Final Motivation for the Additional Postponement of Compliance Timeframes in terms of Regulation 11 of the Section 21 NEM:AQA Minimum Emissions Standards

For Public Comment

Motivation Report Prepared by

December 2014

Final Motivation for the Additional Postponement of Compliance Timeframes in terms of Regulation 11 of the Section 21 NEM:AQA Minimum Emissions Standards

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Executive Summary

This is an application in terms of Regulation 11 of Government Notice No. 893 in Government Gazette 37054 of 22 November 2013 (“GN 893”) for the postponement of the compliance timeframes set in Regulations 9 and 10 of GN893. This application was previously submitted to the Minister of Environmental Affairs as an application for exemption. The application for exemption was made in terms of Section 59 of the National Environmental Management: Air Quality Act (Act No. 39 of 2004) (NEM:AQA) for an exemption from the default application of certain Minimum Emissions Standards (MES) published in Government Notice No. 893 in Government Gazette 37054 of 22 November 2013 (“GN 893”), for certain point sources at Sasol Synfuels (Pty) Limited (“Sasol Synfuels”) that are unlikely to comply for key reasons. A copy of the exemption application was also provided to the National Air Quality Officer.

After the conclusion of the stakeholder engagement process, Sasol was directed to rather seek postponement from the compliance timeframes in the MES to address its challenges. Consequently the exemption application was submitted as a postponement application to the National Air Quality Officer, for the postponement of compliance timeframes for existing plant standards that come into effect on 1 April 2015. For the purposes of clarity, we refer to this application as the “additional postponement application” to distinguish it from the exemption application previously submitted to the Minister as well as to distinguish it from the postponement applications submitted by Sasol to the DEA on 30 September 2014 (“the initial postponement applications”). In an effort to ensure this process is transparent and that stakeholders were given a fair opportunity to make representations, Sasol conducted a further notice and comment process. All comments received during the comment period on the draft additional postponement applications have been included in the updated Comment and Response Report.

While this additional postponement application contains materially the same content as the exemption application, it was, prior to being made available for further comment, updated in four respects. First, based on the stakeholder comments received during the public participation process, Sasol has updated some aspects of the applications. Secondly, Sasol is in the process of restructuring its corporate structure and so the Introduction has been updated to explain those changes. Thirdly, Sasol has updated this report’s Chapter 7, now entitled “Sasol’s roadmap to sustainable air quality improvement”. This is done to consolidate information presented throughout this application to emphasise Sasol’s actions toward sustainable air quality improvement, aligned with the intent of the NEM:AQA and the MES, including Sasol’s commitment to the ongoing investigation of and, where feasible, implementation of sustainable compliance solutions. Lastly, the stakeholder engagement chapter reflects the further commenting period linked to this application.

Sasol Synfuels proposes alternative emissions limits and alternative special arrangements to be incorporated as licence conditions in place of the MES operating automatically during the period of the postponement.

The intended purpose of the alternative emissions limits and alternative special arrangements is to define the proposed licence conditions with which Sasol must comply for the duration of the postponement period. These proposed licence conditions have been established based on what is considered reasonable and achievable in the light of the assessments done by Sasol Synfuels’s independent consultants, and are based on the information and technologies currently available to Sasol Synfuels. Sasol Synfuels does not seek to increase emission levels relative to its current emissions baseline through this application. The alternative emissions limits and alternative special arrangements proposed by Sasol have been informed by independent specialist air quality studies on the basis that these limits do not affect ambient air quality beyond the NAAQS, which have as their overarching objective, ambient air quality that is not harmful to human health or well-being.

Furthermore, these proposed limits and arrangements are aligned with the National Framework for Air Quality Management in that the technologies utilised to deliver pollution control- are technically possible and incurred at a cost which is acceptable to society in the long-term and the short-term.

This application is made in terms of Regulation 11 of GN 893 which entitles a person to apply in writing to the National Air Quality Officer for a postponement from the compliance timeframes set out in Regulations 9 and 10.

Regulation 12 prescribes that an application for a postponement must include –

a) An air pollution impact assessment compiled in accordance with the Regulations prescribing the format of an Atmospheric Impact Report (as contemplated in Section 30 of the NEM:AQA) by a person registered as a professional engineer or as a professional natural scientist in the appropriate category.
b) A detailed justification and reasons for the application.
c) A concluded public participation process undertaken as specified in the NEMA Environmental Impact Assessment Regulations.

Regulation 13 limits the period for which a postponement may be granted to 5 years per postponement.

This application complies with Regulations 12 (a) and (b). An Atmospheric Impact Report has been included as well as an independent peer review report on the modelling methodology employed in the Atmospheric Impact Report. The detailed justification and reasons are included and have been supplemented by a technical appendix outlining technology investigations with respect to the selected point sources which are the subject of this application.

With regards to compliance with Regulation 12 (c), a public participation process was undertaken as specified in the NEMA Environmental Impact Assessment Regulations when the exemption application was submitted. In addition, a further public commenting period was provided to allow, in particular, comments on the fact that this is no longer an exemption application but is now a postponement application.

Sasol respectfully requests these additional five year postponements of the compliance timeframes for various existing plant standards and associated special arrangements for Sasol Synfuels.

Progress on advancing air quality improvement roadmaps during the past year

The stakeholder engagement process on Sasol's applications in Secunda was initiated in September 2013, some 15 months ago. As discussed in Section 7.5, over this period, and independently to the postponement application process, work on implementing the air quality improvements outlined in Chapter 7 and the associated technical appendix to this application has been ongoing, aligned with Sasol's project development and governance process. A high level overview is provided on the progress achieved in these 15 months.

- Capital applications were advanced, in accordance with Sasol's project development and governance processes, for the implementation of continuous emissions monitoring at steam plants and incinerators;
- Construction of the first two of seven regenerative thermal oxidiser units of the Tar Value Chain phase 1 project has concluded, and these are presently in the process of being commissioned;
- Idea generation activities have advanced on the Tar Value Chain Phase 2 project;
- Further sampling was done to confirm the influence of the improved efficiency drip trays on VOC abatement at the Rectisol plant;
- Further sampling and analyses were done, and improved opacity meters were installed, to improve definition of the particulate matter emissions at the boilers.

- The project to renew and improve electrostatic precipitator internals has progressed in line with the boiler renewal programme;
- Initiatives to improve stability and reduce downtime at the Wet Sulphuric Acid plant have been ongoing, to sustain reduced H_2S emissions at the Eastern factory;
- A sample point has been designed and funds approved for the CO_2 test run at Phenosolvan, which will commence in January 2015;
- Dynamic modelling of floating disc technology has been done, to further confirm the VOC reduction efficiencies obtained from physical measurements on two storage tanks;
- Following the successful conclusion of a pilot study on composting of waste sludges, primarily biosludge, internal approval was obtained to take this project to scale, subject to the necessary environmental authorisations being obtained. If successfully implemented, this project is anticipated to reduce incineration load (and consequent emissions) and further reduce other wastes to landfill. Both of these reductions are aligned with the intent of the relevant environmental legislation;
- PM_{10} and $PM_{2.5}$ analysers have been ordered, for installation at Sasol's Bosjesspruit ambient monitoring station, which is expected to come online during the first half of 2015.
- In line with Sasol's commitment to implementing offsets within an appropriate regulatory regime, Sasol's pilot offset study was advanced, and detailed analysis of results are under way, to better understand the potential of offsets as a sustainable indoor and ambient air quality improvement intervention, to inform Sasol's inputs to air quality offset policy development

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Glossary

Definitions of terms as per GN 893, that have relevance to this application:

Existing Plant - any plant or process that was legally authorized to operate before 1 April 2010 or any plant where an application for authorisation in terms of the National Environmental Management Act 1998 (Act No.107 of 1998), was made before 1 April 2010.

Fugitive emissions - emissions to the air from a facility, other than those emitted from a point source.

New Plant - any plant or process where the application for authorisation in terms of the National Environmental Management Act 1998 (Act No.107 of 1998), was made on or after 1 April 2010.

Point source - a single identifiable source and fixed location of atmospheric emission, and includes smoke stacks.

Point of compliance – means any point within the off gas line, where a sample can be taken, from the last vessel closest to the point source of an individual listed activity to the open-end of the point source or in the case of a combination of listed activities sharing a common point source, any point from the last vessel closest to the point source up to the point within the point source prior to the combination/interference from another Listed Activity.

Definitions of terms as per the NEM:AQA that have relevance to this application:

Priority area - means an area declared as such in terms of Section 18.

Priority area air quality management plan - means a plan referred to in Section 19.

Additional terms provided for the purpose of clarity in this application:

Additional postponement applications – Sasol submitted draft applications for exemption in terms of Section 59 of NEM:AQA from certain MES, along with draft applications for postponement from certain MES. These exemptions were motivated on the basis that the applicable standards were infeasible based on, amongst others, technology, brownfields, environmental and economic constraints. Since the conclusion of the stakeholder engagement process, Sasol has been directed to rather seek postponement from the compliance timeframes in the MES to address its challenges. Consequently the exemption application will instead be submitted as a postponement application, in addition to its existing postponement applications which have already been submitted to the National Air Quality Officer. Natref now therefore makes application for postponement in respect of those applications which were previously submitted, advertised and made available for public comment, as exemption applications. These are referred to herein as *additional postponement applications*.

Alternative emissions limits – the standard proposed by Sasol based on what is considered reasonable and achievable as a consequence of the assessments conducted and which Sasol proposes as an alternative standard to be incorporated as a licence condition with which it must comply during the period of postponement. The alternative emission limits are specified as *ceiling emissions limits* or *maximum emission concentrations*, as defined in this Glossary. In all instances, these alternative emission limits seek either to maintain emission levels under normal operating conditions as per current plant operations, or to reduce current emission levels, but to some limit which is not identical to the promulgated minimum emissions standards. Specifically, these alternative emissions limits do not propose an increase in current average baseline emissions.

Atmospheric Impact Report - in terms of the Minimum Emission Standards an application for postponement must be accompanied by an Atmospheric Impact Report as per Section 30 of the NEM:AQA. Regulations Prescribing the Format of the Atmospheric Impact Report (AIR) were published in Government Notice 747 of 2013).

Ambient standard - The maximum tolerable concentration of any outdoor air pollutant as set out in the National Ambient Air Quality Standards in terms of Section 9(1) of the NEM:AQA.

Ceiling emissions limit – Synonymous with "maximum emission concentrations". The administrative basis of the Minimum Emissions Standards is to require compliance with the prescribed emission limits specified for existing plant standards and new plant standards under all operational conditions, except shut down, start up and upset conditions, based on daily average concentrations as defined in Part 2 of the MES. Whereas average emission values reflect the arithmetic mean value of emissions measurements for a given process under all operational conditions over a 3 year period, the ceiling emission would be the highest daily average emission concentration obtained. Hence, ceiling emission values would be higher than average emission values, and the difference between ceiling and average values being dependent on the range of emission levels seen under different operational conditions. Since the Minimum Emissions Standards specify emissions limits as ceiling emissions limits or maximum emission concentrations, Sasol Synfuels has aligned its alternative emissions limits with this format, to indicate what the 100^{th} percentile emissions measurement value would be under any operational condition (excluding shut down, start up and upset conditions). It is reiterated that Sasol Synfuels does not seek to increase emission levels relative to its current emissions baseline through its additional postponement applications and proposed alternative emissions limits (specified as ceiling emission limits), but rather proposes these limits to conform to the administrative basis of the Minimum Emissions Standards.

Criteria pollutants – Section 9 of NEM:AQA provides a mandate for the Minister to identify a national list of pollutants in the ambient environment which present a threat to human health, well-being or the environment, which are referred to in the National Framework for Air Quality Management as "criteria pollutants". In terms of Section 9, the Minister must establish national standards for ambient air quality in respect of these criteria pollutants. Presently, eight criteria pollutants have been identified, including sulphur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), carbon monoxide (CO), lead (Pb), particulate matter (PM_{10}), particulate matter ($PM_{2.5}$) and benzene (C_6H_6). In this document, any pollutant not specified in the National Ambient Air Quality Standards ("NAAQS") is called a "non-criteria pollutant".

Existing plant standards - The emission standards which existing plants are required to meet. Emission parameters are set for various substances which may be emitted, including, for example, particulate matter, nitrogen oxides and sulphur dioxide.

Initial postponement applications – Consequent upon the first round of public participation which took place in September 2013, Sasol's draft applications for postponement in terms of Regulations 11 and 12 of GN 893 were made available for public comment in April 2014. These applications are referred to in this motivation report as *initial postponement applications*, and the final versions have been submitted to the NAQO. Copies of these documents are also available on SRK's website.

Listed activity - In terms of Section 21 of NEM:AQA, the Minister of Environmental Affairs has listed activities that require an atmospheric emissions licence. Listed Activities must comply with prescribed emission standards. The standards are predominantly based on 'point sources', which are single identifiable sources of emissions, with fixed location, including industrial emission stacks.

Maximum emission concentrations – Synonymous with “ceiling emissions limits”. Refer to glossary definition for ceiling emissions limits.

Minimum emissions standards – prescribed maximum emission limits and special arrangements for specified pollutants and listed activities. These standards are published in Part 3 of GN 893.

Minister – the Minister of Environmental Affairs.

New plant standards - The emission standards which existing plants are required to meet, by April 2020, and which new plants have to meet with immediate effect. Emission parameters are set for various substances which may be emitted, including, for example, particulate matter, nitrogen oxides and sulphur dioxide.

Postponement – a postponement of compliance timeframes for existing plant standards and new plant standards and their associated special arrangements, in terms of Regulations 11 and 12 of GN 893. In the context of Sasol’s applications, these postponements are referred to as *initial postponements* and *additional postponements*, as defined in this Glossary.

GN 893 – Government Notice No. 893, 22 November 2013, published in terms of Section 21 of the National Environmental Management: Air Quality Act (Act No 39 of 2004) and entitled ‘*List of Activities which Result in Atmospheric Emissions which have or may have a Significant Detrimental Effect on the Environment, Including Health and Social Conditions, Economic Conditions, Ecological Conditions or Cultural Heritage’*. GN 893 repeals the prior publication in terms of Section 21, namely Government Notice No. 248, 31 March 2010. GN 893 deal with aspects including: the identification of activities which result in atmospheric emissions; establishing minimum emissions standards for listed activities; prescribing compliance timeframes by which minimum emissions standards must be achieved; detailing the requirements for applications for postponement of stipulated compliance timeframes.

Sasol Synfuels – the entity now known as Sasol Chemical Industries (Pty) Limited operating through its Secunda Synfuels Operations, formerly known as Sasol Synfuels (Pty) Limited. To avoid unnecessary confusion, the name “Sasol Synfuels” has been retained in this report.

Special arrangements –specific compliance requirements associated with a listed activity’s prescribed emissions limits in Part 3 of GN 893. These include, among others, reference conditions applicable to the listed activity prescribed emission limits, abatement technology prescriptions and transitional arrangements.

List of Abbreviations

AEL – Atmospheric Emissions Licence

AIR - Atmospheric Impact Report

AQMP – Air Quality Management Plan

BAT - Best Available Technique

BID - Background Information Document

CBOs - Community Based Organisations

CO – Carbon Monoxide

CTL – Coal-to-liquid

CRRs - Comment and Response Reports

ESP – Electrostatic Precipitator

FGD – Flue Gas Desulphurisation

FT – Fischer-Tropsch

GHG – Green House Gas

GO – General Overhaul

HOW – High Organic Waste

HPA – Highveld Priority Area

HCl – Hydrogen Chloride

H_2S – Hydrogen Sulphide

I&APs - Interested and Affected Parties

LOC - Logistics Operations Centre

MES - Minimum Emission Standards

NAQO - National Air Quality Officer

NAQF – National Framework for Air Quality Management

NAAQS - National Ambient Air Quality Standards

NEMA - National Environmental Management Act (Act No. 107 of 1998)

NEM:AQA - National Environmental Management: Air Quality Act (Act No. 39 of 2004)

NGOs – Non-Government Organisations

NH_3 - Ammonia

NO_2 – Nitrogen Dioxide

NOx – Oxides of Nitrogen

PM – Particulate Matter

$PM_{2.5}$ - Particulate Matter with radius of less than 2.5 μm

PM_{10} - Particulate Matter with radius of less than 10 μm

ppb – parts per billion

SAS - Sasol Advanced Synthesis™

SCI - Sasol Chemical Industries (Pty) Limited

SCR - Selective Catalytic Reduction

SO_2 - Sulphur Dioxide

t/h – tons per hour

TOC – Total Organic Compounds

VOC – Volatile Organic Compound; equivalent to TVOC (Total Volatile Organic Compounds)

WHO – World Health Organisation

WSA – Wet Sulphuric Acid

US EPA - United State Environmental Protection Agency

1 Introduction

Sasol is an international integrated energy and chemical company that employs more than 34 000 people working in 37 countries. In South Africa, Sasol owns and operates facilities at Secunda in the Mpumalanga Province, Sasolburg in the Free State Province and Ekandustria in Gauteng.

The Secunda complex is made up of:

- Sasol Chemical Industries (Proprietary) Limited, operating through its Secunda Synfuels Operations (formerly Sasol Synfuels (Proprietary) Limited) and through its Secunda Chemicals Operations, including those operating divisions known as Sasol Polymers, Sasol Solvents, Sasol Nitro and the Logistics Operations Centre ("LOC").
- Sasol Oil (Proprietary) Limited, which markets fuels blended at Secunda (as well as those produced at Natref in Sasolburg).
- Sasol Mining (Proprietary) Limited, which mines the gasification feedstock and utilities coal used at the Secunda complex.

Sasol is currently undergoing corporate restructuring which involves consolidating the majority of its operations into a single business, namely, Sasol Chemical Industries (Pty) Limited ("SCI"). However, in order to avoid unnecessary confusion, references to these entities have been kept in this report as previously described. This additional postponement application relates only to the operating entity known as Sasol Chemical Industries (Proprietary) Limited, operating through its Secunda Synfuels Operations (formerly Sasol Synfuels (Proprietary) Limited) and which will therefore be referred to as "Sasol Synfuels" in this application.

In 2010, the Department of Environmental Affairs (DEA) published Minimum Emissions Standards (MES), in terms of the National Environmental Management: Air Quality Act (Act No. 39 of 2004) (NEM:AQA). In November 2013, the Regulations within which the MES were contained, were repealed and replaced by GN893, and this application is therefore aligned with the 2013 MES. The MES serves to define maximum allowable emissions to atmosphere for a defined range of pollutants and specific activities that can generate such emissions. In terms of GN 893, existing production facilities are required to comply with MES prescribed for existing plants by 1 April 2015 ("existing plant standards") unless otherwise specified, as well as with MES applicable to new plants by 1 April 2020 ("new plant standards") unless otherwise specified.

The MES apply to many of Sasol's activities including those of Sasol Synfuels at the Secunda complex.

It is Sasol's intention to comply with the DEA's objective to improve air quality in South Africa. For various reasons that are more fully detailed in this report, however, Sasol Synfuels will not be able to comply with the MES for certain emissions from its Secunda operation either within the MES timeframes or for the foreseeable future. Sasol Synfuels is therefore applying for additional postponements for certain emission sources. As part of this application, Sasol Synfuels specifically proposes compliance to alternative emissions limits and alternative special arrangements for the duration of the postponement.

The present application is made in terms of Regulation 11 of GN 893 which entitles a person to apply in writing to the National Air Quality Officer for a postponement from the compliance timeframes set out in Regulations 9 and 10.

As required by Regulation 12, this application therefore includes:

- This motivation report outlining detailed reasons and a justification for the additional postponement application, supplemented with a technical appendix outlining the technologies and constraints considered by Sasol.
- An independently compiled Atmospheric Impact Report (AIR) compiled in accordance with the Atmospheric Impact Report Regulations of October 2013, along with a further independent peer review report on the modelling methodology employed in the AIR.
- A Stakeholder Engagement Report outlining the public participation process that is being conducted in accordance with the NEMA: Environmental Impact Assessment Regulations. This includes a detailed overview of comments received thus far from Interested and Affected Parties, along with Sasol's responses.

This motivation report is accordingly structured to present more detailed information on Sasol Synfuels and associated activities at the Secunda complex. Thereafter, the MES are presented in general, together with the specific requirements for activities at Secunda before the reasons motivating the request for additional postponement are presented. In order to demonstrate the implications of the application on ambient air quality the key findings of the stand-alone AIR are then presented, before presenting a summary of the public participation process that has been conducted in support of this application. A technical appendix providing further details on the specifics of each additional postponement request is a further accompanying document to this motivation report.

2 Sasol Synfuels

2.1 Overview

Sasol was established in 1950 and started producing synthetic fuels and chemicals in 1955, from the world's first commercial coal-to-liquids (CTL) complex in Sasolburg. The company privatised in 1979 and listed on the JSE Ltd in the same year. In the late 1970s and early 1980s, Sasol constructed two additional CTL plants at Secunda. The two plants, which are referred to as the East and West facilities, are for the most part, mirror images of one another, and each has some 75,000 barrels per day capacity of refinery equivalent products. Sasol's activities in South Africa are at once both diverse and yet highly interdependent with main activities at facilities located in Secunda, Mpumalanga and Sasolburg, Free State.

Sasol is well known both locally and internationally for its core activity of converting coal to liquid fuels (known as coal-to-liquids or 'CTL'). What is perhaps less well known is the range of other activities that are built on and around that core CTL process. These various activities serve to maximise the range of products and associated value that can be derived from the basic raw materials that are used in the Sasol process, as well as the provision of so-called utilities (most notably steam) that are critical inputs to the industrial process. Sasol describes its business as one of 'integrated value chains'. By integrated value chains is meant a high degree of integration between all the process units whereby the maximum utility (and thus commercial value) can be derived from the basic material inputs of coal, water and air, while also minimising emissions. In this section the Sasol integrated value chain concept is presented in order to gain an understanding of the Sasol Synfuels operation.

2.2 The basic building blocks

The best way of understanding Sasol's activities is by considering them at atomic and molecular level. These activities are fundamentally based on carbon and hydrogen and the creation of hydrocarbons for liquid fuel and a vast array of chemical products. Coal is mined and then gasified to liberate the carbon in the form of carbon monoxide. However, because coal is low in hydrogen content, an additional source of hydrogen is required and that is derived from water. The gasification process thus results in a raw gas stream of carbon monoxide and hydrogen, which is later combined to form hydrocarbon chains in the Fischer–Tropsch (FT) process. The hydrocarbon chains are then used principally in the manufacturing of liquid fuels.

A key requirement for the CTL process is stripping out a range of unwanted components from the incoming raw gas stream. The incoming coal for example, contains ash and sulphur, which needs to be separated out from the raw gas stream. During the gasification process, tars and other components are formed which also have to be removed from the raw gas. Instead of treating these components as waste, Sasol's industrial process converts these components to other chemical products, which have commercial value. In a similar vein, the incoming coal stream is a mixture of coarse coal and fine coal, where the gasification process can only operate with coarse coal. The fine coal is used to generate steam, which is a key utility required throughout the entire industrial process. If the fine coal was not used in the process, it would have to be discarded.

Importantly, the concept of integration is not just one of multiple product streams all of which are derived from the basic raw gas, but also one of positioning the various components of the industrial process in such a way as to derive the maximum utility from the incoming raw materials. Perhaps the best example is the very close proximity of all the processing units to the source of the steam so that steam is delivered at the required temperature and pressure to the various processing units. The further the steam is transported the greater the energy loss, and so the design of the plant serves to minimise the distances over which the steam needs to be transported.

Finally, the CTL process has been designed to deal with some unusual challenges that are a function of the environment in which the plant operates. Firstly, the plant is located some 1,600 m above sea level, with an associated equipment efficiency loss compared to sea level plants. The air is far less dense than at the coast, which means that dry cooling is less effective. In addition the coal available to Sasol is of poor quality and has a high ash content of some 30-34%, however is fortunately of a low sulphur content. Such coal could not be exported economically and so must be used in relatively close proximity to where it is sourced. Finally, the plant operates in a water-stressed environment.

2.3 The Secunda Complex

The town of Secunda is located in Govan Mbeki Local Municipality, which is part of the Gert Sibande District Municipality in Mpumalanga Province. The Sasol Secunda industrial complex lies to the South-Southwest of the town, with the associated coal mining activities occurring in various directions from the town (Figure 1). Sasol Synfuels is the world's only commercial coal and gas based synthetic fuels manufacturing facility, producing synthetic gas (syngas) primarily from low-grade coal, with a much smaller portion of feedstock being natural gas. The process uses advanced high temperature FT technology to convert syngas into a range of synthetic fuel components, heating fuels (including industrial pipeline gas), ammonia, sulphur and chemical feedstock for downstream chemical production facilities within the Secunda complex and Sasol's facilities in Sasolburg.

2.4 Products and activities

Sasol Synfuels produces synthetic fuel components, along with a range of intermediate streams that serve as chemical feedstocks for the production of products including ethylene, propylene, detergent alcohols, phenols, alcohols and ketones. Importantly, in addition to producing key components to manufacture saleable products, Sasol Synfuels is self-sufficient in producing the oxygen and steam required for the production process and generating some 40% to 45% of the complex's total electricity demand. Sasol Synfuels operates one of the world's largest oxygen production facilities, currently consisting of 16 trains.

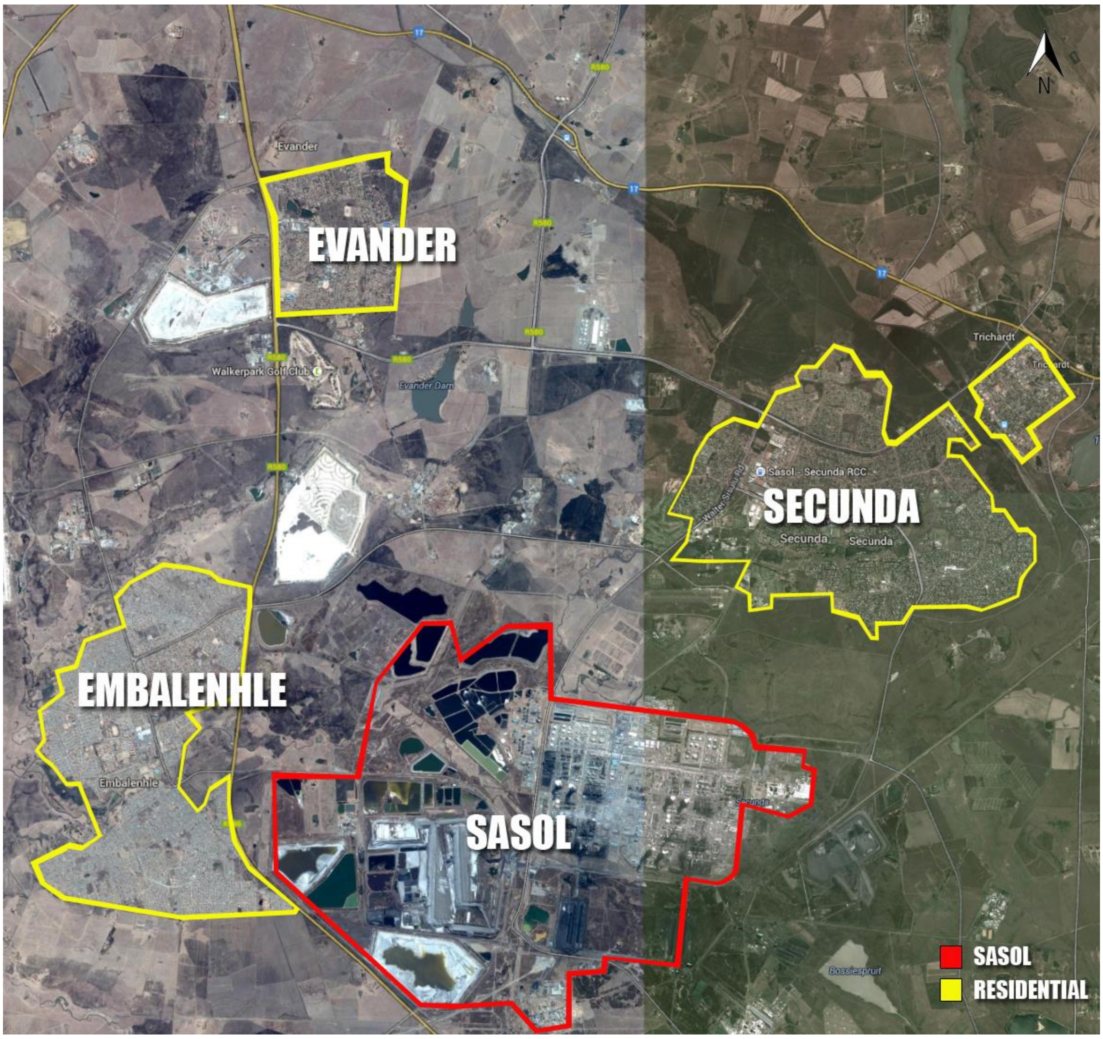


Figure 1: Map showing the position of Sasol's Secunda complex, in which Sasol Synfuels operate

2.5 Atmospheric emissions

Sasol Synfuels operations generate a range of atmospheric emissions. The emissions are presented below as a function of the activities and facilities where they are emitted. These sources include the steam plants, the sulphur removal process (including the Rectisol process unit, sulphur recovery and the Wet Sulphuric Acid plant), incinerators and others. These sources are described in the following section and illustrated schematically in Figure 2.

What follows below is a summary of the processes which are the subject of Sasol's applications.

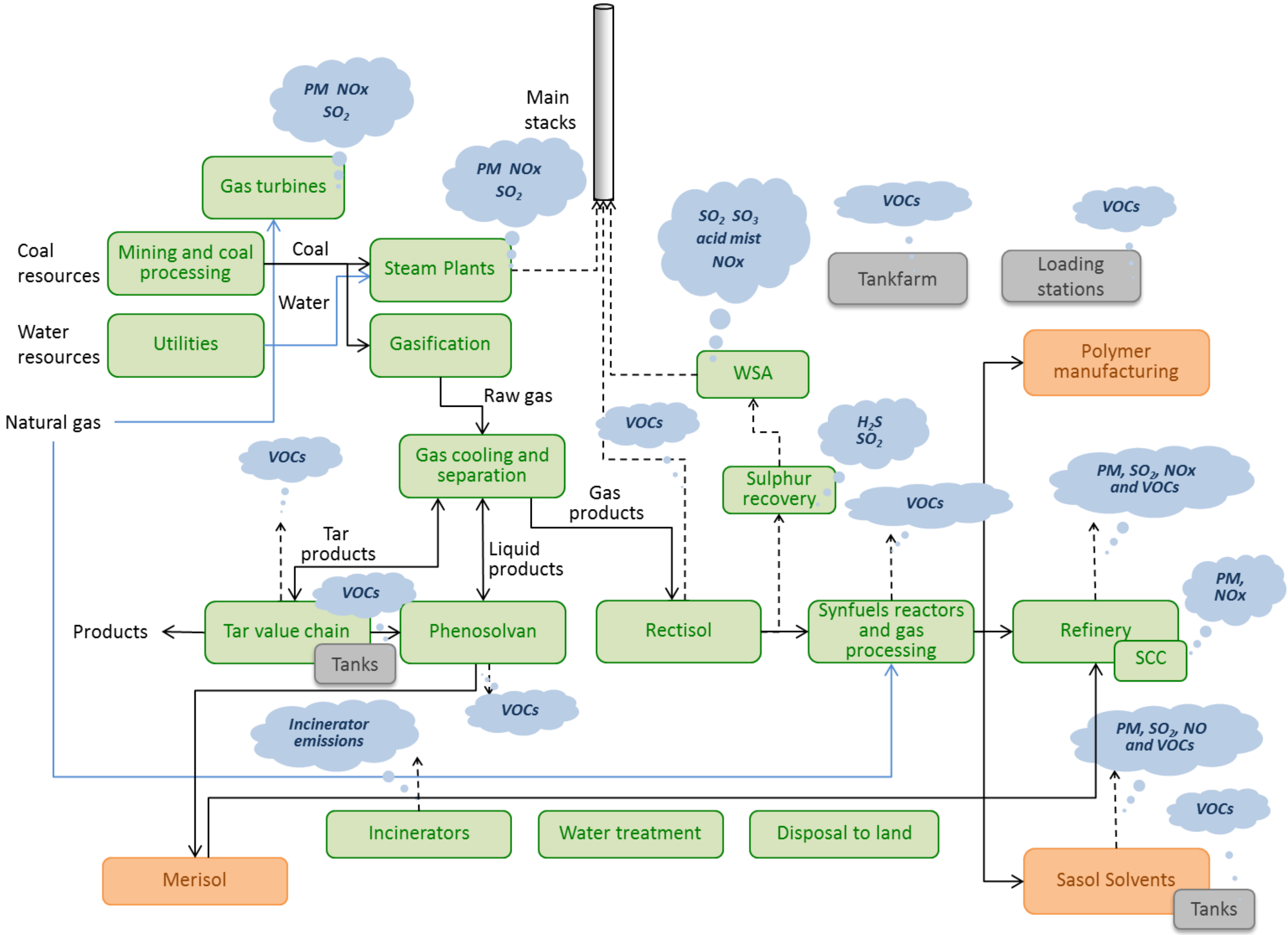


Figure 2: Schematised illustration of the industrial process at Sasol Synfuels, highlighting sources of atmospheric emissions

*Note that this represents the East factory, since the West factory is largely identical, but does not, for instance, have a WSA plant

2.5.1 Steam Plants

Steam is a critical industrial process requirement across the Synfuels operation. Process steam must be available at the right quality, in terms of temperature and pressure, and in the right quantity at all processes where steam is required, at all times. To meet these exacting steam requirements a large fleet of small boilers was built rather than a small fleet of large boilers. The fleet of boilers allows both planned and unplanned disruptions to steam generation to be managed without compromising the supply of steam to users across the complex.

The Sasol Synfuels East and West operations have a fleet of 17 pulverised coal fired boilers, each with a maximum production capacity of 540 tons per hour (t/h) of 40 bar superheated steam. The superheated steam is fed into common steam headers from where it is routed to the various users. The layout of the entire facility is based on minimising the distance over which the steam has to be moved with the largest steam users placed closest to the steam plants, to minimise the loss of heat from the system. In addition to process demands, steam is supplied to generate ‘critical power’ which is needed in the event of a loss of power from the national grid. That critical power allows for safe plant shutdown without damage to the plant. Excess steam is used to generate additional electricity, which offsets some of the facility’s electricity demand from the national grid.

All boiler work, including maintenance and upgrades, are driven by a strictly applied general overhaul (GO) schedule, to assure that process steam supply is not interrupted. Not only is the GO schedule coordinated internally within the Secunda complex, but also with other fuel refineries to avoid inland fuel shortages, and the national electricity supplier to avoid possible regional power shortages. The GO schedule is also aligned with other statutory inspections prescribed for pressure vessels. The net effect of the GO schedule is to ensure that boilers are shut down individually in a routine, sequential manner. A single cycle of boiler shutdowns through the entire fleet of 17 boilers takes several years.

In addition the steam plants are integrated with the Rectisol and sulphur recovery plants. Two tall stacks (301 m on the East factory and 250 m on the West factory) serve to co-disperse emissions from the steam plant and the sulphur recovery plant. The high boiler outlet temperatures from the steam plants provide essential buoyancy to the much cooler off-gas stream from the sulphur recovery plant, significantly improving atmospheric dispersion of these emissions. That requirement for high boiler emission temperatures constrains boiler operations, such as constraining further improvements in boiler efficiencies through further heat recovery. Atmospheric emissions from the boilers include the greenhouse gas carbon dioxide (CO_2), as well as SO_2, NO_x and PM.

2.5.2 The sulphur removal process

The first step in the CTL process involves a series of chemical reactions, collectively known as “gasification”, which converts solid coal, water (in the form of steam) and oxygen into a raw (or unpurified) synthesis gas (syngas), comprising mainly carbon monoxide (CO) and hydrogen (H_2). The syngas is then transformed into various hydrocarbon streams in the patented Sasol Advanced Synthesis™ (SAS) reactor, which is based on the Fischer-Tropsch process. The hydrocarbon chains are precursors for a wide array of liquid fuel and chemical product components.

Iron oxide catalyst assists the chemical conversions that take place in the SAS™ reactors, and these catalysts only work effectively in the presence of a highly purified syngas stream. Contaminants in the gas stream such as sulphur (in the form of hydrogen sulphide, H_2S) ‘poison’ the catalyst and thereby reduce the efficacy of the chemical transformation. A sulphur removal process is therefore essential to purify the syngas stream prior to the SAS™ reactors, to remove both sulphur and other reaction contaminants. The necessity to exclude all sulphur from the gas stream prior to the SAS™ reactors means that Sasol Synfuels produces low sulphur fuels.

Three key process units are involved in the sulphur removal process, as described below.

The Rectisol plants

The process of removing impurities from the raw gas stream begins at the Rectisol plants where hydrogen sulphide (H_2S) and traces of Volatile Organic Compounds (VOCs) are removed. At Rectisol, the raw gas is first cooled and then sent to an absorption column where VOCs are absorbed using methanol, where after most of the CO_2 and almost all H_2S is removed in the higher sections of the column. After the Rectisol process, the cleaned syngas (pure syngas) is sent to the SAS™ reactors.

From the Rectisol plant's absorption column, the methanol stream containing the impurities is sent to the methanol regeneration section where the methanol is flashed at near-atmospheric pressure and impurities released into an "off-gas" stream. The off-gas stream arising from the Rectisol process (primarily carbon dioxide, with a smaller portion of H_2S and also containing trace quantities of VOCs) is routed to the main stack via the Sulphur Recovery Plant, where most of the H_2S is removed prior to the off-gas being emitted to atmosphere.

The Sulphur Recovery Plant

When Sasol's facilities in Sasolburg and Secunda were first constructed, there was no proven technology to extract any of the compounds from the "off-gas" that was separated from the raw syngas. As a result the off-gas was routed directly to the stack and emitted directly to atmosphere. The effect of this was to create odour episodes as far afield as Johannesburg and Pretoria because H_2S has a "rotten eggs" smell.

For more than a decade, Sasol scientists collaborated with international technology suppliers to find a way of removing sulphur from the off-gas stream. After extensive research and development, the Sulfolin process was developed, and sulphur recovery plants based on that process were built on the Synfuels East and West factories. The sulphur recovery plants, excluding the impact of the Wet Sulphuric Acid plant, now remove some 75% of the H_2S that was previously emitted to atmosphere. As importantly, the recovered sulphur is turned into a high purity (up to 99%), saleable product through a filtering and granulation process. The remaining H_2S in the off-gas stream is emitted from one of two main stacks in combination with emissions from the steam plant boilers as described in Section 2.5.1. As previously described the heat from the steam plant boilers enhances the buoyancy of all emissions, especially the cooler H_2S, resulting in improved dispersion in the atmosphere.

The Wet Sulphuric Acid Plant

Sasol took a significant further step to reduce its H_2S emissions, when the Wet Sulphuric Acid (WSA) plant was commissioned in 2010 with the intent to further reduce H_2S emissions from the Sasol Secunda complex by 2 tons/hour as one of Sasol's commitments to the Highveld Priority Area Air Quality Management Plan. Certain H_2S-containing streams from the Rectisol process were diverted from the East Factory's Sulphur Recovery plant to the WSA plant where H_2S is converted to sulphuric acid. The plant was designed to achieve a 99% conversion efficiency of H_2S from these streams into product, with the remaining 1% of H_2S emissions being converted to SO_2.

In order to mitigate the emissions from the WSA plant itself, the following emission abatement controls were included in the design of the plant, representing best available techniques (BAT) at the time:

- A wet scrubber to control SO_2 and acid mist emissions.
- A wet electrostatic precipitator (ESP) to further reduce acid mist emissions.
- Selective Catalytic Reduction (SCR) to limit NOx emissions.

Theoretically the WSA technology, which is a proven technology in other applications worldwide, would increase the sulphur recovery rate on the Eastern factory from 75% to 85%, thereby reducing H_2S emissions (and trace VOC emissions) to atmosphere. However, the technology had never been applied in the unique Sasol Synfuels CTL process. Extensive engineering work was conducted subsequent to the plant's commissioning to stabilise and optimise the plant's operations in line with its design intent. Unfortunately, the plant continues to experience operational challenges, and work is ongoing to improve performance to reach this design intent.

2.5.3 Incinerators

The High Organic Waste incinerators

The purpose of the two High Organic Waste (HOW) incinerators is to treat nitrogen-rich effluent streams from the Sasol Synfuels Phenosolvan (Ammonia and phenols recovery) and Sasol Solvents (Carbonyl recovery) facilities. At the water recovery plant where the HOW incinerators are situated, the combined waste streams are combusted in the presence of fuel gas and air. Emissions from the HOW incinerators include PM, SO_2, NOx, CO, hydrogen chloride (HCl), Total Organic Compounds (TOCs), dioxins and furans, metals, mercury (Hg), cadmium plus thallium (Cd + Tl), hydrogen fluoride (HF) and ammonia (NH_3). While some of these emissions are high in concentration, the streams are low in volume. Exit gas temperatures of the HOW incinerators exceed 200°C.

The Biosludge incinerators

Process effluent streams including Reaction Water and Stripped Gas Liquor, along with plant runoff and storm water streams, are treated in an aerobic activated sludge wastewater treatment process which generates excess activated sludge (biosludge) requiring disposal. This excess activated biosludge, together with a smaller stream of neighbouring Secunda's domestic sewage sludge which Sasol treats on behalf of the municipality, is thickened. This de-watered sludge has a solids concentration of ~12%, which is the upper limit of what can be achieved through mechanical de-watering. The centrifuged sludge is then pumped to four Lurgi multiple-hearth incinerators for incineration. Emissions from the biosludge incinerators include PM, SO_2, NOx, CO, HCl, TOCs, dioxins and furans, metals, mercury (Hg), cadmium plus thallium (Cd + Tl), hydrogen fluoride (HF) and ammonia (NH_3). While some of these emissions are high in concentration, the streams are low in volume.

3 The Minimum Emissions Standards

3.1 Overview

NEM:AQA is a specific environmental management act as contemplated in the NEMA, and aims to give effect to the Constitutional right to an "environment that is not harmful to health or wellbeing 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". In this context, therefore, Sasol makes these applications.

The Regulations identifying listed activities and prescribing MES for those activities were made in terms of Section 21 of the NEM:AQA, and promulgated in Government Notice No. 893 on 22 November 2013 (GN 893). Amongst others, Part 3 of the Regulations includes MES, which oblige existing production facilities to comply with certain emission limits and associated special arrangements by 1 April 2015 ("existing plant standards") unless otherwise specified, as well as with certain emission limits and associated special arrangements applicable to new plants by 1 April 2020 ("new plant standards") unless otherwise specified. GN 893 includes amongst others, the identification of activities which result in atmospheric emissions; establishing MES for the listed activities; prescribing compliance timeframes by which MES must be achieved; and detailing the requirements for applications for postponement of stipulated compliance timeframes.

The 2013 Regulations of GN 893 repealed and replaced the Regulations that had been published in March 2010 under Government Notice No. 248. GN 893 contains substantial amendments to the previous MES, including changes to the listed activities and their associated special arrangements, additional activities subject to Regulation and changes to some of the prescribed emission limits. Notwithstanding the amendments, the compliance timeframes prescribed in the 2010 Regulations remain unchanged. The net effect of GN 893 was to alter compliance requirements with less than two years in which to comply.

3.2 The MES applicable to Sasol Synfuels

Due to the diversity and integrated nature of the Sasol Synfuels operations, there are a number of different MES listed activity categories that apply to the Secunda activities. The applicable MES are summarised in Table 1 together with an indication of whether or not Sasol will comply with the prescribed limits and associated special arrangements contained in the MES and its associated compliance timeframes. Green colour coding reflects compliance with the MES, red reflects applications for additional postponements as detailed in this motivation report, and orange reflects applications for initial postponements (detailed in a separate motivation report). Blue colour coding reflects the 2020 standards for which compliance is challenging, based on the assessment of presently available technologies. Sasol Synfuels is applying here for additional postponements, but has also made a parallel application for postponement of the compliance timeframes for other MES (the initial postponement applications), where compliance will be attained in the short- to medium term. In the interests of enabling an understanding of the full implications of Sasol Synfuels's applications, both the initial and additional postponement requests are indicated in Table 1, together with the MES with which Sasol Synfuels will comply within the prescribed compliance timeframes.

Table 1: Summary of Sasol Synfuels' compliance with the MES (note that this is a summarised version of the MES)

MES Category	Substance(s)	Emission limits or special arrangements*		Applicable Sasol Synfuels Activities
		New plant standards	Existing plant standards	
Category 1: Sub-category 1.1	Particulate matter	50	100	Steam plant
	Sulphur dioxide	500	3500	
	Oxides of nitrogen	750	1100	
Category 1: Sub-category 1.4	Particulate matter	10	10	Gas turbines
	Sulphur dioxide	400	500	
	Oxides of nitrogen	50	300	
Category 2: Sub-category 2.2	Particulate matter	100	120	Superflex Catalytic Cracker ™
	Sulphur dioxide	400	550	
	Oxides of nitrogen	1 500	3 000	
Category 2: Sub-category 2.4	Total Volatile Organic Compounds	Type 3 storage vessels shall be of the following type: a) External floating-roof tank with primary rim seal and secondary rim seal for tank with a diameter greater than 20m, or b) fixed-roof tank with internal floating deck/roof fitted with primary seal, or c) Fixed roof tank with vapour recovery system		Storage tanks at Tankfarm
	Total Volatile Organic Compounds	Type 1, 2 and 4 tanks comply Some type 3 storage tanks comply		Storage tanks at Tankfarm
	Total Volatile Organic Compounds	All installations with a throughput of greater than 50,000m^3 per annum of products with a vapour pressure greater than 14 kPa, must be fitted with vapour recovery or vapour destruction units. Emission limits for vapour recovery/destruction using non-thermal treatment: Existing plant standard: 40 000 New plant standard: 40 000		Loading stations
Category 3: Sub-category 3.6	Hydrogen sulphide	3 500	4 200	Rectisol and Sulphur Recovery Plants
	Total Volatile Organic Compounds	130	250	
	Sulphur dioxide	500	3 500	
Category 3: Sub-category 3.6	Hydrogen sulphide	3 500	4 200	Phenosolvan
	Total Volatile Organic Compounds	130	250	
	Sulphur dioxide	500	3 500	
Category 3: Sub-category 3.3 Sub-category 3.6	Hydrogen sulphide	3 500	4 200	Sources in Tar Value Chain – Phase 1
	Total Volatile Organic Compounds	130	250	
	Sulphur dioxide	500	3 500	
Category 3: Sub-category 3.3	Total Volatile Organic Compounds	Type 3 storage vessels shall be of the following type: a) External floating-roof tank with primary rim seal and secondary rim seal for tank with a diameter greater than 20m, or b) fixed-roof tank with internal floating deck/roof fitted with primary seal, or c) Fixed roof tank with vapour recovery system		Sources in Tar Value Chain – Phase 2
Category 6	Total volatile organic compounds	Type 3 storage vessels shall be of the following type: a) External floating-roof tank with primary rim seal and secondary rim seal for tank with a diameter greater than 20m, or b) fixed-roof tank with internal floating deck/roof fitted with primary seal, or c) Fixed roof tank with vapour recovery system		Storage tanks (Sasol Solvents)
Category 7: Sub-category 7.2	Total Fluoride	5	30	Wet Sulphuric Acid Plant
	Hydrogen chloride (primary)	15	25	
	Hydrogen chloride (secondary)	30	100	

MES Category	Substance(s)	Emission limits or special arrangements*		Applicable Sasol Synfuels Activities
		New plant standards	Existing plant standards	
	Sulphur dioxide	350	2800	
	Sulphur trioxide	25	100	
	Oxides of Nitrogen	350	2000	
Category 8: Sub-category 8.1	Particulate matter	10	25	HOW incinerators
	Carbon Monoxide	50	75	
	Sulphur dioxide	50	50	
	Oxides of nitrogen	200	200	
	Hydrogen chloride	10	10	
	Hydrogen fluoride	1	1	
	Sum of Lead, arsenic, antimony, chromium, cobalt, copper, manganese, nickel, vanadium	0.5	0.5	
	Mercury	0.05	0.05	
	Cadmium + Thallium	0.05	0.05	
	Total Organic Compounds	10	10	
	Ammonia	10	10	
	Dioxins and furans	0.1	0.1	
	n/a	Exit gas temperatures must be maintained below 200ºC		
Category 8: Sub-category 8.1	Particulate matter	10	25	Biosludge Incinerators
	Carbon Monoxide	50	75	
	Sulphur dioxide	50	50	
	Oxides of nitrogen	200	200	
	Hydrogen chloride	10	10	
	Hydrogen fluoride	1	1	
	Sum of Lead, arsenic, antimony, chromium, cobalt, copper, manganese, nickel, vanadium	0.5	0.5	
	Mercury	0.05	0.05	
	Cadmium + Thallium	0.05	0.05	
	Total Organic Compounds	10	10	
	Ammonia	10	10	
	Dioxins and furans	0.1	0.1	
	n/a	Exit gas temperatures must be maintained below 200ºC		
Category 8: Sub-category 8.1	Particulate matter	10	25	Sewage solids incinerator
	Carbon Monoxide	50	75	
	Sulphur dioxide	50	50	
	Oxides of nitrogen	200	200	
	Hydrogen chloride	10	10	
	Hydrogen fluoride	1	1	

MES Category	Substance(s)	Emission limits or special arrangements*		Applicable Sasol Synfuels Activities
		New plant standards	Existing plant standards	
	Sum of Lead, arsenic, antimony, chromium, cobalt, copper, manganese, nickel, vanadium	0.5	0.5	
	Mercury	0.05	0.05	
	Cadmium + Thallium	0.05	0.05	
	Total Organic Compounds	10	10	
	Ammonia	10	10	
	Dioxins and furans	0.1	0.1	
	n/a	Exit gas temperatures must be maintained below 200ºC		

In the case of emission limits, these are specified as mg/Nm^3 under normal conditions of 273 Kelvin and 101.3 kPa, at respective O_2 reference conditions for each listed activity as specified in the MES; ng $I\text{-}TEQ/Nm^3$ in the case of dioxins and furans

Colour coding:

Blue	2020 standard for which no feasible technology is presently available to attain compliance and for which Sasol continues to seek reasonable measures for longer-term certainty
Red	Additional postponements requested, on compliance timeframes for the prescribed emission limit or special arrangement
Orange	Initial postponements of compliance timeframes for the prescribed emission limit or special arrangement
Green	Will comply with the prescribed emission limit or special arrangement within the prescribed compliance timeframes
White	Compliance status to be determined (refer to accompanying postponement application motivation report for reasons)

4 Reasons for Applying for Additional Postponements

Sasol has conducted extensive assessments on the technical, operational and financial implications of strict compliance with the existing and new plant standards. Based on these assessments, for those point sources where Sasol does not already comply with the MES, Sasol has concluded in one of three different ways:

- There are point sources for which compliance can be achieved at reasonable cost for the air quality benefits achieved; in some instances this can be achieved within the prescribed compliance timeframes and hence Sasol would comply fully with the MES.
- There are point sources for which compliance can be achieved at reasonable cost for the air quality benefits achieved; however, due to lengthy project development timeframes for developing and implementing complex solutions in an existing brownfields facility, Sasol requires postponements on the compliance timeframes in order to implement and successfully commission new equipment. These point sources are the subject of the initial postponement applications.
- There are certain point sources for which strict compliance with the MES is, for a variety of reasons explained below, not reasonable or achievable with presently available technology/ or other solutions. Following direction received after conclusion of the stakeholder engagement process, Sasol now seeks postponement for these point source standards instead of exemptions, and specifically proposes compliance to alternative emissions limits and arrangements for the duration of the postponement period. These point sources are the subject of this motivation report.

Legal compliance is of paramount importance to Sasol, and it is for this reason that Sasol is submitting postponement applications as provided for in law, in line with guidance received, to ensure its compliance in relation to the emission limits incorporated into its atmospheric emissions licences with which it must comply.

In the second scenario described above, Sasol commits to comply with the MES for those point sources over time, and hence it is appropriate to apply for postponement of compliance timeframes, to ensure compliance during the period required for project development and implementation. In some instances, this may take no more than the maximum allowable postponement application period of five years; in other instances, it is already known that in excess of five years of postponement will be required, and therefore multiple postponement applications will be necessary in these instances.

In the third scenario described above and which applies here, Sasol is in a challenging position. A potential approach to responding to these specific, unachievable point source standards would be to apply for multiple or “rolling” postponements to the end of the facility’s life, or until such time as a feasible technology is identified and implemented, whichever arises first. Sasol gave full consideration to this compliance approach and the potential repercussions, and therefore previously applied for exemptions in those cases where compliance is, based on presently available technologies, not feasible. This view was premised on the fact that a postponement by its design inherently offers only short-term relief, even in the face of long-term challenges to compliance for which no appropriate mechanism to provide long-term regulatory certainty is currently available to Sasol.

Sasol has now been advised that its exemption applications will not be considered and that Sasol should instead apply for postponement. For this reason, and in order to ensure Sasol’s compliance with the time 1 April 2015 timeframes, Sasol is now bringing the present additional postponement application. Sasol continues to seek reasonable measures to secure longer-term certainty.

4.1 Overview

The reasons for applying for these additional postponements fall into several categories that are detailed below. Before presenting each of these reasons in more detail, Sasol's overarching approach to environmental management and air quality management in particular, is presented. The reasons that underpin the additional postponement applications should be read in the context of Sasol's environmental management philosophy. These reasons are specific to each listed activity, as described in the technical appendix to this motivation report, but fall into general categories, namely: the integrated nature of Sasol's activities, financial implications, industrial process compatibility, technology limitations, other unintended environmental impacts, and the challenges inherent in modifying a brownfields operation.

4.2 Sasol's environmental management philosophy

Sasol recognises that continuous improvement in environmental management performance is an important business imperative. Introducing capital intensive environmental improvements must be balanced with the focus on socio-economic sustainability of its business. Sasol has a history of proactive environmental performance improvements and in respect of air quality management has significantly reduced atmospheric emissions from its various facilities in line with a risk-based environmental improvement approach, regardless of whether or not such emissions reductions were required by law. For that reason numerous of the emissions from Sasol's various facilities already comply with much of the MES. In addition, and in response to the outcome of the Highveld Priority Area (HPA) assessment and Air Quality Management Plan (AQMP), Sasol Synfuels voluntarily committed to certain emissions reductions for the furtherance of ambient air quality improvements.

Based on an assessment of significant capital expenditure on projects which have resulted in significant environmental improvements over the past ten years, Sasol has spent over R20 billion, averaging at R2 billion annually. The bulk of these improvements have delivered ambient air quality and greenhouse gas emission improvements (refer to Table 2). This expenditure excludes the Clean Fuels 1 programme, implemented in 2006 at a cost of R12 billion, which removed lead from petrol to improve vehicle tailpipe emissions, as well as the Clean Fuels 2 programme, which will further improve vehicle tailpipe emissions, once implemented.

Table 2: Sasol's major capital expenditure over the last 10 years resulting in significant environmental improvements (only incorporating projects over R100m each)

Year	ZAR million	Project with environment related benefit	Environmental improvement in subsequent years
2003	520	Waste Recycling Facility in Secunda	Recycle waste streams and reduce waste dumping.
2004	130	Rehabilitation of Secunda waste disposal site	Improved air and water quality.
2005	12 000	Mozambique Natural Gas conversion project	Significant reductions in Sasolburg of H_2S (100%) Green House Gas (GHG) (39%), SO_2 (42%) and NO_x (37%).
	400	Hydrogen Sulphide reduction in Secunda	Reduced H_2S emissions.
2008	1 000	Wet sulphuric acid plant in Secunda*	H_2S emissions reduced when the plant is operational.
2009	300	Carbon capture and storage in Mongstad	Piloting technology for carbon capture and storage.
	100	Energy efficiency projects in Secunda	Reduced GHG emissions.
2010	2 300	280MW combined cycle gas turbines in Secunda	Reduced GHG emissions.
2011	500	Upgrade boiler 9 in Secunda*	Reduced particulate matter emissions.
	1 900	140MW Gas engines in Sasolburg	Reduced GHG emissions and improved air quality.
2012	2 000	Regenerative thermal oxidisers in Secunda	Reducing VOC emissions such as benzene.

Note: These are publicly quoted figures from previous annual reports or other official Sasol publications. Actual expenditure may have occurred over more than one year, and may have escalated beyond these publicly reported numbers. This excludes the Clean Fuels I and II projects. Numerous smaller projects – such as rehabilitation projects, water treatment plants, conversion from elevated flares to ground flares, and other emission reduction projects each individually to the value of less than R100m per annum – are also excluded.

**Projects also included in Sasol's commitments to the Highveld Priority Area Air Quality Management Plan*

Table 3: Projects included in Sasol Synfuels' Highveld Priority Area Air Quality Management Plan commitments. Note that two of these projects (indicated with *) are included in the list of projects shown in Table 2

Emission component & source	Commitment made	Status update
Fugitive VOCs arising from tar processes and product storage.	Implementation of a leak detection and repair programme to reduce fugitive emissions.	Completed
VOC emissions from fuel loading facilities.	Installation of vapour recovery unit at fuel loading facility.	Completed
Reduction of VOC emissions being vented from forced feed evaporator.	Short term unit de-bottlenecking, bypass of the forced feed evaporator at Coal Tar Filtration.	Completed
VOC emissions from various tanks.	Installation of Evapostops on various tanks on the Synfuels site.	Pilot studies to assess technology effectiveness underway.
Reduction of particulate matter from boilers.	Ammonia pressure and quality control project to reduce particulate matter.	Completed
Hydrogen sulphide emissions from the complex.	Wet Sulphuric Acid plant*.	Implemented but experiencing operational challenges.
Particulate matter (PM) from boilers exceeding normal operating parameters due to air ingress from damaged air heater (boiler 9).	Reduction of particulate matter (PM) from boilers (through air heater replacement and general overhaul of Boiler 9)*.	Completed

Sasol supports reasonable and achievable environmental performance standards being set by government, with the goal of achieving sustainable ambient air quality improvements in the most effective manner. Standards ought to be based on a defendable cost-benefit analysis which identifies and implements the most effective solutions and regulatory tools, as provided for in the regulatory framework. In the context of the MES, Sasol's view is that emissions abatement must target emissions that result in non-compliance with the National Ambient Air Quality Standards (NAAQS), where the costs of the abatement are justified and achieve material improvements in prevailing ambient air quality.

The MES are based on compliance with emission concentrations and not on pollution load. The effect of atmospheric emissions on ambient air quality is a direct function of pollution load and other factors, and only indirectly of emission concentrations. As an example, Sasol's approach to air quality improvement for its incinerators is to explore diversion of portions of the waste streams away from the incinerators, for beneficial use, an approach that is also aligned with the waste hierarchy. This would result in a pollution load reduction, but would not be expected to lower the concentration of pollutants measured in the incinerator emissions.

Finally, but importantly, it is strongly emphasised that Sasol Synfuels does not seek to increase emissions relative to its current emissions baseline through its additional postponement applications. In the way that they have been presented, the MES compel absolute compliance with *ceiling* emission limits, or maximum emission concentrations, rather than *average* emission limits. The MES make provision for exceedance of the limits only for extraordinary events (including shut down, start up and upset conditions), and not for the variability that is inherent in day-to-day operations. These ceiling limits mean that emitters must be capable of complying with the prescribed ceiling limits, or maximum emission concentrations, under all operational circumstances, including normal production variability. To demonstrate its commitment to compliance with sustainable standards, Sasol Synfuels has proposed alternative emissions limits as conditions to be included in its Atmospheric Emission Licences, which it commits to comply with, for the period of the postponement. The alternative emissions limits that Sasol Synfuels is proposing are thus not to increase emissions in any way but to simply reflect the new administrative conditions applied in the MES, i.e. are expressed as maximum emission concentrations, to accommodate normal production variability. Without exception, for the emission sources seeking additional postponements, Sasol Synfuels's average baseline emissions will not increase, and in some cases pollution load will be reduced to sustainably improved levels.

4.3 Integrated nature of Sasol's activities

The Secunda industrial complex is one of two commercial-scale CTL plants in the world. It is a complicated and unique industrial process with high levels of integration between processes, leading to a large array of diverse petrochemical and chemical products. As previously described the process integration serves to maximise the utility derived from the basic raw materials and this occurs broadly in two key ways. The first of these is to view what would otherwise be waste products as having potentially commercial value and to develop processes and markets to realise that commercial value. The second is to maximise the use of the energy in the raw materials feedstock.

There are many examples of where such 'wastes' have been turned into commercial products. The development of the sulphur recovery process previously described, saw a process being developed to reduce H_2S emissions by some 75% (prior to the additional of a Wet Sulphuric Acid plant), with the sulphur being captured and sold on to customers. The best example of maximising the use of the energy sourced from the raw materials, is the use of fine coal (which would otherwise need to be discarded) as a fuel for the steam plants, and the deliberate design of the plant layout in such a way as to ensure the shortest possible distance for the steam to travel to process users, to reduce the energy loss from the system.

The integration of Sasol's fuel and chemical value chains occurs not only within the Secunda complex, but also between the Secunda complex, Sasol's Sasolburg complex and even with the Natref refinery in Sasolburg. Within the Sasol Synfuels process those linkages are critical and extensive, which means that decisions to retrofit or modify components of the process have to consider all possible upstream and downstream knock-on effects. These knock-on effects, if not properly assessed and managed, could result in significant process disruptions for a whole range of other Sasol activities. Such assessments render emissions abatement choices complex and time consuming.

Against the background of the highly integrated nature of the Sasol Synfuels process, the MES are structured around controlling emissions sources within the Sasol Synfuels operation as if the emissions sources within the plant are all discrete sources, which they are categorically not. Abatement at individual sources within Sasol Synfuels has to be developed in a manner cognisant of the up- and down- stream consequences of such abatement and cannot be considered only per individual source. Sasol Synfuels therefore applies for additional postponements because it is not possible to comply with the standards as they have been set, as an array of discrete sources each with its own MES, without significant disruptions to the industrial process.

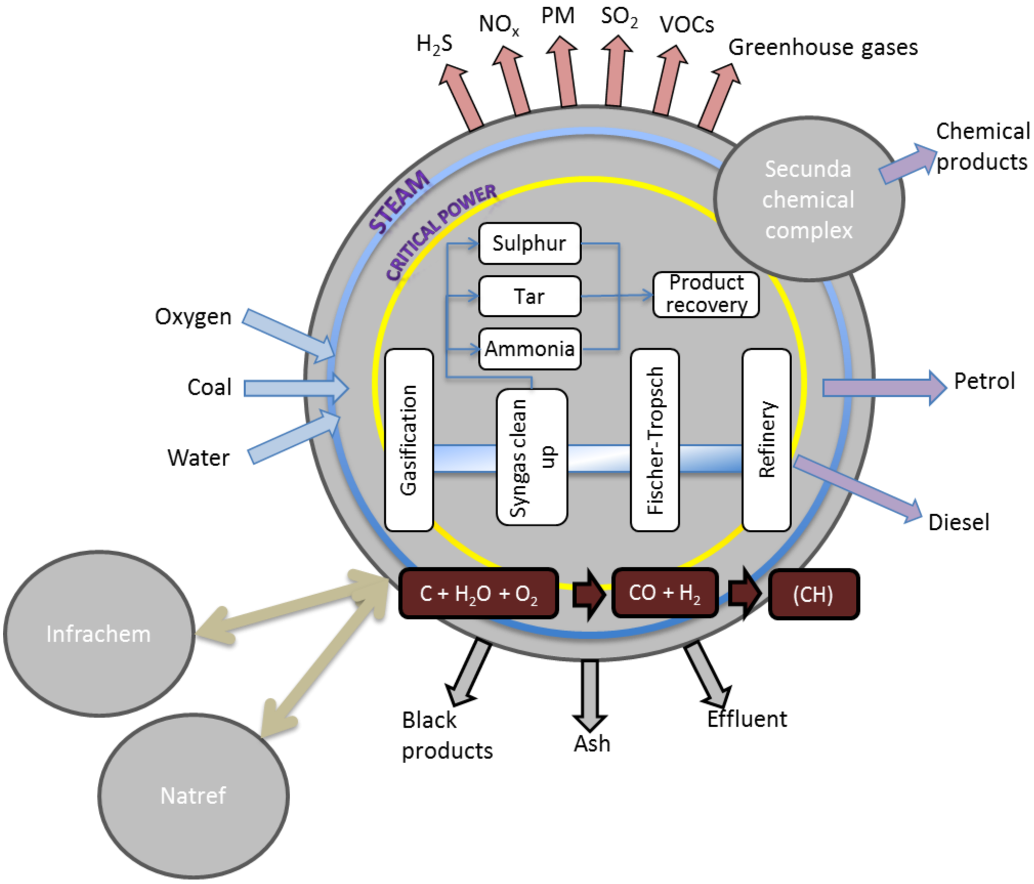


Figure 3: Schematised presentation of the integrated industrial process at Sasol Synfuels to illustrate the high degree of integration and the complexity of the industrial process

4.4 Financial implications

Compliance with the MES comes at a significant financial cost, which is supported by Sasol when the decision takes into account a risk-based approach. For example, renewal of the electrostatic precipitator fields on the steam plant boilers, an investment that Sasol Synfuels is committed to undertake, will cost in excess of R850 million. Ongoing investments which realise abatement of VOCs (detailed in the motivation report for the initial postponements) will incur costs of R7.5 billion. Other technologies such as baghouses, or semi-dry and dry Flue Gas Desulphurisation (FGD) options on the Steam plant would invoke significantly more prohibitive capital and operating costs. For the HOW and Biosludge incinerators, only end of pipe abatement or replacement of the incinerators themselves will result in full compliance with the MES, but also with significant capital costs. By contrast, an approach aligned with the waste hierarchy to divert portions of the waste streams to these incinerators and thereby reduce pollutant load, would realise an improvement in air quality impacts (albeit not meeting the MES) in a significantly more cost-effective manner.

Sasol has argued that it is not the costs *per se* but rather the limited air quality benefits that will be realised as a result of implementing technology for compliance, which supports its additional postponement requests. The air quality benefits of full compliance with the MES have been assessed in the AIR and compared with the current emissions baseline, where in most cases the air quality risk of current emissions is low and the benefit of full compliance is marginal. Sasol respectfully submits that there is no benefit to industry, government and society for industry to be required to invest for compliance at high costs which – if implemented – did not appear to take a risk-based approach and delivered no meaningful improvements in ambient air quality. On this basis, therefore, Sasol commits to taking the reasonable measures aimed at sustainable air quality improvement outlined in Chapter 7 of this application.

4.5 Industrial process compatibility

Emissions abatement that results in reduced efficiencies or does not work as effectively as it should when integrated into the unique industrial process at Secunda, introduces significant unintended consequences. The requirement for highly stable steam production for example, cannot be compromised without significant industrial process risks and production risks that are not tenable to Sasol. A good example of industrial process demands is the WSA plant that was commissioned in early 2010 at a capital cost in excess of R1 billion to further reduce H_2S emissions from the Sulphur Recovery plant. WSA technology is commercially proven in a number of contexts, but has never been implemented in Sasol Synfuels' unique CTL integrated value chain. After significant effort incurred to stabilise the new plant built at Sasol Synfuels in order to attain operations in line with design intent, Sasol has concluded that the current WSA plant is not yet proven in the CTL process at Secunda, and hence building a further unit would not be appropriate, until such time as the existing WSA plant has been modified to the point that it operates reliably and within design. Sasol continues to work towards the goal of stabilising the WSA plant.

A second important example of process compatibility challenges is the limitation on PM abatement options available to the Steam plants. The steam plant boilers were designed with the integration with the Rectisol / sulphur recovery process in mind, as described in Section 2.5.1, which calls for high boiler off-gas temperatures. Sasol Synfuels currently employs electrostatic precipitators (ESPs) to minimise its boiler PM emissions. Technologies investigated to reduce PM emissions further to the levels required by the new plant standards, revealed significant compatibility challenges. Replacing ESP internals with baghouses introduces significant operational challenges and costs, since ordinary bags would not suffice. Much more resilient bag material would be required to withstand high flue gas temperatures, and more frequent bag filter failures would occur, increasing the risk of non-compliance. Sulphur trioxide injection is also not feasible because of the high flue gas temperatures; if the emissions temperatures were reduced to accommodate these technologies, the current buoyancy benefit of the steam plant emissions would be lost, severely impairing the co-dispersion of H_2S emissions from shared emission stacks.

4.6 Technology limitations

Although there are many emissions abatement technologies available to Sasol these technologies will often not result in the level of emissions reductions required by the MES, particularly the new plant standards. For example, it is unlikely that low NOx burners retrofitted into the Steam plant's boilers (which in themselves would result in significant additional coal feed) nor selective non-catalytic reduction would achieve compliance with the new plant standards for boiler NOx emissions, as outlined in the technical appendix.

Renewal of the boiler electrostatic precipitators (ESPs) would improve PM emissions, and is a technology which is proven within the Sasol Synfuels facility. While renewal of the electrostatic precipitators can be implemented to sustainably and consistently achieve the existing plant standards, the same would not reduce emissions to the limits prescribed by the new plant standards. Another example is the de-stoning of gasification feed coal as an abatement option for H_2S emissions, which would not result in compliance with either the existing or the new plant MES and would increase discard coal volumes. Drip tray replacements to reduce VOC emissions are entirely feasible for the Rectisol Plant but will not result in compliance with the MES. Finally, wet ESP electrode replacement and automated control of the wet ESP are both feasible abatement technologies for the WSA to reduce SO_3 and acid mist emissions, but it is not certain whether these technologies will sufficiently reduce emissions to ensure compliance with the new plant standards under all normal operating conditions.

4.7 Unintended cross-media environmental impacts

Some of the emissions abatement options may result in compliance with the MES but would invoke a range of additional unintended or undesired environmental consequences. This inevitably requires that the impacts be balanced against each other. The use of FGD for example to limit SO_2 emissions from the Steam plants has not inconsiderable negative environmental impacts. For one, it would require an additional 4,000 Megalitres per year of water, which would have to be diverted from other existing users. FGD would furthermore require the mining and transport of large volumes of lime or limestone, and would result in additional carbon dioxide (CO_2) emissions and additional waste production. Many of the abatement technologies identified result in reduced process efficiencies, such as low NOx burners that require a higher coal throughput. De-stoning of coal feed for gasification would require increased volumes of waste, and would increase the ratio of mined coal that would need to be discarded, therefore reducing the lifetime of existing mines. Emissions from the biosludge incinerators could be reduced by rather landfilling the biosludge waste to divert it from incinerators, but that transfers the potential impact to another medium, and is contrary to the intent of the waste management hierarchy.

4.8 Modifying a brownfields operation

Sasol supports the principle that new plants should be required to comply with new plant standards. In the case of an existing brownfields operation, however, modification is considerably more challenging than building a new greenfields plant. In the case of greenfields plant the entire plant can be designed in a manner that caters for all requirements and the plant can be conceptualised and 'packaged' in any specific way. In the case of a brownfields operation that benefit does not exist, and every modification or retrofit has to be developed around the existing plant. In the case of Sasol Synfuels, there is very little available space for example, because the plant was specifically designed to have steam-using facilities as close as possible to the source of the steam. The use of wet, dry or semi-dry FGD for limiting SO_2 emissions from the steam plants are all constrained by limited space as is Selective Catalytic Reduction (SCR) for reducing NOx emissions. That lack of space is challenging enough in its own right, but it also creates further access problems for construction teams. Not only is access a problem for workers but bringing in the kind of plant and equipment that would be required to install retrofits is even more challenging.

On-going maintenance requirements of an operational plant mean that there will be competition for both access to the plant and working space. Construction crews would have to be very carefully scheduled and coordinated so that the construction process did not limit the ability of teams to complete their maintenance obligations. This is not to say that such coordination is not possible, but simply that the timeframes for implementation are, in practice, considerably longer. A brownfields site also presents multiple occupational health and safety hazards that do not exist on a greenfields site. These hazards relate principally to having energised systems, in terms of electricity, gas, steam and other utilities, as well as pipelines transporting flammable or explosive products around the site.

5 Alternative Emissions Limits

5.1 Overview

Given the various reasons cited above, Sasol Synfuels is of the view that compliance with certain of the MES is not possible now, or indeed in the foreseeable future, based on presently available technologies. Refer to the note on the assessment of feasibility of compliance with the prescribed MES, provided in this report's associated technical appendix, for an explanation of how this determination is reached. Sasol Synfuels therefore seeks postponement of the compliance timeframes of those MES where compliance is not foreseeable based on presently available technologies.

Sasol Synfuels supports the principle of being held to reasonable emissions limits. Proposals are presented here on what are considered to be justified, reasonable and achievable alternative emissions limits, which Sasol believes could be enforced by the authorities and which could be included as conditions in its Atmospheric Emissions Licence (AEL), to prevail during the period of postponement. Before presenting those alternative emissions limits, it is necessary to briefly present a view on why Sasol believes these alternative emissions limits are aligned with a risk-based approach to sustainable ambient air quality improvement.

5.2 Alignment between the MES and a risk-based approach to ambient air quality improvement

International best practice in setting emissions standards is to critically consider BAT, not as a standard in its own right but as a guiding principle and philosophy that has a limit value attached to what best available technology could potentially achieve without severe technical and economic consequences being imposed on the industry in question. Even where BAT does form the basis of the standards setting process, it is seldom applied retrospectively due to the difficulty and uncertainties of retrofitting old facilities with new equipment. Typically, time frames coupled to these reductions for existing plants are more flexible than the approach taken in the MES. As such the trend globally is to create clear distinctions between existing facilities and new facilities, in recognition of the technical and economic challenges that lie in retrofitting existing industrial facilities.

It is Sasol's view that the MES as they stand are not aligned with the NAAQS, as various modelling studies indicate that the MES imply ambient concentrations that are significantly below the corresponding NAAQS. There is no flexibility for local authorities to apply discretion to emission standards for licence holders in their jurisdiction as a function of the risks posed by the emissions.

The stringency of emission limits cannot be assessed in isolation from how those limits should be applied. Such specifications include, for example, the conditions under which the limit applies (e.g. 100% of the time during normal operations), whether it is a ceiling or an average limit and similarly what measurement averaging period constitutes compliance, for instance 10-minute values, 1-hour values, daily values, monthly values, annual values). The MES as they stand compel substantial redundancy in emissions abatement, with significant cost implications and marginal benefit to that additional capital investment. If there was scope to agree compliance conditions with the authorities, again as a function of risk, then the MES would have been much more practicable in implementation. Unfortunately no such scope exists in the MES as they stand.

Applying emissions limits as ceiling limits or maximum emission concentrations, in the way stipulated currently in the MES makes the limits more stringent than they appear at face value, and setting such limits as ceiling limits is not usual practice in all jurisdictions. The European approach, for example, provides for the natural variability of emissions during normal operations. Some of the alternative emissions limits proposed by Sasol are significantly higher than the MES. As explained above, it must be remembered that the administrative basis of the MES is to comply under all operational circumstances, with exceedances of the MES only being tolerated for shut down, start up and upset conditions. That administrative requirement means that Sasol Synfuels must request ceiling emission limits rather than average emission limits to ensure that it can comply given the variability of emissions that the process experiences even under normal operational circumstances.

It is important to stress that a difference in ceiling emission limits and average emissions limits does not necessarily imply differences in pollution load to the ambient environment. Sasol Synfuels will not, through its additional postponement applications, increase its pollution load by altering its average emissions concentrations. Rather it seeks to align its AEL conditions with sustainable limits, specified as the MES requires, i.e. in the form of ceilings emissions limits, also known as maximum emission concentrations.

5.3 Proposed Alternative Emissions Limits

The MES contain emission limits which have been incorporated into Sasol Synfuels' atmospheric emissions licence and which must be complied with by 1 April 2015. However, as Sasol Synfuels seeks here to postpone compliance with these emission limits, it proposes alternative emission limits which could be incorporated into its atmospheric emissions licences instead of the minimum emission standards currently contained therein. The intended purpose of the alternative emissions limits and alternative special arrangements is to define the proposed licence conditions with which Sasol must comply for the duration of the postponement period. The proposal is that these will therefore be substituted for the MES emission limits which are currently contained in the atmospheric emissions licences. Where applicable, these are at least aligned with current licence emission limits, and where licence conditions do not currently regulate particular emission parameters, Sasol's proposed licence conditions have been established based on what is considered reasonable and achievable in the light of the assessments done by Sasol Synfuels's independent consultants, and are based on the information and technologies currently available to Sasol Synfuels. This is consistent with the requirements of the NAQF, namely that pollution controls are technically possible and incurred at a cost which is acceptable to society in both the short and long-term. Sasol Synfuels does not seek to increase emission levels relative to its current emissions baseline through this application. The alternative emissions limits and alternative special arrangements proposed by Sasol have furthermore been informed by independent specialist air quality studies on the basis that these limits do not affect ambient air quality beyond the NAAQS, which have as their overarching objective, ambient air quality that is not harmful to human health or well-being. The proposed alternative emissions limits are summarised in Table 4.

As described in this report, this application relates to postponement of the 2015 existing plant standard only. However, for completeness' sake, the limits which Sasol could meet in the longer term, based on current available information, are included, which extend beyond the five-year timeframe.

Table 4: Summary listing of the MES for which Sasol Synfuels is applying for additional postponements together with alternative emissions limits proposed by Sasol Synfuels for incorporation into its AEL

Applicable Sasol Synfuels Activities	Substance(s)	MES*		Alternative emissions limits (maximum daily average concentration)
		New	Existing	
Steam plant	Particulate matter	50	100	130 (until 31 March 2024) # 100 (applicable from 1 April 2024)
	Sulphur dioxide	500	3 500	2 000
	Oxides of nitrogen	750	1 100	1 400
Rectisol and Sulphur Recovery Plants	Hydrogen Sulphide	3 500	4 200	12 500
	Total Volatile Organic Compounds	130	250	300
	Sulphur dioxide	500	3 500	Compliance status to be determined
Wet Sulphuric Acid Plant	Total Fluoride	5	30	Compliant
	Hydrogen chloride (primary)	15	25	Compliant
	Hydrogen chloride (secondary)	30	100	Compliant
	Sulphur Dioxide	350	2 800	800
	Sulphur trioxide	25	100	100
	Oxides of Nitrogen	350	2000	Compliant
HOW Incinerators	Particulate matter	10	20	1 400
	Carbon Monoxide	50	75	Compliant
	Sulphur dioxide	50	50	Compliant
	Oxides of nitrogen	200	200	2 450
	Hydrogen chloride	10	10	Compliant
	Hydrogen fluoride	1	1	7
	Sum of Lead, arsenic, antimony, chromium, cobalt, copper, manganese, nickel, vanadium	0.5	0.5	21
	Mercury	0.05	0.05	0.27
	Cadmium + Thallium	0.05	0.05	0.12
	Total Organic Compounds	10	10	50
	Ammonia	10	10	Compliant
	Dioxins and furans	0.1	0.1	Compliant
	n/a	Exit gas temperatures must be maintained below 200ºC		Operate at current exit gas temperature. No chlorinated compounds to be fed to incinerators.
Biosludge Incinerators	Particulate matter	10	20	890
	Carbon Monoxide	50	75	5 000
	Sulphur dioxide	50	50	150
	Oxides of nitrogen	200	200	640

Applicable Sasol Synfuels Activities	Substance(s)	MES*		Alternative emissions limits (maximum daily average concentration)
		New	Existing	
	Hydrogen chloride	10	10	20
	Hydrogen fluoride	1	1	28
	Sum of Lead, arsenic, antimony, chromium, cobalt, copper, manganese, nickel, vanadium	0.5	0.5	2.4
	Mercury	0.05	0.05	0.85
	Cadmium + Thallium	0.05	0.05	Compliant
	Total Organic Compounds	10	10	50
	Ammonia	10	10	47
	Dioxins and furans	0.1	0.1	Compliant

**mg/Nm^3 under normal conditions of 273 Kelvin and 101.3 kPa, at respective O_2 reference conditions for each listed activity as specified in the MES; ng I-TEQ/Nm^3 in the case of dioxins and furans*

#also included in the finalised initial postponement application

The emission abatement technologies and constraints attaching to each of these plants are detailed in the technical appendix.

6 The Atmospheric Impact Report

6.1 Overview

The AIR is a regulatory requirement and has to be compiled and submitted as part of an application for postponement. Sasol Synfuels has aligned its additional postponement applications with the requirements for postponements contained in the MES, and hence has prepared an AIR which supports both the initial and additional postponement applications. The purpose of the AIR is to provide an assessment of the implications for ambient air quality and associated potential impacts, of the emissions that will occur if the additional postponements are granted and proposed alternative emissions limits were accepted. The AIR was completed by independent consultants and not Sasol itself. Airshed Planning Professionals (Airshed) was appointed to this end. The full AIR is included in Annexure A, with key elements of the report and the findings being summarised in this section of the motivation report.

6.2 Study approach and method

6.2.1 Dispersion modelling

Dispersion modelling is a key tool in assessing the ambient air quality implications of atmospheric emissions. A dispersion model serves to simulate the way in which emissions will be transported, diffused and dispersed by the atmosphere and ultimately how they will manifest as 'ground-level' or 'ambient' concentrations. For the purposes of this assessment, the "Regulations Regarding Air Dispersion Modelling" (Government Gazette No. 533 published 11 July 2014) were used to guide dispersion model selection. The CALPUFF model was selected mainly because it can simulate pollution dispersion in low wind (still) conditions, which occur frequently in the area where Sasol Synfuels operates. In addition CALPUFF can be used to model chemical transformations in the atmosphere, specifically in relation to the conversion of NO to NO_2 and the secondary formation of particulates.

6.2.2 Peer review of dispersion modelling methodology

The dispersion modelling methodology was reviewed by E^{x}ponent Inc, which was identified as the appropriate peer reviewer in light of its extensive international experience in the design, development, and application of research and regulatory air quality models. One of E^{x}ponent's directors played a significant role in the development of the CALPUFF modelling system. The peer reviewer was provided with a plan of study and a draft AIR, which was prepared by Airshed in accordance with the Dispersion Modelling Regulations, as referenced by the AIR Regulations of October 2013.

The peer reviewer's findings were assessed in terms of their potential impact on air quality. For cases where the peer review findings were identified as having a potentially significant impact on the dispersion model's results, the dispersion model inputs and/or settings were revised and the model was re-run taking into account the recommendations. Conversely where the findings were expected to have very marginal effects on the results, the findings were noted. Airshed's plan of study, the peer reviewer's report and Airshed's comments on each of the findings are included as Annexure B.

Two key comments were considered material for the purposes of the study, and actions were taken to address the findings.

The first relates to the use of the Probability Density Function (PDF) for dispersion from tall stacks under convective conditions, typical of the Highveld. This is of significance for tall stacks in convective conditions since it better considers short-term elevated concentrations that typically occur during down draught conditions. This finding was deemed to be significant for other regions included in the peer reviewer's assessment, but not the Sasolburg area, since this area is not known for convective conditions.

The second relates to the peer reviewer's aim of replicating Airshed's results independently. Errors in the initial input files sent to the peer reviewer meant that Airshed's updated modelled results could not be replicated. Since it was important for the peer reviewer's assessment to independently model and obtain similar results to Airshed, updated input files were sent to E^{x}ponent for a re-run to ensure that the results were satisfactory.

The remainder of findings and comments on these are detailed in Annexure B. They relate to, among others, land use category data, wet and dry deposition of emissions and chemical transformation of NO_x.

6.2.3 Ambient air quality monitoring stations

As opposed to predicted ambient concentrations using a dispersion model, ambient air quality monitoring serves to provide direct physical measurements of selected key pollutants. Sasol operates three ambient air quality monitoring stations in and around Secunda, namely at Secunda Club, Langverwacht and Bosjesspruit, specifically sited to monitor Sasol's impacts on ambient air quality. Data for 2010, 2011 and 2012 from all three stations were included in the AIR investigation. The monitoring stations are accredited (ISO/IEC17025) to ensure data quality and availability, with 90% data availability for the three years.

6.2.4 Emissions scenarios

In order to assess the impact of each of the additional postponements for which Sasol has applied, four emission scenarios were modelled, with the results throughout the AIR presented as illustration in Figure 4.

- **Current baseline emissions**, reflective of the impacts of present operations, which are modelled as *averages* of measurements taken from continuous emission monitoring (where available) or periodic emission monitoring. This scenario is represented by the first column in the presentation of all AIR graphs (shown in blue in Figure 4). Baseline emissions were derived from accredited (ISO/IEC17025) third parties and laboratories. Emissions measurements follow the requirements prescribed in Schedule A of GN 893. The reason baseline emissions were modelled as averages of measured point source emissions was to obtain a picture of long-term average impacts of Sasol's emissions on ambient air concentrations, which could be reasonably compared with monitored ambient concentrations, as a means of assessing the representativeness of the dispersion model's predictions. Modelling baseline emissions at a ceiling level, which is seldom reflective of actual emissions, would over-predict ambient impacts and therefore doesn't allow for reasonable assessment of the model's representativeness;

The following three scenarios are modelled to reflect the administrative basis of the MES, being ceiling emission levels. These scenarios are therefore theoretical cases where the point source is constantly emitting at the highest expected emission level possible under normal operating conditions, for the given scenario (i.e. the maximum emission concentration).

- **Compliance with the 2015 existing plant standards**. This is modelled as a ceiling emissions limit (i.e. maximum emission concentration) aligned with the prescribed standard, and reflects a scenario where abatement equipment is introduced to theoretically reduce emissions to conform to the standards. This scenario is represented by the second column in the presentation of all AIR graphs (shown in red in Figure 4). For example, this considers the renewal of ESPs and the implementation of low NO_x burners to meet Steam plant boiler existing plant standards, and some technology to theoretically achieve compliance with existing plant standards for H_2S emissions from the Sulphur Recovery plant;
- **Compliance with the 2020 new plant standards.** This is modelled as a ceiling emissions limit (i.e. maximum emission concentration) aligned with the prescribed standard, and reflects a scenario where abatement equipment is introduced to theoretically reduce emissions to conform to the standards. This scenario is represented by the third column in the presentation of all AIR graphs (shown in green in Figure 4). For example, this considers the implementation of FGD at the Steam plant's boilers, which would result in lowered flue gas temperatures from the boilers with a resulting detrimental effect on the co-dispersion of other pollutants including NO_x and PM; and,
- **A worst-case scenario of operating constantly at the requested alternative emissions limits**, which have been specified as ceiling emissions limits (i.e. maximum emission concentrations). This scenario is the represented by the fourth column in the presentation of all AIR graphs (shown in purple in Figure 4). It is re-emphasised that Sasol Synfuels will not physically increase its current baseline emissions (expressed as an average). In some instances the scenario appears higher than the baseline, only because it portrays the worst case outcome where the maximum emission concentration occurs under the 99^{th} percentile worst meteorological conditions – and this is modelled assuming these conditions prevail for the entire duration of the modelling period. Sasol Synfuels seeks alternative emissions limits which are aligned with the manner in which the MES are stated and which accommodate the natural variability inherent in emissions under different operating conditions, and hence must request a ceiling emissions limit rather than an average emissions limit. The alternative emission limit is hence simply a different way of expressing current baseline emissions (in cases where further abatement is not possible), or may even reflect a reduction in average baseline emissions (in cases where further abatement is possible, but not to a level which achieves compliance with the MES ceiling emissions limits).

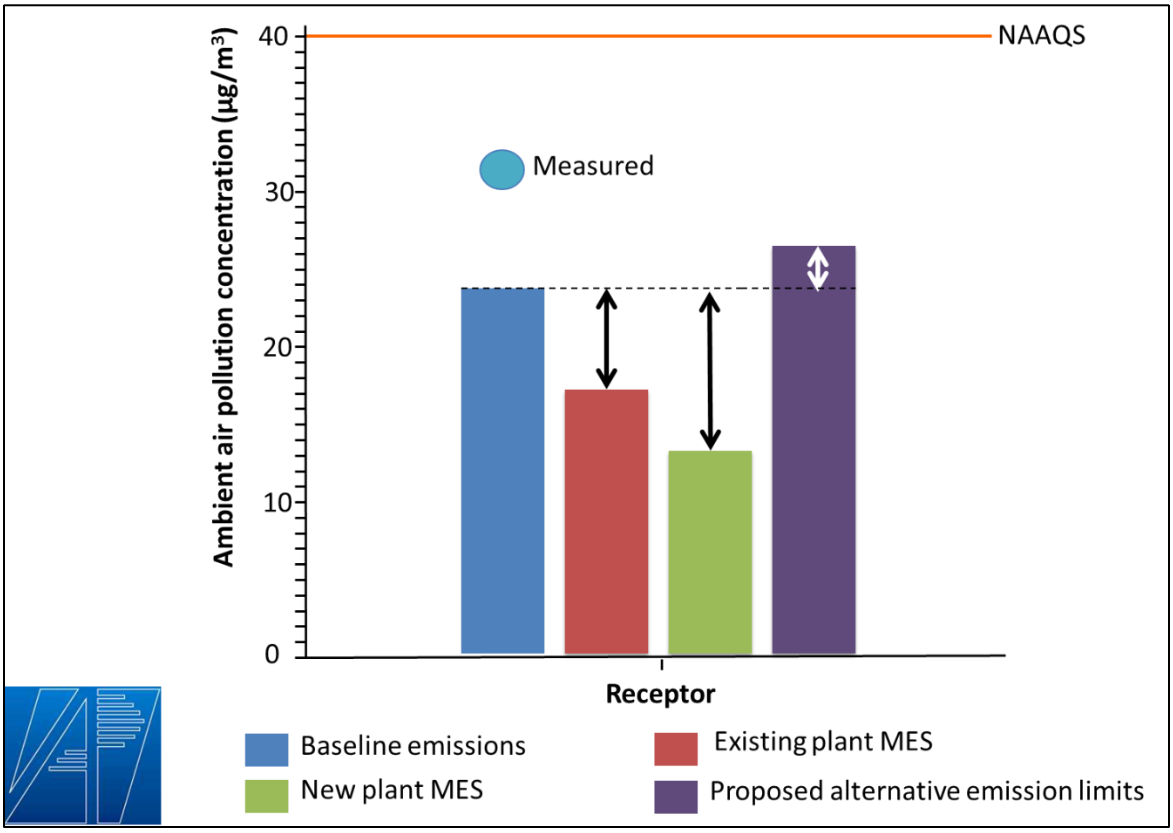


Figure 4: Schematic displaying how the dispersion modelling scenarios are presented in the AIR, for each receptor point in the modelling domain

In Figure 4, the black arrows above the red and green bars reflect the predicted delta (i.e. change) in ambient impacts of Sasol Synfuels' baseline emissions versus the given compliance scenario. At a practical level, the white arrow on the purple bar represents the theoretical delta increase in short-term ambient impacts, where maximum emission concentrations occur, compared with the predicted impact of average current baseline emissions.

The blue dot in Figure 4 represents physically measured ambient air quality, reflective of the total impact of all sources in the vicinity, as the 99^{th} percentile recorded value over the total modelling period. On a given day, there is a 99% chance that the actual measured ambient air quality would be lower than this value, but this value is reflected for the purpose of aligning with modelling requirements.

The orange line represents the applicable National Ambient Air Quality Standard (NAAQS) or, where not available, relevant international benchmark, used for interpretation of the dispersion modelling results, as described in Section 6.2.5.

6.2.5 National Ambient Air Quality Standards

Once ambient concentrations have been predicted using the dispersion model, or direct physical measurements sourced, the predicted or measured concentrations are typically compared to defined standards or other thresholds to assess the health and/or environmental risk implications of the predicted or measured air quality. In South Africa, NAAQS have been set for criteria pollutants at limits deemed to uphold a permissible level of health risk and the assessment has accordingly been based on a comparison between the predicted concentrations and the NAAQS. The measured concentrations have been used to ascertain the representativeness of the modelling and to assess compliance with the NAAQS as a function of all sources of emissions.

For non-criteria pollutants where NAAQS have not been set, health effect screening levels that could be used for assessing the non-criteria pollutants emitted by Sasol Synfuels, have been identified from literature reviews and internationally recognised databases. These non-criteria pollutants for which screening levels were identified include H_2S, SO_3 and various emissions from incinerators, namely lead, arsenic, antimony, chromium, cobalt, copper, manganese, nickel and vanadium. In the case of H_2S, Sasol commissioned an independent toxicologist to conduct a desktop study of suitable health benchmarks for use in the AIR (Annexure C). The screening levels used are listed in Table 5.

Table 5: Most stringent health-effect screening level identified for all non-criteria pollutants assessed

Compound	Acute exposure[(a)] [units: µg/m³]	Chronic exposure[(b)] [units: µg/m³]
Lead (Pb)	[(c)]	[(d)]
Arsenic (As)	0.2 [(g)]	0.015 [(g)]
Antimony (Sb)	[(c)]	[(d)]
Chromium (Cr)	[(c)]	0.1 [(e)]
Cobalt (Co)	[(c)]	0.1 [(f)]
Copper (Cu)	100 [(g)]	[(d)]
Manganese (Mn)	[(c)]	0.05 [(e)]
Nickel (Ni)	0.2 [(g)]	0.014 [(g)]
Vanadium (V)	0.8 [(f)]	0.1 [(f)]
Hydrogen sulphide (H_2S)	135 [(h)]	[(d)]
Sulphur trioxide (SO_3)	22.5 [(f)]	[(d)]
Ammonia (NH_3)	1184[(f)]	[(d)]

(a) Hourly concentrations compared with short-term / acute exposure health effect screening level
(b) Annual concentrations compared with long-term / chronic exposure health effect screening level
(c) No hourly health screening level
(d) No annual health screening level
(e) US-EPA IRIS Inhalation Reference Concentrations (µg/m³) – chronic
(f) US ATSDR Maximum Risk Levels (MRLs) (µg/m³) - acute
(g) Californian OEHHA (µg/m³) – acute
(h) Haahtele *et al*., 1992 - acute (4-hour average)

6.2.6 Sensitive receptors

Fifteen sensitive receptors were defined in and around the Secunda complex and at various distances from the sources within the 50 km-by-50 km modelling domain. The fifteen receptors include residential areas, ambient air quality monitoring stations and points of maximum predicted pollutant concentrations, and are illustrated in Figure 4. The predicted ambient concentrations for each of the four emissions scenarios have been presented as bar charts relative to the NAAQS (where these exist) and to measured ambient concentrations (also where these exist) for each sensitive receptor. The sensitive receptors are listed in Table 6.

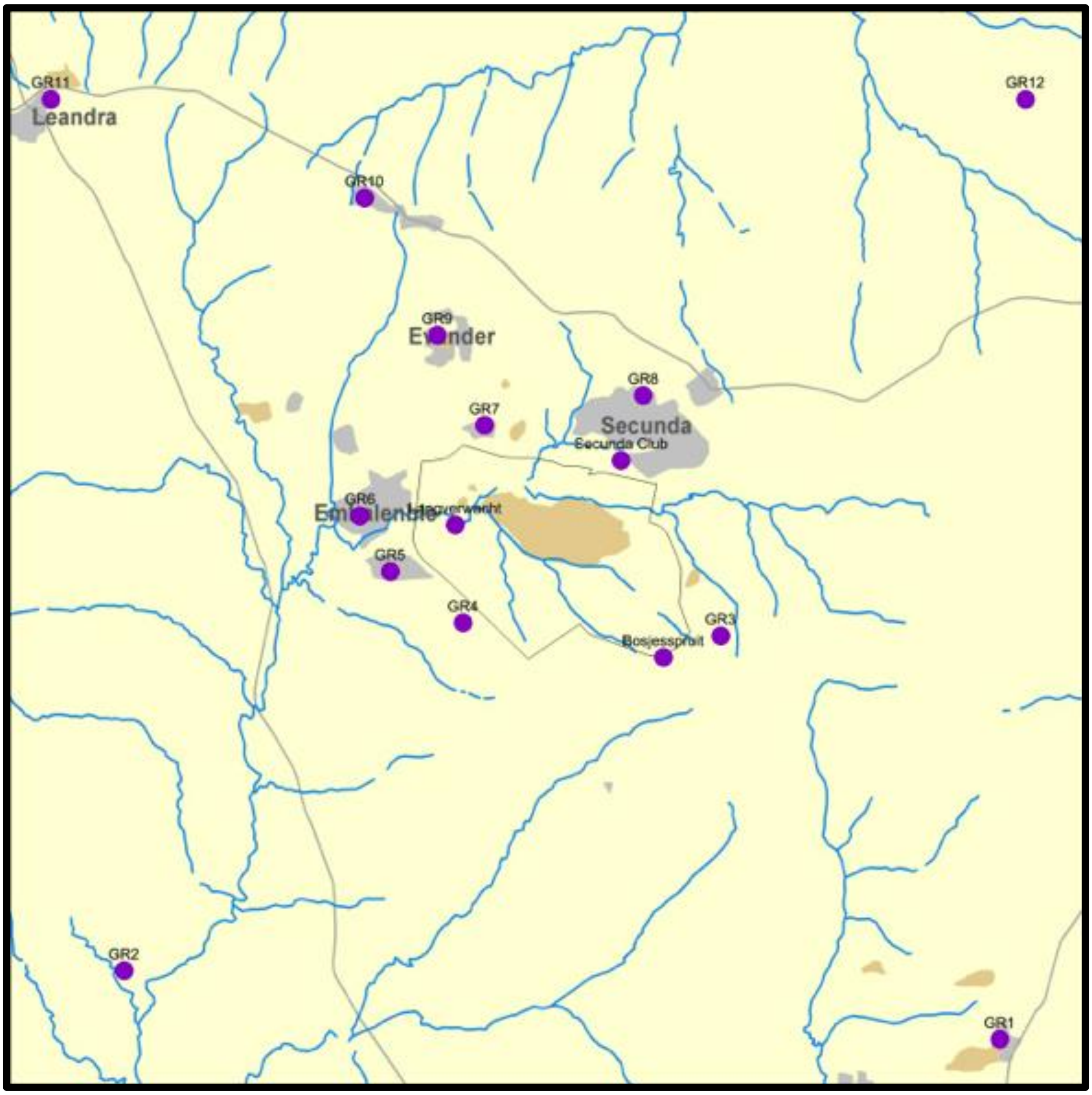


Figure 5: Map showing the positions of the fifteen sensitive receptors identified for presenting the predicted ambient air quality for the different pollutants referenced in this application and for each emissions scenario

Table 6: Summary listing of the sensitive receptors illustrated in Figure 5

Receptor code name	Receptor details	Distance from source (metres)
Langverwacht	SASOL Langverwacht monitoring station	4 718
Secunda Club	SASOL Secunda Club monitoring station	4 971
GR4	Edge of plume (ash disposal facility)	5 648
GR7	Winkelhaak Mines	6 394
Bosjessspruit	SASOL Bosjesspruit monitoring station	7 324
GR5	Embalenhle - point of maximum predicted concentrations	7 775
GR8	Northern boundary of Secunda (residential area)	8 042
GR3	Point of maximum near Bosjesspruit	8 851
GR6	Embalenhle (residential area)	9 158
GR9	Evander (residential area)	11 131
GR10	Kinross (residential area)	18 376
GR2	SW (Edge of domain)	28 262
GR12	NE (Edge of domain)	30 158
GR1	SE (Edge of domain)	31 043
GR11	NW (Edge of domain); Leandra (residential area)	31 289

6.2.7 Model performance

Although atmospheric models are indispensable in air quality assessment studies, their limitations should always be taken into account. As detailed in the AIR, dispersion modelling has inherent uncertainty. The accuracy of the model predicted ambient concentrations are vulnerable to three main sources of errors resulting from: incorrect input emissions data; inaccurate meteorological data and inadequate scientific formulation of the model.

The emphasis in this assessment has been on the ‘delta’, being the difference in predicted ambient concentrations under the four emissions scenarios modelled. The model uncertainty is therefore a constant factor among the scenarios, and the delta can be considered, with a reasonable degree of confidence, as representative of the differences in ambient concentrations that would materialise under different emissions scenarios. The intention behind the atmospheric impact modelling for this motivation has therefore been to show the contribution of each source applying for additional postponement or postponement to ground level concentrations of applicable criteria pollutants in the vicinity of the Sasol Synfuels facility. The delta approach is consistent with the risk based approach that underpins Sasol Synfuels’s environmental management philosophy. The modelled contribution of the baseline scenario is compared with the modelled contributions of the scenarios depicting compliance with existing and new plant standards, to determine the difference that compliance with the MES will make to ambient concentrations of these pollutants in relation to the NAAQS. Since the aim of the dispersion modelling was to illustrate the change in ground level concentrations from the current levels (the baseline emission scenario) to those levels resulting from compliance with the prescribed emission limits (the existing and new plant standards), the intention was not comprehensively to include all air emissions from Sasol Synfuels or those associated with activities other than Sasol Synfuels. Unaccounted emissions include those from unintended emissions within the plant (fugitive emissions) and small vents, as well as air emissions from other industries, emissions from activities occurring within the communities and domestic fuel burning (especially during the winter season), as well as long-range transport of pollutants into the local air shed.

Since model inputs are only estimates, even the most sophisticated models will have inherent uncertainties and will have the potential to underestimate or overestimate actual concentrations. Model performance was assessed by using the fractional bias method, as recommended by the US Environmental Protection Agency, which concluded that model predictions lay well within a factor of two when compared with the measured data, and hence was considered reasonably representative. Further detail on this analysis is included in the AIR.

6.2.8 Compliance with AIR Regulations

As far as practically possible and as summarised in Appendix B-1 of the AIR, the air quality assessment was compiled in accordance with the Regulations prescribing the format of the Atmospheric Impact Report of 2013 (as contemplated in Section 30 of the NEM:AQA). Due to the nature of this application process, the procedure prescribed by these Regulations was adapted to reflect the purpose of the assessment, through evaluation of different compliance scenarios, as described above, and thus represents a “fit for purpose” assessment. This notwithstanding, as also explained in the preface to the AIR, further detail on our point sources which do not form part of the postponements have been incorporated into the AIR in light of stakeholder comments received. This information does not alter the conclusions arising from the initial air quality assessment.

Baseline Modelling

The dispersion modelling was conducted using baseline emissions representative of normal operating conditions for affected point sources. The MES regulates normal operating conditions; therefore only normal operating conditions were included in the assessment. Maximum emissions and emissions during start-up, shut-down, maintenance or upset conditions are in many cases not available as measurements are not conducted during these upset conditions. Due to safety concerns and practical considerations, emissions are measured during operations representative of normal operating conditions during planned, scheduled measurement campaigns.

Fugitive Emissions

Sasol manages fugitive emissions from its facilities, which includes fugitive volatile organic compounds (VOCs) and fallout dust. These fugitive emissions are managed in accordance with a leak detection and repair (LDAR) programme in the case of VOCs which has been in implementation since 2006, and dust fallout management, as described further in the AIR.

VOC Emissions

VOC dispersion modelling of low-elevation sources was not conducted, since many of the VOC sources included in this application are fugitive sources that will be addressed along with the point sources. These sources cannot be quantified sufficiently for dispersion modelling as the VOC emissions vary significantly with changes in temperature and operating conditions, making dispersion modelling impractical in assessing the impact of these sources on cumulative ambient VOC concentrations.

On site, VOC emissions are managed in accordance with the requirements of the Occupational Health and Safety Act. Ambient concentrations of VOCs are recorded by the monitoring stations. The monitored VOCs would therefore reflect the ambient impact of all of Sasol’s sources, including compliant point sources and fugitive sources, along with VOCs from any third party sources. The measurements therefore provide a comprehensive view of ambient VOC levels, and the assumption that these are all Sasol’s impacts; can therefore be considered as the most conservative means in assessing the ambient VOC impact from the facility.

Sasol Synfuels operates two monitoring stations close to the factory boundary which can be used to assess the VOC impact from the facility – the Sasol Club Monitoring Station close to the town of Secunda and the Langverwacht station close to the eMbalenhle town. The NAAQS for benzene is 10 µg/m^3 (3.2 parts per billion) until 31 December 2014, where after it is reduced to 5 µg/m^3 (1.6 ppb). The 2015 NAAQS of 1.6 ppb was used to assess the monitored benzene values.

Dispersion modelling for VOC emissions from the main stacks (a high-elevation source) has been conducted.

6.3 Key findings

In presenting these findings it is necessary to briefly describe the use of the 99th percentile to show predicted and measured ambient air pollution concentrations. As a simulation (and simplification) of reality, dispersion models will always contain some degree of error. Model validation studies elsewhere have indicated that typically the highest predicted concentrations are overestimated as a result of the way that meteorological processes are parameterised in the model.

At the same time the NAAQS include both a limit value and the requirement that the limit value be met for at least 99% of the time. For hourly average values (such as the ambient SO_2 and NO_2 standards) that implies that up to the highest 88 hourly average values can be discarded and for daily averages (such as the ambient PM_{10} standard) up to 4 days can be discarded. For annual averages the limit value is the standard with no exceedances being allowed. All the predicted and measured values shown in this report are based accordingly on the 99th percentile values except for annual averages.

6.3.1 Particulate matter

The PM sources included in the AIR cumulatively account for more than 98% of the Secunda complex's total point source PM emissions.

As described in further detail in Section 5.1.4.4 of the AIR, the CALPUFF modelling suite enabled inclusion of the impact of the chemical conversion of sulphur dioxide and nitrogen oxides to secondary particulates within the dispersion model results. Thus, the predicted PM_{10} concentrations reflected in the AIR dispersion modelling results include direct emissions of PM_{10} plus secondary particulates formed from Sasol's emissions.

Predicted daily annual average PM_{10} concentrations resulting from PM emissions from all PM sources at Sasol Synfuels are shown in Figure 6. It can be seen from the figure that the PM emissions result in predicted concentrations that are well less than the NAAQS (<10%), and significantly less than the measured ambient concentrations at each of the monitoring stations. The modelled predictions imply that full compliance with even the new plant standards at the steam plants will result in only a small reduction in ambient PM_{10} concentrations. Not unexpectedly the alternative emission limits result in the highest predicted ambient PM_{10} concentrations. It must be remembered that the alternative limits are expressed as ceiling limits or maximum emission concentrations, and so the emissions scenario was run as if those emissions will be maintained at all times, which they will not.

At the same time, measured PM_{10} concentrations are seen not to comply with the NAAQS, with frequent exceedances recorded. The measured concentrations obviously reflect all the sources in the airshed and these sources would include other industries, community sources such as domestic fuel burning (especially during the winter season) and veld fires. Given the negligible change in ambient PM_{10} concentrations predicted for full compliance with the MES, MES compliance by Sasol Synfuels at the steam plants would be immaterial to compliance with the PM_{10} NAAQS, given the significant and largely uncontrolled contributions from other sources.

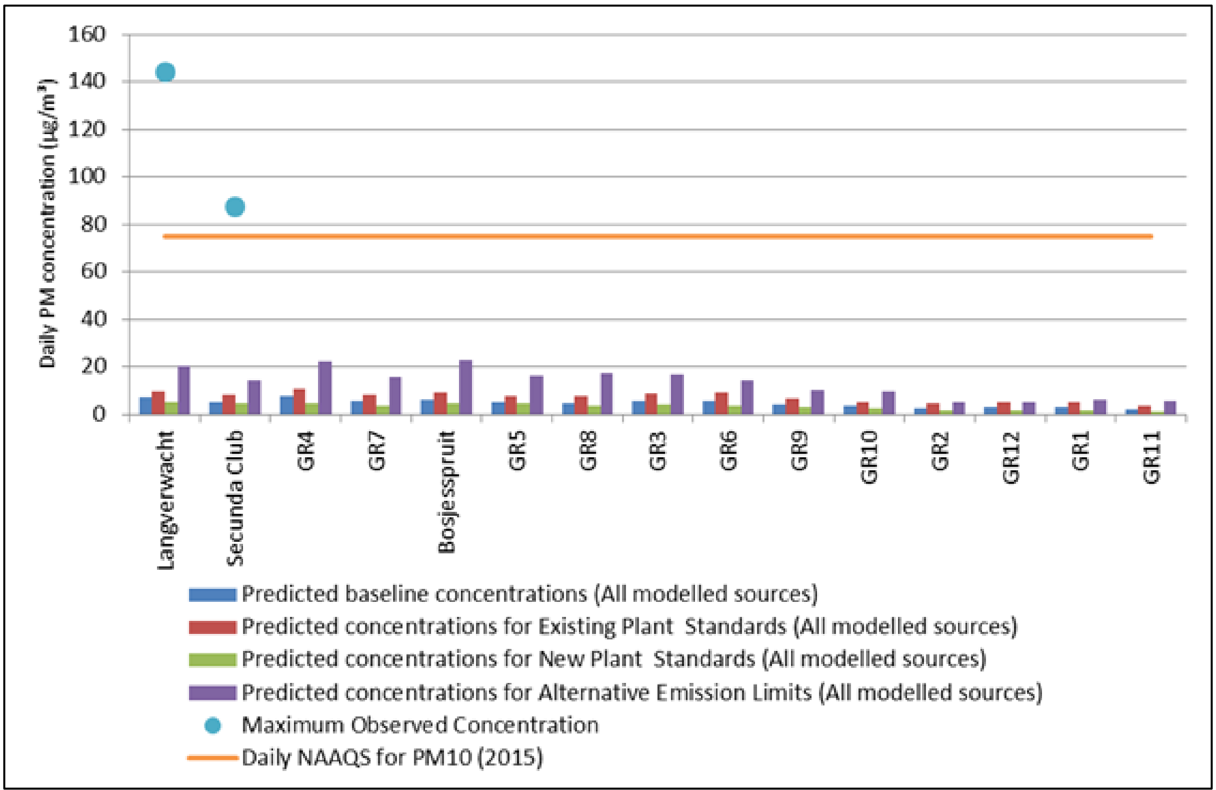


Figure 6: Predicted daily average ambient concentrations of PM_{10} for combined sources at the fifteen sensitive receptors, for each of the four emissions scenarios modelled

6.3.2 Sulphur dioxide

The SO_2 sources included in the AIR cumulatively account for more than 99% of the Secunda complex's total SO_2 emissions.

Predicted ambient hourly average SO_2 concentrations resulting from emissions from the Sasol plant are shown in Figure 7. It can be seen from the figure that the highest predicted ambient concentrations are predicted to occur under the existing plant MES emissions, with progressively lower concentrations for the alternative emissions limits, baseline emissions and then the new plant MES, respectively. The predicted ambient concentrations from the baseline (namely current emissions) are well less than what they would be under the existing plant standards scenario, because the Sasol Synfuels's boilers already emit at concentrations below the standard. This highlights how critically important it is to differentiate between load and concentration where it is the former that determines the ambient concentrations, but the MES is expressed as the latter.

Reductions of Sasol's total impacts on ambient SO_2 concentrations (for hourly concentrations, at the 99^{th} percentile) of up to 75 $\mu g/Nm^3$ are predicted between the baseline and the new plant MES at Bosjesspruit and GR3, which represents ~20% of the NAAQS. Even the highest predicted ambient concentrations under the worst-case alternative emissions limit scenario are seen to be no more than 49% of the NAAQS[1].

Measured ambient SO_2 concentrations are seen to comply with the SO_2 NAAQS. At the same time it can be seen that Sasol is a significant contributor to the measured ambient concentrations but this is expected given that the monitoring stations (Langverwacht, Secunda Club and Bosjesspruit) were specifically located to record the Sasol specific contributions to ambient air quality. Thus even with a

[1] This excludes the scenario for compliance with the existing plant standards since these become redundant in the light of the lower emissions that occur already.

relatively high contribution of SO_2 from the Secunda complex to ambient concentrations, there is still absolute compliance with the NAAQS. The difference between the measured and the predicted concentrations can be attributed to sources other than Sasol. These sources were not directly modelled but are considered to be "background" concentrations with a key source likely being power generation. The reality of what will transpire should the authorities grant the alternative emissions limits, is ambient concentrations that fall within the range between the predicted concentrations under baseline emissions and those predicted under the alternative emissions limits, which will be well less than the SO_2 NAAQS.

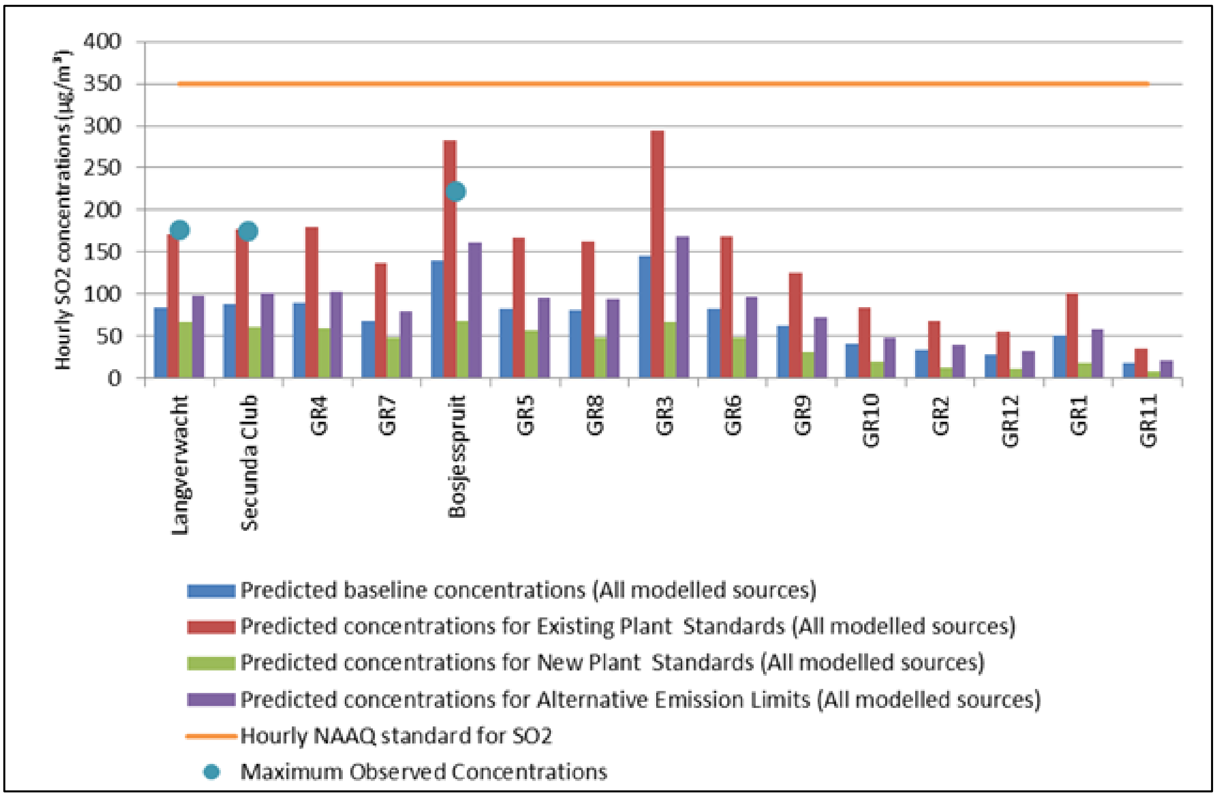


Figure 7: Predicted hourly average ambient concentrations of SO_2 for combined sources at the fifteen sensitive receptors, for each of the four emissions scenarios modelled

6.3.3 Nitrogen dioxide

The NO_x sources included in the AIR cumulatively account for more than 90% of the Secunda complex's total NO_x emissions. Emissions not included arise from other Sasol business units operating in the complex, small burners and heaters, as well as flares.

Predicted ambient hourly average NO_2 concentrations resulting from NO_x emissions from the Synfuels plant are shown in Figure 8. It can be seen from the figure that the highest predicted ambient concentrations are predicted to occur under the alternative emissions limits existing plant MES emissions, with progressively lower concentrations for the, baseline emissions and then the new plant MES, respectively.

Measured ambient NO_2 concentrations at Sasol's monitoring stations are seen to be no more than 75% of the NAAQS limit value. Comparisons between the predicted and the measured ambient NO_2 concentrations indicate that the Sasol Synfuels steam plant is a significant contributor to the measured ambient concentrations especially at the stations closest to the Sasol Synfuels facility. These stations were specifically selected to assess Sasol Synfuels' impact on ambient air quality around the facility.

Model predictions indicate no more than a 25% reduction in ambient concentrations of NO_2 will be achieved at the sensitive receptor of predicted highest concentration (which is less as a fraction of the NAAQS limit value), as a result of compliance with the existing plant standards. What is also noteworthy is the effect of full compliance with the new plant standards, which for reducing SO_2 emissions via FGD, would result in cooler, less buoyant emissions from the steam plant. The effect on NO_x emissions is to reduce dispersion and this has the effect of higher ambient NO_2 concentrations. The net effect is thus a conundrum where higher ambient concentrations of NO_2 result under new plant standards, than existing plant standards. That notwithstanding, the highest predicted ambient NO_2 concentrations occur for the proposed alternative emissions limits, which is to be expected given that these are set as ceiling rather than average emissions. As with SO_2, the reality will likely be ambient NO_2 concentrations that lie somewhere between the ambient concentrations predicted for baseline emissions and those predicted for the alternative emissions limits.

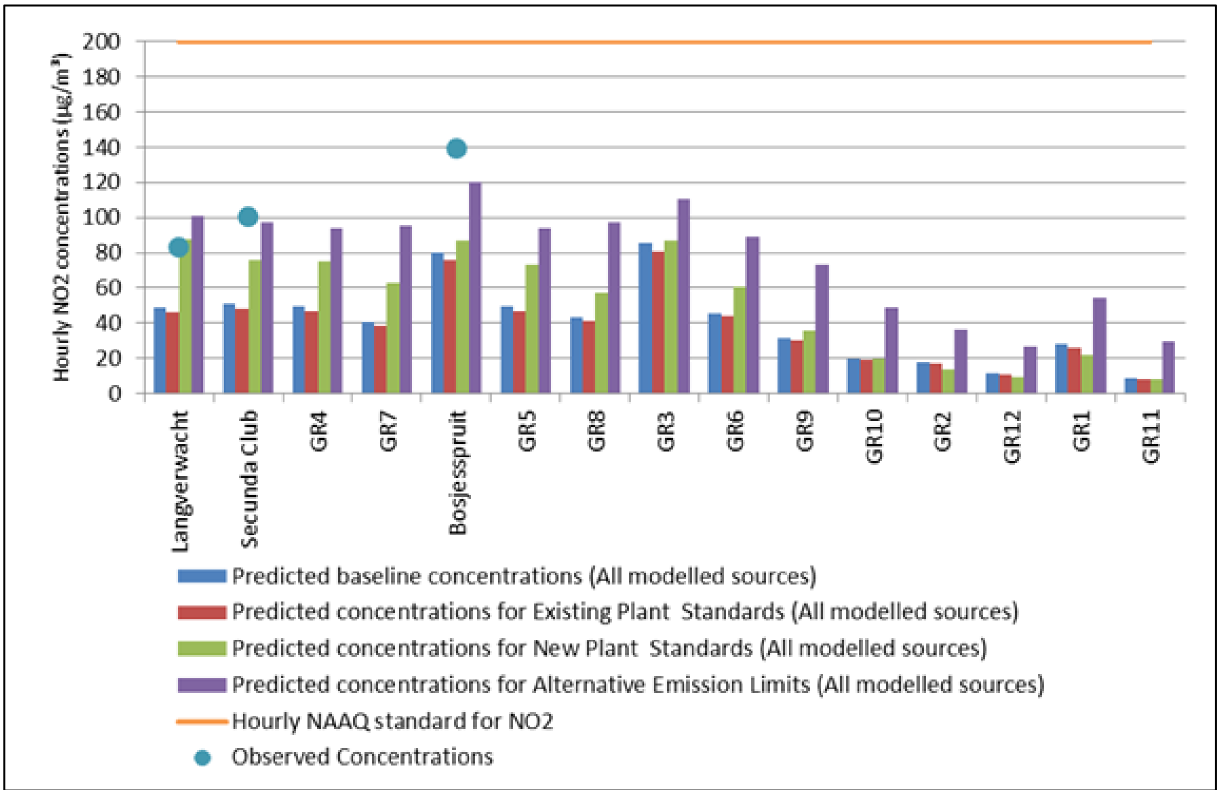


Figure 8: Predicted hourly average ambient concentrations of NO_2 for combined sources at the fifteen sensitive receptors, for each of the four emissions scenarios modelled

6.3.4 Hydrogen sulphide

No H_2S point sources from the Secunda complex were excluded from the AIR.

Predicted ambient 24-hour H_2S concentrations resulting from emissions from the Sasol Synfuels plant are shown in Figure 9. It can be seen from the figure that the highest predicted ambient H_2S concentrations occur, not unexpectedly, under the alternative emissions limit of 12 500 mg/Nm^3. This alternative emission limit (or maximum emission concentration) scenario was not predicted to exceed the WHO (2000) daily health guideline (150 µg/m^3) (shown in Figure 9) or the 4-hour health effect screening level of 135 µg/m^3 (Haahtele *et al*., 1992)[2] (shown in Figure 10). In fact the predicted concentrations are less than 30% and for the most part less than half of the WHO guideline, and less than 80% of the 4-hour health effect screening levels respectively.

It is expected that Sasol is the dominant source of H_2S in the study area, evidenced further by the close correlation between the measured and modelled H_2S values particularly at the Sasol Club and Bosjesspruit monitoring stations. As explained in the AIR, polar plots (showing the direction of emission sources contributing to ambient concentrations) of the H_2S measured at the Langverwacht station indicates the distinct presence of other H_2S-emitting sources that were not included in the model, coming from a direction lying North North West from the Sasol Secunda complex. These are thought to be unidentified lower-elevation sources around the monitoring station, which accounts for the gap between the measured and monitored values.

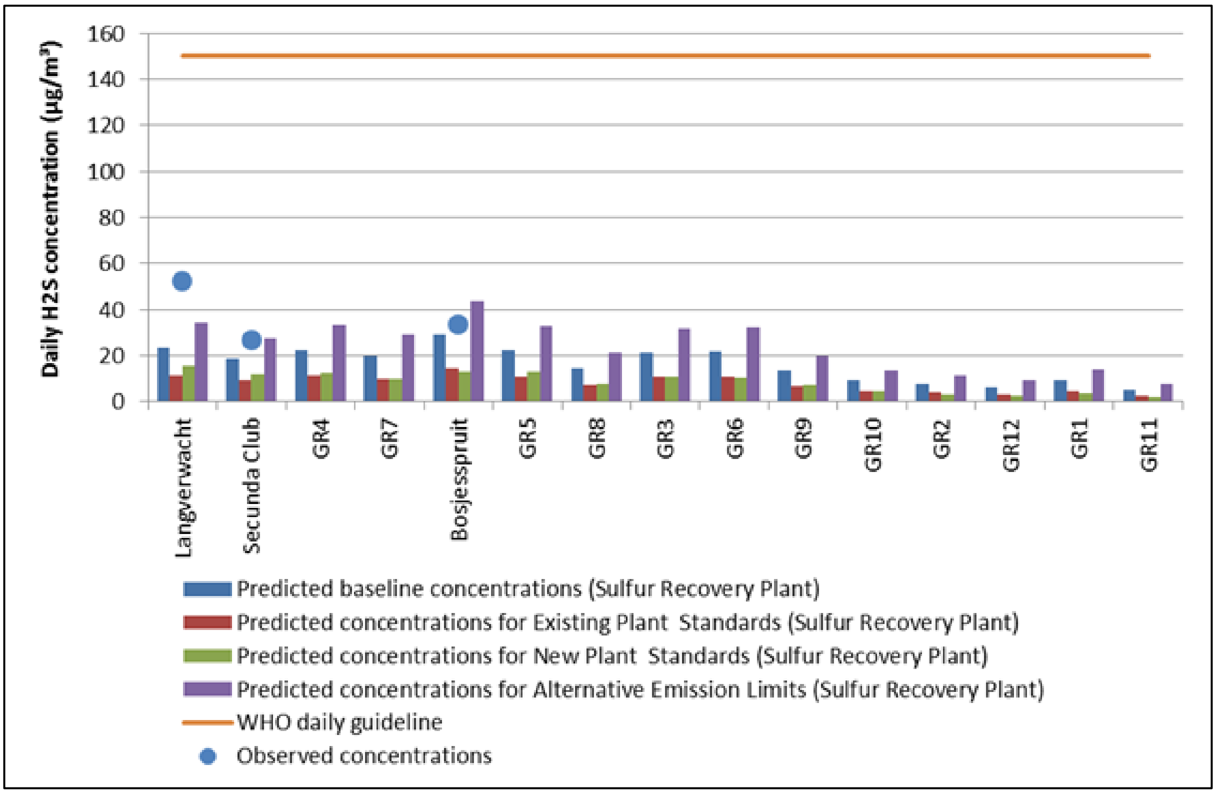


Figure 9: Predicted daily average ambient concentrations of H_2S at the fifteen sensitive receptors against the WHO guideline value, for each of the four emissions scenarios modelled

2 These screening levels were derived in the absence of NAAQS for H_2S, through a desktop study conducted by an independent toxicologist in Annexure C).

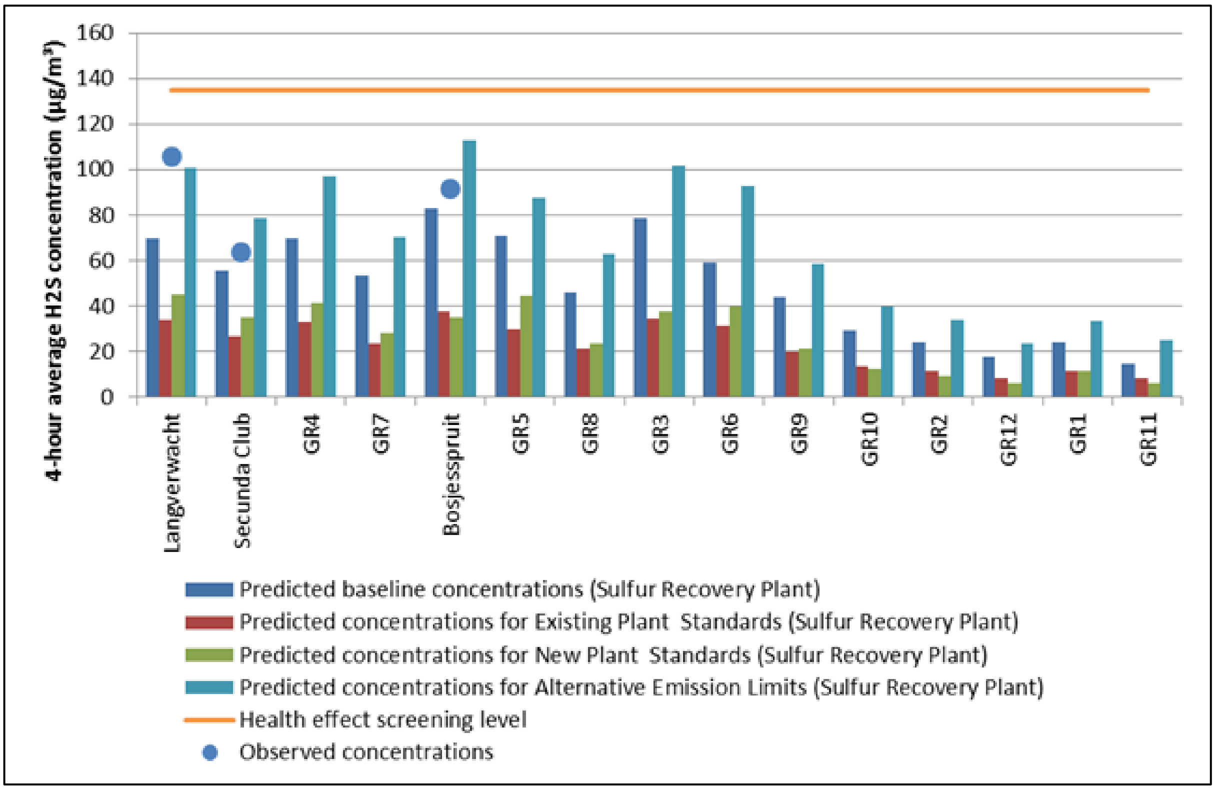


Figure 10: Predicted 4-hourly average ambient concentrations of H_2S at the fifteen sensitive receptors against 4-hour health effect screening level, for each of the four emissions scenarios modelled

What must be noted is the effect of modelling full compliance with the new plant standards where the predicted ambient concentrations under the existing plant standards are seen to be less than the predictions under the new plant standards. The reason for this poorer performance under the new plant standards is that FGD is assumed to have been implemented as an emissions abatement measure to reduce SO_2 emissions from the steam plants. As has been described earlier, the steam plants currently provide significant buoyancy to the H_2S emissions, and the effect of losing that buoyancy as a result of implementing FGD would be to dramatically inhibit the dispersion of the H_2S emissions with resultant increases in the predicted ambient concentrations.

6.3.5 Total volatile organic compounds

As explained above, the assessment of Sasol Synfuels's total ambient VOC impacts was done by conservatively assuming all measured benzene concentrations at Sasol's Sasol Club Monitoring Station close to the town of Secunda and Langverwacht station close to the eMbalenhle town were as a result of Sasol's activities.

The NAAQS for benzene is 10 µg/m^3 until 31 December 2014, where after it is reduced to 5 µg/m^3. The 2015 NAAQS of 5 µg/m^3 was used to assess the monitored benzene values. The blue dots in Figure 11 illustrate the observed ambient benzene concentrations, which lie well within the 2015 NAAQS.

Dispersion modelling for VOC emissions from the main stacks has been conducted, and is also portrayed in Figure 11 and Figure 12. Predicted ambient annual benzene (as an indicator of VOCs) arising from emissions from the Rectisol plants (both West and East Plants) are shown in Figure 11 and Figure 12. Figure 12 depicts the same information as Figure 11, but with the y-axis scaled so that the bar chart is visible: the highest predicted ambient benzene concentrations for the baseline scenario are less than 0.5% of the annual NAAQS. As a result the differences in ambient concentrations under the various emissions scenarios are negligible. The difference between the alternative emission limit of 300 mg/Nm^3 and the new plant standard manifests as a less than 2% change relative to the NAAQS, at most. It should be borne in mind that, while baseline emissions appear to be lower than the new plant standards, these reflect average emissions, with ceiling emissions under normal operating conditions potentially peaking at the level displayed by the alternative emissions scenario.

Monitored concentrations, conservatively assumed to originate all from the Secunda complex, are below 30% of the NAAQS.

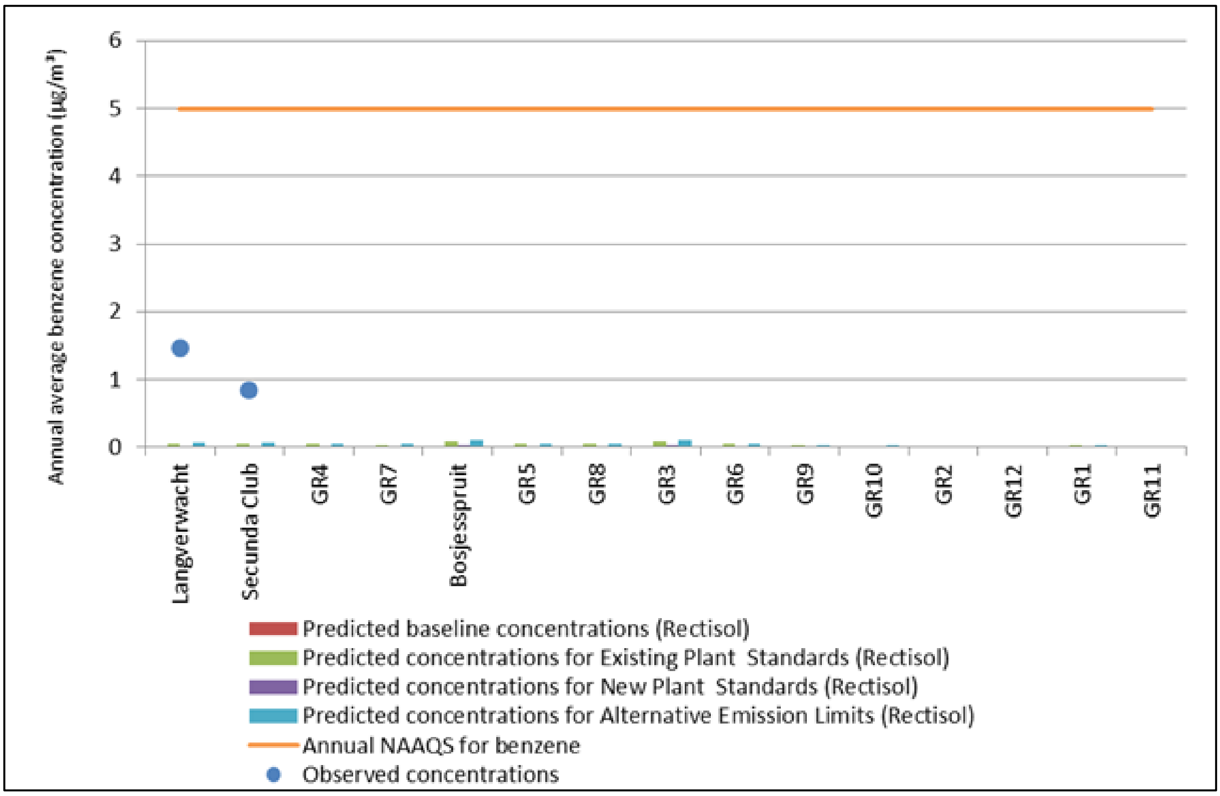


Figure 11: Predicted annual average ambient VOC concentrations at the fifteen sensitive receptors, for each of the four emissions scenarios modelled (unscaled)

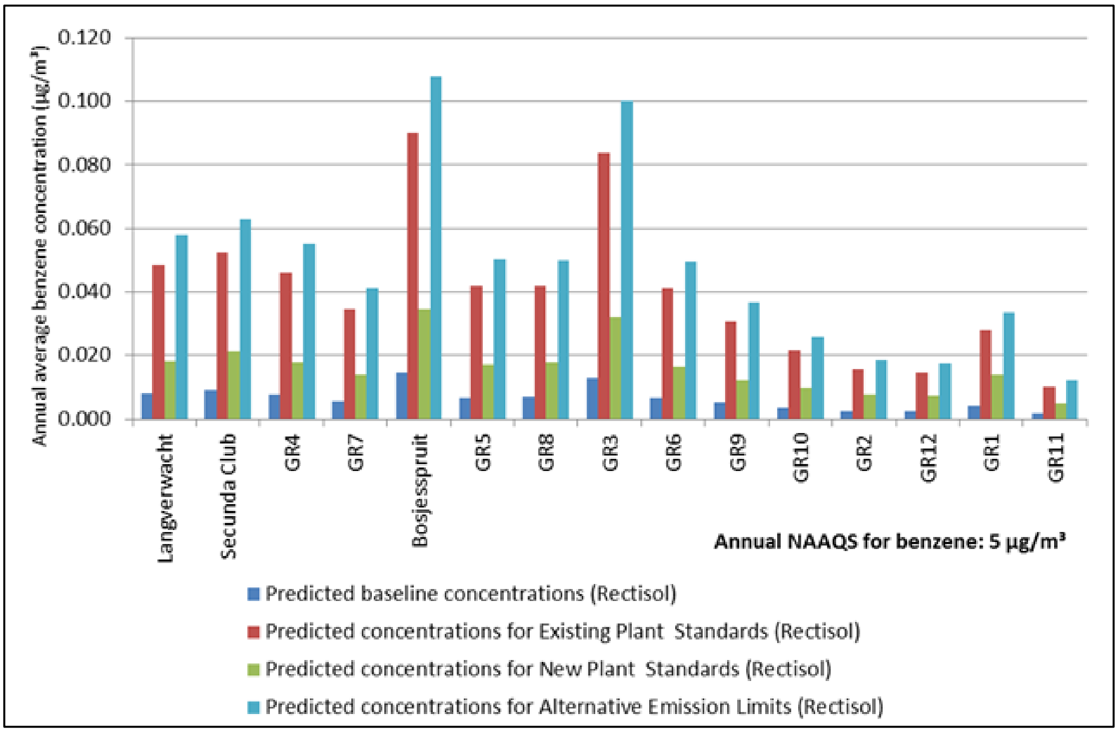


Figure 12: Predicted annual average ambient VOC concentrations at the fifteen sensitive receptors, for each of the four emissions scenarios modelled (with the y-axis scaled so that the bar chart is visible)

6.3.6 Sulphur trioxide (SO_3) and acid mist

Predicted ambient annual sulphur trioxide (SO_3) concentrations deriving from emissions from the Sasol Synfuels plant are shown in Figure 12, which has been scaled to show the y axis. The current baseline emissions are predicted to contribute no more than 0.8 µg/m^3 to ambient SO_3 concentrations, against a benchmark health guideline level of 22.5 µg/m^3 (not shown on the graph since the y-axis has been scaled to make the bars visible). Compliance with the existing plant standards is expected to have a similar impact as the baseline. Compliance with the new plant standards would realise a predicted improvement in ambient air quality of up to 0.5 µg/m^3. The requested alternative emissions limit (or maximum emission concentration), which is marginally higher than the existing plant standards, results in predicted ambient concentrations below 0.8 µg/m^3.

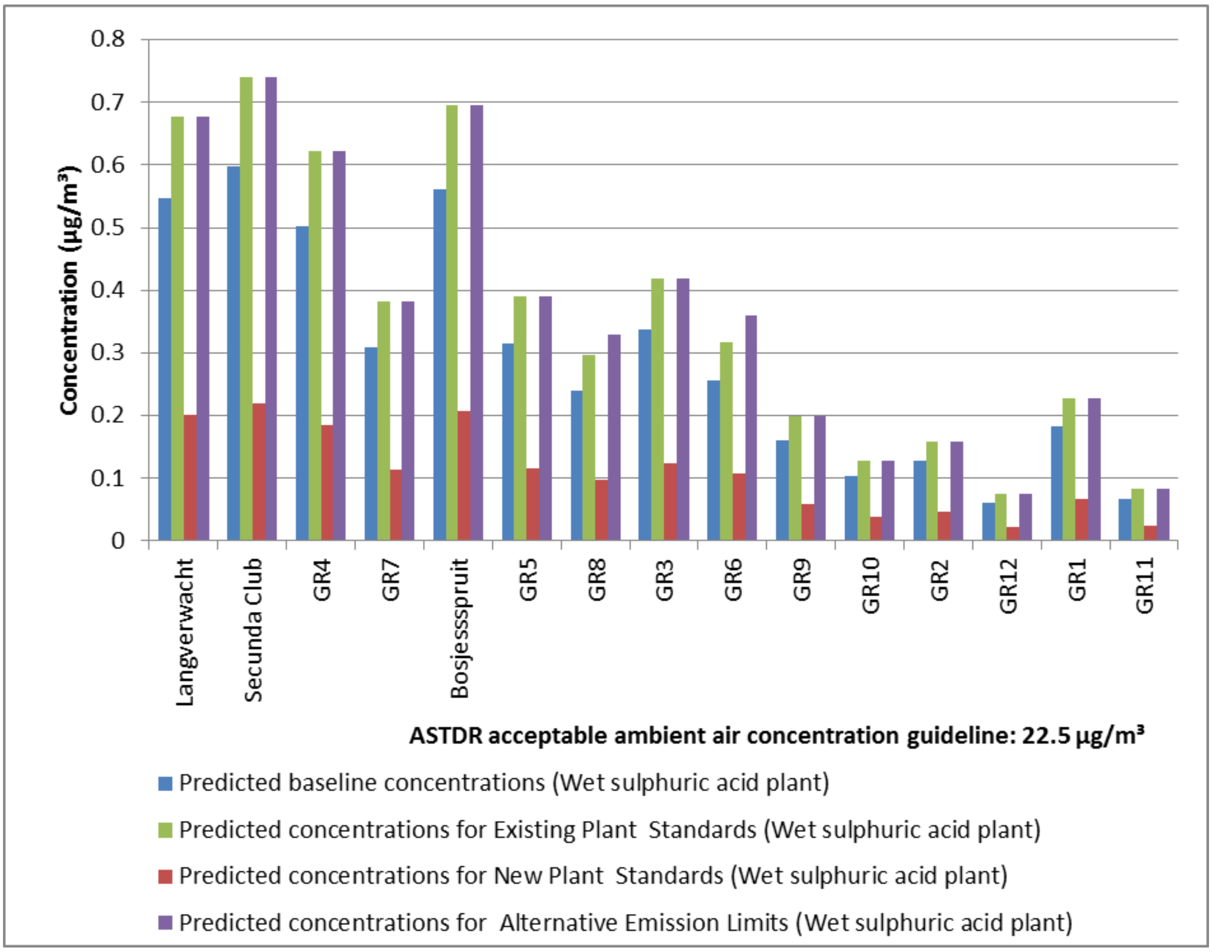


Figure 13: Predicted hourly average ambient SO_3 concentrations at the fifteen sensitive receptors, for each of the four emissions scenarios modelled

6.3.7 Incinerator emissions

The implications for ambient concentrations of the criteria pollutants SO_2, PM_{10} and NO_x arising from emissions from the incinerators have already been discussed. For the remaining non-criteria pollutants, since NAAQS do not exist, the strictest health effect screening levels were derived from the following sources: World Health Organisation (WHO); US-EPA IRIS inhalation reference concentrations; Californian OEHHA; US ATSDR Maximum Risk Levels. The derived non-criteria pollutants are listed in Table 7, which is an extract of applicable non-criteria pollutants from Table 5.

Predicted ambient pollutant concentrations deriving from combined emissions from the HOW and Biosludge incinerators are shown in Table 8 relative to these strictest health effect screening effect levels. This is a summary of the screening exercise for the non-criteria pollutants that would possible exceed the screening level concentrations, namely manganese (Mn), ammonia (NH_3), hydrogen chloride (HCl) and hydrogen fluoride (HF). It can be seen from Table 8 that the maximum predicted concentrations are significantly lower than the health screening level. The remaining predicted concentrations are at least an order of magnitude below the commensurate health screening level. The full results of the non-criteria pollutant screening exercise are reflected in the AIR.

Table 7: Strictest health effect screening levels used for assessment of HOW and Biosludge incinerator emissions

Compound	Strictest health effect screening level	
	Acute exposure[(a)] [units: μg/m^3]	Chronic exposure[(b)] [units: μg/m^3]
Lead (Pb)	[(c)]	[(d)]
Arsenic (As)	0.2 [(g)]	0.015 [(g)]
Antimony (Sb)	[(c)]	[(d)]
Chromium (Cr)	[(c)]	0.1 [(e)]
Cobalt (Co)	[(c)]	0.1 [(f)]
Copper (Cu)	100 [(g)]	[(d)]
Manganese (Mn)	[(c)]	0.05 [(e)]
Nickel (Ni)	0.2 [(g)]	0.014 [(g)]
Vanadium (V)	0.8 [(f)]	0.1 [(f)]

(a) Hourly concentrations compared with short-term / acute exposure health effect screening level
(b) Annual concentrations compared with long-term / chronic exposure health effect screening level
(c) No hourly health screening level
(d) No annual health screening level
(e) US-EPA IRIS Inhalation Reference Concentrations (μg/m^3) – chronic
(f) US ATSDR Maximum Risk Levels (MRLs) (μg/m^3) - acute
(g) Californian OEHHA (μg/m^3) – acute

Table 8: Summary listing of the maximum predicted concentrations of selected non-criteria pollutants compared to the strictest health effect screening levels (see Table 7). The predicted concentrations derive from combined emissions from the HOW and Biosludge incinerators

Compound	Maximum concentration[(a)]	Screening level
Baseline operations		
Mn	0.0021	0.05 [(b)]
NH_3	0.0031	1184 [(c)]
HCl	0.0276	2100 [(c)]
HF	0.0205	240 [(c)]
Existing and New Plant Standards		
Mn	0.0002	0.05 [(b)]
NH_3	0.1353	1184 [(c)]
HCl	0.1353	2100 [(c)]
HF	0.0137	240 [(c)]
Alternative emissions limit scenario		
Mn	0.0251	0.05 [(b)]
NH_3	9.0631	1184 [(c)]
HCl	5.3992	2100 [(c)]
HF	5.3992	240 [(c)]

(a) Maximum predicted concentration across the 12 receptors

(b) Chronic exposure level, μg/m^3

(c) Acute exposure level, μg/m^3

6.4 Overall findings of the AIR

6.4.1 Compliance with the NAAQS

The purpose of the MES is to achieve the intent of the NEM:AQA which means ensuring that ambient air quality is achieved that does not threaten the health or well-being of people and the environment. To all intents and purposes that means ambient air quality that complies with the NAAQS. Thus in assessing the request for additional postponements, the effect of granting such a request has to be assessed in terms of the implication for ambient air quality.

Regarding compliance with NAAQS, measured ambient air quality from the three Sasol monitoring stations is seen to comply with the NAAQS and other health risk screening limits, the exception being for PM_{10}. The compliance in respect of the NAAQS in the vicinity of Sasol's plant suggests that current emissions from Sasol and other emitters in the airshed are broadly acceptable in regulatory terms. In respect of PM_{10} it is known that there are multiple sources of PM including other industries, vegetation burning, dust, discard coal combustion and domestic fuel use.

Given the high background loading of PM_{10}, Sasol Synfuels maintains control of PM emissions from the Secunda complex. Modelling of PM emissions from the Secunda complex reveals low resultant concentrations of ambient PM_{10}, even when the chemical transformation of SO_2 and NOx into particulates is considered. Predicted ambient PM_{10} concentrations are seen to be less than 10% of the NAAQS and an even smaller fraction of the measured concentrations. This implies that reducing PM_{10} emissions from Sasol Synfuels activities will not reduce ambient concentrations of PM_{10} significantly, and will not result in compliance with the NAAQS given other dominant sources of PM.

In respect of the other criteria pollutants most notably SO_2 and NO_2, as well as H_2S, predicted ambient concentrations highlight Sasol as the dominant source of the concentrations measured at the monitoring stations (for short-term average measurements), and these measured concentrations are all seen to comply with the NAAQS. Thus at the level of principle, reducing emissions of these pollutants will serve to further reduce ambient concentrations that already comply with the NAAQS. The same holds true for the non-criteria pollutants where health risk screening limits are not exceeded by measured pollutant concentrations.

6.4.2 The effect of the alternative emissions limits

The alternative emissions limits proposed by Sasol Synfuels are in some instances significantly higher than the MES, i.e. as reported on a concentration basis. It is reiterated that the administrative basis of the MES is to comply under all operational circumstances, with emissions exceeding the MES only being tolerated for shut down, start up and upset conditions. That administrative requirement means that Sasol Synfuels must request ceiling emissions limits rather than average emissions limits to ensure that it can comply under all operating conditions given the known variability of emissions under normal operational circumstances.

The predicted ambient concentrations for the alternative emissions limits are a worst-case depiction because they have been modelled as if the emission will be maintained at those levels continually, which they will not. Yet even under the worst-case emissions scenario full compliance with the NAAQS is predicted in all circumstances. In the case of the incinerator emissions, resultant ambient concentrations are a fraction of the respective limits.

The key finding is that compliance with the MES will in most (but not all) circumstances reduce ambient concentrations, but in a circumstance where there is already full compliance with the NAAQS. In the case of PM_{10}, compliance with the MES will not achieve compliance with the NAAQS and other measures are more likely to be more effective in this regard.

6.4.3 Health effects

The AIR Regulations prescribe an assessment of the health effects of the emissions for which relief is sought from the MES based on the degree to which there is compliance with the NAAQS. It cannot be argued that compliance with the NAAQS means no health risk. Indeed the World Health Organisation indicates that there is no safe limit in respect of exposure to PM. The NAAQS prescribe, however, a permissible or tolerable level of health risk. The overall findings of the AIR are that the alternative emissions limits requested by Sasol Synfuels will result in permissible health risks.

6.4.4 Ecological effects

An assessment of air pollution impacts on soil, water and receptors other than human was not formally included in the AIR. Nonetheless, the AIR includes a brief literature review of available studies on deposition of atmospheric sulphur and nitrogen on South African ecosystems.

Sasol has furthermore conducted its own literature study of the ecological impacts of atmospheric emissions in the Mpumalanga Highveld air shed, which is hereunder summarised.

Anthropogenic emissions of sulphur and nitrogen is a relatively new phenomenon in South Africa which became prominent once large scale coal fired power plants were introduced during the 1960s. Sasol estimates that it contributes about 15% of the total sulphur and nitrogen emissions into the Mpumalanga Highveld air shed. It is, however, currently not considered possible to isolate any single point source contribution from the deposition impacts from the other sources, either anthropogenic or natural. Due to this contribution to the total sulphur (S) and nitrogen (N) emission load in the Mpumalanga Highveld, Sasol has for many years actively supported research efforts to quantify the ecological impact of these atmospheric pollutants in South Africa where there are large differences between the European situation where most of this type of research has taken place.

The research work to date has focused on: (1) better understanding the transport and fate of atmospheric pollutants in order to determine the spatial deposition rates; and (2) measuring directly deposition impacts to water, soil and ecosystems. The critical load mapping approach developed for the European situation has been extensively used as a proxy for assessing risk. Recent critical load mapping has identified some areas in the inland region of South Africa where critical threshold limits have been exceeded although for the majority of the sites pollutant concentrations have been found to be well below the critical thresholds considered necessary for environmental damage to occur.

While sulphur emissions are the dominant acidification inputs, nitrogen emissions are responsible for the formation of low level ozone through the reaction between oxides of nitrogen (NOx) and volatile organic compounds (VOC) - both from human and natural sources – in the presence of sunlight. Ozone is known to cause damage to vegetation and be harmful to materials. Despite the ozone concentrations in South Africa being above the European critical levels for crop damages, no vegetation damages have to date been reported. Reasons suggested for this are varied including the view that impacts have either not been identified due to a lack of local research attention on this topic; or vegetation, as in some known species to have adapted to the high ozone levels.

The observed evidence to date is that there have been no widespread ecological impacts which can directly be attributed to atmospheric deposition. The majority of soils in the inland region of South Africa have a sufficiently large capacity to buffer the additional acidifying inputs but less so the additional sulphate making salt build and flux a more important criterion. The salt loads need to be assessed against the other water quality drivers of the catchment. According to the work reviewed there have at most been some limited changes to soil and water quality which can be linked to atmospheric deposition of sulphate and nitrate species.

While the evidence tends to suggest that the South African situation is not at a tipping point the understanding of the linkage between atmospheric emission concentrations and ecological impacts remains an important area of research. Sasol continues to actively support joint research on this issue. In addition to continued assessments of atmospheric dry and wet deposition of sulphur and nitrogen species, further studies on the effects of ozone, a secondary pollutant, on local forests and agriculture in South Africa are thought to be necessary to better quantify ozone impacts on ecosystems. The current knowledge base needs to be expanded to permit reliable quantification of air pollution impacts on people, crops and natural systems and to enable accurate assessment of industrial activity impacts in order for a rational basis for cost effective strategies on reducing air pollutants to be implemented.

6.4.5 Assessment of costs and benefits

In concluding the findings of the AIR assessment, it must be emphasised that Sasol Synfuels has investigated exhaustively abatement measures that could reduce the emissions targeted for reduction by the MES. The principle of cost-benefit is recognised in the NAQF and must be considered in decisions regarding compliance with the MES, and applications for additional postponement as is the case here. At a qualitative level, the overarching objective of the MES is to ensure compliance with the NAAQS, which is already the case for all criteria pollutants save for PM_{10}. On this basis, there is no material benefit to be obtained from the implementation of high cost abatement technologies to comply with the MES. If the gains are predicted to be small percentage changes in ambient concentrations, as is the case for numerous of the listed activity emissions from Sasol Synfuels, then the benefits are even more marginal. The overarching conclusion of the AIR is that it suggests that the cost of strict compliance with the MES for these listed activities is not commensurate to the benefits that would be realised. A marginal cost-benefit case is not aligned with the stated objectives of the NAQF.

7 Sasol's roadmap to sustainable air quality improvement

Sasol follows a Group-wide risk-based approach to identifying and managing its priority environmental risks. Sasol's environmental policies, targets, standards and guidelines are all then driven as a function of the identified risks in a systematic focus on continuous environmental improvement.

This Chapter outlines the holistic approach to sustainable air quality improvement, while the specifics of how and when compliance will be attained for the sources described in this postponement application, is summarised in Figure 14.

7.1 Commitment to continued implementation of Sasol's risk-based approach

Sasol prioritises emission reductions as a function of addressing risk and identifies emissions abatement opportunities which will realise the greatest improvements in onsite or ambient air quality. Often these interventions are win-win outcomes, with other benefits such as improving production efficiencies, reducing waste and demand for raw materials and generating new products from streams that would otherwise have been wastes.

Over the past decade, Sasol has spent in excess of R20 billion, or R2 billion per year, on various projects that have delivered significant environmental improvements, as detailed in this report. This expenditure excludes very significant investments in the Department of Energy's Clean Fuels 1 programme and imminent Clean Fuels 2 programme, which has resulted in, and will further result in reduced motor vehicle emissions. The environmental improvements were driven by Sasol's business objectives of delivering sustainable returns to shareholders in a socially and environmentally responsible manner. As an example of its ongoing air emissions improvements, Sasol continues to work towards its internal target of reducing VOC emissions by 80% by 2020, off a 2009 baseline, which is not driven by legal requirements.

Indeed Sasol Synfuels has investigated a range of potential emissions abatement options that would have potentially yielded the emissions performance required of the MES. Emissions abatement is in many cases simply not, based on presently available technologies, feasible because of the significant industrial process risks that are introduced by trying to make generic abatement approaches fit the Sasol Synfuels process. Sasol cannot justify introducing such process risks when the benefits of taking the risks are seen to be so marginal.

7.2 Upholding Highveld Priority Area Plan commitments

Sasol Synfuels made commitments to certain emissions abatement interventions as part of the Highveld Priority Area Air Quality Management Plan, and has made significant progress towards achieving these commitments, as outlined in Table 9. Sasol Synfuels has made major efforts and will continue with those efforts to improve the Wet Sulphuric Acid plant's performance.

Table 9: Sasol Synfuels commitments to the Highveld Priority Area Air Quality Management Plan

Emission component & source	Commitment made	Status
Fugitive VOCs arising from tar processes and product storage.	Implementation of a leak detection and repair programme to reduce fugitive emissions.	Completed
VOC emissions from fuel loading facilities.	Installation of vapour recovery unit at fuel loading facility.	Completed
Reduction of VOC emissions being vented from forced feed evaporator.	Short term unit de-bottlenecking, bypass of the forced feed evaporator at Coal Tar Filtration.	Completed
VOC emissions from various tanks.	Installation of Evapostops on various tanks on the Synfuels site.	Pilot studies to assess technology effectiveness underway.
Hydrogen sulphide emissions from the complex.	Wet Sulphuric Acid plant.	Installed, but experiencing operational challenges.
Particulate matter (PM) from boilers exceeding normal operating parameters due to air ingress from damaged air heater (boiler 9).	Reduction of particulate matter (PM) from boilers (through air heater replacement and general overhaul of Boiler 9).	Completed
Reduction of particulate matter from boilers.	Ammonia pressure and quality control project to reduce particulate matter.	Completed

7.3 Commitment to compliance with reasonable and achievable standards which achieve sustainable ambient air quality improvements

Sasol is committed to compliance with all applicable environmental laws, including air quality laws such as the MES.

Sasol's roadmap for compliance with air quality law involves a multi-faceted approach, aligned with a risk-based philosophy:

7.3.1 Compliance with point source standards along achievable timelines

For some point sources, through Sasol's proactive environmental improvement approach, Sasol will comply with the point source standards within the prescribed timeframes for existing plant standards and new plant standards.

For certain other point sources, Sasol's technology investigations have identified that compliance is achievable within the short to medium term, but the implementation of compliance solutions has a schedule that extends beyond the compliance timeframes. In these cases, Sasol has applied for postponements which are detailed in the initial postponement application. With the passage of time, all these point sources will attain full compliance with the MES.

7.3.2 Approach to compliance in respect of additional postponement applications

Sasol had previously applied for exemption from default application of the MES in cases where compliance cannot feasibly be achieved with presently available technologies, and will not materially improve ambient air quality. As described elsewhere in this report, Sasol is making an application for additional postponements in these cases. While Sasol's concerns with the MES remain, Sasol proposes three commitments to assure its stakeholders that sustainable environmental improvements will continue to be implemented and that, where reasonably feasible and achievable in the longer term, it will comply.

A. Commitment to compliance with alternative emissions limits

Sasol does not propose that for the duration of its additional postponement period its atmospheric emissions licences contain no emissions limits. Instead, for this period Sasol seeks alignment of the NEM:AQA's future emission limits prescribed in its atmospheric emission licences with alternative emissions limits (specified as maximum emission concentrations) that have been informed by integrated environmental management principles. Sasol Synfuels asserts that the alternative emission limits requested in this additional postponement application are the best that can feasibly be achieved on its facility, with presently available technology. Sasol furthermore intends that all the legal obligations associated with licence conditions, be attached to these alternative emissions limits, if incorporated in its licences. As described in the AIR, these alternative emissions limits will not cause exceedances of the NAAQS.

B. Commitment to periodic technology scans for sustainable compliance solutions

Despite not being able to comply using currently available technologies in the short to medium term, Sasol commits that, throughout the postponement period, it will conduct continued technology scans to investigate any future solutions that emerge which may enable it to comply over the longer term. Where promising new technologies are identified, Sasol commits to embarking on more detailed technical investigations, in accordance with Sasol's project governance framework. In this manner, it may be possible that in future, feasible solutions are identified, and that compliance is eventually achieved with the standards, albeit in the longer term. In order to ensure that the National Air Quality Officer (NAQO) is kept abreast of developments, Sasol proposes providing annual feedback to the NAQO as well as a comprehensive status report on its investigations and conclusions at the end of the postponement period.

C. Commitment to engage with the DEA to advance the regulatory implementation of alternative compliance mechanisms

Sasol is supportive of appropriate alternative compliance mechanisms to achieve the objectives of the Constitution, the NAQF and the NEM:AQA. Evident from the AIR prepared for this application, as well as other air quality assessments, is the significant air quality challenge on the Highveld arising from ground-level emissions of PM from domestic fuel use and the exposure of communities to the same.

Sasol believes that air quality offsets could provide significant air quality improvements with associated community health and socio-economic benefits, particularly in priority areas. Sasol will conclude a detailed assessment of the potential ambient air quality improvements that can be attained through a pilot offset study by the end of 2014. It is hoped that the pilot may demonstrate more holistically sustainable improvements in ambient air quality, and in particular, make a contribution towards the PM_{10} challenges in the HPA where Sasol's Secunda facility is located and in which respect there are exceedances of the NAAQS which are not, on the basis of the AIR, attributable to Sasol's activities. Sasol will grow its knowledge of how off-site projects might work from this pilot investigation. Offsets, if clearly defined in scope and properly supported by Regulations providing appropriate incentives for investment, may provide a significant lever to improve ambient air quality. To this end, Sasol commits to engage with the Department and other stakeholders to advance the regulatory implementation of offsets as an alternative compliance mechanism.

7.4 Summary of roadmap to sustainable air quality improvement

In summarising this chapter, Sasol follows a Group-wide risk-based approach to identifying and managing its priority environmental risks. Sasol's environmental policies, targets, standards and guidelines are all then driven as a function of the identified risks with a systematic focus on continuous environmental improvement.

Figure 14 presents a summary of the information contained within the Secunda motivation reports and associated technical appendices, demonstrating the Secunda roadmap to air quality improvement, described by emission source.

A short description is provided for the seven types of air quality improvement actions depicted in Figure 14, which Sasol has adopted in past years, and which Sasol will continue to act on. The labelling below corresponds to the labels included in Figure 14's legend. These actions include:

a) Proactive investments informed by a risk-based approach and aligned with voluntary internal targets. For example:
   - Investments on the VOC roadmap, to reduce emissions of VOCs by 80% by 2020, off a 2009 baseline.

b) The implementation of commitments to the Highveld Priority Area air quality management plan. For example:
   - The construction of a wet sulphuric acid plant on Sasol Secunda's eastern factory.

c) Implementation of solutions to reach compliance with existing or new plant standards, where feasible solutions for compliance have been identified, and where the initial postponement applications were made, to allow for the successful implementation of projects. For example:
   - The construction of 7 regenerative thermal oxidisers to treat VOC emissions from various point and fugitive emission sources.
   - Renewal of steam plant electrostatic precipitators to reach existing plant PM standards under all normal operating conditions.

d) Implementation of solutions driven by MES compliance, which are aligned with NEMA sustainable development principles and which result in point source emission improvements, but which are unlikely to reach the prescribed emission limits set by the MES. For example:
   - Solutions informed by the waste hierarchy either to avoid waste incineration or divert portions of waste streams from incinerators for beneficiation.

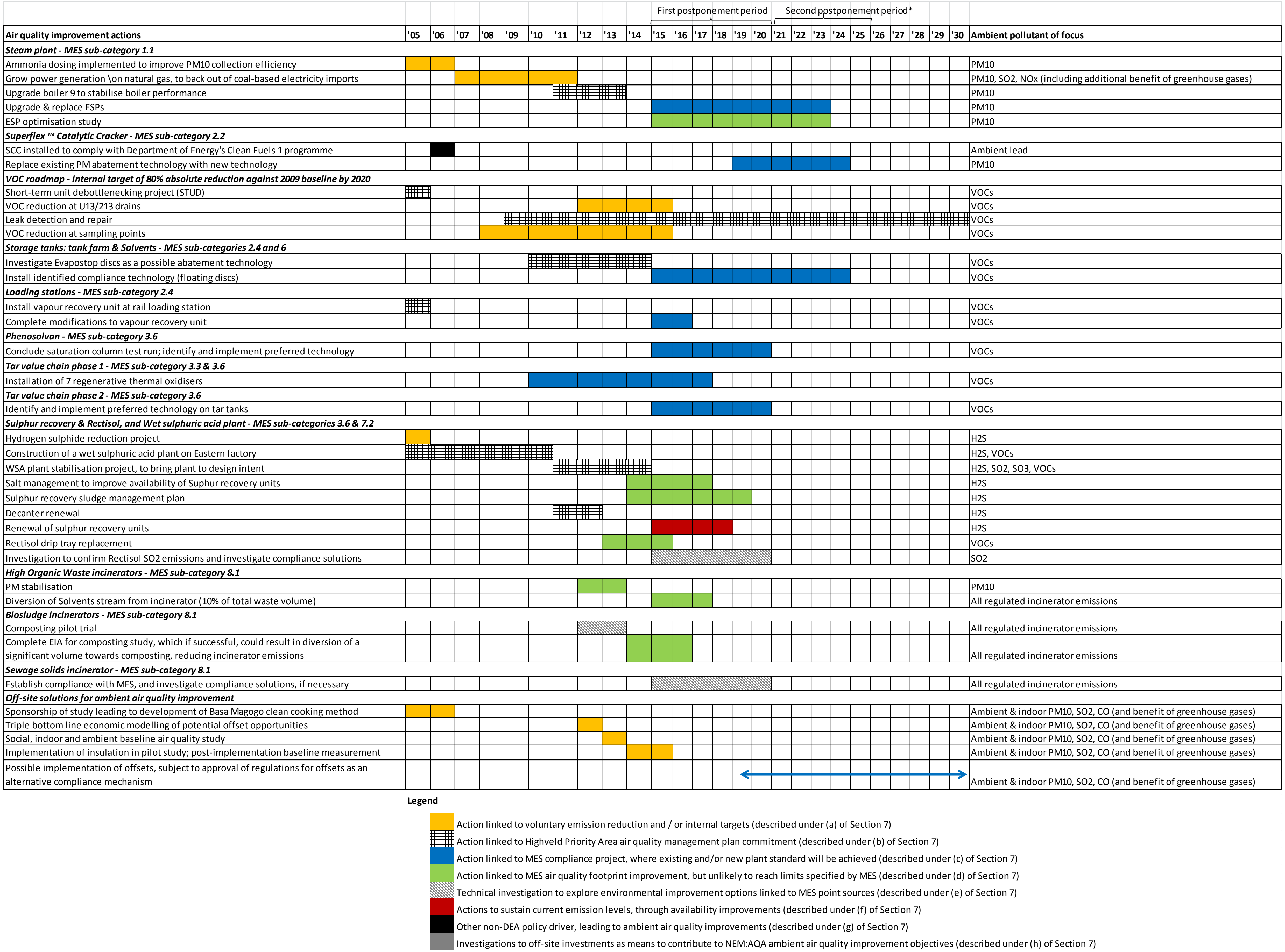
e) Technical investigations driven by MES compliance. For example:
   - Investigations initiated recently due to November 2013 amendments to the MES, for Rectisol SO_2 emissions and the sewage solids incinerator.

f) Implementation of measures which, while not materially reducing mean emission concentrations, serve to manage emission peaks by improving availability. This includes the renewal of the sulphur recovery plant, as part of the renewal roadmap for the Sasol Secunda facility.

g) Compliance with other government policies which either directly or indirectly result in ambient air quality improvements. For example:
   - The Department of Energy's Clean Fuels programme

h) Studies implemented to investigate the feasibility and potential for air quality offsets to deliver sustainable ambient air quality improvements. For example:
   - Sasol's current air quality offset pilot study, investigating the feasibility of RDP house insulation to reduce winter domestic coal burning

Through these actions, Sasol will in most cases comply with the MES, as identified technical solutions are implemented. For a limited number of point sources, while sustainable emission reduction interventions have and will continue to be implemented along the lines summarised above and illustrated in Figure 14, feasible compliance with the new plant standards is not foreseen with presently available technologies. For these limited cases, Sasol’s approach will be to responsibly manage its emissions while striving towards the desired environmental outcome of ambient air quality improvement, by upholding its commitments outlined in Section 7.3.2 (a) - (c).



* Compliance projects with project schedules exceeding April 2020 will require a further postponement of compliance timeframes, for which application will be made closer to 2020

Figure 14: Roadmap to sustainable air quality improvement for the Sasol Secunda complex

7.5 Progress on advancing air quality improvement roadmaps during the application process

The stakeholder engagement process on Sasol Synfuels applications was initiated in September 2013, some 15 months ago. At the same time as, but independently to the postponement application process, work on implementing the air quality improvements outlined above in the roadmap, and the associated technical appendix to this application, has been ongoing, aligned with Sasol's project development and governance process. A high level overview is provided on the progress achieved since the commencement of the process.

- Capital applications were advanced, in accordance with Sasol's project development and governance processes, for the implementation of continuous emissions monitoring at steam plants and incinerators;
- Construction of the first two of seven regenerative thermal oxidiser units of the Tar Value Chain phase 1 project has concluded, and these are presently in the process of being commissioned;
- Idea generation activities have advanced on the Tar Value Chain Phase 2 project;
- Further sampling was done to confirm the influence of the improved efficiency drip trays on VOC abatement at the Rectisol plant;
- Further sampling and analyses were done, and improved opacity meters were installed, to improve definition of the particulate matter emissions at the boilers.
- The project to renew and improve electrostatic precipitator internals has progressed in line with the boiler renewal programme;
- Initiatives to improve stability and reduce downtime at the Wet Sulphuric Acid plant have been ongoing, to sustain reduced H_2S emissions at the Eastern factory;
- A sample point has been designed and funds approved for the CO_2 test run at Phenosolvan, which will commence in January 2015;
- Dynamic modelling of floating disc technology has been done, to further confirm the VOC reduction efficiencies obtained from physical measurements on two storage tanks;
- Following the successful conclusion of a pilot study on composting of waste sludges, primarily biosludge, internal approval was obtained to take this project to scale, subject to the necessary environmental authorisations being obtained. If successfully implemented, this project is anticipated to reduce incineration load (and consequent emissions) and further reduce other wastes to landfill. Both of these reductions are aligned with the intent of the relevant environmental legislation;
- PM_{10} and $PM_{2.5}$ analysers have been ordered, for installation at Sasol's Bosjesspruit ambient monitoring station, which is expected to come online during the first half of 2015.
- In line with Sasol's commitment to implementing offsets within an appropriate regulatory regime, Sasol's pilot offset study was advanced, and detailed analysis of results are under way, to better understand the potential of offsets as a sustainable indoor and ambient air quality improvement intervention, to inform Sasol's inputs to air quality offset policy development

8 Stakeholder engagement

Sasol has structured its public participation process in support of postponement applications along the Environmental Impact Assessment (EIA) Regulations published under the National Environmental Management Act (Act 107 of 1998) (NEMA), as specified in the November 2013 Minimum Emissions Standards (MES) Regulations.

The stakeholder engagement process is an important component of the application process and is closely linked to the technical steps and activities required in the preparation of Motivation Reports (Figure 15).

The initial stakeholder engagement process comprised two rounds of engagement; public meetings that took place during the announcement phase and a second round of public meetings and focus group meetings that took place when the Draft Motivation Reports in support of postponement applications were made available for public comment.

Since the conclusion of the initial stakeholder engagement process in June 2014, the Minister of Environmental Affairs has formally notified Sasol that she will not consider its exemption applications, and has advised that postponement applications should be made instead. Sasol will therefore submit its previous exemption applications as additional postponement applications. While the additional applications contain materially the same content as the original exemption applications, a further opportunity will be provided to stakeholders to comment on these as additional postponement applications.

The final postponement applications that have not been affected by the Minister's notification were submitted to the National Air Quality Officer (NAQO) for decision-making in September 2014. Stakeholders were notified that their comments on final postponement applications could be submitted directly to the NAQO.

A copy of the Stakeholder Engagement Report is attached in Annexure D.

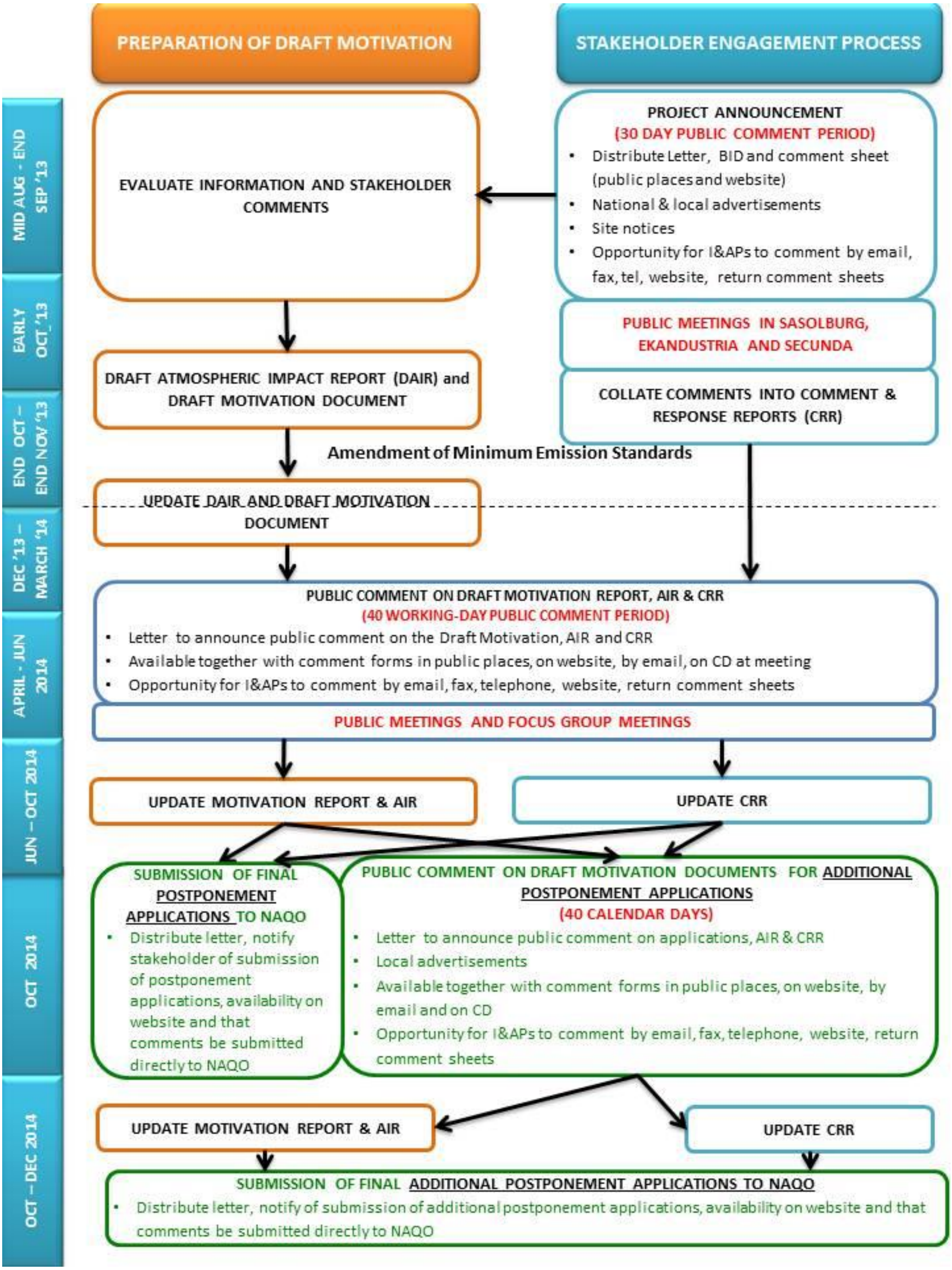


Figure 15: Technical and Stakeholder Engagement Process

8.1 Project announcement

Sasol's application process was announced between **15 September 2013 and 15 October 2013.** Stakeholders were invited to separate public meetings which were held from 7 – 10 October 2013 for the different Sasol operations. The public meeting for the Secunda operation took place on Thursday, 10 October 2013, 13:00 – 15:00, at the eMbhalenhle Community Hall in Secunda. Stakeholders received notification of public meetings and were invited to participate in the process as follows:

- A letter of invitation was sent to stakeholders to invite them to the public meetings and register as stakeholders.
- The invitation letter was accompanied by a Background Information Document (BID), providing more information on Sasol's operations and a Comment Form for stakeholders to submit their comments.
- Advertisements were placed in national and local newspapers to announce Sasol's application process.
- The BID, invitation letter and comment forms were made available in public places and on the SRK website www.srk.co.za.
- Telephonic and sms notification were made to stakeholders to inform and remind them of public meetings and opportunities to comment.

Key issues and comments raised by stakeholders

The key comments, concerns and suggestions raised by stakeholders during announcement are summarised as follows. For a comprehensive record of stakeholder comments, please refer to Annexure E.

- **Comments relating to Sasol's application process** - Stakeholders' comments focused on Sasol's reasons for applying for postponements, legal requirements, timeframe for compliance and requests for details regarding which plants and processes require exemption.
- **Stakeholder engagement** - It was noted that the Background Information Document (BID) did not provide sufficient information for meaningful stakeholder comment. Stakeholders commented on the poor attendance of stakeholders at the public meetings and suggestions were made for more convenient venues and times for public meetings, as well as an extended stakeholder comment period.
- **Environmental concerns** - Stakeholders expressed concern regarding Sasol's air quality emissions and its actual contribution to air pollution in the area. Other environmental concerns raised were the impact of Sasol's emissions on water quality, health and socio-economic factors such as Sasol's obligation to re-invest in communities in their area of operation and to empower communities to care for the environment.
- Stakeholders asked how compliance to the MES will impact acid rain in the area, bee farming and dust generation on cattle grazing and cattle health. Information was requested on how these impacts will be mitigated.

8.2 Public comment on the Draft Motivation Report

Due to the fact that the public meetings held during the first round of stakeholder engagement was poorly attended, despite reasonable efforts, it was proposed to hold focus group meetings with key stakeholders, in addition to public meetings during the second round of engagement to encourage greater stakeholder participation in Sasol's application process.

The public meeting for the Secunda operation took place on Thursday, 22 May 2014, 13:00 – 15:00, at the Kruik Conference Centre in Secunda. Stakeholders received notification of public meetings and were invited to comment on the Draft Motivation Report during the comment period from **15 April to 13 June 2014**, as follows:

- Distribution by email and mail, of an invitation letter to attend public meetings, accompanied by a Comment Form in English. These documents were available in, Afrikaans and isiZulu upon request.
- Posting the letter, Comment Form and Draft Motivation Reports on the SRK website (www.srk.co.za).
- Placing the letter, Comment Form and the Draft Motivation Reports in publicly accessible venues close to the Secunda operation, as during the announcement phase.
- Advertisements in two national newspapers to announce the availability of the Draft Motivation Report for public comment:
  - Sunday Times (English), Sunday 30 March 2014; and
  - Beeld (Afrikaans), Tuesday 1 April 2014.
- Advertisements in local newspapers:
  - Ridge Times (English and Afrikaans), Wednesday 2 April 2014; and
  - Ekasi (Zulu), Friday 15 April 2014).
- Telephonic and SMS notifications were sent to stakeholders to notify them of opportunities to comment.

Focus group meeting with the South African Communist Party

A follow-up focus group meeting was held with the South African Communist Party on their request. This meeting took place on 21 May 2014 at the Sasol Fundu Park Conference Room in Secunda. Comments made at this meeting are included in the CRR for the Secunda operation.

Focus group meeting with key stakeholders

A focus group meeting was held with key stakeholders, such as NGOs, environmental and conservation groups and organised sectors of society (business and labour, organised civil society groups and community based organisations) on 23 May 2014, at the Hacklebrooke Conference Centre in Johannesburg. All comments made at this meeting have been included in the CRRs of all Sasol operations.

Key issues and comments raised by stakeholders

The key issues, comments and concerns raised by stakeholders during the comment period on the draft Motivation Reports are summarised below. For a comprehensive record of stakeholder comments, please refer to Annexure E.

- **Application process** - Stakeholders questioned the legal basis of Sasol's applications since the Highveld priority area in which Sasol operates is located is in non-compliance with ambient air quality standards. Stakeholders questioned why Sasol has not investigated solutions to compliance timeously and were of the opinion that Sasol had sufficient time since 2010 to find solutions for compliance to the MES, so as not to ask for postponements or exemptions.
- **Environmental concerns** – Questions were raised regarding the meaning of technical terms used in the presentation such as ceiling limits and average emissions. Concern was also expressed regarding PM_{10} emissions that remain high in the area of Sasol's operation even when domestic coal burning emissions have reduced after winter. Stakeholders felt that Sasol was shifting the blame for non-compliance with ambient air quality standards to communities.

  It was noted that Sasol should give priority to environmental health before profits. Stakeholders stressed that residents in Secunda, especially children, suffer from respiratory diseases as a result of Sasol's operations. Some stakeholders were of the opinion that if ceiling limits are raised, it negatively affects resident's health.

Some stakeholders were of the opinion that postponements from the MES should not be granted for Sasol operations as there was no legal basis for their application. In addition that Sasol has not addressed the adverse health impacts of their operations, or cumulative impacts. Applications have not been submitted within the appropriate time of compliance date and no postponement should be allowed for hazardous air pollutants, such as PM and other hazardous emissions.

- **Stakeholder engagement** – Stakeholders noted that the information given in the presentations was too technical for the general public to understand fully and said that more effort should have been put in to explain complex terms to stakeholders in general and to surrounding communities through capacity building initiatives. In addition, that the 40 day comment period was not sufficient to comment on reports and consult with specialists.

  Questions were raised as to how stakeholders were to provide comment on reports when it is stated in the draft motivation reports that it was a criminal offence to publish any part of the document without written consent of the author.

8.3 Way forward on application process

Stakeholders were informed in writing (email, fax, post) that the Minister of Environmental Affairs formally notified Sasol that she would not consider its exemption applications, and advised that postponement applications should be made instead. In line with the Minister's notification, Sasol submitted the following to the NAQO for decision-making:

- final postponement applications that have not been affected by the Ministers' notification; and
- previous exemption applications as additional postponement applications.

8.4 Notification of public comment on draft Motivation Reports in support of additional postponement applications

Stakeholders were notified in writing (mail, email, fax) and advertisements in local newspapers of the availability of draft Motivation Reports in support of additional postponement applications for public comment for a period of forty (40) days. The applications were available on the SRK website http://www.srk.co.za/en/za-sasol-postponements, for viewing in public places, and on request from the stakeholder engagement office.

8.5 Notification of submission of final additional postponement applications

Stakeholders were notified in writing (mail, email and fax) that the final postponement applications have been submitted to the NAQO for decision-making and that comments on the reports can be submitted directly to the NAQO within 21 days. Final Motivation Reports in support of additional postponements will be made available electronically for stakeholder's information, on the SRK website (http://www.srk.co.za/en/za-sasol-postponements) or on request from the stakeholder engagement office.

8.6 Comment and Response Report

All comments, concerns, questions and suggestions raised for the Secunda operation during the stakeholder engagement process, including comments during public meetings and written comments received from stakeholders were recorded in the Comment and Response Report (CRR). The CRR provides a consolidated record of stakeholder comments, as well as responses from the SRK, Airshed and the Sasol project team members. The CRR is attached as Annexure E.

9 Conclusions

Sasol operates large complex industrial facilities in Sasolburg and Secunda both of which generate atmospheric emissions due to the nature of the activities. The publication in 2010 and the subsequent amendment in 2013 of Minimum Emissions Standards (MES) has meant that Sasol is obliged to reduce many of its emissions to comply with the MES requirements. The Sasol Synfuels plant at Secunda in Mpumalanga, is complex. The plant converts coal into liquid fuels and chemicals; a process known as coal to liquids or CTL. The CTL process requires that the coal be gasified, where after the carbon in the gas stream is combined with hydrogen to form the hydrocarbon chains that are the basic building blocks of the liquid fuels and the chemical products produced. The Fischer-Tropsch (FT) process which is employed uses a catalyst that is easily poisoned by impurities in the gas stream, most notably sulphur. It is essential that the sulphur be removed from the raw gas stream prior to the gas entering the FT reactor.

Sasol has over the years developed ways of turning these process impurities into commercial products that can be sold on to a variety of customers, as described in this report. The net effect is an industrial process that has multiple product streams all of which are highly dependent on one another, with similarly highly integrated utilities, most especially heat and steam. The Sasol Synfuels complex is not a disparate grouping of various industrial processes and activities but is one integrated system. The MES apply to the Sasol Synfuels industrial process in a discrete way. Individual MES categories apply to different activities at Sasol Synfuels and require compliance at individual components of the process without recognising the complexity of the CTL process.

The highly integrated nature of the industrial process both in terms of product and utility streams means that emissions abatement requires a thorough understanding of the up-stream and down-stream effects of the abatement option in question. Sasol has investigated a wide range of possible abatement options but for some of the MES compliance can either not be achieved or would present significant (and unacceptable) industrial process risks to the Sasol Synfuels process, with presently available technologies. Sasol Synfuels has provided a range of reasons as to why it requires these additional postponements that mostly stem from the integrated nature of the plant but include financial implications, industrial process compatibility, technology limitations, other unintended environmental impacts and the specific challenges inherent in modifying a brownfields operation.

Sasol Synfuels seeks in terms of this additional postponement application to operate in terms of limits that are reasonable, achievable and most importantly provide a benefit in air quality improvement which is commensurate to the costs of compliance. Sasol Synfuels has accordingly proposed alternative emissions limits to which it could be held and which would underpin its AEL during the period of postponement. Sasol Synfuels furthermore commits to conducting periodic technology scans to identify reasonable measures to reduce emissions that may emerge over time.

Since the administrative basis of the MES are ceiling limits, or maximum emission concentrations, Sasol's proposed alternative emissions limits are aligned with this approach. Maximum emission concentrations are, by definition, higher than reported average baseline emission concentrations, but this does not mean that Sasol is applying for any increases in its current atmospheric emissions.

Sasol Synfuels has assessed the ambient air quality implications of the alternative emissions limits or other emissions management controls that it has proposed, conducted by an independent third party and published as an AIR.

Key findings of the AIR include that there is compliance with the NAAQS at all of the ambient air quality monitoring stations operated by Sasol, except in the case of PM_{10} where non-compliance is evident. Work done elsewhere indicates that non-compliance with the PM_{10} NAAQS is largely a function of low level emissions from multiple sources across the Highveld, most notably domestic fuel use, rather than industrial emissions. Predicted ambient concentrations from the different emission scenarios (including current emissions, compliance with the MES and the requested limits), are all in compliance with the NAAQS, as shown in Table 10. In many instances the reductions in ambient concentrations brought about by moving from current emissions to the MES are small and even negligible. In the case of the incinerator emissions where there are low loads (but concentrations that exceed the defined MES) the resultant predicted concentrations are negligible.

Sasol is committed to supporting government in efforts to manage, and where required, reduce atmospheric emissions in the priority areas where its major operations are located. Compliance with the MES is a priority, and where this can be achieved through feasible technologies, identified solutions will be implemented. Where short to medium term compliance is not feasible, Sasol believes that its roadmap to sustainable air quality improvement will ensure that Sasol's emissions are responsibly managed and practicably minimised, in a manner aligned with the intent of the Constitution, the NEM:AQA and the NAQF. The possibility of offsets where more meaningful sustainable development benefits in terms of improved air quality and corresponding improvements in health and socio-economic outcomes may potentially be achieved is an area of interest that Sasol would like to fully explore.

Table 10: Concluding summary of Sasol Synfuels' compliance with the MES and compliance in the vicinity of the Sasol Secunda complex with the NAAQS

MES Category	Substance(s)	Emission limits or special arrangements*		Compliance with NAAQS** or international health screening levels	Applicable Sasol Synfuels Activities
		New plant standards	Existing plant standards		
Category 1: Sub-category 1.1	PM	50	100	Daily standards exceeded	Steam plant
	SO_2	500	3500		
	NOx	750	1100		
Category 1: Sub-category 1.4	PM	10	10	Daily standards exceeded	Gas turbines
	SO_2	400	500		
	NOx	50	300		
Category 2: Sub-category 2.2	PM	100	120	Daily standards exceeded	Superflex Catalytic Cracker ™
	SO_2	400	550		
	NOx	1 500	3 000		
Category 2: Sub-category 2.4	TVOC	Type 3 storage vessels shall be of the following type: a) External floating-roof tank with primary rim seal and secondary rim seal for tank with a diameter greater than 20m, or b) fixed-roof tank with internal floating deck/roof fitted with primary seal, or c) Fixed roof tank with vapour recovery system			Tank farm
	TVOC	All installations with a throughput of greater than $50,000m^3$ per annum of products with a vapour pressure greater than 14 kPa, must be fitted with vapour recovery or vapour destruction units. Emission limits for vapour recovery/destruction using non-thermal treatment: Existing plant standard: 40 000 New plant standard: 40 000			Loading stations
Category 3: Sub-category 3.6	H_2S	3 500	4 200		Rectisol and Sulphur Recovery Plants
	TVOC	130	250		
	SO_2	500	3 500		
Category 3: Sub-category 3.6	H_2S	3 500	4 200		Pheno-solvan
	TVOC	130	250		
	SO_2	500	3 500		
Category 3: Sub-category 3.3 Sub-category 3.6	H_2S	3 500	4 200		Sources in Tar Value Chain – Phase 1
	TVOC	130	250		
	SO_2	500	3 500		
Category 3: Sub-category 3.3	H_2S	3 500	4 200		Sources in Tar Value Chain – Phase 2
	TVOC	130	250		
	SO_2	500	3 500		
Category 6	TVOC	Type 3 storage vessels shall be of the following type: a) External floating-roof tank with primary rim seal and secondary rim seal for tank with a diameter greater than 20m, or b) fixed-roof tank with internal floating deck/roof fitted with primary seal, or c) Fixed roof tank with vapour recovery system			Storage tanks (Sasol Solvents)

MES Category	Substance(s)	Emission limits or special arrangements*		Compliance with NAAQS** or international health screening levels	Applicable Sasol Synfuels Activities
		New plant standards	Existing plant standards		
Category 7: Sub-category 7.2	Total Fluoride	5	30		Wet Sulphuric Acid Plant
	HCl (primary)	15	25		
	HCl (secondary)	30	100		
	SO_2	350	2800		
	SO_3	25	100		
	NOx	350	2000		
Category 8: Sub-category 8.1	PM	10	25	Daily standards exceeded	HOW incinerators
	CO	50	75		
	SO_2	50	50		
	NOx	200	200		
	HCl	10	10		
	HF	1	1		
	Sum of Lead, arsenic, antimony, chromium, cobalt, copper, manganese, nickel, vanadium	0.5	0.5		
	Mercury	0.05	0.05		
	Cd + Tl	0.05	0.05		
	TOC	10	10		
	Ammonia	10	10		
	Dioxins and furans	0.1	0.1		
	n/a	Exit gas temperatures must be maintained below 200ºC		n/a	
Category 8: Sub-category 8.1	PM	10	25	Daily standards exceeded	Biosludge Incinerators
	CO	50	75		
	SO_2	50	50		
	NOx	200	200		
	HCl	10	10		
	HF	1	1		
	Sum of Lead, arsenic, antimony, chromium, cobalt, copper, manganese, nickel, vanadium	0.5	0.5		
	Mercury	0.05	0.05		
	Cd + Tl	0.05	0.05		

MES Category	Substance(s)	Emission limits or special arrangements*		Compliance with NAAQS** or international health screening levels	Applicable Sasol Synfuels Activities
		New plant standards	Existing plant standards		
	TOC	10	10		
	Ammonia	10	10		
	Dioxins and furans	0.1	0.1		
Category 8: Sub-category 8.1	PM	10	25	Daily standards exceeded	Sewage solids incinerator
	CO	50	75		
	SO_2	50	50		
	NOx	200	200		
	HCl	10	10		
	HF	1	1		
	Sum of Lead, arsenic, antimony, chromium, cobalt, copper, manganese, nickel, vanadium	0.5	0.5		
	Mercury	0.05	0.05		
	Cd + Tl	0.05	0.05		
	TOC	10	10		
	Ammonia	10	10		
	Dioxins and furans	0.1	0.1		
	n/a	Exit gas temperatures must be maintained below 200ºC		n/a	

In the case of emission limits, these are specified as mg/Nm^3 under normal conditions of 273 Kelvin and 101.3 kPa, at respective O_2 reference conditions for each listed activity as specified in the MES; ng I-TEQ/Nm^3 in the case of dioxins and furans

***Reflects compliance of ambient air quality with the NAAQS (for hourly, daily and annual standards as applicable for each given pollutant), or predicted model compliance with health benchmarks, where no NAAQS are specified*

Colour coding:

Blue	2020 standard for which no feasible technology is presently available to attain compliance and for which Sasol continues to seek reasonable measures for longer-term certainty
Red	Additional postponements requested, on compliance timeframes for the prescribed emission limit or special arrangement
Orange	Initial postponement of compliance timeframes for the prescribed emission limit or special arrangement
Green	Will comply with the prescribed emission limit or special arrangement within the prescribed compliance timeframes
White	Compliance status to be determined (refer to initial postponement application for an explanation)

Annexures

Annexure A: Atmospheric Impact Report

(Identical to the AIR submitted as part of the Final Initial Postponements)

Annexure B: Peer Review Report on the approach to the Atmospheric Impact Report

(Identical to the Peer Review submitted as part of the Final Initial Postponements)

Annexure C: Toxicological Review for Hydrogen Sulphide

Annexure D: Volume 1 - Stakeholder Engagement Report

Annexure E: Volume 2 - Comments and Response Report

Annexure F: Further Technical Information in support of the additional postponement application