Motivation for the postponement of compliance timeframes in terms of Regulation 11 of the Listed Activities and Associated Minimum Emission Standards identified in terms of Section 21 of the National Environmental Management: Air Quality Act 39 of 2004 as amended.

Report Prepared by

National Petroleum Refiners of South Africa (Pty) Limited

natref

March 2019

Motivation for the postponement of compliance timeframes in terms of Regulation 11 of the Listed Activities and Associated Minimum Emission Standards identified in terms of the Section 21 of the National Environmental Management: Air Quality Act 39 of 2004 as amended.

National Petroleum Refiners of South Africa (Pty) Limited

Jan Haak Road
Sasolburg
1947

March 2019

Executive Summary

National Petroleum Refiners of South Africa (Proprietary) Limited (Natref) operates the only inland crude oil refinery in South Africa, in Sasolburg in the Northern Free State. The refinery is operated on behalf of two shareholders, Sasol Oil (Pty) Ltd (63.64%) and Total South Africa (Pty) Ltd (36.36%). Amongst a variety of environmental aspects, the refinery also has atmospheric emissions. Minimum Emissions Standards (MES) were published in 2010 (Government Notice (GN) 248), revised in 2013 (GN 893) and 2018 (GN 1207), listing certain industry types that emit atmospheric emissions requiring an Atmospheric Emissions Licence (AEL) and prescribing maximum allowable emissions for those industry types. The MES prescribed 'existing' and 'new plant' standards. For existing plants such as Natref, compliance with existing plant standards was required by 2015 and new plant standards by 2020. The regulations also contain a provision for emitters to apply for postponement of the compliance timeframes where such is required.

This motivation report forms part of an application by Natref for postponement of compliance timeframes for its Sulfur Recovery Unit (SRU) specified in subcategory 2.3(a) of the MES. Natref previously applied for and was granted postponement for various sources. The refinery's AEL was subsequently amended to reflect the postponement decisions. One of the postponement decisions granted was for the requirement of 95% SRU availability (for an existing plant). Natref is now obliged to request postponement for SRU availability as Natref cannot achieve compliance with the new plant standard of 99% SRU availability by 1 April 2020 for various reasons detailed below.

As an inland refinery, Natref has a very high crude to finished products conversion ratio. This high conversion ratio is required because an inland refinery does not have a ready market for sale of poorer quality fuels such as bunker oil. The high conversion ratio translates however, into larger atmospheric emissions and Natref has had to make a number of investments into emissions abatement technology over the past 15 years. Such investments have resulted in material reductions in SO_2, NO_x, VOC and PM emissions. The SRU is an important emission abatement component of the refinery, especially in respect of SO_2.

In order to ensure 99% availability, the reasons for SRU downtime were investigated, identified and prioritised for implementation of mitigation measures. Following which, various interventions have been partially implemented with the remaining activities scheduled sequentially until project completion in 2023.

There are two key reasons for applying for postponement of the compliance timeframe until 2023. The first of these is the Turnaround and Inspection (T&I) schedule and the second is Natref's project governance. As an inland refinery Natref is critical to the supplying of liquid fuels in Gauteng and OR Tambo International Airport (ORTIA). As such any production interruptions have important implications for liquid fuel supply and a potentially serious impact on the economy of the region and the country as a whole. Downtime of the refinery has to be carefully scheduled and aligned with the availability of other fuel sources to avoid shortages of liquid fuels. For this reason, any modifications to the refinery can only be done during scheduled T&I downtime and that has the effect of pushing out the schedule for modifications.

Natref uses a project governance process known as stage-gate. Stage-gate is a series of stages each having a gate at which point progression to the next stage is considered. Each stage has exacting criteria that must be fully met before progression through the gate to the next stage is allowed. Stage-gate serves to ensure that the complexity of modifying what is a unique and highly complex industrial process is done successfully without impacting on production schedules and without harm to employees or the general public. Stage-gate is also fully integrated with the T&I schedule. By definition

the stage-gate process demands considerable time and simply cannot be expedited without potentially compromising the key success factors that it is designed to assure.

As required by the MES, a postponement application must include an Atmospheric Impact Report (AIR), in this regard an AIR was prepared by Airshed Planning Professionals to determine the impact of:

- Emissions when the SRU is 100% available.
- Theoretical emissions assuming 99% SRU availability (MES compliance).
- Emissions assuming 95% SRU availability (Alternative limit proposed)

The AIR concluded that for all criteria pollutants, for all scenarios, the modelled concentrations of pollutants are below the National Ambient Air Quality Standards (NAAQS). .

In terms of the MES an application for postponement must contain a concluded Public Participation Process. The requirements of which are detailed in Chapter 6 of the Environmental Impact Assessment (EIA) Regulations (Government Notice No. 326, 7 April 2017). As part of the Public Participation Process, the Draft Motivation Report and Atmospheric Impact Report was made available for public comment. Public Open days were held in January 2019 to facilitate comments from the public on the documents. All comments received, and associated responses have been documented and included in the Comments and Response Report, Annexure D.

In conclusion, Natref is applying for postponement of certain compliance timeframes in the MES to allow for sufficient time to complete the necessary compliance project activities underway to improve the SRU availability to meet the new plant standards (i.e. as set out in subcategory 2.3 (a) of the MES). This motivation document serves to detail the basis of, and reasons for, the request for postponement.

Table of Contents

List of Tables

List of Figures

Glossary

Definitions of terms as defined in GN 893 that have relevance to this application:

AEL – Atmospheric Emission Licence, Licence No. FDDM-MET-2013-17-P2, issued by the Fezile Dabi District Municipality in March 2018, to the National Petroleum Refiners of South Africa (Pty) Ltd. (Natref) for its operations in Sasolburg.

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

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

New Plant – Any plant or process where the application for authorisation in terms of the National Environmental Management Act (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.

Total volatile organic compounds (VOCs or TVOCs) – means organic compounds listed under US-EPA Compendium Method TO-14.

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

Alternative special arrangements – Specific compliance requirements associated with prescribed emissions limits of a listed activity in Part 3 of GN 893as amended by GN 551 and GN 1207. These include, among others, reference conditions applicable to the prescribed emission limits of the listed activity, abatement technology prescriptions and transitional arrangements.

Atmospheric Impact Report – in terms of the Minimum Emission Standards, an Atmospheric Impact Report as per Section 30 of the NEM:AQA must accompany an application for postponement. The Regulations prescribing the format of the Atmospheric Impact Report (AIR) were published in GN 747 of 2013 as amended by GN 284.

Ambient standard – The maximum tolerable concentration of any outdoor air pollutant as set out in the National Ambient Air Quality Standards published in terms of Section 9 (1) of the NEM:AQA. These standards are herein referred to as the NAAQS.

Criteria pollutants – Section 9 of NEM:AQA obliges the Minister to identify a national list of pollutants in the ambient environment, which present a threat to human health, well-being or the environment. These pollutants are referred to in the National Framework for Air Quality Management as “criteria pollutants”. Once these pollutants are identified, the Minister is then required to establish national standards for ambient air quality in respect of these criteria pollutants. Presently, eight criteria pollutants have been identified. These include sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), carbon monoxide (CO), lead (Pb), particulate matter (PM_{10}), particulate matter ($PM_{2.5}$) and benzene (C_6H_6). In this document, any pollutant not currently 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 but not limited to, for example, particulate matter, nitrogen oxides and sulfur dioxide.

Listed activity – In terms of Section 21 of the NEM:AQA, the Minister of Environmental Affairs has listed activities that require an AEL. 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, called a “point of compliance”.

Minimum Emission Standards – Prescribed maximum emission limits and the manner in which they must be measured, for specified pollutants. These standards are published in Part 3 of GN 893, as amended by GN551. These standards are referred to herein as "MES".

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. The standards contain emission parameters for various substances that may be emitted, including, for example, particulate matter, nitrogen oxides and sulfur 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.

GN 893 – Government Notice 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 List of Activities published in terms of Section 21, namely Government Notice 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; and detailing the requirements for applications for postponement of stipulated compliance timeframes.

GN 551 – Government Notice 551, 12 June 2015, published in terms of Section 21 of the National Environmental Management: Air Quality Act (Act No. 39 of 2004) and entitled '*Amendments to the list of Activities which result in Atmospheric Emission which have or may have a Significant Detrimental Effect on the Environment, including Health, Social Conditions, Economic Conditions, Ecological Conditions or Cultural Heritage'* published in Government Notice No. 893, Gazette No. 37054 dated 22 November 2013.

GN 1207 - Government Notice 2017, Gazette No. 42013 dated 31 October 2018, published in terms of Section 21 of the NEM:AQA and entitled '*Amendments to the Listed Activities and Associated Minimum Emission Standards Identified in Terms of Section 21 of the National Environment Management: Air Quality Act, 2004 (Act No.39 of 2004)*.

Shutdown schedule - A programme for the scheduled period for which a plant or piece of equipment, such as a tank, is out of commission for maintenance for an extended period of time.

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

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

2014 Postponement Application - Postponement application submitted ahead of the 1 April 2015 compliance timeframe for existing plant standards, for various sources at the Natref facility, which application was substantially granted.

2017 Postponement Application – Postponement application submitted ahead of the 1 April 2018 compliance timeframe for existing and new plant standards, for various sources at the Natref facility, which application was substantially granted.

2019 Postponement Application – This postponement application that is being submitted ahead of the 1 April 2020 compliance timeframe to meet new plant standards.

List of Abbreviations

AEL	Atmospheric Emission Licence
AIR	Atmospheric Impact Report
AQMS	Air quality monitoring stations
BAT	Best Available Techniques
CDU	Crude Distillation Unit
CO	Carbon Monoxide
C_6H_6	Benzene
DEA	Department of Environmental Affairs
DEBITS	Deposition of Biogeochemically Important Trace Species
DHC	Distillate Hydrocracker
ESP	Electrostatic precipitator
FCC	Fluidised Catalytic Cracker
FYTD	Financial Year to Date
GN	Government Notice
H_2S	Hydrogen sulphide
I&APs	Interested and Affected Parties
LDAR	Leak Detection and Repair
LPG	Liquid Petroleum Gas
MES	Minimum Emissions Standards
NAAQS	National Ambient Air Quality Standards
NAQO	National Air Quality Officer
NEM:AQA	National Environmental Management: Air Quality Act
NOx	Oxides of nitrogen
NU	Naphtha Unifiner
ORTIA	OR Tambo International Airport
$PM_{2.5}$	Particulate Matter with radius of less than 2.5 µm
PM_{10}	Particulate Matter with radius of less than 10 µm
RCD	Reduced Crude Desulfurisation
SO_2	Sulfur dioxide
SRU	Sulfur Recovery Unit
SWS	Sour Water Stripper
T&I	Turnaround and Inspection
TVOC	Total volatile organic compounds
VDU	Vacuum Distillation Unit
VOC	Volatile organic compounds
VRU	Vapour recovery unit
VTAPA	Vaal Triangle Airshed 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 South Africa (Pty) Ltd (63.64%) and Total South Africa (Pty) Ltd (36.36%). As with all refineries, Natref has a suite of environmental aspects such as resource use, waste and pollution and has a number of sources of atmospheric emissions.

In March 2010, the Department of Environmental Affairs (DEA) published Minimum Emission 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 Government Notice No. 893 in Government Gazette 37054 of 22 November 2013 (GN 893) which were in turn, amended by GN 551 and GN 1207. This application is therefore aligned with the 2013 MES (i.e. GN 893 as read with GN 551 and GN 1207). The MES serves to define maximum allowable emissions to atmosphere for a defined range of pollutants and regulate specific activities that can generate such emissions. In terms of the MES, existing production facilities were required to comply with the MES prescribed for existing plants by 1 April 2015 ("existing plant standards"). Existing plants were then further required to comply with the MES applicable to new plants by 1 April 2020 ("new plant standards"). The MES also provides for emitters to request inter alia postponements of the compliance timeframes where so required.

Natref previously submitted a postponement application ahead of the 1 April 2015 compliance timeframe for existing plant standards, for various sources at its facility (the "2014 Postponement Application"). Postponement of the compliance timeframes for the existing plant standards was subsequently granted until 31 March 2018 for some points of compliance at the refinery, and until 31 March 2020 for the Sulfur Recovery Unit (SRU). Natref's Atmospheric Emission Licence (AEL) was also amended to reflect the postponement decisions granted. Natref was then compelled to submit a further MES Postponement Application in 2017 due to challenges in meeting the MES by 31 March 2018, for four emission points while three emission points already meet the new plant standards. The postponement was granted to Natref in March 2018 and the AEL[1] amended accordingly.

Natref is now obliged to apply for postponement of the MES new plant standards. The current Postponement Application is neither a repeat of the 2017 postponement application, nor an extension for the postponements granted in March 2018. Rather, this application seeks a postponement only in respect of the SRU availability requirement set out in subcategory 2.3 of the MES. Natref is therefore applying for postponement to allow for sufficient time to complete the necessary compliance project activities underway to improve the SRU availability to meet MES new plant standards. This motivation serves to detail the basis of, and reasons for, the request for postponement.

2 Background

2.1 Operations

Natref was founded in 1968 and commissioned in 1971 and today employs approximately 600 permanent employees in Sasolburg and 80 employees at its Durban Operations (raw material storage). The refinery is situated in the Metsimaholo Local Municipality which is part of the Fezile Dabi

[1] A copy of Natref's AEL, which has been partially redacted to protect certain sensitive commercial information not related to the emissions which are the subject of this application, is included in Annexure D.

District Municipality. Due to the refinery being inland, imported crude oil is pumped from Durban Operations to the Sasolburg facility via an approximately 600 km pipeline.

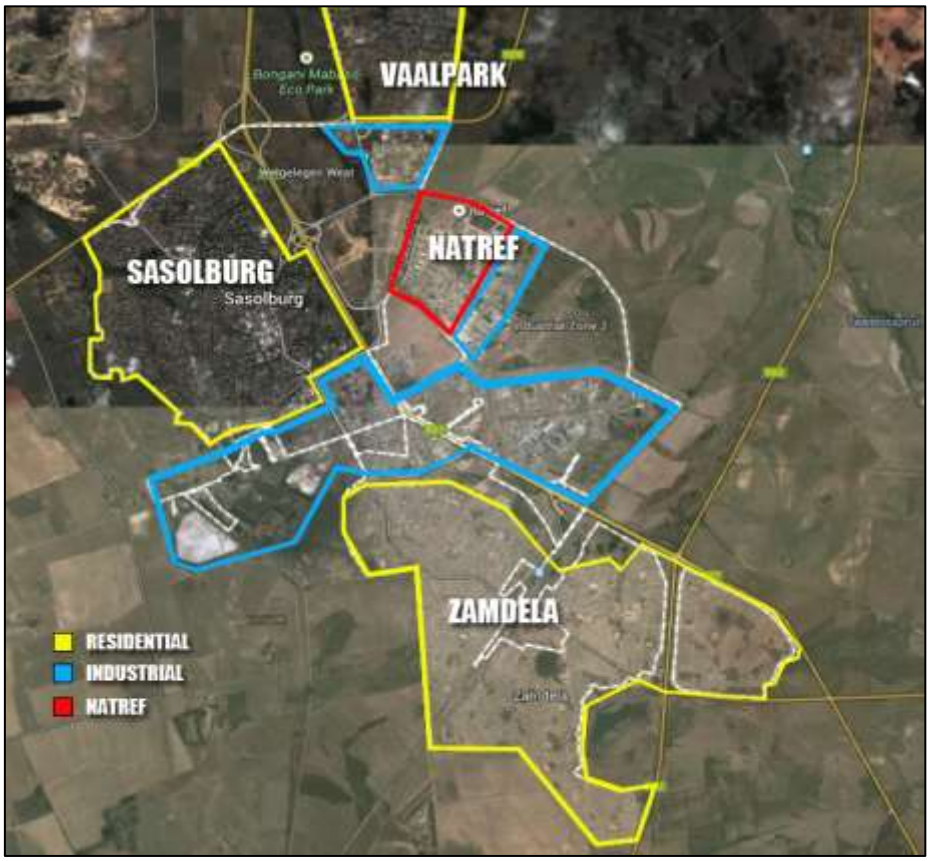

Figure 2-1: Map showing the position of the Natref refinery, located in the Northern Free State

The total refining capacity of South Africa's refineries is approximately 35 million tons per year of which Natref produces 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 one of importing and storing crude oil, producing refined products, and blending such products with additives to produce marketable products conforming to fuel specifications (Figure 2-2). Crude oil is procured by Sasol Oil and Total South Africa, with stocks being managed by Durban Operations ensure a reliable feed to the refinery, via the pipeline. The crude oil is then refined to produce petrol, diesel, jet fuel, bitumen and fuel oil. 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.

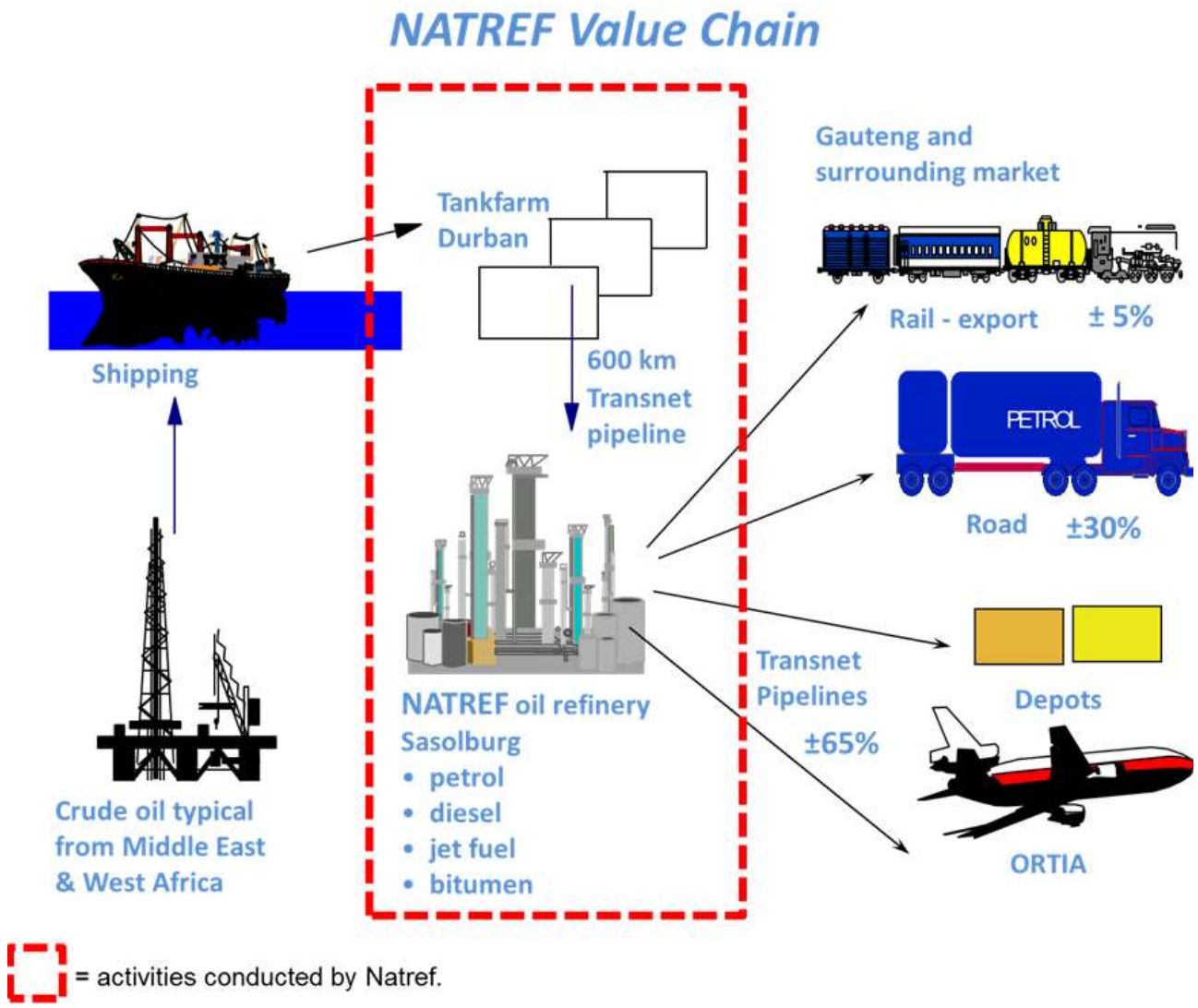

Figure 2-2: Natref's activities in the liquid fuel value chain

2.2 Overview of the Facility

2.2.1 Natref process

Natref boasts 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 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 of the crude. Fuel oil is typically poor quality and has a high sulfur content. Conventional refineries, typically located at the coast, are able to sell large amounts of this fuel oil to ships as bunker fuel oil due to their location. 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 oil than a typical refinery.

The Reduced Crude Desulfurisation (RCD), Fluidised Catalytic Cracker (FCC) and Distillate Hydrocracker (DHC) allow Natref to 'crack' (complex heavy hydrocarbons are 'cracked' or broken down into simpler, lighter hydrocarbon molecules) and thereby convert a high proportion of the heavy bottom components of the crude into petrol, diesel, jet fuel and Liquid Petroleum Gas (LPG). Whereas typical refineries can leave much of the sulfur content of their crude oil in the fuel oil component, Natref must manage proportionally more sulfur because of this higher product recovery.

Presently, the Natref process reduces sulfur content in petrol and diesel by 85 to 90%, by removing the sulfur from the refined crude. More than 96% of the sulfur removed from petrol and diesel is recovered and supplied to the market as chemical feedstock, with the remaining being emitted to atmosphere as sulfur dioxide (SO_2). The process of removing the sulfur from petrol and diesel, consequently results in vehicle tail pipe emissions containing relatively little sulfur, with associated positive implications for urban air quality.

2.2.2 Natref design intent regarding higher sulfur crudes

Crude oil with a sulfur content of less than 1% (by mass) is referred to as 'low' sulfur crude and more than 1% as 'high' sulfur crude. Natref can process higher sulfur crudes, but nevertheless elected to steadily decrease high sulfur crude as a feedstock to meet its commitments made in terms of the Vaal Triangle Airshed Priority Area (VTAPA) Air Quality Management Plan. The use of lower sulfur crudes reduces the SO_2 emissions from the refinery as less sulfur enters the refinery through the feed. Natref is constrained in further reducing sulfur content in its crude feedstocks since the refinery was never designed to process 100 % low sulfur crudes. Natref's refining margin would be further reduced as a consequence and potentially compromise business sustainability.

2.3 Minimum Emission Standards applicable to Natref

Natref has one centrally positioned main stack for its various MES listed activities. The refinery was designed around this main stack and in the past Natref measured its emissions on the main stack alone. There are six other small locally positioned stacks. The current compliance monitoring points are summarised in Table 2-1 together with an indication of compliance with the MES. It can be seen from the table that from 1 April 2018 Natref has complied with existing and new plant standards for 12 out of 17 monitoring points. Additional time is required to continue the implementation of abatement on monitoring points 2, 6, 8 and 17 (Table 2-1), for which postponements were granted in March 2018. Monitoring Point 4 is the subject of this application.

The following Colour Coding applies to Table 2-1

	Meets new plant standards
	2019 Postponement Application
	Postponement Granted

Table 2-1: Monitoring points

	Unit Number	Category	Description	Routing	Pollutant	Status
1	B11001A, B, C B11002	2.1	CDU/ VDU Furnaces	Main Stack	SO_2, PM NOx	Already meets new plant standards
2	B28001	2.2	FCC and CO Boiler (ducting)	Main Stack	SO_2, PM NOx	Postponement granted until 31 March 2022, PM
3	U28008	2.3	Sulfur Unit (SRU), including amine Treating	Main Stack	Efficiency	No postponement required. Current efficiency above 95%
4	U28008	2.3	Sulfur Unit (SRU), including amine Treating	Main Stack	Availability	Postponement granted until 1 April 2020 for SRU availability of 95% during the postponement period. Natref requires more time to achieve the MES new plant standard for SRU availability requirement of 99% hence this 2019 Postponement Application
5	B16001 B17001 B17002 B17003	2.1	RCD & DHC Furnaces	Main Stack	SO_2, PM NOx	Already meets new plant standards
6	B12002	2.1	Vacuum pre-flash off gas furnace	Main Stack	SO_2, PM NOx	Postponement granted until 31 March 2021, SO_2
7	B24001	2.1	Amine off-gas furnace	Main Stack	SO_2, PM NOx	Already meets new plant standards
8	B28004 B28005 B28006	2.1	Boilers and hot oil heater	Main Stack	SO_2, PM NOx	Postponement granted until 31 March 2020, PM
9	B14003 B14004 B15001/2	2.1	DU & Platformer Furnaces	Main Stack	SO_2, PM NOx	Already meets new plant standards
10	B24002	2.1	Acid gas furnace	Main Stack	SO_2, PM NOx	Already meets new plant standards
11	B25001	2.1	Hydrogen Plant	Local Stack	SO_2, PM NOx	Already meets new plant standards
12	B14001	2.1	NU Furnace	Local Stack	SO_2, PM NOx	Already meets new plant standards
13	B14002	2.1	NU Furnace	Local Stack	SO_2, PM NOx	Already meets new plant standards
14	B14005	2.1	Platformer Furnace	Local Stack	SO_2, PM NOx	Already meets new plant standards
15	B14006	2.1	Platformer Furnace	Local Stack	SO_2, PM NOx	Already meets new plant standards
16	B17004	2.1	Hydrocracker furnace	Local Stack	SO_2, PM NOx	Already meets new plant standards

	Unit Number	Category	Description	Routing	Pollutant	Status
17	F29009; F29010; and F29011	2.4	Tank Farm		TVOCs	Postponement granted until 31 March 2019, technology compliance

3 Current plant and process improvements

Natref's environmental management philosophy, which is fundamentally risk-based has realised sustainable reduction in Natref's pollution load for SO_2, NO_x, PM, H_2S and VOC emissions. This risk based approach considers Best Available Techniques (BAT) and Best Practicable Environmental Options for refineries, appropriately adapted for Natref's specific inland conditions, associated constraints and technical implications in the context of its long term financial sustainability.

3.1 Natref's environmental management philosophy

Natref recognises continual improvement in environmental management performance as essential to its business but capital intensive environmental improvements must be considered in the context of overall financial sustainability. Mindful of the higher emissions load because of its very high crude to white product conversion ratio, Natref has steadily but significantly reduced its SO_2, NOx and PM emissions over the past 15 years. Natref is committed to comply with all applicable environmental laws, including air quality laws such as the MES. Natref's roadmap to compliance with air quality laws involves a multi-faceted approach, aligned with its risk-based philosophy.

3.2 Environmental improvements over the past 15 years

The following sections highlight the Air Quality Improvement measures achieved over the last 15 years.

3.2.1 SO_2 emission reductions

Natref's SO_2 emissions have been reduced through:

- Installation of a H_2S/SO_2 analyser at the SRU tailgas for optimal sulfur recovery.
- Routing of Sour Water Stripper (SWS) off-gas, one of the large SO_2 emission sources at Natref (approximately 48% of SO_2 emissions) to the SRU to reduce SO_2 emissions and to recover additional sulfur as a saleable product to the market.
- Switching to lower sulfur crudes: As detailed previously, Natref has steadily reduced SO_2 emissions from the refinery by sourcing lower sulfur crude oil.
- Revamping the CDU/VDU furnaces in 2012, to allow for 100% fuel gas firing. This reduces fuel oil firing and SO_2, PM and NOx emissions are reduced accordingly at increased efficiency, reducing the overall environmental impact.

3.2.2 PM emission reductions

Natref's PM emissions have been reduced through:

- Replacement of FCC cyclones in 2016 to reduce FCC PM.
- Replacement of CDU/VDU furnaces to allow for 100% fuel gas firing.
- Reduction in Refinery Fuel Oil firing refinery wide.

3.2.3 NOx improvements

Natref's NO_x emissions have been reduced through:

- Installation of Low NOx burners on new furnaces (CDU and VDU furnaces upgraded in 2012).
- Installation of new heaters with Low NOx burners as part of an upgrade to the Diesel Unifiner in 2010, which reduced NOx emissions.

- Reduction in Refinery Fuel Oil firing refinery wide.

3.2.4 VOC improvements

Natref's VOC emissions have been reduced through:

- Installation of geodesic domes or double mechanical seals on tanks where applicable, in addition to the ongoing Leak Detection and Repair (LDAR) programme to reduce VOCs.
- Installation of a vapour recovery unit (VRU) at the road and rail loading facility for petrol and diesel, which reduced VOC emissions.

3.2.5 SRU availability improvement project

Based on the current project schedule, compliance with new plant standards for this MES category (subcategory 2.3) is expected by 1 April 2023. Postponement had already been granted from existing plant standards until 31 March 2020. This application is being made for postponement of the new plant standards for SRU availability from 1 April 2020 to 31 March 2023. This will allow for sufficient time to safely complete the necessary compliance project activities currently underway. Refer to Section 4 below for more detail.

4 Postponement requested – SRU availability

As noted above, this application is being made for postponement of the new plant standards for SRU availability from 1 April 2020 to 31 March 2023. For e\se of reference, the MES applicable to a refinery SRU are shown in Table 4-1. For various reasons Natref will not be able to comply with the compliance timeframes. As such, in this section the sulfur recovery process is described together with the progress made to date towards compliance with the MES and the date by when it is anticipated that compliance will be achieved. Thereafter, the reasons for not being able to comply with the MES implementation date are presented.

4.1 Description of the point source

Sulfur in the crude oil feedstock is converted predominantly to hydrogen sulphide (H_2S, also called acid gas) during the hydrocracking and hydrotreating processes in a refinery. To reduce what would otherwise be emissions of sulfur to atmosphere, sulfur recovery processes are deployed to extract (and ultimately use) the sulfur from these off-gases. An amine solvent absorption process in the Amine Treating Unit (see description below) is used to extract the sulfur from which concentrated acid gas is then sent to a Sulfur Recovery Unit (SRU). This sulfur removal process is usually the most cost-effective method of reducing refinery sulfur compounds in air emissions.

Natref's SRU also processes H_2S and ammonia from the refinery waste water stripper column. Acid gas and waste water stripper off-gasses are combusted in the SRU to form SO_2, which in turn is reacted with H_2S in the feed stream to produce a liquid sulfur product, water vapour and heat. The existing Natref SRU is a 2-stage Claus unit designed to process 142 tons/day of sulfur in the SRU's feed at an efficiency of 95%. As such SO_2 emissions from Natref are directly a function of SRU availability. MES subcategory 2.3 prescribes special arrangements applicable to the availability of sulfur recovery units as shown in Table 4-1.

Table 4-1: Summary listing of the MES.

Applicable Natref activities	Substance with prescribed emission limits special arrangements	Applicable special arrangements	Postponement request date	Management controls
SRU	Hydrogen Sulphide	Sulfur recovery units should achieve 95% recovery efficiency and availability of 99%	From 01 April 2020 - 31 March 2023: 95% availability From 1 April 2023: 99% availability*	Management as per current licence conditions from 1 April 2015 to 1 April 2023

** Note that the project plan is on track. As indicated in the 2014 Postponement Application the project schedule is 9-10 years, therefore, Natref requires a postponement for 3 (three) years to safely complete the necessary compliance project activities currently underway. The project, once completed, is expected to achieve compliance with subcategory 2.3 of the MES for new plants.*

4.2 Progress made to date

Natref performed a vulnerability study on the SRU and related upstream source units (Amine and Waste Water Stripper). The study was to identify how the availability of the existing SRU could be increased to the requisite 99% before 1 April 2020. The study revealed constraints to meeting the availability requirement prioritised as a function of impact on existing operations and SRU availability, and also provided recommendations to address those constraints. The various findings of the vulnerability study are summarised in Table 4-2, together with the current status of the recommendations.

Table 4-2: SRU vulnerability study challenges and solutions

No.	Challenges	Solutions	Status
1	Hydrocarbon carry-over leading to combustion chamber damage; catalyst fouling in reactor D26001; and equipment blockage with black sulfur.	Several tie-ins were installed during the May 2018, shutdown for further work to continue outside of the shutdown period.	Tie-ins completed, rest in progress
2	High operating temperature in the combustion chamber of the reaction furnace to ensure complete ammonia destruction, leading to refractory damage and waste heat boiler tube sheet failure.	The operating parameters were adjusted to prevent equipment damage in future.	Completed
3	The condenser tube failures of C26004, C26005 and C26006 as a result of welding failure leading to the SRU shutdown due to steam leakage into the process.	C26006 was replaced during the May 2018 Turnaround and Inspection (T&I) shutdown. Spare heat exchangers have been manufactured for C26004 and C26005 and will be replaced at the next possible opportunity.	Completed
4	High final condenser temperature leading to potential fire in stack ducting resulting in a shutdown of the SRU.	The pipeline tie-ins were installed during the May 2018 T&I shutdown for further work to continue outside of the shutdown period.	Tie-ins completed, rest in progress
5	Low acid gas flow rate leading to SRU trips and reduced availability during low acid gas feed conditions.	The basic engineering has been completed and the solution is to be implemented in next T&I shutdown.	In progress
6	Temperature management	Repair tracing and jacketing systems on the SRU during the Hydrocracker block T&I.	Completed

No.	Challenges	Solutions	Status
7	Temperature management	The basic engineering has been completed and the solution is to install a temperature indicator on the outlet of the SRU air cooler.	In progress

The previous performance of the SRU in terms of availability is presented in Table 4-3 below:

Table 4-3: SRU availability performance

Financial Year	SRU Availability (%)
1 July 2018 – 31 Oct 2018 (FYTD)	99.91%
1 July 2017 – 30 June 2018	98.56%
1 July 2016 – 30 June 2017	99.64%
1 July 2015 – 30 June 2016	99.08%
1 July 2014 – 30 June 2015	99.2%

4.3 Road map to compliance - project schedule

Based on the latest SRU project schedule, Natref anticipates meeting the new plant standards for SRU availability by March 2023 as shown in Table 4-3, subject to successful completion of all project governance processes, including approval of the necessary capital.

Table 4-3: SRU project schedule as per latest available information

Key Project Phases	Anticipated completion date
Idea Generation	Complete
Prefeasibility	Complete
Feasibility	Complete
Project Governance	Complete
Basic Engineering	Complete
Final Investment Decision	Complete
Construction and Commissioning	March 2023

4.4 Postponement request

Natref therefore requests a three year postponement of the MES compliance timeframes for SRU availability, from 1 April 2020 to 31 March 2023. By March 2023, it is anticipated that the compliance projects currently underway will be completed and compliance with the requirements of subcategory 2.3 (a) of the MES will be achieved. Natref also requests that the SRU availability outside the T&I shutdown period be maintained at 95% for the period of postponement.

Natref has consistently communicated its commitment to meeting its compliance obligations in the **air quality improvement** roadmaps which informed and supported its previous postponement applications towards compliance with the MES by 2025. To the extent necessary, further applications as provided for in the applicable regulatory dispensation will be made.

4.5 Reason for postponement

At its simplest, the reason for Natref applying for postponement is that there is not enough time to complete the modifications required to get the SRU to a sustained 99% availability. The schedule for completion cannot be accelerated for two important but related reasons, namely: 1) The strictly controlled T&I schedule; and 2) Natref's project development and governance process.

4.5.1 T&I schedule

The continued availability of liquid fuels is essential to the economy of any country but for South Africa that requirement is rendered more complex by Gauteng being the economic heartland of the country. Not only do liquid fuels have to be available, they have to be available in Gauteng which also has the largest airport in Africa, ORTIA, and associated demand for aviation fuel. Natref is an essential enabler of liquid fuel availability in Gauteng and so can only be shutdown for maintenance in a prescribed manner that is aligned with the availability of other sources of liquid fuels in Gauteng, to assure supply. Natref simply cannot be shutdown at short notice, hence any work on the SRU, including maintenance, renewals or upgrades of equipment components or tie-ins into this system, can only occur during a planned shutdown. This shutdown schedule is not under Natref's direct control as it must be coordinated with the shutdown activities of other fuel refineries, to avoid an inland fuel shortage. It is also not possible to only shut down the SRU and keep the rest of the refinery operating as an SRU outage results in SO_2 emissions not complying with current AEL conditions. To comply with the AEL, production rates have to be reduced affecting fuel production with significant consequential financial and market supply implications.

4.5.2 Due diligence obligations – project development and governance framework

Natref uses a project development and governance framework that is known as 'stage-gate'. The stage gate process ensures:

- That learning from previous project experience is carried forward into new projects. Stage gate provides a framework to carefully guide the development and implementation of bespoke solutions and assure success. Among the many important aspects, stage gate demands investigations and design considerations address the additional complexities of interfacing new (or altered) equipment into an integrated and operational brownfields facility, particularly one as unique as Natref. For example, such considerations would include whether additional utilities (e.g. steam or power) are needed for the new equipment, and whether the new equipment changes the throughput or capacity requirements of other process upstream or downstream units.
- For governance, stage gate prescribes adherence to rigorous project development quality standards and business requirements at each successive stage of project development, before a project is approved to proceed to the next development stage. This governance process is aimed at assuring robust and workable solutions so that projects achieve their technical and commercial objectives. Good project governance means that all projects need to be properly motivated, evaluated and approved in a systematic and consistent manner.

The duration of the various development phases (the "stages") is typically linked to the complexity of the development, including interfaces with surrounding processes, and upstream and downstream process impacts. The governance process (the "gates") serve as a crucial quality control mechanism to ensure that a project is not advanced to the next stage until it has fully met the criteria of the previous stage.

Project schedules within the stage gate process are a function of:

- Technology complexity: including managing upstream and downstream impacts, as well as key plant infrastructure interfaces that result from integrating new equipment into an existing process.
- The level of operational risk incurred by introducing new equipment to the existing process and any unintended consequences that may arise.
- Installing new equipment within a plant that is continuously operational requires careful planning for implementation during windows provided within the highly coordinated, complex-wide integrated shutdown schedule. This is particularly important to minimise impacts on safety and production, and to carefully prioritise and plan over the long-term for cases where multiple separate projects require implementation within the same portion of the plant.

Given these considerations, it is Natref's experience that timeframes for implementation of capital projects on its brownfield sites often exceed five years and frequently also exceed ten years.

4.5.3 Previous Postponement Application

The activity defined as “Sulfur Recovery Unit” was included in the 2014 Postponement Application. Natref sought a five year postponement from the 1 April 2015 compliance date for existing plant standards. In that postponement period Natref continued with the stage gate process. At the time of the 2014 Postponement Application, the project had not yet concluded prefeasibility and so different options were still under consideration for MES. It was also not known at the time whether one intervention would achieve compliance with the 2020 MES. The conclusion of the feasibility phase of the stage gate process has since confirmed that Natref can meet the new plant requirements with the implementation of the SRU project.

5 The Atmospheric Impact Report

5.1 Overview

As required by the regulations and in support of Postponement Applications, Natref commissioned an independent Atmospheric Impact Report (AIR) to assess the ambient air quality implications and associated environmental and human health risks of the Postponement Application and the proposed alternative emissions limits. Airshed Planning Professionals was appointed to conduct the atmospheric impact assessment independently and the methodology and datasets were independently peer reviewed by Exponent Inc. The AIR is submitted as a stand-alone document included in Annexure A, but a summary is included here to facilitate Interested and Affected Parties (I&AP) comments thereon.

5.2 Study approach and method

A dispersion model serves to simulate the way in which emissions will manifest as ‘ground-level’ or ‘ambient’ concentrations. For the purposes of this assessment, the Regulations Regarding Air Dispersion Modelling (GN 533 of July 2014) determined the dispersion model selection.

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 ambient air quality monitoring stations in and around Sasolburg, namely at the Leitrim, AJ Jacobs and Eco Park. In addition, DEA operates three air quality monitoring stations in and around Sasolburg, namely at Three Rivers, Sharpeville, and Zamdela.

Data from the Sasol and DEA monitoring stations for 2015, 2016 and 2017 were included in this investigation. The Sasol monitoring stations are accredited (ISO/IEC17025) to ensure data quality and availability. Accreditation certificates from the DEA monitoring stations have not been provided. These measured values are indicated as orange dots in all the AIR graphs.

In order to assess the impact of the postponements for which Natref is applying, three emissions scenarios were modelled:

1. **Scenario 1**, reflective of 100% SRU availability. Source emissions were provided as averages of measurements taken from periodic emission monitoring during normal operating conditions. This scenario is represented by the first column in the presentation of all AIR graphs. Source emissions were derived from 3rd parties and accredited (ISO/IEC17025) laboratories. Emissions measurements follow the requirements prescribed in Schedule A of GN 893.
2. **Scenario 2** reflects emission conditions when the SRU operates at 99% availability (theoretical compliance with the 2020 new plant standards). This scenario is then represented by the second column in the presentation of all AIR graphs.
3. **Scenario 3** assumes the SRU operates at 95% availability. This scenario is represented by the third column in the presentation of all AIR graphs.

Once ambient concentrations have been predicted using the dispersion model they are compared to the NAAQS. NAAQS have been set for criteria pollutants at limits deemed to uphold a permissible or tolerated level of health risk. The NAAQS are represented as an orange line in all the AIR graphs. This comparison provides an assessment of the potential for air quality to impact on human health. Where no NAAQS exists for a relevant non-criteria pollutant, health screening effect levels based on international guidelines are used. In addition, the measured concentrations are also used to ascertain the representativeness of the modelling and to assess the extent to which the NAAQS are met as a function of all sources of emissions.

42 receptors were identified in the vicinity of Natref (within the 57-by-57 km modelling domain). Sensitive receptors included residential areas, schools, hospitals and clinics, as well as monitoring stations. Ambient air quality monitoring stations (AQMS) were the first receptors identified because comparison of the predicted concentrations could be compared with measured concentrations for model validation. A full list of receptors is provided in Appendix J of the AIR.

The dispersion modelling methodology and datasets was reviewed by Exponent 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. Airshed's Plan of Study, the peer reviewer's report and Airshed's comments on each of the findings are included as Appendix B.

5.3 Overall findings of the AIR

5.3.1 Compliance with the NAAQS

The purpose of the MES aims to achieve the intent of the NEM:AQA which means ensuring that ambient air quality does not threaten the health or well-being of people and the environment. As the NAAQS provide a limit at which the risk to health should be considered tolerable, postponement applications should be considered in terms of the extent to which ambient air quality that meets the NAAQS.

For all criteria pollutants, barring PM and SO_2, both the simulated and observed ambient concentrations are below the NAAQS. For PM and SO_2 (for daily and annual averaging periods), while the observed ambient concentrations are above the NAAQS, the simulated ambient concentrations emanating from Natref's sources are well below the NAAQS demonstrating the contribution to ambient concentrations from other sources. To address these other sources Natref is in the process of executing a Joint Offset Implementation Plan with Sasol that aims to achieve a reduction in PM and SO_2 emissions from some of the other sources.

5.3.2 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. The World Health Organisation indicates that there is no safe limit in respect of exposure to PM. However, the NAAQS prescribe a permissible or tolerable level of health risk. The overall findings of the AIR are that the alternative emissions limit requested by Natref will result in permissible health risks.

5.3.3 Ecological effects

The impact of emissions on the environment is assessed in terms of Section 5.2 of the AIR. The analysis covers impacts to vegetation, of dustfall, potential corrosion and impacts associated with sulfur and nitrogen deposition.

The simulated off-site annual concentrations of SO_2 and NO_2 for all emission scenarios are not likely to exceed the levels for even the most sensitive vegetation types. Estimated dustfall rates for the three simulation scenarios were less than 8.3 mg/m^2.day which is substantially below the target dustfall rates of 600 mg/m^2.day (residential) and 1200 mg/m^2.day required by the National Dust Control Regulations (Government Gazette No. 36974). Corrosion rates were calculated using the ISOCORRAG method and are listed in Table 5-38 of the AIR (Annexure A). It is noted that corrosion rates remain relatively unchanged between the three scenarios.

Estimates of S and N deposition rates for the Highveld are comparable with some of the industrialised regions of Europe and North America raising concern that the acidic loading of sulfur and nitrogen on the ecosystems of the Highveld could have implications for ecosystem functioning. While investigating the impact of S and N deposition rates as a result of Natref was beyond the scope of the AIR, Sasol, a partner in Natref, supports long-term deposition quantification studies in South African under the DEBITS (Deposition of Biogeochemically Important Trace Species) programme, as part of the International Global Atmospheric Chemistry Project. Three DEBITS sites are maintained within South Africa, one located near Amersfoort, on the Mpumalanga Highveld, downwind from major industrial sources. More details regarding these investigations are provided in Section 5.2.4 of the AIR.

6 Public Participation

In terms of the MES (Government Notice No. 893, 22 November 2013) a postponement application must include – "*a concluded public participation process undertaken as specified in the NEMA and the Environmental Impact Assessment Regulations made under section (24(5) of the aforementioned Act.*"

As such the Public Participation Process (PPP), undertaken as part of Natref's application for postponement of the compliance timeframes, was structured to meet the requirements of Chapter 6 of the Environmental Impact Assessment (EIA) Regulations (Government Notice No. 326, 7April 2017) published under the National Environmental Management Act (Act 107 of 1998) (NEMA), as specified in the MES.

A Public Participation Report, detailing the project Public Participation Process undertaken is attached in **Annexure C** while all comments received, with associated responses, are included **Annexure D**.

The public participation process is an important component of the application process and is closely linked to the technical activities required for the preparation of the Motivation Report (Figure 6-1).

The proposed technical and public participation activities, as well as the broad timeframes for roll out of these processes are shown below.

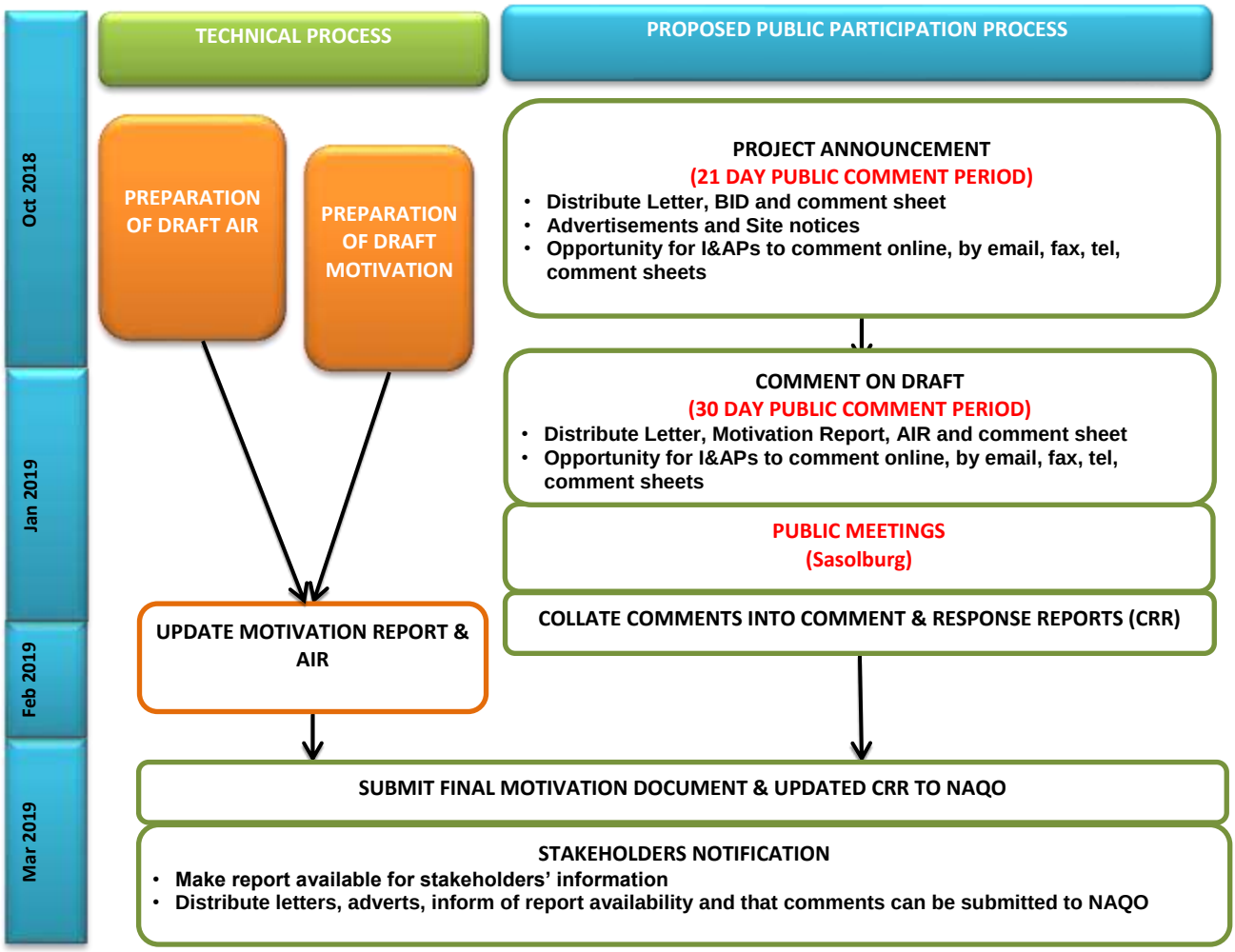

Figure 6-1: Technical and Public Participation Process

7 Conclusions

The Natref refinery is operated as a joint venture between Sasol and Total and is the only inland petroleum refinery in South Africa and essential to the provision of liquid fuels in Gauteng as the economic heartland of South Africa, and to ORTIA as the largest airport in Africa. By virtue of being an inland refinery, Natref refines a very high percentage of its crude feedstock into fuel product because it does not have a ready market for low quality fuel such as bunker oil. Coastal refineries typically provide such lower grade fuel to shipping. The high fuel products to crude ratio at Natref makes the control of atmospheric emissions additionally complex but Natref has systematically reduced atmospheric emissions such as SO_2, H_2S, VOCs, NO_x and PM over the last fifteen years through a variety of emissions abatement projects.

In 2013 the MES Regulations were published that prescribed maximum emissions for a range of activities that result in atmospheric emissions. The MES have specific provisions for petroleum refining that apply to Natref. When originally published the MES Regulations required compliance with existing plant standards by existing plants such as Natref by 2015 and compliance with more stringent new plant standards by 2020. The MES Regulations make provision though for postponements of the compliance timeframes where this might be needed. Natref applied for and was granted certain postponements in respect of the existing plant standards and is now obliged to apply for postponement of the new plant standards for one requirement only and that is a 99% availability of the SRU as specified in subcategory 2.3 (a) of the MES.

Natref is confident that the compliance requirement can be met by the refinery but simply needs more time by which to complete the modifications needed to achieve compliance. The time needed is driven by a strict Turnaround and Inspection (T&I) schedule that applies to the refinery so as to ensure that there are no shortages of liquid fuels. Natref has to conform to that schedule for reasons as stated above. Natref also makes use of a project development and governance process known as stage-gate. The stage gate process serves to ensure that projects are carefully conceptualised, engineered and implemented in a manner that meets technical and commercial objectives whilst managing the complexities of integration into the existing process and ensuring that the projects can be safely implemented. The stage gate process and the T&I schedule mean that the SRU project can only be completed in 2023 and postponement is accordingly applied for the period between the date of implementation of the new plant MES and the project completion date.

Annexures

Annexure A: Atmospheric Impact Report

Annexure B: Independent Peer Review Report

Annexure C: Public Participation Report

Annexure D: Comments and Response Report

Annexure E: Redacted Atmospheric Emission Licence