi. the proposed depth(s) to the top and the bottom of the formation into which well fracturing fluids are to be injected;

xvii. authorised source and volume of water to be used

xviii. re-use and disposal of flowback;

xix. fracturing fluid compositions, concentrations and estimated total volume to be used;

xx. anticipated surface and downhole treating pressure range;

xxi. maximum injection treatment pressure;

xxii. annuli and offset well pressure monitoring programme to be performed;

xxiii. testing and flowback plan;

xxiv. equipment rig up and testing, including testing of all high pressure equipment;

xxv. a design of the fracture geometry including fracturing target zones, sealing mechanisms and aquifers;

xxvi. micro-seismic monitoring programme;

xxvii. monitoring of pressure on the production string and well annuli during rig up and testing; and

xxviii. monitoring of any adjacent or offset wells for pressure on the production string and other well annuli as required.

(4) **Quantitative Risk Assessment Report**

(a) A Proponent must assess potential risks within a structured quantitative Risk Assessment Report and develop a Risk Management Plan for each well to be drilled and hydraulically fractured addressing the following aspects-

i. The risks during normal operations and including occupational and health and safety risks;

ii. The risks associated with accidents or unplanned events in terms of probability of incidents and the associated consequences of the surface and sub-surface activities;

iii. identification of chemical ingredients and characteristics of each additive in terms of their risk to the social and ecological environment;

iv. assessment of potential environmental and health risks of fracturing fluids and additives in both diluted and concentrated form;

v. assessment of buildings, via building surveys, in proximity of hydraulic fracturing operations which may be affected due to increased seismic activity; and

vi. definition of operational practices and controls for the identified risk in the Risk Management Plan.

(b) A Risk Management Plan must be submitted to the competent authority as part of the application for Environmental Authorisation for appraisal and must be submitted to the designated agency before commencing with hydraulic fracturing Production operations.

(5) **Baseline monitoring programme for production**

(a) A baseline monitoring programme for production must be submitted to the Competent Authority and relevant departments. The baseline monitoring programme for production must be submitted together with the appraisal Environmental Impact Assessment application. The baseline monitoring programme for production must detail the nature of the monitoring programme and the methods for data collection. The baseline monitoring programme for production must immediately commence following approval of the application for environmental authorisation by the Competent Authority to run concurrently with the appraisal Environmental Impact Assessment process.

(b) The baseline monitoring programme for production, which must be approved by the Competent Authority with the appraisal Environmental Impact Assessment application, must include –

i. Relevant geological information;
ii. a surface water baseline monitoring plan which will be considered by the Department of Water and Sanitation;
iii. a groundwater baseline monitoring plan which will be considered by the Department of Water and Sanitation and by the Council for Geoscience;
iv. a seismicity baseline monitoring plan which will be considered by the Council for Geoscience;
v. an air quality and greenhouse gas baseline monitoring plan which will be considered by the Department of Environmental Affairs: Air Quality Directorate;
vi. a biodiversity baseline monitoring plan which will be considered by the Department of Environmental Affairs: Biodiversity Directorate;
vii. a road infrastructure baseline monitoring plan,
viii. the siting of the various monitoring devices and stations;
ix. the sampling methodology for each plan;
x. the monitoring points for each plan;
xi. the monitoring parameters for each plan;
xii. the monitoring frequency for each plan; and
xiii. the reporting frequency for each plan.

(c) The draft baseline monitoring programme and data that it generates must be peer reviewed by a minimum of two independent and recognised experts.
(d) The designated Competent Authorities must consider the baseline monitoring programme for production and –
i. where needed request additional information and adaptation of the baseline monitoring programme if required; and
ii. decide to accept or reject the baseline monitoring programme for production as part of the Environmental Impact Assessment application for appraisal.

(6) **Ongoing Monitoring**

(a) After the Baseline Monitoring Programme is conducted, a holder must continue ongoing with monitoring in accordance with an approved Ongoing Monitoring Plan as part of appraisal operations and -
i. have all 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;

ii. submit the results of the analysis and interpretation to the designated agency and the Department responsible for water within 7 days of the receipt of the analysis and interpretation; and

iii. submit monitoring assessment reports in accordance with the approved monitoring plan.

(b) The Ongoing Monitoring Plan should contain monitoring procedures to address all environmental issues and aspects identified during the EIA, concerning operational, closure and post-closure impacts.

(c) The Ongoing Monitoring Plan gives effect to continuous monitoring of all environmental issues and aspects throughout and after the construction, operation and decommissioning phases of the activity, including the monitoring of legacy impacts following closure of operations.

(d) Monitoring reporting should include the disclosure and discussion of monitoring data with stakeholders and the independent Monitoring Inter-departmental Unit.

(e) Monitoring records must be maintained by the holder and submitted to the Monitoring Inter-departmental Unit at any time during the period up to and including 30 years after the well is permanently plugged or decommissioned.

(f) Monitoring results must also be included in the Environmental Management Program Report required in terms of the Environmental Impact Assessment Regulations.

5. Baseline monitoring programme implementation and reporting

(a) The approved baseline monitoring programme for appraisal must commence as part of the Environmental Impact Assessment for appraisal activities –

i. on sites which have been accepted by the Competent Authority after consideration of the screening site selection report; and

ii. in accordance with the baseline monitoring programme for production which was accepted by the Competent Authority with submission of the application for environmental authorisation.

(b) The baseline monitoring programme for production must be overseen by a specialised inter-departmental monitoring unit to be established under the existing shale gas monitoring committee consisting of appointed panel members from those Departments governing the

One Environmental System, namely: Water and Sanitation, Environmental Affairs and Mineral Resources.

(c) Analysis of baseline data collected during the baseline monitoring programme for production must be executed using relevant nationally and internationally accredited facilities and according to relevant national norms and standards, or international norms and standards if relevant.

(d) Baseline data should be collected for a period of 12 months in the case of seismicity, air quality and greenhouse gas emissions, biodiversity, and road infrastructure. Baseline data should be collected for a period of time, no shorter than 36 months in the case of surface water and groundwater. All data must be collected, coordinated and logged by the project proponent under the guidance of the Environmental Assessment Practitioner and inter-departmental monitoring unit.

(g) Baseline monitoring reports for production must be submitted prior to decision-making on the appraisal Environmental Impact Assessment process where the data will be publically disclosed. There must be disclosure of information on water use, volumes and characteristics of wastewater and air emissions, and fracking fluid additives and volumes, which must be displayed, on an ongoing basis, on a public disclosure register for all phases of the project life-cycle.

(e) The results must, at a minimum, 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.

(7) Geological information and groundwater baseline monitoring

(a) As part of the baseline monitoring report for production, submitted to the Competent Authority during the Environmental Impact Assessment process for production, a Proponent must describe geological information and assess the current quality and quantity of groundwater and other geohydrological features of the approved sites prior to production activities and submit a groundwater baseline monitoring report to the designated agency for approval.

(b) The report must be submitted to the Competent Authority as part of the Environmental Impact Assessment for production. The report must be compiled in partnership with the

Environmental Assessment Practitioner and inter-departmental monitoring unit, and as a minimum include the following information –

i. geological map of the area (that can encompass several hydraulic fracturing sites for appraisal) at the appropriate scale and with details that will allow understanding of the potential structural aspects;
ii. analysis of all available geological information such as published and unpublished map sheets, satellite imagery and published and unpublished scientific papers;
iii. data from stratigraphic exploration boreholes to understand the regional stratigraphy and possible structural complexity. Proposed depth(s) to the top and the bottom of the formation into which well fracturing fluids are proposed to be injected;
iv. borehole analysis: core logging, downhole geophysics, camera, water strikes, hydrogeochemical character, injection tests in fractures or formations;
v. physical and chemical properties of the stratigraphic formations such as porosity, permeability, naturally occurring fissures and fractures, total organic carbon, clay and mineralogy;
vi. 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 and kimberlite and tectonic structures;
vii. groundwater and deep groundwater assessment;
viii. a hydrocensus fulfilling the standard requirements of the Department responsible for water indicating all potentially affected water resources, at least 3 kilometres radius from the furthest point of horizontal drilling, as well as identify priority water source areas and domestic groundwater supplies indicated on relevant geohydrological maps; and
ix. models of fluid migration within the target geological formation.

(8) **Surface water baseline monitoring**

(a) The report must be submitted to the Competent Authority as part of the Environmental Impact Assessment for production. The report must be compiled in partnership with the Environmental Assessment Practitioner and inter-departmental monitoring unit, and as a minimum include the following information –

i. water quality monitoring data of resources within the appraisal work programme;
ii. water quantity monitoring data of resources within the appraisal work programme;
iii. habitat integrity monitoring data of resources within the appraisal work programme; and
iv. weather data such as daily precipitation and evaporation, regionally, and within the appraisal work programme.

(b) Surface water baseline monitoring should cover all four seasons, for a period not less than 36 months, including at least a wet and a dry year, at representative sites.

(9) **Seismicity baseline monitoring**

(a) The report must be submitted to the Competent Authority as part of the Environmental Impact Assessment for production. The report must be compiled in partnership with the Environmental Assessment Practitioner and inter-departmental monitoring unit, and as a minimum include the following information –

i. all available background seismicity data;
ii. building typologies in the region;
iii. structural integrity of buildings and structures;
iv. desktop studies of existing geological maps;
v. identified stressed faults which must be avoided in the fracturing process;
vi. identified fracture behaviour of targeted formations;
vii. seismic reflection and refraction data where available;
viii. stress data from proximal boreholes where available; and
ix. other relevant available geophysical data such as gravity.

(10) **Air quality and greenhouse gases baseline monitoring**

(a) The report must be submitted to the Competent Authority as part of the Environmental Impact Assessment for production. The report must be compiled in partnership with the Environmental Assessment Practitioner and inter-departmental monitoring unit, and as a minimum include the following information, as it regards environmental and human health –

i. NOx baseline concentrations;
ii. SO_2 baseline concentrations;

iii. PM baseline concentrations;

iv. VOCs baseline concentrations;

v. CO_2 baseline concentrations; and

vi. N_2O baseline concentrations.

(11) **Biodiversity baseline monitoring**

(a) The report must be submitted to the Competent Authority as part of the Environmental Impact Assessment for production. The report must be compiled in partnership with the Environmental Assessment Practitioner and inter-departmental monitoring unit, and as a minimum include the following information –

i. species diversity and abundance;

ii. habitats;

iii. terrestrial ecosystems;

iv. aquatic ecosystems; and

v. Broad-scale processes.

(12) **Road infrastructure baseline monitoring**

(a) The report must be submitted to the Competent Authority as part of the Environmental Impact Assessment for production. The report must be compiled in partnership with the Environmental Assessment Practitioner and inter-departmental monitoring unit, and as a minimum include the following information –

i. condition of roads and bridges within affected by appraisal;
ii. current traffic volumes;
iii. remaining life of roads and bridges; and
iv. pavement condition data.

6. Environmental Impact Assessment Process

(a) The Environmental Impact Assessment phase for appraisal may commence after the dedicated competent authorities have accepted and approved the baseline monitoring programme for production.

(b) The Environmental Impact Assessment must –

i. be executed in adherence to Appendix 3 of the Environmental Impact Assessment Regulations of 2014.

7. Specialist studies

(a) Specialist studies must be executed by relevant nationally accredited and independent specialists, and should be undertaken in adherence to Appendix 6 of the Environmental Impact Assessment Regulations of 2014.

(b) The following specialist studies may be considered, depending on the scope of work outlined in the exploration work programme:

i. Biodiversity impact assessment consistent with applicable protocols (Appendix C);
ii. Agriculture impact assessment consistent with applicable protocols (Appendix D);
iii. Heritage resources impact assessment consistent with applicable protocols (Appendix E);
iv. Electromagnetic interference assessment with applicable protocols (Appendix F);
v. Air quality and greenhouse gas emissions impact assessment;
vi. Surface water and groundwater impact assessment;
vii. Noise impact assessment;
viii. Socio-economic impact assessment;
ix. Traffic impact assessment; and
x. Waste management impact assessment.

8. Public Participation

(a) Public participation should be undertaken during the Environmental Impact Assessment Phase in adherence to Chapter 6 of the Environmental Impact Assessment Regulations of 2014.

9. Environmental Management Programme

(a) The Environmental Management Programme (EMPr) must adhere to the regulations as set out in Appendix 4 of the Environmental Impact Assessment Regulations of 2014 and contain at a minimum –

i. information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address identified environmental impacts in respect of the following key phases of the project lifecycle –

- planning and design;
- pre-construction and construction activities;
- the operation or undertaking of the activity in question;
- the rehabilitation of the environment; and
- closure and post closure monitoring of legacy impacts.

ii. details of the person who prepared the EMPr; and the expertise of that person to prepare an EMPr;

iii. a detailed description of the aspects of the activity that are covered by the EMPr;

iv. information identifying the persons who will be responsible for the implementation of the measures;

v. information in respect of the mechanisms proposed for monitoring compliance with the environmental management programme and for reporting on the compliance;

vi. as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and

vii. a description of the manner in which it intends to-

- modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;
- remedy the cause of pollution or degradation and migration of pollutants; and
- comply with any prescribed environmental management standards or practices.

(b) The EMPr must, where appropriate, contain -

i. time periods within which the measures contemplated in the EMPr must be implemented;

ii. measures regulating responsibilities for any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of exploration activities which may occur inside and outside the boundaries of the Exploration Right area; and

iii. an environmental awareness plan describing the manner in which-

- the Proponent intends to inform his or her employees of any environmental risk which may result from their work; and
- risks must be dealt with in order to avoid pollution or the degradation of the environment.

(c) The Proponent and any person issued with an environmental authorisation-

i. must at all times give effect to the general objectives of integrated environmental management laid down in Section 23 of the NEMA;

ii. must consider, investigate, assess and communicate the impact of his or her exploration activities on the environment;

iii. must manage all environmental impacts-

- in accordance with his or her approved EMPr, where appropriate; and
- as an integral part of the reconnaissance, prospecting or mining, exploration or production operation, unless the Minister of Minerals and Energy directs otherwise

(d) must monitor and audit compliance with the requirements of the EMPr;

10. Subsequent environmental authorisations

(1) Environmental authorisation for production activities

(a) The Proponent may apply for Environmental Authorisation for additional shale gas development activities if –

i. The application for Environmental Authorisation, screening site selection report, appraisal work programme, quantitative risk assessment, baseline and ongoing monitoring programmes for production are accepted by the Competent Authority; and

ii. Following the Environmental Impact Assessment process for appraisal, the application for Environmental Authorisation for appraisal receives a positive decision and appraisal activities are undertaken in a manner consistent with the associated EMPr.

(b) Each Environmental Authorisation for production, based on the scope of work as outlined in the production work programme requires a separate Environmental Authorisation, which may be obtained by –

i. Specifying and assessing additional and cumulative impacts and actions based on continuous monitoring; and
ii. Updating the EMPr based on the continuous monitoring data and availability of new information.

11. Financial Penalties

(a) Strict enforcement and penalties will be applied in the event of non-compliance of the Environmental Authorisation. Over and above the usual remedies such as suspension or revocation of the Environmental Authorisation, the Environmental Authorisation should provide for significant administrative penalties in the case of violations of conditions in the Environmental Authorisation and/or other legislative provisions.

12. Financial Provisioning for closure

(a) An Proponent must provide details for financial provisioning for closure, contamination events and on-going life-cycle monitoring post well decommissioning as provided for in the National Environmental Management Act: Regulations: Financial provision for rehabilitation, closure and post closure of prospecting, exploration, mining or production operations (GN1147) No. 39425.

Appendix A: Pre-production phases of shale gas development activities showing the activities, timeframes and regulatory check that will be implemented as part of the MIRs for exploration and appraisal.

<table>
<tr><th colspan="5">Pre-production phases of shale gas development</th></tr>
<tr><td>Phase</td><td>Exploration</td><td rowspan="4">Competent authority accept or rejects checks 1-4</td><td>Appraisal</td><td rowspan="4">Competent authority accept or rejects checks 1-6</td><td rowspan="4">Commencement of appraisal activities</td></tr>
<tr><td>Activities</td><td>2-D seismics, 3-D seismics, vertical exploration wells, roads, trucks, water and waste management.</td><td>2-D seismics, 3-D seismics, vertical exploration wells, horizontal exploration wells, hydraulic fracturing, trucks, water management, waste management, flaring</td></tr>
<tr><td>Typical timeframe</td><td>3 years</td><td>5 years</td></tr>
<tr><td>Regulatory checks – approval required</td><td>1. Screening site-selection report
2. Shale gas exploration work programme
3. Baseline monitoring programme for appraisal
4. Environmental authorisation required for exploration activities</td><td>1. Screening site-selection report
2. Shale gas appraisal work programme
3. Quantitative risk assessment report
4. Baseline monitoring programme for production
5. Ongoing monitoring programme
6. Environmental authorisation required for exploration activities</td></tr>
<tr><td></td><td colspan="4">Three to five years baseline monitoring prior to hydraulic fracturing activities →</td></tr>
</table>

Appendix B: Decision-making mandates and permit requirements

Decision	Competent Authority	Legislation	Regulatory process
Exploration and Production Rights	DMR and PASA	MPRDA	EMPr initial submissions made to PASA in 2010 and 2011. DMR requested EMPrs to be updated in November 2014. DMR has not yet decided on any of the existing Exploration Right applications.
Environmental Authorisation	DMR and PASA	NEMA	No applications for Environmental Authorisation in terms of the NEMA have been submitted to date. Applications would be guided by the NEMA Minimum Information Requirements (MIRs) amongst other

Decision	Competent Authority	Legislation	Regulatory process
			legislation. DMR is the competent authority with DEA providing decision on appeals.
Atmospheric Emission Licence	DEA	NEM:AQA	Integrated into the Environmental Authorisation process with the establishment of the One Environmental System. DEA remain the competent authority.
Waste License	DMR	NEM:WA	Integrated into the Environmental Authorisation process with the establishment of the One Environmental System. DMR are the competent authority.
Water Use License	DWS	NWA	Integrated into the Environmental Authorisation process with the establishment of the One Environmental System. DWS are the competent authority. The Catchment Management Agencies will process all applications but the final authority to issue the license will be National Office – currently the Director General possibly later the Deputy-Director General of Water Sector Regulation.
Municipal Planning Decision	Relevant local authority	SPLUMA, LUPA and By-laws	For non-invasive 3-D seismic surveys rezoning will not be required. For the development of well pads, regional services, infrastructure servitudes, wastewater treatment works, housing developments, camps, gravel pits, landfill sites, roads, the subdivision of farmland etc., these will require rezoning. A Municipal Application must be submitted to the Municipality or in some cases (if the general welfare of the inhabitants of the region are affected) the land development applications could require provincial approval and in other instances when the activity is considered a national interest, the national Minister responsible for SPLUMA then has decision-making oversight.
Provincial Planning Decision	Provincial competent authority	SPLUMA and LUPA	

Appendix C: Protocol for biodiversity assessments

Colour	Sensitivity	Interpretation of Sensitivity	Further Assessment Requirements
Dark Red	Very High	No loss or degradation of Very High sensitivity areas is acceptable. These areas are irreplaceable and no ecologically equivalent areas exist for securing the features they contain.	Full biodiversity impact assessment conducted by competent terrestrial ecologist is required (Level 1 assessment as contemplated in Part 3 Chapter 4 of the Strategic Environmental Assessment for Electricity Grid Infrastructure (2016)).
Red	High	In High sensitivity areas, loss or degradation is acceptable only if ecologically equivalent sites are identified and secured through biodiversity offsets or equivalent mechanisms. An ecologically equivalent site means a site that contains equivalent ecological processes, ecosystems and species, and that compensates for the full ecological impact of the activity as identified through a detailed study.	Full biodiversity impact assessment conducted by competent terrestrial ecologist, plus an ecological offset study is required. (Level 1 assessment as contemplated in Part 3 Chapter 4 of the Strategic Environmental Assessment for Electricity Grid Infrastructure (2016)).
Yellow	Medium	Other natural or semi-natural areas that do not contain currently known sensitive or important features, and are not required for meeting targets for representing biodiversity or maintaining ecological processes. Provided that Very High and High areas are secured, loss of habitat in Medium sensitivity areas should not compromise the ability to achieve biodiversity targets in the Karoo, as long as the impacts in the Medium sensitivity areas do not extend into adjacent areas of higher importance or sensitivity.	Biodiversity impact assessment conducted by competent terrestrial ecologist (Level 3 assessment as contemplated in Part 3 Chapter 4 of the Strategic Environmental Assessment for Electricity Grid Infrastructure (2016)).
Green	Low	Areas in which there is no remaining natural habitat, e.g. urban areas, larger scale highly degraded areas, large arable intensively farmed lands. Shale gas development activities in these sites should result in minimal biodiversity loss, as long as the impacts do not extend to adjacent Very High and High sensitivity areas.	Biodiversity impact assessment conducted by competent terrestrial ecologist (Level 3 assessment as contemplated in Part 3 Chapter 4 of the Strategic Environmental Assessment for Electricity Grid Infrastructure (2016)).

Appendix D: Protocol for agricultural assessments

Sensitivity Class	Interpretation of Sensitivity	Further assessment requirements for electricity grid infrastructure developments
Very High	Very High and High agricultural sensitivity	Should the development envelope be required to be located on areas identified as Very High or High sensitivity as determined through the sensitivity mapping process, a comprehensive Agricultural Impact Assessment shall be undertaken for such areas. The Agricultural Impact Assessment shall be undertaken by a competent agricultural scientist undertaken in accordance with the NEMA regulations pertaining to specialist reports and impact assessment. The assessment of agricultural impacts and application for agricultural authorisation should be by way of a report compiled and signed off by a SACNASP-registered agricultural scientist.
High		
Medium	Medium agricultural sensitivity	Should the development envelope be required to be located on areas identified as Medium sensitivity as determined through the sensitivity mapping process, a compliance statement by a competent agricultural scientist is required.
Low	Low agricultural sensitivity.	Should the development envelope be required to be located on areas identified as Low sensitivity as determined through the sensitivity mapping process, a compliance statement by a competent agricultural scientist is required.

Appendix E: Protocol for Heritage (including palaeontology) Impact Assessments

Sensitivity Class	Interpretation	Assessments at project level	Motivating for exemption from an HIA	Permit requirements
Very High	Very High sensitivity includes all known heritage and palaeontological sites.	Proposed shale gas development infrastructure should avoid these areas. If avoidance cannot be achieved, a Heritage Impact Assessment (HIA) would almost certainly be required.	A HIA may not be required if such motivation was included in the initial notification prepared by a competent heritage specialist. In order to motivate for a HIA not to be required the inputs from an archaeology specialist is required as part of the notification. Site visits to inform the notification may also be necessary to motivate for an HIA not to be required, and are up to the discretion of the specialist providing input to the notification. In most cases, it will be sufficient for only the heritage specialist preparing the notification to visit the site before an exemption from further assessment can be motivated. If exemption from further	A permit under Section 27 of the NHRA will be required
High	High sensitivity includes all areas which are, or have the potential to be, highly sensitive in terms of heritage and palaeontological resources because either: Previous assessments have identified heritage resources which are classified as being of high significance, or there is a high probability of encountering a significant heritage resource.	These areas include or have the potential to include heritage and palaeontological resources of conservation status or have the potential to include cultural heritage resources which will require conservation or lengthy mitigation. A HIA would almost certainly be required to investigate the potential presence of these resources and, where applicable, the potential impact to such resources in the context of the proposed development.		If the development impacts on heritage and palaeontological resources of medium or high significance a permit under Section 35 of the NHRA would normally[1] be required before impact and/or mitigation may occur.
Medium	Medium sensitivity represents areas	These areas include resources which		

[1] Note that Heritage Western Cape currently does not require 'permits' for generally protected heritage resources under the NHRA when developments trigger Section 38 of the NHRA. Instead, a work plan is required which is very similar to a permitting process.

(orange)	inside of the shale gas development region which are or have the potential to be sensitive to development in terms of heritage resources because either: Previous assessment of the area have identified heritage resources which are considered to be of medium significance, or there is a medium probability of encountering significant heritage resources	may require mitigation or have the potential to include cultural heritage resources which will require mitigation. A HIA is likely to be required to investigate the potential presence of these resources and, where applicable, the potential impact to such resources in the context of the proposed development.	assessment is motivated, the notification must contain proposed mitigation measures for inclusion in the Environmental Management Programme (EMPr).	
Low (green)	Low sensitivity represents areas not likely to be sensitive to development in terms of heritage resources because previous assessment has revealed the area to contain no resources or resources of low significance.	No further assessment is necessary for proposed development in these areas.	A HIA is not required in Low sensitivity areas therefore applications for exemption do not apply.	No permit is required for development to proceed in these areas.

Appendix F: Protocol for electromagnetic interference assessment

<table>
<tr><th>Sensitivity Class</th><th>Interpretation</th><th>Assessments at project level</th></tr>
<tr><td>Very High</td><td>In Very High sensitive areas there is a high likelihood of significant negative impacts that cannot be mitigated. In-depth assessment of the potential impacts, and proof of efficacy of proposed mitigation measures, will be required before development can be considered in these areas. Following construction, proof of compliance with mitigation requirements will be required should the proposed development be considered favourably.</td><td rowspan="3">Proponents intending to undertake shale gas development that triggers an environmental assessment process in Very High to Medium sensitivity areas must prove to the relevant Competent Authority that the proposed development will not have an unacceptable negative impact on the SKA project. In order to do so, the proponent must request a comment from SKA South Africa confirming no unacceptable impact on components of the array.

SKA South Africa will conduct a high level risk assessment on the proposed development, and will consider the following:
The potential Radio Frequency Interference (RFI) and Electromagnetic Interference (EMI) emitted;
The footprint of the proposed shale gas development activities;
The distance of the footprint of activities from the radio site;
The elevation drill rigs relevant to the radio site; and
Whether the shale gas development activities will be in line of sight of the receptors, or whether topographical shielding exists.

Should SKA South Africa determine that an in-depth assessment is required, the proponent will be required to undertake, at own cost, the relevant assessments. These can be sub-contracted to relevant experts in the field, and will include:
Radio frequency measurements of operational facilities of equivalent electrical and structural design, to determine the RFI and EMI characteristic emissions profile;
Radio frequency propagation modelling between the proposed facility and the nearest SKA stations at risk; and
Any other studies that may be required and will be determined in consultation</td></tr>
<tr><td>High</td><td>In High sensitivity areas there is potential for negative impacts that can potentially be mitigated. In-depth assessment of the potential impacts and proven mitigation measures will be required before development can be considered in these areas. Following construction, proof of compliance with mitigation requirements will be required, should the proposed development be considered favourably.</td></tr>
<tr><td>Medium</td><td>In Medium sensitivity areas there is a low potential for negative impacts, and if there are impacts there is a high likelihood of mitigation. Further high level risk assessment of the potential impacts is required.</td></tr>
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	An in-depth assessment may be required, if found necessary through the high level risk assessment.	between the SKA project and the relevant proponent. The results of such an in-depth assessment shall be provided to the SKA South African for consideration. Based on the results of high level risk assessment and in-depth assessment (where required), SKA South African shall issue a comment in the form of a 'letter of objection' or 'letter of no objection' on whether the proposed development can proceed and whether any specific mitigation is required. Proponents must receive a 'letter of no objection' from SKA South Africa before submitting an application for environmental authorisation in terms of NEMA. The 'letter of no objection' shall be submitted together with the application for environmental authorisation. Any mitigation requirements stipulated by SKA South Africa in its comment will be included as a condition on the Environmental Authorisation. Any mitigation measures recommended will be tested by SKA South Africa to ensure compliance following implementation, and the Environmental Authority responsible for the EA will be notified of the results of these tests.
Low	No expected impacts.	No assessment or authorisation for electricity grid infrastructure development in terms of the SKA project is required if the proposed development is not within the sensitive distances from radio sites. SKA South Africa must, however, be notified as an Interest and Affected Party if the development is located within the Northern Cape Province.