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Environmental Engineers (Pty) Ltd

ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT PROGRAMME REPORT FOR THE PROPOSED USE OF SECONDARY (WASTE) MATERIALS AS ALTERNATIVE FUELS AND RAW MATERIALS (AFRS) AT LAFARGE'S CEMENT PLANT IN LICHTENBURG

Prepared For

Lafarge Industries South Africa (Pty) Limited

METAGO PROJECT NUMBER: L017-01

DMR REFERENCE NUMBER: RDNW (KL) 6/2/2/101

DEDECT REFERENCE NUMBER: NWP/WM/NM3/2011/06

REPORT NO. 3

August 2011

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ACCRONYMS AND ABBREVIATIONS

Below, a list of acronyms and abbreviations used in this report.

AFRs	Alternative fuel and raw materials/resources
APCO	Air Pollution Control Officer
APP	Airshed Planning Professionals
BID	Background Information Document
DA	Department of Agriculture
DACERD	Department of Agriculture, Conservation, Environment and Rural Development
DEAT	National Department of Environmental Affairs and Tourism
DLA	Department of Land Affairs
DLM	Ditsobotla Local Municipality
DMR	Department of Mineral Resources
DoH	Department of Health
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EES	Environmental and Energy Services
EIA	Environmental impact assessment
EMP	Environmental management programme or plan
GDP	Gross Domestic Product
ha	Hectare
IAP	Interested and/or affected party
km^2	Square kilometres
m^3	Cubic metres
mamsl	Metres above mean sea level
mbgl	Metres below ground level
mm	Millimetres
NEM:AQA	National Environmental Management: Air Quality Act, 59 of 2008
NEM:WA	National Environmental Management: Waste Act, 39 of 2004
NEMA	National Environmental Management Act, 107 of 1998
NGO	Non-government organisation
NMMDM	Ngaka Modiri Molema District Municipality
^oC	Degrees Celsius
SACNSP	South African Council for Natural Scientific Professions

EXECUTIVE SUMMARY

Introduction

Lafarge Industries South Africa (Pty) Ltd (Lafarge), an existing cement manufacturer, operates a cement manufacturing plant and two quarries in the North West Province. Due to the plant's connection to the quarry via a railway line, the plant is also considered to be part of a mine. The cement manufacturing plant, located approximately 4km north east of Lichtenburg within the Ditsobotla Local Municipality and Ngaka Modiri Molema District Municipality, is the subject of this report.

In broad terms, Lafarge proposes to re-use waste materials as alternative fuels and raw materials/resources (AFRs) in the cement kilns at the Lichtenburg cement plant. The proposed project will comprise a change in the kiln fuel used at the plant from coal to a combination of coal and AFRs, substitution of raw materials, areas for storing hazardous and non-hazardous AFR materials to be use, and an input point(s) for delivering the material to the kilns. The AFR project is referred to in this report as "the project".

Metago Environmental Engineers (Pty) Ltd (Metago) is the independent firm of consultants that has been appointed by the applicant company to undertake the environmental assessment and related processes.

This document is a **summary** of the EIA/EMP report.

Legal framework

Given that the project incorporates several listed environmental activities this report has been compiled in terms of the National Environmental Management Act, 107 of 1998 (NEMA) and the regulations there under (Regulation 385 of 21/04/2006) as regulated by the Department of Economic Development, Environment and Tourism (DEDECT). In addition, given that the project will be located on a mine, this report will be an amendment to the mine's approved EMP report and has therefore also been compiled in accordance with the requirements of the Mineral and Petroleum Resources Development Act, 28 of 2002 (MPRDA) and the regulations there under (Regulation 527 of 23/04/2004) as regulated by the Department of Mineral Resources (DMR).

It should also be noted, that although the application for environmental authorisation was submitted prior to the enforcement of the National Environmental Management: Waste Act (NEM:WA), 59 of 2008, and therefore separate application for waste-related activities was not required, the principles and requirements of the Waste Act were taken into consideration in the compilation of this report.

Project overview

The main aim of the project is to use Kilns 2, 3 and 4 to co-process alternative fuels and raw materials (AFRs) and through this recover both energy and raw materials to be used in the manufacturing of clinker.

Implementation of the project requires minor changes to existing infrastructure on site. These changes include:

- additional storage facilities (covering an estimated area of 64m^2); and
- feed lines for delivery of AFRs to the kilns (pipelines, conveyors/elevators/cranes).

The preparation of AFR materials will take place mainly off site at Lafarge's approved waste management facility, located in Kaalfontein, near Kempton Park in Gauteng Province. The materials will leave the Kaalfontein facility and arrive at the Lichtenburg plant as follows:

- tyres (shredded and whole);
- other solid waste (including solid shredded wastes (SSW)); and
- hydrocarbon wastes.

The AFR programme being proposed is outlined below.

Waste stream	**Timeline**	**Replacement ratio**
Whole and shredded tyres	Year 1	Ramp up after test trials – average of 10%
Hydrocarbon wastes		Ramp up after test trials – from 7%
Whole and shredded tyres	Year 2 onwards*	Average of 20%
Hydrocarbon wastes		From 7% ramping up to 50% over the next 5 years
Other solid waste (including solid shredded waste)		From 5% (in 2014) ramping up to 25%

** Only if test trials provide satisfactory results.*

Key activities that will take place during the operational phase of the project are outlined below.

Activity	**Inputs/Outputs**	**Potential environmental issues**
<u>Transportation of AFRs to site</u> AFR materials will be transported to site using existing rail infrastructure and road transport. No new facilities are needed for the project. As no additional employment opportunities will be created by the project, there will be no increase in the number of workers travelling to and from site.	Liquid AFRs Solid AFRs Rail wagons Tankers	Exhaust emissions (negligible)

Activity	**Inputs/Outputs**	**Potential environmental issues**
Quality control The main quality control will take place at Lafarge's Kaalfontein facility. Liquid wastes will be transported in sealed containers. If the seals are broken, the material will not be accepted at the plant gate. Solid wastes will be baled (where applicable) prior to transport. If the bales look like they've been tampered with, the material will not be accepted at the gate. Waste transported directly to the plant will undergo the same quality control procedures as those at the Kaalfontein site, prior to being accepted.	Liquid AFRs Solid AFRs Rail wagons Tankers	-
Handling of AFR materials on site AFR materials will require handling once on site to storage facilities and then from the storage facilities to the kilns. In broad terms, the AFR materials will comprise both liquid and solid AFRs. The feed line and input point to the kilns will depend on the type of material used.	Liquid AFRs Solid AFRs Equipment	Pollution of groundwater through uncontrolled spills Pollution from litter
Temporary storage of AFRs on site AFR materials will be temporarily stored on site, within the boundaries of the existing plant, prior to being co-processed in the kilns. Storage facilities have been located to maximise efficiency of existing infrastructure	Stockpile pads/bunkers Sealed tanks Liquid AFRs Solid AFRs	Pollution of groundwater resources through uncontrolled spills Pollution from litter
Co-processing of AFRs in the kilns AF materials will replace a portion of coal used in the kilns and therefore be mainly used for energy recovery. The small amounts of raw materials recovered in the process are negligible. Prior to feeding the materials into the kilns, materials will be weighed and dosed to ensure the correct amount and content of material is fed to the kilns. Under normal operating conditions a cement kiln produces no ash. In turn the proposed project will not produce any ash. The reason is due to certain conditions obtained in the kilns (extremely high temperatures, long residence time and higher oxygen levels), the waste materials combust with any solid residue forming part of the clinker. Organic components are destroyed and inorganic components are bound up in the structure of the clinker.	Liquid AFRs Solid AFRs Equipment Kilns (high temperature) Dust (recycled) Emissions	Air pollution (change to emissions and potential public health and environmental effects) (normal and upset conditions)
Emission control Air cleaning equipment at the plant will continue to be used for the project. The kilns are equipped with baghouse, electrostatic precipitators and gravel bed filters. Cleaned gas is emitted to atmosphere via stacks.	Dust (recycled) Cleaned emissions (emitted to atmosphere)	Air pollution (change to emissions and potential public health and environmental effects) (normal and upset conditions)
Other waste management – handling, temporary storage No additional waste will be generated by the project.	-	-
Power use Negligible amounts of additional power will be needed to operate additional equipment on site. Existing facilities and supply mechanisms will continue to be used.	Eskom power using existing facilities	-

In terms of other support services and facilities, the following is applicable:

- no additional water is needed for the operational phase;
- no additional facilities such as workshops, stores are needed for the project;
- as the project will not increase the operational workforce on site, no additional sanitation or sewage treatment facilities are needed; and
- no additional employment opportunities will be created by the project and therefore no additional housing is needed.

Summary of environmental impacts

Potential environmental impacts were identified by Metago in consultation with IAPs, regulatory authorities, specialist consultants and Lafarge. The range of environmental issues considered in the EIA was given specific context and focus through consultation with authorities and IAPs. Issues raised pertain to: procedural issues; air emission license; technical project-specific questions; soil pollution; noise disturbance; natural vegetation and impacts on surrounding agricultural land uses; road use and related impacts; air pollution and associated health risks; ongoing communication between Lafarge and the surrounding communities; water-related issues including pollution; and socio-economic issues (employment/recruitment, procurement opportunities, benefits to local communities).

All identified impacts are considered in a cumulative manner such that the impacts of the current activities on and surrounding the site and those potentially associated with the project are discussed and assessed together. A summary of the potential impacts in the unmanaged and managed scenarios (as per Section 7 of the EIA/EMP amendment report), is provided in Table 1 below.

TABLE 1: TABULATED SUMMARY OF POTENTIAL IMPACTS

Potential impact	**Significance of the impact (the ratings are negative unless otherwise specified)**							
	Construction		**Operation**		**Decommissioning**		**Closure**	
	Unman.	**Man.**	**Unman.**	**Man.**	**Unman.**	**Man.**	**Unman.**	**Man.**
Contamination of groundwater	Low	Low	Low	Low	Low	Low	Low	Low
Negative change in air emissions	Not applicable		High	Medium to low	Not applicable		Not applicable	
Noise pollution	Low	Low	Low	Low	Low	Low	Not applicable	
Negative visual impact	Low	Low	Low	Low	Low	Low	Not applicable	
Safety hazards	Not applicable		High	Low	High	Low	Not applicable	

Geology

The proposed project does not involve the exploitation or sterilisation of mineral resources therefore no impacts on geology are expected.

Topography

The topography of the area has been changed by current plant activities. The proposed project will add and/or modify infrastructure within the fenced off plant boundary. Potential impacts relating to the topography include alteration of drainage patterns and visual aspects. These issues are discussed further below. No other impacts on the topography are expected.

Soils and land capability

Topsoil is generally a resource of high value containing a gene bank of seeds of indigenous species. A loss of topsoil (through sterilisation, erosion or contamination) would generally result in a decrease in the rehabilitation and future land use potential of any land that is disturbed by the project. Directly linked to this is the capability of the soil to be used for grazing, arable, wilderness or wetland potential. Project-related infrastructure will be positioned within the boundaries of the existing plant and within areas where natural soil resources have already been disturbed. As a result no further disturbance of additional soil resources are expected and therefore no additional impacts on either soil resources or land capabilities on site are expected as a result of the project.

Biodiversity - natural vegetation and animal life

Impacts on the natural vegetation and associated animal life generally relate to the physical disturbance of these resources and the knock-on effects this has for the ecological system in general. Given the lack of natural vegetation and limited animal life on site, which has already been extensively disturbed by the presence of the existing cement plant, no further impacts are expected on site. Of more significance, however, is the potential for impacts on the natural vegetation and animal life found at the Lichtenburg biodiversity conservation centre as a result of potential changes in air emissions. This issue is discussed further under air quality.

Water Resources

Issues around water resources concern changes to on-site and downstream drainage patterns, contamination of surface and groundwater systems and reduction in groundwater availability through abstraction and/or pollution. These are discussed further below.

With regards to the **drainage patterns**, the natural drainage of the area has been changed by current plant activities and the presence of storm water control measures to manage dirty runoff from the site. With project-related activities taking place within the bounds of existing storm water controls and on existing paved plant areas, as well as planned with containment areas to prevent spillages, no impacts on

drainage patterns or nearby surface water systems are expected as a result of the project. When considered cumulatively with existing operations on site, the relatively small scale of project specific activities together with existing management measures on site limit the potential for any significant cumulative on-site impacts.

With regards to **reducing groundwater levels and availability**, although Lafarge sources its water from abstraction boreholes located upstream of the cement plant, no additional water supply is required as part of the proposed project. As a result, no impacts on groundwater resources due to abstraction activities are expected.

With regards to **pollution of groundwater resources**, groundwater systems have the potential to become polluted through the incorrect storage and handling of materials on site. As a base case, even in the unmanaged scenario, in all project phases, material handling and storage will take place within the paved plant area, on concrete based surfaces. During construction and decommissioning existing managed facilities will be used as far as possible. In addition the liquid AFR facilities for the operational phase have been planned in such a manner that any spillages will be contained. At closure, impacts will only be experienced if polluting sources are not managed correctly during the operational phase and removed from site during decommissioning. With the implementation of the measures outlined in the EIA/EMP report, the significance of potential impacts is low.

Air quality

In the unmanaged scenario the use of AFRs has the potential to pollute the air and cause related health impacts. The main source of pollution is via the stacks. The constituents of concern in the use of AFRs are chlorides (as potential chlorine supply for dioxin formation) and heavy metals. The specialist investigation included the prediction of the ground-level concentration of inhalable particulates, nitrogen oxides, sulphur dioxide, organic compounds, dioxins and furans and trace metals.

Air quality impacts have been assessed based on compliance with ambient air quality guidelines. The comparison of predicted pollutant concentrations to ambient air quality guidelines and standards facilitates a preliminary screening of the potential, which exists for human health impacts.

The air specialist made use of a theoretical model to conservatively predict air quality impacts during the operational phase of the project as this is the period during which AFRs would be used. In the unmanaged scenario, the model predicted that that the contribution of Lafarge's operations (including the AFRs) to ambient air concentrations have the potential to exceed South African standards and that potential impacts may extend beyond the project boundaries impacting on the nearest potentially sensitive receptor sites.

When considered cumulatively, the significance of potential off-site impacts is rated as high, given the presence of potential receptor sites (mainly a small area of the Lafarge village) within the zone of influence. With the management measures outlined in the EIA/EMP report, the significance reduces to medium to low.

Noise

Activities associated with the project during the construction, operation and decommissioning phases have the potential to generate noise and cause related pollution. The more significant noise-related impacts are expected to occur during the construction and decommissioning phases with the establishment and dismantling of project-specific facilities on site. All activities will however take place within the plant boundary and within an area zoned for industrial use. During the operational phase, the noise emissions from project-related activities will be similar to those already taking place on site.

Noise pollution will have different impacts on different receptors because some are very sensitive to noise and others are not. In this regard, although there are residential receptors adjacent to the plant (that is, Lafarge employees living at the recreational club, hostel and staff housing), these are not expected to be sensitive to noise generated by the project. It should be noted that no major construction or decommissioning activities are needed for the project. Given the plant's location within an industrial zoned area, the nearest potential sensitive receptors (people living on small holdings and farms and people visiting the Lichtenburg biodiversity conservation centre) are located over 2km from the site. In all relevant phases of the project, the increase in noise emissions due to project activities is not expected to be disturbing (result in complaints) off site when considered cumulatively with existing on-site activities. In both the unmanaged and managed scenario, the significance of this potential impact is low/insignificant.

Archaeology

Due to the positioning of project-related infrastructure within the boundaries of the existing plant, no heritage or paleontological resources occur on the project sites. No impacts are therefore expected.

Visual

The existing plant has resulted in a negative visual impact through the presence of infrastructure as well as dust plumes and stack emissions (during upset conditions) associated with the plant's activities. This is partially mitigated by the plant's location within an industrial zoned area. Project-related activities and facilities will be placed within the plant boundary and adjacent to existing facilities.

The visual impact is determined by assessing the change to the existing visual landscape. In both the unmanaged and managed scenario, the construction, operation and decommissioning of the additional storage facilities and AFR feed lines will add to the negative visual impact on site however this change is unlikely to be noticeable given the presence of existing facilities and activities. Even the use of lights at

night specific for the AFR areas will not add to the existing light pollution from the site. In the unmanaged scenario, the significance of this potential impact is low in all project-related phases. In the managed scenario, the potential impact would be insignificant in all project-related phases.

Socio-economic

When considering **positive and negative socio-economic impacts**, given the main scope of the project (re-use of waste materials as fuel and raw material resources in the kiln) and the formal structures needed to source quality-dependent AFR materials, no significant positive or negative impacts on the socio-economic environment are expected.

When considering **land uses on the site and in the surrounding area**, the land use on the project site has been impacted on by the current plant activities and no further on-site impacts are expected, this discussion focuses on potential impacts on land uses surrounding the project site. The most significant of which are residential areas, farming activities and the Lichtenburg biodiversity conservation centre to the north of the plant. The proposed changes to the cement making process have the potential to negatively impact land uses through pollution of groundwater systems (used for domestic and irrigation purposes), noise pollution and a negative change in air emissions as a result of co-processing alternative fuels and raw materials. These issues have been addressed in the respective sections above.

When considering the **disturbance of roads by project-related traffic**, raw materials, final products and staff are currently transported to and from site via road and/or rail. During construction and decommissioning, transport of materials will be via road. The construction phase will contribute about two construction-related trucks on public roads over the total three to six-month construction period. Similarly, during the decommissioning phase, minimal additional trucks will be required to remove project-specific infrastructure/waste from site. Potential cumulative impacts during these two phases are therefore expected to be negligible. As the proposed project will not result in additional employment, increased traffic due to staff-related transport is not applicable.

The planned method of transport for the operational phase of the project is mainly via rail. The use of rail transport during the operational phase ensures that project-related disturbance of public roads and related impacts on road-users are kept to a minimum. Should rail facilities not be available, road transport will be used. However, this is expected to be ad hoc and for short periods of time.

When considering safety hazards, the storage and handling of AFR materials (waste) has the potential to result in safety hazards for third parties during the operational and decommissioning phases of the project. Given the location of the AFR project sites within the boundaries of the fenced plant, this section focuses on the potential risks to visitors entering the plant. This assessment does not consider employees as this is covered by the relevant occupational health and safety legislation.

The incorrect storage and handling of AFRs on site could present a potential risk of injury and/or death to third parties visiting the plant. This injury or death could result from unexpected fires and/or explosions. In the unmanaged scenario, the significance of this potential impact is high. With the management measures outlined in the EIA/EMP report, the significance reduces to low.

Interested and affected parties

During the consultation process, many stakeholders raised concerns regarding Lafarge's ongoing communication with communities surrounding the cement plant. In this regard, as part of the public feedback process on this EIA/EMP process, an open day has been planned to assist Lafarge in meeting its stakeholder communication commitments.

In addition to this, Lafarge will set up a structured communication process with neighbouring communities and other key stakeholders in line with best practice; arrange and facilitate regular communication with its stakeholders through newsletters and information-sharing meetings; and keep a record of all meetings for auditing purposes.

Conclusion

Provided that all the objectives, actions and procedures included in the EIA/EMP report are implemented, Metago is of the view that there is no environmental reason why this project and the associated activities should not be approved. Key to this is compliance with the National Policy for the Thermal Treatment of General and Hazardous Waste (Government Notice 777, DEA 2009), careful planning on the sourcing and blending of AFRs that meet the required specifications, responsible implementation of the project by Lafarge and monitoring to confirm predicted impacts and where necessary, provide input on additional management measures if required.

ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT PROGRAMME REPORT FOR THE PROPOSED USE OF SECONDARY (WASTE) MATERIALS AS ALTERNATIVE FUELS AND RAW MATERIALS (AFRS) AT LAFARGE'S CEMENT PLANT IN LICHTENBURG

1 INTRODUCTION

1.1 INTRODUCTION TO THE PROPOSED PROJECT

Lafarge Industries South Africa (Pty) Ltd (Lafarge), an existing cement manufacturer, operates a cement manufacturing plant and two quarries in the North West Province. Due to the plant's connection to the quarry via a railway line, the plant is also considered to be part of a mine. The cement manufacturing plant, located approximately 4km north east of Lichtenburg within the Ditsobotla Local Municipality and Ngaka Modiri Molema District Municipality, is the subject of this report. The regional and local setting of Lafarge's operations and the project site is illustrated in Figure 1.1 and Figure 1.2 respectively.

In broad terms, Lafarge proposes to re-use waste materials as alternative fuels and raw materials/resources (AFRs) in the cement kilns at the Lichtenburg cement plant. The proposed project will comprise a change in the kiln fuel used at the plant from coal to a combination of coal and AFRs, substitution of raw materials, areas for storing hazardous and non-hazardous AFR materials to be use, and an input point(s) for delivering the material to the kilns. The AFR project is referred to in this report as "the project".

1.2 LEGAL FRAMEWORK

Given that the project incorporates several listed environmental activities (see application attached in Appendix A) this report has been compiled in terms of the National Environmental Management Act, 107 of 1998 (NEMA) and the regulations there under (Regulation 385 of 21/04/2006) as regulated by the Department of Economic Development, Environment and Tourism (DEDECT). In addition, given that the project will be located on a mine, this report will be an amendment to the mine's approved EMP report and has therefore also been compiled in accordance with the requirements of the Mineral and Petroleum Resources Development Act, 28 of 2002 (MPRDA) and the regulations there under (Regulation 527 of 23/04/2004) as regulated by the Department of Mineral Resources (DMR). In accordance with the above legislation this report covers the legal requirements of both the MPRDA and NEMA as outlined in Table 1.1 below.

It should also be noted, that although the application for environmental authorisation was submitted prior to the enforcement of the National Environmental Management: Waste Act (NEM:WA), 59 of 2008, and therefore separate application for waste-related activities was not required, the principles and requirements of the Waste Act were taken into consideration in the compilation of this report.

FIGURE 1.1: REGIONAL SETTING

FIGURE 1.2: LOCAL SETTING

TABLE 1.1: REQUIREMENTS FOR EIA/EMP REPORTS

Mining Regulation 527	Environmental Regulation 385	Section in report
Environmental impact assessment (EIA)		
	Description of the property and location of the activity on the property	Section 1.5 and 1.6
	Details of the person who compiled the EIA, and his/her expertise	Section 1.3.2
Details of the public engagement process and identification of how all issues raised have been addressed	Details on the public involvement process including –compliance with the PSS, IAP database, issues table, additional comments/objections	Section 2
	Comment on the need and desirability of the proposed activity(ies) in the context of alternatives	Section 6
Comparative assessment of land use and development alternatives regarding environment, social and cultural impacts	Description and comparative assessment of alternatives identified during the EIA	Section 6
	Description of proposed activity(ies)	Section 5
Assessment of the environment likely to be impacted by the mining operations, alternative land use or developments, including cumulative impacts	A description of the environment that may be affected by the activity	Section 3
	Methodology used to determine impact significance	Section 7
	Summary of findings and recommendations of specialist reports	Sections 3, 7 and 8
Determine appropriate mitigatory measures for each significant impact. Describe arrangements for monitoring and management of impacts	Description of environmental issues, assessment of significance, and extent to which these can be mitigated	Sections 7 and 8
Consider environmental, social and cultural impacts and the assessment to include nature, extent, duration, probability significance and cumulative impacts	Assessment to include: cumulative impacts, nature, extent, duration, probability, reversibility of resource loss, mitigation	Section 7
Knowledge gaps, adequacy of predictive measures, assumptions and uncertainties	Assumptions, uncertainties and knowledge gaps	Section 9
	Provide an authorisation opinion – with possible conditions	Section 10
	Environmental impact statement – summary of key findings and comparative assessment of the positive and negative implications of the activity and alternatives	Section 10
Include appendices for supporting and technical information	Specialist reports as appendices	Appendices
Environmental management programme/plan (EMP)		
	Details of the person who compiled the EMP, and his/her expertise	Section 1.3.2
	Detailed description of the activity aspects covered in the EMP	Section 5
Description of management/technical options chosen	Details on the management/mitigation measures from planning and design stages through to closure (where relevant)	Sections 7 and 8
Description of objectives and specific goals for mine closure, and management of environmental impacts, socio-economic conditions (SLP), historical and cultural aspects		Sections 5.3, 7 and 8
Action plans with time frames	Time frames for implementation where appropriate	Section 8.1
	Identification of responsible persons for implementation	Section 8.1
Planned monitoring and EMP performance assessment		Section 8.2

Mining Regulation 527	Environmental Regulation 385	Section in report
Environmental awareness plan		Section 8.3
Procedures for environmental emergencies and remediation		Section 8.3
Financial provision for remediation and closure – quantum and method of provision		Section 8.5
Signed undertaking to comply with the provisions of the Act and Regulations		Section 8.6
Appendices for supporting information		Appendices

The other key environmental legal requirements have been referenced in Section 7 of the report and/or listed in Section 11 of the report. In this regard, there are other approvals that are required prior to construction and/or commissioning of the project-related related activities.

There are several local and international policies/frameworks established to ensure that the use of waste materials as alternative fuels and raw materials is conducted in such a manner so as manage wastes in a responsible manner (and in line with the national waste management strategy) and to minimise potential negative effects on the environment. These (referenced in Section 12) have been taken into account when undertaking the environmental assessment process and compiling this report.

1.3 INTRODUCTION TO THE ENVIRONMENTAL IMPACT ASSESSMENT

1.3.1 EIA APPROACH AND PROCESS

A summary of the approach and key steps in the combined EIA process and corresponding activities are outlined in Table 1.2 below.

1.3.2 EIA TEAM

Metago Environmental Engineers (Pty) Ltd (Metago) is the independent firm of consultants that has been appointed by the applicant company to undertake the environmental assessment and related processes. Alex Pheiffer (project manager) has nine years of relevant experience and is registered with the South African Council for Natural Scientific Professions (SACNSP) as a professional natural scientist (*PrSciNat*). Stella Moeketse (project assistant) has two years of relevant experience. Brandon Stobart (project reviewer) has over 12 years of relevant experience and is registered as an environmental assessment practitioner (EAP) with the Interim Certification Board. The environmental project team that will be managed by Metago is outlined in Table 1.3.

Neither Alex, Brandon nor Metago has any interest in the project other than fair payment for consulting services rendered as part of the environmental assessment process.

TABLE 1.2: EIA PROCESS

**Note: DEDECT was previously known as DACERD.*

Objectives	Corresponding activities
Application phase (June 2009)	
• Notify the decision making authorities of the proposed project • Initiate the environmental assessment process.	• Application submitted to DACERD in June 2009. • DACERD acknowledged receipt of application. • Notified DMR of the process (June 2009).
Scoping phase (July 2009 – July 2011)	
• Identify interested and/or affected parties (IAPs) and involve them in the scoping process through information sharing. • Determine the issues associated with the proposed project. • Consider alternatives. • Identify any fatal flaws. • Determine the terms of reference for additional assessment work.	• Notify IAPs of the project and environmental assessment process (social scans, distribution of BIDs, newspaper advertisements, telephone calls and site notices). • Focussed meetings with local municipality and ward councillors (July 2009). • Public scoping meetings with IAPs (August 2009). • Focussed meeting with DACERD (October 2009). • Compilation of scoping report. • Distribute scoping report to IAPs, DMR and other regulatory authorities for review (November 2009). • Record comments (January/February 2010). • Forward scoping report including IAP comments to DACERD for review (March 2010 and February 2011). • DEDECT comments on scoping report (July 2011).
EIA/EMP phase (October 2009 to December 2011)	
Detailed specialist investigations (October 2009 to April 2011)	
• Describe the affected environment. • Define potential impacts. • Give management and monitoring recommendations.	• Specialist investigations of issues identified during the scoping stage.
Reporting (December 2009 to December 2011)	
• Assess potential impacts with assistance from appointed specialists where required. • Identify appropriate management measures • Determine outcome of application	• Compilation of EIA/EMP amendment report. • Distribute EIA/EMP amendment report to IAPs, DMR and other regulatory authorities for review (August 2011). • Record comments (a feedback open day has been arranged) (September 2011). • Forward EIA/EMP amendment report including IAP comments to DEDECT and IAP comments to DMR for review and decision making (September 2011). • Circulate DMR and DEDECT's decisions to all IAPs registered on the public involvement database.

TABLE 1.3: ENVIRONMENTAL PROJECT TEAM

Team	Name	Designation	Tasks and roles	Company
Project management	Alex Pheiffer	Project manager	Management of the process, team members and other stakeholders. Report compilation.	Metago Environmental Engineers (Pty) Ltd
	Stella Moeketse	Project assistant	Management of the process and other stakeholders.	
	Brandon Stobart	Project reviewer	Report and process review	
	Various	Translator	Written translations where necessary	Perfect Language Bureau
Specialist investigations	Gerrit Kornelius	Air quality specialist	Air quality study	Airshed Planning Professionals (Pty) Ltd
Technical project team	Hannes Diedericks	Lichtenburg Plant Manager	Technical project	Lafarge Industries South Africa (Pty) Ltd – Lichtenburg plant
	Skhumbuzo Mzoboshe	Lichtenburg Environmental Engineer		
	Rantsadi Moatshe	General Manager		Industrial Ecology
	Tsidi Luse	Business Development Manager		

1.4 CONTACT DETAILS FOR RESPONSIBLE PARTIES

1.4.1 CONTACT DETAILS FOR APPLICANT

The contact details for the project representatives are outlined in Table 1.4.

TABLE 1.4: CONTACT DETAILS

Contact people	Address	Telephone/ fax numbers	Email
Hannes Diedericks (Plant Manager)	Physical: 1 Manana Road Industrial Site Lichtenburg 2740 Postal: P O Box 188 Lichtenburg 2740	Tel: 018 633 3000 Fax: 018 633 3118	Hannes.diedericks@lafarge-za.lafarge.com
Skhumbuzo Mzoboshe (Environmental Engineer)			Skhumbuzo.Mzoboshe@lafarge-za.lafarge.com

1.5 REGIONAL SETTING

The regional and local setting of the mine and project is outlined below and illustrated in Figure 1.1 and Figure 1.2 respectively.

Aspect	Detail
Province	North West
Local authorities	Ditsobotla Local Municipality (NW384) and Ngaka Modiri Molema District Municipality (DC38)
Ward Number	5
Farm(s) on which the plant is located	Portions 61, 71 and Stand No. 1024 of the farm Lichtenburg Town and Townlands 27 IP
Neighbouring towns	Lichtenburg
Surrounding communities	Various private land owners, farm labourers, formal and informal settlements in and around Lichtenburg
Servitudes	Railway line and power lines
Catchment	Upper reaches of the Harts River Catchment (C31A)
Co-ordinates of plant	26° 8' 4.9" S and 26 ° 11' 1.2" E

1.6 SURFACE AND MINERAL RIGHTS INFORMATION

1.6.1 SURFACE RIGHTS AND LAND CLAIMS

Surface rights on the project site are held by Lafarge as outlined in Table 1.5. Surrounding land is owned by the local municipality, Transnet and some private landowners. Farm boundaries are shown in Figure 1.2.

TABLE 1.5: SURFACE RIGHTS ON THE PROJECT SITE

Farm	Portion	Landowner	Title deed number
Lichtenburg Town and Townlands 27 IP	61	Lafarge Industries South Africa (Pty) Limited	T7966/1973
	71		T1444/1984
	Stand No. 1024		T32433/74

1.6.2 RIGHT TO MINE/PROSPECT

There are no known existing prospecting and/or mining rights for the project site on which infrastructure will be located. Lafarge does hold mining rights for its Tswana and Lovedale quarries from which it sources limestone as a raw material in the cement manufacturing process.

1.7 PROJECT MOTIVATION (NEED AND DESIRABILITY)

Lafarge firmly supports the principle of waste management hierarchy, and the need to conserve non-renewable resource, and to recover, re-use and recycle materials to their fullest potential. By recycling the energy from waste, the plant will be able to play a valuable role in maximizing the utilization of latent

energy within a waste material, and providing an environmentally beneficial alternative to landfilling. By co-processing waste in cement kiln and substituting for coal a non-renewable resource, savings are made through resource conservation and associated CO_2 emissions. For example, waste tyres are regarded as a nuisance waste and create significant environmental issues when they are burnt in the veldt rather than in a controlled environment. Lafarge has a special Industrial Ecology department, which is dedicated to support cement plants in the management of co-processing nuisance waste.

1.8 BACKGROUND ON AFR PROJECTS IN SOUTH AFRICA

1.8.1 WHAT ARE AFRS

AFR refers to "alternative fuel and raw material/resource" which is a non-traditional material used in clinker and cement production in South Africa. In the industry, it is also referred to as secondary materials. In most cases, AFRs are waste materials that can be used to recover energy and some raw materials thereby reducing the cement plant's use of non-renewable natural resources. The cement manufacturing process provides an option to re-use these waste materials due to the conditions provided by the kiln. One of these conditions is high temperatures which are needed to heat and fuse raw materials to generate clinker from which cement is made (see Section 4.2 for a description of the cement making process). The cement kiln technology enables optimal energy recovery of waste and results in a considerable reduction in fossil fuel use. Usually cement plants make use of fossil fuels such as coal, heavy fuel oil and gas as their energy source in the kiln. At Lafarge, this fuel source is coal. The proposed AFR project will substitute a portion of this coal with selected waste materials. As the kilns burn at extremely high temperatures (the flame temperature is up to 2 000^{o}C), have a long residence time and generate surplus oxygen during and after combustion, co-processing of these waste materials ensures full energy recovery from the waste as well as re-uses any solid residue from the waste as a raw material in the generation of the clinker. The cement kiln can burn a wide range of wastes, but it also has more stringent requirements than most other kilns. The combustibles used must have the most stable characteristics possible (in terms of calorific power, water content and chlorine). In this regard, the type of waste chosen as an AFR needs to meet certain internal quality requirements from a process and product perspective.

The use of these waste materials is referred to as co-processing as defined by the National Policy in Thermal Treatment of General and Hazardous Waste drafted in terms of the NEMWA, 59 of 2008. In this regard, co-processing is the "utilisation of alternative fuels and/or raw materials in industrial processes for the purpose of energy and/or resource recovery and resultant reduction in the use of conventional fuels and/or raw materials through substitution".

1.8.2 LAFARGE'S OPERATIONS

Lafarge currently operates 166 cement plants in 50 countries around the world with a production capacity in excess of 200 million tons. The cement manufacturing process is energy and raw material intensive. The production of 1 ton of cement uses approximately 1.6 tonnes of raw materials. Natural resource optimisation is therefore of strategic importance for the sustainable development of the cement industry. In Europe, co-processing is widespread. In 2009, the rate of substitution of raw materials in European cement production was 6.5% (more than a 50% increase since 2001). In 2009, 83 of Lafarge's plants were using AFRs materials in their process with substitution rates varying between 10 and 40%. Lafarge's use of AFRs began in the 1990s.

Lafarge, both internationally and locally, has made a commitment to replace non-renewable resources by alternative ones every time it is technically and economically feasible. To keep in line with Lafarge's international operations, Lafarge South Africa has made a commitment to implement the use of AFRs in its cement kilns should this prove feasible. In 2007, ECO2 (a Lafarge and NPC-CIMPOR joint venture company) was formed to specifically develop alternative fuels and energy from wastes in South Africa in a professional and sustainable manner. Similar companies have been set up by Lafarge in other countries where AFRs are used. The role of these companies is to undertake the research and studies needed to investigate the feasibility of using AFRs within each country.

Internationally, Lafarge make use of the following waste materials as alternative fuels: tyres, solid shredded waste (SSW), solvents, used oils, animal meal, biomass and alternative raw materials. To meet cement plant AF quality specifications, pre-treatment of some materials is needed. If wastes are well-fitted for the cement process, then a direct stream can be established into the kiln. For wastes that are well-fitted to the cement process but have issues with handling and size, pre-treatment in the form of re-packaging, shredding, blending, stabilisation, settling, centrifugation etc is undertaken. For solid AFRs this is done through a sorting and shredding facility to produce SSW. For liquid AFRs, pre-treatment produces a blended liquid with an overall composition that meets strict specific quality requirements. Of relevance to this project are tyres, SSW and blended liquid wastes. Examples of these are provided in the text box below.

Tyres

Solid shredded waste (SSW)

Liquid AF tanks

Text box 1: Examples of AFRs used by Lafarge international applicable to this project

When looking at the use of waste materials in the cement making process, Lafarge Lichtenburg currently re-uses gypsum and fly ash (all process waste materials) in the production of cement.

1.8.3 STATUS OF AFR PROJECTS IN SOUTH AFRICA

The use of AFRs (secondary materials) in cement kilns is not new to South Africa. In South Africa, PPC was the first cement company to investigate the use of AFRs in their kilns. PPC conducted feasibility studies and trial burns to understand the potential impacts on both the cement manufacturing process and environment. These trial burns were conducted before EIA legislation came into effect requiring the authorisation of such activities. EIAs for the co-processing of secondary materials in cement-making plants that have been approved include:

- a record of decision for PPC's Hercules operations in Gauteng, issued in October 2008; and
- a conditional record of decision for PPC's Dwaalboom operations in the Limpopo Province, issued in May 2009 and valid for one year, to allow PPC Dwaalboom to conduct trial burns.

It should be noted that although Dwaalboom received a conditional record of decision, this decision is not yet in effect and is dependent on the outcome of discussions between PPC and the Minister of Environmental Affairs.

The details and status of various other environmental assessment processes involving the use of AFRs in South African kilns is provided in Table 1.6. Most EIAs that have been completed (approved or pending decisions) assessed that any potential impacts from the co-processing of AFRs would not result in significant environmental impacts. The assessments were however based on trial burns at specific plants. In other instances, trial burns have been approved in order to allow the cement plants to verify the outcomes of the EIA and provide site-and waste-specific data.

TABLE 1.6: OTHER CEMENT PLANTS IN SOUTH AFRICA AND THEIR EIA/AFR STATUS

Province	Operation	Status of EIA	Decision	Comments
North West	Afrisam's operations at Dudfield	Approved	Positive	-
	Pretoria Portland Cement's (PPC) operations at Slurry	Scoping report submitted in August 2007.*	Decision pending	Trial burns in a staged approach proposed prior to full scale implementation
Western Cape	PPC's operations at De Hoek, West Coast	Final EIA report submitted in May 2009.	Decision pending	
Eastern Cape	PPC's operations at Port Elizabeth	Scoping report submitted in November 2007.*	Decision pending	
KwaZulu-Natal	Natal Portland Cement's (NPC) Simuma Facility, Port Shepstone	Final scoping report approved in April 2010. Environmental assessment phase currently underway	Trial burns approved –conducted from June to August 2010	

** Note that given that these EIA processes commenced under the old Environment Conservation Act, record of decisions can be issued on the scoping report.*

2 STAKEHOLDER CONSULTATION

The range of environmental issues to be considered in the EIA has been given specific context and focus through consultation with authorities and IAPs. Included below is a summary of the people consulted, the process that was followed, and the issues that have been identified.

2.1 AUTHORITIES AND INTERESTED AND AFFECTED PARTIES (IAPS)

The following authorities and IAPs are involved in the EIA/EMP process:

Regulatory authorities:

- Provincial Department of Economic Development, Environment and Tourism (DEDECT) (previously known as department of Agriculture, Conservation, Environment and Rural Development – DACERD) – Environment, Air Quality and Waste Management sections;
- Provincial Department of Mineral Resources (DMR);
- National Department of Environmental Affairs and Tourism (DEAT): Waste Stream Management and Thermal Waste Treatment;
- National DEAT: Air Quality – Air Pollution Control Officer (APCO);
- Provincial Department of Health (DoH);
- Provincial Department of Water Affairs (DWA);
- Provincial Department of Agriculture (DA);
- Provincial Department of Land Affairs (DLA);

IAPs:

- landowners, land occupiers and communities surrounding the project area;
- surrounding industries;
- non-government organisations and associations;
- local authorities (Ngaka Modiri Molema District Municipality and Ditsobotla Local Municipality); and
- any other people/entities that choose to register as IAPs.

The public involvement database being used in the environmental process is presented in Appendix B. The database, derived from an existing Lafarge database, was updated through a deeds search of immediately adjacent portions of land, direct consultation with IAPs and social scans in the surrounding area. The database is being updated on an ongoing basis throughout the environmental process.

2.2 STEPS IN THE CONSULTATION PROCESS

Table 2.1 sets out the steps in the consultation process that has been conducted to date:

TABLE 2.1: CONSULTATION PROCESS WITH IAPS AND AUTHORITIES

TASK	DESCRIPTION	DATE
Notification - regulatory authorities and IAPs		
Application to DACERD	Formal application was submitted by Metago to DACE (now referred to as DEDECT). A copy of the relevant parts of the application and the response are attached in Appendix A.	10 June 2009
DMR notification	DMR were notified of the project verbally during a telephone discussion with the DMR official. No separate application is required.	June 2009
Social scan	A social scan of the project area was conducted by Metago. The purpose of the social scan was: • to identify relevant stakeholders, including: NGOs, municipal ward councillors, landowners, land occupiers, and other interested and affected parties; and • inform them in writing of the proposed project and associated scoping and EIA/EMP processes. The main output of the social scan was the IAP database (Appendix B).	August 2008
Distribution of background information document (BID)	BIDs were distributed to IAPs via the Ditsobotla Local Municipality ward councillors, during the social scan, at the public scoping meetings and by fax, post and/or e-mail to authorities and IAPs on the project's public involvement database. A copy of the BID is attached in Appendix C. The purpose of the BID was to inform IAPs and authorities about the proposed project, the environmental assessment process, possible environmental impacts and means of inputting into the environmental assessment process. Attached to the BID was a registration and response form, which provided IAPs with an opportunity to submit their names, contact details and comments.	June - July 2009
Site notices	Ten (10) laminated A2 site notices in English, Setswana and Afrikaans were placed at key conspicuous positions in and around the proposed project area. These areas included two main security gates at Lafarge Cement Plant, Lichtenburg Library, Lichtenburg Post Office, Ditsobotla Local Municipality notice board, Lichtenburg Shoprite, entrance to Choppers Supermarket, Lichtenburg Clinic, Blydeville Community Clinic and Boikhutso Community Clinic. Copies of the site notices and photographs of the places where site notices were displayed are attached in Appendix C.	17 July 2009
Newspaper advertisements	Two block advertisements were placed in one national (the Daily Sun) and one local newspaper (Noordwester). Copies of the advertisements are attached in Appendix C.	17 July 2009
Notices via municipal accounts	A4 copies of the site notices were delivered to the local municipality and sent out with the July municipal accounts.	August 2009
Scoping stage meetings and submission of comments		
Public scoping meetings	Three public scoping meetings were held to cater for the nearest communities and language differences. In the most part the meetings were held in English with Afrikaans and Setswana translators available if required. These meetings were held at the Blydeville Community Hall, Boikhutso Community Hall and Lichtenburg Town Hall. The purpose of the scoping meetings was to provide IAPs with a more detailed description of the project, ensure that IAPs understood the process, to hear and record IAPs comments and concerns so that they could be addressed during	18 August 2009

TASK	DESCRIPTION	DATE
	the process and to identify the scope of work for specialist investigations and the EIA process going forward. The same project information was presented at all three meetings. Minutes of the meetings are attached in Appendix C.	
Focussed meeting with DACERD	A focussed meeting was held with representatives from the Environmental, Air and Waste divisions of DACERD. The purpose of the meeting was to obtain initial input from DACERD on the application, the approach to the scoping report and the EIA process. Minutes of the meeting are included in Appendix A	6 October 2009
Review of scoping report		
Public review of scoping report	Copies of the scoping report were made available for public review at the following places: Lafarge Cement Plant, Lichtenburg Public Library, Ditsobotla Local Municipality, Boikhutso Community Library, Blydeville Clinic and Metago's library in Johannesburg. Electronic copies of the report were also made available to IAPs on request (electronically by e-mail or on CD). Summaries of the scoping report were distributed to all IAPs registered on the project's public involvement database via post and/or e-mail. All registered IAPs were also notified of the availability of reports/summaries and review periods via short text messages (sms). IAPs were given 40 days (excluding December holidays) to review the scoping report and submit comments in writing to Metago. The closing date for comments was Monday 18 January 2010. This was explained further in the distribution covering letter	40 days from distribution (excluding December holidays)
Regulatory authority review of scoping report	The DMR is mandated to manage the regulatory authority review process except for that of DEDECT. This process ran simultaneously with the IAP review process. DEDECT commenced its review on completion of the IAP review process.	November 2009 to July 2011
Written comments received	Written comments were received from regulatory authorities and IAPs. These have been summarised in the issues table and included in full in Appendix A and Appendix C respectively.	January 2010 to July 2011
Review of EIA/EMP report		
Direct communication with IAPs	Given the time passed from when IAPs reviewed the scoping report, Metago contacted all IAPs registered on the project's database telephonically (where contact numbers were available) to confirm contact details in preparation for the distribution of the EIA/EMP report and summary documents.	3 – 8 August 2011
Newspaper advertisements	Block advertisements have been placed in one national (the Daily Sun) and two local newspapers (Noordwester and Mafikeng Mail). The purpose of the newspaper advertisements is to notify IAPs of the availability of the EIA/EMP report for review and the details of the public open day. Copies of the advertisements are attached in Appendix C.	11 – 12 August 2011
Site notices	A2 site notices in English, Setswana and Afrikaans have been placed at key areas around the plant. A copy of the site notices isattached in Appendix C.	11 – 12 August 2011

TASK	DESCRIPTION	DATE
IAPs and authorities (excluding DEDECT) review of EIA/EMP report	Similar to the scoping review process, copies of the EIA/EMP report have been made available for public review at the following places: Lafarge Cement Plant, Lichtenburg Public Library, Ditsobotla Local Municipality, Boikhutso Community Library, Blydeville Clinic and Metago's library in Johannesburg. Electronic copies of the report will be made available to IAPs on request (electronically by e-mail). Summaries of the EIA/EMP report (in Setswana and English) will be distributed to all IAPs that are registered on the project's public involvement database via post and/or e-mail. All registered IAPs will also be notified of the availability of reports/summaries and review periods via short text messages (sms). IAPs will be given 40 days to review the report and submit comments in writing to Metago. The closing date for comments is Wednesday 21 September 2011. This will be explained further in the distribution covering letter.	From 12 August 2011
Public open day	A public open day has been planned. The purpose of the open day will be to provide background information on Lafarge's operations in Lichtenburg, feedback on the outcomes of the AFR EIA process and an opportunity for IAPs to submit comments.	21 September 2011
DEDECT review of EIA/EMP report	A copy of the final EIA/EMP report, including all review comments, will be forwarded to DEDECT following the public review period for decision making.	September 2011

2.3 SUMMARY OF ISSUES RAISED

A description of issues that have been raised to date by authorities and IAPs is given in Appendix D. Issues raised pertain to:

- procedural issues;
- air emission license;
- technical project-specific questions;
- soil pollution;
- noise disturbance;
- natural vegetation and impacts on surrounding agricultural land uses;
- road use and related impacts;
- air pollution and associated health risks;
- ongoing communication between Lafarge and the surrounding communities;
- water-related issues including pollution; and
- socio-economic issues (employment/recruitment, procurement opportunities, benefits to local communities).

3 DESCRIPTION OF THE CURRENT ENVIRONMENT

The information in this section was sourced from the site's approved EIA/EMP reports (Eko Rehab 2001; EES 2004; and SRK 2006), site visits undertaken by Metago and input from specialist work undertaken for the project. It is intended to provide readers with an understanding of the environment in and around the proposed project area as it relates to the potential impacts of the project.

3.1 GEOLOGY

The cement plant is located in the upper part of the Malmani Dolomite Formation of the Transvaal Sequence. One or more groups of the Karoo Sequence of Dwyka Formation occur in the area. Of significance is the presence of the dolomites which influence the presence of groundwater on site and in the surrounding areas. Given that the project does not include any mining activities and that the placement of project-related infrastructure will not sterilise any minerals, no further information on the geology is deemed necessary. Groundwater related aspects are discussed further under Section 3.7.

3.2 CLIMATE

Information in this section was sourced from the Lichtenburg weather station and air specialist study included in Appendix E (Airshed 2011). As a whole, the various aspects of the climate (as discussed below) influence the potential for environmental impacts. More specifically for this project, meteorological and wind related data are of interest to understand potential pollution plumes emanating from the site's operations. These are therefore the focus of this section. Other climatic data is included for completeness.

3.2.1 REGIONAL CLIMATE

Lichtenburg has a mild climate. Sunshine hours range from 70% to 80% of the possible sunshine duration even during the peak of the cloudy (or rainy) season. Detailed features of this climatic zone and the climate in the vicinity of the project area are outlined below.

3.2.2 RAINFALL AND EVAPORATION

The plant is located in a semi-arid region, Average annual rainfall varies from about 250mm in the south-west of the region, to just over 600mm in the extreme north. The town of Lichtenburg recorded an average rainfall of approximately 596mm over 29 years. The rainfall usually occurs as thunderstorms. The main rainfall season lasts from November to March with the peak of the rainy season being January. The evaporation for Lichtenburg exceeds the mean annual precipitation.

3.2.3 TEMPERATURE AND EXTREME EVENTS

High temperatures occur in summer due to the clear skies. The average maximum temperature is 33^{o}C in mid-summer and 22^{o}C in mid-winter. Average daily minimum temperatures are 18^{o}C in mid-summer and 5^{o}C in mid-winter. Frost occurs during winter.

Extreme weather events have included hail (1 to 3 occurrences per year), frost (31 to 60 days per year) and snow (occasionally during 1972 and 1994).

3.2.4 WIND AND ATMOSPHERIC STABILITY

Wind roses provide an indication of wind directions and speeds based on measured data. The 16 spokes represent the directions from which winds blew during the period. The colours in the wind rose reflect the different categories of wind speeds, the yellow area, for example, representing winds of 2.1m/s to 3.6m/s. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. Each dotted circle represents a 5% frequency of occurrence. The figure given in the centre of the circle describes the frequency with which calms occurred, i.e. periods during which the wind speed was below 1 m/s. For this project, wind data has been sourced for the Lichtenburg South African Weather Services station for 2004 and 2005.

The seasonal average and diurnal day- and night-time wind roses for Lichtenburg are illustrated in Figure 3.1. It is noted that considerable seasonal variation occurs both in velocity and direction. The spatial and diurnal variability in the wind field is also evident from the figure. The wind dominates from the north with a 20% frequency of occurrence for the total period. Increased wind frequencies for northwesterly winds of 5-10 m/s are noted for daytime hours. Nocturnal airflow is characterised by less frequent strong winds (5-10 m/s) from the north and more frequent moderate winds (2-4 m/s) from the east. Night time also has an increase in calm periods, typical of night time flow regimes in most regions.

It is important to understand the atmospheric stability in order to understand the potential for dispersion. The atmospheric boundary layer constitutes the first few hundred metres of the atmosphere and is normally unstable during the day as a result of turbulence from the sun's heating effect on the earth's surface. The thickness of this mixing layer depends predominantly on the extent of solar radiation, growing gradually from sunrise to reach a maximum at about 5 to 6 hours after sunrise. This situation is more pronounced during the winter months due to strong night-time inversions and a slower developing mixing layer. During the night, a stable layer with limited vertical mixing exists. During windy and/or cloudy conditions, the atmosphere is normally neutral. For elevated releases, the highest ground level concentrations would occur during unstable, daytime conditions. The wind speed resulting in the highest ground level concentration depends on the plume buoyancy. In contrast, the highest concentrations for ground level, or near-ground level releases would occur during weak wind speeds and stable atmospheric conditions.

FIGURE 3.1: SEASONAL AND DIURNAL WIND ROSES FOR LICHTENBURG

3.3 TOPOGRAPHY

The topography of the area is generally flat with gentle undulations. The plant is located on a watershed at an altitude of 1 485 m above mean sea level (m amsl) with drainage flowing towards the Groot Harts River (to the south-west) and the Groot Harts tributary (to the south-east) (Figure 3.2). The natural topography of the site has been impacted on by the existing plant infrastructure and activities.

3.4 SOIL AND LAND CAPABILITY

As a baseline, this information will be used to identify the presence and status of sensitive soil resources on the project site linked to the need to preserve soil resources for rehabilitation purposes.

In this regard, natural soil resources at the plant are restricted to areas outside of the plant's boundary. The majority of the plant area is paved. Where bare soils exist, these have been disturbed by the existing facilities/activities and are therefore not considered valuable from a conservation perspective or for rehabilitation purposes. Linked to this is the land capability of the soils. The pre-development and pre-zoning land capability of the area was grazing. This land capability has been completely altered by the current plant facilities and activities. As all project-related infrastructure will be positioned within the plant area, no further information on soil resources and land capabilities within the plant area is deemed necessary.

3.5 NATURAL VEGETATION

As a baseline, this information will be used to identify the occurrence and status of natural vegetation on site and in the surrounding areas so as to understand the potential for negative impacts through physical on-site disturbance and/or secondary off-site effects.

In this regard, as the proposed project site is used for cement production and packaging very limited (almost negligible) natural vegetation occurs within the boundaries of the existing plant. In the surrounding areas, there are small pockets of natural vegetation however these have been extensively disturbed by farming practises and the presence of well-developed urban and industrial areas. Due to the urban area, common exotic species normally used in private gardens do occur.

FIGURE 3.2: BASELINE ENVIRONMENT ON AND SURROUNDING THE CEMENT PLANT

The more significant area of natural vegetation occurs outside of the plant's boundary at the Lichtenburg biodiversity conservation centre (Figure 3.2 and Section 3.12.2). The centre covers a reserve of 6 000 hectares and includes a wetland area comprising dams and pans. Given the importance of this vegetation to support a breeding programme of endangered species already in place by the National Zoo, to supplement the populations of local and international zoos and act as a haven for various faunal species (see Section 3.6) as well as the centre's potential as a sensitive air receptor site, further detail on the natural vegetation within this area is provided below. Information on the natural environment within the centre was sourced by Metago from Acocks (1995), internet research (NZG, 2010) and personal communications with an employee of the centre (pers. comm. T Sikhwivhilu, May 2010).

The vegetation in the region is a mixture of grassland with a trend to sour grassveld towards the north, east and south, and a mixed grassland with a trend towards a sweet veld to the west. In the broader context, the area is located within the Dry Highveld Grassland Bioregion (Mucina and Rutherford, 2006) of Southern Africa. Within this bioregion, the site is located within the Carletonville dolomite grassland vegetation type, near the boundary of the western Highveld sandy grassland. The Carletonville dolomite grassland is better conserved than the western Highveld sandy grassland. There are statutory and private conservation areas and has therefore a conservation status of vulnerable. Only a small portion of the western Highveld sandy grassland is statutorily conserved and therefore has a conservation status of endangered. Most of the natural vegetation within these regions has been disturbed/transformed by farming practises (ploughing and grazing), urban sprawl or mining activity.

The conservation centre is expected to be representative of the natural veld type of the area. In this regard, the following species are of general occurrence: *Themeda triadra* (Red grass), *Setaria flablatta, Cymbopogon plurinodis* (Narrow-leaved turpentine grass), *Eragrostis lehmanniana* (Lehmann's love grass), *Elionurus muticus* (Wire grass), *Anthospermum pumilum, Heteropogon contortus* (Spear grass), *Eragostis superba* (Sawtooth love grass), *Eustachys paspaloides* (Fan grass), *Eragrostis chloromelas* (Heart-seed love grass), *Anthephora pubescens* (Wool grass), *Triraphis andropogonoides, Hypoxis hemerocallidea* (African star grass), *Lippia scaberrina, Eragostic gummiflua* (Gum grass), *Vernonia oligocephala* (Bicoloured-leaved Veronica), *Trichoneura grandiglumus, Barleria macrostegia, Scilla nervosa* (Sandy lilly), *Dicoma macrocephala, Sporobolus fimbriatus* (Fringed dripseed) and *Berkheya onopordifolia* (no common name).

3.6 ANIMAL LIFE

The presence of animal life on site and in the surrounding areas is closely linked to the presence and status of natural vegetation within these areas. Given the very limited natural vegetation and current activities on-site, limited fauna occurs on site. In the surrounding areas, previous studies done as part of the approved EMP reports (Eko Rehab 2001; ESS 2004; SRK 2006) identified the following:

- At least 150 bird species were identified in the area. This variety can be attributed to the variety of habitats in the area which includes vlei, indigenous and exotic vegetation and grassland.
- Freshwater fish occur in some of the old quarries where freshwater dams have formed. Fish species in the quarry dams are the same as in nearby dams, where species like yellow fish, carp, mudfish and catfish occur.
- Some mammals were observed but this is limited to the mammals such as Grey Duiker, Steenbok, Water Mongoose, Slender Mongoose, Porcupine, Springhare, Rock-hare, Blesbuck, Springbuck, Zebra, Otter, Ground Squirrel, Gantail Ground Squirrel, Lequan.
- No endangered or rare species were identified.

As outlined above in Section 3.3, the Lichtenburg biodiversity conservation centre supports a breeding programme and acts as a haven for various animal species. Given the centre's potential as a sensitive air receptor site, further detail on animal life within this area is provided below. The information was sourced by Metago from internet research (NZG, 2010) and personal communications with an employee of the centre (pers. comm. T Sikhwivhilu, May 2010).

The centre breeds unusual animals such as the addax, scimitar-horned and Arabian oryx, and the mohrr gazelle. Other fauna include the pygmy hippo, Pere David's deer, white rhino, blue wildebeest and various antelope. All faunal species roam freely within the 6 000 ha reserve. The centre is also host to a wide variety of birds. The centre's reserve includes a wetland area comprising a series of dams and pans. It is understood by Metago that no specialist biodiversity studies have been done for the centre. The information provided is the best available information at this stage.

3.7 WATER RESOURCES

Understanding the occurrence and use of water resources in proximity to the project site as well as the drainage of the site will assist in understanding the potential for pollution of these resources as a result of the project. The water qualities of these resources provide a starting point from which to measure any potential changes resulting from project activities. It is also relevant that there are existing facilities / activities on site which have the potential to pollute water resources. Information in this section was sourced from the site's approved EMP reports (Eko Rehab 2001; ESS 2004; SRK 2006).

3.7.1 PRESENCE OF WATER RESOURCES

Natural water resources in the vicinity of the plant include perennial watercourses (Groot Harts River and its tributary) and groundwater aquifers (the Transvaal dolomites). The establishment of storm water control measures at the plant has resulted in a quarry dam being used to collect and manage dirty water runoff from the site.

In terms of surface water features, the existing cement plant is located in the upper reaches of the Harts River catchment (C31A). With reference to Figure 1.2 and Figure 3.2, the Groot Harts River, a tributary of the Harts River, is the main river flowing through the town of Lichtenburg. Flow at the plant is towards the Groot Harts River and one of its tributaries (referred to in this report as the Groot Harts tributary). The Groot Harts River flows in a southerly direction into the Harts River which then flows south-westerly towards the Vaal Dam (downstream of the Vaal River) and then into the Orange River. Both the Groot Harts River and its tributary are perennial watercourses.

Groundwater in the vicinity of the site occurs within the Transvaal dolomites. These dolomites are considered the most significant groundwater resources in the area. The water supply wells for both Lafarge and the Lichtenburg municipality are all located upstream of Lafarge's operations within these dolomites. Due to the long residence times and slow recharge rates these aquifers are highly sensitive to pollution and over-abstraction. The local aquifer in the vicinity of the cement plant is considered to be a major sole-source aquifer.
Data sourced from boreholes in the vicinity of the plant indicates that the depth of the water table varies between three and six metres below ground level (mbgl).

3.7.2 WATER USE

Surface water use in the vicinity of the plant is limited to irrigation, livestock watering and natural ecosystems. Surface water is not used for domestic purposes as residential areas obtain groundwater for domestic purposes through the town water supply scheme. There are boreholes north of the plant that are used mainly to supply Lichtenburg town and the surrounding areas with domestic water. Of these, there are three boreholes (labelled as Lafarge BH 1, 2 and 3) which provide Lafarge with its water supply. The nearest Lichtenburg water supply borehole (labelled Lichtenburg BH5) is located approximately 3.5 km north-west of the plant. The cement plant is also located between two significant springs (dolomitic eyes) located at the source of the Groot Harts River and tributary. Both the Lafarge and Lichtenburg municipal supply boreholes are located at the headlands of the western spring (Figure 3.2). At Lafarge, the groundwater is used for domestic use and in the event that water shortages occur, it can be diverted to the plant.

3.7.3 WATER QUALITY

Pre-project water qualities have been sourced from the various EIA/EMPs compiled for the site (Eko Rehab 2001; ESS 2004; SRK 2006).

Generally, the surface water qualities of samples taken from the quarry north of the plant are of good water quality.

Generally, the groundwater qualities of samples taken from water supply boreholes are of ideal and good water quality. The groundwater is characterised by high calcium, magnesium and alkalinity due to the dolomitic origins of the aquifer. The groundwater also indicates active recharge of the dolomitic aquifer and no evidence of contamination is present. These boreholes are however located upstream of Lafarge's operations.

At the cement plant, there are stockpiles of coal and bauxite which may impact on groundwater resources. There are plans by Lafarge to surface these areas in the near future. All other plant areas are paved limiting the potential for pollution through seepage.

3.8 AIR QUALITY

Information in this section was sourced from the specialist study included in Appendix E (Airshed 2011).

Identification of existing sources of emissions in the region and the characterisation of existing ambient pollution concentrations is fundamental to the assessment of cumulative air impacts. Given Lafarge's current operations on site, monitoring data from the plant is available to help understand the plant's current potential for air pollution and related impacts and its contribution to ambient air quality.

3.8.1 EXISTING SOURCES OF POLLUTION

The main sources of air pollution in the region can be described as follows:

- stack emissions from industrial operations;
- fugitive emissions from industrial and mining operations and dust entrainment on paved and unpaved roads;
- vehicle tailpipe emissions;
- household fuel combustion (coal, wood);
- biomass burning; and
- various miscellaneous fugitive dust sources, including: agricultural activities and wind erosion of open areas.

At the cement plant, existing emission sources and key pollutants are outlined in Table 3.1.

TABLE 3.1: EXISTING PROCESS EMISSION SOURCES AT THE PLANT

Existing key pollutants	Activity
Inhalable particulates (PM10)	Raw material off-loading and stockpiling, Raw material milling, mixing and blending, Coal grinding, Heating circuit (pre-calciner, pre-heater), Kiln, Clinker cooler, Cement milling, product handling and packaging
Oxides of nitrogen (NO_X)	Heating circuit (pre-calciner and pre-heater), Kiln
Sulphur dioxide (SO_2), organic compounds, heavy metals, dioxins	Kiln

3.8.2 AMBIENT AIR QUALITY

As listed in Table 3.1, current emissions from the cement plant emanate from physical processes such as milling and materials handling and chemical reactions from the combustion processes that occur during the cement manufacturing process. Dust fallout monitoring and continuous stack monitoring is undertaken at the plant. The results of the monitoring programme are presented below together with a discussion on available ambient air quality data. The following key criteria pollutants are discussed: particulate matter less than 10µm (PM10), nitrogen dioxide and sulphur dioxide.

3.8.2.1 PM10

No background measurements for PM10 are known to have been carried out in the area. Some information on background concentration of particulate matter in the Southern African region was provided by the SAFARI 2000 project (as cited in Airshed 2011). The average concentration of particulate matter observed (relevant to South Africa) ranged between 18.7 ±3 µg/m³ and 42.1±3.1 µg/m³. Individual source contributions to this figure are difficult to determine; from the composition of the samples a large contribution from biomass burning is evident. The higher concentration is presumably more impacted by biomass burning. The conclusion to be drawn is that background PM10 will make up a material portion of the total PM10 in the area and that the contribution to cumulative impact is season-dependent.

Regarding the contribution of the plant to PM10 values in the area, this was modelled using an emission inventory for the factory including the known point sources (stacks for the kilns, coolers and coal mills) and fugitive sources (materials handling and dust raised by moving vehicles). The details of the emission inventory and the modelling technique are given in the specialist report. The conclusion is that the contribution of the Lafarge operations to the ambient annual average PM10 concentration exceeds the SA standard for a small area outside the plant boundary, but is a small fraction of the standard in the main residential areas of Lichtenburg. Similarly, the frequency of exceedence of the daily PM10 concentration standard exceeds the allowed 4 days per year for a small area outside the plant (this includes the Lafarge residential village), but the daily standard is never exceeded in the main residential areas of Lichtenburg.

3.8.2.2 Nitrogen dioxide

The contribution of Lafarge's emissions to ambient concentration was modeled using the kiln NO_2 emissions only. The results assume that all emissions of nitrogen oxides from the kiln occur as nitrogen dioxide, which is considered by the specialist as a conservative assumption.

The conclusion is that the contribution of the Lafarge operations to the ambient annual average NO_2 concentration does not exceed the SA standard in any location. The frequency of exceedence of the hourly NO_2 concentration standard exceeds the allowed 88 hours per year for a small area outside the

plant (including a portion of the Lafarge residential village), but the hourly standard is never exceeded in the main residential areas of Lichtenburg.

3.8.2.3 Sulphur dioxide

The contribution of the Lafarge SO_2 emissions to the ambient SO_2 concentration was modelled but the contribution to the annual average is less than 5% of the SA standard outside the plant boundary.

3.8.2.4 Dust fallout

Lafarge monitors monthly dust fallout levels in the Lichtenburg area surrounding the plant. Monitoring results for the year 2009 (February to December) are presented below (Table 3.2, see Figure 3.2 for the location of monitoring sites).

TABLE 3.2: ANNUAL AVERAGE DUST FALLOUT RESULTS (MG/M^2-D).

Location	Plant	Foreign	Total
2	464	186	651
3	316	125	441
4	170	73	243
6	345	140	484
18	122	36	158
15	483	173	656

The following points are noted by the specialist:

- All total values are below or very close to the proposed South African permissible value for residential and light commercial areas, even those located in or very close to the plants.
- Given the predominance of northerly winds, Point 18 may be regarded as a background value. The fact that the plant component at this point is close to 80% casts some doubt on the validity of the method used to distinguish between factory-related and other dust.
- The fact that Points 2 and 3 (Burgersdorp/Kieserville) have significantly higher loadings than Point 4 may indicate that there are activities not related to Lafarge that impact on deposition values.

3.8.2.5 Heavy metals

To understand Lafarge's current contribution to ambient heavy metal concentrations, heavy metal emissions were calculated from emission tests carried out by Lafarge between 2008 and 2010. Further detail on the tests undertaken is given in the specialist report.

The more notable heavy metals include manganese, nickel and mercury. For all the other metals, the predicted ambient values off-site are orders of magnitude lower than the reference concentration. In terms of predicted lifetime cancer risk, it is noted that all of the predicted lifetime risks are below 1 per million in the residential areas for the individual heavy metals and for the combined risk the 1 per million is only exceeded in the Lafarge residential area closest to the plant.

3.8.2.6 Dioxins and furans

When considering baseline dioxin and furan concentrations three scenarios were considered, namely the occurrence of these compounds in association with large particles (100µm), small particles (10µm) and in the gas phase respectively. Under these scenarios the highest concentration is found under the association with large particles, but the area of high concentration is limited to the vicinity of the plant. The dioxin/furan concentration isopleths are very similar for the small particle and the gas scenarios and are of considerably lower concentration than for the large particle scenario.

3.8.3 POTENTIAL RECEPTOR SITES

In the vicinity of the plant, potential receptors (receptors include people, flora, fauna etc. that are exposed to the potential impacts on air quality as described above) include residential areas (private small holdings, Lafarge plant hostel and staff housing, Lafarge recreational club, Lichtenburg town and communities), farming practises and the natural environment/tourist area (Lichtenburg biodiversity conservation centre).

3.9 NOISE

Current ambient noise levels at the proposed project site are expected to be continuous and representative of a low level industrial environment. Existing sources of noise include the existing cement plant (machinery, equipment and the railway line), neighbouring industrial activities, farming activities and day to day workings of the nearby town.

Given the presence of the cement plant within an industrial zoned area, limited noise sensitive receptors are expected to occur in the surrounding areas.

3.10 HERITAGE AND PALEONTOLOGICAL RESOURCES

Due to the positioning of project-related infrastructure within the boundary of the plant and adjacent to existing facilities, no heritage and/or paleontological resources occur at the project sites.

3.11 VISUAL LANDSCAPE

The plant is located within an area that is zoned for light industrial use approximately 4 km north-east of Lichtenburg. The natural landscape of the area has been influenced by the presence of the industrial type activities, including the cement plant, within the industrial zoned area. Given the size of the plant and the relatively flat topography of the land, the plant is visible from surrounding residential areas and people travelling along the R52 between Lichtenburg and Koster. The nearest tourist attraction is the Lichtenburg biodiversity conservation centre located approximately 2.5 km north west of the site. The centre is

frequented by local and overseas tourists and school groups (pers. comm. T Sikhwivhilu, May 2010). The cement plant has been operational for approximately 80 years and is a known feature of the landscape.

3.12 SOCIO-ECONOMIC STRUCTURE

The socio-economic structure of an area provides an understanding of the receiving environment from a human perspective. This includes an understanding of the population and the surrounding associated land uses that may be affected by the project.

3.12.1 SOCIO-ECONOMIC PROFILE

Given the limited potential for both positive and negative impacts on the socio-economic profile of the community (see Section 7.12), this section provides an overview of the profile on a provincial, municipal and local level. The information provided below is based on the latest statistical data from Statistics South Africa.

3.12.1.1 Provincial level (North West Province)

The North West province is South Africa's fourth-smallest province, taking up 8.7% of South Africa's land total area with a mid-2009 population of 3.45 million people. The province has the lowest number of people aged 20 years and older (5.9%) who have received higher education. The literacy rate is approximately 47%.

Mining and mineral processing contributes 23.3% to the provincial economy, and makes up 22.5% of the South African mining industry as a whole. Employment along the Platinum Corridor, from Pretoria to eastern Botswana accounts for over a third of total employment in North West. The province is also an important food basket in South Africa. Maize and sunflowers are the most important crops and the North West is the major producer of white maize in South Africa. North West contributes 6.3% share of total South Africa's Gross Domestic Product (GDP).

3.12.1.2 District and Local Municipality level (Ditsobotla and Ngaka Modiri Malema)

The Ngaka Modiri Molema District Municipality (NMMDM) is one of four district municipalities in the North West province. It covers an area of 31 039 km^2 and has five local municipalities within its area of jurisdiction. The local municipalities include Mafikeng, Ditsobotla, Ratlou, Ramotshere Moiloa and Tswaing. The Ditsobotla Local Municipality (DLM) covers an area of 5 833km^2 with an estimated population of 147 600. The district municipality has an estimated population of 763 000.

The district and local municipality show similar statistics in terms of population age groups, education and employment. In this regard, there is a high youthful population with 35% of the population falling within the age bracket of 15 to 35 years; 68 to 70% are under the age of 35. There is a low level of education

with only 3% of the population having attained tertiary education; 36 to 40% having attained some sort of primary and/or secondary schooling. The unemployment rate is high (43%) comprising both unemployed and not economically active people. On average, approximately 70% of the population earns less than R1 600 per month. Most of the rural population is employed in the different industries as labourers.

Concerning basic services, there are low levels of the provisions such as water, electricity, housing, and sanitation services in both the district and local municipalities. The local municipality however shows a slightly higher level of service to that of the district. About 16-17% of households are supplied with electricity for lighting purposes. Water in the dwelling is provided to 4-7% of households. Flush sanitation is available to 7-11% of households. Municipal waste removal services are provided to 6-10% of households.

3.12.1.3 Local level (Lichtenburg)

The total number of people in Lichtenburg is currently estimated to be 130 381 (Statistics South Africa, 2001). It is estimated that unemployment is between 20 and 30%. Most of the residents are labourers in the various industries. Cement factories in the area are a major source of employment.

Schooling in the area is poor with about 37% of the population over 20 having completed primary schooling. Twenty one percent of the general population of Lichtenburg is estimated to be illiterate.

Housing in Lichtenburg varies from formal to informal residential areas in the surrounding townships. The provision of basic services varies between the urban and rural areas. About 67% of households are supplied with electricity. Water in the dwelling is provided to 28.5% of households. Flush sanitation is available to 45% of households. Municipal waste removal services are provided to 45% of households. Only 13% of households are currently living in informal dwellings or settlements. Social infrastructure in Lichtenburg and the surrounding areas is well developed.

3.12.2 LAND USE ON AND SURROUNDING THE SITE

3.12.2.1 Land use on site

The project site falls within the boundaries of the existing cement plant located in the light industrial zone of Lichtenburg town.

3.12.2.2 Land use surrounding the site

With reference to Figure 3.2 and Figure 3.3, surrounding land uses comprise agricultural areas, light industries, old diggings and quarries, residential areas and the Lichtenburg biodiversity conservation centre. The more sensitive land uses that may experience secondary impacts as a result of potential project-related pollution (via water and/or air) emanating from the site are the agricultural and residential areas and the conservation centre. These are discussed in further detail below.

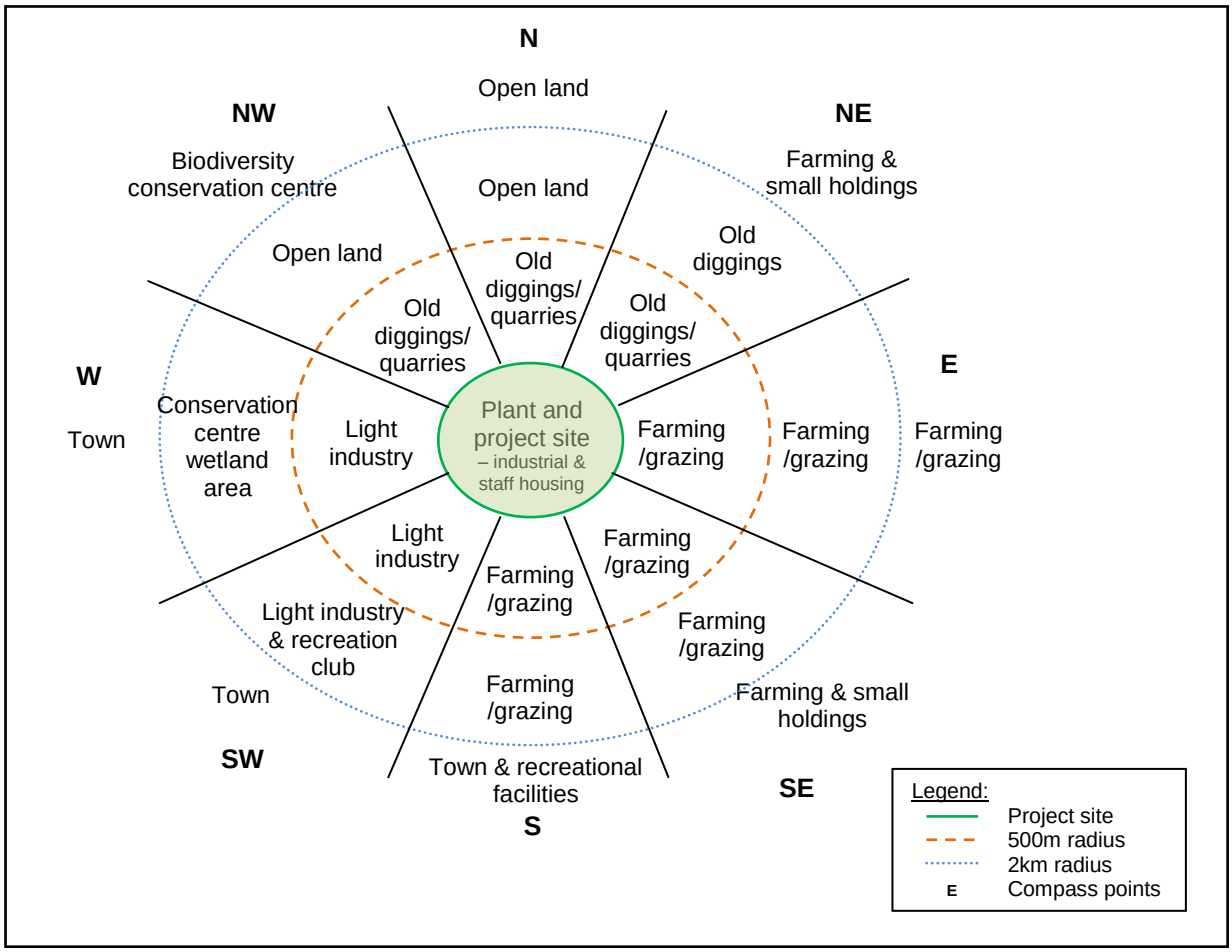

FIGURE 3.3: LAND USE DIAGRAM

Agriculture is one of the main economic activities of the region. Agricultural activities such as maize, sunflower and grazing take place on private land in the surrounding areas. Some of these operations fall under the Nord-Wes Ko-operasie (NWK) Limited. The NWK is one of South Africa's largest agricultural companies and engages in the trading of agricultural and related products and aids, and related services (NWK, 2010). Given this, the farm products as well as natural resources such as soils and water that support these farming activities are an integral part of the land use. Any changes to these resources through project-related pollution could have secondary impacts on these land uses.

Residential areas comprise Lafarge plant hostel and staff housing, Lafarge recreational club, the town of Lichtenburg, several formal and informal community groups including Blydeville and Boikhutso on the south western outskirts of town and people, including labourers, living on small holdings and farms. Details on the profile of the local communities are included in Section 3.12.1.

The Lichtenburg biodiversity conservation centre is one of the main tourist attractions in Lichtenburg (NGZ, 2010). The centre is operated by the National Zoological Gardens of South Africa, and is there mainly to further the breeding programmes of endangered species already in place by the National Zoo,

and to supplement the populations of local and international zoos. Details on the type of vegetation and animal life present at the centre are provided in Sections 3.3 and 3.6 respectively.

In addition to the above and with reference to Figure 1.1, Figure 1.2 and Figure 3.2, a network of roads and railway lines service the area. These include:

- the R52 regional road between Biesiesvlei and Koster;
- the R503 regional road between Mafikeng and Coligny (at the N14 national road);
- the R505 regional road between Zeerust and N14 national road;
- smaller district and town roads in and around the town of Lichtenburg;
- the railway line between Lafarge's Tswana quarry and cement plant; and
- the railway line from Coligny servicing the cement plant.

There are a number of other industrial and cement-making operations in and around Lichtenburg. The more significant of these is Afrisam's Dudfield operations (approximately 22km east of Lichtenburg) and PPC's Slurry operations (approximately 50km north east of Lichtenburg) (Figure 1.1). Both these plants are investigating the use of AFRs in their kilns. Further detail is provided in Section 1.8.3.

4 CURRENT ACTIVITIES AND INFRASTRUCTURE AT THE PLANT

As the proposed project will be located at the existing cement plant, this section provides a summary of the current facilities and operations at the plant.

4.1 OVERVIEW OF CURRENT ACTIVITIES AND SURFACE INFRASTRUCTURE LAYOUT

An overview of the current plant infrastructure and activities are summarised in Table 4.1. Reference should be made to the surface layout illustrated on Figure 4.1 when reading this section. A summary of raw materials, waste materials produced, production rates, resource usage and plant details are provided in Table 4.2.

TABLE 4.1: SUMMARY OF CURRENT INFRASTRUCTURE AND ACTIVITIES

Aspect	Infrastructure	Description
Access to the site and transport	Road access	• Access to the plant is along the Manana Road. There are two main access security gates along this road, a receiving/dispatch gate and a staff/visitors gate.
	Rail access	• There is a railway line and sidings servicing the plant site.
	Transport mechanisms	• Both road and rail are used to transport materials to and from site. Major routes leading in and out of Lichtenburg include the R52, R505 and the R503. These routes are used for transporting raw materials to and/or product/wastes from site. • More specifically, coal is transported to site via rail – approximately 12 trains per month (comprising 40 35-ton wagons).
Power supply	Power lines and substation	• Power at the plant is supplied by Eskom via 88kV and 33kV lines. The lines feed into on-site substations. Power is then distributed around the plant via 11kV lines.
Water supply and storage	Potable water - pipelines and storage tanks	• Potable water at the plant is sourced from boreholes (Boreholes 1, 2 and 3) and stored in reservoir tanks prior to use. • From the tanks, the water is either pumped to a water softener or remains untreated. The water softener is needed due to the source of water (dolomitic). • Distribution throughout the plant is via pipelines. • Softened water is used for domestic purposes (in the houses, recreation club, ablution facilities). Untreated water is used for garden irrigation. In the event of shortages, untreated water can be used in the plant as an emergency supply.
	Process water - pipelines and storage tanks	• Process water is sourced from the quarry north of the plant and is pumped into a raw water sump. The quarry collects rainfall, treated sewage effluent and abstracted groundwater. • From the sump, the water is pumped to the plant. • Process water is used for cooling. • In event of water shortages, Boreholes, 2 and 3 can be diverted to the plant as emergency supply.
Processing plant	Cement manufacturing and packing	• Key components of the processing plant are detailed in Table 4.4.
Waste management facilities	Waste collection and handling facilities	• Management of general and industrial waste on site is outlined in Table 4.3 • The plant has a salvage yard at which waste is sorted and collected by a contractor.

Aspect	Infrastructure	Description
Water management facilities	Sewage treatment facilities	• There are two sewage treatment plants on site. These service the cement factory and the plant housing (hostels and staff housing). • The township plant is a biofiltration system that services the factory. The treatment plant has a peak flow capacity of 45m3/hr and caters for approximately 280 people. • The compound plant is a biological treatment plant that services the hostel, staff housing and the office block. The treatment plant has a peak flow capacity of 114m3/day and caters for approximately 500 people. • Treated effluent from both plants is pumped to the quarry north of the cement plant for re-use in the process. • There are two sceptic tanks that cater for the packing and dispatch sections of the plant. The sewage is collected by the local municipality and transported to their sewage treatment plant.
	Pollution control dams	• Due to the high evaporation of water in the conditioning towers, there is no need for pollution control dams at the plant.
	Stormwater management	• The cement plant is located on a watershed. Stormwater management measures are in place within the plant area. These comprise: clean water cut off drains upstream of the site, dirty stormwater channels and the plant quarry dam.
	Water treatment facilities	• Apart from softening the water sourced via the boreholes, no other water treatment facilities occur on site.
Support infrastructure and services	Offices and parking areas	• There is a main office block at the security entrance to the plant. Within the plant area there are several smaller offices associated with various sections of the plant. • There is a parking area at the main offices for employees and vistors. • There is a truck parking area near the receiving/dispatch gate.
	Clinic	• There is a staff clinic located in close proximity to the main office block.
	Workshops and stores	• Within the plant, there are several workshops and stores for servicing equipment and machinery and storing consumables. The workshops are located on impermeable substrates and within bunded areas. • Apart from raw materials and process additives, the following materials are stored on site: industrial paraffin (for start-up only), oils, grease, water softener, equipment.
	Control rooms	• Within various sections of the plant there are high technology rooms for controlling the cement manufacturing process.
	Fuel (petrol and diesel) storage and handling	• Fuel storage and handling areas are located within the plant area. These facilities are bunded with appropriate measures to contain any spills.
	Security control	• There is a security fence surrounding the entire plant. • At all receiving/dispatch points (road and rail), there are weighbridges controlling the amount of material transported to site and product leaving site.
Housing	Housing facilities	• Next to the cement plant is a residential area comprising houses and hostels built for Lafarge employees and their families. • The facilities cater for 280 people in houses and 120 people in family quarter hostels.

FIGURE 4.1: LOCATION OF CURRENT AND PROPOSED INFRASTRUCTURE AT THE PLANT

TABLE 4.2: DATA FOR THE CURRENT PLANT

Features		**Statistics**	**Comments**
Group	**Specific**		
Raw materials to plant	Crushed limestone	2.2 million tons/annum	Source: via rail from Lafarge quarries Makes up 94% of the raw mix
	Raw milling additives	Bauxite: 36 500 tons/annum	Source: via road from Elmin Hellenic Mining Enterprise Makes up 1% of the raw mix
		Magnetite:54 750 tons/annum	Source: via road from Rhovan Mine Makes up 1% of the raw mix
		Pozzsand:191 625 tons/annum	Source: via road from Ash Resources Makes up 4% of the raw mix
	Cement milling additives	Fly ash: 657 000 tons/annum	Source: via road and rail from Ash Resources
		Gypsum:109 500 tons/annum	Source: via road from Protea Chemicals
	Fuels	Coal: 410 625 tons/annum	Source: via rail and road from Exxaro Coal and Kendal
		Industrial paraffin: 40 000 litres per start-up	Used for plant start-up only. Source: via road from Chevron
Intermediate products	Clinker	2.7 million tons/annum	-
Product	Cement	3 million tons/annum	Transported to Lafarge depots in Kaalfontein (Ekhurhuleni), Polokwane, Nelspruit and Richards Bay
	Burnt limestone	180 000 tons/annum	-
Waste materials	Kiln bricks	700 tons/annum	LWB, Refrac Technique, RHI Refectories, and Vesuvius.
Resource use	Power demand	90 MVA (installed capacity)	Sourced from Eskom.
	Water demand	Potable: 0.12 Ml/day (120 m^3/day)	Sourced from boreholes with a combined supply capacity of 2 800 litres/minute.
		Process: 2.116 Ml/day (2 116 m^3/day)	Sourced from the quarry. Supply rate: 4 400 litres/minute.
Employment	Operational staff	444	Recruited from surrounding areas.
Plant	Life of plant	More than 50 years.	Dependent of availability of raw materials and resources to produce cement. Given cement's role in the building industry it is unlikely that the plant will close in the near future.
	Operating times	24 hours a day, 7 days a week, 365 days a year.	-
	Area covered by plant	Approximately 99ha	-

TABLE 4.3: LAFARGE GENERAL AND INDUSTRIAL WASTE MANAGEMENT PROCEDURE

Waste stream type	Example	Origin	Storage/ handling on site	Removal/ disposal
Process waste	Limestone, cement, cement additives etc	Spillages and broken bags	Within plant area	Recycled in the plant
Building material	Concrete slabs	Building maintenance	Temporarily stored at quarry	Used for rehabilitation
Hazardous waste	Oil rags, grease, paints, oil filters, filter bags and fluorescence tubes	Plant maintenance	Collected in designated skips/bins and temporarily stored at the salvage yard for removal by contractor	Collected by Enviroserv
Used oil	Contaminated oil	Equipment and mobile equipment maintenance		Collected and recycled by Oilkol
Scrap metal	Steel and copper	Plant modification		Collected and recycled or disposed of by North West Recycling. Disposal (where applicable) to LTX refuge disposal site (controlled and operated by local municipality)
Clean used paper	Printing paper	Old documents		
Domestic waste	Plastic, clothing, food scraps, newspapers and magazines, food packaging , cans and bottles	Plant personnel		
Damaged cement bags	Cement bags	Packing plant		
Rubber belts	Old conveyor belts	Conveying system		
Pellets	Damaged or broken pellets	Packing plant		Collected by Paleor
Garden waste	Grass and trees	Garden maintenance	Not applicable	Eleane Gardening Services

4.2 PROCESS FLOW – MAIN PROCESS COMPONENTS

A process flow diagram of the main process components activities is presented in Figure 4.2. Each step in the flow diagram is described in Table 4.4.

FIGURE 4.2: PROCESS FLOW DIAGRAM SHOWING MAIN PROCESSING COMPONENTS OF THE PLANT AND PROPOSED CHANGES

TABLE 4.4: MAIN COMPONENTS OF THE CEMENT MANUFACTURING PROCESS

Stage	Description
Material handling and storage	• Various materials require handling and storage on site. These include raw materials (limestone and additives for the kiln and cement milling), fuels (coal and industrial paraffin) and interim process materials (ground raw mix, clinker and ground cement). • Additives used in the kiln include: magnetite (Fe_2O_3 - contains iron ore), pozzsand (SiO_2 – contains silica) and bauxite (Al_2O_3 – contains alumina). Additives used in the cement milling circuit include: limestone ($CaCO_3$), gypsum and fly ash. These materials are stored in a dry form on two surfaced, covered circular stockpiles (limestone) and surfaced, covered store areas (other materials). From the stockpiles, the materials are conveyed to the raw milling circuit. • Fuel sources are stored as follows: coal is stored in an open stockpile (Lafarge has plans to surface theses stockpiles in the near future) adjacent to the railway line and industrial paraffin (in liquid form) in sealed tanks in a dedicated storage area. • Interim process materials are stored in covered storage areas/stockpiles and within bunkers at the additive feeding plant.
Raw milling circuit	• The crushed limestone from the Lafarge quarry together with the kiln additives are ground in a ball mill to produce a raw mix (fine powder). This is a dry milling process. • From the mill, the raw mix is conveyed to blending silos prior to the heating circuit.
Coal grinding plant	• Coal used as fuel in the kiln is fed from the stockpile to a grinding plant before being fed into the kiln.
Heating circuit	• Prior to the kiln, the raw mix is fed to a pre-calciner and pre-heater where the material is heated to approximately 900°C. • From the pre-heater, the material is fed into the rotary kiln which operates like an industrial oven. There are three (3) kilns in operation at the plant. • In the kilns, the ground coal is used as an energy resource. The raw mix is heated to a temperature of up to 1450°C. As the material heats, water is evaporated, minerals decompose and react and partial melting takes place. • The partial melting causes the material to aggregate into lumps or nodules, typically of 1–10 mm diameter. This is called clinker.
Cooling	• From the kiln, the hot clinker falls onto a cooling grate which comprises a perforated grate within an enclosed chamber through which cold air is blown. • The cooling process recovers most of the heat and cools the clinker to around 100°C, at which temperature it can be conveniently conveyed to storage silos prior to being fed into the cement mills. • These coolers have two main advantages: they cool the clinker rapidly, which is desirable from a quality point of view, and, because they don't rotate, hot air can be ducted out of them for use as pre-calciner combustion air.
Milling circuit - cement	• The clinker is fed together with limestone and gypsum, at a certain ratio, into the cement mills to produce different types of cement. The limestone and gypsum are used as bulking and grinding materials. The gypsum is added as a setting additive for cement and to facilitate the grinding of clinker. • The clinker is then ground into the final cement product.
Fans	• A large volume of gases has to be moved through the kiln system. Fans are used to suck air through the pre-heaters, force air through the cooler bed, and to propel the fuel into the kiln. Fans account for most of the electric power consumed in the system.
Product handling and packing	• The cement is transported to silos where it is despatched to the packing plant. • In the packing plant the cement is placed into cement bags or bulk form ready for distribution to clients.
Air cleaning equipment	• Air cleaning equipment at the plant comprises baghouses, electrostatic precipitators and gravel bed filters. • The mills are equipped with dedicated baghouses. These baghouses collect fugitive dust emissions which are recycled back into the process. • The kilns are equipped with dedicated precipitators and gravel bed filters. Cleaned gas is emitted to atmosphere via stacks.

5 AFR PROJECT DESCRIPTION

A description of the project is provided below. The main aim of the project is to use Kilns 2, 3 and 4 to co-process alternative fuels and raw materials (AFRs) and through this recover both energy (mainly) and raw materials (to a lesser extent) to be used in the manufacturing of clinker.

5.1 CONSTRUCTION PHASE

A summary of the key construction activities (per project component) is provided in Section 5.1.2. Other construction related issues are discussed below.

5.1.1 TIME TABLE

If the decisions for the project are positive, the construction phase would commence immediately after receipt of the environmental authorisations. The construction phase would be short in duration, approximately three to six months.

5.1.2 KEY CONSTRUCTION ACTIVITIES

It should be noted that no major construction is needed for the project. Activities that will take place on site during the construction phase are listed in Table 5.1. Where additional information is needed, this is provided in the sections that follow.

TABLE 5.1: LIST OF CONSTRUCTION ACTIVITIES

Activity	
C1	Mixing of concrete and concrete work
C2	General building activities
C3	Erection and dismantling of scaffolding
C4	Painting, grinding and welding
C5	Handling and temporary storage of building materials – equipment, steel, gas (welding), paints
C6	Transportation of building materials/equipment/structures to site
C7	Operation/movement of construction vehicles/machinery on site
C8	Handling and storage of waste (not AFRs) – empty paint containers, containers, redundant concrete, steel off-cuts, wood off-cuts, other construction waste
C9	Manage construction areas

5.1.3 SITE FACILITIES

Existing facilities on site will be used. These include: store and work areas, a lay-down area and refuelling areas. These areas are located where necessary within bunded areas with impermeable floors and facilities for collecting and handling any spills.

5.1.4 TRANSPORTATION

During the construction of the project, it is estimated that approximately two trucks in total over the three to six month period will deliver construction materials to site. As no additional employment opportunities will be created by the project, there will be no increase in the number of workers travelling to and from site. The negligible amount of general and industrial waste generated will form part of the site's existing waste management programme. No increase in traffic volumes due to the removal of waste from site is expected.

5.1.5 STORM WATER CONTROL

Due to the existing plant, there are storm water measures already in place on site. All construction activities will take place within these stormwater controls. These stormwater controls are detailed in Section 4.1.

5.1.6 WATER SUPPLY AND USE DURING CONSTRUCTION

Water during the construction phase is needed for cement mixing and general building activities. These amounts are expected to be negligible. The plants existing supply network will be used.

As no additional employment opportunities will be created by the project, no additional water for washing and sanitation purposes is needed.

5.1.7 POWER SUPPLY AND USE DURING CONSTRUCTION

Negligible amounts of additional power will be needed during the construction phase. The plants existing supply network will be used.

5.1.8 SOLID WASTE MANAGEMENT DURING CONSTRUCTION

Lafarge operates with a waste management system. All waste generated during the construction phase will be handled in line with the waste management procedure. For ease of reference and completeness, details from Lafarge's waste management procedure relevant to the proposed project are included in Section 7.7.

5.1.9 EMPLOYMENT AND HOUSING

No additional employment opportunities will be created during the construction phase. An existing general contractor at the plant will be used to establish the proposed facilities. As such no additional housing is needed for the construction phase.

5.2 OPERATION PHASE

5.2.1 CHANGES TO SURFACE INFRASTRUCTURE

Implementation of the project requires changes to existing infrastructure on site. These changes are illustrated conceptually on Figure 4.1 and include:

- additional storage facilities (covering an estimated area of 64m^2); and
- feed lines for delivery of AFRs to the kilns (pipelines, conveyors/elevators/cranes).

5.2.2 OFF-SITE PREPARATION OF AFR MATERIALS

The preparation of AFR materials will take place mainly off site at a dedicated waste management facility. The waste management facility has an approved waste license and is located at Kaalfontein, near Kempton Park in the Gauteng Province. A separate independent EIA for the establishment and operation of the facility was conducted by WSP (an environmental consultant company). The specific purpose of this facility is to source suitable waste materials and prepare these wastes, according to a set of internal standards, into a form that can be used as AFRs in the cement kilns. Any waste materials that do not meet the necessary requirements will be rejected at the facility. The materials will leave the Kaalfontein facility and arrive at the Lichtenburg plant as follows:

- tyres (shredded and whole);
- hydrocarbon wastes;
- other solid waste (including solid shredded wastes (SSW)).

The AFR materials will be sourced as outlined in the table below.

Waste category	Type of waste	Industrial sector producing the wastes
Scrap tyres	Whole tyres and shredded tyres	Automobile, tyre manufacturing, tyre dealers, transport services, rubber processing, SATRP
Hydrocarbon waste	Waste oil, hydrocarbon liquids, hydrocarbon sludge, hydrocarbon solid waste, solvents, grease, inks, resins, pigments, paints, tar, spent pot liner	Petroleum industry, mechanical industry, oil refinery, service stations, waste management companies, distillation plants, chemical industry, paint manufacture, textile industry, recyclers, cleaning companies, non-ferrous metal refining industry
Other solid waste	Sorted municipal waste, cardboard, paper, wood, non-pvc plastic, broken pellets, timber, synthetic textiles, other biomass waste.	Textile industry, packaging, municipalities, plastic processors, households, agricultural industry

In line with the ACMP AFR charter, wastes that will not be co-processed in Lafarge's kilns and therefore not accepted at the Kaalfontein facility include anatomical hospital wastes, asbestos-containing wastes, bio-hazardous wastes, electronic scraps, entire batteries, explosives, high concentration cyanide wastes, radioactive wastes and unsorted municipal garbage.

The location for the Kallfontein facility was chosen for its position, economic, social, competitive and strategic reasons. The facility site was considered as an alternative to the cement kiln sites where

material will be utilised. The reduced haulage distance for the waste and the packaging optimisation of the final product which will be sent to the cement kilns made this alternative more attractive. The site's linkage to a rail network also offered added advantage for the transportation of the final bulk product in a safe and secure rail transport system which is less prone to accidents that may lead to spills of blended alternative fuels. The reduced capital and operating expenses associated with this facility due to the fact that Lafarge has been operating a depot and most of the infrastructure is in place makes this option attractive. Other factors that make the Kaalfontein site attractive include:

- It is close to the source of waste material i.e. the urbanised Gauteng Province;
- The site is not close to any sensitive receptors or sensitive environment (based on preliminary screening); and
- The site is close to built-up industrial areas and contains most of the required facilities.

5.2.3 TIME TABLE

The AFR programme being proposed is outlined in Table 5.2.

TABLE 5.2: PROPOSED AFR PROGRAMME

Waste stream	Timeline	Replacement ratio
Whole and shredded tyres	Year 1	Ramp up after test trials – average of 10%
Hydrocarbon wastes		Ramp up after test trials – from 7%
Whole and shredded tyres	Year 2 onwards*	Average of 20%
Hydrocarbon wastes		From 7% ramping up to 50% over the next 5 years
Other solid waste (including solid shredded waste)		From 5% (in 2014) ramping up to 25%

** Only if test trials provide satisfactory results.*

5.2.4 KEY OPERATION ACTIVITIES

Key activities that will take place on site during the operational phase of the project are discussed in Table 5.3. The table outlines additional activities and changes to existing activities as a result of the AFR project. The table does not include all existing activities on site. These are discussed in Section 4. Key input, outputs, wastes and emissions associated with each activity have also been identified. The conceptual production process is illustrated conceptually in Figure 5.1.

TABLE 5.3: LIST OF OPERATION ACTIVITIES INCLUDING INPUTS/OUTPUTS/WASTES/EMISSIONS

Activity		**Inputs/Outputs**	**Potential environmental issues**
01	Transportation of AFRs to site AFR materials will be transported to site using existing rail infrastructure and road transport. No new facilities are needed for the project. The source of materials, preferred route and estimated average increase in rail and traffic numbers is detailed in Table 5.4. As no additional employment opportunities will be created by the project, there will be no increase in the number of workers travelling to and from site.	Liquid AFRs Solid AFRs Rail wagons Tankers	Exhaust emissions (negligible)
O2	Quality control The main quality control will take place at Lafarge's Kaalfontein facility. Liquid wastes will be transported in sealed containers. If the seals are broken, the material will not be accepted at the plant gate. Solid wastes will be baled (where applicable) prior to transport. If the bales look like they've been tampered with, the material will not be accepted at the gate. Waste transported directly to the plant will undergo the same quality control procedures as those at the Kaalfontein site, prior to being accepted.	Liquid AFRs Solid AFRs Rail wagons Tankers	-
O3	Handling of AFR materials on site AFR materials will require handling once on site to storage facilities and then from the storage facilities to the kilns. In broad terms, the AFR materials will comprise both liquid and solid AFRs. The specific types of materials to be used are detailed in Section 5.2.2. The feed line and input point to the kilns will depend on the type of material used (Table 5.4). The anticipated input points are illustrated conceptually on Figure 4.1.	Liquid AFRs Solid AFRs Equipment	Pollution of groundwater through uncontrolled spills Pollution from litter
O4	Temporary storage of AFRs on site AFR materials will be temporarily stored on site, within the boundaries of the existing plant, prior to being co-processed in the kilns. Storage facilities have been located to maximise efficiency of existing infrastructure (Figure 4.1). The preferred storage method per waste type is outlined in Table 5.5. Alternatives considered are discussed in Section 6.2.	Stockpile pads/bunkers Sealed tanks Liquid AFRs Solid AFRs	Pollution of groundwater resources through uncontrolled spills Pollution from litter
O5	Co-processing of AFRs in the kilns AF materials will replace a portion of coal used in the kilns and therefore be mainly used for energy recovery. The small amounts of raw materials recovered in the process are negligible. Prior to feeding the materials into the kilns, materials will be weighed and dosed to ensure the correct amount and content of material is fed to the kilns. Under normal operating conditions a cement kiln produces no ash. In turn the proposed project will not produce any ash. The reason is due to certain conditions obtained in the kilns (extremely high temperatures, long residence time and higher oxygen levels), the waste materials combust with any solid residue forming part of the clinker. Organic components are destroyed and inorganic components are bound up in the structure of the clinker.	Liquid AFRs Solid AFRs Equipment Kilns (high temperature) Dust (recycled) Emissions	Air pollution (change to emissions and potential public health and environmental effects) (normal and upset conditions)

Activity		**Inputs/Outputs**	**Potential environmental issues**
O6	Emission control Air cleaning equipment at the plant will continue to be used for the project. The kilns are equipped with baghouse, electrostatic precipitators and gravel bed filters. Cleaned gas is emitted to atmosphere via stacks.	Dust (recycled) Cleaned emissions (emitted to atmosphere)	Air pollution (change to emissions and potential public health and environmental effects) (normal and upset conditions)
O7	Other waste management – handling, temporary storage No additional waste will be generated by the project.	-	-
O8	Power use Negligible amounts of additional power will be needed to operate additional equipment on site. Existing facilities and supply mechanisms detailed in Section 4.1 will continue to be used.	Eskom power using existing facilities	-

FIGURE 5.1: PROCESS FLOW DIAGRAM SHOWING CHANGES TO MAIN PROCESSING COMPONENTS AT THE PLANT

TABLE 5.4: DELIVERY OF AFR MATERIALS TO SITE

Waste groups	Source	Transportation	
		No. of additional trips	Possible route
Non-hazardous			
Tyres (shredded and whole)	Via Kaalfontein facility	1 train per month[#] (25-ton wagons)	Transnet line between Kempton Park and the site
Solid waste (including solid shredded waste (SSW))	Via Kaalfontein facility	2 trains every month[#] (25-ton wagons)	
Hazardous			
Hydrocarbon wastes	Via Kaalfontein facility and direct from third party source	1 tanker per week (25 000l)	Via road

Notes:
[#] Trains delivering AFRs to site will be used to take product from site and therefore only the additional trip to site is reflected.

TABLE 5.5: STORAGE AND HANDLING OF AFR MATERIALS ON SITE

Waste groups	Quantities		Temporary storage on site	Delivery to storage facility	Feed to kilns
	tonnes/ month	m^3/ month*			
Non-hazardous					
Tyres (shredded and whole)	3000	2000	On 42 m^2 surfaced area in covered bunkers/ stores/ shed (SSW and shredded tyres) and open air (whole tyres)	Front-end loader	Elevator/ Conveyor/ crane system at back end of kiln
Solid waste (including solid shredded waste (SSW))	8333	5555			
Hazardous					
Hydrocarbon wastes	4167	2778	In sealed tanks within bunded surfaced area (22 m^2) with collection facilities for any spills	Pumped from tanker to sealed tanks	Pumped via pipeline from tank to a holding facility next to the kiln and then into the front end of kiln

Notes: The quantities provided in the table are estimates.
** Calculated by dividing the tons by an estimated factor of 1.5.*

5.2.5 OTHER SUPPORT SERVICES AND FACILITIES

In terms of other support services and facilities, the following is applicable:

- no additional water is needed for the operational phase;
- no additional facilities such as workshops, stores are needed for the project;
- as the project will not increase the operational workforce on site, no additional sanitation or sewage treatment facilities are needed; and
- no additional employment opportunities will be created by the project and therefore no additional housing is needed.

5.3 DECOMMISSIONING AND CLOSURE PHASES

The decommissioning and closure of project-related facilities is expected to be directly linked to the decommissioning and closure of the entire plant site. Given the ongoing need and use of cement, it is unlikely that this will happen in the next 50 years. Pre-mature decommissioning would only take place should the AFR programme result in unacceptable emissions to atmosphere resulting in unacceptable health impacts.

Given the project's location within the site boundary, decommissioning would only comprise:

- dismantling and removal of conveyor/elevator/crane system ;
- dismantling and removal of liquid AFR storage tanks and feed pipelines;
- demolition and removal of reinforced concrete bund structures;
- demolition and removal of storage bunkers/stores/shed for shredded waste and tyres;
- removal of fencing around tyre storage facility;
- removal of un-used AFR materials and other waste from site to be recycled, re-used or disposed of at a permitted landfill site.

The AFR project areas would be incorporated into the plant site and would only be rehabilitated (i.e. concrete bases stripped and vegetation re-established) during decommissioning of the entire site.

In terms of closure, the rehabilitation of project-specific land back to its pre-development state (i.e. grazing) would not be feasible given the project's location within the cement plant and the plant's location within a light industrial zoned area. It is expected that the plant area would remain zoned for industrial use.

Given the above, a conceptual assessment of decommissioning activities has been provided in Section 7.

6 PROJECT ALTERNATIVES CONSIDERED

Alternatives considered during the environmental assessment process are discussed below.

6.1 ALTERNATIVE TRANSPORT OPTIONS

The scoping report identified that waste materials could be transported to site via road and/or rail. Given the source of materials, type of materials to be transported and safety considerations, rail transport mechanisms are preferred. In the event that rail transport is not available, materials will be transported by road. Both scenarios have been considered in the environmental impact assessment section. No other alternatives were considered.

6.2 ALTERNATIVE WASTE MATERIALS

In the scoping process, waste materials identified as potential AFRs included:

- tyres (shredded and whole tyres);
- treated bulk sewage sludge;
- paper packaging such as cardboard boxes, plastics;
- hydrocarbon liquids such as waste oils, inks, solvents, resins, paint waste, chemicals, gums, glues, pigments, tars;
- biomass such as wood chips, cuttings, garden refuse.

Based on initial work conducted by ECO2 (a Lafarge and NPC-CIMPOR joint venture company), the following wastes have been excluded and have not been considered further in the process:

- treated bulk sewage sludge – a lack of availability in the volumes that would be required has resulted in this material being unfeasible at this stage.

The sourcing of wastes for AFRs will take place off-site at a dedicated Lafarge waste management facility (as detailed in Section 5.2.2). AFRs will be delivered to the plant as tyres (whole and shredded), solid shredded waste bales and blended liquid wastes. The AFRs will comprise a mixture of those wastes identified above that meet specific internal standards as highlighted in Section 5.2.2. No other alternatives were considered.

6.3 ALTERNATIVE USE OF AFR MATERIALS

It is acknowledged that in addition to use of AFRs as a fuel source at the cement kilns there are other potential uses for these materials. Broadly speaking these uses include:

- shredded tyres for surfacing roads and sport facilities, use in shoes, carpeting, rubberised products such as mouse pads, notebook covers, pencil cases, containers/planters, traffic cones;

- whole tyres used for flood control, crash barriers, noise barriers, erosion control, swings, artificial reefs;
- paper packaging can be re-processed to form new packaging, fill material, insulation, mulch;
- many hydrocarbon wastes can be treated or filtered for re-use; and
- garden waste can be used for composting/mulch.

In line with the national waste management strategy (DEA, March 2010) all of the above are possible uses. The waste management hierarchy makes provision for the re-use, recovery and recycling of waste as the second tier in a 5-tier group. This is illustrated in Figure 6.1.

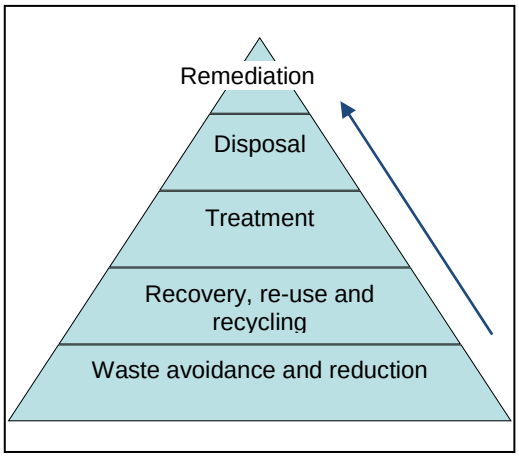

FIGURE 6.1: WASTE HEIRARCHY (NWMS 2010)

However, the decision as to which of these uses is the preferred use falls outside the scope of this EIA. This EIA only assesses the potential use of AFRs as an alternative to coal.

6.4 ALTERNATIVE STOCKPILE LOCATIONS

Given that the AFR storage facilities will be located so as to maximise efficiency of existing infrastructure, storage will be restricted to areas within the current plant boundary. No alternative locations outside of the plant boundary have been considered.

6.5 ALTERNATIVE OPTIONS FOR THE HANDLING AND STORAGE OF AFRS ON SITE

In the handling (unloading, dosing, transfer) and storage of AFRs on site, the key environmental considerations are pollution of surface and groundwater resources and the generation of dust. Other environmental aspects such as disturbance of soils/land capability, biodiversity, heritage, noise and visual are not relevant given the project's location within the plant boundary (see Figure 4.1 and Section 7). In this regard, the specific design of the handling and storage components as presented in Section 5 caters for the following:

- all storage areas will be established on existing concrete-bases ;
- for liquid AFRs, storage facilities will be bunded with spillage containment and management measures – bunded areas will be capable of holding 125% of the volume of the hazardous/polluting substances that could be spilled therein;
- where necessary, storage facilities will be placed undercover to prevent unnecessary runoff and seepage.

No other alternatives are deemed necessary.

6.6 THE "NO PROJECT" OPTION

The assessment of this option requires a comparison between the alternative of proceeding with the project (i.e. substituting a portion of coal with AFRs) with that of not proceeding with the project (i.e. continued use of coal in the kils). Regardless of how controversial this project is, proceeding with the co-processing of AFRs in Lafarge's cement kilns will:

- reduce Lafarge's use of a non-renewable resource (coal);
- contribute to reducing Lafarge's carbon footprint and thereby aiding in climate change;
- assisting Lafarge to remain competitive within the industry;
- assist in certain aspects with waste management in South Africa by providing an alternative to incineration and landfilling i.e. providing a re-use option; and
- make more efficient use, through the recovery of energy, of a material that would otherwise be disposed of in a landfill adding to South Africa's existing landfill problem.

The "no-go option" assumes that operations at the plant remain as is and the use of AFRs and associated benefits as detailed above are not materialised.

7 IMPACT ASSESSMENT AND CONCEPTUAL MANAGEMENT MEASURES

7.1 STRUCTURE OF THIS CHAPTER

Potential environmental impacts were identified by Metago in consultation with IAPs, regulatory authorities, specialist consultants and the Lafarge/ECO2 project team. The impacts are discussed under issue headings. All identified impacts are considered in a cumulative manner such that the impacts of the current activities on site and those potentially associated with the project are discussed and assessed together.

The discussion and impact assessment for each sub-section covers the construction, operational, decommissioning and closure phases where relevant. This is indicated in the table at the beginning of each sub-section. Included in the table is a list of project activities/infrastructure that could cause the potential impact per project phase. The activities/infrastructure link to the description of the project (Section 5). Although no direct impacts can physically occur on site during the planning and detailed design phase, there may be specific planning and design management measures that are required to limit or prevent potential impacts. Where relevant, this is specified in the various sections. The decommissioning and closure phases are directly linked to the decommissioning and closure of the site as a whole. These phases therefore assess the contribution of the project to the overall closure of the site.

Management measures to address the identified impacts are discussed in this section and included in the EMP (Section 8). These are a combination of existing and proposed Lafarge measures. In most cases (unless otherwise stated), these management measures have been taken into account in the assessment of the significance of the managed/mitigated impacts only and the unmanaged scenario does not take account of either the current or proposed management on site.

An example of how this chapter is structured is given in the text box on the following page.

7.2 METHODOLOGY USED FOR ASSESSING IMPACTS

Both the criteria used to assess the impacts and the method of determining the significance of the impacts is outlined in Table 7.1. This method complies with the method provided in the EIA guideline document. Part A provides the approach for determining impact consequence (combining severity, spatial scale and duration) and impact significance (the overall rating of the impact). Impact consequence and significance are determined from Part B and C. The interpretation of the impact significance is given in Part D. Both mitigated and unmitigated scenarios are considered for each impact.

EXAMPLE SHOWING HOW THIS CHAPTER HAS BEEN STRUCTURED

5.2 TOPOGRAPHY

Environmental component heading

5.2.1 ISSUE: HAZARDOUS EXCAVATIONS

Issue heading

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
			N/A*
Activity/infrastructure 1 Activity/infrastructure 2	Activity/infrastructure 1 Activity/infrastructure 2	Activity/infrastructure 1	-

** N/A – not applicable.*

Bars showing phase of operation in which impacts could occur, and link to project activities

Assessment of impact

Description of the issue and associated impact in terms of severity, duration, spatial scale, consequence, probability and significance – considering all phases of project including any cumulative impacts

Tabulated summary of the assessed impact per phase of the project

Management	Severity	Duration	Spatial Scale	Consequence	Probability of Occurrence	Significance
Construction						
Unmanaged	**L**	**M**	**L**	**M**	**M**	**M**
Managed	**L**	**L**	**L**	**L**	**L**	**L**
Operation						
Unmanaged	**L**	**M**	**L**	**H**	**M**	**H**
Managed	**L**	**L**	**L**	**L**	**L**	**L**
Decommissioning						
Unmanaged	**L**	**M**	**L**	**H**	**M**	**M**
Managed	**L**	**L**	**L**	**L**	**L**	**L**
Closure						
Unmanaged	**L**	**M**	**L**	**L**	**L**	**L**
Managed	**L**	**L**	**L**	**L**	**L**	**L**

Conceptual description of management measures

Identification of management objectives and conceptual description of management actions

Emergency situation

Description of any emergency situations where relevant with reference to relevant procedures

TABLE 7.1: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of severity, spatial extent and duration**
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action. Irreplaceable loss of resources.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints. Noticeable loss of resources.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints. Limited loss of resources.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national

PART B: DETERMINING CONSEQUENCE

SEVERITY = L

DURATION	Long term	**H**	**Medium**	**Medium**	**Medium**
	Medium term	**M**	**Low**	**Low**	**Medium**
	Short term	**L**	**Low**	**Low**	**Medium**

SEVERITY = M

DURATION	Long term	**H**	**Medium**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Low**	**Medium**	**Medium**

SEVERITY = H

DURATION	Long term	**H**	**High**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Medium**	**Medium**	**High**
			L	**M**	**H**
			Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/ national
			SPATIAL SCALE		

PART C: DETERMINING SIGNIFICANCE

PROBABILITY (of exposure to impacts)	Definite/ Continuous	**H**	**Medium**	**Medium**	**High**
	Possible/ frequent	**M**	**Medium**	**Medium**	**High**
	Unlikely/ seldom	**L**	**Low**	**Low**	**Medium**
			L	**M**	**H**
			CONSEQUENCE		

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	**Decision guideline**
High	It would influence the decision regardless of any possible mitigation.
Medium	It should have an influence on the decision unless it is mitigated.
Low	It will not have an influence on the decision.

***H = high, M= medium and L= low and + denotes a positive impact.**

7.3 GEOLOGY

The proposed project does not involve the exploitation or sterilisation of mineral resources therefore no impacts on geology are expected.

7.4 TOPOGRAPHY

The topography of the area has been changed by current plant activities. The proposed project will add and/or modify infrastructure within the fenced off plant boundary. Potential impacts relating to the topography include alteration of drainage patterns and visual aspects. These issues are discussed further in Sections 7.7 and 7.11 respectively. No other impacts on the topography are expected.

7.5 SOILS AND LAND CAPABILITY

Topsoil is generally a resource of high value containing a gene bank of seeds of indigenous species. A loss of topsoil (through sterilisation, erosion or contamination) would generally result in a decrease in the rehabilitation and future land use potential of any land that is disturbed by the project. Directly linked to this is the capability of the soil to be used for grazing, arable, wilderness or wetland potential.

Project-related infrastructure will be positioned within the boundaries of the existing plant and within areas where natural soil resources have already been disturbed. As a result no further disturbance of additional soil resources are expected and therefore no additional impacts on either soil resources or land capabilities on site are expected as a result of the project.

7.6 BIODIVERSITY - NATURAL VEGETATION AND ANIMAL LIFE

Impacts on the natural vegetation and associated animal life generally relate to the physical disturbance of these resources and the knock-on effects this has for the ecological system in general. Given the lack of natural vegetation and limited animal life on site, which has already been extensively disturbed by the presence of the existing cement plant, no further impacts are expected on site.

Of more significance, however, is the potential for impacts on the natural vegetation and animal life found at the Lichtenburg biodiversity conservation centre as a result of potential changes in air emissions. This issue is discussed further under Section 7.8.

7.7 WATER RESOURCES

Issues around water resources concern changes to on-site and downstream drainage patterns, contamination of surface and groundwater systems and reduction in groundwater availability through abstraction and/or pollution. These are discussed further below.

7.7.1 ISSUE: ALTERNATION OF DRAINAGE PATTERNS AND SURFACE WATER POLLUTION

With regards to the drainage patterns, the natural drainage of the area has been changed by current plant activities and the presence of storm water control measures to manage dirty runoff from the site. With project-related activities taking place within the bounds of existing storm water controls and on existing paved plant areas, as well as planned with containment areas to prevent spillages, no impacts on drainage patterns or nearby surface water systems are expected as a result of the project. When considered cumulatively with existing operations on site, the relatively small scale of project specific activities together with existing management measures on site limit the potential for any significant cumulative on-site impacts.

7.7.2 ISSUE: REDUCING GROUNDWATER LEVELS AND AVAILABILITY

With regards to reducing groundwater levels and availability, although Lafarge sources its water from abstraction boreholes located upstream of the cement plant, no additional water supply is required as part of the proposed project. As a result, no impacts on groundwater resources due to abstraction activities are expected.

7.7.3 ISSUE: POLLUTION OF GROUNDWATER RESOURCES

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure of entire site
Handling and storage of building materials Waste management	Handling and storage of AFRs Waste management	Handling and storage of used equipment, materials Waste management	Remaining infrastructure and materials – if not removed from site (unlikely)

Assessment of impact

Introduction – Groundwater systems have the potential to become polluted through the incorrect storage and handling of materials on site. As a base case, even in the unmanaged scenario, in all project phases, material handling and storage will take place within the paved plant area, on concrete based surfaces. During construction and decommissioning existing managed facilities will be used as far as possible. In addition the liquid AFR facilities for the operational phase have been planned in such a manner that any spillages will be contained. At closure, impacts will only be experienced if polluting sources are not managed correctly during the operational phase and removed from site during decommissioning.

Severity – In all phases of the project, the severity of potential impacts is low, even in the unmanaged scenario, as limited volumes of pollutants would enter the groundwater system (if any). This is aided through the relatively small volumes of material to be stored on site at any one time as well as the planned storage and handling methods (base case). In the managed scenario, which ensures that the base case is implemented, this severity will remain low in all phases.

Duration – In both the unmanaged and managed scenarios, the duration of impacts will be short and quickly reversible.

Spatial scale – In all phases, even in the unmanaged scenario, groundwater pollution would not extend beyond the site boundary.

Consequence – In both the unmanaged and managed scenarios, the consequence of potential impacts in all phases of the project is low.

Probability – Even in the unmanaged scenario, in all phases of the project, it is unlikely that groundwater resources on-site will become polluted by project activities. This in turn reduces the likelihood of off-site pollution.

Significance – In the unmanaged scenario, the significance of this potential impact is low. In the managed scenario, the significance is reduced to negligible.

Tabulated summary of the assessed impact per phase of the project

Management	Severity	Duration	Spatial Scale	Consequence	Probability of Occurrence	Significance
All phases						
Unmanaged	**L**	**L**	**L**	**L**	**L**	**L**
Managed	**L**	**L**	**L**	**L**	**L**	**L**

Conceptual description of existing and proposed management measures

Discussion of the management measures is provided below and in the EMP (Section 8).

Objective

The objective of the management measures is to prevent unacceptable groundwater pollution related impacts.

Actions

In the construction, operation and decommissioning phases Lafarge will ensure that all potentially polluting materials are handled in a manner that they do not pollute groundwater. In this regard:

- storage facilities will be on impermeable floors and will have appropriate runoff containment measures such as bunds, canals and sumps with traps. These bunded areas will be capable of holding 125% of the volume of the hazardous/polluting substances that could be spilled therein;
- where necessary, storage facilities will be placed undercover to prevent unnecessary runoff and seepage;
- no potentially polluting materials will be stockpiled directly on bare ground;
- existing stores, workshops and re-fuelling areas will be used – no new facilities will be established;

- Lafarge will ensure that containment measures for any new or existing facilities to be used by the project are maintained in good working order;
- all workers will be trained on the handling and storage of AFR materials on site – the necessary material safety data sheet (MSDS) information will be kept on site at all times;
- ad hoc spills of potentially polluting substances (even in dirty areas) will be reported to the environmental manager and cleaned up immediately;
- all project activities will take place within the bounds of a surface dirty water management system; and
- the waste management practices, as set out in Section 4.1, will continue to be implemented on site during all phases of the project.

In the decommissioning phase, all un-used AFR materials will be removed from site and either returned to the supplier or disposed of in accordance with Lafarge's waste management procedure.

Lafarge will ensure that surface water management systems on site comply with Regulation 704.

There will be an incident management system, including procedures and training, for dealing with incidents.

Emergency situations

Major spillage incidents will be handled in accordance with the Lafarge's emergency response procedure (see Section 8.4).

7.8 AIR QUALITY

The information in this section is based on the air specialist study in Appendix E (Airshed 2011).

7.8.1 ISSUE: NEGATIVE CHANGE IN AIR EMISSIONS

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
-		-	-
Not applicable	Use of AFRs	Not applicable	Not applicable

Assessment of impact

Introduction – In the unmanaged scenario the use of AFRs has the potential to pollute the air and cause related health impacts. The main source of pollution is via the stacks. The constituents of concern in the use of AFRs are chlorides (as potential chlorine supply for dioxin formation) and heavy metals. The specialist investigation included the prediction of the ground-level concentration of inhalable particulates, nitrogen oxides, sulphur dioxide, organic compounds, dioxins and furans and trace metals.

Air quality impacts have been assessed based on compliance with ambient air quality guidelines. The comparison of predicted pollutant concentrations to ambient air quality guidelines and standards facilitates a preliminary screening of the potential, which exists for human health impacts.

The main conclusions of the air quality investigation are discussed below. Supporting information is provided in the specialist report in Appendix E. The methodology used during the air quality assessment is discussed in detail in Appendix E. For the purposes of this assessment, results are compared to South African guidelines where available. In the absence of South African guidelines, use is made of international guidelines.

Sensitive receptor points include the Lafarge village (located south west of the plant), the main residential areas of Lichtenburg, surrounding farming and grazing land and the biodiversity conservation centre (Section 3.12.2).

Severity – The air specialist made use of a theoretical model to conservatively predict air quality impacts during the operational phase of the project as this is the period during which AFRs would be used.

In the unmanaged scenario, the model predicted that thoracic particulates (PM_{10}) concentrations will exceed the proposed daily and annual average South African limits for a small area outside the plant boundary (including a small portion of the Lafarge village) but that the exceedence will not reach the rest of the potential receptor sites. The exceedances are predicted to occur for more than four days of the year at the nearest receptor (a small portion of the Lafarge village) but that the daily standard will never be exceeded at the main residential area of Lichtenburg.

For oxides of nitrogen, the model predicted that the contribution of Lafarge's operations to ambient annual average concentrations will not exceed the SA standard at any location. The frequency of exceedance of the hourly standard will however exceed the allowed 88 hours per year for a small area outside the plant, but the hourly standard will not be exceeded at the main residential area of Lichtenburg.

For sulphur dioxide, the model predicted that the contribution of Lafarge's operations will be less that 5% of the SA standard outside of the plant boundary.

For trace metals, the model predicted that ambient concentrations of trace metals are expected to increase somewhat from the baseline, but under the conservative assumptions made by the specialist, the concentrations are not expected to exceed the most conservative health-based screening values at the nearest receptor sites. Stack (emission) concentrations of trace metals for the kilns may however exceed the SA standards for kilns that use AFR, if limits on the feed material and rate are not implemented.

For dioxins and furans, the model predicted that contribution to dioxin concentrations will be a fraction of the US EPA 1 per million (over a lifetime) carcinogenic risk concentration.

When considered cumulatively, the severity of potential off-site impacts is rated as high, given the presence of potential receptor sites (mainly a small area of the Lafarge village) within the zone of influence. With mitigation measures, the severity reduces to medium-low, as careful monitoring is required to ensure that no unacceptable impacts and related health issues occur.

Duration – In both the unmanaged and managed scenarios, if human health impacts occur, these are potentially serious and long term in nature.

Spatial scale – In the unmanaged scenario, potential impacts may extend beyond the project boundaries impacting on potentially sensitive receptor sites. With mitigation, potential impacts would remain within the plant boundary.

Consequence – In the unmanaged scenario, the consequence is high. In the managed scenario the consequence reduces to medium as the severity and spatial scale of the impacts is reduced.

Probability – In the unmanaged scenario, there is a high probability of health-related impacts. With mitigation, the probability reduces to medium to low depending on how effective the mitigation measures are.

Significance – In the unmanaged scenario, the significance of impacts is high and reduces to medium to low as the probability of health-related impacts is reduced.

Tabulated summary of the assessed impact per phase of the project

Management	Severity	Duration	Spatial Scale	Consequence	Probability of Occurrence	Significance
Operation						
Unmanaged	**H**	**H**	**M**	**H**	**H**	**H**
Managed	**M-L**	**H**	**L**	**M**	**M-L**	**M-L**
Construction, decommissioning, closure						
Not applicable						

Conceptual description of existing and proposed management measures

Discussion of the management measures is provided below and in the EMP (Section 8).

Objective

The objective of the management measures is to prevent unacceptable air quality related pollution impacts.

Actions

Lafarge will apply in a timeously fashion for an air emission license in terms of the National Environmental Management: Air Quality Act.

Lafarge will maintain an air quality management plan for the site in consultation with an appropriately qualified specialist that will include monitoring of potential impacts.

Lafarge will comply with the ACMP Policy on Secondary Materials, November 2004, and the National Policy on Thermal Treatment of General and Hazardous Waste, July 2009 (see Appendix F).

Lafarge will introduce the AFR materials one stream at a time starting with trial burns ramping up to full-scale production in a controlled manner. Only once stable conditions are achieved for the first stream will Lafarge consider introducing the next stream.

Management measures will be implemented to assist in maintaining good control and performance of air pollution control equipment, such as regular inspections and maintenance. Management measures will be implemented to assist in maintaining a high availability/utilization of air pollution control equipment at all the plant. AFRs will not be used during failure of air pollution control devices.

Lafarge will comply with the conditions of the air emission license as amended from time to time.

Lafarge will investigate options with the local municipality and neighbouring industries to introduce ambient air monitoring stations or programmes in the region to help assist with determining problem areas and working towards creating a better ambient air quality.

Lafarge will monitor air quality in accordance with the programme set out in the air emission license application as amended from time to time. This programme will as a minimum comply with the monitoring programme detailed in Section 8.2.2.

If the monitoring results show unacceptable impacts on ambient air quality, the use of AFR will be stopped and/or reduced in consultation with the relevant department until such time as Lafarge can prove the impacts to be acceptable.

Limitations will be applied to the fuel replacement rate, the heavy metal content of the AFR (specifically lead, mercury and thallium) or both. These limitations will ensure that the use of AFRs in the kilns does not adversely impact on ambient air quality and that the emission limits as set in the National Policy on Thermal Treatment of General and Hazardous Waste, July 2009 are met by Lafarge. If these emission limits are exceeded, Lafarge will immediately stop the feed of AFRs to the kilns.

No AFR materials will be used in the start-up and/or shut down of the kilns. AFRs will only be used when the kiln temperature achieves the required quality standards for clinker.

Full records of the batch calculations should be kept for regular reporting to the licensing authorities.

Emergency situations

Any failure of the air pollution control equipment is considered an emergency situation. Lafarge will follow the emergency response procedure included in Section 8.4.

7.9 NOISE

7.9.1 ISSUE: NOISE POLLUTION

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Vehicle movement General building activities	Vehicle movement General operational activities	Vehicle movement Dismantling of infrastructure	Not applicable

Assessment of impact

Introduction – Activities associated with the project during the construction, operation and decommissioning phases have the potential to generate noise and cause related pollution. The more significant noise-related impacts are expected to occur during the construction and decommissioning phases with the establishment and dismantling of project-specific facilities on site. All activities will however take place within the plant boundary and within an area zoned for industrial use. During the operational phase, the noise emissions from project-related activities will be similar to those already taking place on site.

Severity – Noise pollution will have different impacts on different receptors because some are very sensitive to noise and others are not. In this regard, although there are residential receptors adjacent to the plant (that is, Lafarge employees living at the recreational club, hostel and staff housing), these are not expected to be sensitive to noise generated by the project. It should be noted that no major construction or decommissioning activities are needed for the project. Given the plant's location within an industrial zoned area, the nearest potential sensitive receptors (people living on small holdings and farms and people visiting the Lichtenburg biodiversity conservation centre) are located over 2km from the site. In all relevant phases of the project, the increase in noise emissions due to project activities is not expected to be disturbing (result in complaints) off site when considered cumulatively with existing on-site activities.

Duration – In both the unmanaged and managed scenario, noise emissions will continue for the life of the project.

Spatial scale – Given the existing on-site activities, even in the unmanaged scenario, noise from construction and decommissioning activities would most probably only be audible from areas within the immediate vicinity of the site. During the operational phase, almost negligible amounts of additional noise will be generated and therefore will not be heard from areas outside of the plant's boundary.

Consequence – In both the unmanaged and managed scenario, the consequence of this potential impact is low in all project-related phases.

Probability – In both the unmanaged and managed scenario, sensitive receptors will seldom if at all be exposed to potential impacts.

Significance – In both the unmanaged and managed scenario, the significance of this potential impact is low/insignificant.

Tabulated summary of the assessed impact per phase of the project

Management	Severity	Duration	Spatial Scale	Consequence	Probability of Occurrence	Significance
Construction / Operation / Decommissioning						
Unmanaged	**L**	**M**	**L**	**L**	**L**	**L**
Managed	**L**	**M**	**L**	**L**	**L**	**L**
Closure						
Not applicable						

Conceptual description of existing and proposed management measures

Discussion of the management measures is provided below and in the EMP (Section 8).

Objective

The objective of the management measures is to limit excessive noise pollution.

Actions

In all relevant phases, all registered complaints will be documented, investigated and efforts made to address the area of concern where possible.

Where possible, the activities most likely to cause noise pollution impacts will be restricted to daytime activities.

Emergency situations

None identified.

7.10 HERITAGE (INCLUDING CULTURAL)

Due to the positioning of project-related infrastructure within the boundaries of the existing plant, no heritage or paleontological resources occur on the project sites. No impacts are therefore expected.

7.11 VISUAL

7.11.1 ISSUE: NEGATIVE VISUAL IMPACTS

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
			-
Building activities Use of scaffolding Storage and handling of materials	Storage and handling of materials Venting of stack emissions	Dismantling of infrastructure using scaffolding	Not applicable

Assessment of impact

Introduction – The existing plant has resulted in a negative visual impact through the presence of infrastructure as well as dust plumes and stack emissions (during upset conditions) associated with the plant's activities. This is partially mitigated by the plant's location within an industrial zoned area. Project-related activities and facilities will be placed within the plant boundary and adjacent to existing facilities.

Severity – The severity of visual impacts is determined by assessing the change to the existing visual landscape. In both the unmanaged and managed scenario, the construction, operation and decommissioning of the additional storage facilities and AFR feed lines will add to the negative visual impact on site however this change is unlikely to be noticeable given the presence of existing facilities and activities. Even the use of lights at night specific for the AFR areas will not add to the existing light pollution from the site. Regardless of the related-project phase, the severity of potential impacts in both the unmanaged and managed scenarios is low.

Duration – Even in the unmanaged scenario, the construction and decommissioning of project-specific facilities will be for a few months (less than the life of the project). In the operational phase, although the activities will continue for the life of the project and plant, they are unlikely to be distinguishable from the existing activities/facilities on site resulting in a shortened period during which negative visual impacts could be experienced.

Spatial scale – Although the existing plant and facilities are visible from approximately 10km, most project-specific activities or facilities, in any phase of the project, will only be noticeable from areas within the immediate vicinity of the site.

Consequence – In both the unmanaged and managed scenario, the consequence of this potential impact is low in all project-related phases.

Probability – Even without any management the probability of noteworthy negative off-site visual impacts is unlikely.

Significance – In the unmanaged scenario, the significance of this potential impact is low in all project-related phases. In the managed scenario, the potential impact would be insignificant in all project-related phases.

Tabulated summary of the assessed impact per phase of the project

Management	Severity	Duration	Spatial Scale	Consequence	Probability of Occurrence	Significance
Construction / Operation / Decommissioning						
Unmanaged	**L**	**L**	**L**	**L**	**L**	**L**
Managed	**L**	**L**	**L**	**L**	**L**	**L**
Closure						
Not applicable						

Conceptual description of existing and proposed management measures

Discussion of the management measures is provided below and in the EMP (Section 8).

Objective

The objective of the management measures is to limit excessive visual impacts.

Actions

During construction, operation and decommissioning the following general principles apply:

- where possible, structures will be painted with colours that reflect colours of the surrounding environment;
- all dust plume sources will be managed to limit visual intrusion by dust; and
- night lights will be used only where necessary and should be designed to illuminate only that which requires illumination. The use of standard high pole flood lights should be avoided.

Emergency situations

None identified.

7.12 SOCIO-ECONOMIC

7.12.1 ISSUE: POSITIVE AND NEGATIVE SOCIO-ECONOMIC IMPACT

Given the main scope of the project (re-use of waste materials as fuel and raw material resources in the kiln) and the formal structures needed to source quality-dependent AFR materials, no significant positive or negative impacts on the socio-economic environment are expected.

7.12.2 ISSUE: LAND USE – IMPACT ON EXISTING SURROUNDING AGRICULTURAL, RECREATIONAL/ CONSERVATION AND RESIDENTIAL USES

As the land use on the project site has been impacted on by the current plant activities and no further on-site impacts are expected, this discussion focuses on potential impacts on land uses surrounding the project site. The most significant of which are residential areas, farming activities and the Lichtenburg biodiversity conservation centre to the north of the plant. The proposed changes to the cement making process have the potential to negatively impact land uses through pollution of groundwater systems (used for domestic and irrigation purposes), noise pollution and a negative change in air emissions as a result of co-processing alternative fuels and raw materials. These issues have been addressed in the respective sections above.

7.12.3 ISSUE: DISTURBANCE OF ROADS BY PROJECT RELATED TRAFFIC

Raw materials, final products and staff are currently transported to and from site via road and/or rail. During construction and decommissioning, transport of materials will be via road. The construction phase will contribute about two construction-related trucks on public roads over the total three to six-month construction period. Similarly, during the decommissioning phase, minimal additional trucks will be required to remove project-specific infrastructure/waste from site. Potential cumulative impacts during these two phases are therefore expected to be negligible.

As the proposed project will not result in additional employment, increased traffic due to staff-related transport is not applicable.

The planned method of transport for the operational phase of the project is mainly via rail. The use of rail transport during the operational phase ensures that project-related disturbance of public roads and related impacts on road-users are kept to a minimum. Should rail facilities be not available, road transport will be used. However, this is expected to be ad hoc and for short periods of time.

7.12.4 ISSUE: SAFETY HAZARDS

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
-			-
Not applicable	Storage and handling of materials	Dismantling of infrastructure and disposal of left over AFRs	Not applicable

Assessment of impact

Introduction – The storage and handling of AFR materials (waste) has the potential to result in safety hazards for third parties during the operational and decommissioning phases of the project. Given the location of the AFR project sites within the boundaries of the fenced plant, this section focuses on the potential risks to visitors entering the plant. This assessment does not consider employees as this is covered by the relevant occupational health and safety legislation.

Severity – The incorrect storage and handling of AFRs on site could present a potential risk of injury and/or death to third parties visiting the plant. This injury or death could result from unexpected fires and/or explosions. Regardless of the related-project phase, the severity of potential impacts in the unmanaged scenario is high and reduces to low with the implementation and maintenance of management measures.

Duration – In the context of this assessment, death or permanent injury to third parties is considered long term and permanent.

Spatial scale – For the most part the direct impacts will be located within the site boundary, but the indirect impacts will extend to the communities to which the people below. This is applicable to all phases, in both the unmanaged and managed scenario.

Consequence – In the unmanaged scenario, the consequence of this potential impact is high. With management it reduces to low.

Probability –In the case of third parties in the unmanaged scenario there is a high possibility that safety hazards will present a risk to unaccompanied third parties on-site. With management the risk is unlikely.

Significance – In the unmanaged scenario, the significance of this potential impact is high. In the managed scenario, the significance reduces to low as the probability of impacts occurring is low.

Tabulated summary of the assessed impact per phase of the project

Management	Severity	Duration	Spatial Scale	Consequence	Probability of Occurrence	Significance
Operation, Decommissioning						
Unmanaged	**H**	**H**	**M**	**H**	**H**	**H**
Managed	**L**	**H**	**M**	**M**	**L**	**L**
Construction, Closure						
Not applicable						

Conceptual description of existing and proposed management measures

Discussion of the management measures is provided below and in the EMP (Section 8).

Objective

The objective of the management measures is to prevent unnecessary risk to third parties.

Actions

In all project phases, the storage and handling of AFRs shall be done in a safe and responsible manner so as to minimise the potential for emergency situations.

During the operation and decommissioning phases, the following measures will be implemented:

- Security control measures will be maintained at all access points to the site.
- No visitors will be allowed to enter the site, and specifically AFR storage and handling areas, unless accompanied by a Lafarge representative.
- Where required, visitors will be informed of the hazards associated with AFRs.
- Lafarge will develop and maintain material data safety sheets (MSDS) for all AFRs to be used by the project. These will be available on site at all times.
- All waste tyres must be dealt with in terms of the Waste Tyre Regulations, 2008.
- All hazardous areas will be clearly demarcated with appropriate signage and access control.
- Where required, fire prevention and first aid devices will be established.

During decommissioning, any leftover AFR materials will be disposed of in an appropriate manner at a permitted disposal facility.

Emergency situations

Any injury to a third party will be considered an emergency situation. Lafarge will follow the emergency response procedure included in Section 8.4.

7.13 INTERESTED AND AFFECTED PARTIES

The environmental assessment public participation process is described Section 2. All issues raised by the public including responses to these issues, have been included in Appendix D.

During the consultation process, many stakeholders raised concerns regarding Lafarge's ongoing communication with communities surrounding the cement plant. In this regard, as part of the public feedback process on this EIA/EMP process, an open day has been planned to assist Lafarge in meeting its stakeholder communication commitments. The details of the planned open day are included in Section 2.2.

In addition to this, Lafarge will:

- set up a structured communication process with neighbouring communities and other key stakeholders in line with best practice;
- arrange and facilitate regular communication with its stakeholders through newsletters and information-sharing meetings; and
- keep a record of all meetings for auditing purposes.

8 ENVIRONMENTAL MANAGEMENT PROGRAMME

8.1 ENVIRONMENTAL MANAGEMENT PROGRAMME

This section provides a tabular view of the project's activities, associated impacts and management measures as well as responsible parties and timeframes for implementing measures (see Table 8.1). Only those aspects for which impacts were identified are included in the table.

8.2 MONITORING PROGRAMME

The specific monitoring measures as per the commitments in the EMP are included below.

8.2.1 MONITORING OF AFRS AND QUALITY CONTROL

Loading and initial quality control of AFRs will take place at the Kaalfontein facility and therefore fall out of the scope of this project. Lafarge must ensure that the quality of AFRs prepared at the facility meet the requirements of the air quality study (see Appendix E).

The monitoring of AFRs as they arrive at the Lichtenburg plant will be undertaken by plant personnel. This will comprise a visual inspection of the transport facilities and materials where possible to ensure no tampering has taken place en-route and ad hoc sampling and analysis of AFR materials.

The visual inspection will be undertaken for every wagon and tanker entering the site and a record of the inspection kept for auditing purposes.

Ad hoc sampling of AFR materials and more specifically the blended liquid wastes and SSWs will be done. As a general approach, Lafarge will ensure that the monitoring programme comprises:

- a formal procedure;
- the use of a an accredited, independent, commercial laboratory for undertaking sample analyses;
- parameters to be monitored will be identified in consultation with a specialist in the field and/or the relevant authority;
- the results will be stored in a structured database;
- reports on the data and its compliance with set criteria will be compiled by an appropriately qualified person on a quarterly basis; and
- both the data and the reports will be kept on record for the life of project.

TABLE 8.1: ENVIRONMENTAL MANAGEMENT PROGRAMME

Issues/Impact	Activities	Project phase	Sig		Proposed management measures	Timeframe	Frequency	Responsible parties
			UM	M				
Water resources								
Groundwater pollution (Section 7.7.3)	Handling and storage of building materials Handling and storage of AFRs Handling and storage of used equipment, materials Waste management Remaining infrastructure and materials – if not removed from site (unlikely)	C O D C,O,D Cl	L	L	• Lafarge will ensure all potentially polluting materials are handled in a manner that they do not pollute groundwater. • Storage facilities will be on impermeable floors, have appropriate runoff containment measures, bunded areas capable of holding 125% spill volume. • Where necessary, storage facilities will be placed undercover. • No potentially polluting materials will be stockpiled directly on bare ground. • Existing stores, workshops and re-fuelling areas will be used – no new facilities will be established. • Maintain measures in good working order. • Training of all workers on handling and storage of AFR materials on site. • Ad hoc spills of potentially polluting substances (even in dirty areas) will be reported to the environmental manager and cleaned up immediately. • All project activities will take place within the bounds of a surface dirty water management system that complies with R704. • Continue to implement waste management practices. • Remove all un-used AFR materials from site. • Implement incident management system.	All phases Construction and operation Construction and operation Construction and operation Construction to decommissioning Construction and operation Construction to decommissioning Construction to decommissioning All phases Decommissioning All phases	Ongoing Ongoing Ongoing Ongoing Ongoing Ongoing Ongoing Ongoing Ongoing Once off Ongoing	Environmental Manager
Air quality								
Emissions (Section 7.8)	Use of AFRs	O	H	M-L	• Maintain an air quality management plan for the site in consultation with an appropriately qualified specialist. • Comply with ACMP Policy on Secondary Materials and the National Policy on Thermal Treatment of General and Hazardous Waste (see Appendix F). • Introduce AFR materials one stream at a time starting with trial burns ramping up to full-scale production in a controlled manner. Only once stable conditions are achieved for the first stream will Lafarge consider introducing the next stream. • Maintain good control and performance of air pollution control equipment, such as regular inspections and maintenance. Maintain high availability of air pollution control equipment at all the plant. AFRs will not be used during failure of air pollution control devices. • Comply with the conditions of the air emission license as amended from time to time.	Operation Operation Operation Operation	Ongoing Ongoing As required Ongoing Ongoing	Environmental Manager

Issues/Impact	Activities	Project phase	Sig		Proposed management measures	Timeframe	Frequency	Responsible parties
			UM	M				
Emissions continued.					• Investigate options with the local municipality and neighbouring industries to introduce ambient air monitoring stations or programmes in the region to help assist with determining problem areas and working towards creating a better ambient air quality.	Prior to operation	As required	
					• Monitor air quality in accordance with the programme set out in the air emission license application as amended from time to time.	Operation	Monthly and annually	
					• If the monitoring results show unacceptable impacts, use of AFR will be stopped and/or reduced in consultation with the relevant department until such time as Lafarge can prove the impacts to be acceptable.	Operation	As required	
					• Limit fuel replacement rate, the heavy metal content of the AFR (specifically lead, mercury and thallium) or both.	Operation	Ongoing	Environmental manager
					• Emission limits as set in the National Policy on Thermal Treatment of General and Hazardous Waste, July 2009 will be met by Lafarge. If these emission limits are exceeded, Lafarge will immediately stop the feed of AFRs to the kilns.	Operation	Ongoing	
					• No AFR materials will be used in the start-up and/or shut down of the kilns. AFRs will only be used when the kiln temperature achieves the required quality standards for clinker.	Operation	As required	
					• Full records of the batch calculations should be kept for regular reporting to the licensing authorities.	Operation	Ongoing	
					• Any failure of the air pollution control equipment is considered an emergency situation and will follow the emergency response procedure.	Emergency	As required	
Noise								
Noise pollution (Section 7.9.1)	Vehicle movement General building activities General operational activities Dismantling of infrastructure	C,O,D C O D	L	L	• In all relevant phases, all registered complaints will be documented, investigated and efforts made to address the area of concern where possible.	Construction to decommissioning	As required	Environmental Manager
					• Where possible, the activities most likely to cause noise pollution impacts will be restricted to daytime activities.	Construction to decommissioning	As required	

Issues/Impact	Activities	Project phase	Sig		Proposed management measures	Timeframe	Frequency	Responsible parties
			UM	M				
Visual aspects								
Negative visual impacts (Section 7.11.1)	Building activities Use of scaffolding Storage and handling of materials Venting of modified stack emissions	C C,D C,O O	L	L	• Where possible, structures will be painted with colours that reflect colours of the surrounding environment. • All dust plume sources will be managed to limit visual intrusion by dust. • Night lights will be used only where necessary and should be designed to illuminate only that which requires illumination. The use of standard high pole flood lights should be avoided.	Construction Construction to decommissioning Construction to decommissioning	As required Ongoing Ongoing	Environmental Manager
Socio-economic – Land use								
Safety hazards (Section 7.12.4)	Storage and handling of materials Dismantling of infrastructure and disposal of leftover AFRs	O D	H	L	• The storage and handling of AFRs shall be done in a safe and responsible manner so as to minimise the potential for emergency situations. • Security control measures will be maintained at all access points to the site. • No visitors will be allowed to enter the site, and specifically AFR storage and handling areas, unless accompanied by a Lafarge representative. • Where required, visitors will be informed of the hazards associated with AFRs. • Lafarge will develop and maintain material data safety sheets (MSDS) for all AFRs to be used by the project. These will be available on site at all times. • All waste tyres must be dealt with in terms of the Waste Tyre Regulations, 2008. • All hazardous areas will be clearly demarcated with appropriate signage and access control. • Where required, fire prevention and first aid devices will be established. • During decommissioning, any leftover AFR materials will be disposed of in an appropriate manner at a permitted disposal facility. • Any injury to a third party will be considered an emergency situation and will follow the emergency response procedure.	Operation to decommissioning Operation to decommissioning Operation to decommissioning Operation to decommissioning Prior to operation Operation to decommissioning Operation to decommissioning Operation to decommissioning Decommissioning Emergency	Ongoing Ongoing Ongoing As required Once off and ongoing Ongoing Ongoing Ongoing Once off As required	Environmental manager
Interested and affected parties								
Interested and affected parties (Section 7.13)	The plant	C,O,D,Cl	-	-	• Set up a structured communication process with neighbouring communities and other key stakeholders in line with best practice. • Arrange and facilitate regular communication with its stakeholders through newsletters and information-sharing meetings. • Keep a record of all meetings for auditing purposes.	All phases All phases All phases	Once off As required (annual as a minimum) As required	Environmental Manager

Issues/Impact	Activities	Project phase	Sig		Proposed management measures	Timeframe	Frequency	Responsible parties
			UM	M				
General management commitments					• Include commitment in contractor's agreement that binds contractors to the content of the EMP.	All phases	As required	Plant Manager and Environmental Manager
					• Submission of information as detailed in Section 8.2.4:			
					- Conduct and submit EMP performance assessment to DMR	All phases	Every 2 years	
					- Compile (by qualified person) and submit closure cost update to DMR	All phases	Annually	
					- Submit water monitoring report to DWA	All phases	Annually	
					- Submit air monitoring reports to DMR and DEDECT	All phases	Annually	

8.2.2 AIR QUALITY

Lafarge will ensure that its air quality monitoring programme includes the following:

- The requirements of the National Policy on Thermal Treatment of General and Hazardous Waste, July 2009, will be included in Lafarge's air monitoring programme (see Appendix F).
- A sampling programme for ambient particulate matter will be implemented to the west of the plant close to the Lafarge residential area. This should include measurement of meteorological parameters, dust deposition rate and regular measurements of daily average PM_{10} concentration. Should these screening measurements indicate frequent exceedences of the proposed SA standards, more sophisticated measurements methods such as continuous monitoring will be instituted.

8.2.3 GENERAL

The environmental manager will conduct internal management audits against the commitments in the EIA/EMP amendment report. During the construction phase, these audits will be conducted every two weeks. In the operational phase, these audits will be conducted on a quarterly basis. The audit findings will be documented for both record keeping purposes and for informing continual improvement. In addition, and in accordance with mining regulation R527, an independent professional will conduct an EMP performance assessment every 2 years. The site's compliance with the provisions of the EMP and the adequacy of the EIA/EMP amendment report relative to the on-site activities will be assessed in the performance assessment.

8.2.4 SUBMISSION OF INFORMATION

As a minimum, the following documents will be submitted to the relevant authorities on an ongoing basis:

- EMP performance assessment, submitted every two years to DMR;
- updated closure cost estimate, submitted annually to the DMR;
- water monitoring reports, submitted annually to DWA – these reports will not only present monitoring data (surface and groundwater) but will also provide interpretations of trends in the data and reporting on compliance with water quality guidelines;
- air monitoring reports, submitted annually to the DMR and DEDECT; and
- detailed plan for decommissioning/closure, submitted to DMR five years prior to decommissioning.

8.3 ENVIRONMENTAL AWARENESS PLAN – AFR PROJECT

8.3.1 PURPOSE OF THE ENVIRONMENTAL AWARENESS PLAN

This plan describes the environmental awareness programme for Lafarge's AFR project. The purpose of the plan is to ensure that all personnel and management understand the general environmental

requirements of co-processing AFRs on site. In addition, greater environmental awareness must be communicated to personnel involved in specific activities which can have a significant impact on the environment and ensure that they are competent to carry out their tasks on the basis of appropriate education, training and/or experience.

8.3.2 AFR ENVIRONMENTAL POLICY

A copy of Lafarge's Resource Recovery policy is included in Appendix F.

8.3.3 TRAINING OBJECTIVES OF THE ENVIRONMENTAL AWARENESS PLAN

The environmental awareness plan ensures that training needs are identified and that appropriate training is provided. The environmental awareness plan should communicate:

1. the importance of conformance with the AFR policy, procedures and other requirements of good environmental management;
2. the significant environmental impacts and risks of individuals work activities and explain the environmental benefits of improved performance;
3. individuals roles and responsibilities in achieving the aims and objectives of the policy; and
4. the potential consequences of not complying with environmental procedures.

8.3.4 GENERAL CONTENTS OF THE ENVIRONMENTAL AWARENESS PLAN WITH RESPECT TO AFRS

To achieve the objectives of the environmental awareness plan the general contents of the AFR training plans are as follows:

1. Module 1 – Basic training plan applicable to all personnel and visitors entering the site:
    a. Short (15min) presentation to be included with induction indicating the layout and activities together with their environmental aspects and potential impacts.
    b. Individuals to sign off with site security on completion in order to gain access to the site.
2. Module 2 – Specific training plan:
    a. Lafarge and international AFR policies and guidelines;
    b. Quality control procedure at gate;
    c. Storage and handling methods;
    d. Impact of environmental aspects, for example:
        i. Spillages;
        ii. Groundwater contamination; and
        iii. Dust and emission impacts on local communities (nuisance and health implications).
    e. Emergency response training

Individuals required to complete Module 2 (Specific training module) will need to complete Module 1 first. On completion of the Module 2, individuals will be subject to a short test (written or verbal) to ensure the level of competence has been achieved. Individuals who fail the test will be allowed to re-sit the test after further training by the training department.

The actual contents of the training modules will be developed based on a training needs analysis.

8.4 EMERGENCY RESPONSE PROCEDURES

Emergency procedures apply to incidents that are unexpected and that may be sudden, and which lead to serious danger to the public and/or potentially serious pollution of, or detriment to the environment (immediate and delayed). Emergency environmental situations that have been identified for the AFR project are discussed in Section 8.4.2.

8.4.1 GENERAL EMERGENCY PROCEDURE

The general procedure that should be followed in the event of all emergency situations is as follows.

- Applicable operational managers must be notified of an incident upon discovery;
- Area to be cordoned off to prevent unauthorised access and tampering of evidence;
- If facilities are partially or totally failing and this cannot be prevented, the emergency siren is to be sounded (nearest one available). After hours the Plant Manager on shift must be notified;
- Take photographs and samples as necessary to assist in investigation;
- Report the incident to the responsible person of the Safety, Health Environment and Quality (SHEQ) department (or equivalent);
- The SHEQ department must comply with Section 30 of the National Environmental Management Act (107 of 1998) such that:
    - The SHEQ department must immediately notify the Director-General (DEAT, DMR and Inspectorate of Mines as appropriate), the South African Police Services, the relevant fire prevention service, the provincial head of DACE, the head of the local municipality, the head of the regional DWA office and any persons whose health may be affected of;
    - The nature of the incident;
    - Any risks posed to public health, safety and property;
    - The toxicity of the substances or by-products released by the incident; and
    - Any steps taken to avoid or minimise the effects of the incident on public health and the environment.
- The SHEQ department must as soon as is practical after the incident:
    - Take all reasonable measures to contain and minimise the effects of the incident including its effects on the environment and any risks posed by the incident to the health, safety and property of persons;

  - Undertake clean up procedures;
  - Remedy the effects of the incident; and
  - Assess the immediate and long term effects of the incident (environment and public health);
- Within 14 days the SHEQ department must report to the Director-General DEAT, the provincial head of DACE, the head of the local municipality, the head of the regional DWA office such information as is available to enable an initial evaluation of the incident, including:
  - The nature of the incident;
  - The substances involved and an estimation of the quantity released;
  - The possible acute effects of the substances on the persons and the environment (including the data needed to assess these effects);
  - Initial measures taken to minimise the impacts;
  - Causes of the incident, whether direct or indirect, including equipment, technology, system or management failure; and
  - Measures taken to avoid a recurrence of the incident.

8.4.2 IDENTIFICATION OF EMERGENCY SITUATIONS

The emergency situations that have been identified together with specific emergency response procedures are discussed below.

Spillage of AFR materials within the plant

In the case of major spillages, Lafarge has contracted Spill Response Team (SRT) to deal with any major spillage that we may be encountered in the plant. The following procedure is followed:

- Ensure the immediate safety of anyone within the vicinity of the spill.
- Evacuate the immediate area around the spill.
- Report the spill to your supervisor and Control Room Operator (CRO) at 3159/3254 and Security at 3076/3066
- CRO will call SRT on 080077825326
- Anyone who has been exposed must, if safe to do so, be moved to a safe decontamination area. The treatment of serious injury must take precedence over decontamination and containment.
- If unsure of the hazards presented and associated risks to safety and health, consult your supervisor, or Safety Officer, or Safety and Health prior to taking any action.
- Restrict unnecessary movement into and through the area to avoid spreading contamination. Isolate the affected area at a safe distance by erecting a temporary barricade and placing suitable warning signs.
- It may be necessary to turn off the air conditioning to restrict the spread of gases and vapours.

- Clean-up: Do not re-enter the area until it has been decontaminated by personnel trained and equipped specifically in chemical safety. For any clean-up activities there must be a minimum of two people.
- Evacuate: Evacuate the building as instructed to do so by the emergency personnel. Walk quickly and calmly to the assembly area or as advised by the emergency personnel. Remain in the assembly area in groups.
- In the case of a fire every effort must be made to prevent undue spreading of contamination. However, fire fighting must take precedence over the control of contamination. Do not switch any electrical equipment (including light switches) ON or OFF, as these may spark and become an ignition source.

Failure of air pollution control equipment

In the event of failure of the air pollution control equipment, the plant equipment will be stopped when emissions are high. The following procedure will apply:

- If the emissions exceeds the limits during working hours, the Shift Supervisor will inform the Production Engineer who will inform the Environmental Engineer.
- If the emissions exceed the limits after hours, the Shift Supervisor will inform the Production standby and, he is to inform the Standby Manager.
- The Environmental Engineer is to inform Plant Manager and he, in turn inform the Chief Air Pollution Control Officer.

Injury to third parties

In the event that a third party is injured on site, Lafarge will:

Internal Incident Reports

- All injuries, occupational illnesses, diseases, environmental incidents and other incidents must be reported and recorded
- A complete description must be recorded of all incidents
- The SHE Committee, the SHE Representative and representative trade union must be informed of all SHE – related incidents in writing and records be kept
- Reported incidents must be discussed and noted in the minutes of the SHE Committee meeting and records be kept
- Records must be kept of all reports to external parties e.g. Department of Labour, Department of Mineral Resources (DMR), Compensation Commissioner, and Rail Safety Regulator.

Fatal and LTI Incident

- All fatal and LTI incidents involving Lafarge employee, contractor, or third party shall be reported by the Site Manager to the BU General Manager(CEO) and BU Health & Safety Manager IMMEDIATELY(by phone and/or email). NB: Do not wait until an investigation is conducted
- Site Health & Safety Officer (where appropriate) shall ensure that all fatal and LTI incidents are reported properly.

- Site Manager shall initiate preliminary investigation immediately and send report to BU Health & Safety Manager and Health and Safety Coordinator
- BU Health & Safety Manager shall inform BU Manager and relevant Exco Members of such report upon receipt
- The CEO shall notify the Health and Safety SVP and VP
- Formal investigations shall commence immediately to determine the root causes, contributing factors and the corrective actions to be implemented to prevent recurrence. An investigation report should be completed within 3 days.
- BU Health & Safety Manager shall advise the sites of the members of the investigation team where necessary e.g. the manager, SHE Representative, Union Representative, Health and Safety practitioner, Witness(es).
- Site Health and Safety Officer shall compile fatality flash in case of fatal incident and SER for LTI for communication purposes using the prescribed format. Both fatality flash and SER shall contain root causes, preventative actions and lessons learnt
- Site management shall review the incident with their departments and keep records of the review.

Medical Injury

- All Medical injury involving Lafarge employee, contractor, or third party shall be reported by the Site Manager to BU Health & Safety Manager within 24 hours
- BU Health & Safety Manager shall notify BU Manager (CEO) and Health and Safety Director
- Site Manager shall initiate preliminary investigation with 48 hours and send report to BU Health & Safety Manager and Health and Safety Coordinator
- BU Health & Safety Manager shall inform BU Manager and relevant Exco Members of such report upon receipt
- Formal investigations shall commence immediately to determine the root causes, contributing factors and the corrective actions to be implemented to prevent recurrence. An investigation report should be completed within 5 days.
- Site Health and Safety Officer shall compile SER for communication purposes, using the prescribed format. SER shall contain root causes, preventative actions and lessons learnt

First Aid and Near – Miss Incidents

- All First Aid and Near –miss incidents involving Lafarge employee, contractor, or third party shall be reported by the Site Health & Safety Officer to BU Health & Safety Manager and Health and Safety coordinator on Weekly basis using prescribed Weekly Incident Report Format
- Health & Safety Coordinator shall compile weekly report of all first aid and near-miss incidents reported within the BU. This report shall be communicated to BU Manager and Exco members
- All first aid and near-miss incidents shall be investigated within 7 days
- Incident Investigation process shall determine the root causes, contributing factors and the corrective actions to be implemented to prevent recurrence.
- Site Health and Safety Officer may compile SER depending on the possible severity of incident.

8.5 CLOSURE FINANCIAL PROVISION

Metago calculated a project-specific closure cost estimate in line with the DMR's guideline method. A copy of the full report is included in Appendix G. The financial closure liability associated with the proposed project has been calculated to be R92,892.44 (including VAT). Should this be acceptable to the DMR, Lafarge and the DMR should agree on the method of provision.

8.6 UNDERTAKING SIGNED BY APPLICANT

COMMITMENT/UNDERTAKING BY APPLICANT

I,.....

the undersigned and duly authorised thereto by

.....……

undertake to adhere to the requirements and to the conditions set out in the approved EMP with the exception of the exemption(s) and amendment(s) agreed to be relevant by the Regional Manager: _____ (include relevant province).

Signed at: .....……

On: .....

Signature: ……...……..

Designation: ……...……..

REGIONAL MANAGER: _____ REGION

In terms of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) this document of ……. is approved subject to the conditions as set out in the letter of approval.

Signed at: .....……...

On: .....

Signature: ……..

Designation: ……..

REGIONAL MANAGER: _____

9 ASSUMPTIONS, UNDERTAINTIES AND LIMITATIONS

Any assumptions, uncertainties and gaps in information relevant to specialist and technical information used are provided below.

9.1 TECHNICAL ASSUMPTIONS

This report has been compiled using the best available information at the time.

9.2 AIR QUALITY STUDY

The following key assumptions were made during the air quality study.

For baseline conditions measured emission values were used in a dispersion calculation in order to determine the current impact on the surrounding environment and to provide a baseline from which to understand cumulative impacts. For the project, conservative methods were used to estimate emission values for dioxins and furans with the use of AFR.

For the project under consideration, exact compositions (in terms of the heavy metal content) of the AFR to be used were not available. The approach followed for these pollutants was therefore to calculate the maximum amounts of heavy metals in the kiln feed that can be tolerated for the emission standards not to be exceeded, and then to determine the ambient impact of the pollutants at the emission standard concentrations. Management measures to ensure that the maximum allowable amounts of heavy metals are not exceeded have been included in the management plan.

The air specialist results assume that all emissions of nitrogen oxides from the kiln occur as nitrogen dioxide, which is a conservative assumption.

As the weighted average sulphur content of the alternative fuels is lower than that of the coal presently used, and the sulphur (sulphate/sulphide) content of the raw material will not be influence by the use of the AFR, the same sulphur dioxide concentration was taken for the use of alternative fuels. There is some evidence that emissions of both sulphur dioxide and the oxides of the nitrogen may be reduced by the use of tyres as a substitute for coal (Schreiber et al. 2006), but as a conservative measure this reduction was not allowed for in the emission inventory.

Highly conservative assumptions were made to calculate emissions for the ambient health impact comparisons. These values are unlikely to occur for any material period of time during normal operations.

No emission rates for the start-up and shut down phases are available and they were therefore not modelled except for the heavy metal emissions; the time periods are however short. It has been assumed that kilns will be started up and shut down, and will be returned to normal steady state operation after upsets, using coal only.

10 ENVIRONMENTAL IMPACT STATEMENT & CONCLUSION

This document presents the project plan as defined by Lafarge, presents findings of specialist studies, identifies and assesses potential impacts on the receiving environment in both the unmanaged and managed scenarios, including cumulative impacts, and identifies measures together with monitoring programmes to monitor and mitigate potential impacts.

A summary of the potential impacts (as per Section 7 of the EIA/EMP report), in the unmanaged and managed scenarios is included in Table 10.1 below. The assessment of the proposed project presents the potential for significant impacts to occur on the bio-physical, cultural and socio-economic environments both on the site and in the surrounding area.

TABLE 10.1: TABULATED SUMMARY OF POTENTIAL IMPACTS

Potential impact	**Significance of the impact (the ratings are negative unless otherwise specified)**							
	Construction		**Operation**		**Decommissioning**		**Closure**	
	Unman.	**Man.**	**Unman.**	**Man.**	**Unman.**	**Man.**	**Unman.**	**Man.**
Contamination of groundwater	Low	Low	Low	Low	Low	Low	Low	Low
Negative change in air emissions	Not applicable		High	Medium to low	Not applicable		Not applicable	
Noise pollution	Low	Low	Low	Low	Low	Low	Not applicable	
Negative visual impact	Low	Low	Low	Low	Low	Low	Not applicable	
Safety hazards	Not applicable		High	Low	High	Low	Not applicable	

Provided that all the objectives, actions and procedures included in Section 8 (the EMP) are implemented, Metago is of the view that there is no environmental reason why this project and the associated activities should not be approved. Key to this is Key to this is compliance with the National Policy for the Thermal Treatment of General and Hazardous Waste (Government Notice 777, DEA 2009), careful planning on the sourcing and blending of AFRs that meet the required specifications, responsible implementation of the project by Lafarge and monitoring to confirm predicted impacts and where necessary, provide input on additional management measures if required.

Alex Pheiffer (PrSciNat)
(Project Manager)

Brandon Stobart (EAPSA)
(Project Reviewer)

Stella Moeketse
(Project Assistant)

Metago Environmental Engineers (Pty) Ltd

11 STATUTORY REQUIREMENTS

This section does not cover occupational health and safety legislation requirement. It also does not cover existing approved activities.

Primary authorisation, for the activities described and assessed in the EIA/EMP amendment, is required both from the DMR in terms of the Mineral and Petroleum Resources Development Act, 28 of 2002 and the DACERD in terms of the National Environmental Management Act, 107 of 1998.

Depending on the review and input of DACERD on the EIA/EMP amendment report, a waste use license in terms of the National Environmental Management: Waste Act, 59 of 2008, may be required for waste-related activities.

An (amended) air emission license, for scheduled processes described and assessed in the EIA/EMP amendment, is required from the relevant competent authority in terms of the National Environmental Management: Air Quality Act, 39 of 2004.

12 REFERENCES

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SRK Consulting, October 2006: Lafarge Lichtenburg Cement Production Facility: Amendment to the Environmental Management Programme Report, Johannesburg

APPENDIX A: INFORMATION-SHARING WITH AUTHORITIES

- Relevant sections of the original NEMA application (June 2009)
- DACE letter of acknowledgement
- Minutes of meeting held with DACERD (Environment, Air Quality and Waste Management) on 6 October 2009
- Written comments received – DWAF, DAFF, DMR
- DEDECT comments on scoping report (July 2011)
- Proof of document delivery (August 2011)
- Submission of Waste License application (September 2011)

APPENDIX B: PUBLIC INVOLVEMENT DATABASE

APPENDIX C: INFORMATION SHARING WITH IAPS

- Background information document
- Proof of distribution of BIDs (source material available on request) and EIA/EMP reports (12 August 2011)
- Minutes of social scan meetings held on 29 June and 9 July 2009.
- Site notices displayed in project area on 17 July 2009: Site notice in English, Afrikaans and Setswana, photographs of site notices.
- Newspaper advertisements placed in: Daily Sun and Noordwester on 17 July 2009.
- Minutes of public scoping meetings held in Blydeville, Boikhutso and Lichtenburg on 18 August 2009.
- Written correspondence from IAPs during the Scoping process.
- Scoping report summary in English, Afrikaans and Setswana (distributed on 12 November 2009)
- Newspaper advertisement placed in the Daily Sun, Noordwester and Mafikeng Mail on 11 – 12 August 2011
- EIA/EMP report summary in English, Afrikaans and Setswana (distributed on 12 August 2011)
- Minutes of the feedback open day held at Lafarge recreational club on 21 September 2011.
- Written correspondence received by Metago from IAPs.

APPENDIX D: SUMMARY OF ISSUES RAISED BY AUTHORITIES AND IAPS

APPENDIX E: AIR STUDY

Report prepared by Airshed Planning Professionals (April 2011)

APPENDIX F: INFORMATION SUPPLIED BY LAFARGE

- ACMP Policy for secondary materials, November 2004
- National Policy on Thermal Treatment of General and Hazardous Waste, July 2009
- Lafarge Resource Recovery policy, April 2007

APPENDIX G: CLOSURE COST CALCULATION

Metago Environmental Engineers (Pty) Ltd
Consulting Engineers and Scientists

RECORD OF REPORT DISTRIBUTION

Project Number:	L017-01
Title:	ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT PROGRAMME REPORT FOR THE PROPOSED USE OF SECONDARY (WASTE) MATERIALS AS ALTERNATIVE FUELS AND RAW MATERIALS (AFRS) AT LAFARGE'S CEMENT PLANT IN LICHTENBURG
Report Number:	3
Proponent:	Lafarge Industries South Africa (Pty) Limited

Name	Company	Copy No.	Date issued	Issuer
Manukha Vhudzisani	Department of Mineral Resources	1 - 6	10 August 2011	A Pheiffer
Tshilidzi Masalesa/ Rudzani Mashamba	Department of Water Affairs and Forestry (Mmabatho)	7	By 12 August 2011	A Pheiffer
Dr Shauna Costley	DEAT: Thermal Waste Treatment	8	By 12 August 2011	A Pheiffer
Dee Fischer	DEAT: Waste Stream Management	9	By 12 August 2011	A Pheiffer
Prince Mkhontho	DEAT: Air Quality Air Pollution Control Officer	10	By 12 August 2011	A Pheiffer
Tumi Sehoole	Department of Health	11	By 12 August 2011	A Pheiffer
Lerato Foloti	Department of Land Affairs	12	By 12 August 2011	A Pheiffer
Anton Maluka	Department of Agriculture	13	By 12 August 2011	A Pheiffer
Ntombi Mkhosi	Ngaka Modiri Molema District Municipality	14	By 12 August 2011	A Pheiffer
Nono Kekesi	Ditsobotla Local Municipality	15	By 12 August 2011	A Pheiffer
Public review	Lichtenburg Public Library C/o William van der Walt	16	By 12 August 2011	A Pheiffer
Public review	Ditsobotla Local Municipality C/o Security	17	By 12 August 2011	A Pheiffer
Public review	Boikhutso Community Library C/o Norah Mohushekiwe	18	By 12 August 2011	A Pheiffer
Public review	Blydeville Clinic C/o Nurses	19	By 12 August 2011	A Pheiffer
Public review	Lafarge Cement Plant C/o Skhumbuzo Mzoboshe	20	By 12 August 2011	A Pheiffer
Librarian	Metago's library in Johannesburg	21	By 12 August 2011	A Pheiffer
Following public review				
Joyce Mautsu	Department of Economic Development, Environment, Conservation and Tourism – Waste Management	22-26	September 2011	A Pheiffer

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