Environmental Management

Code of Practice:

Management of Potential Environmental Impact

at

Temporary Asphalt Plants

PREFACE

Sabita is committed to assure that all Sabita members and Associate members adhere to and comply with environmental legislation relevant to the production of asphalt products at fixed and temporary asphalt production plants distributed throughout Southern Africa.

Health, Safety and Environmental issues at an asphalt plant are addressed in the Sabita HSE Management System. Health and Safety management is adequately addressed but Environmental aspects to a lesser extent.

Given the increasing pressure on organisations to visibly demonstrate intent with sustainable development, and the ever-changing environmental legislative landscape, Sabita has realised that there is a need to address Environmental Management aspects separately and in greater detail. In particular, the need for this Code of Practice became an imperative when the National Air Quality Act (Act 39 of 2004) finally took effect in April 2010.

The development of this document has been the initiative and the task of the Sabita Environmental Working Committee (EWC) that deals with Environment issues. To ensure comprehensive stakeholder representation the membership of the EWC consisted of Government Environmental Authorities, Sabita staff and Members (asphalt producers), and Safety, Health, Environment, and Quality management consultants. Sabita gratefully acknowledges the following persons/organisations for their dedication and contributions towards the production of this best practice guideline:

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1. Introduction

The **Southern African Bitumen Association (SABITA)**, established in 1979, is a non-profit organization that represents producers and applicators of bituminous products, consulting engineers and educational institutions.

The main aims and objectives of Sabita consist of advancing best practice in Southern Africa in connection with:

- Use and application of bituminous materials;
- Worker health and safety, and environmental conservation;
- Education and training; and
- Contact with government on the value of road provision and preservation.

In pursuit of these objectives Sabita introduced a Health, Safety and Environmental (HSE) Charter in 2007. In terms of the Charter, all Sabita members undertake to implement the best available techniques to protect the health, safety and wellbeing of all employees, and conserve the environment during the handling and application of bituminous materials.

In support of the HSE Charter Sabita also introduced an HSE Management System (HSE MS) for Member organisations in 2010 and the expectation is that Members will manage HSE within their organisations pursuant to the requirements of the Sabita HSE MS.

2. Purpose of this document

The main objectives of this document are:

- ❒ To provide for a universally accepted Code of Practice that shall be applied as a mandatory standard for SABITA members that operate Temporary Asphalt Plants;
- ❒ To demonstrate that a risk based approach was followed to provide an Environmental Management Plan that addresses the potential environmental impact from Temporary Asphalt Plants;
- ❒ To facilitate the expeditious completion of the process of application and issuing of atmospheric emission licenses for Temporary Asphalt Plants;

This document is also incorporated as an addendum to the Sabita HSE MS to provide guidance for continuous improvement of overall Environmental Management performance.

3. Scope of application

Regardless of degree of mobility of a plant (fixed or temporary) the principles of asphalt production stay the same.

This document provides generic standards and requirements that can be applied across all types of asphalt producing plants regardless of size and state of mobility. The following activities are however excluded from the scope of this document:

- The environmental impact of the laying of the asphalt on the road, consisting mainly of emissions and noise production, forms no part of this document;
- Asphalt plants are often located near or in a quarry; however, this document does not cover quarrying operations.

4. Definitions, terms and abbreviations

In order to ensure universal understanding the following legal and industry definitions, terms and abbreviations used in this document have the following meaning:

"air pollution" means any change in the composition of the air caused by smoke, soot, dust (including fly ash), cinders, solid particles of any kind, gases, fumes, aerosols and odorous substances;

"ambient air" excludes air regulated by the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993);

"atmospheric emission" or **"emission"** means any emission or entrainment process emanating from a point, non-point or mobile source that results in air pollution;

"atmospheric emission licence" means an atmospheric emission licence contemplated in Chapter 5 of the National Environmental Management: Air Quality Act 39 Of 2004;

"fixed asphalt plant" means a static or permanent asphalt plant which is a high production capacity asphalt plant operating from an authorized industrial zoned site and erected on a permanent foundation infrastructure serving multiple customers simultaneously.

"fugitive emissions" means emissions to the air from a facility for which an emission licence has been issued, other than those emitted from a point source;

"licensing authority" means an authority referred to in section 36(1), (2), (3) or (4) responsible for implementing the licensing system set out in Chapter 5 of the National Environmental Management: Air Quality Act 39 Of 2004;

"listed activity" means any activity listed in terms of section 21 of the National Environmental Management: Air Quality Act 39 Of 2004;

"mobile source" means a single identifiable source of atmospheric emission which does not emanate from a fixed location;

"non-point source" means a source of atmospheric emissions which cannot be identified as having emanated from a single identifiable source or fixed location, and includes veld, forest and open fires, mining activities, agricultural activities and stockpiles;

"Normal operating condition" means: any condition that constitutes operation as designed;

"offensive odour" means any smell which is considered to be malodorous or a nuisance to a reasonable person;

"Oxides of nitrogen (NOx)" means the sum of nitrogen oxide (NO) and nitrogen dioxide (NO2) expressed as nitrogen dioxide (NO2)

"Particulate Matter (PM)" means total particulate matter, that is the solid matter contained in the gas stream in the solid state as well as the insoluble and soluble solid matter contained in entrained droplets in the gas stream, as measured by the appropriate method listed in section 4.

"point source" means a single identifiable source and fixed location of atmospheric emission, and includes smoke stacks and residential chimneys;

"risk" The product of the likelihood that a specified undesired event (consequence) will occur and the severity of the consequences of the event;

"SANAS" means the South African National Accreditation System established by Section 3 of the Accreditation for Conformity Assessment Calibration and Good Laboratory Practice, 2006 (Act No. 19 of 2006)

"temporary asphalt plant" means an asphalt plant erected for the duration of and with the sole purpose of supplying asphalt *for a specific road paving contract;*.

"upset conditions" means any temporary failure of air pollution control equipment or process equipment or failure of a process to operate in a normal or usual manner that leads to an emission standard being exceeded;

"waste" means any substance, whether or not that substance can be reduced, re-used, recycled and recovered –

(a) that is surplus, unwanted, rejected, discarded, abandoned or disposed of;

(b) which the generator has no further use of for (the purposes of production;

(c) that must be treated or disposed of; or

(d) that is identified as a waste by the Minister by notice in the *Gazette,* and includes waste generated by the mining, medical or other sector, but –

(i) a by-product is not considered waste; and

(ii) any portion of waste, once re-used, recycled and recovered, ceases to be waste;

5. Minimum applicable standards

5.1 National, Provincial and Local Government Legislation

Asphalt plants are located throughout Southern Africa and mainly in the various Provincial and Municipal jurisdictions of the RSA. A myriad of Acts, Regulations, Bye-laws, International Conventions and Treaties could be applicable as the legal framework within which asphalt plants must manage the potential environmental impact of operations.

Asphalt producers must ensure that they are fully aware of all the applicable regulatory requirements and adequately provide for responsible management thereof. However, the following legal requirements, as applicable, are referenced as the minimum standards to demonstrate compliance with the expectations of this document:

- Constitution of the Republic of South Africa Act, 108 of 1996;
- Environment Conservation Act, 1989 (Act No. 73 of 1989) as amended;
- Atmospheric Pollution Prevention Act, 45 of 1965 as amended;
- National Environment Management Act, 107 of 1998 and Regulations (2010);
- National Environmental Management: Air Quality Act 39 of 2004 read with any applicable provisions of the National Environmental Management Act;
- National Environmental Management: Air Quality Act (39/2004), Government Notice 248, 31 March 2010: List of activities which result in atmospheric emissions which have or may have a significant detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage
- National Environmental Management: Air Quality Act (39/2004), National Ambient Air Quality Standards
- National Environmental Management: Waste Act, No. 59 of 2008

5.2 Emission Standards applicable to Temporary Asphalt Plants

Asphalt production is a listed activity in terms of the National Air Quality Act. Part 3 of Schedule A, NAQ Act, prescribes the following Minimum Emission Standards for listed activity subcategory 5.8 Macadam preparation:

Description:	The production mixtures of aggregate and tar or bitumen to produce road surfacing in permanent facilities or mobile plants		
Application:	All plants		
Substance or mixture of substances		**Plant status**	**mg/Nm³ under normal conditions of 273 Kelvin and 101.3 kPa.**
Common name	**Chemical symbol**		
Particulate matter	N/A	**New**	**50**
		Existing	120
Sulphur dioxide	SO_2	**New**	**1000**
		Existing	1000
Total volatile organic compounds from vapour recovery/ destruction units (Thermal treatment)	N/A	**New**	**150**
		Existing	150

5.3 Industry responsibility and commitment

The legal compliance framework already demonstrates compelling reasons for the development of this best practice document. However, more importantly, Sabita and its members view environmental developments very responsibly. Therefore it promotes the spirit and content of this

document very proactively, and through it wishes to signal its determination to continue and excel as an environmentally responsible industry.

6. Environmental Management Plan (EMP)

6.1 Methodology and structure

For purposes of this Code of Practice the EMP is broadly structured as follows:

- ❒ **Basic plant and process descriptions;**
- ❒ **Brief overview of the types of possible environmental impact;**
- ❒ **Identification and control of the risks associated with environmental pollution;** (Applying a Hazards and Effects Management Process incorporating BowTie methodology)

  Risk assessment and classification:

  - Identification of the environmental aspects (Hazards) that need to be controlled;
  - Classification of the associated Risks using a qualitative Risk Assessment Matrix;
  - Identification of the Top Event/s (initiating event) that could ultimately result in potential negative environmental impact (consequences of non-conformance);
  - Identification and analysis of the potential threats (non-conformance or failure mode) that could cause the Top Event/s;

  Controlling identified environmental aspects and associated risks:

  - Developing effective controls (control barriers) to prevent the Top Event/s;
  - Developing re-active controls to mitigate the potential negative environmental impact if control barriers fail;
- ❒ **Communication to affected and interested parties:**
  - An Environmental Aspect Register representing a consolidated view of the results of the Environmental Aspects and Effects Management Process; (Appendix 1)
  - Aspect Control Sheets for MEDIUM to HIGH risk aspects; (Appendix 2)
- ❒ **Mandatory protocol for establishing and operating a Temporary Asphalt Plant**

6.2 Basic plant and process descriptions

Basic plant types

The concept for asphalt mix plants has more or less been the same during the last 30 years. Today they are divided into two main types: Drum mix (continuous process) plants and batch mix plants.

Generally an asphalt plant can be divided into the following main parts:

- hoppers of the cold feed unit;
- aggregate drying unit and connected bag filter, wet or dry scrubber filter systems;
- bitumen storage tanks and filler silos;
- mixing tower: mixing unit,
- silos for storing and loading hot asphalt

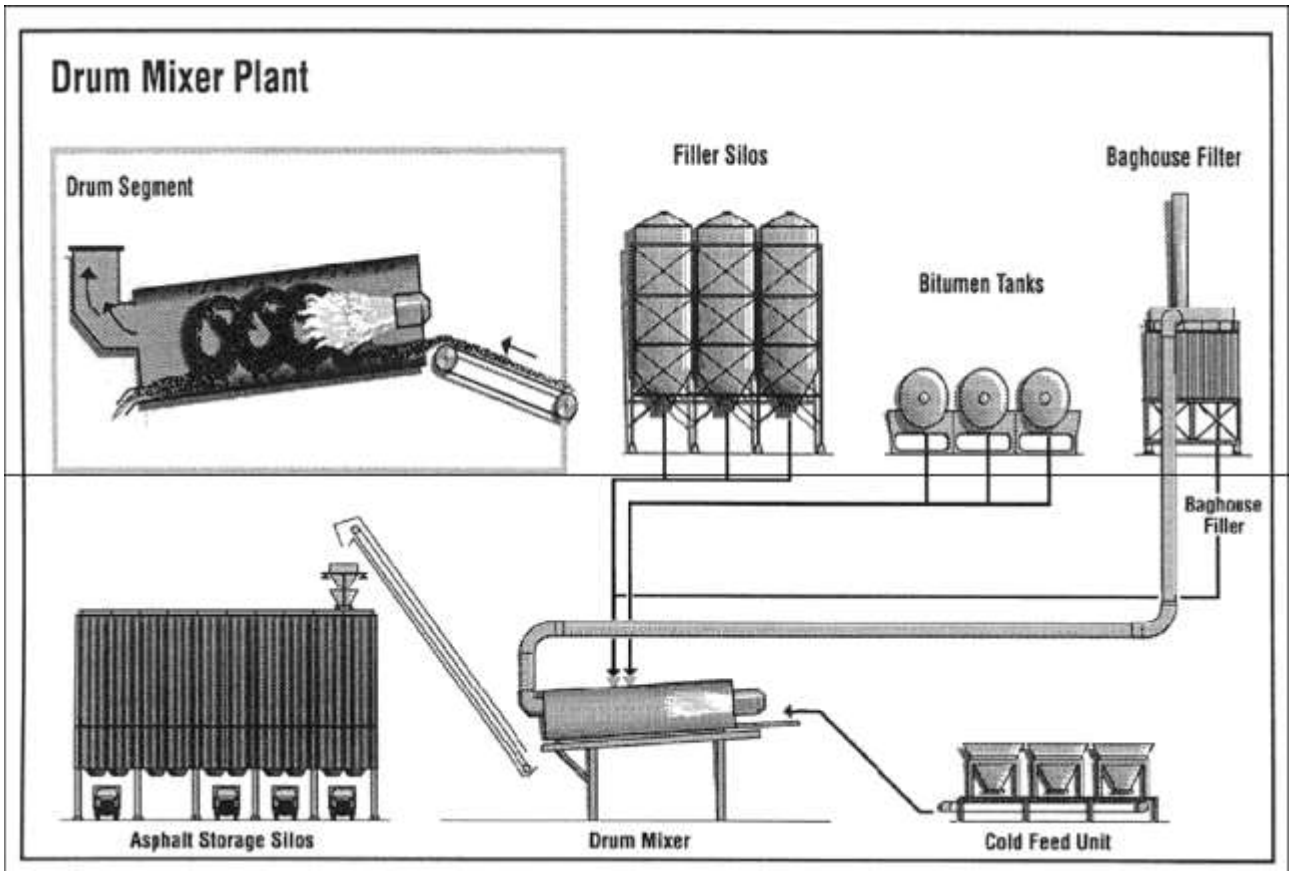

Figure 6.2: Schematic drawing of a typical drum mixer plant setup for temporary plants

Most asphalt plants are permanently sited installations (fixed plants). However in some cases it is advantageous to move an asphalt plant from site to site to supply major works. This requires availability of *temporary* plants. A further variation is the limited use of driven asphalt plants where the mixing and laying of asphalt is unified in a continuous process on the job site.

In recent years there has been an increasing tendency to design plants to recycle old asphalt pavements. It is important for environmental reasons to utilise the growing stocks of RAP because an added advantage of recycling is that the use of virgin aggregate and bitumen can be reduced.

Basic process

The asphalt mixing process consists of heating and drying aggregates which then are mixed with filler and bitumen. The mixed asphalt is then transferred directly to waiting delivery trucks or to silos for short-term (surge) storage or for longer-term storage before loading into trucks for transportation to the paving site.

The complete plant operation is monitored from the control room of the plant. The degree of automation and electronic control varies between plants, depending mainly on plant mobility and age. Small plants can be operated through simple control mechanisms. A fully computerised process control can monitor for example: burner combustion, fuel consumption, process air volumes, drum pressures, exhaust gases, bag-house pressure, flow rates for used materials and finished mix transfer, discharge and storage selection.

6.3 Types of possible environmental impact

Impact may be:

- Associated with **normal operation** of the plant. These may be continuous (e.g. from the drum) or discontinuous (e.g. from loading the lorries)
- Associated with **upsets** resulting from unplanned incidents. These are difficult to quantify since they are by definition unexpected, and may result from various circumstances
- Associated with **changes in operating conditions**, e.g. changes in mix temperature, or
- Associated with **start-up and shut-down** which result from planned filling, purging or draining operations performed when bringing a unit or the plant into or out of service

This document places emphasis on control techniques related to specific emissions of asphalt plants (mostly dust and gaseous organic and inorganic emissions) and less emphasis on non-specific emissions (noise, waste etc.).

Figure 6.3 gives an overview of possible sources of emissions at a typical asphalt plant. The characters in figure 6.3 are related to the examples mentioned in Table 6.3.

Figure 6.3 View of an asphalt plant, indicating possible sources of emissions.

"This picture was intentionally chosen to be able to show all sources of emission. It is not intended to show the most perfect plant with regard to minimizing environmental and visual impact."

Table 6.3 Possible sources of emissions

Possible impact	Source	Source reference number in figure 6.2
Particulates:		
Stack dust	Stack dust	A
Other sources and fugitive dust	Fugitive dust	B
Gaseous emissions	Stack	C
Noise	Plant	D
	Traffic	E
Odour	Stack (fuel)	F
	Loading trucks	G
Water effluent, ground water preservation	Fuel tank	H
Waste	Laboratory waste	J
Visual aspects	The plant itself	K

6.3.1 Brief discussion of the types of emissions from a typical asphalt plant

The operation of a hot mix asphalt plant results in emission of many different pollutants. The most common pollutants emitted from hot mix asphalt plants are atmospheric emissions i.e. particulate matter (PM10), sulphur dioxide (SO2), nitrogen oxides (NOx), volatile organic compounds (VOCs) and carbon monoxide (CO).

❒ Particulates

Stack dust

Stack emission is related to the drying and heating process. (In reality the stack is connected to other parts of the system via the filter system). The amount of dust is determined by operating conditions.

The main source of stack dust is the raw materials that are used for the production of the asphalt and which are dried in the drum (sand and stone). These materials contain a certain percentage of inherent fines and fines that may be produced during the heating process, by mechanical and/or temperature effects. The fines are separated by the hot gas flow in the drum.

Often waste gas is extracted from the mixer unit (hot bucket elevator, screen, hot mineral storage hopper, scales and expansion from the mixer). In the case of recycling, reclaimed asphalt dust is originated if a parallel drum is used. These particulates may contain binder particles in addition to mineral aggregate particles.

Other sources of particles and fugitive dust

Dust may, in theory, also be emitted from the whole filler system, starting from the loading of the silos, from the trucks, transport hoses or screws (pneumatic or mechanical transport), scale and the addition of the filler into the mixer.

In practice the processing of the filler takes place in a closed system including bunker filter attachments, so under normal conditions no emission of filler dust will take place.

Depending on the weather conditions (dry weather in combination with wind) and the quality (grading) of the mineral aggregates dust may be emitted from the storage of the (fine) sand. This may also occur during loading of the materials from tipping by trucks and during feeding of the hoppers. Furthermore, dust on the plant area may be whirled up by traffic and become airborne.

Basically dust may be emitted from all parts of the system where fine dry mineral aggregates are processed: transport system (conveyor belts etc.), screens, scales, addition into the mixer, dry (without bitumen) mixing.

Special attention has to be paid to the possibility of dust production during maintenance activities.

Type of dust

Most of the dust consists of mineral aggregates and are of the inert type. This is also the case with particulates arising from additives such as fibres in some mixes.

In the case of the application of reclaimed asphalt the dust may also contain binder particles.

Hydrocarbons in dust may also result from the combustion depending on the type of fuel. Moreover dust may contain small quantities of heavy metals if waste oils are used.

Attention has to be paid to the dust coming from some artificial aggregates used as replacement for natural mineral aggregates. By-products from other industries may also be used (like slag or fly-ashes), which may require special consideration. *Note: When using certain mineral aggregates, silica dust may occur! This requires specific health risk assessments and management controls.*

❒ Gaseous emissions

Inorganic emissions

SO_2 (stack)

The burning process in the dryer is the main SO_2 source, influenced by the sulphur content of the fuel (particularly oil or brown coal). SO_2 is absorbed by certain mineral aggregate, e.g. limestone, and the alkaline dust-layer in the dust filter. Other mineral materials, e.g. furnace slag, can increase the SO_2 emission.

NOx (stack)

Emission of NOx mainly originates from the burner in the drying drum. The emission depends on the nitrogen content of the fuel, the amount of excess air, flame temperature and burner type.

CO (stack)

Emission is mainly associated with the combustion process in the dryer. The spaces for generation and utilization of the heat have a smooth transition in the dryer and the parallel drums, so the combustion of the fuel is influenced by the direct contact of the burner flame with mineral material. An unfavourable drum geometry where a combustion space is too small also leads to incomplete combustion of the fuel.

Furthermore, the carbon monoxide emission is strongly influenced by the fines content of the mineral, the water vapour content in the drum and the use of RAP, so higher carbon monoxide emissions occur in asphalt plants compared to classical combustion plants. As a consequence, opposite to classical combustion plants CO is not suited to be a leading substance for evaluating the emissions of an asphalt plant.

CO_2 (stack)

Emission is directly related to the type of fuel used and the energy consumption needed for the heating process of the mineral aggregates, reclaimed asphalt and heating system of bitumen tanks. The level of CO_2 emission is determined by process efficiency and depending on the type of fuel used.

Organic emissions

TOC = Total Organic Compounds

Organic emission consists of a large group of substances generally described as hydrocarbons. Their molecular structure is characterised by the combination of carbon and hydrogen atoms; additionally these substances can also contain oxygen, nitrogen, sulphur and phosphorus. These are referred to as TOCs. When measured as emissions from asphalt plants the individual carbon elements are added together to give a figure for Total Carbon.

The emission of hydrocarbons finds its origin in the use of organic constituents and organic fuels in the production process. Especially by the heating or combustion emissions of these substances take place in the form of vapour or of reaction products. The most important source of emission of hydrocarbons is the incomplete combustion of fuel.

The type of fuel, operating conditions and vapours from bitumen in the mixing process, (which may be present in some cases), cause different compositions of the waste gases in respect of their organic constituents.

The hydrocarbons that find their origin in the combustion are mainly emitted by the stack; these emissions can be reduced by regular maintenance of the burner and optimization of the combustion volume.

Another source of organic emission is the bitumen that is heated in the production process. In those places where the bitumen is heated to working temperature fumes are formed.

Possible sources of emission are:

- bitumen tanks, especially out of the vents during loading from the bitumen lorry or continuously by the breathing of the tanks;
- the batch mixer or drum mixer (stack emission);
- the skip;
- the loading station of the asphalt lorries;
- reclaimed asphalt; hydrocarbons may be emitted by heating the reclaimed asphalt in a parallel drum (stack emission);
- when RAP is added “cold” into the batch mixer (stack emission);

The type of the bitumen (crude, way of production) and the temperature are of influence on the rate and the composition of the emission.

The composition of the RAP (bitumen content and bitumen quality) will also influence the composition of the organic emission.

PAH = Polycyclic Aromatic Hydrocarbons

Depending on their impact on the environment and their effect on health, hydrocarbons are divided in various categories. With respect to their toxicity PAH are of the most importance.

Some of these PAH are possibly carcinogenic to humans under prolonged high-level exposure. PAH refers to organic compounds that only contain carbon and hydrogen and consist of two or more benzene rings. Investigations indicate that the hazardous PAH occur in compounds with four or more benzene rings, which usually form only a small percentage of the total PAH emission. The amount of these hazardous PAH in bitumen is very small, less than 10 ppm.

At production temperatures of asphalt which seldom exceed 200°C only a small fraction of vaporous PAH exists. *From measurement data available it shows that emissions of hazardous PAH are well below national limit values, if at all traceable.*

❒ Odour

Main source of odour is the bitumen. Emission occurs during the loading of the bitumen tanks (by expelling gas from the bitumen tank or by pressure release from the bitumen trucks), and by the emptying of the mixer into the skip or into the asphalt trucks. Moreover the odour is related to the bitumen type and crude source.

The processing of reclaimed asphalt may emit odour when heated, especially if it has high moisture content.

Special additives, such as adhesion improvers or types of polymers may emit perceptible odour. Rubber blending into bituminous binders may also produce perceptible odour. As far as known, these do not present any environmental or health concern.

❒ Water effluent

Possible sources of ground (water) pollution are:

- Artificial aggregate storage (seepage, or mixing with the natural soil);
- Some mineral aggregates or artificial aggregates may contain contaminates;
- Fuel oil tanks (if the plant is oil fired);
- Thermal oil for bitumen heating system;
- Gasoil (diesel) tanks, pipe work and fuelling station;
- Solvents (laboratory chemicals);
- Release agents (although nowadays mostly biologically degradable).
- Rainwater that falls in and around hot mix asphalt plant operations and aggregate storage piles can become contaminated with sediments, oil, grease and other materials;
- Runoff from product piles may be caustic. Process wastewater can contain contaminates. If not properly managed, this contaminated water can harm the environment, pollute rivers and lakes and even contaminate drinking water.

❒ Noise

From inside the enclosure of the plant the main sources are:

- the dryer drum;
- burner (especially air intake);
- ventilator behind filter installation (impact high, resonance in stack);
- screeds including by-pass (impact high);
- vertical transport system, hot bucket elevator (impact low when filled);
- pneumatic system (impact low);

Other associated noise sources may be:

- traffic noise on the yard by loaders during transport from the aggregate stock to feeder;
- hopper;
- traffic noise from trucks supplying raw materials and collecting asphalt mixes;

The noise impact is especially influenced by the time of the day or night, not just in the amount of activity.

6.4 Identification and control of the risks associated with emissions

6.4.1 Risk assessment and classification

In accordance with the Risk Assessment Matrix used for purposes of this document (See appendix 3) the risks associated with emissions are broadly classified in terms of the potential harmful effects of pollution on the following:

❒ People

Potential health impact on:

- plant workers and
- the inhabitants of the communities in close proximity to the plant

❒ **Environment**

Potential adverse effects of pollution on the "living environment": (i.e. vegetation, water resources, aquatic life, wild animals, etc.)

❒ **Reputation (Business Continuity and Sustainability)**

In this category consideration is given to the impact of non-compliance with Air Quality Standards and Legal requirements. Repeated exceedance of emission limits can result in external pressure by environmental "lobbyists'" and prosecution by State organs, which can have a massive impact on the Business Continuity and Sustainability of an organisation.

6.4.2 Risk overview

The table below gives a high-level overview of the Environmental Aspects, Reputation issues and potential effects at a typical Temporary Asphalt Plant as assessed and analysed by an Industry environmental working committee:

Index #	Environmental Aspect or Reputation issue	Potential Effects / Impact / Consequences
APE – 00	**Hazardous Emissions (Toxic liquids, particulates, gases or vapours)**	
APE – 01	SO_2 (Sulphur Dioxide)	Uncontrolled regular or continuous emissions exceeding acceptable ambient concentration levels could have major impact and long term detrimental effects on the environment and population in close proximity to the plant.
APE – 02	NO_2 (Nitrogen Oxide)	
APE – 03	PM (PM_{10} Particulate matter)	
APE – 04	TVOC (Total Volatile Organic Compounds)	
APE – 05	CO (Carbon Monoxide and exhaust gases)	
APE – 06	Hydrocarbons (Bitumen, Cut-back Bitumen's, Burner fuels, Diesel)	Potential localised safety and health effects on people at source under normal operating conditions or upset conditions. Not likely to migrate off-site and have any adverse effects on the environment. Spillage in open unprotected areas can however have localised adverse effects on the environment.

Index #	Environmental Aspect or Reputation issue	Potential Effects / Impact / Consequences
APE – 07	Offensive odours (Main concern considered to be rubber blending)	Irritation/nuisance to neighbouring community. Not considered to be a threat to health.
APE – 08	Noise	Noise from plant and yard traffic could be an issue during night operations if plant is located in close proximity to a residential area.
APE – 09	Process waste (including laboratory waste)	1. Effluent from scrubber sludge settling pit/dam migrates off site and contaminates soil or water resource. 2. Irresponsible disposal of solvents, Toluene distil residue, etc. pollutes the environment.
APE – 10	Visual aspects	Evidence of stack emissions, spillage or waste

		creates perception of "mismanagement" and attracts "undue" attention.
APE – 11	Ground/soil (water) pollution	1. Failure during storage and handling of fuels results in pollution. 2. Contaminated storm water migrates off site and pollutes environment.
APR – 00	**Reputation issues**	
APR – 01	Conducting a Listed Activity without an atmospheric emission licence: (In contravention of Section 22 of the AQA)	1. Plant closure and massive financial loss; 2. Prosecution and heavy penalties including imprisonment; 3. Bringing own company/industry in disrepute; 4. "Antagonising" authorities and "lobbyists" resulting in increased resistance and pressure on future licensing requirements.
APR – 02	Risk tolerance or "defiance". Regularly exceeding ambient concentration limits of a listed substance	
APR – 03	Failure to manage aspects of operations that "perceptually" is offensive to the "reasonable person". (i.e. odour, dust, noise and visual aspects)	Unnecessary/undue/unreasonable attention of local population resulting in major effort and cost to restore reputation as a responsible and caring neighbour.

Note: The detailed results of the aspects (hazards) and effects assessment and analysis process are documented in the Aspect register in Appendix 1.

7. Protocol for establishing and operating a Temporary Asphalt Plant

In order to demonstrate responsible care and compliance with the requirements of National Environmental Management Legislation the following protocol shall be MANDATORY for establishing and operating Temporary Asphalt Plants.

Step #	Requirement	Completed (Yes/No)
1	**Need and desirability for establishing a Temporary Asphalt Plant** Motivate why Asphalt cannot be supplied from an existing production facility.	
2	**Site selection** • Exercise meticulous care in selection of the proposed location of the plant. Avoid "blatantly obvious" environmentally sensitive areas that will almost certainly attract external pressure leading to drawn out due diligence processes. • Conduct own due diligence in the form of DEA-BAR.	
3	**Preparation and Application for Atmospheric Emission Licence**	

	• Prepare a SITE SPECIFIC Environmental Management Plan based on the SABITA Code of Practice: Management of Potential Environmental Impact at Temporary Asphalt Plants **(Note for discussion: Consider appointing an emission control officer to oversee the EMP at Temporary Plants)** • Prepare the Application for Atmospheric Emission Licence and make PERSONAL contact with the appropriate person of the licensing authority in the area where the plant will be established. • Arrange a meeting to discuss the application and make CLEAR REFERENCE to the fact that the application is in connection with a Temporary production facility.	
4	**Plant design, construction and commissioning** • Every Temporary Asphalt Plant is designed and constructed pursuant to the minimum acceptable design standards as specified by SABITA Code of Practice: "Design criteria for Temporary asphalt production facilities". • Every such Plant shall be subject to a certification process by an engineer who is competent to pronounce on the compliance with design specifications.	
5	**Operating the plant** • Ensure that competent personnel are assigned to manage and operate. • Ensure that adequate resources have been allocated, and operating procedures established to maintain operational standards i.e.: – Critical spares kept on-site or readily available – Maintenance personnel are on-site or readily available – Planned/routine inspections to verify integrity of critical systems and equipment – Clear (written) instructions for handling "upset conditions" and complaints from the public – Clear (written) consequence management process for wilful conduct that will compromise "licence to operate" – Regular planned and unplanned visits from "head office" officials to assure operation standards are maintained	

Appendix A Aspect register for a typical Temporary Asphalt Plant

Index No	Aspect / Issue	Activity	Location/ Source	Threats (Potential causes)	Top Event/s	Incident / Consequences considered for RAM rating	RISK POTENTIAL			ALARP Documentation
							P	E	R	
APE 01- 05	Air Emissions: – Stack dust – Fugitive dust – Gaseous emission SO_2; NO_2; PM; TVOC; CO; PAH	Plant start-up and shut-down Drying/heating/ mixing process Whole filler system/process	Stack dust and fugitive dust: • Burner; • Stack; • Screens; • Mixing drums; • Aggregate stockpiles; • Conveyor belts • Hoppers; • Bag house; • Scrubbers; • Yard traffic	Outdated plant design; Burner fuel quality; Poor maintenance of burners; Incorrect airflow, pressure and temperature; No or inadequate maintenance of dust filter systems; Operator error;	Loss of: - control; - containment Exposure to: (hazardous substances)	Bag house filter material failure; Wet scrubber water-pump failure; Wet scrubber nozzle failure; Impact on people, environment and reputation. (Continuous long-term emissions at concentrations exceeding control limits)	3B	4B	4C Comments: Due to a lack of reliable baseline data for SA plants this classification is based on data from international sources.	This code of practice; Operating procedures; Maintenance records; Staff training records; Emission monitoring records; Critical spares inventory;
APE - 06	Hydrocarbons (Cut-back Bitumen's, Burner fuels, Diesel)	Site storage and handling	Tank farm; Tanker off-load facilities; Fuel dispensing facility	Substandard storage tanks & transfer lines; Procedures not followed;	Loss of: - containment	Tank over-fill and un-ignited spillage migrating off-site	3B	3B	3B Comments:	Operating procedures; Staff training records;
APE - 07	Offensive odours	Manufacture/ storage/handling	Loading trucks Stack emission Rubber blending Hot Storage Skip	Odour carried off site by wind	Exposure to	Rubber blending: Irritation/nuisance to neighbouring community.	0A	0A	1C Comments:	Community survey reports; Site inspection reports;

Index No	Aspect / Issue	Activity	Location/ Source	Threats (Potential causes)	Top Event/s	Incident / Consequences considered for	RISK POTENTIAL			ALARP Documentation
							P	E	R	

						RAM rating				
APE - 08	Noise	Plant operation	Blower Fan Exhaust Fan Generator Yard traffic	Inadequate maintenance of plant and vehicle noise suppression devices. No site speed control.	Exposure to	Noise during night operations lead to complaints from local community.	0A	0A	0A Comments: The impact of noise on plant employees was not considered for this classification.	Noise measurement; Community survey reports;
APE - 09	Process waste (including laboratory waste)	Plant operation	Wet Scrubber Sludge Excess Filler Sampling Toluene distil.	Equipment failure; Poor housekeeping; Procedures not followed;	Loss of: - control - containment	Disposal of Lab waste pollutes the environment	0A	2C	1C Comments:	Inspection reports; Written procedure for waste disposal;
APE - 10	Visual aspects	Plant operation	Stack emissions Spills on ground, under conveyors, under skip, etc. Lab samples (Briquettes, etc)	Upset conditions; Poor housekeeping: (Spillage or waste left unattended for long periods; No control of Lab sample storage)	Loss of control	Stack emissions lead to regular complaints from local community.	0A	1E	2B Comments:	Plant operating logbook; Housekeeping policy;
APE - 11	Storm water	Storm water management	Whole plant. Heavy rains.	Inadequate site design On-site contamination Uncontrolled drainage of storm water	Loss of control	Contaminated storm water migrates off site causing soil (water) pollution	0A	2B	1A Comments:	Design drawings Storm water management plan;
APR - 01	Business continuity and sustainability	Establish and Operate Plant	Temporary Plant Conscious decision or management oversight	Ignorance of legal requirements; Onerous licensing process; Risk tolerance and “defiance”;	Exposure to (prosecution)	Operating without an atmospheric emission licence; Operate plant under “upset conditions”	0A	0A	4D Comments:	Legal register; Plant operating logbook;

Appendix B Example Generic Aspect (Hazard) Control Sheet for a typical temporary asphalt plant

HAZARD Control SHEET No: AP/01/July 2011		Page 1 of 2
Aspect/Hazard Group: Atmospheric Emissions	Location: Temporary Asphalt Plant	
Assessment of hazard Top event: Loss of Control/Containment Aspect/Hazard Consequence: Emissions at concentrations exceeding control limits Risk classification (Worst case scenario): R 4 C		
Threats: 1. Inadequate plant design; 2. Exceeding plant design capacity; 3. Excessive heating of bitumen; 4. No or inadequate maintenance of dust collection/filtration systems; 5. Poor maintenance of burners; 6. Incorrect airflow, pressure and temperature; 7. Operator error		
Controls:	**Critical Activity/Task**	**Responsible Position**
Control in design		
• Plant designed to acceptable standard	Approve design	Design engineer
• Plant constructed in accordance with design specs	Oversee plant construction	Project manager
Control in operation		
• General plant operating procedures	Develop procedures	Plant operations manager
• Competent plant operators	Training of operators	Operations/training manager
• Optimum performance of critical process elements	Continuous monitoring of airflow/pressure/temperature	Control room operator
• Periodic measurement/analysis of emissions	Plan/execute measurement	SANAS approved laboratory
• Recognition of potential "upset condition"	Observed stack emission	All plant personnel
• Procedure for handling "upset condition"	Plant shut-down	Control room operator
• DO NOT OPERATE PLANT under "upset conditions"	Clear written instructions	Plant operations manager
Control in maintenance		
• Planned preventive maintenance program	Develop program Execute maintenance	Plant maintenance manager Maintenance technician
• Critical equipment spares inventory	Maintain inventory	Plant maintenance manager
• Critical equipment inspections	Conduct daily inspections	Plant operator
Recovery:		
• Identify cause of "upset condition"	Diagnostic inspection	Control room/senior operator
• Repair and start-up plant	Pre start-up inspection	Maintenance technician

HAZARD Control SHEET No: AP/01/July 2011	Page 2 of 2

References

Legislation:

See paragraph 5.1 of the SABITA Code of Practice for Environmental Management of Temporary Asphalt Plants.

Company and Industry Standards:

1. SABITA Code of Practice for Environmental Management of Temporary Asphalt Plants.
2. EPA-454/R-00-019, December 2000: Hot Mix Asphalt Plants Emission Assessment Report.
3. Environmental Guidelines on Best Available Techniques (BAT) for the Production of Asphalt Paving Mixes, EAPA June 2007.

Revision: First edition July 2011

Determination of ALARP

ADDITIONAL RISK REDUCTION MEASURES FOR CONSIDERATION	IS THE MEASURE CREDIBLE / PRACTICABLE? (Yes / No)	ARE DISPROPORTIONATE RESOURCES REQUIRED TO IMPLEMENT? (Yes / No)
1. Consider switching to an alternative burner fuel i.e. LNG to further reduce emissions	Not practicable for plants operating in areas remote from LNG supply sources	Yes

Is the Risk ALARP? – Y/N	Yes	

Comments:

1. Experience abroad shows that if a temporary asphalt plant operates within design parameters the atmospheric emissions are negligible and within acceptable limits. In the USA extensive atmospheric emission studies have lead to “de-listing” of Asphalt Production Processes. (i.e. bitumen based as apposed to coal tar based asphalt).

METHOD USED (X)		TEAM MEMBERS	
		Expertise	Name
X	Experience/Judgment	HSE:	Anton Ferreira (SABITA), Johan Pretorius (National Asphalt) Peter Greyling (Much Asphalt)
X	Cost-Benefit	Engineering:	Ram Sheoharakh (National Asphalt), Paul Roos (Much Asphalt)
	Quantitative Assessment	Operations:	Rocco Lehman (AVENG GLTA), Brian Neville (Much Asphalt)
	Other	Other:	

Appendix C Risk Assessment Matrix

SEVERITY	CONSEQUENCES			INCREASING LIKELIHOOD				
	PEOPLE	ENVIRONMENT	REPUTATION	A	B	C	D	E
				Never heard of in the Asphalt Industry	Heard of in the Asphalt Industry	Has occurred in the Company or more than once per year in the Industry	Has occurred at the Location or more than once per year in the Company	Has occurred more than once per year in the Location
0	No health effect	No effect	No impact					
1	Slight health effect	Slight effect	Slight impact					
2	Minor health effect	Minor effect	Minor impact					
3	Major health effect	Moderate effect	Moderate impact					
4	Permanent Total Disability	Major effect	Major impact					
5	1 or more fatalities	Massive effect	Massive impact					

Application of the RAM

The four coloured areas describe the level of control required to manage risk:

Light Blue: Manage for continuous improvement, although Businesses may set lower priority for further Risk reduction.

Blue: Manage for continuous improvement through the effective implementation of the Air Quality Management Plan.

Yellow: Identify and implement controls and recovery measures to reduce Risk to ALARP.

Red: Identify and implement Controls and Recovery Measures to reduce the Risk to ALARP and provide a documented demonstration of ALARP by a Bow Tie or equivalent methodology.

Appendix D RAM Consequence Categories, Severities and Likelihood scale

The following tables contain the description and definition of the Severity levels in each of the PER categories, followed by examples as bullet points.

Harm to People

Level	Definition
0	**No injury or health effect**
1	**Slight injury or health effect** – Not affecting work performance and not affecting Daily Life Activities. Examples: • First aid cases and medical treatment cases. • Exposure to health hazards that give rise to noticeable discomfort, minor irritation or transient effects reversible after exposure stops.
2	**Minor health effect** – Affecting work performance, such as restriction to work activities or need to take up to 5 days to fully recover. Or affecting Daily Life Activities for up to 5 days. Or reversible health effects. Examples: • Restricted work day cases or lost work day cases resulting in up to 5 calendar days away from work. • Illnesses such as skin irritation.
3	**Major health effect** – Affecting work performance in the longer term, such as absence from work for more than 5 days. Or affecting Daily Life Activities for more than 5 days. Or irreversible damage to health. Examples: • Long term disabilities (previously called Permanent Partial Disabilities). • Illnesses such as sensitisation, noise induced hearing loss or stress.
4	**Permanent total disability** – resulting from occupational illness. Examples: Illnesses such as corrosive burns, silicosis, cancer and serious work related depression.
5	**1 or more fatalities** – resulting from occupational illness. Examples: • Cancer to a large exposed population.

Environmental Effect

The bullet points in the environmental effect table are a mixture of:

- Effects, e.g. groundwater contamination.
- Events with the potential for environmental effect, e.g. exceeding a limit.
- Indicators of potential effects, e.g. complaints.

Level	Definition
0	**No effect.**
1	**Slight effect** Slight environmental damage – contained within the premises. Example: • Small spill in process area or tank farm area that is readily contained.
2	**Minor effect** Minor environmental damage, but no lasting effect. Examples: • Small spill off-site that seeps into the ground. • On-site contamination. • Complaints from up to 10 individuals. • Single exceedance of statutory or other prescribed limit.
3	**Moderate effect** Limited environmental damage that will persist or require cleaning up. Examples: • Spill from a pipeline into soil/sand that requires removal and disposal of a large quantity of soil/sand. • Observed off-site effects or damage, e.g. fish kill or damaged vegetation. • Off-site contamination over a small localised area. • Complaints from community organisations (or more than 10 complaints from individuals). • Frequent exceedance of statutory or other prescribed limit, with potential long term effect.
4	**Major effect** Severe environmental damage that will require extensive measures to restore beneficial uses of the environment. Examples: • Off-site contamination over an extensive area. • Many complaints from community organisations or local authorities. • Persistent regular exceedances of statutory or other prescribed limits, with potential long term effects
5	**Massive effect** Persistent severe environmental damage that will lead to loss of commercial, recreational use or loss of natural resources over a wide area. Example: • Extended/contiuous exceedances of statutory or other prescribed limits, with potential long term effects.

Impact On Reputation (Business Continuity and Sustainability)	
Level	**Definition**

0	No impact
1	Slight impact • Local public awareness but no discernible concern. • No media coverage.
2	Minor impact • Local public concern. • Local media coverage.
3	Moderate impact - Significant impact in region or country • Regional public concern. • Local stakeholders, e.g. community, NGO, industry and government, are aware. • Extensive attention in local media. Some regional or national media coverage.
4	Major impact - Likely to escalate and affect Group/Company reputation • National public concern. • Impact on local and national stakeholder relations. National government and NGO involvement. • Extensive attention in national media. Some international coverage. • Potential for regulatory action leading to restricted operations or impact on operating licences.
5	Massive impact - Severe impact on Group/Company reputation • Extended national public concern. • High level of concern amongst regulators and potential for plant closure. • Potential for action by international NGOs. • Significant international media attention. • Significant potential for effect on national standards with impact on access to new areas, future grants of licences and/or tax legislation.

Likelihood Scale

The scale of increasing Likelihood is intended to represent a range from highly unlikely to frequent. It is expressed in terms of frequency of events per period per Location (Plant). These descriptions should be used in every application of the RAM so as to promote consistent assessment of risk.

Increasing Likelihood				
A	B	C	D	E
Never heard of in the Asphalt Industry	Heard of in the Asphalt Industry	Has occurred in the Company or more than once per year in the Industry	Has occurred at the Location or more than once per year in the Company	Has occurred more than once per year in the Location

Work in progress

2nd Draft for discussion by Sabita Environmental Working Committee, July 2011

Appendix E Risk assessment and analysis of environmental aspects at Temporary Asphalt Plants

SABITA environmental best practice work group meeting Tuesday 28th June 2011

Workshop objectives: To identify and document process failure modes and controls for environmental aspects at Temporary Asphalt Plants:-

Assessment team:

Name:	Company:	Designation:
Rocco Lehman	AVENG GLTA	Asphalt Manager
Brian Neville	Much Asphalt	Group Technical Manager
Anton Ferreira	SABITA	HSE Consultant (Workshop facilitator)
Ram Sheoharakh	National Asphalt	Maintenance Manager
Johann Pretorius	National Asphalt	HSE Manager
Peter Greyling	Much Asphalt	HS Officer
Paul Roos	Much Asphalt	Plant Maintenance Manager

Results of risk assessment:

Aspect	Source	Control technology	Potential failure mode	Control procedures/recovery
Particulates: **Stack dust**	**Drying and heating process**	**Bag house system** **Wet scrubber** **Dry scrubber**	**Incorrect airflow, pressure and temperature.** **Filter material failure – torn or burnt cloth.** **Water-pump failure.** **Wet scrubber nozzle failure.**	**Competent operators (i.e. can recognise and react to "Upset conditions")** **Plant / bag house operating procedures:** ✍ **Visual checks of stack emission;** ✍ **Continuous monitoring of system airflow, pressure and temperature;** ✍ **Plant shut-down and repair for "Upset**

			Corrosion / erosion. No maintenance; or Inadequate maintenance	conditions"; ✍ Critical spares on site. (i.e. additional set of bag house filter bags; Water-pump) Planned maintenance program: ✍ Competent maintenance personnel on site or readily available; ✍ Scheduled maintenance of identified "critical" equipment;
		Measurement of stack emissions pursuant to approved standards: Refer to Schedule A of Air Quality Act for reference methods for sampling and analysis;	Incorrect methods/standard Equipment failure (i.e. if continuous monitoring equipment is installed)	Confirm valid national standards with SSA Periodic measurement done by approved inspection authority (SANAS accredited laboratories) Maintenance of monitoring systems should be included in the contract/service agreement

Aspect	Source	Control technology	Potential failure mode	Control procedures/recovery
Fugitive dust	Loading, Mixing, Drying & Heating process. Aggregate Stockpiles Loading Platform (loader) Cold feed bins Scalping screen Screening House Screening Plant Excess Filler (Fines): Raw materials en route to storage silo / receptacle.	No specific control measures currently applied.	Dust evolving essentially as a result of: ✍ "open to atmosphere" processes; ✍ "leakage" from enclosed processes ✍ maintenance activities	Regular inspection and maintenance to assure dust does not "escape" from enclosed system. The following was also considered: Dust suppression by water spray is possible but not practicable for the following reasons: ✍ Increased use of scarce water resources; ✍ Possible limited water supply; ✍ Higher moisture content of the raw materials would result in increased pressure on heating and drying process ultimately leading to increased carbon emissions;
	Conveyor belts	Selective feed sequence of aggregate.	Incorrect feed method.	Feed sequence should be from finest to most coarse aggregate.
	Yard traffic - Access and site Roads	No specific control measures currently applied.	No speed control on dry unpaved roads.	Traffic calming measures (speed humps) and enforcement of maximum speed limits.
Gaseous emissions	Stack Bitumen Heating Burners Hopper / Hot Storage	Monitoring and control of drum temperature.	Poor fuel quality Poor temperature control in drum mixer.	Switch to cleaner burner fuels. Proper setup and maintenance of burners. Optimizing burner setup.
Odour	Loading trucks Stack Rubber blending Hot Storage Skip	No specific process control measures currently in place to remove or contain odour.	"Offensive odours" carried off site by wind irritate your "neighbours".	Cover lorry load bin with tarpaulin?

Aspect	Source	Control technology	Potential failure mode	Control procedures/recovery
Noise	Plant Blower Fan Generator Exhaust Fan General plant operations	Noise measurement. Isolation at source: ✍ Enclosure/cladding ✍ Silencers Isolation along the path: ✍ High walls/dense vegetation on site perimeter	Noise suppression/isolation barriers not in place or not maintained.	Site selection. Plant design & layout. Planned maintenance program.
	Traffic	Vehicle exhaust system silencers	Damaged/faulty silencers	Vehicle inspection and maintenance.
Process waste	Water effluent Wet Scrubber Sludge Recyclable Asphalt Reclaimed Asphalt Pavement (RAP) Excess Filler	Sludge settling pit / dam. Planned recycling of recyclable materials.	Insufficient design/capacity of settling pit / dam; Effluent overflow migrates off site.	Design approved by competent person. Design of settling pit / dam incorporates sufficient secondary containment. (i.e. a soil berm wall).
Laboratory waste	Sampling Toluene distillation	Operating procedures Safe storage facilities	Procedures not followed	Enforce procedures for safe storage of samples and safe disposal of distil residue
Visual aspects	Stack emissions Spillage Briquettes from Lab	Immediate/timely action to rectify conditions that may lead to negative perceptions.	Upset conditions; Visual evidence of spillage or waste left unattended; Poor housekeeping culture.	To minimise the visual impact: ✍ Practice "good housekeeping" at all times; ✍ Ensure that "upset conditions" are rectified as soon as possible; ✍ Where necessary, engage with "neighbours" to manage potential negative perceptions;
Ground /Soil (Water) Pollution	Burner Fuels storage Own use Diesel storage/dispensing	Design standards Operating procedures	Storage tank overfill; Leaking pipelines/flanges	Fuel tanker to storage transfer procedure; Routine inspection of storage and transfer facilities; Bund walls and spill reaction plans; Stock reconciliation procedure;

Aspect	Source	Control technology	Potential failure mode	Control procedures/recovery
	Storm water ingress	Site design & layout	Contaminated storm water migrates off site.	Storm water management plan: Site design & layout incorporates physical barriers to prevent flooding of facilities and controlled drainage of storm water.