

**Fact Sheet and Position Statement on Hydraulic Fracturing**

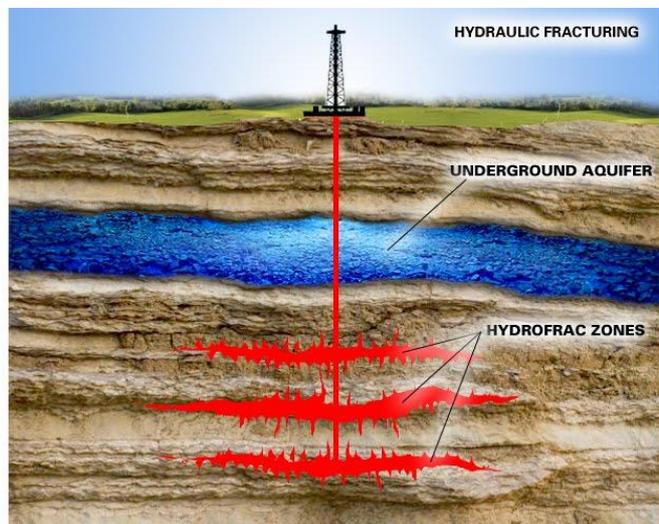
**Introduction**

Hydraulic fracturing - also referred to as 'hydro-fracking' or 'fracking' - a process of horizontal drilling coupled with multi-stage hydraulic fracturing - is a relatively new process of natural gas extraction.

[Picture Credit: Fracking]

The basic process of hydro-fracking is as follows:

- A well is drilled vertically to the desired depth, then turns ninety degrees and continues horizontally for several hundreds of metres into the shale believed to contain the trapped natural gas
- Horizontal drilling may extend for several kilometres
- A mix of water, sand, and various chemicals is pumped into the well at high pressure in order to create fissures in the shale through which the gas can escape
- Natural gas escapes through the fissures and is drawn back up the well to the surface, where it is processed, refined, and shipped to market
- Wastewater (also called 'flowback water' or 'produced water') returns to the surface after the fracking process is completed. In Michigan, United States of America, this water is contained in steel tanks where it is stored long-term for later use by means of deep injection in other oil and gas waste wells.

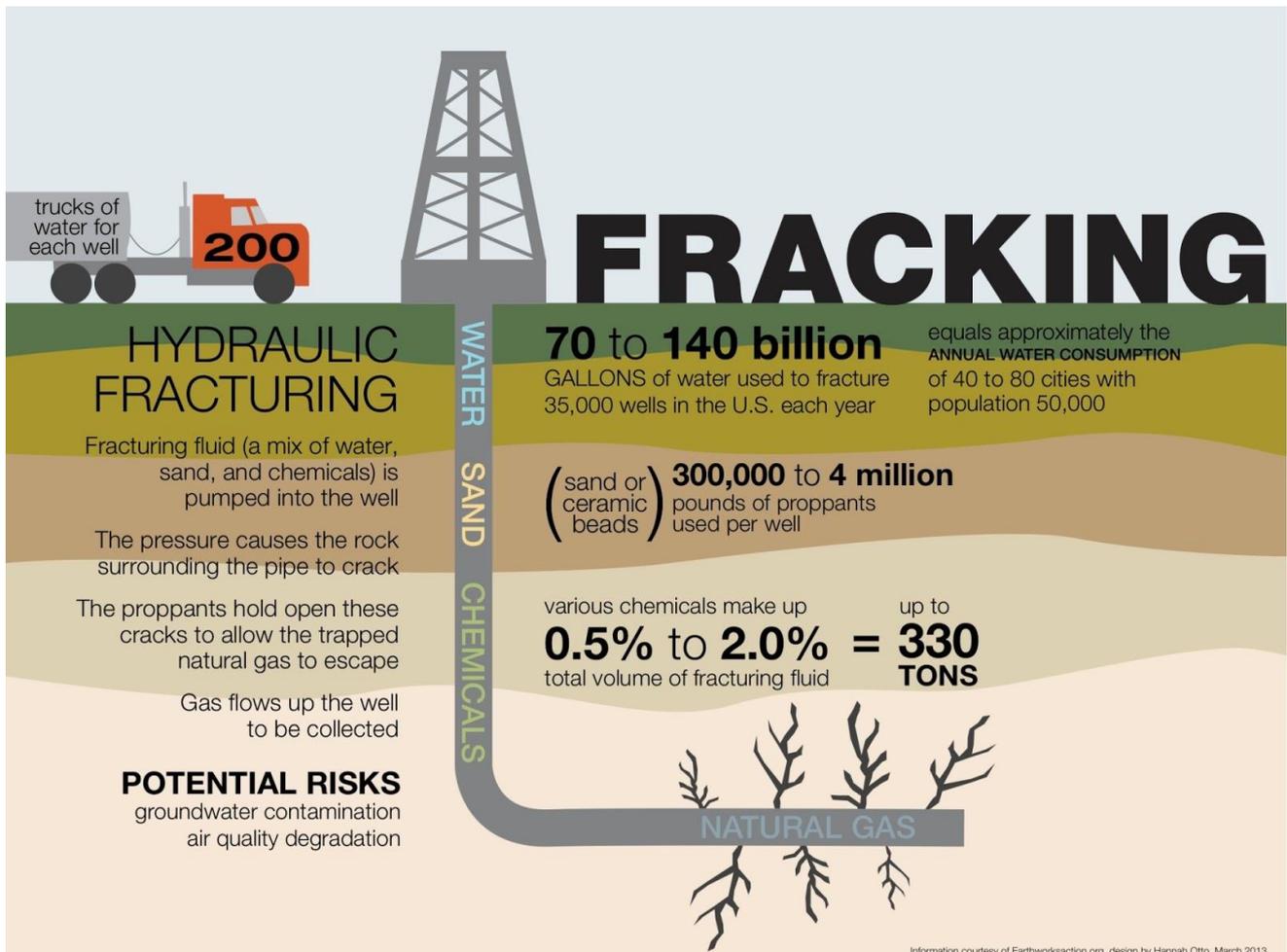


Fracking is fundamentally different from traditional gas extraction methods. Fracking wells can go thousands of metres deeper than traditional natural gas wells. Each fracking exercise requires between fifteen and twenty million litres of local freshwater per well - up to 100

times more than traditional extraction methods. It utilises 'fracking fluid', a mix of water, sand, and a cocktail of toxic chemicals.

While companies performing fracking have resisted disclosure of the exact contents of the fracking fluid by claiming that this information is proprietary, studies of fracking waste indicate that the fluid contains: formaldehyde, acetic acids, citric acids, and boric acids, among hundreds of other chemical contaminants. (Natural Resources Defence Council; Marcellus Drilling News; United States Environmental Protection Agency; Clean Water Action).

[Picture Credit: Infographics of Fracking Facts]



### Issues Around the Impact of Hydraulic Fracturing

The following issues and resultant impact of hydraulic fracturing have been raised:

#### Water Use

It was estimated by the US Environmental Protection Agency (EPA) in 2010 that 70 to 140 billion (US) gallons of water is used annually to fracture 35 000 wells in the United States each year. This is approximately the annual water consumption of 40 to 80 cities each with a population of 50 000.

The extraction of so much water for fracking has raised concerns about the ecological impacts to aquatic resources, as well as dewatering of drinking water aquifers. It has been estimated that the transportation of seven to nineteen million litres of water (fresh or waste water) requires 1 400 truck trips. Thus, not only does water used for hydraulic fracturing deplete fresh water supplies and impact aquatic habitat, the transportation of so much water also creates localised air quality, safety and road repair issues.

The UN Environment Programme classifies more than 90% of South Africa as arid, semi-arid or sub-humid. South Africa's National Botanical Institute is currently drawing up a report for the government to give some indication of the extent of land degradation across the country; this report suggests that land in 25% of magisterial districts in South Africa is already severely degraded (Environmental Monitoring Group).

Land degradation is more than just an environmental problem in rural areas – it is also one of the causes of migration to the cities, resulting in overcrowding and unemployment. It is therefore a social problem which affects us all, and must be tackled before many people's aspirations of a better life can be met.

### Sand and Proppants

Conventional oil and gas wells use, on average, 140 000kg of proppant (a solid material, typically treated sand or man-made ceramic materials, designed to keep an induced hydraulic fracture open, during or following a fracturing treatment) and shale gas wells can use more than 2 million kilograms of proppant per well. 'Frac sand mines' are springing up across the country in the US, from Wisconsin to Texas, bringing with them their own set of impacts. Mining sand for proppant use generates its own range of impacts, including water consumption and air emissions, as well as potential health problems related to crystalline silica (a known carcinogen).

### Toxic Chemicals

In addition to large volumes of water, a variety of chemicals are used in hydraulic fracturing fluids. The oil and gas industry and trade groups are quick to point out that chemicals typically make up just 0.5 and 2.0% of the total volume of the fracturing fluid. When millions of litres of water are being used, however, the amount of chemicals per fracking operation is very large. For example, a fifteen million litre fracturing operation would use from 80 to 330 tons of chemicals.

Many fracturing fluid chemicals are known to be toxic to humans and wildlife, and several are known to cause cancer. Potentially toxic substances include petroleum distillates such as kerosene and diesel fuel (which contain benzene, ethylbenzene, toluene, xylene, naphthalene and other chemicals); polycyclic aromatic hydrocarbons; methanol; formaldehyde; ethylene glycol; glycol ethers; hydrochloric acid; and sodium hydroxide.

Very small quantities of some fracking chemicals are capable of contaminating millions of litres of water. According to the US Environmental Working Group, petroleum-based products known as petroleum distillates such as kerosene (also known as hydrotreated light distillates, mineral spirits, and a petroleum distillate blends) are likely to contain benzene, a known human carcinogen that is toxic in water at levels greater than five parts per billion (or 0.005 parts per million).

### Surface Water and Soil Contamination

Spills of fracturing chemicals and wastes during transportation, fracturing operations and waste disposal have contaminated soil and surface waters. In 2013, 41 spills impacted surface water in the state of Colorado alone. These spills related to hydraulic fracturing have led to major environmental impacts.

### Air Quality

In many oil and gas producing regions in the United States, there has been a degradation of air quality as drilling increases. For example, in Texas, high levels of benzene have been measured in the air near wells in the Barnett Shale gas fields. These volatile air toxics may be originating from a variety of gas-field source such as separators, dehydrators, condensers, compressors, chemical spills, and leaking pipes and valves. Increasingly, research is being conducted on the potential air emissions released during the fracturing flow back stage, when wastewater returns to the surface.

Shales contain numerous organic hydrocarbons, and additional chemicals are injected underground during shale gas drilling, well stimulation (e.g., hydraulic fracturing), and well work-overs.

Air quality is already a major concern in South Africa. Additional air pollution, especially in areas with little or no air pollution, like the Karoo, will exacerbate the situation:

According to the State of Air in South Africa Report (2013):

- South African air quality, especially in dense urban-industrial areas, remains a national cause for concern
- The fact that particulate matter annual ambient levels are in the vicinity of the minimum quality level, let alone above this level, i.e. in the red zone, is a real cause for concern
- It is clear that continued and increased national, provincial, and local action is required in order to meet the Presidential Outcome 10 Target of Compliance with regard to environmental assets and natural resources by 2020 (<http://www.thepresidency.gov.za/dpme/docs/outcome10.pdf>)
- Further, this shows that in air pollution 'hotspots', members of the public do not enjoy their constitutional right to air that is not harmful to their health and well-being
- It is evident that continuous effort to clean up the air is required (State of Air in South Africa Report, 2013).

### Waste Disposal

It has been reported that anywhere from 25% to 100% of the chemical-laced hydraulic fracturing fluids return to the surface from Marcellus Shale operations. This means that for some shale gas wells, millions of litres of wastewater are generated, and require either treatment for re-use, or disposal. As the industry expands, the volume of waste generated is also increasing rapidly. Between 2010 and 2011 in Pennsylvania (US), it went up by 70% to reach more than 2,3billion litres. The sheer volume of wastes, combined with high concentrations of certain chemicals in the flow-back from fracturing operations, are posing major waste management challenges for the Marcellus Shale states.

The management of domestic waste in South Africa currently faces many real challenges. In terms of the South African Constitution (Act No. 108 of 1996), waste management service delivery is a local government function. The current status of waste management in South

Africa is, therefore, an indication of how well municipalities succeed in performing this function.

Recent initiatives aimed at identifying the challenges experienced by municipalities, identified four broad themes of obstacles to effective waste management, namely financial management, equipment management, labour (staff) management, and institutional behaviour (management and planning). It was noted that these challenges are often symptoms of a number of underlying and inter-related root causes that need to be addressed first. Many of these underlying causes are also often outside of the mandate or control of local government and as such, require close cooperation between local, provincial and national government. The picture is much more bleak when toxic waste is included. As far as toxic and medical waste is concerned, the problems are far more involved and complicated (CSIR).

### Chemical Disclosure

One potentially frustrating issue for surface owners where fracking is implemented, is that it has not been easy to find out what chemicals are being used during the hydraulic fracturing operations in their neighbourhood. To obtain chemical compositions of hydraulic fracturing fluids is usually largely unsuccessful because oil and gas companies refused to reveal this 'proprietary information'.  
(EarthWorksAction).

### Endocrine-disrupting activity linked to birth defects, infertility found near drilling sites

The controversial oil and natural gas drilling technique called hydraulic fracturing, or fracking, uses many chemicals that can disrupt the body's hormones, according to new research accepted for publication in The Endocrine Society's journal *Endocrinology*.

Endocrine-disrupting chemicals, or EDCs, are substances that can interfere with the normal functioning of the endocrine system. EDCs can be found in manufactured products as well as certain foods, air, water and soil. Research has linked EDC exposure to infertility, cancer and birth defects.

"More than 700 chemicals are used in the fracking process, and many of them disturb hormone function," said one of the study's authors, Susan C. Nagel, PhD, of the University of Missouri School of Medicine. "With fracking on the rise, populations may face greater health risks from increased endocrine-disrupting chemical exposure."

The study examined 12 suspected or known endocrine-disrupting chemicals used in natural gas operations and measured their ability to mimic or block the effect of the body's male and female reproductive hormones. To gauge endocrine-disrupting activity from natural gas operations, researchers took surface and ground water samples from sites with drilling spills or accidents in a drilling-dense area of Garfield County, CO – an area with more than 10,000 active natural gas wells – and from drilling-sparse control sites without spills in Garfield County as well as Boone County, MO.

The water samples from drilling sites had higher levels of EDC activity that could interfere with the body's response to androgens, a class of hormones that includes testosterone, as well as the reproductive hormone estrogen. Drilling site water samples had moderate to high levels of EDC activity, and samples from the Colorado River – the drainage basin for the natural gas drilling sites – had moderate levels. In comparison, little activity was measured in the water samples from the sites with little drilling.

“Fracking is exempt from federal regulations to protect water quality, but spills associated with natural gas drilling can contaminate surface, ground and drinking water,” Nagel said. “We found more endocrine-disrupting activity in the water close to drilling locations that had experienced spills than at control sites. This could raise the risk of reproductive, metabolic, neurological and other diseases, especially in children who are exposed to EDCs.” (Endocrine Society).

### Natural Gas Drilling and Hydraulic Fracturing Chemicals with 10 or more Health Effects

The following chemicals used in hydraulic fracturing are known to each have ten or more health effects:

2,2',2"-Nitrilotriethanol	Ethylene glycol	Natural gas condensates
2-Ethylhexanol	Ethylene glycol monobutyl ether (2-BE)	Nickel sulfate
5-Chloro-2-methyl-4-isothiazolin-3-one	Ethylene oxide	Paraformaldehyde
Acetic acid	Ferrous sulfate	Petroleum distillate naphtha
Acrolein	Formaldehyde	Petroleum distillate/ naphtha
Acrylamide (2-propenamamide)	Formic acid	Phosphonium, tetrakis(hydroxymethyl)-sulfate
Acrylic acid	Fuel oil #2	Propane-1,2-diol
Ammonia	Glutaraldehyde	Sodium bromate
Ammonium chloride	Glyoxal	Sodium chlorite (chlorous acid, sodium salt)
Ammonium nitrate	Hydrodesulfurized kerosene	Sodium hypochlorite
Aniline	Hydrogen sulfide	Sodium nitrate
Benzyl chloride	Iron	Sodium nitrite
Boric acid	Isobutyl alcohol (2-methyl-1-propanol)	Sodium sulfite
Cadmium	Isopropanol (propan-2-ol)	Styrene
Calcium hypochlorite	Kerosene	Sulfur dioxide
Chlorine	Light naphthenic distillates, hydrotreated	Sulfuric acid
Chlorine dioxide	Mercaptoacidic acid	Tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione (Dazomet)
Dibromoacetonitrile 1	Methanol	Titanium dioxide
Diesel 2	Methylene bis(thiocyanate)	Tributyl phosphate
Diethanolamine	Monoethanolamine	Triethylene glycol
Diethylenetriamine	NaHCO <sub>3</sub>	Urea
Dimethyl formamide	Naphtha, petroleum medium aliphatic	Xylene
Epidian	Naphthalene	
Ethanol (acetylenic alcohol)		
Ethyl mercaptan		
Ethylbenzene		

(EarthWorksAction).

### Fracking in the United States of America

In the United States, fracking has prompted the largest environmental movement in decades and several states have banned, or are considering banning it. A huge list of celebrities are on board - such as actors Matt Damon, who starred in the fracking film ‘*Promised Land*’, and Alec Baldwin.

The picture below shows a typical scene in preparation for fracking at a new fracking site in the United States with hundreds of tanker trucks converging on the fracking site loaded with millions of litres of water and fracking fluid.

The state of Colorado introduced new fracking-fluid disclosure rules, the most comprehensive in the United States which is said to be the product of days of 'shuttle diplomacy', last-minute compromises and phone calls from the Governor of Colorado.



[Picture Credit: Fracking 2]

The rule, unanimously approved by the Colorado Oil and Gas Conservation Commission, requires drillers to disclose all the chemicals in hydraulic fracturing and their concentrations. No other state requires such a detailed disclosure, according to the Groundwater Protection Council, a national association of state water agencies.

*Key requirements in Colorado's new fracking-fluid disclosure rules, adopted by the state Oil and Gas Conservation Commission include:*

- Filing within 60 days of the fracking job a list of all the chemicals and their concentrations in the fracking fluid.
- The list is to be filed with FracFocus.org, a publicly accessible independent Internet database.
- Filing with the commission for any proprietary chemical a company does not want to disclose, claiming under penalty of perjury that the chemical is a trade secret.
- Filing the chemical family of any trade-secret chemical and its concentration as part of the disclosure form.
- Sending background information on fracking to property owners near wells awarded drilling permits, including details on how to have a baseline well-water test done.

(A Greener Life A Greener World; The Denver Post)

### **New York Bans Hydraulic Fracturing**

New York State will ban hydraulic fracturing after a long-awaited report concluded that the oil and gas extraction method poses health risks, Governor Andrew Cuomo's administration said on Wednesday.

New York Environmental Commissioner Joseph Martens said at a cabinet meeting he will issue an order early in 2015 banning fracking, which has been under a moratorium since 2008. Once that happens, New York will join Vermont as the only states to completely prohibit fracking. The decision ends what has been a fierce debate in New York over the benefits and pitfalls of fracking, a process that involves pumping water, sand and chemicals into a well to extract oil or gas. Many in the state saw gas drilling as a key economic resource while others argued it was too dangerous.

The state's health commissioner, Howard Zucker, said there is not enough scientific information to conclude that fracking is safe. "The potential risks are too great, in fact not

even fully known, and relying on the limited data presently available would be negligent on my part", Zucker said.

New York sits atop a portion of the Marcellus shale, one of the largest natural gas deposits in the United States. The ruling is a blow for energy companies that had been waiting for years to tap the thousands of acres of land they have leased there.

The oil and gas industry immediately slammed Cuomo for the decision. Karen Moreau, the executive director of the New York State Petroleum Council, called it a reckless move that would deprive the state of thousands of jobs and hundreds of millions of dollars in revenue.

"We are resolved to continue to fight for these benefits in New York," she said. Environmental groups, meanwhile, hailed Cuomo as a national leader on the issue. "We hope that this determined leadership Governor Cuomo has displayed will give courage to elected leaders throughout the country and world," said Deborah Goldberg, an attorney with the group Earthjustice.

Cuomo, answering questions from journalists, said the decision on whether to allow this kind of drilling in New York was ultimately up to Martens. He said it was "probably the most emotionally charged issue I have ever experienced," more than gay marriage, gun control or the death penalty.  
(Reuters).

### **Watch a Youtube Animation of Hydraulic Fracturing (Fracking)**

A Youtube animation of hydraulic fracturing can be viewed at the following URL:

<http://www.youtube.com/watch?v=VY34PQUiwOQ>

### **Fracking in the United Kingdom**

No fracking has of yet been conducted in the UK but exploration wells have been drilled in Lancashire where the biggest shale gas deposits are estimated to be. But it is not just in Lancashire - according to Greenpeace shale gas deposits in several sites in Croydon and South London are being looked at.

(A Greener Life A Greener World).

### **Fracking in Europe**

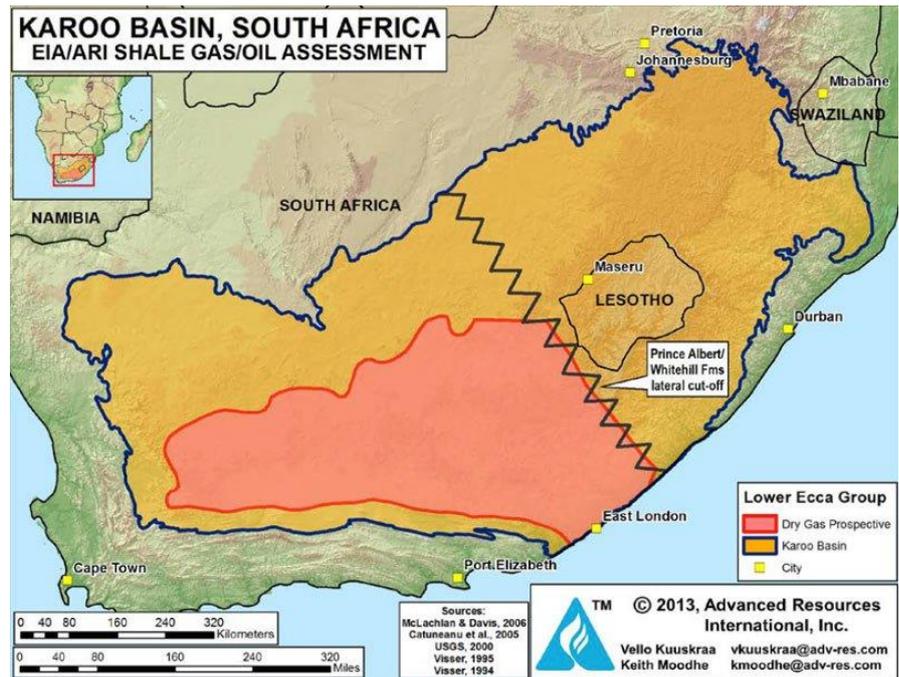
The most of Europe have, so far, said 'no' to fracking, with Poland being the exception. Big industrial countries like Germany and France have more or less ruled out fracking, with the French President Francois Hollande recently repeating his opposition to fracking, saying that it would not happen during his term. The people of Bulgaria gathered in mass to protest against fracking which prompted the government to cancel an exploration contract with ExxonMobil. In Ireland five counties have passed motions for a ban on fracking.

(A Greener Life A Greener World).

## Fracking in South Africa

South Africa lifted a ban on fracking in 2012, and further opened the door to exploitation of the resource by recently publishing regulations on the process, under which drillers will be required to meet American Petroleum Institute standards regarding the type of equipment and chemicals they use. It is said that the regulations include measures to protect wildlife in the region as well as to safeguard water resources.

[Picture Credit: Dry Gas Prospective]



The accompanying map indicates the extent of the Karoo Basin and the identified shale gas prospective area. (GEO Expro).

According to fin24 on 27 November 2016: If exploration for shale gas goes ahead in the Karoo, only 60 to 900 jobs will be created, and it is not going to add much value to the economy if government, as has become the “pattern” of late, simply keeps on spending the additional tax income on paying the salaries of additional government employees.

This is according to the final estimates from the CSIR research on shale gas exploration, which it carried out on the instruction of government.

Other information from the report:

- These are small numbers compared with the jobs that are currently created through agriculture and tourism in the area.
- Agriculture currently provides 38 000 jobs and contributes R5 billion a year to the economy.
- Tourism creates between 10 100 and 16 400 jobs annually and contributes R2.7 billion to the economy a year.

The report also confirms that there is not enough water in the area to extract shale gas using fracking. There is also a risk of water pollution, and it is recommended that hydraulic fracturing not be used in sensitive areas.

Added to this, the possibility of earthquakes “cannot be discounted”.

The area taken into account in the research is the part of the Karoo where there are currently five exploration applications pending – three by Shell, one by Falcon and one by Bundu.

# Strategic Environmental Assessment for Shale Gas Development



According to the Strategic Environmental Assessment (SEA) for Shale Gas Development in South Africa, the phases of the project are as follows:

## **Project duration:**

24 Months

## **Project phases:**

### **Phase 1: *The Conceptualisation and Methodology Phase***

The primary purpose of this phase of the assessment is to set-up and implement all project management structures, convene the project governance groups, recruit authors and experts to the Multi-Author Teams and release a Draft Approach Report at the end of Phase 1 for expert review. This document will also be available to the public on the website.

### **Phase 2: *The Scientific Assessment Phase***

This will be the component of the study where the actual scientific assessment by the Multi-Author teams for all Strategic Issues takes place. At the end of Phase 2 Draft and Final SEA reports will be released for expert and public review.

### **Phase 3: *The Decision-Making Framework Phase***

This phase will translate the outputs from Phase 2 into operational guidelines and decision making frameworks. It is undertaken by the Project Team (CSIR, SANBI and CGS) in close consultation with the various affected Departments. It commences with initial drafts after the delivery of the first draft of the Assessment report, and with final drafts after the delivery of the final Assessment report. The separation of the teams between phase 2 and 3 is to honour the assessment 'mantra' of being 'policy relevant, but not policy prescriptive'. The experts in Phase 2 are not being asked to make decisions about the development of shale gas. They are being asked to give an informed opinion on the consequences of different options. The decisions must be made by mandated authorities (i.e. government), who have contracted the science councils to help them in formulating the framework and content of such decisions



The key to water baseline testing is that it is conducted prior to any drilling or fracking activity so one is able to prove changes in water quality. It is essential to test for water quality prior to drilling activity to establish a water baseline quality, and at least once after drilling has been completed.

*Before Drilling Activity:*

The optimal time to conduct baseline sampling is before companies conduct seismic testing near one's property. Seismic testing involves the use of either trucks or explosives to create vibrations that are read with instruments to map underground rock formations. These vibrations could, in rare instances, mobilise and introduce sediment to a nearby water supply or change water flow.

Water baseline testing should also be conducted prior to commencement of drilling and/or hydraulic fracturing (fracking).

*Post-drilling:*

Post-drilling water quality testing should be done within 6 months of completion of drilling and hydraulic fracturing.

- Property owners may wish to conduct post drilling sampling annually after fracking of a well in the area.
- Subsequent screening using general parameters such as pH, specific conductance, total dissolved solids (TDS), or dissolved methane can be a less expensive way to monitor into the future to see if changes occur.

*If a change in water quality is noted or a problem is suspected:*

- If there is a change in concentration or occurrence of parameters tested, conduct further more sophisticated testing.
- If one notices changes in the water quality or quantity, the Department of Mineral Resources should be contacted immediately. The gas drilling company should also be informed immediately. Some obvious changes to the water supply include:
  - Changes in the appearance such as sediment, foaming, bubbling or spurting faucets
  - Changes in drinking water taste including salty or metallic tastes
  - Changes in water odour such as a rotten egg odour, fuel or oily smell
  - Reduction or loss of water quantity

It is important to note that water quality will vary naturally due in part to season, rainfall, and local geology. Multiple water tests, both before and after drilling and/or fracking, will help to clarify the difference between contamination events and natural variability.

(Watershed Council; ALS).

## **Regulations for Petroleum Exploration and Production**

The Regulations for Petroleum Exploration and Production (hydraulic fracturing) was published in Government Gazette No 38855 of 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

A copy of the applicable Government Gazette is available by visiting the following URL:

[http://www.gov.za/sites/www.gov.za/files/38855\\_rg10444\\_gon466.pdf](http://www.gov.za/sites/www.gov.za/files/38855_rg10444_gon466.pdf)

**CANSA's Position**

CANSA firmly believes that:

- it (CANSA) cannot recommend and/or support the approval of hydraulic fracturing as a mining technology in South Africa before the safety, feasibility and acceptability of the technology to be used has been adequately determined under South African conditions.
- there is sufficient scientific evidence to indicate that fracking fluid contains carcinogens (cancer causing agents) like formaldehyde, benzene, Crystalline silica, diesel fuel, ethylbenzene, toluene, xylene, and possibly other carcinogens as well.
- the South African public and environment should be protected against any form of possible environmental pollution and contamination by carcinogens and/or any other harmful chemicals resulting from fracking to prevent any possible increase in the incidence of additional cases of cancer and/or other health problems resulting from hydraulic fracturing (fracking).
- because water quality may vary naturally due in part to season, rainfall, and local geology, multiple water sample tests, both before and after drilling, should be conducted to help to clarify the difference between contamination events and natural variability.
- costs towards water baseline testing as well as post-drilling testing of water should be for the account of the applicable licenced fracking company.
- fracking rules, similar to that of the state of Colorado in the United States, should be introduced in South Africa as a matter of urgency. These rules should include at least the following:

- filing before commencement of fracking, a list of all the chemicals and their concentrations that will be used in the fracking fluid
  - the list is to be filed on a publicly accessible independent Internet database. The Cancer Association of South Africa (CANSAs) has already made its website available for this purpose. The website can be sourced at [www.cansa.org.za](http://www.cansa.org.za)
  - filing with the Department of Mineral Resources of any proprietary chemical a company does not want to disclose, claiming under penalty of perjury that the chemical is a trade secret that may have any harmful or damaging effect on the health of humans, animals and/or the environment
  - filing the chemical family of any trade-secret chemical and its concentration as part of the disclosure
  - sending background information on fracking to property owners near wells awarded drilling permits, including details on how to have a baseline well-water test done as well as post-drilling water testing
- underground and surface water should be tested before drilling and/or fracking takes place in order to establish a baseline. The following tests should ideally be included:
- Acidity, Alkalinity (Total as CaCO<sub>3</sub>), Specific Conductance, pH, Hardness (Total as CaCO<sub>3</sub>)
  - Metals: Aluminium (classified as a Group I carcinogen by IARC), Arsenic (classified as a Group I carcinogen by IARC), Barium, Beryllium, Boron, Cadmium (classified as a Group I carcinogen by IARC), Calcium, Chromium (classified as a Group I carcinogen by IARC), Cobalt (classified as a Group 2A carcinogen by IARC), Copper, Iron – Dissolved & Total, Lead (classified as a Group 2A carcinogen by IARC), Lithium, Magnesium, Manganese, Mercury, Molybdenum, Nickel (classified as a Group I carcinogen by IARC), Selenium, Silver, Sodium, Strontium, Thorium, Uranium, Zinc
  - Acetic acids
  - Ammonia Nitrogen
  - Benzene (classified as a Group I carcinogen by IARC)
  - Biochemical Oxygen Demand, Chemical Oxygen Demand
  - Boric acids
  - Bromide
  - Chloride
  - Citric acids
  - Ethylene Glycol
  - Formaldehyde (classified as a Group I carcinogen by IARC)
  - Gross Alpha
  - Gross Beta
  - Methylene Blue Active Substances - MBAS (Surfactants)
  - Nitrite-Nitrate Nitrogen, and TKN
  - Oil & Grease
  - Phenolics (Total)
  - Radium 226 (classified as a Group I carcinogen by IARC)
  - Radium 228 (classified as a Group I carcinogen by IARC)
  - Sulphate
  - Toluene (classified as a Group 2B carcinogen by IARC)
  - Total Dissolved Solids

- Total Suspended Solids
  - underground and surface water should be tested following fracking (post-drilling) at least every two years for a period of at least 6 years. Post-drilling testing of water should ideally include testing for the same substances as described above.

CANSA further believes that:

- everyone has the right, as enshrined in the Constitution, to an environment that is not harmful to their health or well-being; and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.
- no amount of legislation, monitoring or enforcement will promote sustainable development if the development is at odds with the environment in which it is taking place (Constitution of the Republic of South Africa, 1996 (Section 24); ALS; Record On Line; Natural Society; Business Insider).

### **Medical Disclaimer**

This Fact Sheet and Position Statement is intended to provide general information only and, as such, should not be considered as a substitute for advice, medically or otherwise, covering any specific situation. Users should seek appropriate advice before taking or refraining from taking any action in reliance on any information contained in this Fact Sheet and Position Statement. So far as permissible by law, the Cancer Association of South Africa (CANSA) does not accept any liability to any person (or his/her dependants/estate/heirs) relating to the use of any information contained in this Fact Sheet and Position Statement.

Whilst CANSA has taken every precaution in compiling this Fact Sheet and Position Statement, neither it, nor any contributor(s) to this Fact Sheet and Position Statement can be held responsible for any action (or the lack thereof) taken by any person or organisation wherever they shall be based, as a result, direct or otherwise, of information contained in, or accessed through, this Fact Sheet and Position Statement.

## Sources and References

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### **ALS**

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### **Business Insider**

<http://www.businessinsider.com/scary-chemicals-used-in-hydraulic-fracking-2012-3?op=1>

### **Clean Water Action**

<http://www.cleanwateraction.org/page/fracking-process>

### **Constitution of the Republic of South Africa**

Constitution of the Republic of South Africa, 1996 (as amended). Section 24.

### **CSIR**

[http://www.csir.co.za/nre/docs/Waste\\_Management\\_Toolkit.pdf](http://www.csir.co.za/nre/docs/Waste_Management_Toolkit.pdf)

[http://seasgd.csir.co.za/wp-content/uploads/2015/02/phases\\_Aug2015.png](http://seasgd.csir.co.za/wp-content/uploads/2015/02/phases_Aug2015.png)

### **Dry Gas Prospective**

<http://www.geoexpro.com/articles/2013/12/a-minute-to-read>

### **EarthWorksAction**

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### **Endocrine Society**

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