

APPENDIX C: CO-FIRING CORRESPONDENCE

From: Kristy Langerman
Sent: 07 September 2012 02:02 PM
To: Mark Van Der Riet; Chiraag Arun Gokaldas
Cc: Dave Lucas; Deidre Herbst; Riana Bothma; Terisha Rampersadh; Shaun Pershad; Lindani Madonsela; Humbulani Ndou; Zama Mkhize; Riana Bothma; Ebrahim Patel
Subject: FW: Application for exemption for co-firing of UCG gas at Majuba Power Station

Hi everyone

Please see below for the response from Dan Hlanyane, the Emission Licencing Authority. This can be considered approval of our request to co-fire. Please keep a copy of Dan's response for your records and audits, and please take note of his requirement for a report on emissions from Majuba once co-firing has commenced. The emissions from the co-firing will need to be reported in the monthly emission report as well.

Regards,
Kristy

From: Dan Hlanyane
Sent: 07 September 2012 02:00 PM
To: Kristy Langerman
Subject: RE: Application for exemption for co-firing of UCG gas at Majuba Power Station

Afternoon

We take note of the request we have no objection to the co-firing, we will appreciate a full report after the pilot on effect on normal emissions of the stations.

Kind regards

TD Hlanyane

From: Kristy Langerman
Sent: 07 September 2012 01:54 PM
To: Dan Hlanyane
Cc: Mark Van Der Riet; Chiraag Arun Gokaldas; Riana Bothma; Terisha Rampersadh; Humbulani Ndou; Zama Mkhize; Lindani Madonsela; Deidre Herbst; Dave Lucas; Shaun Pershad
Subject: Application for exemption for co-firing of UCG gas at Majuba Power Station

Dear Dan

Please find attached an application for exemption for Majuba Power Station, so that the co-firing of UCG gas can be tested. Only a very small amount of UCG gas will be co-fired, so there will be no significant change in emissions. However, it will give us the opportunity to test a technology which has economic and environmental benefits.

We would like to start co-firing on 28 September 2012, and would appreciate your response to this request as soon as possible, so that we can commence with the preparations.

Thanks,
Kristy

Kristy Langerman (nee Ross)
Air Quality Centre of Excellence, Environmental Management, Eskom
Megawatt Park, Maxwell Drive, Sunninghill

Mr T.D. Hlanyane
Director Municipal Health (Air Quality Officer)
Gert Sibande District Municipality
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South Africa
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Date:
31 March 2011

Enquiries:
Mike Beeslaar
Tel +27 17 799 3705

Dear Mr Hlanyane

MAJUBA UNDERGROUND COAL GASIFICATION (UCG) PROJECT FEEDBACK

The following letter provides feedback on the history of and plans for the Majuba Underground Coal Gasification project in the Gert Sibande District Municipality, Mpumalanga. The UCG process is described, and Eskom's understanding of the emission licensing requirements discussed.

The UCG pilot phase was conducted from January 2007. This phase involves gasifying the coal underground, and flaring the gas. Eskom is currently planning the demonstration phase of the project, which will consist of a UCG mine, a gas treatment plant and gas turbine.

The UCG project was granted an exemption from the requirements of the Atmospheric Pollution Prevention Act (Act No 45 of 1965) in 2005. However, the validity of this exemption is questionable, as Julius van Graan, who issued the exemption, was not one of the official CAPCO's listed in Government Gazette Notice No. 31171 (2008). The UCG pilot plant is not a Listed Activity in terms of the National Environmental Air Quality Act (Act no 39 of 2004), as test or experimental installations are exempted from subcategory 3.1 (Combustion installations for carbonisation and Coal Gasification). Subcategory 1.1 (Solid fuel combustion installations) is applicable to the UCG demonstration project, and an application for an Atmospheric Emission License will be submitted once the project has been approved by Eskom's Board.

Eventually, it will probably be advisable for UCG to be a separate Listed Activity. We welcome your participation in the project, and hope that appropriate emission limits can be set in the future and informed by the performance of the demonstration plant.

Yours sincerely



Dr Mark Van der Riet
UCG Project Director

1 Background

Eskom Holdings (Eskom) is developing the production of coal-derived gas from Underground Coal Gasification (UCG). UCG is a process whereby coal is converted in situ into a combustible gas that can be used for power generation or chemical production. This obviates the need for coal mining, transportation, preparation and the transportation and disposal of ash. This will have cost, safety, labour and environmental benefits.

UCG involves injecting steam and air (or oxygen) into a cavity created in an underground coal seam that reacts with coal to form a synthetic gas, see Figure 1.

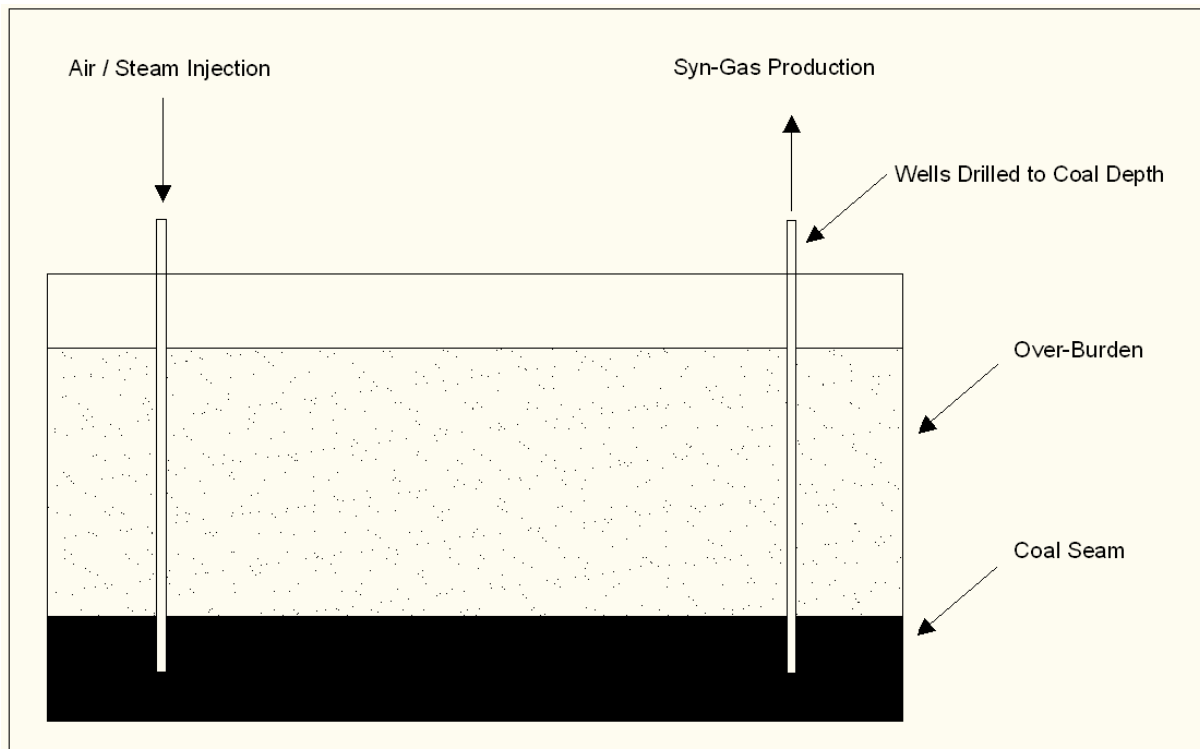


Figure 1: Underground Coal Gasification Schematic

The underground cavity is created as the coal burns, and the boundaries form the walls of an underground reactor. The reactor is able to operate at high pressures (related to its depth) and temperatures. The schematic displayed in Figure 1 is largely simplified. The mining operation is complex with a number of injection and production wells in operation at any given time.

The major components of the UCG syngas are listed in Table 1.

Table 1: UCG gas constituents

Component	Formula	Min	Optimum	Max
		Vol %	Vol %	Vol %
Methane	CH ₄	2.800	3.500	4.500
Ethane	C ₂ H ₆	0.100	0.100	0.100
Propane	C ₃ H ₈	0.050	0.050	0.050
Butane	C ₄ H ₁₀	0.000	0.000	0.000
Pentane	C ₅ H ₁₂	0.000	0.000	0.000
Carbon Monoxide	CO	7.000	9.500	11.000
Hydrogen	H ₂	14.000	15.500	18.000
Hydrogen Sulfide	H ₂ S	0.200	0.200	0.200
Oxygen	O ₂	0.200	0.200	0.200
Water	H ₂ O	5.000	5.000	5.000
Ammonia	NH ₃	0.100	0.100	0.100
Nitrogen	N ₂	51.950	48.750	44.250
Argon	Ar	0.100	0.100	0.100
Carbon Dioxide	CO ₂	18.500	17.000	16.500
Total		100.000	100.000	100.000
LHV [MJ/Nm ³]		3.554	4.283	5.100

UCG has the potential to exploit coal resources previously regarded as either uneconomic for conventional underground coal mining, or inaccessible due to depth, geology or other mining and safety considerations. As such, this technology would assist in extracting three quarters of South Africa's coal resources that are presently classified as "un-minable" with current technology and economics.

The exploration and testing of the UCG technology was initiated under the Minerals Act, (Act 50 of 1991) in 2001, with an EMPR approved by the Department of Minerals and Energy in terms of Section 39(1), in March 2004. An exemption (Ref. 23/4/2/1448) from complying with the requirements of the Air Pollution Prevention Act (Act 45 of 1965) was granted in 2005 (see Appendix A), based on the low levels of emissions expected, for the duration of the research process.

2 Majuba UCG Pilot Project

The pilot phase of the UCG project has successfully proven the feasibility of the technology. The pilot plant was commissioned in the latter half of 2006 and operation commenced on 20 January 2007. The plant produced 5,000 Nm³/hr of low caloric value synthesis gas and was flared from 20 January 2007 to 10 June 2010.

As of 10 June 2010, the capacity of the UCG operation was increased to 11,000 Nm³/hr of low caloric value synthetic gas which is being flared. The UCG plant is expected to operate until the end of 2014 at a level up to 15,000 Nm³/hr, as it evolves into the larger UCG demonstration plant.

2.1 Air Quality Impacts during Pilot Project

The emissions associated with flaring during the pilot operation are tabulated below.

Parameter	Pilot Plant 5,000 Nm ³ /hr	Pilot Plant 15,000 Nm ³ /hr
Height above ground (m)	6	9
Height of nearby buildings (m)	<4	<4
Nature of Pollutants	Gaseous	
Concentration of Pollutants (tons/month)		
CO	12.6	37.8
SO _x	19.7	59.0
NO _x	11.6	34.8
CO ₂	2242	6725
H ₂ S	0.21	0.64
NH ₃	0.13	0.38
VOCs	2.78	8.34
Emission Velocity (m/s)	20	22
Volume of gas emitted		
20% Excess Air (Nm ³ /hr)	10028	30083
5% Excess Air (Nm ³ /hr)	9107	27321
Emission Temperature (°C)	700-1200	

2.2 Permits

The UCG pilot project was granted an exemption from the requirements of the Atmospheric Pollution Prevention Act (Act No 45 of 1965) by then Chief Air Pollution Control Officer, Julius van Graan, on 16 September 2005 (Appendix A). However, according to Government Notice No 31171 (27 June 2008), Julius van Graan was not officially appointed as a Chief Air Pollution Control Officer in terms of Section 6(1)(a) of the Atmospheric Pollution Prevention Act. The legal standing of this exemption is uncertain.

It is Eskom's understanding that an Atmospheric Emission Licence is not required for the emissions from the flare from the UCG pilot plant. Test or experimental installations are excluded from Category 3: Carbonization and Coal Gasification, subcategory 3.1: Combustion installations. The UCG Pilot Project is thus not a Listed Activity in terms of the Air Quality Act.

3 Majuba UCG Demonstration Project

A Majuba UCG demonstration project is being planned by Eskom. This plant will consist of a UCG mine, a Gas Treatment Plant and a Gas Turbine Power Plant. The demonstration plant turbine will be rated at 110-140MW and will form the basis for the development of future commercial UCG power generation plants.

The UCG mine will produce 250,000 Nm³/hr of gas for the demonstration phase of the project. This gas will be treated in the Gas Treatment Plant to meet the turbine inlet gas requirements and the applicable Minimum Emission Standards (Republic of South Africa Government Gazette Vol. 537 of March 2010, National List of Activities and Associated Emission Standards). The process flow diagram for the demonstration plant is illustrated in Figure 2.

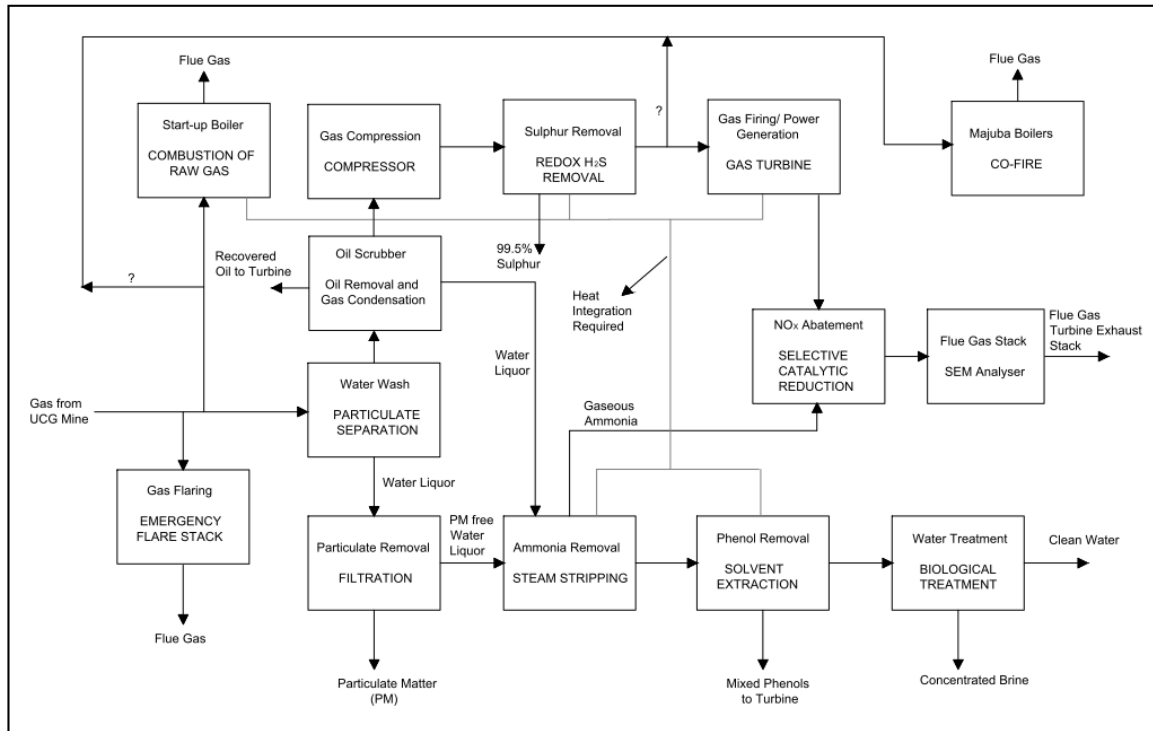


Figure 2 Process Flow Diagram for the planned UCG Demonstration Plan

The sulphur removal and NO_x abatement unit operations have been specifically included in order to meet the emission limits.

3.1 Air Quality Impacts during Demonstration Project

The emissions from the turbine stacks during normal operation and from the flares during start-up, shut-down and emergency flaring associated with the demonstration project are tabulated below.

Parameter	Normal Operation Turbine Stack	Start-up, Shutdown and Emergency Flaring
Height above ground (m)	To be determine during detailed design	
Height of nearby buildings (m)	To be determine during detailed design	
Nature of Pollutants	Gaseous	
Concentration of Pollutants (tons/month)		
CO	4.5	706*
SO _x	816	1100*
NO _x	48	650*
CO ₂	124126	125535*
H ₂ S	TBD	12*
NH ₃	TBD	7.2*
VOCs	17	156*
Emission Velocity (m/s)	To be determine during detailed design	
Volume of gas emmitted	1021850	544363
Emission Temperature (°C)	544	700-1200
TBD - To be determine		
* - These emissions will be limited		

3.2 Permits

The UCG process utilises coal as the primary source of fuel. It is therefore considered to be a solid fuels combustion facility. The UCG Demonstration plant will be designed to ensure compliance with the Minimum Emission Standards for New Plants for Solid Fuel Combustion Facilities during normal operation (i.e. emissions from the gas turbines). The technology however is benchmarked

as a cleaner coal technology and therefore improved emission targets will be set for any future commercial operation.

Once the Majuba UCG demonstration project has been finally approved by Eskom's Board, an Atmospheric Emission License will be applied for in terms of the National Environmental Management: Air Quality Act (Act No 39 of 2004). We anticipate that the application will be submitted June 2012.

Appendix A



DEPARTMENT: ENVIRONMENTAL AFFAIRS AND TOURISM
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DIRECTORATE: AIR POLLUTION CONTROL

The General Manager: Research, Development & Demonstration
Eskom
Private Bag 40175
CLEVELAND
2022

2005/09/16

Attention: Mr M. van der Riet

Sir,

ATMOSPHERIC POLLUTION PREVENTION ACT, 1965 – SECTIONS 9 & 12.
MAJUBA POWER STATION – UNDERGROUND COAL GASSIFICATION PROJECT.

Your letter, dated 2005/07/07, refers.

Exemption is hereby granted, from the requirements of the above-mentioned Act, for phases 1 & 2 of the underground coal gasification project at Majuba Power Station.

All possible steps must however be taken to minimise any impact on the environment.

Yours faithfully

A handwritten signature in black ink, appearing to be 'J. van Graan', written over a horizontal line.

AIR POLLUTION CONTROL OFFICER: CHIEF