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

Report Prepared by

National Petroleum Refiners of South Africa (Pty) Limited

natref

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National Petroleum Refiners of South Africa (Pty) Limited

Jan Haak Road
Sasolburg
1947

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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 National Petroleum Refiners of South Africa (Proprietary) Limited (Natref) that are unlikely to comply for key reasons. A copy of the exemption application was also provided to the National Air Quality Officer (NAQO).

After the conclusion of the stakeholder engagement process, Natref 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 final postponement applications submitted by Natref 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, Natref conducted a further notice and comment process. All comments received during 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 three respects. First, based on the stakeholder comments received during the public participation process, Natref has updated some aspects of the applications. Secondly, Natref has updated this report’s Chapter 7, now entitled “Natref’s roadmap to sustainable air quality improvement”. This is done to consolidate information presented throughout this application to emphasise Natref’s actions toward sustainable air quality improvement, aligned with the intent of the NEM:AQA and the MES, including Natref’s commitment to the ongoing investigation of and, where feasible, implementation of sustainable compliance solutions. In respect of these initial postponements, Natref is able to achieve compliance within a 5-10 year period. Lastly, the stakeholder engagement chapter reflects the further commenting period linked to this application.

Natref 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 Natref 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 Natref’s independent consultants, and are based on the information and technologies currently available to Natref. Natref 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 Natref 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 controls 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 NAQO 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.

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

Progress on advancing air quality improvement roadmaps during the past year

The stakeholder engagement process on Natref's applications was initiated in September 2013, some 15 months ago. As discussed in Section 7.4, 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 Natref's project development and governance process. A high level overview is provided on the progress achieved in these 15 months.

- Capital applications and procurement processes, in line with Natref's project development and governance process, were advanced for the implementation of emissions monitoring infrastructure on eleven (11) points of compliance for boilers and furnace associated with the refinery's main stack as per the 2013 MES definition for "point of compliance";
- Installation was completed for six (6) new emission sampling points on the refinery local stacks, which were not part of the postponement applications. Subsequently emission surveys were performed on these stacks in October 2014 which re-confirmed that the SOx, NOx and PM are in compliance with both existing and new plant standards;
- The Front End Engineering Design development and governance process was progressed for the installation of particulate matter abatement technology on the Fluid Catalytic Cracking unit;

- The tender process was completed as part of the Front End Engineering Design for a new Sulphur Recovery Unit to reduce SOx emissions and meet MES requirements regarding efficiency and availability specifications;
- Preliminary engineering studies were initiated in accordance with 2013 MES standards to explore the viability of implementing alternative disposal technologies for waste gas streams currently routed to the vacuum off-gas furnace.

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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 - means 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 – Natref 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 presently infeasible based on, amongst others, technology, brownfields, environmental and economic constraints. Since the conclusion of the stakeholder engagement process, Natref 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 Natref based on what is considered reasonable and achievable as a consequence of the assessments conducted and which Natref proposes as an alternative standard to be incorporated as a licence condition with which it must comply during the period of postponement. The alternative emissions 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 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.

"Bubble" cap for SO_2 emissions –allowable SO_2 emissions from a refinery shall be calculated as the sum of SO_2 emissions from refinery Combustion Installations and Catalytic Cracking Units expressed in units of kg per ton [of crude oil throughput].

Bunker fuel oil – a grade of fuel oil suitable for powering ships (see also definition for fuel oil).

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, Natref 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 Natref 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 environmental 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 ($PM_{2.5}$), 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.

Fuel oil – a collective term to describe numerous grades of fuel oils, including, amongst others, refinery fuel oil, bunker fuel oil, etc.

Initial postponement applications – Consequent upon the first round of public participation which took place in September 2013, Natref'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 Natref'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.

Natref – National Petroleum Refiners of South Africa (Proprietary) Limited, a joint venture between Sasol Oil (Pty) Ltd (63.64%) and Total South Africa (Pty) Ltd (36.36%).

Special arrangements –specific compliance requirements associated with a listed activity's prescribed emissions limits in Part 3 of GN 893 of NEM:AQA. 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

BAT - Best Available Techniques

CONCAWE – Conservation of Clean Air and Water in Europe (oil companies' European association for environment, health and safety in refining and distribution)

BID - Background Information Document

BREF - Best Available Techniques Reference documents

CRR - Comment and Response Report

CO_2 – Carbon dioxide

EET – Emissions Estimation Technique

ESP – Electrostatic Precipitator

FCC - Fluidized Catalytic Cracker

FGD - Flue-gas desulphurisation

FSS - Fourth Stage Separators

I&APs - Interested and Affected Parties

LDAR – Leak Detection and Repair

NAAQS - National Ambient Air Quality Standards

NAQF – National Framework for Air Quality Management

NAQO - National Air Quality Officer

NEMA - National Environmental Management Act (Act 107 of 1998)

NEM:AQA - National Environmental Management: Air Quality Act (Act 39 of 2004)

NO_x – Oxides of nitrogen

NO_2 – Nitrogen dioxide

MES - Minimum Emissions Standards

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

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

PM – Total particulate matter that is a solid contained in a gas stream

ppm – parts per million (10^{-6})

ppb – parts per billion (10^{-9})

RCD - Residual Crude Desulphurisation

SO_2 - Sulphur dioxide

SRU – Sulphur Recovery Unit

SWS – Sour Water Stripper

TSS -Third Stage Separators

VOCs or TVOCs – (Total) Volatile Organic Compounds

VTAPA – Vaal Triangle Air-shed Priority Area

1 Introduction

National Petroleum Refiners of South Africa (Proprietary) Limited (Natref) operates the only inland crude oil refinery in South Africa, and employs approximately 600 permanent staff. The refinery is located in Sasolburg in the Northern Free State, and is operated on behalf of two shareholders, Sasol Oil (Pty) Ltd (63.64%) and Total South Africa (Pty) Ltd (36.36%).

In March 2010, the Department of Environmental Affairs (DEA) published Minimum Emissions Standards (MES), in terms of the National Environmental Management: Air Quality Act (NEM:AQA). In November 2013, the Regulations within which the MES were contained, were repealed and replaced by GN 893, 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 Natref.

It is Natref'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, Natref will not be able to comply with the MES for certain emissions either within the MES timeframes or for the foreseeable future.. Natref is therefore applying for additional postponements for certain emission sources. As part of this application, Natref 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 Natref.
- 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 Natref's responses.

This motivation report is accordingly structured to present more detailed information on Natref and activities at the refinery. Thereafter, the MES are presented in general, together with the specific regulatory requirements for listed activities at Natref before the reasons motivating the request for additional postponements 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. Finally, the motivation report is concluded by summarising 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 Natref

2.1 Overview

Natref is the only inland crude oil refinery in South Africa and is located in Sasolburg, in the Northern Free State. Natref is owned by two shareholders, being Sasol Oil (Pty) Ltd (63.64%) and Total South Africa (Pty) Ltd (36.36%). The refinery was founded in 1968 and commissioned in 1971. Natref employs more than 600 permanent employees in Sasolburg and 80 employees at its Durban product storage facility, Natcos. The refinery is situated in the Metsimaholo Local Municipality which is part of the Fezile Dabi District Municipality. Because the refinery is inland, approximately ±600 km from the crude oil vessel offloading facilities in Durban, imported crude oil has to be pumped from Durban to the Natref facility via a pipeline.

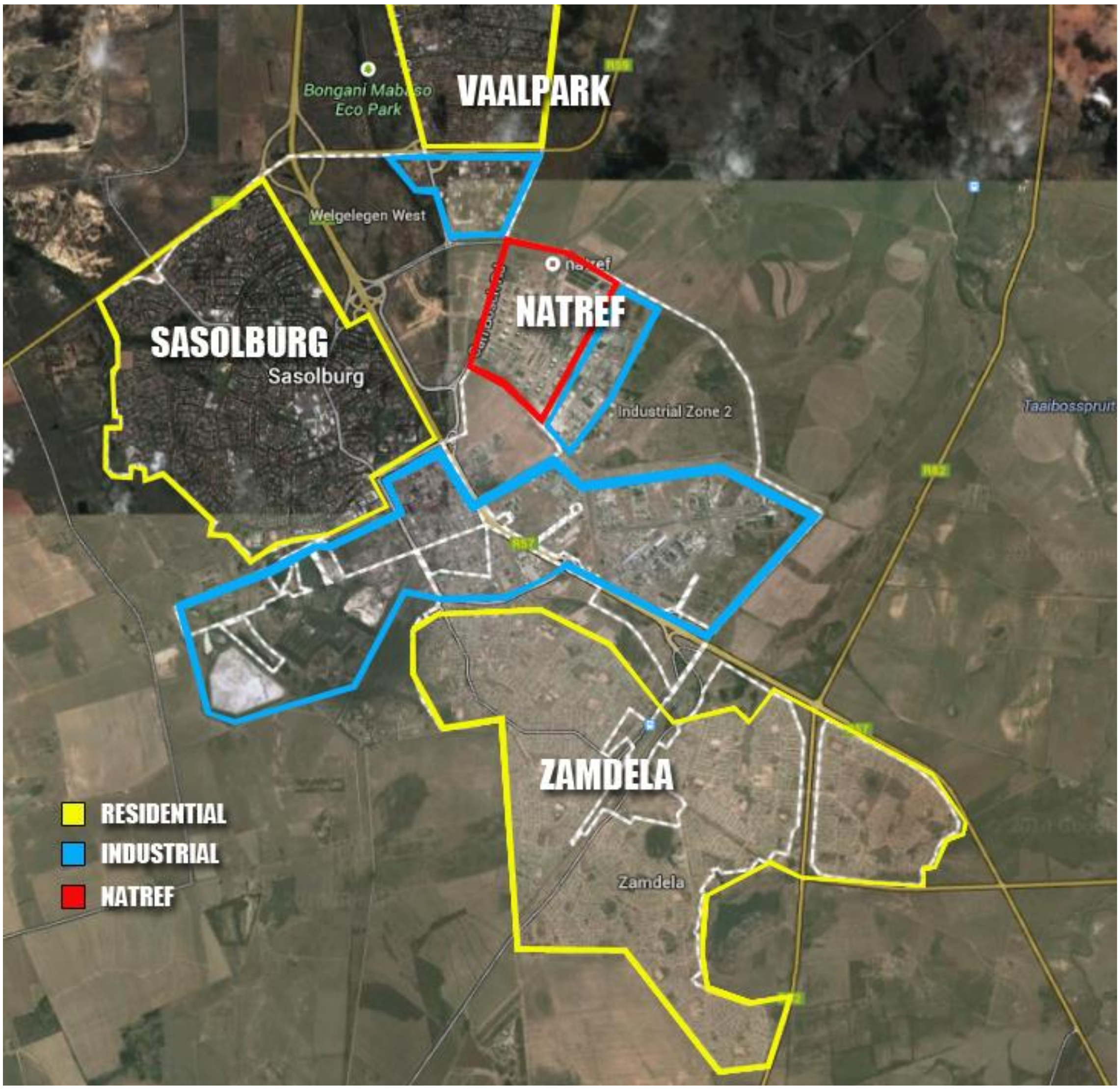

Figure 1: Map showing the position of the Natref refinery, located in the Northern Free State

The total refining capacity of South Africa's refineries is approximately 35 million tons per year. Natref's capacity is 5.4 million tons per year (±15% of the total). Due to its geographical location, refined fuel products from Natref are sold to the inland market (predominantly Gauteng and the Free State). Natref's business model is storing and refining crude oil to produce refined products, and blending of these products with additives, to produce marketable products conforming with fuel specifications, as illustrated in Figure 2. Crude oil is procured by Sasol Oil and Total South Africa. Through a joint venture, Natref co-owns the Natcos crude oil storage facility in Durban (the Natcos "Tankfarm"), which maintains Natref's crude oil stocks to ensure a reliable feed to the refinery, via a Transnet pipeline. At the refinery, crude oil is refined and the main products produced are petrol, diesel, jet fuel, bitumen and fuel oil. The refined product is then blended with Sasol's or Total's special additives, and is marketed by those two companies to their customers, via three logistics outlets – 65% via pipeline; 30% via road; and the remaining 5% by rail.

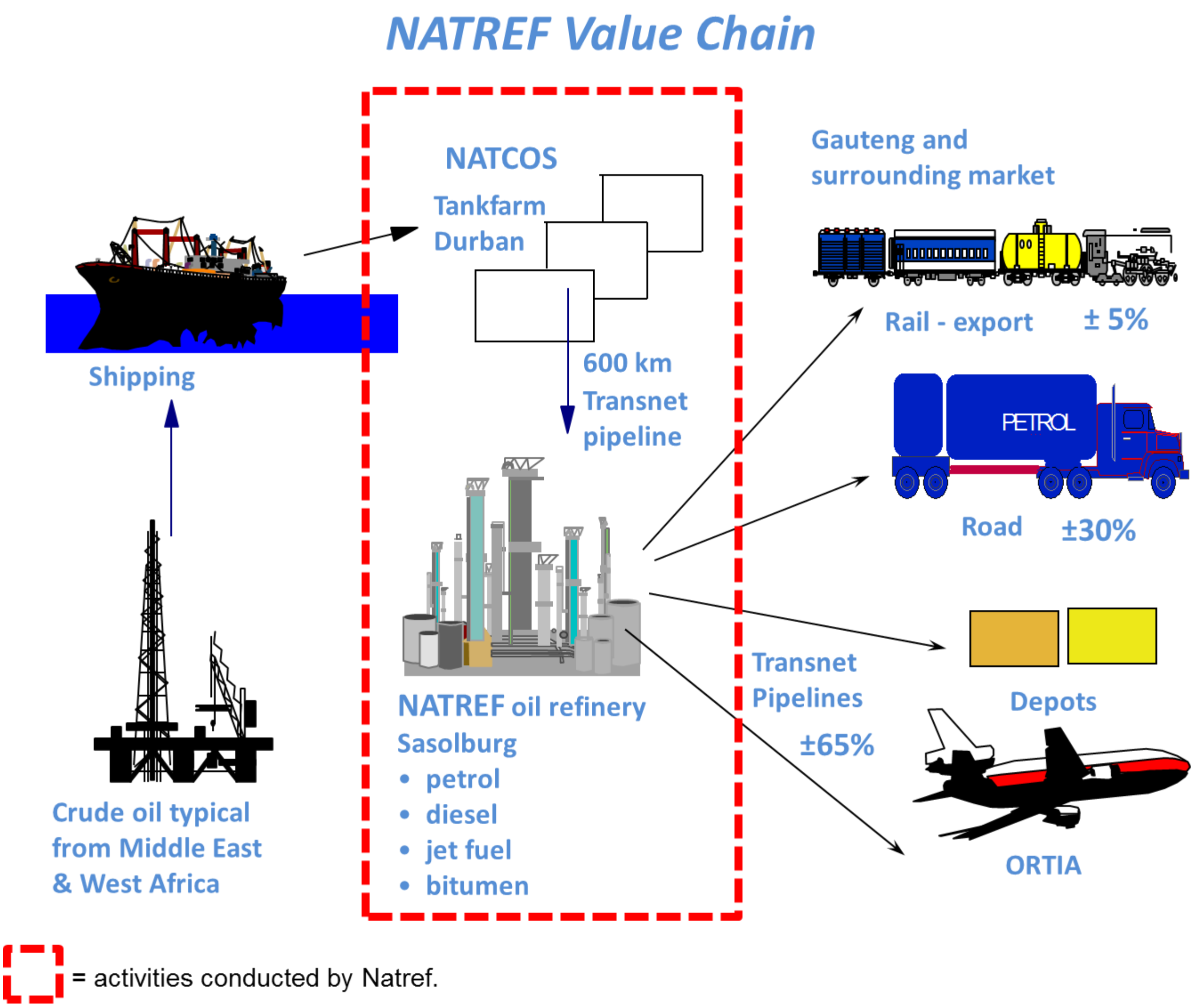

Figure 2: Natref's activities in the liquid fuel value chain

2.2 The activities of South Africa's only inland crude oil refinery

Natref is significantly more complex than conventional refineries, which is necessitated by its inland location. There are four key ways in which Natref differs from the typical refinery, described below. The production processes undertaken at Natref are illustrated schematically in Figure 3.

2.2.1 Natref upgrades 98% of its crude oil into finished products for the inland market

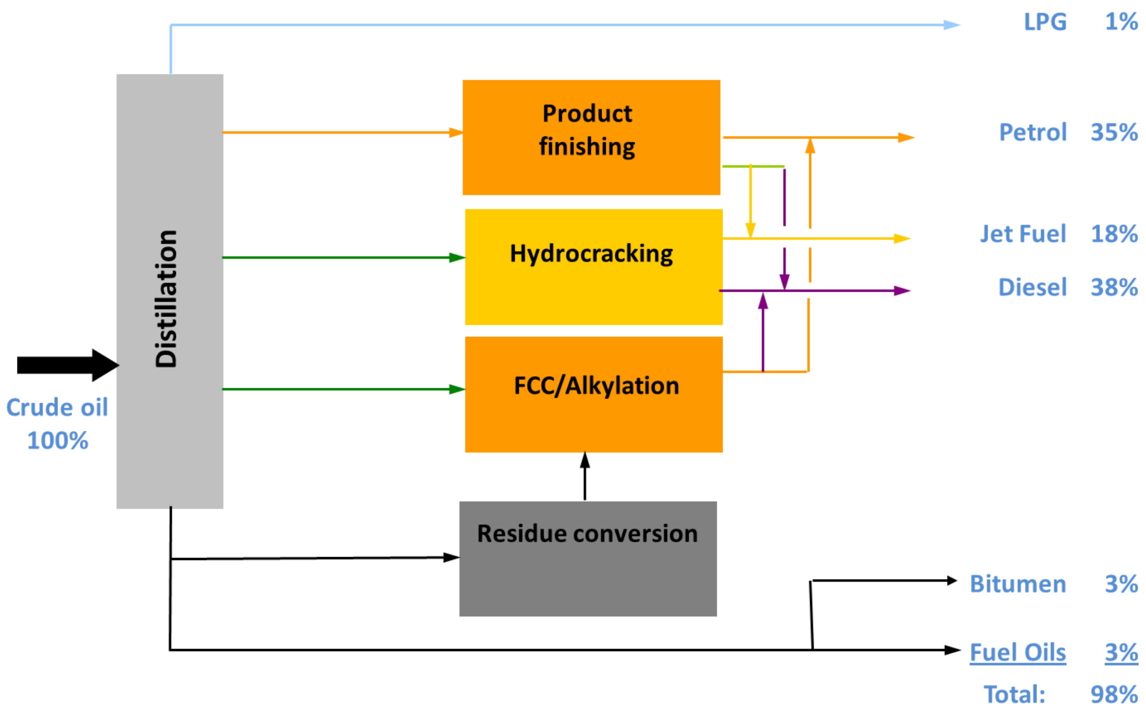

Figure 3: Natref is a complex refinery, including a combination of a fluidised catalytic cracker (FCC), residual crude desulphurisation unit (RCD) and a hydrocracker (DHC)

Most refineries only have Distillation and Product Finishing processes, whereas Natref includes a Fluid Catalytic Cracker (FCC) in combination with a residual crude desulphurisation unit (RCD) and a Distillate Hydrocracker (DHC). As a result of these additional activities, the Natref refinery sees very high product recovery with some 98% (by volume) crude oil being converted into finished products, 92% of which constitutes petrol, diesel and jet fuel, 3% being bitumen and only 3% being fuel oil.

Typical refineries only convert 65 – 70% (by volume) to petrol, diesel, jet fuel and bitumen products, and produce larger percentages of fuel oil from the 'heavy bottom' components in the crude oil. Fuel oil is typically poor quality and has a high sulphur content. Conventional refineries are able to sell large amounts of this fuel oil to ships as bunker fuel oil. Given that Natref does not have easy access to the bunker fuel oil market (because it is inland) the refinery process is geared towards minimising the quantities of residual fuel oil and concomitantly producing a larger proportion of other fuel products from the crude than a typical refinery.

It is specifically the inclusion of the RCD, FCC and hydrocracker at Natref that allows this additional product recovery. The RCD, FCC and hydrocracker allow Natref to 'crack' (cracking is the process whereby complex heavy hydrocarbons are broken down into simpler, light hydrocarbon molecules) and thereby convert a high proportion of the heavy bottom components into petrol, diesel, jet fuel and liquid petroleum gas or LPG. Whereas typical refineries can leave much of the sulphur content of their crude oil in the fuel oil component, Natref must manage proportionally more sulphur because of the higher product recovery.

Presently, the Natref process reduces sulphur content in its petrol and diesel by 85 to 90%. Some 97% of the sulphur removed from petrol and diesel is recovered and supplied to the market as chemical sulphur feedstock, with the remaining 3% being emitted to atmosphere as sulphur dioxide (SO_2). The process of removing the sulphur means that vehicle tail pipe emissions contain relatively little sulphur, with associated positive implications for urban air quality. The Department of Energy has promulgated new specifications for fuel products produced at all South African refineries (Clean Fuels II specifications), and once implemented, sulphur in petrol and diesel streams will be reduced by more than 98%, through the installation of additional desulphurisation capacity at the refinery.

Refinery complexity is objectively assessed through an independent scoring metric which can be applied to any refinery globally and compares the relative refining configuration apart from throughput capacity. In terms of this metric, Natref's complexity is classed as above average for the Asia Pacific region and in a South African context is considered the most complex refinery in the country, with the most recent scoring results from 2012 indicated that the Natref refinery is on average 20% more complex. The process units and associated infrastructure required for future mandatory compliance projects, most notably the Clean Fuels II project, will further increase the Natref complexity factor by another 16% - 20%. At that stage, it will then be ranked as part of the most complex refinery configurations globally.

2.2.2 Natref is constrained without an inland fuel oil market, and must burn a minimum quantity internally

Despite the fact that Natref produces significantly less fuel oil than conventional refineries, there is only a limited market for the fuel oil that is produced at the refinery. Natref therefore uses the balance of the fuel oil internally as a fuel source to harness the energy component of this fuel. It should be noted that the use of fuel oil by ships (in the form of bunker fuel oil) means that the sulphur emissions associated with the use of the bunker fuel oil occur at sea. In the case of Natref, of necessity, those emissions occur at the refinery itself.

2.2.3 The design intent of Natref is to process higher sulphur crudes

Crude oil with a sulphur content of less than 1% (by mass) is referred to as low sulphur crude while that with sulphur content of more than 1% is referred to as high sulphur crude. Natref is well suited to process higher sulphur crudes, due to the installation of the complex RCD, FCC and hydrocracking processes, which were installed to upgrade heavy bottom distillation fractions to white products. Despite the capability of processing higher sulphur crudes, Natref has chosen to steadily decrease high sulphur crude in its crude mix, reducing the sulphur content of the feed from more than 1.2% in 2007 to less than 1% in 2012. The process of reducing higher sulphur crudes has been to comply with Vaal Triangle Air-shed Priority Area (VTAPA) commitments (described in Section 4.2.2). The use of low sulphur crudes reduces the SO_2 emissions from the refinery as less sulphur enters the refinery through the feed.

Natref is constrained in further reducing sulphur content in its crude feedstocks, since the refinery was never designed to process low sulphur crudes. Natref's refining margin would be further reduced and potentially compromise business sustainability, if the refinery processed even lower sulphur crudes. The business implications of not going for even lower sulphur content crudes must also be seen in the light of the additional high cost refinery upgrades that are required to meet the Clean Fuels II specifications.

2.2.4 Proximity to a major freshwater source

Natref is located in close proximity to the Vaal River, a critically important freshwater system in terms of drinking water and ecological and commercial demands. Considered balancing of the consequential environmental constraints is required, in terms of the impacts of air quality improvement against freshwater demand and meeting exacting effluent performance standards.

2.3 Atmospheric Emissions

Natref's refining and product storage activities result in a range of atmospheric emissions, which are presented schematically in Figure 4. The emissions derive from the fuel gas- and fuel oil-fired Boilers and Furnaces, the FCC, the Sulphur Recovery Unit (SRU), various other process units and the Tankfarm (where petroleum products are stored). It can be seen from the diagram that there are numerous processes where atmospheric emissions are generated and which feed into the main stack as a single point source, as well as six "local stacks" across the refinery site.

What follows below is a summary of the processes which are the subject of Natref's applications and which are regulated in terms of the MES.

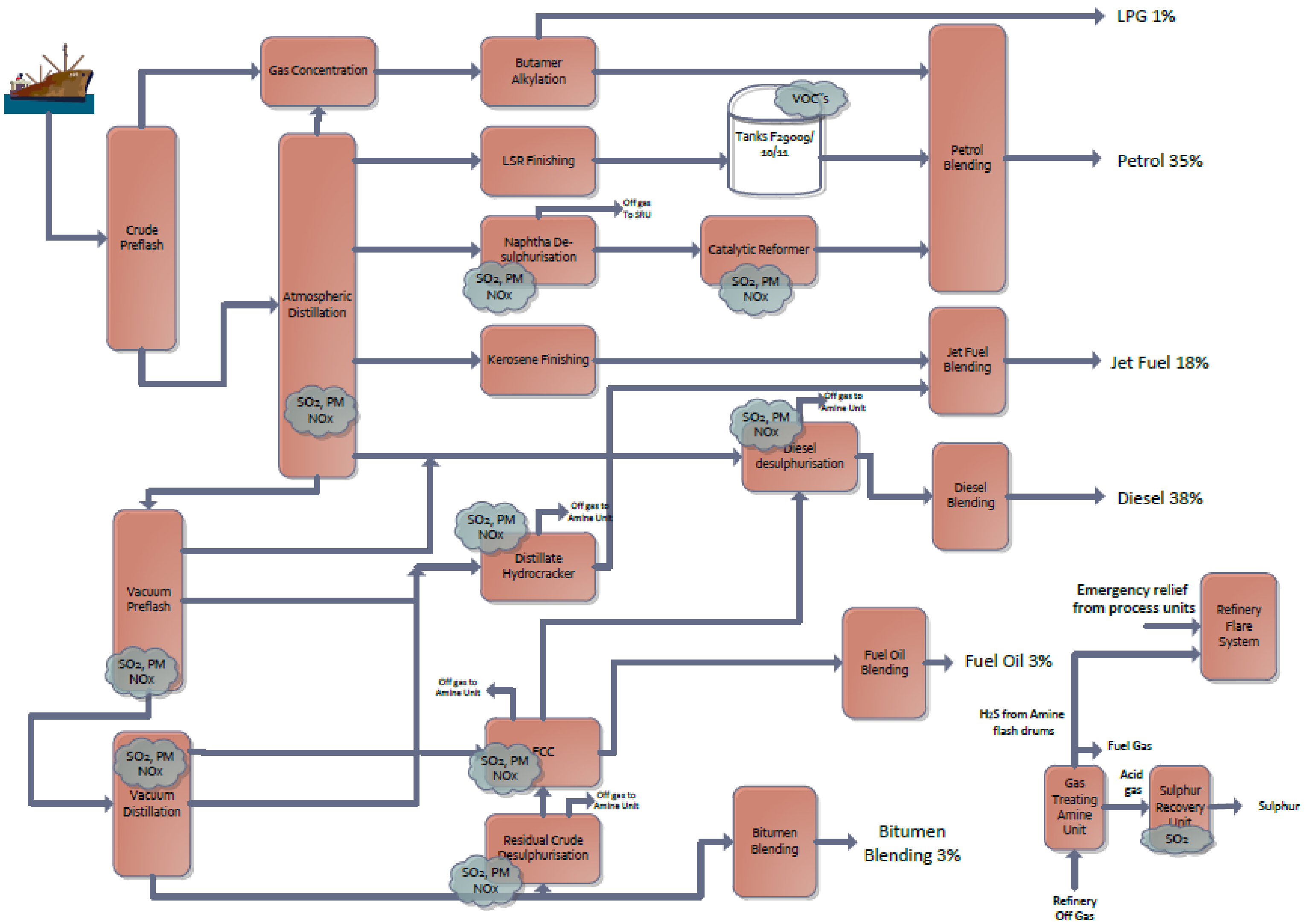

Figure 4: Schematic illustration of the various emissions sources across Natref

2.3.1 Fuel gas and fuel oil fired boilers

Natref has two 58MW boilers, which are used to produce steam for the various production steps in the refining process. Steam is used inside the refinery to provide heat for process units, steam for vacuum ejectors and as a raw material input in some process units, such as hydrogen production. In combusting the fuel required to produce the steam combustion emissions including PM, SO_2 and NO_x are generated, which are emitted to atmosphere via an exhaust stack. Natref's boilers have been built to be fuel flexible so that they can be fuelled on refinery fuel gas and/or refinery residual fuel oil. This flexibility allows the refinery to manage fluctuations and the supply/demand balance in the refinery fuel system. The pollution load is less for fuel gas than for residual fuel oil. Fuel gas is obtained from various refinery off-gases, which are recovered and used as an internal fuel, as well as a limited amount of natural gas import, but given that fuel gas is limited in volume it must be supplemented by fuel oil.

Natref's boilers have been specifically designed to be integrated with the refinery processes. The two boilers are small, with the hot exhaust gases being specifically routed to the main stack to assist in maximising the atmospheric emission dispersion of the other refinery process emissions that are also routed to the main stack. The boilers are situated in the middle of the refinery complex, in close proximity to the various refinery processes that require steam. This close proximity minimises the distance (and the heat loss) in transferring the steam to the users but this means that plot space around the boilers is limited. The steam dependence of the refinery process means that boiler availability is essential at all times.

2.3.2 Fuel Gas and Fuel Oil fired Furnaces

Many of Natref's individual refinery processes and utility systems have dedicated furnaces to supply the heat required by those processes. A variety of furnaces and burner types are used in refineries, largely determined by the heat release characteristics required by a particular process. Some furnaces are designed to be fired on fuel gas while others are designed to be fired predominantly on fuel oil, or a combination so as to provide flexibility in managing the refinery fuel system, and balance fuel demand and supply. Refinery process heaters are typically rectangular or cylindrical enclosures with multiple fired burners of specialised design. Furnaces and heaters are an integral part to refinery operation since the key processes in refineries are based on heating and partial evaporation of hydrocarbons. As such, availability of all refinery furnaces is essential to Natref's production stability. PM, SO_2 and NO_x emissions are generated in combusting the fuel to produce heat.

2.3.3 Vacuum off-Gas Furnace

The vacuum off-gas furnace differs from the other furnaces at Natref, in that it is utilised for the combustion of hydrogen sulphide (H_2S) containing vacuum pre-flash off-gas and a polymer from the Alkylation unit. The flue gas from this furnace is a very small stream but with high SO_2 emission concentrations (namely small load). The furnace contributes less than 4% to refinery SO_2 emissions, and even less to PM and NO_x emissions and is typical of all refineries that have a vacuum unit.

2.3.4 Fluidised Catalytic Cracker

Catalytic cracking is a conversion process for upgrading heavier hydrocarbons into more valuable petrol and other products. The process uses heat and a catalyst to break larger hydrocarbon molecules into smaller, lighter molecules. While FCCs are common processes to many refineries globally, the combination of an RCD, FCC and hydrocracker is very uncommon, and this too makes the Natref refinery considerably more complex than refineries without these process units.

The FCC unit produces a relatively high yield of petrol, along with other feedstreams suitable for making high octane petrol components. One drawback of the FCC process is the low quality of the mid-distillate products in terms of sulphur content and other properties. As a result, mid-distillate products from the FCC need further treatment prior to storage.

The FCC uses a catalyst in a fluidised bed at elevated temperatures to break down the long chain hydrocarbons in the gas phase. Atmospheric emissions occur during the regeneration of the catalyst, and include mainly PM, with lower concentrations of SO_2 and NO_x. FCC availability directly affects the production stability of Natref. Any additional outage time on this unit directly affects fuel production levels of the facility, with significant financial implications. Thus, any work, including maintenance, retrofits of compliance technology and any renewals or upgrades of equipment components, is planned to take place during a planned shutdown schedule, with planned outages. This schedule is coordinated with the shutdown activities of other fuel refineries, to avoid an inland fuel shortage.

2.3.5 Sulphur Recovery Unit

Sulphur in the crude oil feedstock is converted predominantly to hydrogen sulphide (H_2S, also called acid gas) during the cracking and hydrotreating processes in the refinery. To reduce what would otherwise be emissions of sulphur to atmosphere, refineries employ sulphur recovery processes to extract the sulphur from these refinery off-gases and produce various products. The acid gas is removed from the cracking and hydrotreating off-gases by an amine solvent absorption process in the Amine treating unit (see description below). The amine solution is regenerated by heating and the concentrated acid gas is then sent to a SRU. Natref's SRU also processes H_2S and ammonia from another plant, the refinery waste water stripper unit.

Acid gas and waste water stripper off-gas are combusted with air to form SO_2, which in turn is reacted with H_2S in the feed stream and produces liquid sulphur product, water vapour and heat. The existing Natref SRU is a 2-stage Claus unit designed to process 142 tons/day of sulphur in the SRU's feed. The unit is designed with an efficiency of 95%.

The availability of the existing SRU directly affects SO_2 emissions from Natref. Any additional outage time on this unit would result in increased SO_2 emissions which would compel a reduction in refinery production rates in line with current licence conditions, thereby affecting fuel production levels of the facility, with consequential significant implications. Thus, any work, including maintenance, renewals or upgrades of equipment components or tie-ins into this system is planned to take place during a planned shutdown schedule. This schedule is coordinated with the shutdown activities of other fuel refineries, to avoid an inland fuel shortage.

2.3.6 Amine treating unit Flash Drums

H_2S containing off-gas from the refinery process units are routed to the refinery's Amine treating unit. In this unit the H_2S is removed from the fuel gas by amine absorption, and the resulting concentrated H_2S off-gas stream is routed to the SRU where it is converted to a sulphur product. The clean, H_2S-free gas exiting the Amine treating unit is routed to refinery fuel gas to form part of the internal fuel pool.

The Amine Flash Drums in the amine treating unit provide for the separation of liquid hydrocarbons from amine. There are two such drums at Natref. One of the flash drums is operated at a low pressure of $1kg/cm^2$ or less in order to remove all hydrocarbons from the amine mixture. Given the requirement to operate at low pressure, one of the drums is currently vented to the refinery flare system. The SO_2 emissions from the drums are very low compared to the total refinery emission load. The H_2S emissions from this stream is very small (low ppm levels) on a small flow rate. Since the MES does not define "H_2S rich" or specify the threshold limit of H_2S (e.g. ppb, ppm or volume %), Natref has requested postponement (included in the initial postponement application) on this point source. The overall contribution of this stream to refinery SO_2 is negligible.

2.3.7 Tankfarm

Natref operates three Light Straight Run (LSR) petrol component storage tanks, which are designed according to a petroleum industry standard. These tanks are hemispheroids with a diameter of less than 20 m. Each of these tanks is equipped with a pressure relief valve and a vacuum breaker to release into the atmosphere. In line with the Department of Energy's Clean Fuels II specifications to improve vehicle exhaust emissions, Natref is implementing various changes and upgrades to the refinery. The implication is that once Clean Fuels II is implemented, these tanks will be used to store benzene-free isomerate products containing less than 10 parts per million of sulphur. Product storage at these three tanks is conducted in an accepted manner, but fugitive emissions of VOCs (volatile organic compounds) may occur (namely emissions that 'escape' to atmosphere rather than being deliberately released). After the Clean Fuels II upgrade programme is completely implemented, these tanks will not store products that could emit VOCs and will thus be in full compliance with the MES.

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, Natref 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. 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 GN893 repealed and replaced the Regulations that had been published in March 2010 under Government Notice No. 248. GN893 contains substantial amendments to the previous MES, including: changes to the listed activities and their associated special arrangements, additional activities subject to Regulation, changes to compliance monitoring requirements and changes to some of the prescribed emission limits. Notwithstanding the amendments and despite apparent extensions on compliance timeframes that the Department of Environmental Affairs intended to grant to refineries in recognition of the major capital expenditure programmes to be implemented for compliance with the Department of Energy's Clean Fuels II programme, 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 Natref

The Natref refinery is predominantly classified under MES listed activities falling under "Category 2: Petroleum industry, the production of gaseous and liquid fuels as well as petrochemicals from crude oil, coal, gas or biomass". Table 1 includes a summary of compliance with the prescribed emission 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. Natref 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 transparency both the initial and additional postponement requests are indicated in the Table 1, together with the MES for which Natref will comply within the prescribed compliance timeframes.

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

MES Category	Substance(s) with prescribed emission limits and/or associated special arrangements	Emission limits or special arrangements*		Applicable Natref Activities
		New plant standards	Existing plant standards	
Category 1: Sub-category 1.2	Particulate matter	50	75	Fuel oil fired boilers
	Sulphur dioxide	500	3 500	
	Oxides of nitrogen	250	1 100	
Category 1: Sub-category 1.4	Particulate matter	10	10	Fuel gas fired boilers
	Sulphur dioxide	400	500	
	Oxides of nitrogen	50	300	
Category 2: Sub-category 2.1	Particulate matter	70	120	Furnaces except vacuum off-gas furnace
	Sulphur dioxide	1 000	1 700	
	Oxides of nitrogen	400	1700	
Category 2: Sub-category 2.1	Particulate matter	70	120	6 Gas fired furnaces to local stacks
	Sulphur dioxide	1000	1700	
	Oxides of nitrogen	400	1700	
Category 2: Sub-category 2.1	Particulate matter	70	120	Vacuum off-gas furnace
	Sulphur dioxide	1000	1700	
	Oxides of nitrogen	400	1700	
Category 2: Sub-category 2.1	Hydrogen sulphide	Special arrangement: No continuous flaring of hydrogen sulphide-rich gases shall be allowed		2 Flares
Category 2: Sub-category 2.1	Hydrogen sulphide	Special arrangement: No continuous flaring of hydrogen sulphide-rich gases shall be allowed		Amine treating unit Flash Drums
Category 2: Sub-category 2.2	Particulate matter	100**	120**	FCC
	Sulphur dioxide	1 500	3 000	
	Oxides of nitrogen	400	550	

<table>
<tr><th rowspan="2">MES Category</th><th rowspan="2">Substance(s) with prescribed emission limits and/or associated special arrangements</th><th colspan="2">Emission limits or special arrangements*</th><th rowspan="2">Applicable Natref Activities</th></tr>
<tr><th>New plant standards</th><th>Existing plant standards</th></tr>
<tr><td>Category 2:
Sub-category 2.1 and Sub-category 2.2</td><td>Sulphur dioxide</td><td>Special arrangement:
a bubble cap of all Combustion Installations and Catalytic Cracking Units shall be 0.4 kg SO_2/ton for new plants</td><td>Special arrangement:
a bubble cap of all Combustion Installations and Catalytic Cracking Units shall be 1.2 kg SO_2/ton for existing plants</td><td>Furnaces plus FCC</td></tr>
<tr><td>Category 2:
Sub-category 2.3</td><td>Hydrogen sulphide</td><td colspan="2">Special arrangement:
Sulphur recovery units should achieve 95% recovery efficiency and availability of 99%**</td><td>SRU</td></tr>
<tr><td>Category 2:
Sub-category 2.4</td><td>Total volatile organic compounds</td><td colspan="2">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</td><td>Tankfarm</td></tr>
</table>

** 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*

*** these requirements will take more than five years to comply with; hence this is the first request for a five-year postponement, to be followed by subsequent applications closer to 2020*

Colour coding:

Blue	2020 standard for which no feasible technology/solution is presently available to attain compliance and for which Natref 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

4 Reasons for applying for Additional Postponements

Natref 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 Natref does not already comply with the MES, Natref 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 Natref 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, Natref requires postponements of the compliance timeframes in order to implement and successfully commission new equipment. These point sources are the subject of the initial postponement application.
- 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, Natref 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 Natref, and it is for this reason that Natref 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, Natref 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, Natref 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/solution is identified and implemented, whichever arises first. Natref 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 Natref.

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

4.1 Overview

The reasons for applying for additional postponements fall into several categories that are detailed below. Before presenting each of these reasons in more detail, Natref'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 this environmental management philosophy, and these reasons are specific to each listed activity, as described in the technical appendix to this motivation report, but include: the absence of an inland fuel oil market, the challenges inherent in modifying a brownfields operation, financial implications, and unintended environmental cross-media impacts.

4.2 Natref's environmental management philosophy

Natref recognises that continuous improvement in environmental management performance is an important and ongoing business imperative. Introducing capital intensive environmental improvements must however be balanced with the focus on financial sustainability of its business. Natref has steadily improved its emission performance, reducing its SO_2, NO_x, PM and VOC emissions significantly over the past 15 years, mindful of higher emissions arising from its very high crude-to-white product conversion ratio.

Natref actively manages impacts by reducing production load if hourly exceedances are observed at ambient monitoring stations as a result of upset conditions at the Natref plant. This approach aims to ensure that Natref's contribution to the 88 allowable exceedances stipulated for the hourly NAAQS is reduced.

4.2.1 Environmental improvements over the past 15 years

Natref has reduced SO_2 emissions from in excess of 65 ton/day in 2000 to 32 ton/day presently, representing a substantial step change of more than 50% reduction. This achievement, along with reduction of other emissions, was on the back of a roadmap of projects implemented over the past decade and a half, including:

- Installation of a H_2S/SO_2 analyser at the SRU tailgas for optimal sulphur recovery which reduced SO_2 emissions.
- Installation of secondary roof seals for floating roof tanks with a diameter greater than 20m to reduce fugitive VOCs from product storage.
- Construction and installation of a vapour recovery unit at the road and rail loading facility for petrol and diesel, which reduced VOC emissions.
- Construction and installation of a new loading gantry to improve safety during loading and to reduce VOCs resulting from product loading.
- Routing of Sour Water Stripper (SWS) off-gas, one of the largest SO_2 emission sources at Natref (approximately 48% of SO_2 emissions) to the SRU to reduce SO_2 emissions and to recover additional sulphur as a saleable product to the market. SO_2 emissions from this stream were thus reduced by more than 95%.
- Natref has steadily reduced SO_2, PM and NOx emissions from the refinery by reducing the amount of fuel oil fired internally. Fuel oil used in the refinery reduced by 65% pre-2000 to 2014. Natref now burns the lowest amount of fuel oil that can be sustainably achieved, given its location and flowscheme.
- Installation of new heaters with low NO_x burners as part of an upgrade to the Diesel Unifiner, which reduced NO_x emissions.
- The crude unit furnaces, are the largest furnaces in the refinery, two of these furnaces were replaced in 2012. The new furnaces are all fitted with low NOx burners, which reduced NOx emissions. Furnaces are also higher in efficiency, resulting in reduced fuel oil firing and thereby reduced SO_2, and PM and NOx emissions.
- The vacuum unit furnace was revamped and retrofitted with low NOx burners, resulting in reduced NOx emissions.

- Natref has undertaken a program to install geodesic domes on tanks with a diameter greater than 20m to further reduce VOC emission from petrol and crude storage tanks. This technology improves on double mechanical seals.
- In order to reduce PM emissions from existing levels, replacement of the existing FCC cyclones is planned by Natref. This would reduce PM emissions, but will not reach existing plant standards. In order to meet existing plant standards, additional abatement technology will be required. The replacement of the existing cyclones will be a start of a program of investments to improve PM emissions. This crucial first step is required first to inform the technology required for further improvements.

4.2.2 Commitments to VTAPA Air Quality Management Plan

The Natref operation falls within the Vaal Triangle Air-shed Priority Area (VTAPA) and as such is required to respond to the air quality assessment that was conducted to determine both the prevailing air quality and the major atmospheric emission sources impacting on that air quality (as detailed in Section 18 of NEM:AQA). The VTAPA Air Quality Management Plan articulates a requirement for reduced SO_2 emissions from Natref to facilitate air quality improvements in the local airshed. Natref has responded to those emission reduction requirements by committing to the following:

- *Installation of a high efficiency SRU:* The commitment to install a second SRU in addition to the existing SRU was subject to promulgation of the Clean Fuels II specification as agreed with the Department of Energy. At the time of the agreement, the MES governing point source emissions were not yet promulgated, so the technology design basis for an SRU could not be finalised. Subsequently, the 2010 MES was promulgated, and in November 2013, amended. Natref is therefore aligning the performance of the second SRU to achieve at least 95% recovery efficiency and an availability of 99%, as specified in the 2013 MES.
- *Switch to low sulphur crudes:* As detailed previously Natref has steadily reduced SO_2 emissions from the refinery by sourcing lower sulphur crude oil. The crude used in the refinery now has a sulphur content of less than 1% compared to more than 1,2% in 2007.

4.2.3 Clean Fuels II

The Natref refinery is currently conducting engineering studies for solutions to comply with the Department of Energy's Clean Fuels II programme. This programme will require extensive upgrades to the refinery, to enable the production of fuels that conform to so-called "Euro V" diesel and petrol specifications. The Euro V specification in Europe was developed to improve urban air quality, by reducing emissions from motor vehicle tailpipes, notably a reduction of the sulphur content of petrol from 500 to 10 parts per million, benzene content to less than 1% and diesel sulphur content from 500 to 10 parts per million. This reduction in fuel pollutants will have a direct positive impact on ground level emissions from all motorised vehicles. Reduction in vehicle SO_2 emissions arising from fuel consumption from the Natref refinery's output, as a result of Clean Fuels II upgrades, is estimated at 26 tons/day SO_2. At face value, this may not sound significant, but when compared with emissions from the refinery itself, at 32 tons/day, this reduction in vehicle emissions occurring at near ground-level is a very significant sulphur mass balance change in Natref's value chain. Any removal of sulphur from vehicle tailpipes requires that the sulphur be processed elsewhere – in this case, this large volume of sulphur removed from the fuel will be processed at Natref, and recovered as additional sulphur product.

4.2.4 Best Available Techniques

In identifying potential environmental improvements, specifically possible reductions in atmospheric emissions, Natref relies extensively on two key reference documents namely Best Available Techniques (BAT) to reduce emissions from refineries (developed by Conservation of Clean Air and Water in Europe (CONCAWE)), and the BAT Reference Documents (BREFs) for the oil refining industry. CONCAWE was established in 1963 to research environmental issues relevant to the oil industry including, amongst others, fuels quality and emissions, air quality, water quality, soil contamination, waste, occupational health and safety, petroleum product stewardship and cross-country pipeline performance.

The CONCAWE BAT[1] report provides comprehensive information, based on actual refinery experience, for the development of BREFs for the oil refining industry. This report describes techniques for minimising and controlling air, water, and waste emissions/discharges, as well as protecting soil and groundwater. Implications of pollution controls for energy use are also addressed. Although these documents were prepared prior to the development of MES, the principles remain valid.

Several important BAT principles are presented in the report including:

- Oil refineries differ in size, complexity, the types of processes they operate, and the crude oils they process. Climatic/environmental conditions and the location of the refinery (e.g. inland or coastal, etc.) influence the nature and disposal outlets of emissions and their impact on the environment. BAT therefore includes a site-specific content to account for these differences and does not apply a ‘one-size-fits-all’ approach.
- It is the impact of pollutants on the environment (and associated risk) that should dictate the required level of control achieved by BAT and not simply the implementation of available controls. The controls invoke a financial cost and the BAT principles support the implementation of BAT where there is direct benefit obtained in terms of reduced risk, in response to that cost.
- BAT costs are frequently quoted as the hardware costs associated with their installation/implementation. This approach significantly underestimates the actual cost of implementing BAT where total costs, including design, infrastructure preparation, and installation costs are typically four times the hardware costs. The existing level of control at a refinery also significantly affects the cost of BAT. For example, a technology offering 99% emissions control may be cost effectively applied to an otherwise uncontrolled site, the same technology installed at a site which has controls that are 97% effective would provide a very poor emission reduction return for the investment.
- Cross media impacts can often result from the application of controls and these should be recognised in deciding on BAT at a given location. The additional energy and other resource demands of BAT, waste generation and environmental impact of disposal are examples of such cross-media impacts.
- Once appropriate emission limits have been decided on as a function of the impact risk, the facility should be allowed to achieve the limits using the techniques of their choice and weighing up the full implications of control measures employed.

The BREF[2] document provides a well-researched and credible presentation of the different techniques that can be used in controlling the environmental aspects of oil refinery operations. Close to 600 techniques have been considered in the determination of BAT; with the techniques being analysed consistently to highlight the advantages and disadvantages of each. Each technique is described together with the environmental benefits, the cross-media effects, the operational data, the applicability and economics.

Accordingly, the uniform application of standards at all sites is not considered appropriate in all instances.

[1] Best available techniques to reduce emissions from refineries, Prepared for the CONCAWE Air and Water Quality Management Groups by its Special Task Forces AQ/STF-55 and WQ/STF-28, CONCAWE, Brussels, May 1999

[2] Integrated Pollution Prevention and Control (IPPC), Reference Document on Best Available Techniques for Mineral Oil and Gas Refineries, December 2001

4.2.5 The rationale underpinning the MES

Natref 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 the most effective solutions. In the context of the MES, Natref'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.

Importantly, it is emphasised that Natref does not in any way seek to increase emissions relative to its current emissions baseline through its postponement application. In the way that they have been presented, the MES compel absolute compliance with *ceiling* emission limits 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 under *all* operational circumstances, including normal production variability. To demonstrate its commitment to compliance with sustainable standards, Natref has proposed alternative emission limits as conditions to be included in its Atmospheric Emissions Licence, which it commits to comply with, for the period of the postponement. The alternative emissions limits that Natref 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 postponement, Natref's average baseline emissions will not increase, and in some cases will be reduced to sustainably improved levels.

4.3 Financial implications

Compliance with the MES will incur significant financial costs, and these costs must be borne in addition to the costs of compliance with Clean Fuels II, which imposes significant cash flow constraints on the business, adding no additional margin. For example, implementation of PM reduction for the FCC and a new SRU, technologies that could practicably reduce PM and SO_2 emissions, are estimated to cost in the region of R2-3 billion. Other technologies such as flue gas desulphurisation (FGD) options would invoke prohibitive capital and operating costs, notwithstanding the considerable cross-media impacts that would potentially also be incurred. Disposal of fuel oil as a waste material (in place of Natref using it internally as an energy source for boilers and furnaces) would not only incur high operating costs for waste management, but require a new energy source at additional operating costs. Natref is of the view that it is not the costs *per se* but rather the limited air quality benefits that will be realised as a result of the solutions to attain compliance, which support its 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 deemed to be marginal.

Natref respectfully submits that there is no benefit to industry, government and society for industry to be imposed with compliance costs which – if implemented – did not appear to take a risk-based approach and delivered no meaningful improvements in ambient air quality.

4.4 Refinery fuel management

As described, the refinery can make use of two principal fuels, namely fuel gas or fuel oil. The purpose of refinery fuel management is to ensure that the refinery is supplied with the necessary heat for crude oil processing and utilities (steam/power) as a function of the available fuel. Fuel management is a process of optimising refinery operating costs while minimising the impact on the environment. Several limiting factors and constraints that are refinery specific, govern fuel management choices:

- Availability of suitable cleaner fuels for refinery energy needs.
- Operational flexibility or limitations within the refinery fuel system.
- Refinery configuration and crudes processed (especially sulphur content).
- Complexity with respect to number of units and the degree of process and energy integration of the various units.
- Age of the various units and technology restrictions.
- Quantity and quality of produced fuels.
- Safety and environmental restrictions imposed on individual units or the refinery complex.
- Climatic and/or local conditions.

4.5 Unintended cross-media environmental impacts

Pollution control systems typically transfer a pollutant (e.g. gaseous emissions) to another medium (e.g. liquid effluents or solid wastes), or use additional energy (with its own pollution consequences) to chemically transform the pollutant into a less hazardous form. Inevitably it is site-specific conditions that best define which form of pollutant discharge and into which media is least undesirable. These site specific conditions include, for example, prevailing media quality (air, water, land) as options for disposal, the costs and availability of energy, accessibility to waste handling services and infrastructure, and importantly, the nature and associated infrastructure of the activities that generate the pollution in the first place.

Effluent discharge specifications are necessarily stringent for inland industrial sources such as the Natref refinery, which discharges its effluent into the Vaal river system, a critically important fresh water source. In investigating emission abatement options Natref must carefully consider other unintended environmental impacts, since pollutants removed from air emissions must be converted into solid wastes or liquid effluents. The challenges in safely disposing of such solid wastes or liquid effluents are considerable in their own right and integrated environmental principles require that such knock-on impacts which may have more significant potential impacts, be properly considered when planning any modification to an industrial process.

Flue Gas Desulphurisation for example may result in reduced SO_2 emissions but requires large volumes of water, and results in increased effluent volumes. Low NO_x burners, while being a technically feasible abatement technology for Natref to lower its NO_x emissions, would require a larger fuel throughput to ensure the same level of energy output. In identifying the most effective form of abatement, it is important that the least net effect on the environment be considered.

4.6 Modifying a brownfields operation

Modifying an existing brownfields operation is considerably more challenging than building a new greenfields plant, since it may be influenced to a significant extent by the need to clear plot space, to tie into existing facilities, and to build in areas that may already be congested with other operating equipment. In the case of greenfields plant the entire plant is 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 at all, and every modification or retrofit has to be developed around the existing plant- since no two sites are the same, the cost of installing particular facilities on one site may be very different from that for the same facilities on a different site. Depending on the nature of the control technology, its ability to be technically and economically retrofitted onto an existing facility can vary from being no more difficult than including it in a grassroots design, to being essentially impossible to utilise without rebuilding portions of the existing process. This distinction in available technology's applicability to new and existing facilities is a crucial one to include in any determinations of what constitutes BAT. It forms the basis for the justifiable establishment of different BAT criteria for new and existing facilities and equipment.

As a simple example, Natref has space limitations that constrain the implementation of abatement equipment. The use of FGD for limiting SO_2 emissions from boilers and furnaces is constrained by amongst others, a lack of space where the FGD plant could be established. That lack of space is challenging enough in its own right, but it also creates access problems for construction teams. 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, or implementation of other committed capital investments. This is not to say that such coordination is not possible, but simply that the timeframes are, in practice, considerably longer. A brownfields site also offers multiple occupational health and safety hazards that do not exist on a greenfields site. These hazards relate principally to having energised systems, both in terms of electricity, but also in terms of gas, steam and other utilities.

4.7 Geographical constraints on the inland Natref refinery

As described earlier in this report, Natref has, by virtue of its inland location, a number of differences from typical refineries. Perhaps the most significant difference is that Natref has a limited inland market for the fuel oil it produces and as such needs to use the balance of the fuel oil it produces in its own refinery process. If the fuel oil was not used in the refinery, then it would have to be disposed of as a waste product. A further significant difference is the proximity of the refinery to a critically important freshwater source, namely the Vaal river system, which requires careful balancing of environmental cross-media impacts, particularly with regards to exacting environmental performance standards for effluent quality.

5 Proposed Alternative Emissions Limits, special arrangements and other Emission Management Controls

5.1 Overview

Given the various reasons cited above, Natref 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. Natref therefore seeks postponement of the compliance timeframes of those MES where compliance is not foreseeable based on presently available technologies. Natref supports the principle of being held to reasonable emissions limits. Proposals are presented here on what are considered to be reasonable and achievable alternative emissions limits, which Natref believes could be enforced by the authorities and which could be included as conditions in its Atmospheric Emissions Licence (AEL). Before presenting those alternative emissions limits, it is necessary to briefly present a view on why Natref believes these alternative emissions limits are aligned with a a risk-based approach to sustainable ambient air quality improvement, informed by the CONCAWE and BREF technology references for refineries.

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 rigid 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 Natref'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 Natref 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 non-compliance to MES only being tolerated for shut down, start up and upset conditions. That administrative requirement means that Natref 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. Natref will not, through its additional postponement application, 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. Proposed Alternative Emissions Limits

As described above, the proposed alternative emissions limits have been derived as a function of the technologies that are known to be feasible, and 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. The proposed alternative emissions limits are summarised in Table 2. The intended purpose of the alternative emissions limits and alternative special arrangements is to define the proposed licence conditions with which Natref 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, Natref's proposed alternative emissions limits and alternative special arrangements 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. It is reiterated that Natref will not, through these proposed alternative emissions limits, increase its baseline emissions.

The changes introduced in GN 893 include a change in the point at which compliance must be achieved and monitored. In the 2010 Regulations, Natref's main stack was defined as the point source, and therefore was the point of compliance. Investment in process units to achieve an overall refinery emission limit could be optimised over the entire facility, to achieve the required outcome at lowest complexity and cost-effectively. Following the November 2013 amendments, a definition for "point of compliance" was introduced, along with point source emission standards effective on every point source. This was a fundamental departure from the previous approach to the refinery category standards. It removed the flexibility for refineries to optimise among process units and identify the least complex and most cost-effective manner to achieve the required emission reductions, and therefore moved to effectively increase compliance costs. Concomitantly, it meant that compliance monitoring was moved away from the stack where emissions are released to atmosphere and closer towards the process unit where emissions are generated. Thus the point in the facility where compliance for point sources regulated by the MES has to be assessed through emission monitoring has changed significantly.

Thus, Table 3 specifies alternative emissions limits which Natref proposes are incorporated into its Atmospheric Emissions Licence, effective 1 April 2018. Before that time, Natref proposes that its current licence conditions continue to apply, as conditions which Natref must be held to. These consider emissions limits at its main stack, where compliance monitoring is currently conducted. Further details are included in Natref's initial postponement application's technical appendix.

Natref requires time to implement sample ports at the points of compliance for point sources regulated by the MES, as recently defined by the 2013 MES. Natref, in its initial postponement application, requested postponement from compliance monitoring at the points of compliance up until 1 April 2018, and requested interim alternative emissions limits aligned with current production levels and emissions performance. . Emission limits were transformed to align with the emission limit reference conditions for the 2013 MES Category 2 listed activities, namely 10% O_2, and reporting in terms of emission concentration rather than emission load. The initial postponement request related only to limitations in measurement of emission concentrations at the newly defined "points of compliance", until sample points for monitoring have been installed.

Table 2: Summary listing of the MES for which Natref is applying for postponement together with alternative emissions limits proposed by Natref for incorporation into its Atmospheric Emission Licence, to prevail till 1 April 2018

Emission component	Alternative Emission Limit Requested (maximum daily average concentration)	Averaging period for compliance monitoring
	All values specified at 10% O_2 273 K and 101.3 kPa, mg/Nm^3	
SO_2	From now until 1 April 2018: 5600 (equivalent to current permit limits of 32 tons/day)	Daily average
NO_x	From now until 1 April 2018: 520 (equivalent to current permit limits of 2.8 tons/day)	Daily average
PM	From now until 1 April 2018: 255 (equivalent to current permit limits 120mg/Nm^3)	Daily average

The table below reflects the alternative emissions limits requested to be applicable from 1 April 2018, once measurement equipment has been installed at the defined points of compliance. Natref can thereafter begin to monitor for compliance at these defined points.

- As described in this report, this application relates to postponement of the 2015 existing plant standard only. However, for completeness' sake, the limits which Natref could meet from 1 April 2018 in the longer term, based on current available information, are included in Table 3, which extend beyond the five-year timeframe.

Table 3: Summary listing of the MES for which Natref is applying for postponement together with alternative emissions limits proposed by Natref for incorporation into its Atmospheric Emission Licence, to prevail from 1 April 2018

Applicable Natref Activities	Substance(s) with prescribed emission limits and/or associated special arrangements	Emission limits or special arrangements*		Alternative emissions limits applicable from 1 April 2018
		New plant standards	Existing plant standards	
Fuel oil fired boilers	Particulate matter	50	75	300
	Sulphur dioxide	500	3 500	5 200
	Oxides of nitrogen	250	1100	500
Fuel gas fired boilers	Particulate matter	10	10	Compliant
	Sulphur dioxide	400	500	Compliant
	Oxides of nitrogen	50	300	500 After 1 April 2020: 250**
Furnaces except vacuum off-gas furnace	Particulate matter	70	120	150
	Sulphur dioxide	1 000	1 700	3 200
	Oxides of nitrogen	400	1 700	Compliant
Vacuum off-gas furnace	Particulate matter	70	120	150
	Sulphur dioxide	1 000	1 700	50 000 After 1 April 2020: 3 200
	Oxides of nitrogen	400	1 700	Compliant
Furnaces including vacuum off-gas furnace, plus FCC	Sulphur dioxide	Special arrangement: a bubble cap of all Combustion Installations and Catalytic Cracking Units shall be 0.4 kg SO_2/ton for new plants.	Special arrangement: a bubble cap of all Combustion Installations and Catalytic Cracking Units shall be 1.2 kg SO_2/ton for existing plants.	1.2 kg SO_2/ton [crude oil throughput]

**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 accompanying technical appendix to this report.

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. Natref 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 are accepted. The AIR was completed by independent consultants and not Natref itself. Airshed Planning Professionals 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 Natref 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 the 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, one of Natref's shareholders, operates three residential ambient air quality monitoring stations in and around Sasolburg, namely at AJ Jacobs, Leitrum and Ecopark. Data for 2010, 2011 and 2012 from AJ Jacobs and Leitrim were included in this investigation since operation of the Ecopark station only commenced in 2012. NO_2, NO and NO_x observations made at Ecopark monitoring station for 2012 was however included in the analysis of NO_2/NO_x ratios as reported in the AIR. The monitoring stations are accredited (ISO/IEC17025) to ensure data quality and availability, with a high level of 90% data availability for the three years.

6.2.4 Emission estimation methods

According to Natref's atmospheric emission licence, its main stack is defined as the point source and therefore the point where compliance is assessed. As detailed above, the 2013 MES includes a new definition for the "point of compliance" which implies that every listed activity or group of listed activities regulated by the MES must now prove compliance regardless of where the emissions are emitted to atmosphere. Natref does not currently have measurement points at every "point of compliance" and so it has been necessary to scientifically estimate emissions from the compliance points based on available empirical data. Emissions after abatement were also then calculated based on available empirical data using two key reference documents, namely:

1. Air pollutant emission estimation methods for E-PRTR reporting by refineries.
2. Emission Estimation Technique Manual for Petroleum Refining.

A brief background on these estimation method documents is given below.

Air pollutant emission estimation methods for E-PRTR reporting by refineries[3]

This report provides the estimation algorithms and emission factors for uncontrolled releases of air pollutants from stationary sources at oil refineries which CONCAWE recommends for E-PRTR (European Pollutant Release and Transfer Register) reporting purposes, where measurements have not been undertaken. The emission estimation algorithms are fully referenced and the emission factors provided in a consistent metric unit base. The European Commission and the European Environment Agency both recognise the techniques and indeed reference this document as a source of sector specific calculation methods in the European Union (2006).

[3] Air pollutant emission estimation methods for E-PRTR reporting by refineries, 2009 edition, Prepared by the CONCAWE Air Quality Management Group's Special Task Force on Emission Reporting Methodologies (STF-69), Brussels

Emission Estimate Technique Manual for Petroleum Refining[4]

The purpose of all Emission Estimation Technique (EET) Manual is to assist Australian manufacturing, industrial and service facilities to report emissions of listed substances to the National Pollutant Inventory (NPI). The Manual contains procedures and recommended approaches for estimating emissions from facilities engaged in petroleum refining, and was drafted by Pacific Air & Environment, in conjunction with the NSW Environment Protection Authority, on behalf of the Commonwealth Government. The manual(s) were also developed through a process of national consultation involving State and Territory environmental authorities, and key stakeholders.

6.2.5 Emissions scenarios

In order to assess the impact of each of the additional postponements for which Natref has applied, four emissions scenarios were modelled with the results throughout the AIR presented as illustration in Figure 5.

- **Current measured baseline emissions from the main stack**, reflective of the impacts of present operations, which are modelled as *averages* of measurements of total emissions taken from periodic emission monitoring at the main stack. This approach is taken since monitoring is not currently conducted at the recently re-defined “point of compliance” locations feeding into the main stack. The baseline therefore represents the total impact of a number of listed activities. This scenario is represented by the first column in the presentation of all AIR graphs (shown in blue in Figure 5). 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 Natref’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 not 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**, which in terms of refineries, requires concurrent compliance with two prescribed emission limits for SO_2. The more stringent compliance requirement is illustrated in the results.
  - For all listed activities, and all applicable criteria pollutants, a ceiling emissions limit (i.e. maximum emission concentration) is modelled, aligned with the prescribed standard, which 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 5). For example, this considers the implementation of Low NOx burners to comply with the existing plant standard for NOx emissions from fuel gas fired boilers.
  - In addition, for SO_2 emissions generated by Category 2.1 and 2.2 listed activities, compliance with both ceiling emission limits as well as conformance with a SO_2 bubble cap for existing plants (1.2 kg SO_2/ton of crude oil throughput), is modelled.
- **Compliance with the 2020 new plant standards**, which in terms of refineries, requires concurrent compliance with two prescribed emission limits for SO_2. The more stringent compliance requirement is illustrated in the results.

[4] Emission Estimation Technique Manual for Petroleum Refining, National Pollutant Inventory, 1999

– For all listed activities, and all applicable criteria pollutants, a ceiling emissions limit (i.e. maximum emission concentration) is modelled, aligned with the prescribed standard, which 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 5). For example, this considers ceasing to use available fuel oil as an energy source for boilers and furnaces, and management of this stream as a waste, being replaced with some theoretical source of an alternative fuel for compliance. Other alternatives would include theoretical compliance with the stringent new plant standard for NO_x emissions from fuel oil fired boilers, by the implementation of a technology such as Selective Catalytic Reduction, or flue gas desulphurisation for SO_2 emissions abatement.

– In addition, for SO_2 emissions generated by Category 2.1 and 2.2 listed activities, compliance with both ceiling emission limits as well as conformance with a SO_2 bubble cap for new plants (0.4 kg SO_2/ton of crude oil throughput), is modelled.

- **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 represented by the fourth column in the presentation of all AIR graphs (shown in purple in Figure 5). It is re-emphasised that Natref will not physically increase its current baseline emissions (expressed as an average). Natref 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. After the (single or multiple) postponement period(s) is concluded, conformance with the prescribed standards would be achieved, as measured at the defined point of compliance.
- As described above, emission estimation methods were used to calculate what emissions at the “points of compliance” are likely to be. These estimated emissions concentrations were then cumulated for the various “points of compliance”, into single emission concentration values for the total main stack system.

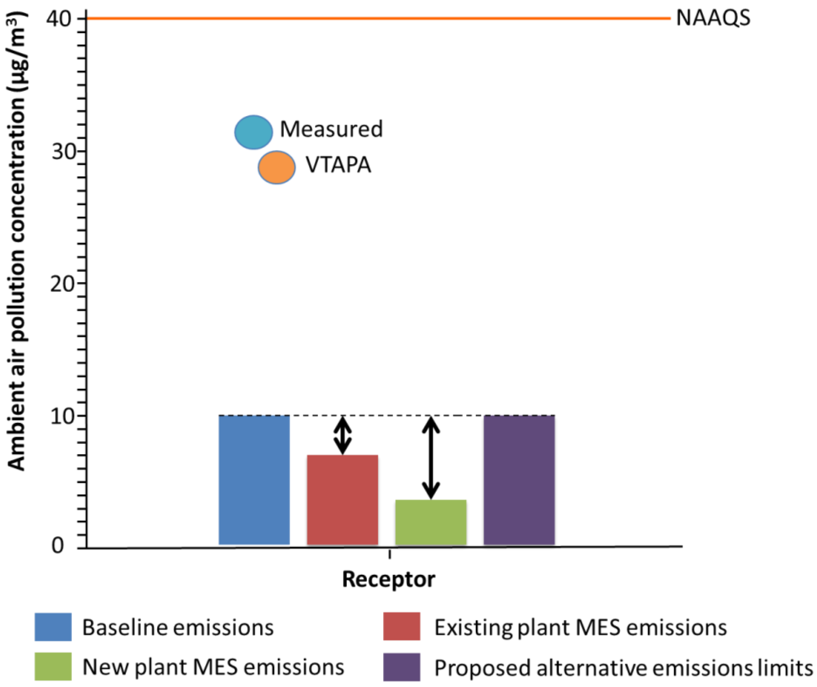

Figure 5: Schematic displaying how the dispersion modelling scenarios are presented in the AIR, for each receptor point in the modelling domain

In Figure 5, the black arrows above the red and green bars reflect the predicted delta (i.e. change) in ambient impacts of Natref’s baseline emissions versus the given compliance scenario The purple bar represents the emissions expected as a result of Natref’s proposed alternative emissions limit, aligned with its baseline emissions and specified as maximum emissions concentrations.

The blue dot in Figure 5 represents physically measured ambient air quality, reflective of the total impact of all sources in the vicinity, as the 99th 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) used for interpretation of the dispersion modelling results, as described in Section 6.2.6.

6.2.6 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.

6.2.7 Sensitive receptors

Twelve sensitive receptors were identified in the vicinity of the Natref operations (within the 50-by-50 km modelling domain). Receptors included residential areas, ambient air quality monitoring stations and points of maximum predicted pollutant concentrations. The receptors are illustrated in Figure 6. Some of the receptors were extracted from the modelling data sets as grid intercept points corresponding with the identified receptor areas and have been given code names such as GR1 (Grid Receptor 1). Receptor code names have been included in figures and tables for the sake of brevity. Receptors are presented in the figures and tables in increasing distance from the Natref main stack. The sensitive receptors are listed in Table 4.

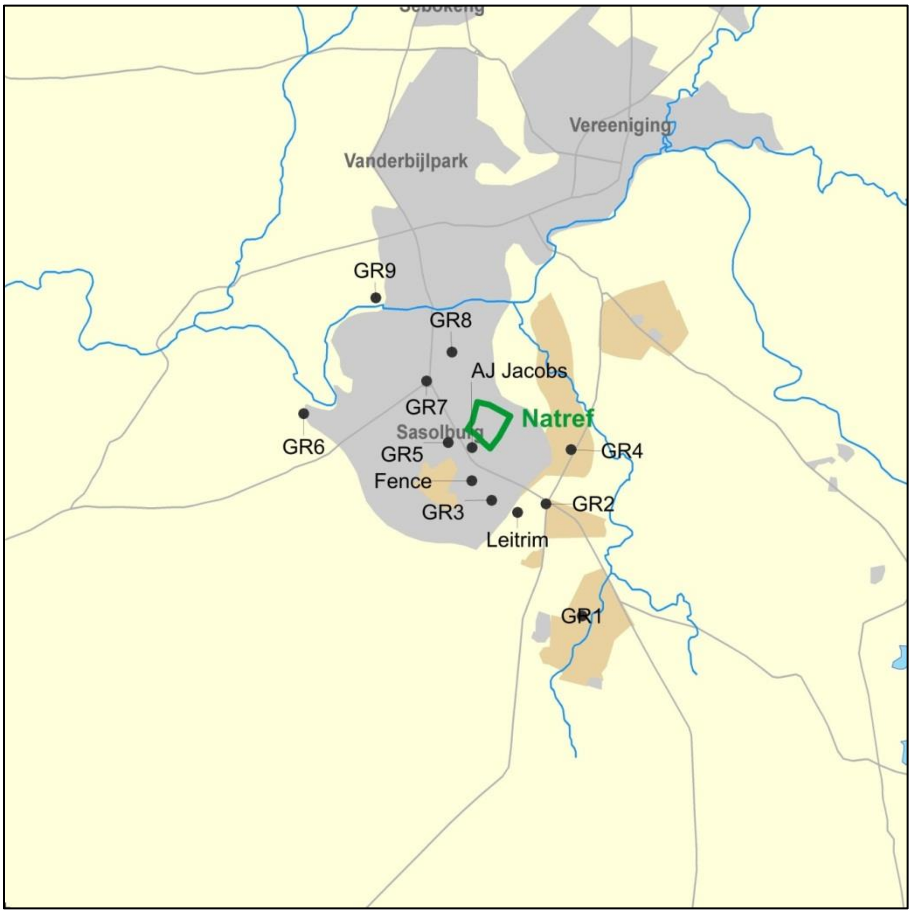

Figure 6: Map showing the positions of the twelve sensitive receptors identified for presenting the predicted ambient air quality for the different pollutants referenced in this application and for each emissions scenario

Table 4: Summary listing of the sensitive receptors illustrated in Figure 6

Receptor code name (a)	**Receptor details**	**Distance from source (metres)** (b)
GR5	Sasolburg - point of maximum	2 405
Fenceline	SASOL Fence-line monitoring station	3 218
AJ Jacobs	SASOL AJ Jacobs monitoring station	3 585
GR3	Zamdela - point of maximum	4 170
GR7	SASOL Eco-Park monitoring station	4 183
GR8	Vaalpark	4 503
GR4	Edge of industrial zone	4 797
Leitrim	SASOL Leitrim monitoring station	5 097
GR2	Zamdela (boundary)	5 412
GR9	Vanwaarshof AH	9 377
GR6	Marlbank river estate AH	10 221
GR1	Edge of impact plume (South East of plant)	11 775

(a) Code names used in Figures and Tables for brevity

(b) Figures and tables present findings for receptors in increasing distance from site

6.2.8 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 Natref’s cumulative impacts from its main stack to ground level concentrations of applicable criteria pollutants in the vicinity of the Natref refinery. The delta approach is consistent with the risk based approach that underpins Natref’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 Natref or those associated with activities other than Natref. 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.

6.2.9 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, and the use of emissions estimation methods, 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

Natref manages fugitive volatile organic compounds (VOCs) emissions from its facility in accordance with a leak detection and repair (LDAR) programme, as described further in the AIR.

6.3 Key findings

In presenting these findings it is necessary to briefly describe the use of the 99^{th} 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 the limit value can be exceeded for up to 88 hourly average values (or 1% of the time). Equivalently for daily averages (such as the ambient PM_{10} standard) up to 4 daily average values can be exceeded. 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 99^{th} percentile values except for annual averages.

6.3.1 Particulate Matter

The PM sources included in the AIR cumulatively account for more than 99% of Natref's measured 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 Natref's emissions.

The predicted ground-level PM_{10} concentrations as a result of emissions from Natref are shown in Figure 7. The predicted concentrations are very low, at less than 10 µg/m^3 across all receptors. No exceedances of the daily PM_{10} NAAQS were predicted, however, measured concentrations highlight persistent non-compliance with the NAAQS with observed daily average exceedances of the NAAQS limit value at AJ Jacobs and Leitrim monitoring stations of 43 (2010) and 89 (2010) days respectively. Small reductions (up to a 2% reduction compared with the baseline operations) in ground-level PM_{10} concentrations are theoretically predicted if Natref were to achieve the existing and new plant standards. The alternative emission limits proposed are predicted to result in a reduction in ambient PM of approximately 1% at the closest receptors (GR5, AJ Jacobs, Fenceline and GR3), although this improvement would have no material effect in achieving compliance with the NAAQS, due to high contributions from other sources.

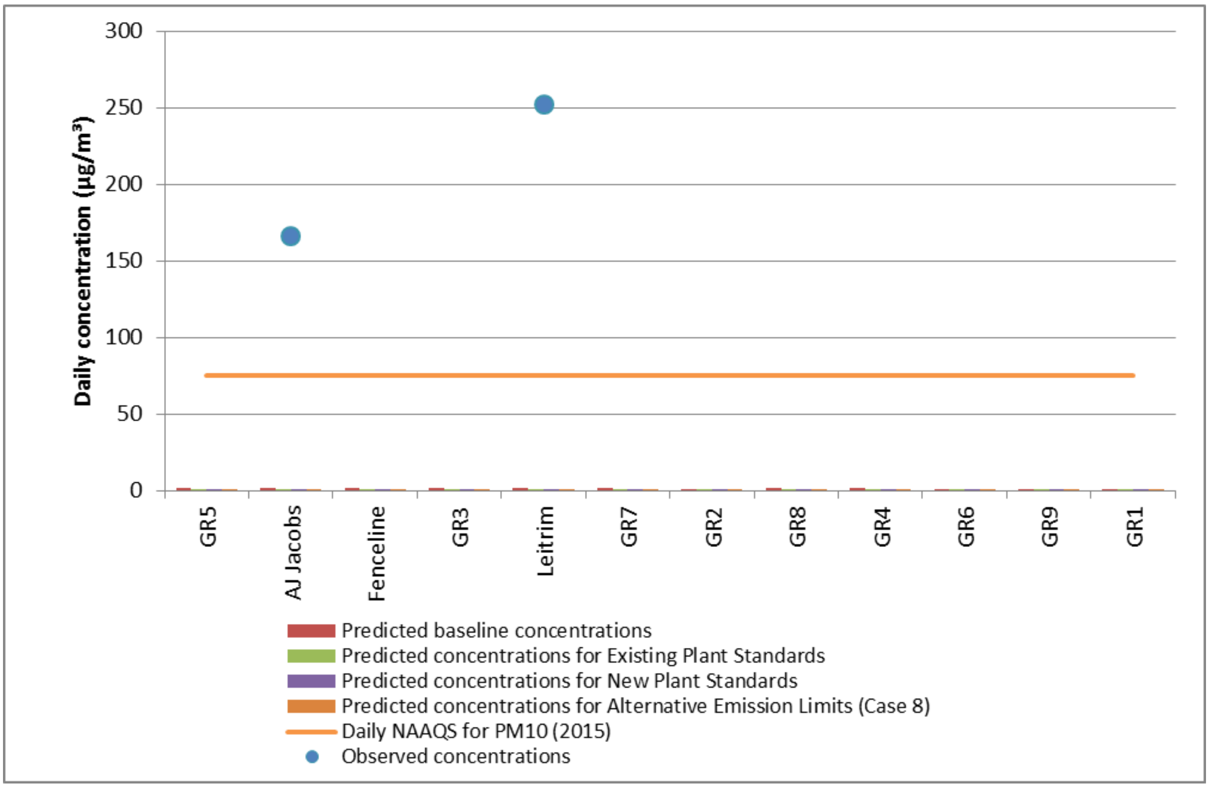

Figure 7: Predicted daily average ambient concentrations of PM_{10} for combined sources at the twelve sensitive receptors, for each of the four emissions scenarios modelled

6.3.2 Sulphur dioxide

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

The MES call for compliance with point source standards, as well as a bubble cap on total SO_2 emissions from processes listed under Category 2.1 (furnaces) and 2.2 (catalytic crackers). The MES requires compliance with the point source standards and the bubble cap concurrently, so the stricter of both requirements is the applicable emission reduction used for dispersion modelling. The predicted ambient concentrations as a function of these emissions sources are shown in Figure 8.

Ambient SO_2 at all sensitive receptors is measured (in the case of the air quality monitoring stations) or predicted (in the case of Vaal Triangle Air-shed Priority Area assessment) to be in compliance with hourly NAAQS, that is, within permissible risk levels.

Ambient SO_2 concentrations as a result of emissions from Natref operations were predicted to fall below the hourly NAAQS for the baseline and all compliance scenarios, as well as the alternative emissions limit scenario. In almost all cases Natref's ambient SO_2 concentrations are predicted to be less than 50 $\mu g/m^3$ when compared with the NAAQS limit value of 350 $\mu g/m^3$. Reductions in predicted ambient SO_2 concentrations would be expected if Natref were theoretically able to comply with all applicable existing and new plant standards.

Theoretical compliance with the new plant standards is, not surprisingly, predicted to result in the largest relative reductions in ambient SO_2 concentrations at all 12 receptors. The largest reductions are expected at the AJ Jacobs and Fenceline monitoring stations and at GR3 within the Zamdela residential area. The alternative emissions limit scenario is not predicted to increase ambient SO_2 concentrations at any sensitive receptor modelled, relative to the current baseline.

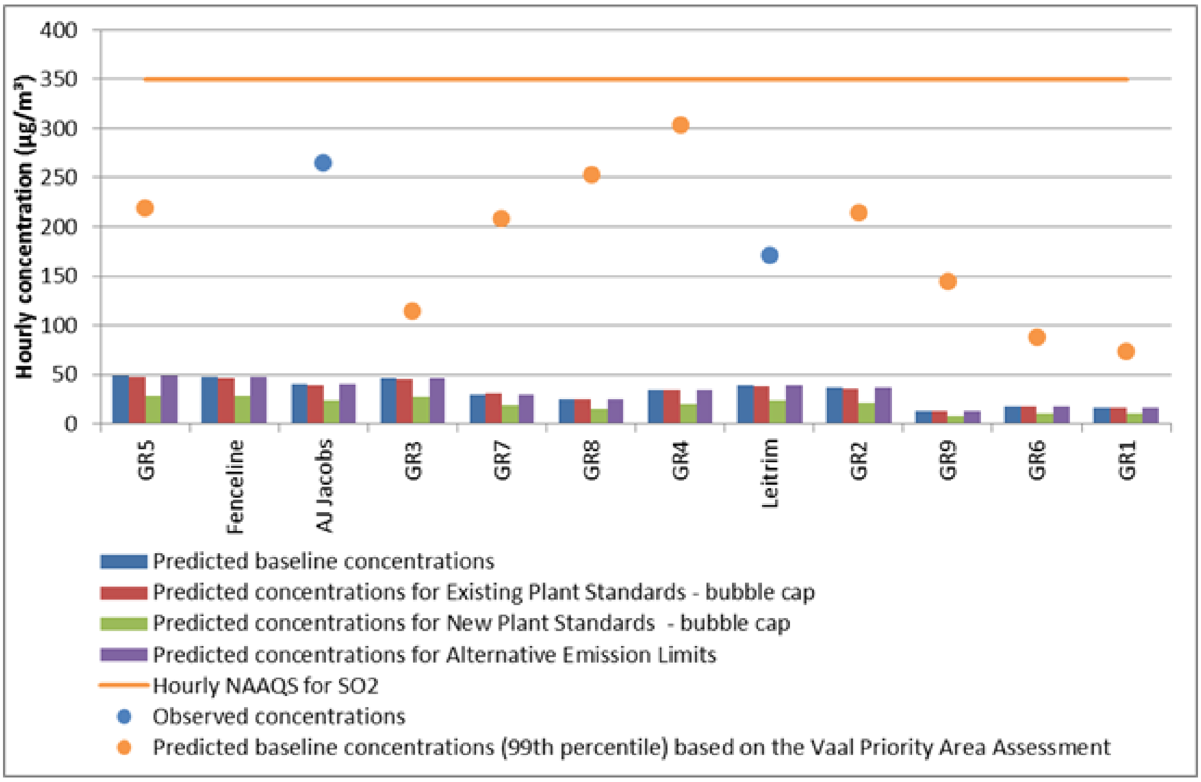

Figure 8: Predicted hourly average ambient concentrations of SO_2 for combined sources at the twelve sensitive receptors, for each of the four emissions scenarios modelled

6.3.3 Nitrogen dioxide

The NO_x sources included in the AIR assessment cumulatively account for more than 85% of Natref's total NO_x emissions. Emissions not included arise from other compliant processes in the refinery, as well as flares.

The predicted hourly average NO_2 concentrations are shown in Figure 9. Both predicted and measured ambient NO_2 at all sensitive receptors in the VTAPA are in compliance with the hourly NAAQS, with the maximum measured value being less than half of the NAAQS limit value. Against that background Natref's predicted baseline contribution to current ambient NO_x concentrations is well below 10 µg/m^3 or less than 5% of the NAAQS limit value.

Elevated ambient NO_2 concentrations, relative to the baseline, are expected at all receptors if Natref were theoretically to emit at the maximum concentrations allowed by the existing plant standards. The predicted ambient NO_2 concentrations under baseline emissions are seen to be well below the concentrations predicted for the existing plant standards because Natref's emission concentrations are less than the existing plant standards. Theoretical compliance with the new plant standards would result in slightly reduced ambient NO_2 concentrations from Natref relative to the present baseline, and the alternative emissions limit scenario also predicts marginal improvements in ambient air quality. Again the net effect of compliance with the new plant MES would translate into negligible changes in ambient NO_2 concentrations.

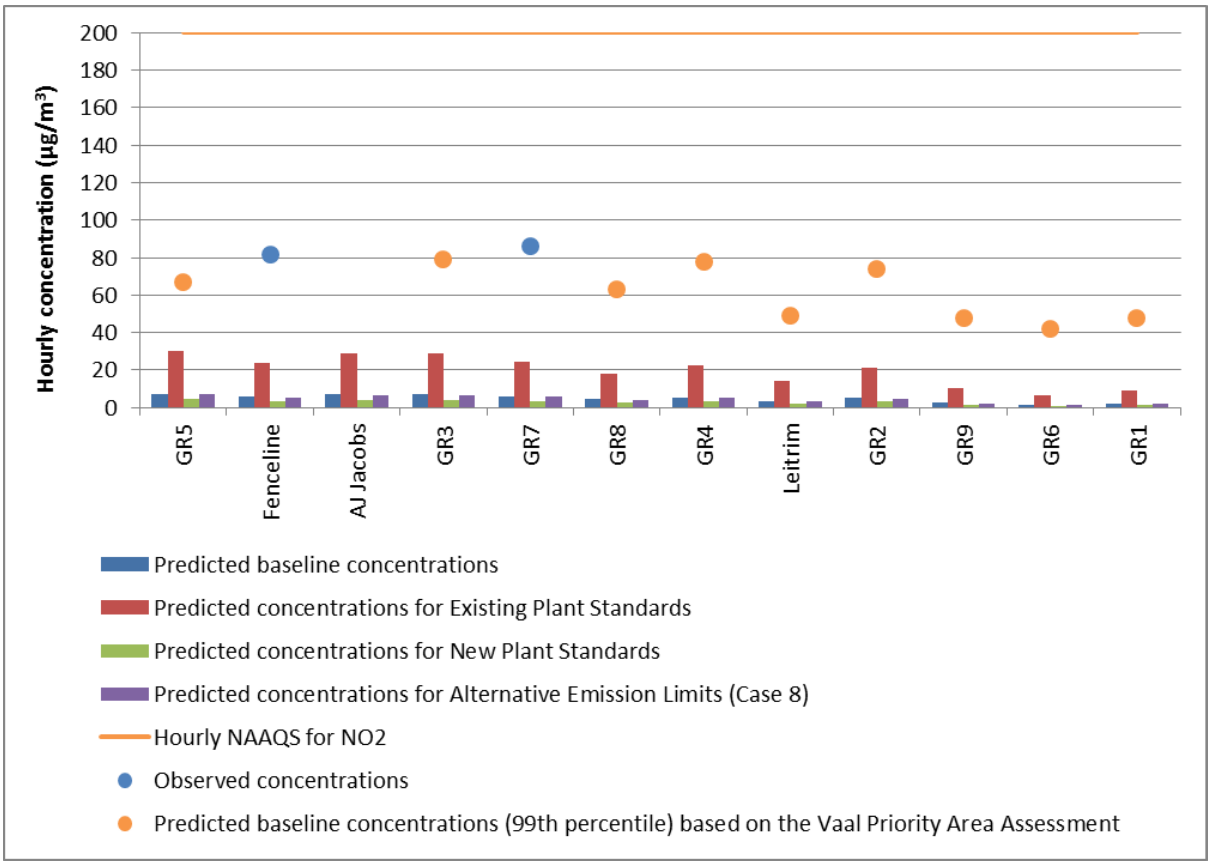

Figure 9: **Predicted hourly average ambient concentrations of NO_2 for combined sources at the twelve sensitive receptors, for each of the four emissions scenarios modelled**

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.

Prevailing air quality is best reflected in directly measured concentrations of the pollutants in question and in the case of Natref, measured ambient air quality from three monitoring stations complies with the NAAQS for SO_2 for all averaging periods, except for the daily standard which is exceeded during area specific incidents and NO_x but not PM_{10}. The compliance in respect of the NAAQS suggests that current emissions from both Natref 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 contributing to ambient PM_{10} load in the Vaal Triangle Area Priority Air-shed, including other industries and ground level sources such as domestic fuel use. Despite the fact that there is non-compliance with the PM_{10} NAAQS, the predicted contribution of Natref PM emissions to ambient PM_{10} concentrations is significantly less than the NAAQS limit value and measured concentrations. Reducing these contributions by a further 1% or 2% would be negligible from an ambient air quality point of view, but significant in terms of the costs of achieving the MES.

Dispersion modelling further indicates that Natref is not the dominant contributor to ambient NO_x concentrations at any of the receptors modelled, nor is it the dominant contributor to ambient SO_2 concentrations other than for receptors closest to the source. In respect of the other criteria pollutants most notably SO_2 (all averaging periods except daily) and NO_2 (all averaging periods), predicted ambient 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.

6.4.2 The effect of the alternative emissions limits

The alternative emissions limits proposed by Natref must conform to the administrative basis of the MES, which is to comply under all operational circumstances, with emissions exceeding the MES only being tolerated for shut down, start up and upset conditions. Natref has therefore requested ceiling emissions limits to ensure that it can comply under normal operational circumstances, where emissions exhibit natural variability.

Natref's modelled alternative emissions limits will not increase compared to the baseline emissions concentrations. Under the alternative emissions scenario compliance with the NAAQS is predicted in all circumstances. Again the key finding is that the MES will reduce ambient concentrations, but in a circumstance where there is already compliance with the NAAQS, or where Natref's compliance with the MES will not make a noticeable improvement in ambient air quality due to its very low contribution to pollution load.

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 Natref 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 were 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.

6.4.5 Assessment of costs and benefits

In concluding the findings of the AIR assessment, it must be emphasised that Natref 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 postponements 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 PM_{10} and daily SO_2 during area specific incidents. On this basis, there is no material benefit to be obtained with 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 Natref, 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 Natref's roadmap to sustainable air quality improvement

This Chapter outlines Natref's holistic approach to sustainable air quality improvement.

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

Section 4.2 details Natref's environmental management philosophy, which is founded upon a risk-based approach to ambient air quality improvements, which has realised sustained, and sustainable, improvements in Natref's pollution load to the ambient environment, for SO_2, NOx, PM, H_2S and VOC emissions. This considers Best Available Techniques for refineries, adapted for Natref's specific conditions.

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

Natref is committed to comply with all applicable environmental laws, including air quality laws such as the MES. Natref's roadmap for compliance with air quality law involves a multi-faceted approach, aligned with a risk-based philosophy:

7.2.1 Compliance with point source standards along achievable timelines

For the purposes of addressing reasonable and achievable compliance with the MES, postponements are applied for, in order to complete due diligence obligations aligned with typical project schedules for projects of this nature, as detailed in the initial postponement application. These upgrades will sustainably address, through various point source interventions, PM, SO_2, NOx and VOC emissions.

These intended plans are subject to conclusion of financing arrangements with the government for the major upgrades required in terms of Clean Fuels II, which will materially affect the financial viability of the refinery, and impact on the ability to undertake further air quality improvement projects.

SO_2 improvements

The Clean Fuels II programme would reduce SO_2 emissions attributable to Natref's fuel products from vehicle tailpipes, by 26 tons / day, which, at ground-level, is expected to improve ambient air quality in urban areas with high traffic.

In order to further improve reliability and availability of sulphur recovery at the refinery, a second high efficiency SRU would have to be installed, at an estimated cost of more than R1.6 billion. This can only be implemented once the plant is designed, approved, constructed, commissioned and optimised in accordance with exacting due diligence requirements. This process furthermore requires critical resources (including labour and manufacturing capacity) to be made available, mindful of the concurrent Clean Fuels II programme.

NO_x improvements

Natref intends to install low NOx burners on the two existing boilers onsite, all new or revamped furnaces or boilers will be installed with low NOx burners in the future.PM improvements

It is intended to reduce PM emissions from the FCC, using a technology such as Third Stage Separators (TSS) and Fourth Stage Separators (FSS), or Electrostatic Precipitators (ESPs) for example. This would theoretically reduce PM emissions to below 120 mg/Nm^3, and bring about compliance with the new plant standards. The installation of these units can only be done during a shutdown.

VOCs improvement

In addition to Natref's on-going LDAR programme to reduce VOCs, Natref will continue to install geodesic domes on tanks where applicable. Post CFII VOCs will no longer be emitted from three LSR storage tanks.

7.2.2 Approach to compliance in respect of additional postponement applications

Natref had previously applied for exemption from default application of the MES in cases where:

- Compliance cannot feasibly be achieved with presently available technologies.
- Compliance cannot be achieved due to refinery specific constraints (such as fuel management and water and waste management).

In these cases it is believed that compliance will not materially improve ambient air quality, and as described elsewhere in this report, Natref is making an application for additional postponements in these cases. While Natref's concerns with the MES remain, Natref 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

Natref does not propose that for the duration of its additional postponement period its atmospheric emissions licences contain no emissions limits. Instead, for this period Natref 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. Natref asserts that the alternative emissions limits requested in this additional postponement application are the best that can feasibly be achieved on its facility, given refinery specific constraints and presently available technology. Natref 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, Natref 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 or operational alternatives are identified, Natref commits to embarking on more detailed investigations, in accordance with its 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. New technology should be proven/widely commercialised and should not have any significant cross-media impacts. In order to ensure that the NAQO is kept abreast of developments, Natref 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

Natref 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 ambient PM challenge in the Vaal Triangle.

7.3 Summary of roadmap to sustainable air quality improvement

In summarising this chapter, Natref follows a risk-based approach to identifying and managing its priority environmental risks. Natref'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 10 presents a summary of the information contained within the motivation reports and associated technical appendices, demonstrating the roadmap to sustainable air quality improvement, described by emission source.

A short description is provided for the seven types of air quality improvement actions depicted in Figure 10, which Natref has adopted in past years, and which Natref will continue to act on. The labelling below corresponds to the labels included in Figure 10's legend. These actions include:

a) The implementation of improvements based on Natref's risk-based approach. For example:

- Reduction in fuel oil firing and replacing with refinery fuel gas or natural gas.
- Installation of double mechanical seals and geodesic domes on tanks.
- Replacement of FCC cyclones to reduce FCC PM.
- Installation of LoNox burners on new or revamped furnaces.
- Construction of Vapour Recovery Unit at the Road & Rail loading facility to reduce VOCs.
- Construction of new loading gantry to reduce VOCs.
- Processing of Sour Water Stripper Off-gas in Sulphur Recovery Unit to reduce SO_2 emissions.
- Installation of H_2S and SO_2 analyser at the SRU tailgas for optimised operation and SO_2 reduction.

b) The implementation of commitments to the Vaal Triangle Air-shed Priority Area air quality management plan. For example:

- Reduction in crude oil sulphur content.

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:

- Compliance monitoring points will be installed at 9 point of compliance prior to 2018.
- Re-routing of Amine off-gas away from flare to prevent continuous flaring of H_2S rich gas.
- Installation of PM reduction technology on the FCC.
- Installation of a second SRU.

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:

- Re-routing of vacuum pre-flash off-gas away from B12002.
- Installation of Lo NOx burners on Natref's two steam boilers.

e) Technical investigations driven by MES compliance, i.e. investigations initiated recently due to November 2013 amendments to the MES. For example:

- The point of compliance' definition necessitating investigations into installation of sampling points at these specific locations.
- Inclusion of MES category 2.2 for the FCC, which was not in the 2010 MES.

f) 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.
- Energy efficiency projects which increase power production without increasing air quality or greenhouse gas emissions, and back out of electricity supplied by the national grid.

Through these actions, Natref 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 10, feasible compliance with the new plant standards is not foreseen due to refinery specific limitations or presently available technologies. For these limited cases, Natref'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 7.2.2 (a) - (c).

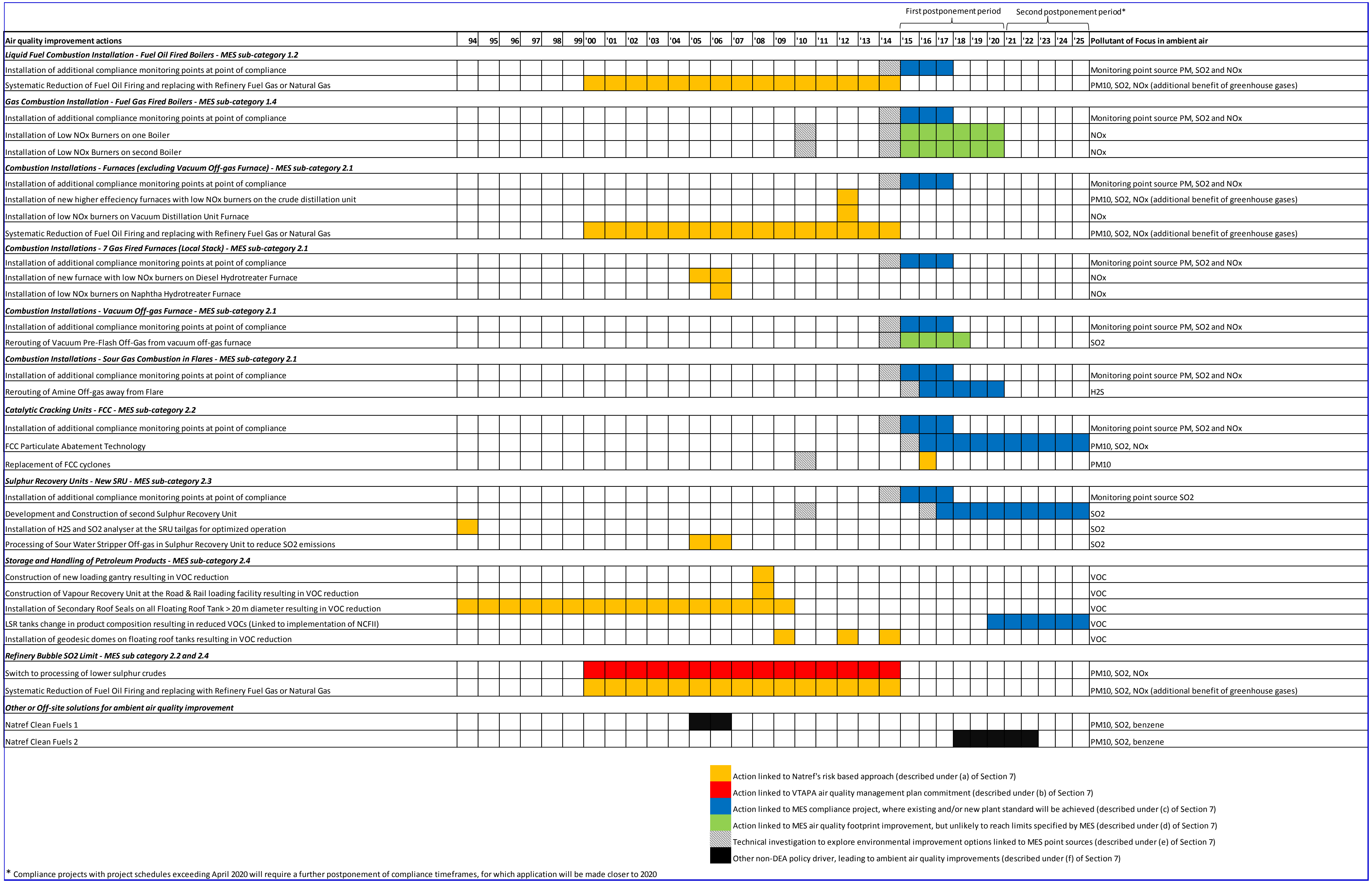

Figure 10: Natref's roadmap to sustainable air quality improvement

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

The stakeholder engagement process on Natref's 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 Natref's project development and governance process. A high level overview is provided on the progress achieved since the commencement of the process.

- Capital applications and procurement processes, in line with Natref's project development and governance process, were advanced for the implementation of emissions monitoring infrastructure on eleven (11) points of compliance for boilers and furnace associated with the refinery's main stack as per the 2013 MES definition for "point of compliance";
- Installation was completed for six (6) new emission sampling points on the refinery local stacks, which were not part of the postponement applications. Subsequently emission surveys were performed on these stacks in October 2014 which re-confirmed that the SOx, NOx and PM are in compliance with both existing and new plant standards;
- The Front End Engineering Design development and governance process was progressed for the installation of particulate matter abatement technology on the Fluid Catalytic Cracking unit;
- The tender process was completed as part of the Front End Engineering Design for a new Sulphur Recovery Unit to reduce SOx emissions and meet MES requirements regarding efficiency and availability specifications;
- Preliminary engineering studies were initiated in accordance with 2013 MES standards to explore the viability of implementing alternative disposal technologies for waste gas streams currently routed to the vacuum off-gas furnace.

8 Stakeholder engagement

Natref 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 11**).**

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 Natref that she will not consider its exemption applications, and has advised that postponement applications should be made instead. Natref 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 C.

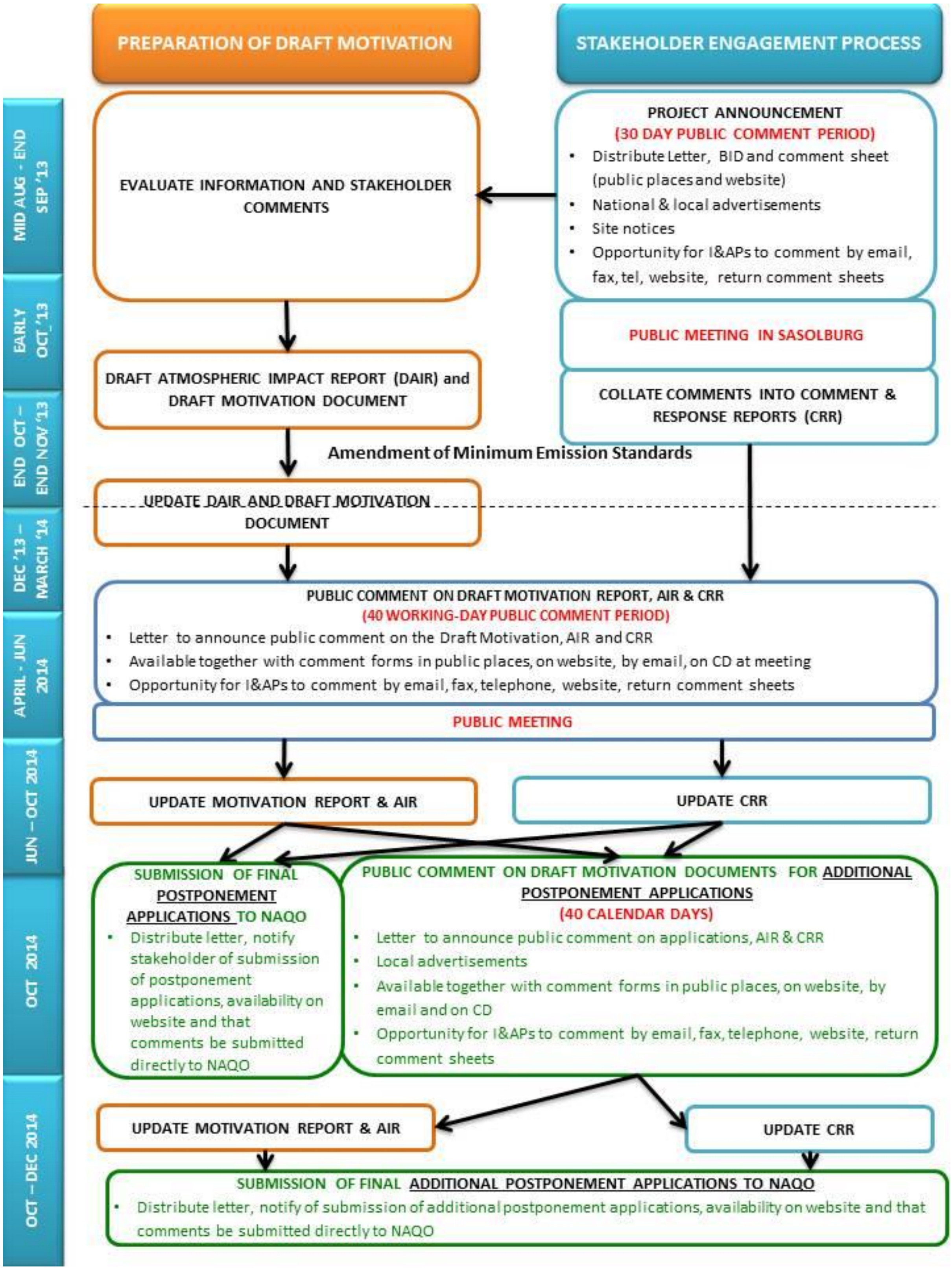

Figure 11: Technical and Stakeholder Engagement Process

8.1 Project announcement

Natref's application process was announced between **15 September and 15 October 2013.** Stakeholders were invited to a public meeting for the Natref Operation on Tuesday, 8 October 2013, 10:00 – 12:00, at the Boiketlong Community Hall in Sasolburg. Stakeholder's received notification of public meeting and was invited to participate in the process as follows:

- A letter of invitation was sent to stakeholders to invite them to the public meeting and register as stakeholders.
- The invitation letter was accompanied by a Background Information Document (BID), providing more information on Natref's operations and a comment form for stakeholders to submit their comments.
- Advertisements were placed in national and local newspapers to announce Natref'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 the public meeting 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 D.

- **Comments relating to Natref's application process -** Stakeholders' comments focused on Natref's reasons for applying for postponement, legal requirements, timeframe for compliance and requests for details regarding which processes require postponement.
- **Stakeholder engagement -** It was noted that the BID did not provide sufficient information for meaningful stakeholder comment. Stakeholders commented on the poor attendance at the public meeting and made suggestions for more convenient venues and meeting times. Some stakeholders requested an extended public comment period.
- It was requested that the Sasol Community Group be notified well in advance of the public meeting to enable Zamdela Community attendance.
- **Environmental concerns -** Stakeholders expressed concern regarding Natref's air emissions and actual contribution to air pollution in the area. Other environmental concerns regarding the impact of Natref's emissions on water quality, health and socio-economic aspects, such as Natref's obligation to re-invest in communities in their area of operation, and to empower communities to care for the environment, were also raised.

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 Natref's application process.

The public meeting for the Natref operation took place on Tuesday, 20 May 2014, 14:00 – 16:00, at the Casa Mia Conference Centre in Sasolburg. Stakeholders received notification of the public meeting and were invited to comment on the Draft Motivation Reports during the comment period from **15 April to 13 June 2014**, as follows:

- Distribution by email and mail, of an invitation letter to attend the public meeting, 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 Report on the SRK website (www.srk.co.za).
- Placing the letter, Comment Form and the Draft Motivation Report in publicly accessible venues close to the Natref 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;
  - Beeld (Afrikaans), Tuesday 1 April 2014;
- Advertisements in local newspapers
  - Sasolburg Ster (English), Wednesday, 2 April 2014;
  - Puisano (Sesotho), Friday, 11 April 2014; and
  - Vaal Weekblad (Afrikaans), Wednesday, 2 April 2014.
- Telephonic and SMS notifications were sent to stakeholders to notify them of opportunities to comment.

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 D**.**

- **Application process** - Stakeholders were of the opinion that Natref had the opportunity to provide inputs into the MES in 2010 and that they should now comply with it. Certain stakeholders felt that Natref had no legal basis to apply for postponement.
- **Environmental concerns** – Questions were raised as to how Natref was going to mitigate its greenhouse emissions and assist government in meeting its climate change response plan. It was also requested that the data presented in the Air Impact Modelling Report should be verified. Some stakeholders rejected the idea of offsetting as they felt that it was governments' responsibility to improve housing and insulation. They noted that industry was using offsetting as an excuse for non-compliance with the MES.
- Questions were asked regarding the differences between the impacts of Sasol and Natref's on the environments and it was noted that the different presentations regarding Sasol and Natref created suspicion. Some stakeholders were of the opinion that postponements from the MES should not be granted for Natref as there was no legal basis for their application, and that Natref has not addressed the adverse health impacts of their operation. Applications have not been

submitted within the appropriate time of the 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 as well as to surrounding communities. 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 Natref that she would not consider its exemption applications, and advised that postponement applications should be made instead. In line with the Minister's notification, Natref 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 (forty) days. The documents were available on the SRK website http://www.srk.co.za/en/za-natref-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 application has been submitted to the NAQO for decision-making and that comments on the applications can be submitted directly to the NAQO within 21 days. The Final Motivation Report in support of additional postponements was made available electronically for stakeholder's information, on the SRK website http://www.srk.co.za/en/za-natref-postponements, or on request from the stakeholder engagement office.

8.6 Comment and Response Report

All comments, concerns, questions and suggestions raised for Natref 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 Natref project team members. The CRR is attached as Annexure D.

9 Conclusions

The Natref refinery, which is operated by Total South Africa and Sasol, is a key source of liquid fuels for the inland market and for OR Tambo International Airport in particular. As an inland refinery Natref is presented with a range of challenges that are not experienced by a typical refinery, the most significant of which is managing fuel oil, since an inland refinery like Natref does not have a ready fuel oil market like the shipping industry which has a demand for bunker fuel oil. As a result Natref seeks to minimise the amount of fuel oil it produces by maximising the proportion of petrol, diesel and aviation fuel that can be produced from the crude oil feedstock, producing only 3% of fuel oil product from crude oil volumes processed. At the same time Natref was designed to process generally higher sulphur crudes.

Apart from its own internally defined environmental performance improvements, Natref has embarked on a process of reducing its emissions of SO_2, NO_x and PM in line with the emissions reduction that were identified for the refinery in the VTAPA. This comes on the back of a process to procure lower sulphur crudes with a commensurate reduction in sulphur dioxide emissions. At the same time Natref is compelled to comply with the requirements of Clean Fuels II, which will see the petrol and diesel produced at the refinery having reduced concentrations of sulphur. As a result, the Clean Fuels II specification will see further improvements in motor vehicle tail pipe emissions with concomitant improvements in urban air quality, but the sulphur removed from the fuel products will then remain at the refinery, and which is mostly recovered as additional sulphur product.

Against this background compliance with some of the MES is not feasible based on presently available technologies. The complex configuration of the plant, the need to use its own fuel oil, the fact that the refinery is a brownfields (existing plant) operation and other reasons, collectively make compliance with the MES challenging. In addition, the MES are based on compliance at production process level and not for the refinery as a whole. That means that the refinery now has to account for its emissions at the source of those emissions and not at the point at which they are emitted to atmosphere. Natref has accordingly proposed a range of alternative emissions limits to which it can be held and which it proposes be written into its atmospheric emissions licence, to prevail for the duration of the requested postponement period. Natref furthermore commits to conducting periodic technology scans to identify reasonable measures to reduce emissions that may emerge over time.

As part of this application for postponement from the compliance timeframes for its listed activities, Natref has had an independent third party assessment conducted of the implications of the proposed alternative emissions limits and alternative special arrangements for ambient air quality. Not only are measured concentrations of SO_2 and NO_2 seen to be fully compliant with the relevant NAAQS, bar the daily SO_2 standard which is exceeded at one monitoring station, but predicted concentrations indicate that the ambient concentrations under fully compliant emissions would not be materially improved by that MES compliance. In the case of PM_{10} it is clear from the measured air quality that there is non-compliance with the NAAQS. In this case though the predicted concentrations of PM_{10} from Natref are seen to a small percentage of both the NAAQS limit values and the actual measured PM_{10} concentrations. As a result full compliance with the MES for PM would not have a significant impact on ambient air quality improvement, but would have significant cost and technical integration implications for Natref.

Natref fully support efforts to improve ambient air quality in a risk-based approach. In this spirit, Chapter 7 outlines Natref's roadmap to sustainable air quality improvement, which demonstrates Natref's commitments to continual, sustainable environmental improvement.

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: Volume 1: Stakeholder Engagement Report

Annexure D: Volume 2: Comments and Response Report

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