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**MINIMUM EMISSIONS STANDARDS (MES)**

**JOINT OFFSET  
IMPLEMENTATION PLAN**

**SASOL  
SASOLBURG  
OPERATIONS AND  
NATREF**

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## Glossary

**Air quality offsets guideline** – the Air Quality Offset Guideline published in terms of section 24J(a) of the National Environmental Management Act, 107 of 1998 as GN 333 in Government Gazette 39833 of 2016. Refer to “Draft air quality offsets guideline” for more information. Since the publication of Sasol’s and Natref’s draft offset implementation plan, the Air quality offsets guideline was published. Sasol’s and Natref’s offset implementation plan has since also been informed by the Air quality offsets guideline.

**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.

**Criteria pollutants** – Section 9 of NEM:AQA provides a mandate for the Minister to identify a national list of pollutants in the ambient environment which present a threat to human health, well-being or the environment, which are referred to in the National Framework for Air Quality Management as “criteria pollutants”. In terms of Section 9, the Minister must establish national standards for ambient air quality in respect of these criteria pollutants. Presently, eight criteria pollutants have been identified, including sulfur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), ozone (O<sub>3</sub>), carbon monoxide (CO), lead (Pb), particulate matter (PM<sub>10</sub>), particulate matter (PM<sub>2.5</sub>) and benzene (C<sub>6</sub>H<sub>6</sub>). In this document, any pollutant not specified in the National Ambient Air Quality Standards (NAAQS) is called a “non-criteria pollutant”.

**Draft air quality offsets guideline** – The draft air quality offsets guideline published in GN 597 in GG 38894 of 2015 sets out a draft guideline for the application of offsets during the implementation of the atmospheric emissions licensing system stipulated in Chapter 5 of the NEM:AQA, as well as guiding principles for the implementation of offsets.

**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.

**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 publication 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.

**Hydrogen Sulfide (H<sub>2</sub>S)** – a colourless gas with the characteristic odour of rotten eggs. A by-product of oil refining and burning, as well as other sources including sewage treatment plants, and household solid fuel burning. Toxic at high concentrations.

**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.

**Nitrogen Dioxide (NO<sub>2</sub>)** – one of a group of highly reactive gases known as “oxides of nitrogen,” or “nitrogen oxides (NO<sub>x</sub>).” NO<sub>2</sub> forms quickly from emissions from cars, trucks and buses, power plants, and off-road equipment. In addition to contributing to the formation of ground-level ozone, and fine particle pollution, NO<sub>2</sub> is linked with a number of adverse effects on the respiratory system, including airway inflammation in healthy people and increased respiratory symptoms in people with asthma.

**Particulate matter (PM)** – a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.

The size of particles is directly and inversely linked to their potential for causing health problems, i.e. the smaller the particles, the more harmful they potentially are to one's health. Particles that are 10 micrometers in diameter or smaller generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects. PM is generally placed into two categories:

- "Inhalable coarse particles" are larger than 2.5 micrometers and smaller than 10 micrometers in diameter.
- "Fine particles" are 2.5 micrometers in diameter and smaller.

**Point source** – A single identifiable source and fixed location of atmospheric emission, and includes smoke stacks.

**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. **Priority area** – means an area declared as such in terms of Section 18 of NEM:AQA.

**Priority area air quality management plan** – means a plan referred to in Section 19 of NEM:AQA.

**Sulfur Dioxide (SO<sub>2</sub>)** – one of a group of highly reactive gases known as "oxides of sulfur." SO<sub>2</sub> is linked with a number of adverse effects on the respiratory system, bronchoconstriction and increased asthma symptoms.

## List of Abbreviations

AEL – Atmospheric Emissions Licence

CO – Carbon Monoxide

DEA – Department of Environmental Affairs

DOIP – Draft Offset Implementation Plan

H<sub>2</sub>S – Hydrogen Sulfide

IPCC – Intergovernmental Panel on Climate Change

MES – Minimum Emissions Standards

NAAQS – National Ambient Air Quality Standards

NAQF – National Framework for Air Quality Management in the Republic of South Africa (2013)

NAQO – National Air Quality Officer

NEM:AQA – National Environmental Management: Air Quality Act

NO<sub>2</sub> – Nitrogen Dioxide

NO<sub>x</sub> – Oxides of Nitrogen

OIP – Offset Implementation Plan

PM – Particulate Matter

PM<sub>2.5</sub> – Particulate Matter with radius of less than 2.5 µm

PM<sub>10</sub> – Particulate Matter with radius of less than 10 µm

SO<sub>2</sub> – Sulfur Dioxide

# 1 Introduction

Sasol is an international integrated energy and chemical company that employs approximately 31 000 people working in 37 countries. In South Africa, Sasol owns and operates petrochemical and chemical manufacturing facilities in Secunda in Mpumalanga and Sasolburg in the Free State. In the Free State, Sasol also jointly owns the Natref refinery, which employs approximately 600 people, with shareholder Total SA. In this document, 'Sasol' refers to Sasolburg Operations, while the joint venture refinery is referred to separately as 'Natref'.

In 2013, the Department of Environmental Affairs (DEA) published revised Minimum Emissions Standards (MES), under the auspices of the National Environmental Management: Air Quality Act (NEM:AQA). The MES serves to define maximum allowable emissions to atmosphere for a defined range of pollutants and specific activities that can result in such emissions. The MES apply to many of Sasol's and Natref's activities.

Sasol and Natref applied for postponement of the compliance timeframes contained in the MES which prescribe maximum emission limits for specified industrial activities. Decisions on these postponement applications were made in February 2015 by the National Air Quality Officer (NAQO) in concurrence with the Fezile Dabi District Municipality licensing authority, and Sasol's and Natref's Atmospheric Emissions Licences (AELs) were accordingly amended to align with those concurrent postponement decisions. The amended AELs for Sasol and Natref both contain the following condition: *'A definite offset implementation plan to reduce PM and SO<sub>2</sub> pollution in the ambient / receiving environment and the implementation plan is to be presented to the NAQO and the licencing authority by 30 June 2015 and followed by an appropriate public participation process. The conditions associated with this will be included as an Annexure to the AEL'*. Sasol and Natref complied with this requirement by submitting a draft plan to local and national authorities. That plan has subsequently been refined in light of further discussion with authorities and other leadership structures, and was informed by the publication of the draft air quality offsets guideline, to ensure consistency with that document. The offset plan has since also been informed and updated, as necessary, by the Air Quality Offsets Guideline (Government Notice No. 333), published on 18 March 2016. The difference between the Draft and gazetted guidelines has not resulted in material changes. The difference between the draft final guidelines has not resulted in material changes.

Further public consultation on this plan has been undertaken as required in terms of the postponement decisions above. Sasol and Natref value engagements with their stakeholders to ensure that the offset plan is fit for purpose, and appropriately considers the needs of the Zamdela community where the offset activities will be focused.

Sasolburg Operations and Natref have developed this offset implementation plan together, and propose to implement it in a coordinated, collaborative manner in order to realise synergies through scale, to pool resources and limit the intrusion / imposition on community members through an aligned engagement approach.

The purpose of this document is to provide detail on the offset implementation plan referred to above. The document is structured to:

- Present a rationale for offsets as a component of Sasol and Natref's air quality improvement roadmap (refer to Section 4 and Annexure 1);
- Outline Sasol and Natref's air emissions offset commitment (refer to Section 6);
- Share the outcomes of work done to date by Sasol at pilot scale to demonstrate learnings, potential benefits and challenges that could potentially be experienced through the implementation of community-based offsets (refer to Section 5 and Annexure 2);

- Describe the public participation process that was undertaken to obtain input on the draft offset implementation plan and the manner in which Sasol and Natref intend to consult with communities during implementation of this plan (refer to Section 7); and
- Introduce the proposed success criteria by which to measure offset performance (refer to Section 8).

It should be noted that Sasol and Natref have detailed the elements of the offset implementation plan to the extent possible, based on the level of the current definition of proposed programme activities. Refinement and detailed scoping of programme activities will be on-going, and will be shared with, and informed by, stakeholders through an engagement approach that is described in Section 7.

## 2 Offset Implementation Plan in the Context of Postponements from the Minimum Emissions Standards

A Section 21 facility is an industry which operates one or more “listed activities”, as described within the Listed Activities and Minimum Emission Standards (MES). The MES serves to define maximum allowable emissions to atmosphere for a defined range of pollutants and specify the listed activities that can result in such emissions. For example, the MES specify emission limits for emissions of sulphur dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>) and particulate matter (PM) arising from the combustion of fuels like coal and oil in power plants and furnaces. The MES apply to many of Sasol’s and Natref’s listed activities.

Through environmental improvements implemented over the last decade, Sasol and Natref already comply with many of the MES. In 2013 and 2014, Sasol and Natref embarked on a process to apply for postponement of the 1 April 2015 compliance timeframe for some of the MES applicable to some of their listed activities. The postponement applications included motivation reports outlining the reasons for requesting postponements, Air Impact Reports (AIRs) and an extensive public participation process as documented in the form of Stakeholder Engagement Reports including Comment and Response Reports. The documents related to that process are available through the website of the independent consultant who facilitated the applications for Sasol and Natref (<http://www.srk.co.za/en/za-sasol-postponements> for Sasol’s applications and <http://www.srk.co.za/en/za-natref-postponement> for Natref’s application).

The National Air Quality Officer (NAQO) in concurrence with the Fezile Dabi District Municipality licensing authority granted postponements to Sasol and Natref in February 2015, and stipulated conditions to be upheld for the period of postponement. One of the conditions of the postponements included the requirement to submit an offset implementation plan to reduce particulate matter (PM) and sulfur dioxide (SO<sub>2</sub>) pollution in the ambient / receiving environment to the authorities by 30 June 2015. That condition has since been incorporated in Sasol’s and Natref’s AELs and is therefore a legally binding requirement. As per the AEL condition, Sasol and Natref are also required to undertake an appropriate public participation process on their offset plan, prior to the plan’s approval and inclusion as an Annexure to their AELs.

Following consultation with the licensing authority, a joint implementation plan for the two facilities has been developed, since this enhances coordination, minimises disruption in the community, and enables an economy of scale.



### **3 Sasol's and Natref's Air Emissions Offset Objectives**

The DEA's Air Quality Offsets Guideline defines air emissions offsets as *"an intervention, or interventions, specifically implemented to counterbalance the adverse and residual environmental impact of atmospheric emissions in order to deliver a net ambient air quality benefit within, but not limited to, the affected airshed where ambient air quality standards are being or have the potential to be exceeded and whereby opportunities and need for offsetting exist."*

As part of Sasol's AELs, amended following postponement decisions, a condition is included for Sasol and Natref to develop an offset implementation plan to offset particulate matter (PM) and sulfur dioxide (SO<sub>2</sub>). Sasol and Natref identified opportunities to do so in respect of PM and SO<sub>2</sub> in the area near their Sasolburg facilities as guided by the draft Air Quality Offsets Guideline as it then was, as well as the VTAPA plan.

Before this requirement for an offset implementation plan had been imposed, and informed by its own ambient air quality monitoring programme, Sasol recognised that high levels of PM in the ambient environment are prevalent, particularly in winter months. The levels exceed the NAAQS, meaning that human health is potentially at risk. Non-industrial sources are known to contribute significantly to the exceedances of the NAAQS for PM, and hence Sasol began a programme of investigating the possibility that community-based offsets might achieve significant ambient improvements in PM levels. A pilot study in KwaDela, Mpumalanga has been undertaken, and results have been integrated across air quality and numerous other quality of life parameters.

More specific information regarding the scientific rationale for offsets is included in Annexure 1 and regarding the offset pilot study in KwaDela in Annexure 2.

#### **3.1 Offset objective in terms of air quality outcomes**

Sasol and Natref's offset plan seeks to demonstrate improvements in ambient levels of PM and SO<sub>2</sub> in the areas where offsets are implemented. On-going monitoring of ambient PM and SO<sub>2</sub> will be required to measure the improvements in these pollutant levels and the extent to which these can be directly attributed to the implementation of offsets by Sasol and Natref, over time.

#### **3.2 Offset objective in terms of broader socio-economic outcomes**

Sasol and Natref's position is that offsets may deliver sustainable and tangible ambient air quality improvements with socioeconomic benefits not always achievable through further point source abatement. To this end, ambient air quality improvement is not the sole measure of success. Rather, it is one of a suite of measures or metrics aligned with the goal of "quality of life" or "well-being" improvement, which may also include other environmental improvements, such as greenhouse gas emission reductions.

#### **3.3 Measurement of offset outcomes**

Due to the early stage of knowledge and development of offsets, no quantified goals have been set for specific programme outcomes. Rather, the offset implementation plan outlines the various metrics along which Sasol and Natref will aim to quantify the beneficial impacts of their offset programme of activities. As knowledge, experience and data on offset

performance evolve over time, the intent would be to gradually move toward definitive offset target setting for key metrics.

## 4 Air Emissions Offsets for Sustainable Air Quality Improvement

### 4.1 Offsets as a recognised air quality improvement mechanism

In the context of national policy development, Sasol and Natref have also advanced their policy thinking on environmental offsets generally, including air emission offsets. Within this arena, Sasol and Natref believe that formally recognised air emission offsets may represent a sustainable mechanism to improve ambient air quality, with the potential to deliver other concurrent environmental and socioeconomic benefits, including greenhouse gas emission abatement and quality of life improvement, amongst others.

A formal offset mechanism will provide a credible basis for offsets, and ought to be informed by the sustainability principles contained in the National Environmental Management Act (NEMA). Such a mechanism would provide further investment certainty for offsets. Sasol and Natref also support the principle that offsets be embedded in sound regulatory and environmental management governance to distinguish offsets from Corporate Social Investment. A recognised mechanism would enable industry to broadly consider large-scale investments in offsets.

Sasol and Natref have submitted their views regarding development of a formal offset mechanism to DEA as part of their engagement process on environmental offsets. This includes views on air emission offset principles that should underpin rigorous offset projects, informed by an assessment of international practices and guidelines such as the Greenhouse Gas Protocol and Intergovernmental Panel on Climate Change (IPCC). Notwithstanding, Sasol and Natref's offset implementation plan is aligned with the principles outlined in the Air quality offsets guideline, as outlined below.

### 4.2 Application of the DEA's air quality offset principles

Sasol and Natref support offsets as a mechanism which gives effect to the Constitution, the principles of NEMA, the objectives of the NEM:AQA, as well as the aspirations of the National Development Plan.

Since the first draft of this offset plan, the draft Air Quality Offsets Guideline has been formalised. This offset plan is to be assessed, as necessary, by the authorities against the principles contained in the guideline. The offset principles contained in the guidelines have been paraphrased as necessary below.

#### 4.2.1 Outcome based

**Principle:** The implementation, monitoring and evaluation of the air quality offset should be based on the outcome of improved ambient air quality.

**How the principle will be applied:** A comprehensive monitoring programme will be implemented to establish an ambient and indoor air quality baseline. On-going measurements will be conducted with a frequency which will be determined as part of the overarching programme, to confirm the arising air quality and other concurrent benefits. As explained in Section 3.3, due to the early stage of knowledge and development of offsets, no quantified goals have been set for specific programme outcomes. Rather, the offset implementation plan

outlines the various metrics along which Sasol and Natref will aim to quantify the beneficial impacts of their offset programme of activities. As knowledge, experience and data on offset performance evolve over time, the intent would be to gradually move toward definitive offset target setting for key metrics. See Chapter 8 for an overview of metrics, and Annexures 3-7 for the specific metrics to be measured for the baseline campaign and immediate interventions.

#### 4.2.2 No “like for like”

**Principle:** The proposed offset project(s) should address pollutant(s) whose ambient concentration is/are of concern in a particular area, and not necessarily the pollutant(s) whose emission from a facility is/are of concern.

**How the principle will be applied:** The offset condition included in the postponement decisions, as reflected in Sasolburg Operations’ and Natref’s licences, stipulates the pollutants of concern as particulate matter and sulfur dioxide. These are therefore the focus of the offset interventions, while other pollutants (such as oxides of nitrogen, carbon monoxide, and greenhouse gases such as carbon dioxide, etc.) may also be quantifiably reduced in the process.

#### 4.2.3 Transparency and acceptability

**Principle:** Air quality offsets should be based on open, fair and accountable administrations by applicants and authorities, including the undertaking of a public consultation process to ensure public buy-in of offset projects.

**How the principle will be applied:** Chapter 7 outlines the public consultation process undertaken, and a detailed Stakeholder Engagement Report has been included as part of this submission. Chapter 7 also outlines that an on-going multi-stakeholder platform will be established to report back to stakeholders on progress with implementation of all elements of the programme and results.

#### 4.2.4 Complementarity

**Principle:** In administering offsets, authorities should take into account not only the impacts of offsetting, but also all other measures taken and/or to be taken by the proponent to reduce emissions within the applicant’s facility.

**How the principle will be applied:** Sasol’s and Natref’s postponement applications included air quality improvement roadmaps outlining the measures planned to be taken at their respective facilities to reduce emissions.

#### 4.2.5 Sustainability

**Principle:** The offsets projects should be based on long-term air quality improvement without impeding on other socio-economic and environmental objectives. Offsets that provide for short-term solutions should not be considered.

**How the principle will be applied:** Sasol’s and Natref’s projects are being scoped to try and build sustainability into the outcomes, so that the longevity of benefits extends beyond the period of investment. This involves, amongst others, partnering through existing structures and institutions, the use of service level agreements, and capacity building. Where on-going investment (e.g. through provisions for maintenance) may be necessary, Sasol and Natref will provide funding for the period of the offset programme, linked to postponement decisions.

## 4.2.6 Measurable and scientifically robust

**Principle:** An approved offset must have measurable air quality outcomes. Offsets should represent actual reduction of atmospheric emissions from various sources and not incomplete or inaccurate accounting of emissions, and therefore should cater for good understanding of emission sources. A realistic baseline in the absence and presence of the offset project should be understood.

**How the principle will be applied:** A comprehensive baseline campaign forms part of the offset plan, as detailed in Annexure 3. Key metrics will be measured over time as the programme progresses, to assess benefits arising from the offset activities.

# 5 Sasol's Air Emissions Offset Investigations to date

## 5.1 Overview

Sasol and Natref continue to investigate offsets and to consider the policy framework, the mechanisms and other guiding tools required to bring about a credible, justifiable and meaningful offset regime. To this extent, Sasol and Natref have engaged and continue to engage with the DEA and other stakeholders to share learnings and views, to contribute towards the creation of a common understanding of how the risks posed by airshed non-compliance with the PM NAAQS can most effectively be addressed, so that NEM:AQA objectives are ultimately met. In the section that follows Sasol's on-going KwaDela pilot study is summarised. More detail on the pilot study is in Annexure 2. The KwaDela study, which was initiated in 2012, is Sasol's most in-depth investigation of offsets to date.

## 5.2 The KwaDela pilot study

Sasol initiated one of the first comprehensive pilot scale studies on ascertaining the domestic solid fuel use and associated emissions reduction benefits of interventions that would limit heat loss from Reconstruction and Development Programme (RDP) houses. Reduced heat loss would imply less domestic fuel required for at least space heating, during cold winter months. The pilot study, which is already far progressed, is being conducted in KwaDela, a residential area of some 1 000 households in Mpumalanga, where the interventions took the form of three different configurations of RDP home insulation, on all willing and eligible households:

- Basic retrofit: The ceiling and draught proofing (window sill and door insulation) retrofit (on 396 homes);
- Intermediate retrofit: The ceiling and draught proofing plus a Trombe wall<sup>1</sup> on the north façade (on 20 homes); and

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<sup>1</sup> A Trombe wall is a sun-facing wall originally developed by the French engineer Félix Trombe in 1956. It is built from material that can act as a thermal mass combined with an air space, insulated glazing and vents to form a large solar thermal collector. For the KwaDela study the design was adjusted to exclude extra building mass and air vents. A single layer of polycarbonate sheeting is mounted on a treated wooden frame and fixed to the northern facade of test houses. The wall is also painted black. Solar heat is trapped in the space between sheet and wall, is then absorbed by the wall from where it radiates into the living space over a period of several hours. In summer the acute sun angle limits the heat collection of the Trombe wall and thus does not cause excessive heating.

- Full retrofit: The full retrofit comprises the Basic retrofit plus outside wall insulation on the east, south and west façade and a Trombe wall on the north façade (89 homes).

In order to conduct this detailed study, Sasol has partnered with independent experts in community quality of life and air emissions research, namely the Nova Institute and North West University, respectively. Sasol has also shared knowledge, learning and best practice with Eskom, which is also implementing a pilot study. A comprehensive monitoring programme was established to measure and establish a baseline of among others, coal use, fire cycles, indoor and ambient air temperature, and indoor and outdoor air quality. A broad range of household well-being indicators was also collected.

## 5.3 Results

In the first year after implementation, promising positive results, including statistically significant improvements in indoor household temperatures, were recorded. A significant proportion of households also reported that they discontinued solid fuel use in winter. The full retrofit is clearly more effective in eliminating coal use. Approximately 18% of coal using households who received a basic retrofit discontinued coal use while 42% of those who received the full retrofit stopped using coal. The impact at ambient level is less clear. There is a small yet measurable year-on-year reduction in daily ambient PM<sub>2.5</sub> concentrations especially during the morning and evening PM peaks typically linked to domestic fuel burning. Detailed feedback was obtained from households who received the retrofits. The overwhelming majority of respondents were satisfied with the intervention.

The results of the pilot study present important learnings for the manner in which Sasol and Natref have prepared this offset implementation plan:

- The complexity of various sources impacting on ambient air quality is not to be underestimated. Multiple factors outside of the project implementer's control could be at play – therefore, no commitment to an outcome-based target is possible at this stage, although Sasol and Natref do commit to detailed monitoring to see whether impacts are visible, and furthermore, projects proposed are informed by the Vaal Triangle Airshed Priority Area air quality management plan, which highlights the main air quality challenges for the region;
- Given the complexity and number of emission sources, it is unlikely that a single offset intervention will meaningfully improve ambient air quality. For this reason, Sasol and Natref have proposed a programmatic approach, to allow for learning and adaptability as time progresses, to respond to measured results on key outcome metrics;
- Interventions dependent on behavioural changes for successful outcomes (for example linked to solid fuel burning and waste burning) are necessarily complex; and
- The establishment of a comprehensive emissions baseline and emission source inventory is critical to explaining offset performance over time within a potentially very variable year-on-year baseline. For this purpose, extra components have been included in the baseline campaign to increase robustness.

## 5.4 Quality of life survey

Importantly, a quality of life survey was also conducted in eMbalenhle, Lebohang and KwaDela between August and October 2013. The purpose of the survey was to provide a baseline for measuring the impact of any single or combined interventions in the communities for potential quality of life improvement. The survey investigated perceived well-being, self-reported health and standard of living. In general, respondents tend to be more satisfied with life domains related to relationships (closest partner, household members, neighbours, trust, sensation, motivation, communication) than with their environment (terrain, air, house, light, sounds). The ratings for satisfaction with work and education (discovery) are conspicuously low and satisfaction with air quality in eMbalenhle was the lowest satisfaction score of all.

These survey results for a quality of life baseline provide further support for the possibility that community-based offset programmes could contribute meaningfully to various sustainable development imperatives, including air quality improvement.

## 6 Sasol's and Natref's Offset Plan (2015-2020)

### 6.1 Programme of activities approach

Sasol and Natref's air emissions offset interventions are structured as a programme of activities. The aim is to show progressive implementation of interventions, building knowledge and experience, towards increasing improvements in quality of life outcomes, including ambient air quality. Since knowledge of solutions to effect ambient air quality improvements through community-based offsets is relatively nascent, the programme is inherently intended to grow and adapt over time as experience, successes, shortcomings and learnings are obtained. The sequencing and staggering of activities is mindful of the current state of knowledge, and how this will grow over time.

This phased approach seeks to balance the vital continued gathering of detailed scientific data on quality of life and air quality baselines and feasible solutions to inform more effective longer-term activities of a more complex nature, with the need to demonstrate visible activities on the ground in the short term.

Successfully driving ambient air quality improvements, particularly where these involve investments much more directly impacting on communities, cannot be achieved by Sasol's and Natref's actions alone. Sasol and Natref strive for a collaborative, constructive relationship where all parties play a meaningful role toward the successful execution of the offset implementation plan. For this reason, much emphasis is placed on on-going stakeholder engagement and community participation as part of this plan.

At a high level, the programme of activities comprises:

- **On-going stakeholder consultation** for the purposes of awareness creation around the implementation plan; educating communities about air quality and their role in diminishing pollution as well as personal exposure; reporting progress on offset implementation and addressing challenges.
- **A detailed quality of life and air quality baseline campaign** in Zamdela to identify the key opportunities for air quality improvement, against which holistic quality of life improvements will be tracked.
- **Implementation of specific projects** aimed at improving air quality, in two phases:
  - **Immediate interventions** are to commence with implementation during 2016. These will be visible and on the ground actions in specifically Amelia and Iraq, within the broader Zamdela community, promoting prevention and management of veld and waste fires through direct interventions. The emphasis is on demonstrating commitment to improving ambient air in the region where the emissions from veld and waste fires are indeed a problem. Whilst baseline information will not be available, the Definition of Victory will be demonstrated by both a reduction in the number of veld and waste fires as well as the time taken to respond to such fires. It is anticipated that the potential for reduction in air pollution from such fires, will be significantly improved through the increased collection and segregation of waste, reduction of illegal dumping and better management and response to veld fires.
  - **Large Scale interventions:** The roll out of any intervention to scale will be informed by both the outcome of the detailed quality of life campaign and source apportionment study as well as the success of the immediate interventions. Whilst recognising that the quality of life and source apportionment studies are important levers in establishing that the correct interventions that realise maximum benefits in air quality improvement are implemented, Sasol and Natref will continue to roll out to scale the immediate interventions throughout the broader Zamdela irrespective. Sasol and

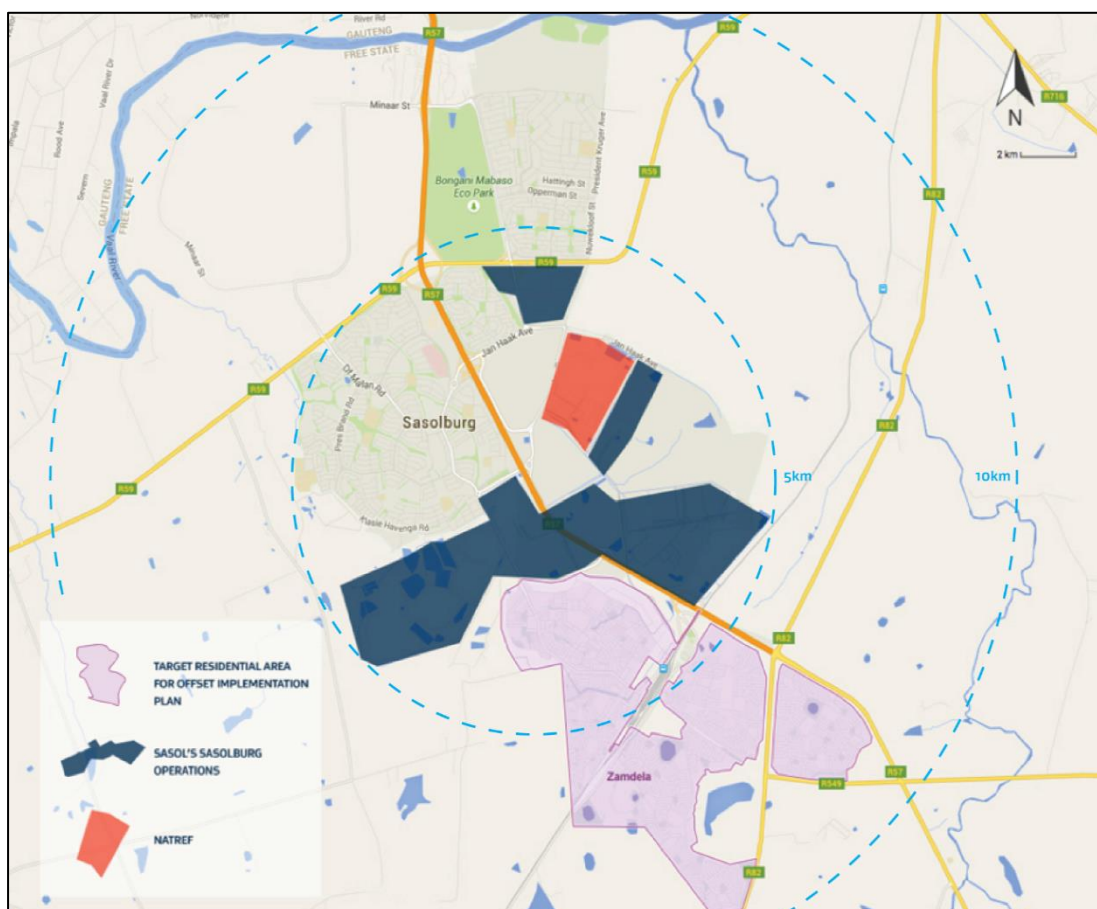
Natref are cognisant that results of these studies may reveal other problematic sources and that the offset plans will accordingly need adjusting. The large scale interventions can therefore be confirmed during the course of 2017 when baseline results are confirmed.

- **On-going research-related activities** to increase knowledge of the impact of community pollution sources on ambient air quality, and to monitor the impact of interventions done in and around Zamdela in order to confirm that ambient air quality is indeed improving as per the goals set out within this plan.
- **Education and Information sharing:** The offset plans are underpinned by on-going community education and training on environmental matters.

It should be noted that Sasol and Natref have detailed the elements of the offset implementation plan to the extent possible, based on the level of current definition of proposed programme activities. Refinement and detailed scoping of programme activities will be on-going, and will be shared with, and informed by, stakeholders through an engagement approach which is described in Section 7.

## 6.2 Geographical scope

The AEL condition specifies that the offset implementation plan must address PM and SO<sub>2</sub>. In light of the Air Quality Offsets Guideline and aligned with the VTAPA plan, which requires interventions to be targeted near the facility in areas with identified opportunities for offsets, as confirmed through consultation with authorities, the focus area for the implementation plan has been identified as Zamdela, a large community in the proximity of both Sasol's and Natref's facilities.



**Figure 1: Location of Zamdela in relation to Sasol and Natref facilities**


The Atmospheric Impact Report (AIR) prepared as part of Sasol's and Natref's postponement applications (respectively available from [http://www.srk.co.za/files/File/South-Africa/publicDocuments/Sasol\\_Postponement/InfraChem\\_/ANNEXURE\\_A\\_INFRACHEM\\_Atmospheric\\_Impact\\_Report.pdf](http://www.srk.co.za/files/File/South-Africa/publicDocuments/Sasol_Postponement/InfraChem_/ANNEXURE_A_INFRACHEM_Atmospheric_Impact_Report.pdf) and [http://www.srk.co.za/files/File/South-Africa/publicDocuments/Natref\\_Postponement/FinPost/ANNEXURE\\_A\\_NATREF\\_Atmospheric\\_Impact\\_Report.pdf](http://www.srk.co.za/files/File/South-Africa/publicDocuments/Natref_Postponement/FinPost/ANNEXURE_A_NATREF_Atmospheric_Impact_Report.pdf)) confirms that the area within a 5 km radius of the facilities is where the highest concentrations from Sasol and Natref were modelled. While these concentrations lie well within the NAAQS, offsets are nevertheless logically focused in Zamdela, confirming the guidance received from authorities and aligned with the process which informed decisions on the areas to implement offsets in.

## 6.3 Sasol and Natref's commitment

Sasol and Natref commit to implementing an offset programme, targeting low-income communities near their Sasolburg facilities, informed by guidance provided by authorities, their own research and sustainable development objectives and importantly, also the inputs of the targeted community and other stakeholders.

The envisaged components of the "programme of activities" for advancing offsets within the next five years are outlined hereunder, comprising a pipeline of initiatives at various stages of development.

### 6.3.1 Detailed quality of life and air quality baseline

 BASELINE ASSESSMENTS	PURPOSE	Stakeholder Support	PROGRESS	CRITICAL NEXT STEPS: Perform analysis and commence reporting
	To perform source apportionment studies in order to determine the contributors that negatively impact air quality.	Technical Solutions		
		Schedule		
	To implement appropriate longer term offset solutions based on findings		Commenced in June 2016 Air samples have been taken and sent overseas for analysis	

A detailed baseline is a crucial component of any credible offset programme, since:

- It establishes the key emission sources contributing to ambient concentrations of pollutants, thereby pointing to the types of offset interventions which are necessary to effect a meaningful change in ambient air quality;
- It sets the starting point, against which improvements resulting from the offset activities can be measured, against defined and measurable success criteria.

Details of the components of the baseline campaign are presented in Annexure 3. The careful planning and sound execution of the baseline campaign is essential to meet Sasol's and Natref's offset principles of completeness and accuracy.

Commencing in the course of 2016, a comprehensive ambient and indoor air quality monitoring campaign will be conducted in Zamdela by an independent and appropriately qualified party. This will include the quantification of various pollutant species in both the ambient and indoor domain (including PM and SO<sub>2</sub>), all relevant meteorological data, as well as the sophisticated profiling of sources through chemical analysis of ambient PM samples. An attempt will also be made to quantify the possible greenhouse gas footprint of the significant sources in the area through energy profiles and mass balance calculations. From an indoor household perspective, temperature measurement will be taken, together with chimney temperatures to monitor fire making activity. Moreover, activities undertaken that could influence both indoor and ambient air quality will be determined through amongst others the conducting of comprehensive surveys in the area.



A comprehensive set of surveys will also be conducted, including a broad quality of life survey supplemented with gathering of detailed information regarding household energy consumption patterns and the extent of household understanding / education regarding air pollution and air quality. The survey will be supplemented by direct measurements consisting of a combination of stove temperature measurements, coal-use logbooks kept by the household and the periodic weighing of coal containers.

A coal merchant survey will be done at a number of local coal merchants to obtain information on the origin, price and format in which coal is sold. A sample of coal bags (or tins) will be weighed.

A community source survey will investigate relatively small, distributed non-household sources within the residential area. Regional and local dust sources will be investigated through a GIS land-use assessment.

The gathering of this data will allow for the compilation of an emission inventory for Zamdela and for the integration of air quality, quality of life, energy consumption patterns and air quality education information to draw insights regarding how to best give effect to ambient air quality improvements in ways that also achieve significant co-benefits, including socioeconomic outcomes.

It is important to note that during the planning of the baseline work, attention was particularly given to the priority area improvement plans to guide the establishment of the monitoring regime.

*Approximate timeframe of activities:* on the ground activities for baseline data gathering commenced in May 2016, and the components of the baseline that will be prioritised are air quality measurements, with all related surveys to follow. Activities will take approximately 18 months to complete. Various aspects of the baseline campaign will be on-going throughout implementation, to track progress on the impacts of the offset projects.

### 6.3.2 Interventions


Sasol and Natref engaged with the Fezile Dabi District Municipality to establish the types of interventions that could be implemented in the short term in the Zamdela community. The interventions described below have been selected because:

- They are directly informed by the priorities identified in the Vaal Triangle Airshed Priority Area Air Quality Management Plan which outlines known air quality challenges;
- Given the desire to execute solutions in the short-term, the impetus has been on initiatives likely to have a high probability of success with associated positive impact on air quality improvement;
- Given the expected benefits, it is anticipated that the interventions will resonate with the Zamdela community.

Whilst it is reiterated that it is not yet possible to estimate the extent of the improvements anticipated, intuitively and through the KwaDela Pilot Study results obtained, Sasol and Natref are reasonably satisfied that the interventions identified will contribute towards improved air quality. The exact extent of the contribution can only be assessed through the detailed baseline campaign. Therefore, as part of the implementation, Sasol and Natref will aim to assess the effectiveness of the interventions through quantifiable metrics specified below and in the annexures. The outcomes of the detailed baseline campaign (in particular the source apportionment activities) will inform the extent to which the identified interventions are rolled out or support the implementation of new initiatives to address any new sources that are identified. Notwithstanding this, Sasol and Natref are committed to commence with implementation of the identified initiatives. Due to the outcome of the public meetings as well

as the timing available for immediate implementation, Sasol and Natref will focus their efforts on implementing the interventions in Amelia and Iraq, with the aim of expanding to the remainder of Zamdela, unless the source apportionment and quality of life studies identify other sources that should rather be targeted.

### Reduced smoke (PM) emissions from veld fires

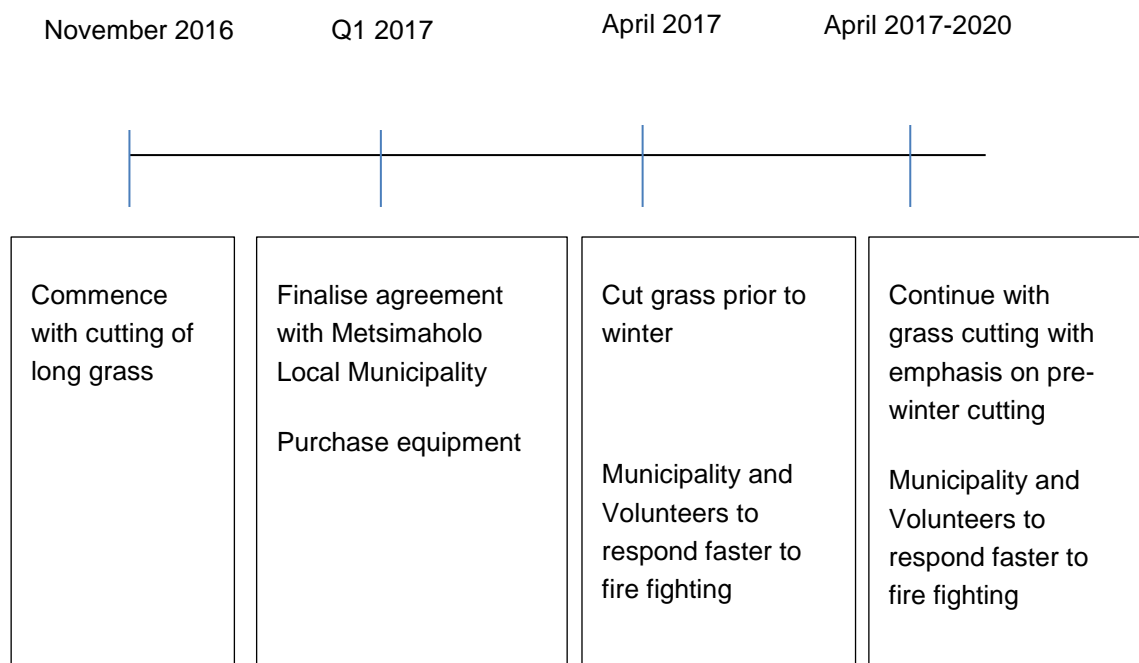
 VELD FIRE MANAGEMENT	<b>PURPOSE</b> Reduce emissions during winterveld, waste and shack fires	Stakeholder Support	●	<b>PROGRESS</b> Metsimaholo Local Municipality Emergency Management engagements Developing solution with Working with Fire or Volunteers Considering procurement of a small first response unit and water carrier for Iraq Appoint service provider to cut long grass in areas	<b>CRITICAL NEXT STEPS:</b> Pursue Working with Fire and volunteers to develop optimal solution Get agreement from Metsimaholo Local Municipality on proposed business model
		Technical Solutions	●		
		Schedule	●		

**Brief description:** Veld fires are a significant source of PM emissions in the Free State during the winter months and also contribute to secondary ozone formation. Sasol and Natref plan to enhance the capacity in the Metsimaholo Municipality to prevent veld fires, with a resultant improvement in ambient air quality. The project considers the reduction in available bio-mass for burning (through the cutting and removal of grass) and enabling a quicker response time to extinguish fires where they do occur. The reduction in duration, amount of bio-mass burning and affected area of fire events will be tracked and the amount of effective or potential emissions saved will be calculated using accepted emission factors.

Although the implementation model is still to be finalised, the concept is that the Municipality could work together with other non-municipal resources, such as SMMEs set up by the project, to do fire prevention by cutting and removing grass. Alternatively, Sasol will provide the necessary tools to the municipality to enable and ensure that the grass cutting takes place on a regular basis. At this stage, the latter option seems to be the more feasible option, although the community would prefer the first option. Should a fire occur, albeit a veld, waste or shack fire, then the Municipality with the assistance of volunteers (model that requires agreement still) will respond with sponsored equipment to extinguish the fire.

Detail on the intervention is included in Annexure 3.


**Timeframe of activities:** Discussions with Metsimaholo are on-going and once agreement on the operating model has been reached, the equipment and fire fighting equipment will be purchased. The first round of grass cutting has commenced in November 2016 to cut and remove long grass. In addition to preventing the grass being burnt, cutting of the long grass also deters criminals that prey on unsuspecting members of the community by hiding in the tall grass. In addition to cutting the grass in November 2016, the intention is to finalise agreement with the Metsimaholo Local Municipality in the first quarter of 2017 and obtain the relevant equipment so that grass cutting can commence by April 2017 before winter.



**Metrics to measure the impact of the initiative:** In addition to preventing and reducing the number of fires on a year on year basis, the metrics for success will typically also include the number of fires extinguished, pictures indicating areas that potentially could have burned but were saved, the area in hectares of grass cut.

**Sustainability of intervention:** The sustainability of the intervention is dependent upon the successful partnership between the Metsimaholo Municipality and associated assistance. Sasol intends to assess the sustainability of the intervention through the monitoring of metrics as reported above, to ensure a responsive approach to veld fire and shack fire management is maintained.

## Vehicle emissions testing

 <p>VEHICLE EMISSIONS REDUCTION</p>	PURPOSE	Stakeholder Support	PROGRESS	CRITICAL NEXT STEPS:	
	Reduce vehicle emission PMs through measuring the exhaust emissions and issuing repair notices	Technical Solutions	Equipment obtained and tested Successful sampling completed Testing commenced on 21 September MLM supports and will take ownership of initiative		Finalise commercial and business model Procure equipment Implement and Roll Out
		Schedule	Finalising commercial and business model		

**Brief description:** PM<sub>10</sub> and SO<sub>2</sub> emissions arise from combustion of fuel in vehicles, including heavy vehicles used for hauling purposes. Poorly maintained vehicles not only emit more emissions but cost more to operate due to inefficient combustion, resulting in higher fuel consumption and cost.

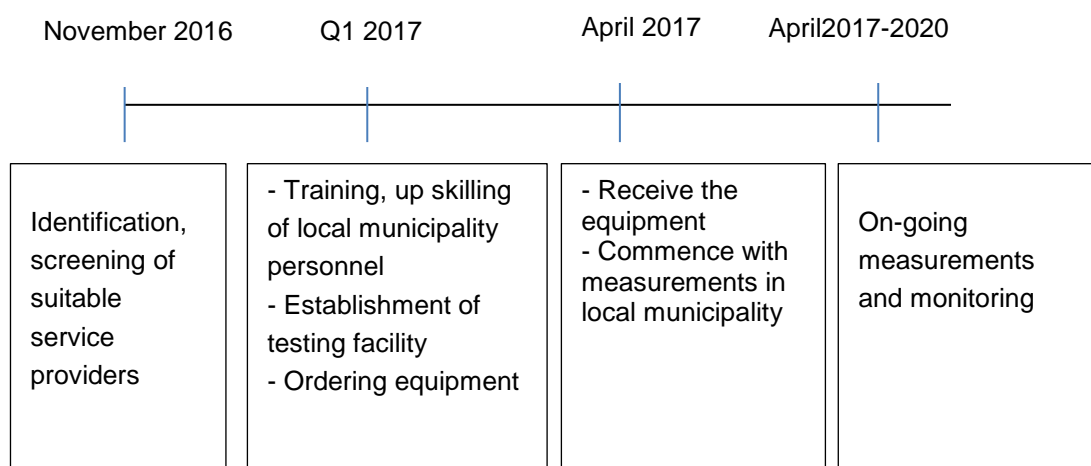
Vehicle emission testing is a proven way to determine whether vehicles are properly maintained and by-laws are in place for this purpose. Fezile Dabi municipality currently does not have testing facilities which some other municipalities, such as Cape Town and Sedibeng, have. The aim therefore will be to enable the Metsimaholo Municipality to conduct testing of vehicles and to possibly issue notices to polluting vehicles. This will be done by sponsoring monitoring equipment and training officials from the Municipality. The Municipality already

indicated that they have the capacity and willingness to do these measurements, however skills transfer and tools are at this stage hampering the process.

Natref purchased the equipment and conducted some measurements on its site. Natref will continue with the measurements on an ad hoc basis. These learnings are being shared with Sasol and the Municipality in order to inform the rollout. Sasol will appoint a Service Provider that will provide a turnkey project to the Municipality by supplying equipment and training the Municipal resources to conduct measurements.

The plan is then to request Sasol's vehicles and Service Providers to test their vehicles on a regular basis at the testing centre/site. This will ensure that vehicles entering Sasol's sites will comply with the requirements and Sasol will work with the owners of the vehicles to ensure that they understand the reason for this and work with Sasol to ensure that their vehicle fleets are properly maintained. Additionally, these vehicles will then be used as training to ensure that the methodologies, processes and procedures are properly embedded within the Municipal system. Proof of testing and all monitoring data will be requested by Sasol to demonstrate efficacy of the initiative.

**Timeframe of activities:** Implementation of the testing facility within the Sasolburg region will commence as soon as the equipment vendors are registered on Sasol's vendors list. Discussions with the turnkey project manager have already commenced. The plan is to begin with the training and establishing of the facility in January 2017 with measurements being conducted from April 2017.



**Metrics to measure the impact of the initiative:** The metrics will be a report provided to Sasol and Natref on all vehicles tested from the Municipality on a monthly basis indicating:

- the total number of measurements undertaken,
- the number of measurements that failed,
- the number of re-measurements
- the number of re-measurements passed.

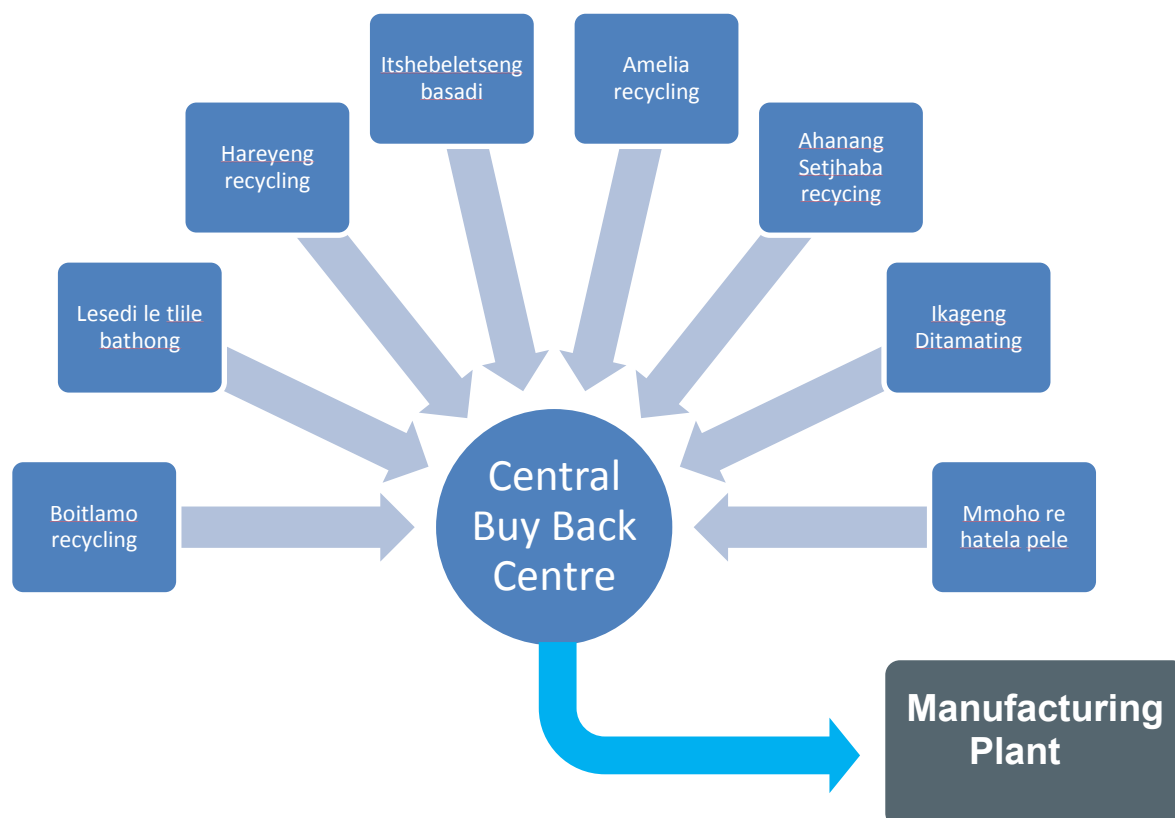
**Sustainability of intervention:** The sustainability of the intervention is dependent upon the successful implementation of vehicle testing by the Metsimaholo Municipality. Sasol intends to assess the sustainability of the intervention through the monitoring of metrics as reported above.

## Waste recycling

 REMOVAL OF RECYCLABLE WASTE	<b>PURPOSE</b> Facilitate higher rates of recycling waste to prevent waste being burned and the release of harmful emissions	Stakeholder Support	●	<b>PROGRESS</b> Consultations with municipalities and waste pickers association undertaken Proposed satellite collection points and buy back centre Metsimaholo Local Municipality proceeding with rezoning of sites Started to buy equipment for sites	<b>CRITICAL NEXT STEPS:</b> Approval and Rezoning of all sites
		Technical Solutions	●		
		Schedule	●		

**Brief description:** Waste burning in Zamdela results in harmful and visible emissions, including PM<sub>10</sub> and SO<sub>2</sub>, among others. Through the stakeholder engagement process, it is evident the community is very aware of this problem, regarding it to be a significant contributor to air quality challenges in Zamdela, especially around Amelia and Iraq. A holistic programme is required to reduce waste burning, through improved waste management practices. This project focuses on avoidance of burning of recyclable waste, complemented by focus on avoidance of burning of non-recyclable waste, as described below. However, the community is also sensitive to the manner in which such a programme is rolled out, so as not to encroach on existing recycling programmes in the area, which contribute to the livelihoods of some community members.

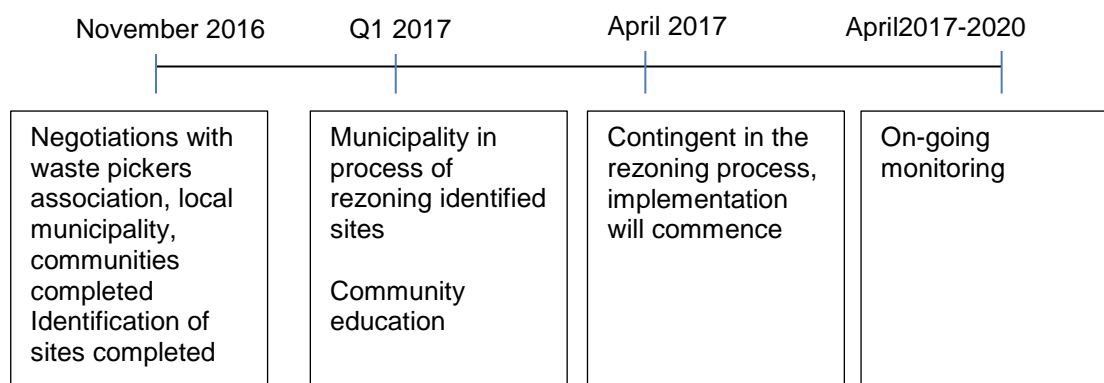
Based on the above concerns raised by the community, the recyclable waste project seeks to reduce recyclable waste by working with the current Waste Picker structures. The concept is to have a hub and spoke business model, as per the figure below, where eight Co-operatives are registered that will all feed into a single buy-back centre. This initiative is supported by the waste pickers, the Metsimaholo Local Municipality as well as the Fezile Dabi District Municipality. The Municipality has made some properties available for the buy-back centre as well as the local collection stations. These properties still need to be rezoned. The Municipality is busy with the rezoning process and Sasol awaits the outcome of the process before implementation can start.



Sasol will assist in establishing the Infrastructure for the hubs as well as the buy-back centre. Representatives of each Co-Operative will collectively manage the Buy Back centre, after some business skills development through Sasol's Incubation Hub. The aim is to have the Buy Back centre commercially sustainable through the funds of recyclables and to later expand the collection area to Northern Free State as is Fezile Dabi's vision.

The Zamdela community also requested environmental education. Sasol will be working closely with the Municipalities (both local and district) to facilitate this process in conjunction with the education drive for the non-recyclable waste required to inform people how to deal with waste in general. Schools will also form a big part of this process. It is not Sasol's and Natref's intentions to negatively impact the livelihood of any individual, however it is their view that it is vital that recycling and environmental education are being taught and practised through a learning medium at schools. This will be implemented and executed in consultation with all role players within the Zamdela waste recycling fraternity. It will also include the element of tyre recycling to avoid the burning of tyres within the Zamdela community. Detail on the intervention is included in Annexure 5.

**Timeframe of activities:** Project execution has commenced but is currently on hold to allow the Municipality to rezone the identified properties. Subsequent to that, the process of implementation will commence in full swing, including the education drive to establish business acumen and skills within the group responsible for the buy-back centre. It is Sasol and Natref's intention to implement sustainable initiatives, meaning that they will not withdraw completely during the embedding phase of the project. However they would like to take a less involved role over time, in order for the project to become self-sustainable.



**Metrics to measure the impact of the initiative include:**

- Tons of waste recycled in each of the hubs
- Tons of waste sold from the buy-back centre
- Both the above will be broken down into component waste streams such as tons of paper, plastics, tyres etc. recycled.

**Sustainability of intervention:** The sustainability of the intervention is dependent upon the success of the business model adopted in the partnership with Waste Pickers. The financial incentive created by the buy-back model should ensure longevity of the recycling activity. To enhance performance, business training is seen as an important enabler for self-sustainability.

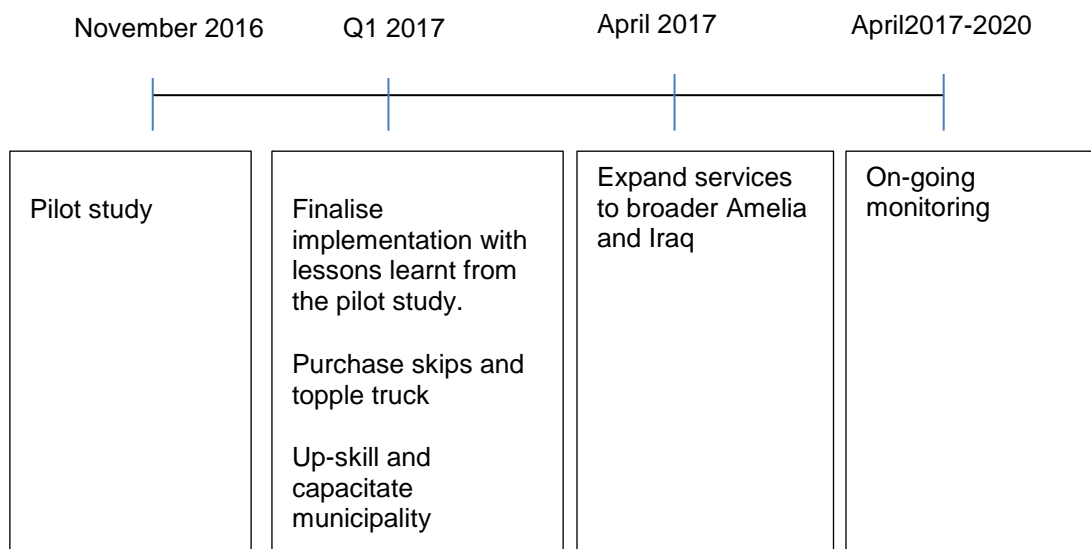
## Non-recyclable Waste

 DOMESTIC WASTE MANAGEMENT	<b>PURPOSE</b> Reduce household waste burning by enabling local municipality to deliver waste removal services Reduce or prevent illegal dumping of waste	Stakeholder Support	●	<b>PROGRESS</b> Solution identified – Eezibins, skips to be placed in identified locations and topple truck to remove waste	<b>CRITICAL NEXT STEPS:</b> Piloting and roll out
		Technical Solutions	●		
		Schedule	●		

**Brief description:** As mentioned above, through the stakeholder engagement process, it is evident the community is very aware of waste burning, considering it to be a significant contributor to air quality challenges in Zamdela. This project focuses on avoidance of burning of non-recyclable waste, initially within Amelia and Iraq with the aim to expand it to the remainder of Zamdela as part of the broader offset strategy and informed by the source apportionment and quality of life study.

The non-recyclable waste project looks at the collection and removal of non-recyclable waste with the aim of reducing potentially harmful emissions from waste burning by reducing waste volumes available for burning, through the implementation of waste removal services and infrastructure (e.g. skips). Basically this entails the clean-up of illegal dumping sites and providing an alternative means (e.g. skip unit) of waste collection and removal. This combined with an awareness and education drive for the residents in the area aims to collect the waste in the skip/collection area for easy removal and disposal. For the piloting phase skips will be used, however this can expand to another collection method. Detail on the intervention is included in Annexure 6. The aim is to work closely with the Municipality and to enable it to deliver the necessary services within currently non-serviced areas. Again the focus is on sustainability of waste removal services with the aim of overcoming certain hurdles specific to these areas. These hurdles include, inter alia, type of vehicles to gain access to the area, type of waste collector e.g bin or skip or something else and community members that forget at which day waste collection takes place. As the project progresses, suggestions from the community will be taken on board to stream line the process.

**Timeframe of activities:** During November 2016 a pilot trial was initiated to clean up a dedicated, demarcated area where waste could be disposed of and removed. The trial included an education campaign to ensure community acceptance, participation and behavioural change. The lessons learned from the trials will then be used to expand into the broader Amelia and Iraq.



**Metrics to measure the impact of the initiative:** The metrics will be

- the tons of waste removed
- the number of illegal dumpsites cleared.

The more waste removed the more potential fuel for burning and hence potential air pollution is avoided.

**Sustainability of intervention:** The sustainability of the intervention is dependent upon the successful implementation by the Metsimaholo Municipality. The purpose of advancing with a trial first, is to assess whether the planned approach is effective, and to modify if needs be. Similarly, education and awareness of community members to change their behaviour with waste dumping and burning will be a vital enabler to the project. The roll out will be expanded more broadly once a workable model is established.



### 6.3.3 Summary of the plan

SO NATREF SO NATREF SO NATREF SO NATREF

		2016				2017				2018				2019				2020			
		JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC
Baseline (Zamdela)		Measurement Survey		Data Collection and Analyses		Preliminary Results		Integration of total results		Final Baseline reports		Ongoing monitoring				Ongoing monitoring				Ongoing monitoring	
Education and Awareness (Zamdela)	AQ PM NO <sub>x</sub>			Develop awareness programme for AQ campaign		Roll out awareness raising campaign	ON-GOING COMMUNITY EDUCATION AND AWARENESS										Measure Effectiveness				
Zamdela I (Vehicle emissions)	PM NO <sub>x</sub>		Aug 16 - Vehicle emission tests Natref	Oct 16 - Identification & screening of Service providers		Mar 17 - Training of Municipal staff establish testing facility	Apr 17 - Roll out of emission testing (municipality)	ON-GOING MONITORING & SUPPORT													
Zamdela II (Veld fire management)	PM + TOXINS			Nov 16 - Grass cutting (Fire Prevention)		Mar 17 - Finalisation of business model	Implement business model & purchase equipment to cut grass before winter	ON-GOING MONITORING & SUPPORT													
Zamdela III (Removal of recyclable waste)	PM + TOXINS	May - July 16 - Engagement with waste pickers		Mar - Oct 16 - Satellite locations + buyback center (acquire and rezone)		Mar 17 - Rezoning of sites 8 locations 1 buy back center	Apr 17 - Commence roll-out	ON-GOING MONITORING & SUPPORT													
Zamdela IV (Domestic Waste Management)	PM + TOXINS	Feb - July 16 - Consultation with local government + community behaviour assessment		Nov 16 - Piloting of possible Solution (skips + tonnie trucks)		Jan 17 - Procurement & Community education	May 17 - Rollout Amelia + Iraq, municipal site unlawful, waste site / landfill site. Assist + arrange move to new site	ON-GOING MONITORING & SUPPORT													

Dates are indicative and may change

### **6.3.4 Refinements to the offset plan in light of stakeholder engagement process**

The stakeholder engagement process is summarised in Chapter 7, from the detailed Stakeholder Engagement Report incorporating the Comments and Responses Report which was prepared by SRK Consulting. Sasol and Natref have considered the comments received, and on that basis, note and emphasise the following important elements of the plan that support the community's comments, as detailed in this chapter as well as the supporting annexures:

- Requests were received for Sasol and Natref to assist in increasing community awareness around air quality issues. Sasol and Natref believe the implementation of the offset programme to be a valuable opportunity to facilitate knowledge sharing, both through the establishment of a bi-annual multi-stakeholder forum, as well as through an education and awareness campaign outlined in Chapter 6;
- A concern was raised regarding the scope of the waste recycling programme. Subsequently meetings have been held with the affected stakeholders and the waste recycling plan has been accordingly amended to partner with the relevant stakeholders and structures already in place. Where possible gaps exist, Sasol and Natref will, through the partnership, assist in putting in place the necessary structures to ensure a smooth and effective execution phase. These consultations form part of the necessary scoping activities for waste recycling management as an immediate intervention outlined in Section 6.3.2 and Annexure 6;
- There is significant support for the non-recyclable waste management programme in Zamdela, as outlined in Section 6.3.2 and Annexure 7, particularly in the areas of Iraq and Amelia, where it appears waste collection services are suboptimal. This will be the biggest focus area for the immediate interventions within the offset implementation plan;
- While the specifics of the medium to longer-term programme are not discussed since they are dependent on the results of the baseline campaign, suggestions have already been received. There are differing views in the Zamdela community about whether a project to address domestic fuel burning would make any improvements in ambient air quality (with more vocal support for such an initiative in the Amelia and Iraq sectors), and also views that dust from unsurfaced roads may be an opportunity in some areas. These views highlight the importance of the baseline campaign outlined in Section 6.3.1 and Annexure 3 in obtaining a fact base to most efficiently and effectively target the primary causes of community-related air pollution through the offset programme. It again has to be emphasised that the current projects will be expanded going forward to include the broader Zamdela, however additional targeted sources could be added if identified by the source apportionment study;
- A number of suggestions were received to plant trees as part of the offset programme. While trees may help to reduce wind-blown dust in a particular area, they will not physically reduce the source of the pollution. Outside of the offset plan, Sasol and Natref will consider the merit of such a proposal as a Corporate Social Responsibility initiative. While the baseline campaign is underway (described in Section 6.3.1 and Annexure 3), which includes various household surveys, a few questions have been added to understand the desire for trees better, to explore this community request in more detail. Any greening initiatives would not form part of the offset implementation plan;

- Numerous requests for job opportunities linked to the offset programme were received. Sasol re-emphasises that the primary aim of the offset plan is to reduce ambient pollutant levels. Where job opportunities arise from the programme, a concerted effort will be made to develop skills and employ locally. These opportunities would arise from the immediate interventions and medium to longer-term activities.

## 7 Stakeholder Engagement

The stakeholder engagement approach for this offset implementation plan is informed by Sasol's and Natref's offset licence conditions, the offset principle of transparency, the principles of consultation contained in the Environmental Impact Assessment Regulations (Government Notice No. 982, 04 December 2014) published under NEMA and guidance provided in the Air Quality Offsets Guideline.

Figure 2 outlines the process that was followed, and timeframes along which the activities took place.

Prior to engaging other stakeholders, the draft offset implementation plan was discussed with the licensing authority and NAQO. It was further informed by stakeholder engagement and the community as described below. Meetings also took place with various community leadership structures, including the Fezile Dabi District and Metsimaholo Local Municipalities to inform them of the process that would unfold and Sasol's and Natref's reasons for implementing offsets.

### 7.1 Public Participation

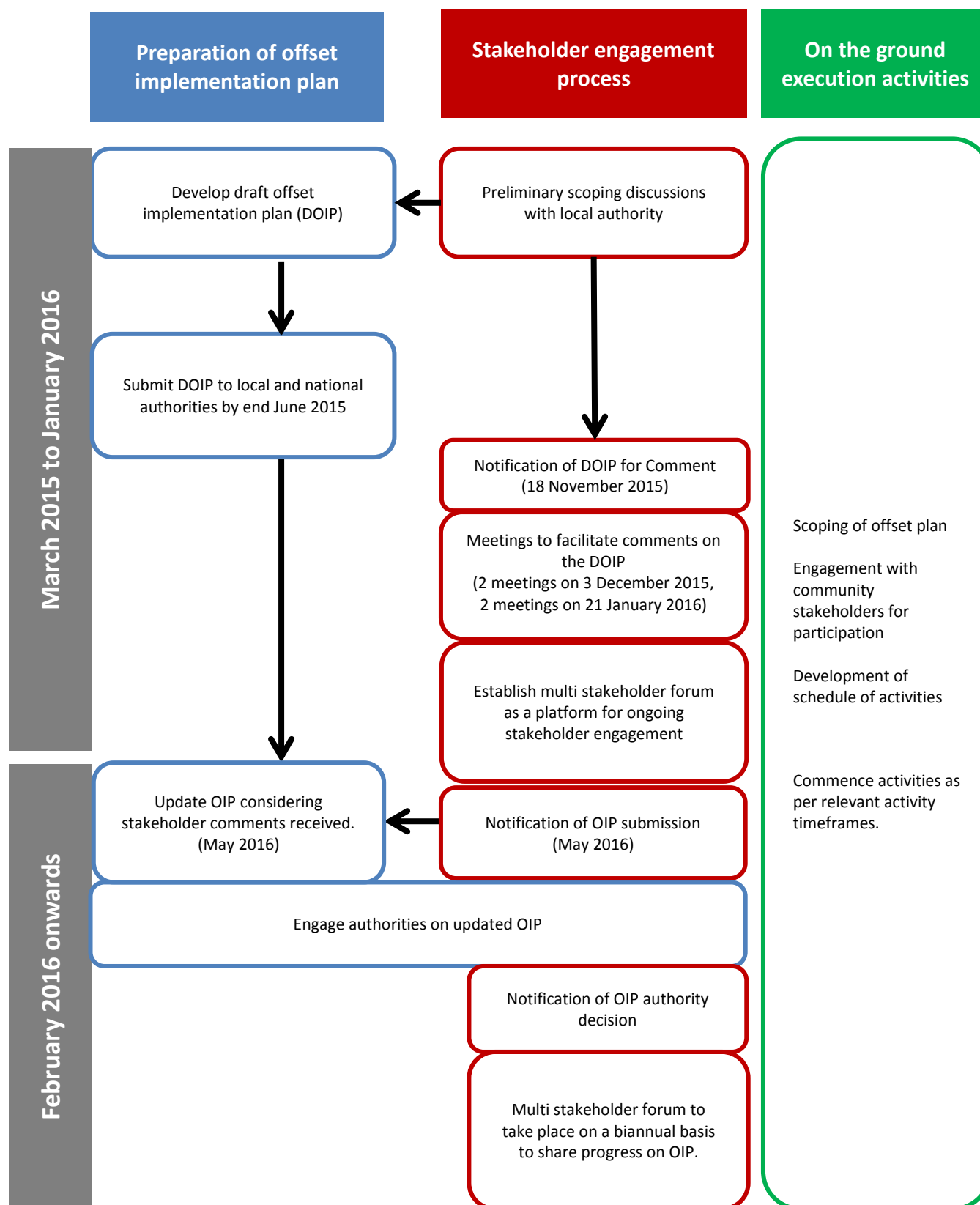
Chapter 6 of the Air Quality Offsets Guideline indicates the requirement for offset programmes to be subjected to a "detailed and transparent public participation programme". The guideline goes on to require that a public meeting be held to which the public and authorities are invited. The guideline also indicates that the public participation process can be undertaken in terms of the National Environmental Management Act 107 of 1998 or a separate process.

The guideline provides direction regarding the public participation process to be undertaken as part of an air quality offset programme. Although the guideline was in draft form at the time the public participation process was undertaken, in order to meet the requirements of the draft guideline as it then was, and ensure effective stakeholder engagement, the scope of work was informed by the requirements of Chapter 6 of the EIA Regulations. These regulations meet all the requirements of the Air Quality Offsets Guideline and go a little further in specifying the steps required as part of the participation process. The final guideline has not impacted the process followed.

Public participation with communities and other registered Interested and Affected Parties included opportunities to comment on the draft plan, a stakeholder consultation meeting to facilitate comments, and notification of the updated plan's submission and authority decision. This process is being facilitated by SRK, an independent Environmental Assessment Practitioner. Meetings took place in Zamdela, where the content of the draft offset implementation plan was shared for public comment. A key objective of these meetings was to ensure that the reasons for, and principles underpinning the offset proposal are well understood by the community and that the community had an opportunity to inform the contents of the proposal.

A period of 50 days was allowed for comment on the draft offset implementation plan, and working with SRK, Sasol and Natref have considered comments received, in a Comment and Response Report (CRR), making any necessary updates to the draft plan. Due to the importance of stakeholder involvement in this programme, a multi-stakeholder forum will be created as the key platform where stakeholders will receive progress updates on implementation of the programme of activities, where successes can be shared, challenges and concerns be highlighted and resolved, and questions can be raised.

Approximately 1,000 community members attended the public meetings on Sasol's offset plan in the Secunda region and Sasol's and Natref's plan in the Sasolburg region.



**Figure 2: Technical and stakeholder engagement process**

## **7.2 Offset plan approval process**

The key compliance requirement was submission of the draft offset implementation plan to authorities by 30 June 2015. This version has now been updated, and has been submitted to authorities as soon as possible after the stakeholder consultation was concluded, considering comments received.

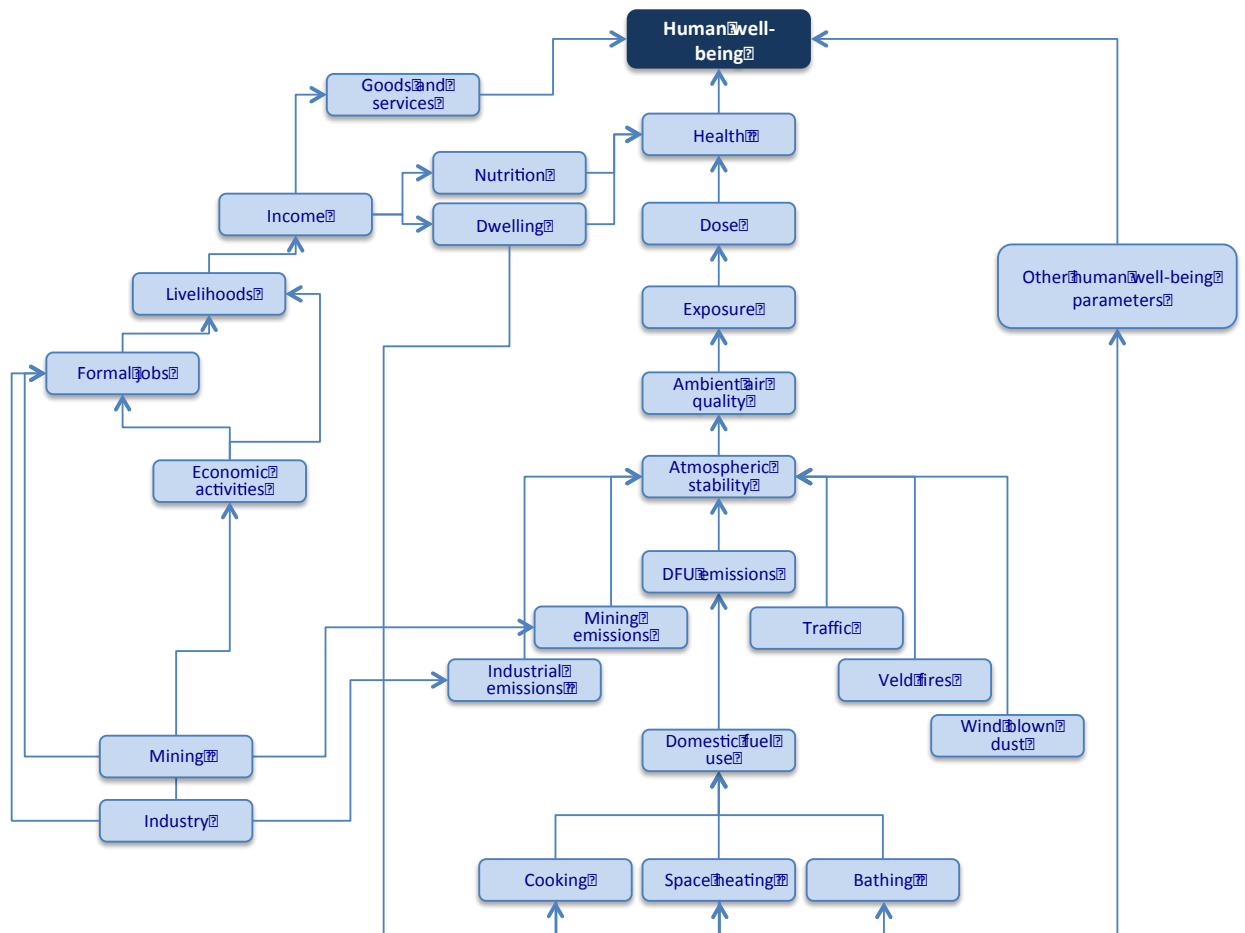
It is now envisioned that further discussions may take place with relevant authorities and that the plan will formally undergo consideration for approval. The offset implementation plan will be appended to the AEL. The plan will need to be executed and monitored as per its commitments. Stakeholder engagement thereafter will principally take place on a biannual basis via the multi stakeholder forum, emphasising the importance of the directly affected communities in the execution of the offset implementation plan.

# **8 Success Criteria**

## **8.1 Overview**

Ambient air quality manifests as a result of multiple complex parameters that are highly variable in space and time. Within that complexity, measuring ambient air quality is similarly challenging, especially within residential areas where a small, localised source such as the burning of waste or a veld fire can significantly influence the measurements over short timeframes. In addition, ambient air quality, which falls to be safeguarded by government, is dependent on so many external factors that a single emitter or entity cannot alone take accountability and responsibility for its improvement. To this end, Sasol and Natref will measure their offset programme of activities using a 'basket of measures' to characterise "improved well-being" aligned with Section 24 of the Constitution and the sustainability principles contained in the NEMA and that would unambiguously indicate a successful offset, rather than just improved air quality.

The principle of a basket of measures is illustrated in Figure 3. The range of performance parameters under the offsets regime is illustrated, highlighting the manner in which they all contribute to reduced risk of adverse human health effects, as a result of poor air quality, and thereby contribute to improving the Constitutional well-being imperative. The culmination of the offset is to reduce the risk of adverse health effects to the same extent or better than the equivalent reduction in industrial emissions. It is important to use a 'basket of measures' approach, which assesses the holistic contribution of an offset to well-being, incorporating dispersion modelling and monitoring tools.



**Figure 3: Schematic illustration of the key performance parameters within an offset regime, contributing to the Constitutional right to an environment not harmful to human health or well-being**

## 8.2 A basket of measures

This basket of measures is intervention-dependent and must include the various elements that present potential compromises to acceptable health and well-being, including ambient air quality. By way of example, in the KwaDela pilot study that undertook the insulation of RDP homes, the measures identified by Sasol and the project team to be important include:

- The extent of ambient air quality improvement in the targeted communities, directly attributable to the intervention and excluding the influence of external factors on baseline variations;
- Measurement of the reduction in solid fuel consumption;
- Reductions in personal exposure of household occupants in the targeted communities on the basis of indoor and ambient pollution exposure;
- Environmental co-benefits, such as avoided greenhouse gas emissions;
- Material improvement in a range of human well-being indicators in the targeted communities, including:
  - Economic benefits accruing to the community through payment for services rendered (linked to job opportunities created and procurement of services from local businesses);
  - Economic benefits accruing to the community through savings on energy costs;
  - Thermal comfort improvement for household occupants better shielded from temperature extremes;

- Sense of well-being arising from improvements to people's homes, including the reduction in dust ingress.

Establishing success criteria is important to the principle of sustainable offsets because there must be a measurable set of outcomes defined *prior* to the offset that can be used to determine what has been achieved *after* the offset intervention. The basket of measures chosen for each intervention will reflect risk reductions to human health and well-being as well as additional sustainable development benefits that may accrue.

## 9 Conclusions

Sasol's and Natref's AEL includes the requirement for an offset implementation plan to be presented to authorities by 30 June 2015, and thereafter subjected to an appropriate public consultation process. This document records that updated draft plan, following conclusion of the public participation process and subsequent actions already taken to date.

The offset plan, once approved, will be implemented in conjunction with the on-going focus on the implementation of the air quality improvement roadmaps outlined in Sasol's and Natref's postponement applications.

Progress on the implementation of this offset plan will be shared through a community engagement platform, and reported back to applicable authorities.



## **Annexures**

## **Annexure 1: The Rationale for Offsets**

## THE RATIONALE FOR OFFSETS

This annexure sets out the context for offsets in the present air quality policy framework, as well as the scientific rationale for advancing offsets within this air quality policy regime.

The terms in this annexure are as defined in the glossary of the main document.

### 1. The objective of the NEM:AQA

Ultimately, the objective of the NEM:AQA is to give effect to the Constitutional right of South Africans to an environment that is not harmful to human health or well-being, and that is protected for the benefit of present and future generations, in respect of air pollution.

The way in which air pollutants result in potentially significant detrimental effects on human health and the environment is through the concentrations of these pollutants at ground level. The severity of the detrimental effects is a function of the concentrations that occur together with the exposure to those concentrations by both people and the environment. Accordingly, National Ambient Air Quality Standards (NAAQS) have been promulgated to define tolerable ambient air quality concentrations for selected pollutants.

### 2. Recognition for the role of offsets within air quality policy

The NAQF, which provides the medium- to long-term plan for the practical implementation of the NEM:AQA, identifies various mechanisms for the implementation of air quality improvement objectives, including the setting of standards for various sources, such as the MES, which prescribe maximum emission limits for specified industrial activities, and many of which apply to Sasol's and Natref's activities. The NAQF further notes the consideration of an offset policy for air pollution as a future focus area, linked to the identification of offsets as a means to channel private sector efforts toward reducing community sources of air pollution in the DEA's Strategy for addressing air pollution in dense, low-income settlements (2013).

All these various mechanisms are aimed at achieving the objective of the NEM:AQA, which can, for practical purposes, be defined as ambient air which does not exceed the NAAQS.

Sasol's and Natref's main facilities in Secunda, Mpumalanga and Sasolburg, Free State, are located in the Highveld Priority Area (HPA) and the Vaal Triangle Airshed Priority Area (VTAPA) respectively. These areas were declared by the Minister since NAAQS for PM are being exceeded. The priority area air quality management plans for both priority areas contemplate offsets as necessary mechanisms to achieve compliance with the NAAQS, as briefly outlined below.

The VTAPA Air Quality Management Plan (2009; 2013 mid-term review) records that "particulate emissions from domestic coal and wood burning have been identified as the major cause of poor ambient air quality in urban areas such as the Vaal Triangle, and have a significant adverse impact on human health." Accordingly, this plan sets objectives to address domestic fuel burning emissions, including:

- By 2015 an evaluation is undertaken of household emission reduction options including but not limited to the rollout of new stoves, retrofit of houses, energy efficient RDP houses, fitment of ceilings, LPG rollout and subsidy and a household emission reduction action plan is developed; Effective interventions, research, awareness raising and education are major aspects in achieving the goal. The role of economic development, technological improvements in combustion equipment and emissions offsetting are also critical;

- By 2017 household emission reduction plan is rolled out by government and assisted by industry through offsetting.

The VTAPA Air Quality Management Plan also seeks to implement offsetting to address veld fires, setting a goal that “by 2017 [a] veld burning emission reduction action plan is rolled out by government and assisted by industry through offsetting.”

The HPA Air Quality Management Plan (2012) similarly states that “all residential areas where wood and coal are combusted experience high concentrations of particulates and [carbon monoxide], particularly those that are densely populated. Here, exposure can be particularly high.” The plan sets a goal that by 2020, air quality in all low-income settlements is in full compliance with ambient air quality standards, and calls for research institutions and organisations to motivate research on domestic fuel use, particularly emission reduction measures.

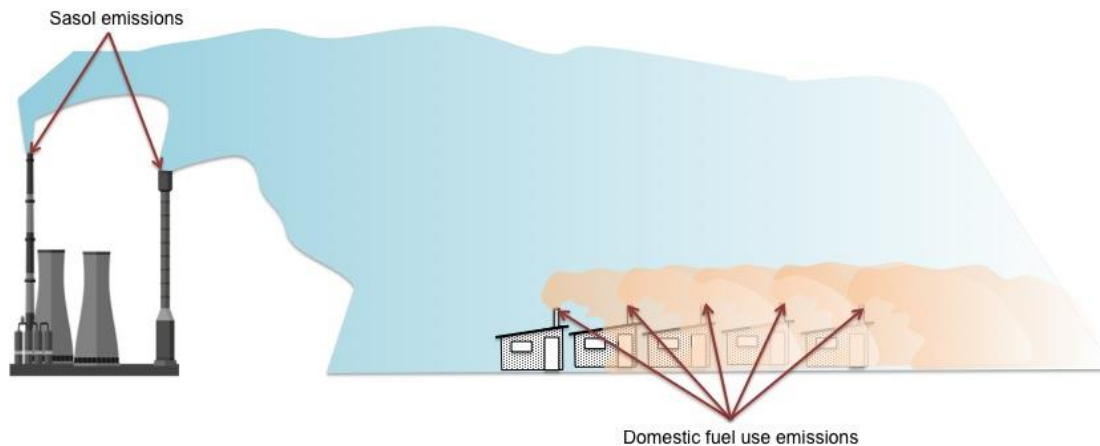
This state of affairs is acknowledged in the DEA’s 2014 State of air quality report and National air quality indicator, which concludes that “it is clear that PM<sub>10</sub> is still the greatest national cause for concern in terms of air quality... Continued and increased national provincial and local action is required in order to bring particulate concentrations down to acceptable levels... Many South Africans may not be breathing air that is not harmful to their health and well-being”.

Sasol’s and Natref’s conclusion is that there is widespread recognition of the significant contribution of community sources to non-compliance with NAAQS, and that it is recognised by the DEA that facilitating private sector investment through a formal offset mechanism, may be the most effective way to address these sources.

### **3. Scientific rationale for air emission offsets**

As described in the main body of this implementation plan, Sasol was granted postponements from compliance timeframes for meeting some of the MES applicable at its industrial facility in Secunda. As part of its postponement applications, Sasol outlined its air quality improvement roadmaps, which included a commitment to offsets. Sasol’s and Natref’s view is that offsets may prove to be a more effective alternative means of achieving compliance with the NAAQS than a solitary focus on compliance with the MES, particularly where it is demonstrated to be challenging.

Sasol’s pilot investigations into community-based offsets are described elsewhere in this document, as an alternative way to achieve the same risk reduction benefits (or better), that the MES are designed to achieve. The principle of an offset in terms of air quality management is thus to reduce the source of risk to receptors, by reducing sources other than emissions from Sasol’s and Natref’s activities. The principle is illustrated diagrammatically in Figure 1. The air quality to which people and the environment are exposed is a function of Sasol (and other industrial) emissions as well as multiple other emission sources including those from domestic fuel use, veld fires, wind-blown dust, etc. Sasol and Natref contend that by reducing other sources, a similar or greater benefit could potentially be achieved than by solely focusing on reductions of Sasol’s and Natref’s emissions.



**Figure A1: Schematic illustration of an air emissions offset**

#### 4. Relative contributions to ambient concentrations

For this offset principle to be credible, it is necessary to examine the contribution made to ambient air quality where people are exposed from Sasol and Natref emissions and from the multiple other contributing sources. These other sources include other industries, biomass burning, dust from agricultural activities, motor vehicle emissions and domestic fuel use. Emissions from domestic fuel use are significant for ambient air quality not in terms of mass but in terms of the fact that the emissions are generated where people are directly exposed, as acknowledged in the priority area air quality management plans.

Under stable atmospheric conditions, which occur frequently on the South African Highveld, emissions from domestic fuel use are typically trapped at ground level and do not disperse readily. As a result of this poor dispersion, people living in those areas are exposed to the full mass of what is emitted without any significant dilution.

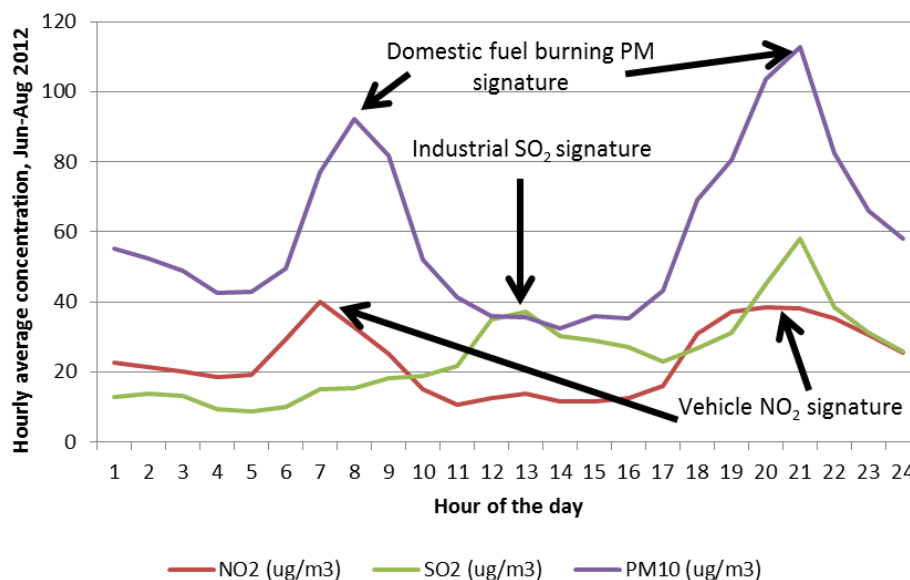
While emissions from sources such as Sasol and Natref are significant in terms of mass, the emissions are substantially diluted before they come to ground where they affect ambient or ground-level air quality. Under stable atmospheric conditions the emissions from industry are often prevented from coming to ground because inversion conditions provide a barrier to the pollution being mixed and transported downwards to ground level. These patterns are well illustrated in measured ambient air quality where average hourly concentrations exhibit the diurnal cycle (the pattern that unfolds during the day and the night) typically experienced in terms of concentrations of  $\text{SO}_2$ ,  $\text{NO}_2$  and  $\text{PM}_{10}$ . The measured diurnal pattern is a function of pronounced atmospheric stability, which is driven at both synoptic scale (continental anti-cyclone) and local scale (rapid cooling of the earth's surface leading to surface temperature inversions, where temperature increases rather than decreases with height).

The atmosphere is at its most unstable during the day and at its most stable during the night, especially in the early hours of the morning when the earth's surface is at its coolest. As the sun rises the surface starts to heat up and this has the effect of initiating turbulence in the atmosphere, which renders the atmosphere progressively more turbulent (unstable) as the day progresses. During the afternoon, heating from the sun starts to reduce; the surface starts to cool and with the cooling of the surface the atmosphere gets progressively more stable. The cooling continues throughout the night until the rising sun the following day again initiates surface warming and turbulence. An unstable atmosphere is one where mixing (diffusion and dispersion of pollutants through the atmosphere) occurs freely, whereas a stable atmosphere is one where mixing is strongly inhibited.

Measured concentrations of pollutants are shown in Figure 2 and can be seen to exhibit the following broad patterns as the day unfolds:

- SO<sub>2</sub> concentrations display a peak during mid-afternoon.
- PM<sub>10</sub> concentrations peak during the early morning and early evening.
- The peak NO<sub>2</sub> concentrations occur in the early morning and early evening.

These patterns are explained by the sources of the pollutants and more specifically whether they are emitted to atmosphere at some height above the ground or whether they are emitted at the surface. Under stable atmospheric conditions (with very little mixing) pollutants emitted at the surface will largely remain at the surface while pollutants emitted at height above the ground simply cannot come to ground. It is only when the atmosphere becomes unstable that pollutants emitted at ground level can start to diffuse and disperse away from the ground and when pollutants emitted at height above the ground are mixed towards ground level.



**Figure A2: Average hourly SO<sub>2</sub>, NO<sub>2</sub> and PM<sub>10</sub> concentrations at the Langverwacht monitoring station calculated over the period June – August 2012 (winter)**

This is why the PM<sub>10</sub> concentrations peak at night, because the primary source of the elevated PM<sub>10</sub> concentrations is from sources at ground level when there is very limited mixing in the atmosphere. In a similar vein this is also the reason why a SO<sub>2</sub> concentration peak is visible during the day, because the primary source of the elevated SO<sub>2</sub> concentrations at this time of the day are industrial emissions from tall stacks. The industrial emissions can only come to ground when the atmosphere is unstable and the emission plumes are brought to ground. In these terms it can be argued that the dominant contribution of measured ambient SO<sub>2</sub> derives from industrial emissions, whereas most measured PM<sub>10</sub> derives from emissions at ground level with a significant contribution from domestic fuel burning, and other sources.

Analysis of measured ambient air quality and how this changes over time, supplemented by dispersion modelling studies shows that emissions from domestic fuel use are anticipated to constitute a significant source. If the air quality to which people are exposed is to be managed to ensure that such people are not exposed to concentrations of pollution that would potentially threaten their health, then small reductions in domestic fuel use emissions would be expected to result in far more significant improvements in localised air quality than large scale reductions of industrial sources where these emissions occur well above ground level.

## **5. Concluding remarks**

Carefully designed and well implemented offsets may have significant potential to reduce personal exposure to air pollution. South Africa has a high prevalence of chronic obstructive pulmonary disease (COPD). COPD is “a disease state characterised by airflow limitation that is not fully reversible. The airflow limitation is usually both progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases”<sup>2</sup>. By definition reductions in personal exposure to such noxious particles and gases is key to reducing the risk of COPD. Offsets present an opportunity for affected communities to have quality of life improved by meaningful reductions in air pollution exposure and associated disease risk. It is to this end that Sasol is working with leading academics and others to investigate various interventions that could be implemented in residential areas that would serve to reduce atmospheric emissions at ground level.

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<sup>2</sup> Pauwels RA, Buist AS, Calverley PMA, Jenkins CR, Hurd SS, GOLD Scientific Committee. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease. NHLBI Global Initiative for Chronic Obstructive Lung Disease (GOLD) Workshop summary. *Am J Respir Crit Care Med* 2001;163:1256-1276.

## **Annexure 2: Details on the Quality of life and Air Quality baseline measurement Campaign**

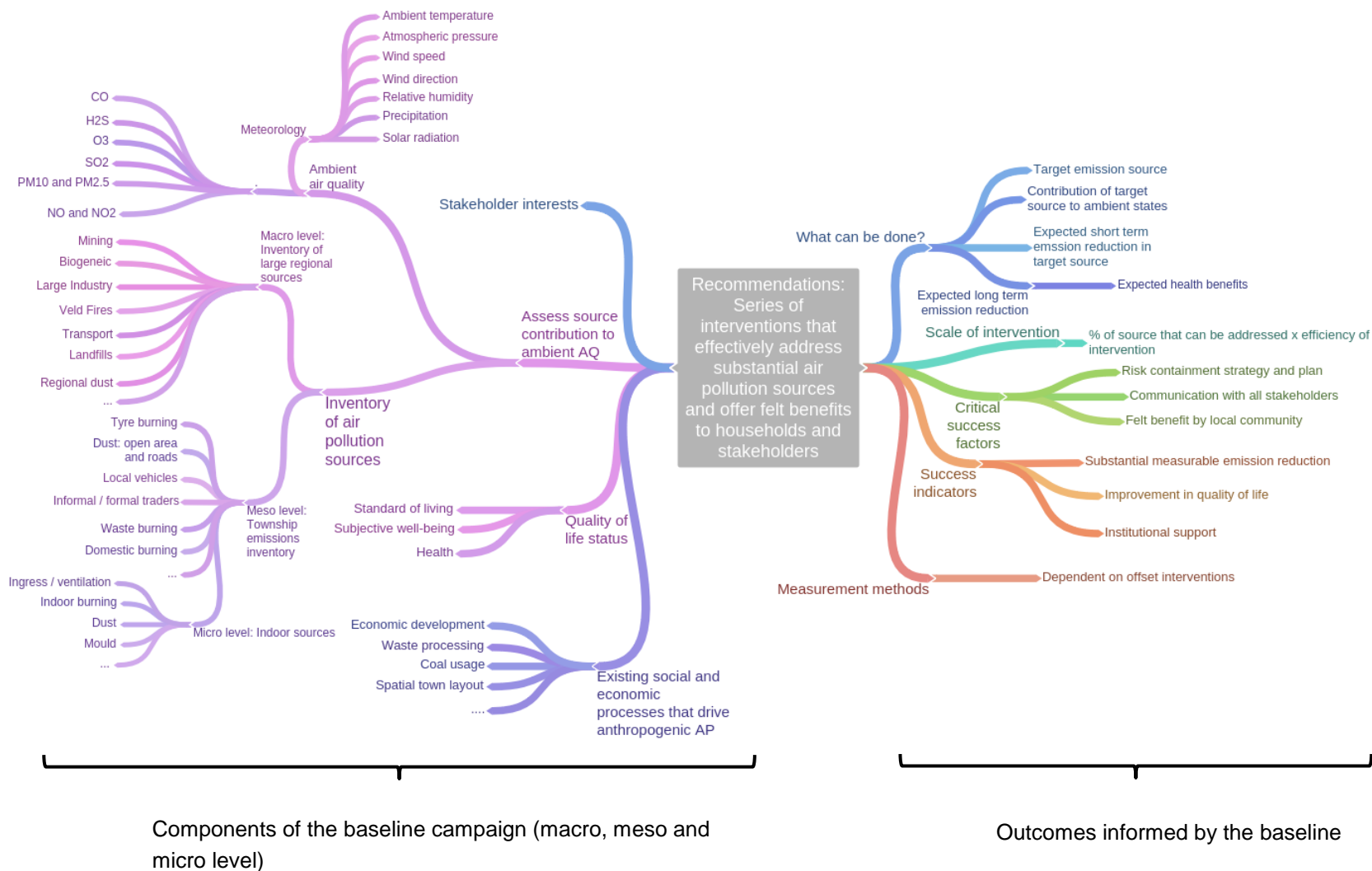


The baseline campaign is the pivotal starting point for the longer-term offset programme of activities, since it establishes the air quality and quality of life benchmark values for a range of parameters, against which the impact of all future offset interventions will be measured.

The campaign design is refined and enhanced based on learnings from the KwaDela study.

Figure C1 depicts a holistic overview of the baseline campaign for both the Sasolburg and Secunda areas. The holistic overview divides the indoor and ambient air quality activities between macro, meso and micro scale, and shows the corresponding components for the quality of life studies. The overall deliverables and what they aim to inform is also indicated to the right of the diagram.

The table below the figure provides more detailed information on the planned activities. The air quality measurement activities are described under the Activity categories: Chemical source apportionment, Ambient air quality measurements, and Indoor air quality measurements. This component of the baseline will therefore establish the concentration of various pollutants in ambient and indoor air, and will chemically analyse samples of ambient particulates to confirm the sources of these pollutants. The source apportionment will be critical to informing the key sources of community-based pollution to be targeted for offsetting over the longer term.



**Figure C1 – conceptual overview of quality of life and air quality baseline campaign**

The quality of life activities are described under the Activity categories General household survey, Community source survey, GIS land use assessment, Rapid *in situ* assessment, Household fuel consumption measurement, Coal merchant survey and Focus group interview. These surveys aim to better understand, at a detailed level, household quality of life and the extent to which that is affected through air pollution impacts. They will also seek to establish an air quality education baseline, and drivers behind household energy consumption and energy carrier choices.

Activity	Parameter measured	Description	#observations Embalenhle	#observations Zamdela	#observations Lebohang
<b>Chemical source apportionment</b>	PM10	28 8-hour samples per season (winter & summer) per location	56	56	0
	Background PM10	14 24 hour samples per season (winter & summer) per location	28	28	0
	Elemental Carbon / Organic Carbon	14 8 hour samples per season (winter & summer) per location	28	28	0
<b>Ambient air quality measurements</b>	SO2		12 months	12 months	0
	CO		12 months	12 months	0
	NO & NO2		12 months	12 months	0
	O3		12 months	12 months	0
	PM10 & PM2.5		12 months	12 months	0
	H2S		12 months	12 months	0
	Solar radiation	Continuous measurement, logged at 1 minute intervals for 12 months			
	Ambient temperature		12 months	12 months	0
	Relative humidity		12 months	12 months	0
	Wind speed				
	Wind direction				
	Precipitation				
	Atmospheric pressure		12 months	12 months	0

<b>Indoor air quality measurements</b>	PM4	Dustrak	7d each in 28hh	7d each in 28hh	0
	CO	High events	7d each in 28hh	7d each in 28hh	0

Activity	Parameter measured	Description	#obs Embalenhle	#obs Zamdela	#obs Lebohang
<b>General household survey</b>	Demographic variables		0	800-1000	200
	Subjective well-being		0	800-1000	0
	Services and standard of living	Structured interview with an adult household representative	0	800-1000	0
	Energy use		0	800-1000	200*
	experience and perceptions of air quality		0	800-1000	200*
	Experience and perceptions on safety and security		0	800-1000	0
<b>Community source survey</b>	Small emission sources like waster burning, informal food vendors, dust etc.	Systematic sample of public areas to log local sources of pollution	1	1	1
<b>GIS land use assessment</b>	Potential sources of wind-blown dust	Existing land use data and on-the-ground verification	1	1	0
<b>Rapid in situ assessment</b>	All visible pollution sources	Structured site visit to visually assess different air pollution sources	1 day, sunrise to sunset	1 day, sunrise to sunset	0
<b>Household fuel consumption measurement</b>	Household solid fuel consumption	fuel logs; container measurements; fire ignition times	20	20	0

<b>Coal merchant survey</b>	Coal origin, format weights and prices	Structured interview with coal merchants	1	1	1
<b>Focus group interview</b>	Experience and perceptions of air quality	Focus group interviews	0	0	4
<b>Focus energy use surveys</b>	Domestic energy use and emission from domestic sources	In-depth structured interview on a comprehensive range of energy applications and fuel use practises	200	200	200
<b>In-depth QOLA interviews</b>	Quality of life in the households including basic necessities , localisation, basic activities, relationships, consciousness and body structure	Three in-depth interviews per household adult representative including open ended and structured interviewing techniques	0	40-50	0
<b>Focus group interviews</b>	QoL perceptions and issues in the community	Four group interviews: two with men and two with women	0	4x(6-10)	0

## **Annexure 3: Management of Veld Fires**

## **1. Background**

This program proposes to prevent large veld fires and reduce their associated impacts on ambient air quality.

Fire fighting services in the area are provided by the Metsimaholo Local Municipality. This project will capacitate and equip the municipality to better respond to veld, shack, waste and tyre burning fires. This will be done through capacitating the fire fighters and fire fighting volunteers in an operating model that the Municipality is comfortable with.

## **2. Offset goal**

The theory behind the program relates to the fact that fewer emissions are emitted if there is less bio-mass to combust during veld fires. Additionally, the shorter the grass - the slower the fire spread and hence the easier it is to extinguish. Also, the quicker the fire is extinguished, the less emissions are emitted.

Furthermore, due to the prevalent illegal dumping in the community, waste dumped in these areas tends to be burnt along with veld as well as for aesthetic reasons. Through this project, such waste burning associated with veld fires will be quickly extinguished.

Based on these principles, the goal is to reduce emissions during the winter veld fires by ensuring that the grass is short and that there is quick response to a fire in the event that a fire does occur.

## **3. Project Overview**

Due to large tracts of open grass lands exposed to sub-zero temperatures, the Free State is known for problematic run-away veld fires during the dry season. Large hectares of dry grass is a catalyst for anthropogenic as well as natural veld fires to spread quickly, resulting in large amounts of particulates and other combustion related emissions being emitted into the atmosphere.

After good rainy seasons, the grass is normally long, resulting in large amounts of organic matter being available for combustion, increasing the amounts of pollutants emitted into the atmosphere. Not only does it result in elevated emissions, fuelled by high wind speeds, a tall grass veld fire can spread easily and become uncontrollable, resulting in property damage and even potentially the loss of human and animal life.

Therefore, the veld fire management offset program aims to reduce the emissions and hence the impact of veld fires within the Sasolburg area. The aim of the project is to empower the municipality to cut the grass soon after the first frost and to remove the grass from the cut areas. A short grass fire is not only easier to control but also results in far less emissions than a tall grass fire. Therefore, by cutting the grass, the amount of emissions, in the event of a veld fire, will be less than what it would have been, had the grass remained tall.

In addition to cutting the grass, the municipal fire fighters will be provided with the necessary support vehicles/equipment. The Fire fighters will then respond, as the first response, to a veld fire and use the sponsored equipment to put the fire(s) out.

With the fire fighters providing a quick response to the veld fires and domestic waste burning, it will prevent the spread of the fire and hence will further reduce the emissions associated with veld and domestic waste fires.

## 4. Project Objectives

For the program to achieve its objective of a decrease in the amount of emissions associated with veld fires, three measurable parameters are required:

- The total hectares of grass cut. The purpose of this metric is to indicate the potential in emissions to be reduced. Typical emission factors associated with dry grass land burning can then be used to indicate the potential emissions in the event the cut area burnt vs. the actual emissions should that area be affected by a veld fire.
- The number of veld fires and domestic fires extinguished by the Fire Fighters. The purpose of this is to demonstrate the effectiveness of the program as well as to indicate the number of veld fires that were prevented from spreading.
- In the event of veld fires being extinguished, the area burnt vs. the area unburnt/saved, if quantifiable. The purpose of this is to again use emission factors and calculate the associated emissions actually emitted vs. the potential emissions; and hence the saving of amount of PM10 and SO2 into the atmosphere. Should the area or potential area be too large, pictures and photos can be used for a more qualitative measure.

## 5. Project Scope and Milestones

### Grass cutting

The principle behind this project is to enable the Municipality to expand their current grass cutting abilities. This can be done through Sasol and Natref providing equipment to cut, rake and bale the grass. Subsequently, an opportunity for an entrepreneur could be developed to bail and sell the grass. To implement the project, a tractor, a slasher, a rake and a bale machine might be purchased, depending on the requirements and needs to execute the tasks.

Through this activity the Municipality will also be enabled to fulfil its commitment in terms of the VTAPA, to manage veld fires.

### The Fit for purpose trailer for Fire Fighters

Fully equipped fire fighting unit(s) will be purchased dependent on the requirements and needs based on the operating model agreed with the Metsimaholo Fire Chief.

### Fire fighting training

Major Milestone
Needs analysis for effective grass cutting - Completed
Obtain tractor and grass cutting equipment/ Complete contract with service provider – in progress
Grass cutting for dry season – first cut will be done in November 2016
Fit for Purpose trailers recommended
Fire extinguishing
Grass cutting area survey report
Number of fires extinguished report



## **6. Project Success Metrics**

In order to measure the success of this program meeting its objective of reduced emissions associated with veld fires, the following parameters will be monitored:

### **Total hectares of grass cut**

The responsibility for reporting lies with the municipality cutting the grass. The total hectares cut for the week/month must be provided to the Project Manager on a monthly basis, who will then do calculations to quantify the emissions avoided.

### **The number of veld and domestic fires extinguished**

The responsibility for reporting will lie with the municipality. A consolidated report indicating the number of fires extinguished must be supplied to the Project Manager on a monthly basis, who will be responsible for calculating emissions avoided on the basis of burnt area vs. the unburnt area.

### **Area burnt vs. area unburnt**

Similar to the number of veld and domestic fires extinguished, as part of the municipal report this information must be supplied on a monthly basis to the Project Manager for inclusion into the actual emissions emitted vs. the avoided emissions, if quantifiable.

## **7. Partners**

The project's success is dependent on the following partnerships:

- Metsimaholo Local Municipality: Conduct grass cutting activities and Fire fighting. They will also conduct educational training on preventative measures.
- Fezile Dabi District Municipality Air Quality Officer: To be kept abreast of the progress of the project.
- The entrepreneur for hay bailing.

## **Annexure 4: Vehicle Emission Testing**

## **1. Background to Program**

Vehicle emissions contribute to ambient air pollution, particularly in urban areas with high vehicle traffic. This is recognised in the Vaal Triangle Airshed Priority Area air quality management plan as a focus area, as published within the plan. The Fezile Dabi Municipal Health By-Law also makes mention of the requirement for vehicles to be tested to address vehicle emissions within the District.

This program focus on enabling the Metsimaholo Municipality to obtain equipment, be trained and execute vehicle emission testing both at a stationary location as well as from a mobile point of view. The idea is that Natref will conduct vehicle emission testing on their own and transfer the lessons learned to the Municipality. Sasol will appoint a Service provide that will train and supply equipment to the Municipality who can then conduct the measurements on an on-going basis. As part of the training, Sasol will request its hauling vehicles to go through the vehicle testing centre to confirm that the vehicles comply with specifications.

## **2. Offset Goal**

The goal of the vehicle emission testing program will be to reduce vehicle emissions, specifically PM<sub>10</sub> emissions, from targeted vehicles by encouraging vehicle owners to properly maintain their vehicles. This will be done through measuring the exhaust emissions with a specialised emission testing device.

In the event that a vehicle fails the emission test, a repair notice could be handed to the vehicle owner. The number of repair notices issued will then serve as a baseline to the extent to which vehicle emissions are elevated.

Owners who receive repair notices, will be requested to commit to a date by which the vehicle will be serviced and re-measured. This will then ensure that especially heavy vehicles are properly maintained to maintain emissions from these vehicles to a reasonable minimum.

Sasol and Natref will work in conjunction with the municipality in order to establish this service, with the aim of rolling it out as a service across the Sasolburg Region.

## **3. Project overview**

PM<sub>10</sub>, SO<sub>2</sub> and NO<sub>x</sub> emissions emanate from vehicles, more so from heavy vehicles used for hauling purposes. Poorly maintained vehicles not only emit more emissions but cost more to operate due to inefficient combustion and hence higher fuel costs.

Vehicle emission testing is a proven way to determine whether vehicles are properly maintained. Certain municipalities have testing facilities, however this is currently lacking in the Fezile Dabi District Municipality. The aim therefore will be to implement a testing facility for vehicles entering the Natref and Sasol One sites to ensure optimum performance and minimum emissions.

Natref will predominantly focus its surveys at its gantry area to conduct surveys on vehicles prior to them leaving the site.

From its side, Sasolburg Operations will also focus its efforts on establishing the service within the Municipality with the assistance of a service provider. Heavy vehicles entering Sasol sites will be requested to undergo regular testing. This testing will then be used as part of training for the Municipality representatives, prior to going out into the field and test community vehicles.

In the event a vehicle fails the test, it will be required to go for maintenance and then undergo a re-testing within a specified period. Given the mandate and power included within the Municipal By-law, the Municipality can issue notices to vehicles not complying with the requirements.

By regular testing from the Municipality's side, it is foreseen that the number of poorly maintained vehicles within the Sasolburg Region will reduce through which ambient air quality improvements can be met.

#### 4. Project Objectives

The objective of the program is to implement a vehicle emissions testing programme for PM<sub>10</sub> emissions, in order to drive vehicle maintenance efforts toward reducing vehicle PM<sub>10</sub> emissions.

A secondary objective is to use the learnings of this programme as a pilot, to inform a potential larger-scale rollout within the District, by the District Municipality with the support of Metsimaholo local municipality based on their lessons learned.

#### 5. Project Scope and Milestones

The project targets PM<sub>10</sub> emissions of vehicles entering the Natref site by informing proper vehicle maintenance on the basis of exhaust gas emission measurements.

The main objective is to use a Service Provider to implement vehicle emission testing within the Local Municipality and to build on the lessons learned from Natref's measurements as to enable the Municipality to conduct regular vehicle emission testing within the Sasolburg Region.

Progress throughout the project roll out will be provided to stakeholders at an appropriate forum potentially the multi stakeholder forum. Lessons learnt as well as the proposed expansion process will be documented and handed over to Fezile Dabi authorities in order for them to consider scaling it up for implementation within the broader district.

Major Milestone
Agree with the Municipality that the services are rendered – completed
Purchase and obtain the monitoring instrumentation – in progress
Establish procedures for monitoring
Train relevant personnel to conduct the measurements

## **6. Project Success Metrics**

The success of the project will be measured on the following metrics:

- Number of vehicles tested
- Number of vehicles failing the emission measurement test
- Number of failed vehicles undertaking maintenance and passing when re-tested after a certain period

## **7. Partners**

For the project study partnering will be between Sasol Oil Truck Stop, Natref, Sasolburg Operations and the municipality.

## **Annexure 5: Metsimaholo Waste Recycling**

## 1. Background to Programme

This programme focuses on the collection and removal of recyclable waste from Zamdela, with the aim of reducing harmful and visible emissions (including particulate matter) resulting from waste burning by removing the waste source, including tyres.

## 2. Offset goal

The goal of this project is to facilitate higher rates of recycling of recyclable waste, to prevent recyclable waste from being burnt and the consequent release of harmful emissions. This will in turn have a positive impact on the ambient air quality in the Zamdela area.

## 3. Project Objectives

To design and implement an effective community based waste recycling model for Metsimaholo to reduce domestic waste burning by:

- Changing the attitudes and behaviours of community members from burning waste to recycling through educational and awareness programmes.
- Reducing the amount of recyclable waste burnt by partnering with the Fezile Dabi District Municipality Waste Management group, community members and waste pickers to establish a hub and spoke buy-back centre/satellite collection points which will enable the effective removal and selling of recyclable waste.
- Establishing the waste to value principle in the community by incentivising community members to recycle.

## 4. Project Scope and Milestones

An integrated community waste recycling value chain will be created in order to educate community members regarding the negative environmental and health impacts that reduce their quality of life when waste is burnt. Community members will be encouraged to take ownership of their own immediate environment by responsibly managing their recyclable household waste.

Recycling collection points (7, with one already in existence) will be established together with a buy-back centre and existing structures will be used for the collection and recycling to the satellite hubs. From there the buy-back centre will collect the waste to be sold off. This program together with the non-recyclable project goes hand in hand with an education drive to educate the community on sorting at source and effective disposal of waste together with the dangers associated with burning/uncontrolled combustion of waste.

Major Milestone
Formalise a partnership with stakeholders – completed
Establish a Metsimaholo Recyclable Waste Removal practice – in progress
Detail scoping and costing
On boarding of stakeholders
MOU's signed
Community awareness and education
Launch project
Monitoring and Evaluation

## **5. Project Success Metrics**

The project impact will be measured as follows:

- Volume of recyclable waste removed within the targeted area in Zamdela
- The volumes could further be broken down to plastics, paper, glass etc.

## **6. Partners**

For the success of this project, a cooperative and collaborative partnership between all key stakeholders is required.

The proposed role of each partner is outlined below:

### **Programme Partners**

- Department of Environmental Affairs - Support through awareness campaigns.
- Fezile Dabi District Municipality - Support through its Waste Department and initiatives with current recyclable waste collectors.
- Department of Education - Permission and support ( all programs at schools need to be approved by DOE
- Schools – Partners.
- Waste collectors – feet on the ground collecting and taking the waste to a central location as well as to run the buy-back centre



## **Annexure 6: Effective Management of Household Waste**

## 1. Background to Program

This program specifically looks at the collection and removal of non-recyclable waste with the aim of reducing potentially harmful emissions from waste burning, by reducing waste volumes available for burning.

## 2. Offset goal

If household wastes and non-routine household wastes are removed effectively and on a continual basis, the extent of waste burning associated with household wastes should accordingly be reduced. This will in turn have a positive impact on the ambient air quality in the Zamdela area. This will also prevent the build-up and possible illegal dumping of waste which eventually is set alight.

## 3. Project Objectives

The objective of this programme is to reduce harmful emissions related to the burning of household waste, which was identified as a problematic source of pollution during recent discussions with the District Authorities. The means by which this is proposed to be achieved is through improved management of non-recyclable household wastes in Zamdela.

## 4. Project Scope and Milestones

Agreeing on an activity with both the Municipality and the community is vital, due to recent past attempts in waste removal that proved not to be sustainable. Based on prior experience in similar past initiatives, Sasol and Natref believe the best model for success lies in the solution being co-created between the community, the Municipality and Sasol. Currently, Sasol's and Natref's view is that such a programme could contain the following elements, for example:

- An educational and awareness campaign stressing the importance of waste separation and proper disposal;
- Establishing a waste removal service in partnership with the municipality in unserved areas – this pilot rollout commenced during November 2016 to prove the concept and the acceptability by the community;
- Where there is current illegal dumping taking place, these areas will be cleaned and rehabilitated for alternative uses, in many cases for the proper waste collection and removal of waste in that area;
- Having regular clean-up campaigns with community participation where building rubble etc. can be removed.

Major Milestone
Brainstorming with the Municipality and stakeholders on possible ideas to be implemented – Completed but still on-going
Buy-in from community leaders with support from communities
Develop education and awareness campaigns
Establish the service that will collect the waste from the households
Assist the Municipality with waste management principles/practices, service delivery with the aim of removing waste that could be burnt
Embed the culture of clean environment and service

## 5. Project Success Metrics

Since the project is aiming at reducing waste burning by removing the source, two measures will be used as success:

- Amount of waste removed from the residences in tonnages – this is potential waste fuel removed.
- In conjunction with the veld fire management project, the number of waste related fires that have been extinguished.
- In addition, a qualitative door to door survey could be conducted after 6-12 months to gauge the impact on residents. This will indicate the success of residents' perception that waste burning has reduced and waste removal has improved their quality of life. This will go hand in hand with the quality of life survey conducted by the NOVA Institute as part of the bigger baseline campaigns.

## 6. Partners

For the success of this project, a cooperative and collaborative partnership between all key stakeholders is required.

The proposed role of each partner is outlined below:

Partner	Role to be played
Sasolburg Operations & Natref	Support to the implementation of the project and providing guidance/consultation to the Municipality on preventing waste associated fires
Metsimaholo Municipality	Delivering the waste removal services
Fezile Dabi District Municipality	Assist with the implementation of the service and the education campaign
Community/church/school leaders	Support and encourage community buy-in as well as setting the example for the implementation
Schools and Boitjhorisong Resource Centre	Assist with the education portion
Community	Implementation and execution