Transnet Port Terminal

Saldanha Terminal

*Dust Management Study*

May 2012

Reference: 0153541IR
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EXECUTIVE SUMMARY

Environmental Resources Management Southern Africa (ERM) and its sub-consultant uMoya-NILU were commissioned by Transnet Port Terminals (TPT) to investigate and report on existing dust mitigation and monitoring at the Transnet Port Terminals Bulk Terminal Saldanha (TPT BTS).

Monitoring demonstrates that the facility complies with relevant regulations but the monitoring network and methodology is insufficient to adequately monitor the dust impact felt by adjacent residents, namely the red staining on buildings up to 14 kilometres from the BTS.

Dust management at the BTS has improved significantly over the past few years, mainly due to the installation of normal world standard mitigation measures such as conveyor covers, stockyard water cannons, tippler covers, belt turners, road paving, and the like. Undoubtedly these measures have considerably reduced dust fallout downwind from the facility. A particular point that needs to be made is the overall commitment of Transnet to dust abatement, best exemplified by halting loading operation when dust reaches unacceptable levels.

However, despite the installation and maintenance of these dust abatement systems, and despite the measured reduction in offsite Fe2O3 measurements, the red dust fallout downwind of the BTS continues, albeit at a reduced rate. This investigation has found that to better control dust, further measures will be required, many of these simply extending and improving the existing mitigation methodologies on the site. It is also important to note that other iron ore operations around the world report similar off site impacts.

In summary, this investigation has found that the following are now negligible or relatively small contributors of visible dust, in some cases due to the implementation of earlier control measures:

- rail wagons (although dust from wagons is reported as a significant issue at other sites);
- wagon unloading (although a problem at the dust extraction plant to some extent reduces the efficacy of this plant; this is explained within the report);
- stockpile stacking, reclaim and static wind erosion when mitigation measures are in operation; and
- ore loaded on moving conveyors.

Remaining significant dust sources are from:

- inappropriate maintenance practices at the dust extraction plant;
- vehicle movements on stockyards;
- transfer points;
- carry back on return conveyor belts; and
• the ship loader.

Perhaps the major dust source is from the formation; removal and handling of belt carry back. Simply described, this carry back is caused by fine ore products which have a lot of wet fines that stick to and coat the loaded belt surfaces with a thin layer of iron ore mud (carry back). When these belts turn over the return pulley, this layer of carry back is free to dry, fall off, and blow in the wind, even during clean up procedures. This dried carry back can be seen readily on all conveyor under-surfaces and on the ground underneath the belts. A key finding of this report is the recommendation of the installation of more effective belt cleaners and provision of formalised carry back residue collection systems at each belt cleaner and return pulley.

A relative ranking table of dust generating activities and sources is provided in full in this report and summarised in this executive summary. The table provides a quick colour coded value for prioritising the implementation of the recommended measure. Red items are priority actions, generally due to their relatively high observed or predicted contribution to dust and their relatively low capex and opex. It should be noted that many of these can be implemented immediately.

Yellow items are those that the project team believe are worth pursuing but only once the red items have been attended to. Yellow items can be considered from a continual improvement viewpoint. Green items in the table are those that the project team consider less worthy of pursuing, either because the relatively high capex and opex, or more usually, because the observed and predicted dust from these sources is minor.

Prior to any implementation the SHEQ team at TPT Saldanha will evaluate each of the items in the context of the SHEQ Risk Assessment Procedure to prioritise and establish a risk ranking.
<table>
<thead>
<tr>
<th>Process</th>
<th>Dust sources</th>
<th>Action</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail transport</td>
<td>Wind entrainment off load</td>
<td>No further action</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Ore spillage</td>
<td>No further action</td>
<td>0</td>
</tr>
<tr>
<td>Rail wagon unloading</td>
<td>Tippler</td>
<td>Continue current SOP</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>DEP filter cleaning</td>
<td>Clean up, revise procedure to address disposal of DEP dust</td>
<td>4</td>
</tr>
<tr>
<td>Stockyard</td>
<td>Static stockpiles</td>
<td>Continue current SOP</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Use sprays on stackers</td>
<td>Continue current SOP</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Use sprays on reclaimers</td>
<td>Continue current SOP</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Uncontrolled vehicle movements</td>
<td>Formalise vehicle movements on stock yard</td>
<td>4</td>
</tr>
<tr>
<td>Conveyors</td>
<td>Live loads</td>
<td>No further action</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Transfer points product spills</td>
<td>Clean up</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prevent spills</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Transfer points residue spills</td>
<td>Clean up</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Install better belt cleaner with residue capture mechanism</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Residue spills at belt scrapers</td>
<td>Clean up</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Install better belt cleaner with residue capture mechanism</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Residue spills at belt turners</td>
<td>Clean up</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Install better belt cleaner with residue capture mechanism</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Ineffective belt sprays</td>
<td>Repair sprays and fit windshield</td>
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</tr>
<tr>
<td>Ship loader</td>
<td>Product spills from loader</td>
<td>Investigate source of spillage on ship loader and mitigate to prevent spills and the need to sweep down</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Product bypass from loaded conveyor</td>
<td>Revise emergency procedure to prevent dumping of ore on quay from loaded conveyor</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Belt residue at quayside</td>
<td>Install better belt cleaner with residue capture mechanism</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Positioning of belt cleaner</td>
<td>Investigate the feasibility of locating a belt cleaner at the belt turning point at the end of the quay</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Quay roadway spills</td>
<td>Clean up</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Loading chute</td>
<td>Install foggers</td>
<td>9</td>
</tr>
<tr>
<td>Spill handling</td>
<td>Poor cleaning procedures</td>
<td>Change to hose down or vacuum methods to reduce multiple handling of spills</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>ADT haulage of spilt product</td>
<td>Use truck with tailgate</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Coke and other product spillage on roadways</td>
<td>Contain other bulk load haulage</td>
<td>6</td>
</tr>
<tr>
<td>Ineffective road cleaning</td>
<td>Improve road cleaning</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------------</td>
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<td></td>
</tr>
<tr>
<td><strong>Monitoring</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PM$_{10}$ monitoring</td>
<td>Continue current monitoring and reporting, provide for maintenance of aging monitors</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Install real time monitors on port boundary, upwind and down wind, with live data to Control Room</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Dust fallout</td>
<td>Expand current network along eastern Port boundary and in the wider surrounding areas. Analyse fallout dust for Fe$_3$O$_4$ content.</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Dust flux</td>
<td>Continue with current monitoring and reporting. Investigate replacement of monitors with improved collection efficiency.</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Operational dust monitoring</td>
<td>Investigate the feasibility of operational monitoring at the stacker-reclaimer, transfer point and ship loader</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Complaints register</td>
<td>Continue current SOP</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Environmental incident register</td>
<td>Continue current SOP</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Red zone delineation</td>
<td>Initial and on-going using dust deposition and flux data, amongst other methods.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Research the mechanism of off site staining</td>
<td>Establish a relationship between Fe$_3$O$_4$ dust and the degree of staining.</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td><strong>General issues</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Awareness training of all staff and contractors</td>
<td>Increase awareness regarding dust control to all staff and contractors and the environmental implications</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Bare non-operational areas</td>
<td>Vegetate non-operational areas</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Ore moisture content</td>
<td>Investigate potential to increase contracted moisture levels and the use of chemical suppressants</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Emergency dust mitigation equipment or procedures</td>
<td>Investigate the efficacy of emergency measures to reduce loader shut down frequency</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Manual control of dust management system</td>
<td>Automate system, integrated with meteorological stations, real time PM10 monitors and system PLC. Provide information from all dust management equipment and processes to the SHEQ Manager via a PC Dashboard</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
1 INTRODUCTION

1.1 BACKGROUND

Transnet Port Terminal’s (TPT) bulk iron ore handling facility (see Figure 1) at the Port of Saldanha receives iron ore by rail from the mines at Sishen in the Northern Cape Province. The ore is tipped from the rail cartridges in two enclosed tipplers into bins for transport via conveyor belts to four stacker/reclaimers in the stockyard. Here the ore is stacked in open stockpiles according to the grade. From the stockyard the ore is reclaimed by the stacker/reclaimers and transported with closed conveyor belts to two ship loaders. In some instances ore is transported directly from the tipplers to the ship loaders and so bypasses the stockyard.

All the iron ore handling activities are potential sources of dust and the impacts in the surrounding environment are evident by red soiling of vegetation and structures. TPT endeavours to understand and limit the impact through ambient air quality monitoring initiatives (eg, CSIR, 2007; SRK, 2009; SGS, 2009; uMoya-NILU, 2010) and by controlling the emission of dust with different dust systems and processes (TPT, 2011).

The storage and handling of ore is a Listed Activity defined in Government Notice No. 248 of 31 March 2010, as contemplated in Section 21(1)((a) of the National Environmental Management: Air Quality Act (Act 39 of 2004). Following the application process, a provisional Atmospheric Emission Licence (AEL) was issue to TPT Saldanha on 1 July 2011 by West Coast District Municipality’s Licensing Authority. The provisional AEL is valid until 31 March 2013 and permits operations to proceed under prescribed conditions. These conditions include requirements in terms of ambient monitoring and reporting and to evaluate the current dust management practices at the port before the Licensing Authority will consider an application for a final AEL. TPT has therefore commissioned ERM to conduct a study of the current dust management practices.
Figure 1: Locality Map of Saldanha Bay
1.2 **SCOPE OF WORKS**

The overall objective of the study is to assess the installed dust control processes and technologies to ascertain whether they are fully functional and are effective at reducing the emission of dust, and the resultant levels of dust in the surrounding environment. This aspect of the study should:

- determine if the dust mitigation measures in place are adequate;
- evaluate and determine if the dust monitoring system is sufficient to draw conclusions on dust management options;
- determine legislative compliance with dust standards and other legislation;
- identify and report on mitigation measures to reduce the identified risks;
- provide a timeframe in which these risks can be mitigated; and
- provide a relative cost for the mitigation options.

1.3 **APPROACH**

An outline of the approach by the specialist team is provided here:

i. *Determine if the dust mitigatory measures in place are adequate:*
   The team undertook a site visit to inspect the existing dust suppression technologies and approaches while they were in operation, and to collect relevant documentation including Standard Operating Procedures for dust monitoring and mitigation systems and technical specifications regarding the dust mitigation systems for review. A first-hand impression of the extent and severity of the iron ore soil ing impact in the area was established through observation during the visit.

ii. *Evaluate and determine whether the dust monitoring system network is sufficient to draw conclusions on dust management options*
   The project team reviewed the existing dust monitoring strategy at the bulk iron ore terminal and in the surrounding residential areas. A particle size distribution analysis was conducted of ore dust collected at the terminal. An understanding of other sources of iron ore dust in the Saldabha Bay area was established during the site visit, on review of specialist study reports and in consultations with the Licensing Authority at the West Coast District Municipality.

iii. *Review the existing dust management plan at the bulk iron ore terminal*
   The current TPT dust management plan and Standard Operating Procedurer were reviewed to establish an understanding of the current
dust management at the terminal. The degree of implementation of this plan was determined through the physical inspection of the system while in operation and in discussion with relevant environmental personnel. The findings were compared with best practice.

iv. Review the current air quality legislation

The sections of the National Environmental Managment: Air Quality Act (Act No. 39 of 2004) and related regulations relevant to TPT were reviewed in terms of dust control, ambient monitoring and licensing. Compliance with these requirments is assessed.

v. Current status and revise the management strategy

The understanding developed of the current dust control and monitoring practices, the nature of the impact on the receiving environment, the legal requirements and the identified shortcomings form the basis for the revision of TPT Saldanha dust management the strategy. The revised strategy assigns responsibilities, timeframe, costs and indicators to measure the success of implementan of the revised strategy.

vi. Dust study report:

In this report, an overview of the legal requirements for the ongoing operation of the Bulk Terminal Saldanha with respect to air quality is provided in Chapter 2. The current dust control systems are described in Chapter 3, shortcomings are highlighted and recommendations are made for improvements. The ambient monitoring initiatives are described in Chapter 4 and the ability to measure the efficacy of the dust control measures and the impact is assessed. The revised dust management plan is presented in Chapter 5 which includes time frames, responsibilities, costs and indicators to measure the success of the plan.
LEGAL REQUIREMENTS

The National Environmental Management: Air Quality Act (Act No. 39 of 2004, the MNEM:AQA) came into full effect on 31 March 2010 when the Atmospheric Pollution Prevention Act (Act No. 45 of 1965) (APPA) was repealed. It is a sub-act to the National Environmental Management Act (Act No. 107 of 1998) (NEMA). Two important regulations that support the NEM:AQA are the National Ambient Air Quality Standards (DEA, 2009) and Listed Activities and their respective Minimum Emission Standards in terms of Section 21 of the AQA (DEA, 2010).

2.1 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT NO. 107 OF 1998)

Section 28 of the NEMA addresses the duty of care and remediation of environmental damage. Sub-section 1 and 3 apply to air quality management at TPT Saldanha. These are:

Sub-section 1: Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

Sub-section 3: The measures required in terms of the above may include measures

i) investigate, assess and evaluate the impact on the environment;

ii) inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment;

iii) cease, modify or control any act, activity or process causing the pollution or degradation;

iv) contain or prevent the movement of pollutants or the cause of degradation;

v) eliminate any source of the pollution or degradation;

vi) remedy the effects of the pollution or degradation.

Regarding the requirements of Section 28 of the NEMA, TPT Saldanha systematically implemented dust control measures throughout their operations to minimise the impact in the surrounding environment. In addition TPT Saldanha has been monitoring ambient air quality including PM10, dust fallout and dust flux in Saldanha Bay since 2006 to understand the effect of their operations in the surrounding environment.
2.2 THE AIR QUALITY ACT (ACT NO. 39 OF 2004)

2.2.1 Atmospheric Emission Licence (AEL)

The Atmospheric Pollution Prevention Act (APPA) was repealed on 31 March 2010. With this, the Atmospheric Emission Licensing (AEL) function was delegated to District and Metropolitan Municipalities. The AEL function is the review and conversion of existing APPA Registration Certificates with AEL’s and the issuing of AEL’s for new Listed Activities. In the West Coast District Municipality the designated Air Quality Officer (AQO) Mr Piet Fabricius (Tel: 022 433 8400, email: westcoastdm@wcdm.co.za).

Mineral processing, storage and handling is classed as a Listed Activity in terms of the NEM:AQA (DEA 2010, Category 5). Sub-category 5.1 refers to the storage and handling of ore or coal not situated on a mine or works as defined in the Mines Health and Safety Act (Act No. 29 of 1996), for facilities designed to hold more than 100 000 tons. This applies to the iron ore storage and handling at TPT Saldanha. The requirement is therefore to meet the met the dust fallout standards promulgated in terms of Section 32 of the NEM:AQA in eight principal wind directions. Details of the dust fallout standard are discussed in Section 2.2.2.

A provisional Atmospheric Emission Licence (AEL) was issue to TPT Saldanha on 1 July 2011 by West Coast District Municipality’s Licensing Authority, valid until 31 March 2013. It permits operations to proceed under prescribed conditions. Relevant to this study, these refer to the operation of dust control equipment and record keeping, more specifically:

The dust control measures at all specified emission points should be operated in line with TPT Saldanha’s Environmental Management Plan (EMP) and should abnormal conditions be experienced that could result in dust releases affecting health and well-being and other land users that includes the nuisance factor, the operation must be stopped until such time as corrective action has been taken. Further to this, conditions of the Provisional AEL require that the following should be implemented at operations that have been identified as major dust generating areas:

- spot spraying of areas of stockpiles to be reclaimed with water prior to reclaiming to prevent dust emissions during scoping of iron ore and during windy days;
- remove iron ore spills beneath conveyor belts on a continuous basis to prevent windblown iron ore fines;
- ensure that all vehicles leaving the port are inspected and, if applicable, sent through the vehicle wash bay to prevent dust being spread to areas outside the Port, as well as keeping records of vehicle count and report these to the relevant authority; and
• screening of split ore may only be done during winter months under strict supervision and must be discontinued in the event of dust creation of change in weather conditions according to TPT Saldanha’s EMP.

In addition, TPT Saldanha are required in terms of the Provisional AEL to investigate the effectiveness of the existing dust control measures and on-site dust monitoring measures and to submit action plans, based on international best practice, on how dust emanating from the various operations can be further reduced and contained to the confines of the Port boundaries.

2.2.2 Ambient Air Quality Standards

The National Ambient Air Quality Standards are health based standards, ie ambient concentrations below the standards imply that air quality is acceptable, while exposure to ambient concentrations above the standard implies that there is a risk to human health, particularly for sensitive individuals. The standards consist of an averaging period, a limit value, a frequency of exceedance and compliance date. The limit value refers to a concentration fixed on the basis of scientific evidence to reduce the harmful effects on human health and the environment, to be attained in the given compliance period and to be maintained once this level has been attained. The frequency of exceedance refers to the tolerated frequency of exceedance of the limit value. In other words, if the frequency of exceedance is within tolerance there is compliance with the standard.

The national ambient air quality standards for particulates and dust fallout are relevant in Saldanha Bay and specifically to TPT Saldanha considering the nature of their activities and their potential contribution to ambient particulate concentrations. Ambient standards for criteria pollutants were published in the Government Gazette (2009), including PM10. Draft national ambient standards for PM2.5 were published in the Government Gazette (2011) on 5 August 2011 for comment as reproduced here as Table 2.1.

<table>
<thead>
<tr>
<th>Pollutants</th>
<th>Averaging period</th>
<th>Limit value (µg/m³)</th>
<th>Exceedances per annum</th>
<th>Compliance date</th>
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</thead>
<tbody>
<tr>
<td>PM₁₀</td>
<td>24-hour</td>
<td>120</td>
<td>4</td>
<td>Immediate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75</td>
<td>4</td>
<td>1 January 2015</td>
</tr>
<tr>
<td></td>
<td>1-year</td>
<td>50</td>
<td>0</td>
<td>Immediate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40</td>
<td>0</td>
<td>1 January 2015</td>
</tr>
<tr>
<td></td>
<td></td>
<td>65</td>
<td>0</td>
<td>Immediate</td>
</tr>
<tr>
<td>PM₂₅</td>
<td>24-hour</td>
<td>40</td>
<td>0</td>
<td>1 January 2016</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24</td>
<td>0</td>
<td>1 January 2030</td>
</tr>
<tr>
<td></td>
<td>1-year</td>
<td>25</td>
<td>0</td>
<td>Immediate</td>
</tr>
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<td></td>
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<td>20</td>
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<td>1 January 2016</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15</td>
<td>0</td>
<td>1 January 2030</td>
</tr>
</tbody>
</table>
3 DUST MANAGEMENT

3.1 EMISSION SOURCES

Iron ore is an inherently dusty product and all aspects of ore handling at the Saldanha Bay Terminal are potential sources of dust which, in turn, result in impacts in the surrounding environment. The dust emission sources listed in Operational Philosophy and Location of Dust Mitigation Systems (TPT 2011) are listed in Table 3.1 with reference to the schematic of the terminal in Figure 2 showing the ore handling infrastructure.

Table 3.1 Dust emission sources at the Saldanha Bay Terminal (TPT, 2011)

<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
<th>Ref in Figure 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open ore</td>
<td>i) Entrained dust from moving wagons</td>
<td>Port entrance adjacent to Main Gate</td>
</tr>
<tr>
<td>wagons</td>
<td>ii) Fall through of dust from wagons alongside rail track onto the tracks, and subsequent entrainment by wind</td>
<td></td>
</tr>
<tr>
<td>Tippler</td>
<td>i) Dust generated from unloading wagons</td>
<td>Tippler 1 and 2</td>
</tr>
<tr>
<td></td>
<td>ii) Dust passing through the dust extraction system</td>
<td>DEP</td>
</tr>
<tr>
<td></td>
<td>iii) Dust generated in removal and replacement of filter bags</td>
<td>DEP</td>
</tr>
<tr>
<td>Conveyors</td>
<td>i) Accumulation of ore below belt turning points, subsequent entrainment of dust by wind</td>
<td>BT All points of belt direction or height change, sampling point, new sampling point</td>
</tr>
<tr>
<td></td>
<td>ii) Accumulation of ore below transfer points and sampling points, subsequent entrainment of dust by wind</td>
<td></td>
</tr>
<tr>
<td></td>
<td>iii) Carry back of ore on the return side of the conveyor and resultant deposit under the conveyor, subsequent entrainment of dust by wind</td>
<td></td>
</tr>
<tr>
<td></td>
<td>iv) Spillage or ore and accumulation below the conveyor, subsequent entrainment of dust by wind</td>
<td></td>
</tr>
<tr>
<td>Stockyard</td>
<td>i) Dust generated during stacking and reclaiming</td>
<td>S/R 1, 2 and 3, SSP stockpile Stockyard, SSP stockpile Stockyard, SSP stockpile</td>
</tr>
<tr>
<td></td>
<td>ii) Accumulated dust on open surfaces, subsequent entrainment by wind and moving vehicles</td>
<td></td>
</tr>
<tr>
<td></td>
<td>iii) Wind entrainment of dust from open stockpiles</td>
<td></td>
</tr>
<tr>
<td>Ship loading</td>
<td>i) Dust from the chute during loading</td>
<td>S/L 1 and S/L 2</td>
</tr>
<tr>
<td></td>
<td>ii) Dust from the ship hold during loading</td>
<td>S/L 1 and S/L 2</td>
</tr>
<tr>
<td></td>
<td>iii) Accumulation and pulverisation of ore split or deposited on the jetty from conveyor during emergency and subsequent entrainment by wind and moving vehicles</td>
<td>Iron ore quay S/L 1 and S/L 2</td>
</tr>
<tr>
<td></td>
<td>iv) Emission of dust from ship loader cleaning</td>
<td></td>
</tr>
<tr>
<td>Roads</td>
<td>i) Entrainment of dust from paved and unpaved roads by wind and moving vehicles</td>
<td>All terminal roads</td>
</tr>
<tr>
<td></td>
<td>ii) Spillage onto roads by from vehicles</td>
<td></td>
</tr>
<tr>
<td></td>
<td>iii) Re-suspension of dust during manual cleaning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>iv) Trucking out dust on vehicle wheels</td>
<td></td>
</tr>
</tbody>
</table>
3.2 CURRENT DUST SUPPRESSION SYSTEM

The components of the current dust management system at the Saldanha Bay Terminal are discussed here. Further detail is contained in the Operational Philosophy and Location of Dust Mitigation Systems (TPT, 2011). The discussion here references Figure 2. Photographs 1 to 7 in Annexure A illustrate key components.

3.2.1 Tippler Dust Extraction Plant

Tippler 1 and Tippler 2 are equipped with an automatic dust extraction system to extract dust that is generated during unloading the wagons. The dust laden air is routed to a dedicated filter house (DEP) where the majority is collected. The residual emissions are released to the atmosphere via a stack on each dust extraction plant. Each stack is equipped with an on-line emission monitoring system measuring the particulate concentration in the exit plume. The extracted dust is removed from the filters by means of airflow to a storage silo. The filters are disposed annually during the shutdown and replaced.

The standard procedure is for the removal of the material is bagging for sale or disposal. This procedure is however not being followed and the material is rather removed by the vacuum truck and dumped on the mixed-grade stockpile as a sludge or fine dry product as there is currently no adequate disposal facility or process. The responsibility and procedure for cleaning the tippler dust plant is detailed in the BTS SHEQ Dust Suppression Procedure (BSTE PRO 015). Appropriate disposal of the material need to be investigated and the procedure requires revision to address the alternatives of the material being reintroduced into the system via the mixed-ore stockpile.

3.2.2 Emergency Sprayers Before the Tipplers

When the dust extraction system on any tippler is not functional, all wagons containing lumpy ore should be wet by means of the Emergency Wetting Sprayers (W before Tipplers in Figure 2), prior to tipping. The Emergency Wetting Sprays are manually activated by the Tippler Operator. The procedure for wetting prior to the tippler is detailed in the BTS SHEQ Dust Suppression Procedure (BSTE PRO 015).

3.2.3 Chemical Sprayers / Dosing System

Two chemical dosing plants (CS in Figure 2) are installed at each tippler. At Tippler 1 it is situated in the Head Chute CV109. Similarly at Tipplers 2 the dosing plant is situated in the head chute of CV209. These dosing systems utilise three wetting sprays to add a mixture of water and surfactant to the ore. The surfactant is a dust suppression agent that is formulated from hydrocarbons and stabilising agents and is designed to allow easy penetration of water through bulk material and to improve the wetting properties of the water.
The dosing system is automated according to the ore type, which is inputted by the Tippler Operator. In order to keep the wetting ratio constant, the amount of water and surfactant added is controlled by the tonnage of ore on the conveyor belt. The tonnage is calculated using an ultrasonic sensor measuring the level of ore on the conveyor belt. The responsibility and procedure for the operation of the watering points is detailed in the BTS SHEQ Dust Suppression Procedure (BSTE PRO 015).

The second chemical dosing plant at the Sampling Point in Figure 2 adds water and surfactant to the ore on CV113 and CV213. This plant is integrated with the PLC.

### 3.2.4 Transfer Chute Spray Systems

Dust suppression in the transfer chutes comprises four systems, ie, enclosed material transfer, matching conveyor speeds, wetting sprays and atomising (or fogging) sprays. All the transfer chutes are completely enclosed. The enclosing plate work not only contains the dust, but also ensures that very little spillage occurs.

The wetting sprays apply water into the ore on the conveyor belts as required increasing the moisture content. There are three wetting nozzles per transfer point which are manually operated by the activated by the Central Control Room Operator when additional ore moisture is required. The wetting sprays are managed by analysing the moisture of the transferred ore by means on online moisture analysers which provide input to the control valves on when to add water.

The primary function of the atomising sprays is to prevent the escape of any dust that is created during the transfer of ore from one conveyor to another. This is done by providing a fine mist of water particles at the entrance and exit of each conveyor transfer chute. The water particles bond to the suspended dust particles and increase their mass, forcing them to settle in the chute. The atomising sprays are not intended to add moisture to the ore and their contribution quickly evaporates along the conveyor. The atomising sprays are automated to activate when the conveyor belt starts, regardless of the ore type or whether ore is on the belt. The responsibility and procedure for the operation of the watering points is detailed in the BTS SHEQ Dust Suppression Procedure (BSTE PRO 015).

### 3.2.5 Stockpile Water Canons

The water cannon system (WC on Figure 2) is used to wet the surface layer of the stockpile layer up to a depth of 300mm to bind the surface and prevent dust from being entrained by wind. The water cannons are manually operated by Central Control Room in the early morning when the wind is calm to ensure higher efficiency. Preference is given to stockpiles that will be reclaimed during the day, and a number of cannons need to be operated simultaneously for effective cover. Specific stockpile sprinklers in the direct
vicinity of a Stacker-Reclaimer are used before and during reclaiming from lump ore stockpiles. The responsibility and procedure for the wetting the stockpiles is detailed in the BTS SHEQ Dust Suppression Procedure (BSTE PRO 015).

3.2.6 **Stacker/Reclaimer Dust Suppression Systems**

The dust suppression system on the Stacker-Reclaimers is manually controlled by the machine operator, at the operator discretion or by instruction. The system consists of transfer chutes, a stacking spray system and a reclaiming spray system. The boom feed chute and the centre chutes on the Stacker-Reclaimers are enclosed to contain dust that is generated when material is transferred through them. They also utilise atomising sprays to suppress any generated dust.

Stacking of iron ore onto the stockpile is an open transfer of material and dust generated in this process immediately escapes into the atmosphere. A wetting spray bar increases the moisture content of the ore before it leaves the boom conveyor. The system to suppress dust during reclaiming consists of bucket wheel atomising sprays and a water spray system. The bucket wheel atomising sprays create a mist to suppress any dust already suspended in the air and the water spray system ensures that the ore has sufficient moisture content.

3.2.7 **Online Moisture Monitoring and Control**

The objective of the Online Moisture Monitoring and Control System is to maintain the moisture content of the ore as high as possible without exceeding the maximum allowable moisture content. The moisture content is measured by two LF Microwave Moisture Analysers mounted on conveyors CV114 and CV214. The Moisture Control Sprayers System comprises the wetting sprayers on the shipside conveyor transfer points i.e.: CV116/113, CV116/213, CV112/113, CV112/213, CV111/113 and CV111/213; the wetting sprayers at the end of the direct loading conveyor CV140; and the two Moisture / Flow Control Wetting Sprayers on CV113 and CV213. These are controlled by the Online Moisture Analysers. Water is added to the ore if the moisture analyser readings are 0.8% and stopped when it reaches 1.2%.
Figure 2   Layout of ore handling infrastructure at the Saldanha Port Terminal (TPT, 2011)
If however the ore is exceptionally dry despite the Moisture/Flow Control Valve being fully, the Programmable Logic Controller (PLC) that controls the plant automatically will open one of the wetting valves associated with the conveyor feeding onto conveyor CV113/213 to increase the ore moisture content. If the moisture remains too low, another wetting valve will be opened. This scenario will be repeated for the maximum of 4 wetting valves are open. Conversely, when the Moisture/Flow Control Valve has been fully closed and the moisture value is still too high, the PLC will close one of the opened wetting valves to limit the amount of moisture added. If the moisture remains too high, another wetting valve will be closed. This scenario will be repeated till all wetting valves are closed.

The responsibility and procedure for the operation of the online watering points is detailed in the BTS SHEQ Dust Suppression Procedure (BSTE PRO 015).

3.2.8 Conveyor Dust Covers

All conveyors are enclosed on the sides and top with dust covers where practical, except CV305 which feeds the SSP stockpile. The intention of the dust covers is to limit the amount of dust picked up off the conveyors by cross winds, to allow for better moisture management by sheltering the ore from rain, and preventing evaporation by sun and wind. The Conveyor Belts Maintenance Manager is responsible for the windshield installation, repair and replacement (BTS SHEQ Dust Suppression Procedure, BSTE PRO 015).

3.2.9 Belt Cleaning

Carry back, which refers to the material that remains on the return side of the conveyor belt after the majority of the ore has been transferred, is a source of dust. Two belt cleaning systems are used to address this issue, namely scrapers and belt turn over point sprays.

The scrapers, as the name suggests, physically scrape material from the return side from the belt. They require specific skills to be maintained properly and the maintenance is conducted by an outside contractor who reports back to the port on a weekly basis detailing the actions taken.

Sprays are installed at the belt turn-over points on conveyors CV114 and CV214 to clean the dirty under-side of the belt to ensure any carry back material is not kicked off as dust when the belt is turned over. These sprays are automated and turn on when the conveyor belt starts. The sprays wet the underside of the belt regardless of whether ore is being transferred or not and operate regardless of the weather.

The responsibility and procedure for cleaning at belt turn over points and the slabs beneath the belts is detailed in the BTS SHEQ Dust Suppression Procedure (BSTE PRO 015).
3.2.10 Emergency Wetting Sprays

Under normal circumstances no water can be added to the ore after the New Sampling Plant with the exception of the Emergency Wetting Sprayers (ES in Figure 2) at the head end of conveyor CV114 and conveyor CV214. If these conveyors stop under load and the ore dries the emergency sprayers are used to add moisture for approximately 10 minutes at restart to prevent excessive dust at the ship loaders (SL 1 and SL2) when the conveyors are restarted.

3.2.11 House Keeping

Housekeeping refers to the protocol to contain the dust or spillages of ore. It includes the treatment of roads and the handling of spillages by the Operations Crew, using the sweeper truck and vacuum truck.

Road Treatment

The silt content on the roads at the terminal varies from 0.33 g/m$^2$ at the entrance and main access road to 0.29 g/m$^2$ on the haul road (SGS, 2012). This fine powder on the surface of the roads is agitated and entrained into the atmosphere when vehicles move over the roads. This source of dust is controlled in three ways. Firstly, a sweeper truck is used to lift the dust from the surface of the paved roads. Its operation is controlled by the Operations Manager and it should be in daily operation. Secondly, a water truck is used to wet the surface of the road to suppress dust generated by vehicular movement. The responsibility and procedure for the operation of the sweeper truck and vacuum truck is detailed in the BTS SHEQ Dust Suppression Procedure (BSTE PRO 015). The water truck applies water on a daily basis and Rota foam, a dust suppressant, on all roads surface on a weekly basis. The operation of the truck is controlled by the Environmental Manager. A second sweeper truck and an additional bobcat have recently been procured.

Thirdly, the wash bay at the Procurement Office is used to clean operational vehicles and the wash bay at the Main Gate is used to clean all dirty vehicles before they exit the port to prevent ore mud being spread by vehicles beyond the port boundaries. The operation of the Wash Bay is controlled by the Operations Manager and should be in operation at all times. The responsibility and procedure for washing dirty vehicles detailed in the TPT Procedure (BSTE PRO 017).

Spillage Handling

Spillage of ore is potentially a significant contributor to dust from the Port. They are handled in two ways. Firstly, the source of the spillage should be identified and addressed, and secondly, spilled ore should be collected and removed promptly. A number of approaches are used to address spillages. The responsibility and procedure for cleaning spillages is detailed in the BTS SHEQ Dust Suppression Procedure (BSTE PRO 015).
Spillages in areas that cannot be accessed by the trucks and loaders such as the below chutes and conveyors are cleaned by the Operations Crew using spades. They pile spilt ore where it can be removed by the larger equipment. These crews operate daily during normal working hours.

Ore that is kicked off the conveyor belts by return idlers, bend pulleys and scrapers is also collected and piled in a location by the Operations Crew for subsequent removal by the vacuum truck. The vacuum truck should operate every day with Operations Crew to reduce the time that spillage stand, thereby reducing the potential for dust to be generated.

A front-end loader and a tipper truck are used to deal with large spillages. They operate every day to reduce the time major spillages are exposed to the atmosphere.

A Bobcat is used to collect spillages in areas that cannot be accessed by the front-end loader. It piles the spilled ore in locations so it can be removed by the front-end loader. The Bobcats operate daily in order to remove any spillage and minimise their potential for dust generation.
TPT Saldanha has implemented three mechanisms to record and manage complaints. Firstly, a register is kept at the main gate where members of the public may record complaints or report incidences. Secondly, complaints may be submitted telephonically to a Call Centre, where they are recorded. Thirdly, complaints may be made directly via telephone to the environmental personnel using published contact numbers. In all cases, the complaint, or incident, is logged on the isometric system for investigation and management follow up. An example of a non-conformance report and the action trail is included in Figure 3.

![Figure 3: Example of a non-conformance report](image)
TPT Saldana has invested in significant dust mitigation measures including conveyor covers, water cannons, chemical sprayers and atomising sprayers, enclosed train wagon tipplers with a de-dusting system, enclosed transfers and truck wash bays and dedicated spill handling. The system described in detail “Operational Philosophy & Location of Dust Mitigation Systems, Transnet Port Terminals, Saldanha Terminal” (TPT, 2011). An overview is provided Section 2.1.2 and Photographs 1 to 7 Annexure A illustrate these.

The following measures appear to be making a significant positive contribution to dust management at the Port:

- train tippler enclosure and associated the dust extraction plant (DEP);
- water sprayers on loaded conveyors;
- water cannons on product stockpiles;
- enclosures and atomiser sprayers on transfer chutes; and
- the general awareness of dust issues with the site environmental staff.

A particular point that needs to be made is the overall commitment of TPT to control dust. This is demonstrated through the investment in dust abatement as discussed in TPT (2011), standard operation procedures for dust management, and the responsibilities granted to the Environment Manager.

However, given the extent of offsite impacts observed during the site visit on 2 February 2012, additional works and protocols are needed. Table 5.1 provides a list of specific areas of concern and recommended improvement, generally presented in accordance with site processes, commencing with inbound trains.

Table 5.1 gives relative values to the dust contribution of each listed source and provides a relative comparison of expected capital expenditure (CAPEX) to install a corrective measure, as well as comparative operation expenditure (OPEX) to maintain this measure. The given values are not absolute, and are provided for indicative comparisons only. Finally, Table 5.1 provides a colour coded value for implementing the recommended measure. Red items are those that are considered priority actions, generally due to their relative high observed or predicted contribution to dust and their relatively low CAPEX and OPEX. It should be noted that many of these measures can be implemented immediately. Green items involve relatively high CAPEX and OPEX or more usually, because the observed and predicted dust from these sources is minor. Yellow items are those that the project team believe are worth pursuing but only once the red items have been attended to. Yellow items can be considered from a continual improvement viewpoint.
<table>
<thead>
<tr>
<th>Process</th>
<th>Dust sources</th>
<th>Action</th>
<th>Relative dust contribution or monitoring value</th>
<th>Capex or time</th>
<th>Opex</th>
<th>Ranking for action (dust contribution by sum of capex/time and opex)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rail transport</strong></td>
<td>Wind entrainment off load</td>
<td>No further action</td>
<td>1 high, 2 med 3 low, 4 negligible</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Ore spillage</td>
<td>No further action</td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Rail wagon unloading</strong></td>
<td>Tippler</td>
<td>Continue current SOP</td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>DEP filter cleaning</td>
<td>Clean up, revise procedure to address disposal of DEP dust</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td><strong>Stockyard</strong></td>
<td>Static stockpiles</td>
<td>Continue current SOP</td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Use sprays on stackers</td>
<td>Continue current SOP</td>
<td></td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Use sprays on reclaimers</td>
<td>Continue current SOP</td>
<td></td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Uncontrolled vehicle movements</td>
<td>Formalise vehicle movements on stock yard</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
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<tr>
<td><strong>Conveyors</strong></td>
<td>Live loads</td>
<td>No further action</td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Transfer points product spills</td>
<td>Clean up</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prevent spills</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Transfer points residue spills</td>
<td>Clean up</td>
<td></td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Install better belt cleaner with residue capture mechanism</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Residue spills at belt scrapers</td>
<td>Clean up</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Install better belt cleaner with residue capture mechanism</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Residue spills at belt turners</td>
<td>Clean up</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Install better belt cleaner with residue capture mechanism</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Ineffective belt sprays</td>
<td>Repair sprays and fit windshield</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Ship loader</strong></td>
<td>Product spills from loader</td>
<td>Investigate source of spillage on ship loader, mitigate to prevent spills and the need to sweep</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Issue Description</td>
<td>Action Description</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Product bypass from loaded conveyor</td>
<td>Revise emergency procedure to prevent dumping of ore on quay from loaded conveyor</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Belt residue at quayside</td>
<td>Install better belt cleaner with residue capture mechanism</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Positioning of belt cleaner</td>
<td>Investigate the feasibility of locating a belt cleaner at the belt turning point at the end of the quay</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Quay roadway spills</td>
<td>Clean up</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Loading chute</td>
<td>Install foggers</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td><strong>Spill handling</strong></td>
<td><strong>Spill handling</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor cleaning procedures</td>
<td>Change to hose down or vacuum methods to reduce multiple handling of spills</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ADT haulage of spilt product</td>
<td>Use truck with tailgate</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Coke and other product spillage on roadways</td>
<td>Contain other bulk load haulage</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Ineffective road cleaning</td>
<td>Improve road cleaning</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td><strong>Monitoring</strong></td>
<td><strong>Monitoring</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PM&lt;sub&gt;10&lt;/sub&gt; monitoring</td>
<td>Continue current monitoring and reporting, provide for maintenance of aging monitors</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Install real time monitors on port boundary, upwind and down wind, with data to Control Room</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Dust fallout</td>
<td>Expand current network along eastern Port boundary and in the wider surrounding areas. Analyse fallout dust for Fe&lt;sub&gt;2&lt;/sub&gt;O&lt;sub&gt;3&lt;/sub&gt; content.</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Dust flux</td>
<td>Continue with current monitoring and reporting. Investigate replacement of monitors with improved collection efficiency.</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>Description</td>
<td>Priority</td>
<td>Resource Required</td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------</td>
<td>-------------------</td>
<td>-------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Operational dust monitoring</strong></td>
<td>Investigate the feasibility of operational monitoring at the stacker-reclaimer, transfer point and ship loader</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Complaints register</strong></td>
<td>Continue current SOP</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Environmental incident register</strong></td>
<td>Continue current SOP</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Red zone delineation</strong></td>
<td>Initial and on-going using dust deposition and flux data, amongst other methods.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Research the mechanism of off site staining</strong></td>
<td>Establish a relationship between Fe$_2$O$_3$ dust and the degree of staining.</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>General issues</strong></td>
<td><strong>Awareness training of all staff and contractors</strong></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bare non-operational areas</strong></td>
<td>Vegetate non-operational areas</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ore moisture content</strong></td>
<td>Investigate potential to increase contracted moisture levels and further chemical suppressants</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Emergency dust mitigation equipment or procedures</strong></td>
<td>Investigate the efficacy of emergency measures to reduce loader shut down frequency</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Manual control of dust management system</strong></td>
<td>Automate system, integrated with meteorological stations, PM10 monitors and system PLC. Provide realtime information from dust management equipment and processes to the SHEQ Manager</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A number of items in Table 5.1 are worthy of more detailed discussion and the following sections consider these by process component. The implementation of these recommendations is detailed in Section 3.4. It is worth noting that in some cases, it might be reasonable from a community engagement and satisfaction viewpoint to undertake works and procedures that will not significantly reduce dust. One such example might be the question if installing foggers on ship loading chutes; it may not provide significant dust amelioration, but it is an example of world best practice that may provide a degree of community satisfaction at a relatively small cost.

Prior to any implementation the SHEQ team at TPT Saldanha will evaluate each of the items in the context of the SHEQ Risk Assessment Procedure to prioritise and establish a risk ranking.
6 RECOMMENDED MANAGEMENT IMPROVEMENTS

6.1 RAIL TRANSPORT

Observations by the project team on the days of inspection showed no visible loss of iron ore fragments or dust from wagons (see Photographs 14, 15 and 16). The absence of dust build-up or increased staining alongside the tracks suggests that wagons are not a significant source of dust during transport of iron ore. Accordingly, as per Table 5.1, no additional mitigation measures are proposed in this part of the process.

6.2 RAIL WAGON UNLOADING

Rail wagons are unloaded in pairs in the enclosed tippler house. Observations on the day when fine ore was unloaded suggest that there is limited fugitive dust from this process (see Photograph 1).

The DEP adjoining each tippler room extracts dusty air from the tipping, scrubs it through particulate filters and exhausts the cleaned air it via a stack. Continuous stack monitoring shows that the levels of dust in the emission are well below the concentrations set in TPT’s APPA Registration Certificate (Ref). However, on the day of inspection, significant dust had been deposited under the DEP (see Photographs 17 and 18), possibly due to filters being cleaned onto the walkways and pavements. Without timely cleaning of this spillage, the effectiveness of an expensive and potentially effective dust mitigation measure is substantially reduced.

6.3 STOCKYARD

The stockyards are generally well managed and maintained and show little direct dust loss during inspections. This is most likely the result of intermittent use of the water cannons.

There was some visible dust from both stacking and reclaiming, and while limited, the use of dust sprays on both stackers and reclaimers would further reduce this emission of dust. With dust control mitigation on the stock yard it does not appear that reducing the stock pile size will not significantly reduce dust from TPT.

On the day of inspection, the most significant source of dust from the stockyards was dust entrained by light vehicle and haul truck traffic (see Photograph 19).
While significant dust mitigation has been afforded by conveyor covers, sprays, chutes and belt scrapers, significant dust sources are evident at transfers, belt turners and considerable lengths of return belts. There are various sources and reasons, such as:

- product and dust leakage from transfer chutes (see Photographs 20 to 22);
- sticky carry back builds up on conveyors falling from return belts throughout the system (see Photograph 23);
- inoperative or ineffective belt scrapers and associated sprayers (see Photograph 24);
- carry back deposition from scrapers and belt runners needing manual clean up (see Photograph 25);
- the return rollers on the extendable ends of the stockyard conveyer s drop waste product onto a concrete pad, which then requires mechanical and manual clean up (see Photographs 26 to 28), and
- open conveyor feeding the Arcelor Mittal stockpile.

The fact that substantial volumes of mud and dust falls from the return belts, means that significant volumes of product waste needs to be cleaned out from under conveyors. This process is time consuming, labour intensive, and was observed to raise dust itself. The failure of the belt scrapers, turners and cleaners to effectively remove fines from the belt, means that a chain of events leads on from this formation of carry back, and dust is generated at every link on this chain. It appears to be a significant dust source from the facility.

A simplification of this chain of events is as follows:

- a thin layer of carry back residue sticks to belt surfaces and on reversal of the belt at the end pulley, is free to drop onto the ground;
- as the belt proceeds, this carry back dries out and commonly falls off as it contacts the lower rollers, or in some cases is dislodged by scrapers. At this time, dust is created;
- by now the dried carry back has become distributed along the length of the conveyor system and piles up on support members or on the ground beneath the belts. Here the dried carry back is free to blow and cause dust;
- this carry back is now brushed up, picked up by bobcat or loader, commonly with multiple handlings and movement, all of which create dust;
• this residue is collected and trucked either to waste, or back onto the stockpile, processes which also create dust; and

• at this point, the carry back is loaded back onto the belts to restart the dust generation process.

If a more effective belt cleaning process was implemented, this chain of dust generating events would, to a large extent, disappear.

Regarding the open conveyor to the Arcelor Mittal stock pile, ensuring sufficient ore moisture will reduce dust from this source.

6.5 **SHIP LOADER**

On the day of inspection, the quay-side roadway was heavily loaded with ore product that was several centimetres thick in many places. In addition, large piles of product were observed to have built up on high sections of the ship loader itself, which provides a large and highly exposed dust source. This is consistent with silt measurements at the quay of between 1 275 and 2 104 g/m² (SGS, 2012). During a windy period of inspection, even large particles were being moved and blown into the faces off the project team.

The belt turner over point at the end of the quay is not equipped with a carry back capture facility. Therefore any residue that adheres to the belt is likely to be deposited under the belt along the quay and will require manual and mechanical clean up, a process which would raise dust. After this turning point the return belt cleaner is at the head of the quay, i.e. as the return bely leave the ship loader area. This implies that the dirty return belt travel the length of the ship loader quay before being cleaned.

Discussions with site staff suggest that shortcomings in the ship loader design mean that product is lost off transfers and deposits on loader members. This is then routinely swept off onto the quay deck. Additionally, it is understood that when a ship reaches design capacity, surplus ore from the loaded conveyor is dumped onto the quay deck, and subsequently picked up by loader for trucking back to the stockyard.

On the day of inspection, the ship loader could not be accessed to inspect any dust emanating from the loading chute. From the quay, none was observed by the team although operators of other iron ore loaders have reported significant dust from loading chutes and in some cases have installed telescopic chutes or foggers to retain dust within the ship holds. It is understood that at Saldanha, telescopic chutes were fitted at one point but were replaced with fixed extensions. Empirical tests by operators have shown that it is best to keep the chute spout about a meter above the hatch during loading to prevent a pumping effect in the hold and dust being generated when the chute is lower.
If the ore is moist no dust will be emitted during loading. Under normal circumstances no water can be added to the ore after the New Sampling Plant. However, correctly set-up and maintained atomising sprayers can reduce dust at the at the ship loaders without adding measurable moisture to loads.

Significant work is required at the ship loader and quay side to manage dust, including the an investigation of the ideal ore moisture content to prevent any dust emission.

6.6 **SPILL HANDLING**

*Table 5.1* refers to a number of issues around spill handling. Spills currently occur at all points along the conveyors, most notably at belt ends, scrapers and transfers. In some cases at the facility, there are formalised semi-enclosed carry back and spill capture points, but in most cases, product and carry back drop uncontained onto the concrete or hardstand below conveyors. From here it is mechanically or manually picked up and transported to the stockyards. Each step in this spill handling process causes dust. Much of this could be prevented by re-engineering spill containment. It is noted that the recommended commissioning of more effective belt cleaners, will to a large extent reduce the scale of such re-engineering, as carry back loss would then be restricted to end pulleys, belt turners and belt cleaning sites. It is recommended that carry back containment bins or bays be provided at these points and at product transfers where spills cannot be prevented. These containment bins should be designed to allow mechanical removal of carry back and product to reduce the likelihood of dust generation.

A variety of product spills were noted on internal haul roads, particularly iron ore pellets and coke, which are dropped from uncovered trucks hauling products from the general bulk terminal. The contribution of these spills to the overall dust signature of the site is unknown.

Articulated dump trucks (ADTs or Moxys as they are commonly known) are used to haul collected iron ore spills back to the stockyards. These truck are not equipped with tailgates and are therefore very likely to spill product onto the sealed internal haul roads, thereby generating a dust source. Sourcing trucks with close sealing tailgates, and possibly covers would remove this source, although the implementation of other recommendations that would reduce the total spill and carry back volume may make this measure obsolete. However, covering or otherwise containing coke, iron ore pellets and other bulk loads would still be feasible and would further reduce dust sources.

Sealed internal haul roads are very clearly highly stained, and road sweeping, vacuuming and watering does not appear to be effective. The heavy staining and heavy traffic is expected to produce fine dust.
6.7 GENERAL ISSUES

Table 5.1 refers to a range of issues that are not specific to any single part of the loading process. These include the:

- lack of environmental awareness training for TPT workers and contractors;
- lack of technical training for operators on operational management of the dust control systems, and awareness of the consequences for poor operational management;
- presence of extensive bare, non-operational areas;
- the low contracted moisture levels for the ore;
- general lack of emergency dust mitigation procedures or equipment, apart from shutting loading operations; and
- manual nature of the dust management process.

For TPT Saldanha to be considered a world class loading facility, all of the listed issues require attention. The following sections provide further detail on these issues.

6.7.1 Environmental Awareness Training

It is very likely that Transnet’s iron ore suppliers undertake formal environmental awareness training of their operators, staff and contractors. This is normal practice at mines and bulk facilities. This training need not be long or detailed, and would usually form part of a new employee or contractor’s start up induction and is commonly part of the health and safety induction. At TPT Saldanha, environmental training should be done according to Transnet’s training matrix with occasional contractors receiving minimal awareness training and permanent site staff, such as conveyor maintenance crews, sweeping crews and plant operators receiving a higher level of training.

6.7.2 Bare Non-Operational Areas

Several bare but non-operational areas were noted. Photograph 29 shows a small area near the breakwater that has been partially revegated. This is an excellent attempt, although it should be noted that this particular environment is very hostile to plant growth, given the salt spray over the breakwater. There are many other areas, particularly along roadsides that could be successfully planted to beautify the site, reduce an area emission source and potential even catch dust.
6.7.3 Low Ore Moisture Levels

TPT (2011) notes that while a relatively high moisture level is critical in managing dust at the port, the contract coarse ore moisture level is 1.2%. While not explicitly stated, the report suggests that the fine ore contract moisture level is around 3.5%. The report also notes that Kumba, who control the water/chemical dosing plant, are penalised should the moisture levels exceed contract specifications. Clearly there is pressure on Kumba to minimise water addition, but it is this water that reduces dust. Other iron ore terminals report product moisture levels up to 7%, although desk top research does not provide information on how similar these products are to those loaded at Saldanha Bay.

The dust extinguishment moisture (DEM) level will vary by product, although theoretically, DEM of iron ore may be around four to seven per cent (Process Online, 2012). Environ reports that West Pilbara (Western Australia) iron ore has a DEM of 7.6% for particle fraction less than 6.3 mm (www.apijv.com.au).

A useful comparison can be made with the Oakajee iron ore rail and port project in Western Australia. This project mines, transports and loads 45 mtpa in a relatively dry and windy environment. Of note the project has determined the DEM and ensures by constant testing that this level is reached and maintained from the mine, along the railroad, at the port and all the way to the shiploader (ORP, 2010).

A related issue is the potential for the use of chemical or other dust suppressants that do not contribute to moisture levels. Jacks Hill iron ore mine in Western Austral has been experimenting with a dust suppressant called Soiltac® to apparently good effect (Mining Magazine, 2006). OneSteel’s Whyalla Steelworks has sprayed paper pulp onto iron ore stockpiles to reduce dust.

It is recommended ERM that TPT investigate the potential to increase contract moisture levels as even a minor increase in moisture levels is likely to significantly aid in dust reduction. Prior to any contract discussions, it is suggested that TPT calculates by direct experimentation (most commonly undertaken by a rotating drum test), the minimum moisture level that extinguishes dust entrainment for all of their products. Any increase in moisture levels would of course need to be within safe shipping limits, as high moisture levels can lead to settling or shifting cargos.

Combined with a revision of moisture content and the further addition of dust suppressants, TPT should consider installation of real time 100% ore moisture sampling to better guide water or suppressant additions.

6.7.4 Emergency Procedures

At this time, it is understood that the only emergency dust mitigation measures are the addition of water to laden conveyors (CV 114 and CV214) if
they restart after tripping and the shutdown of loading when the dust emissions are observed and are unacceptable. The site Environment Manager reports that dust induced loading shut downs occur approximately 10 times per year. Less drastic measures may be more appropriate, for example, the use of portable water sprays or foggers. The effectiveness of such devices though will depend very much on the dust source, but as a longer term measure. An investigation into what are the sources of dust in such emergency situations is recommended, and whether is there some other measure that can reduce this dust.

6.7.5 Automation of Dust Management Processes

Currently the facility’s dust management process is almost entirely manual, and dependent on the judgment and discretion of relatively untrained personnel. Such a discretionary system is prone to operator error due to differences in operator’s opinion, vision, ability to observe, and a range of behavioural issues. As an example, the chemical dosing plant at the old sampling building is operated by Kumba, with limited feedback to the overall TPT system. A world class facility would employ fully automated dust management to provide a consistent and high level of management.

To give a relevant example, the Port Waratah Coal Services (PWCS) 100 mtpa coal loader in Newcastle, Australia, recently automated its dust management system to great effect. The PWCS facility is closer to residences than the Saldanha facility, but the issues are similar, albeit it that contract allowable coal moisture levels are much higher that allowed by Transnet’s contract. PWCS tied their dust management sprays into the facility coal process programmable logic controller system, and the logic controllers use various algorithms supplied with data from up and down wind real time dust monitors, a site weather station, product moisture sensors and predicted weather from the local governmental meteorological service. By automating the system, PWCS removed several layers of guess-work and operator discretion.

It is recommended that TPT investigate the opportunity of automating all of the dust control measures and integrating it with the facility’s process flow system. Automation has the advantage of removing subjectiveness and ensures consistent operation of the abatement equipment. There are various commercial suppliers of such automation systems, but it is recommended that TPT personally investigate similar systems that have been installed elsewhere.

The supply of information from all dust management processes on a real time basis to the Operational Manager and the SHEQ Manager implies that information is available for proactive management. It is recommended that this information is made available via and environmental ‘dash board’.
AIR QUALITY MONITORING AND SOILING

Emission measurements on the two DEP stacks and ambient air quality monitoring at the Port and in the surrounding environment have been conducted for a number of years. Continuous measurements of PM$_{10}$ and wind speed and direction have been made at the TPT offices in Saldanha Bay and in Vredenburg by different consultancies since 2002, including the City of Cape Town, Ecoserv, Titan Technologies. SGS were contracted on July 2007 to managed the network are the current service providers. SGS were contracted in 2008 to undertake dust fallout measurements at three sites, the Port Jetty, the TPT offices in Saldanha Bay and in Vredenburg. CSIR were contracted in October 2006 to monitoring the horizontal flux of total particulates and the iron ore indicator (Fe$_2$O$_3$) was initiated in October 2006. The work was taken over in October 2009 by uMoya-NILU Consulting and in October 2011 by Kayad Knight Piésold Consulting.

A number of on-site flux monitors are located to monitor the contribution of specific areas or activities, e.g. the stock yard and the ship loader. However, specific monitoring on equipment for operational management of dust, e.g. stacker-reclaimers and the ship loaders, is not done.

An overview of the different monitoring initiatives is discussed here with emphasis assessing on whether the respective methodologies are appropriate to draw conclusions on dust management and on monitoring legal compliance.

7.1 EMISSIONS MONITORING

Monitoring of dust concentration in the DEP stack after the filtration process is done on a continuous basis. The information is made available to the operator and is reported monthly to the SHEQ Manager. While emission limits were set in terms of TPT Saldanha’s APPA Registration Certificate, these do not apply in the conditions Provisional AEL. The information is used to manage the tippler operations and to investigate non-compliances. It is noteworthy that the emission measurements are consistently well below the APPA emission limit values.

Currently the information is not immediately available to the SHEQ Manger making proactive management and interventions at the tippler impossible. This considerable inhibits his ability to manage and report accurately on incidences. It is therefore recommended that the in-stack measurements are made available to the SHEQ Manager on an on-going basis.

7.2 PM$_{10}$

In 2002, TPT Saldanha installed two continuous PM$_{10}$ monitoring stations, one near the National Port Authority offices in Saldanha Bay and at the second at
municipal water reservoir in Vredenburg, together with measurements of wind speed and direction. The objective of the on-going PM$_{10}$ monitoring is to monitor compliance with the National Ambient Air Quality Standards.

PM$_{10}$ is regarded as a regional scale pollutant with a range of different contributing sources that include, *inter alia*, industry, combustion processes, windblown dust from storage piles and open areas including farm lands, motor vehicles exhaust emissions and entrained dust from roads. It is therefore extremely difficult to apportion the measured PM$_{10}$ concentrations at Saldanha Bay and Vredenburg to the different sources. Nevertheless, throughout the monitoring term there have been no recorded exceedances of the annual ambient PM$_{10}$ standard of 50 µg/m$^3$, or the daily ambient standard of 120 µg/m$^3$ at either station. Occasional exceedances occur of daily standard of 75 µg/m$^3$ that will come into effect on 1 January 2015. The daily (24 hour) average PM$_{10}$ concentrations for 2009 are shown in Figure 4.

![Figure 4: Daily (24 hour) PM$_{10}$ concentrations in 2009 at Saldanha Bay (top) and Vredenburg (bottom) in µg/m$^3$, showing the daily ambient standard in red (SGS, 2009).](image)

The air quality assessment for the Saldanha Bay IDZ study (Westco, 2011) considered emissions from the Port and major industrial sources to predict PM$_{10}$ concentrations over the region. These predictions confirm the
monitoring results and provide insights into the extent of the influence of individual sources. The spatial extent of PM$_{10}$ resulting from the Port is predicted to be relatively limited with high concentrations at the Port and the immediate surroundings (Figure 5).

The monitoring results indicate that ambient PM$_{10}$ concentrations in Saldanha Bay and Vredenburg complies with national ambient air quality standard, and by inference, pose little risk to human health. TPT Saldanha is a contributing source to the regional PM$_{10}$ concentrations. With the total PM$_{10}$ concentrations below the ambient standard, it can be confidently stated that contribution from TPT Saldanha alone will comply with the PM$_{10}$ standard.

The current siting of the two PM$_{10}$ samplers and the mode of operation cannot provide direct input to TPT regarding dust management. As stated, the information is not specific to the TPT operations at the Port and provides a regional context. The contribution of TPT Saldanha to the regional PM$_{10}$ concentration cannot be determined without a means of apportioning the contribution, ie, by means of a unique ‘fingerprint’ and chemical analysis. Without the direct and real time supply of information to the TPT Saldanha Control Room, the PM$_{10}$ data cannot be used to manage operations in a way to reduce the impact of dust in the ambient environment.

Figure 5: Modelled annual average PM$_{10}$ concentrations from the Port and other significant emission sources in Saldanha Bay (Westco, 2011)

Recommendations are therefore:

- retain the two PM$_{10}$ monitoring stations and replace them as they become unreliable due to age. Retention of these stations will provide continuity of the long term data set and will be useful in proving compliance. In the longer term, removal might be appropriate;
• install real time PM$_{10}$ monitoring stations upwind and downwind of the loader on the prevailing wind with a direct feed into the Control Room PLC for appropriate management of operations when downwind concentrations exceed a set threshold. These monitors will be different to the current high volume air samplers and will enable timely operation changes to reduce dust emissions downwind;

• install an on-site wind sensor with real-time display to the Ops Room and the SHEQ Manager.

7.3 DUST FALLOUT

Dust fallout monitoring at the Port, the TPT offices in Saldanha Bay and in Vredenburg has been ongoing since 2008. The objective of the monitoring is to monitor compliance with the National dust fallout limit of 600 mg/m$^2$/day for light commercial and residential areas, and 1 200 mg/m$^2$/day in other areas, measured as a 30-day average.

The West Coast is a relatively arid environment and is consequently dusty. Besides the natural sources of dust, there are numerous other sources including, inter alia, TPT Saldanha, industry, quarrying, agriculture and entrained dust from roads. Unless a monitor is located close to a dominant source it is extremely difficult to apportion the measured dust fallout at any site to the different contributing sources.

Nevertheless, throughout the monitoring term there have been no recorded exceedances of the monthly dust fall limit value of 600mg/m$^2$/day for light commercial and residential areas at any of the monitoring sites. The monitoring results therefore indicate that dust fall out at the Port, in Saldanha Bay and Vredenburg complies with national limit value for these areas, despite the facility not being either of these land use types.

TPT Saldanha is a contributing source to the regional dust loading and the contribution is illustrated by the iron content of the collected samples. With the total fallout below the national limit value, it can be confidently stated that contribution from TPT Saldanha complies with the limit value, both on site and off site. However, the TPT Saldanha contribution results in an accumulation on buildings, fences and natural surfaces that manifests as a red staining. There are no standards for the iron content in dust fallout. However, establishing a record of deposition can provide input on the effectiveness of the dust control measures.

The current siting of the dust fallout monitors does not meet all the requirements of the draft regulation for dust control (Government Gazette, 2011), i.e. monitoring on the fence line in the eight major wind directions. While this is not possible given the location of the facility, the monitoring network can be expanded along the eastern perimeter.
Recommendations are therefore:

- install dust fallout monitors on the northeastern, eastern and south eastern boundaries of the Port measuring total dust fallout and the iron content;

- install dust fallout monitors at selected sites in Saldanha Bay, measuring total dust fallout and the iron content to understand the spatial extent of Fe$_2$O$_3$ deposition and the accumulation on surfaces which results in run-off soiling (see Section 7.4); and

- the data on iron content should be used to establish trends and to report on and monitor the effectiveness of dust control at the Port.

7.4 DUST FLUX

CSIR were contracted in October 2006 to monitoring the horizontal flux of total particulates and the iron ore indicator (Fe$_2$O$_3$) was initiated in October 2006. The work was taken over in October 2009 by uMoya-NILU Consulting and in October 2011 by Kayad Knight Piésold Consulting. On initiation, four monitors were commissioned, with the network reaching a complement of 14 monitors in September 2007. The network was further expanded to 23 monitors by December 2012 (KKP, 2012).

The horizontal flux of total dust as well as the content of iron ore, indicated as Fe$_2$O$_3$, is measured. The objective of the flux monitoring is to determine the area influenced by emissions of iron ore dust from the Port, to monitor changes in the monitored values, and to assess the effectiveness of dust management at the Port.

An audit of the network in 2011 (EKC, 2011) underlines the poor collection efficiency of the installed wedge-shaped monitors, particularly in high wind speeds. While this weakness may be valid, the monitors provide a relative measure of flux over a five year period that provides valuable information on the distribution of Fe$_2$O$_3$ as well as trends. The average dust and Fe$_2$O$_3$ flux at the respective monitoring sites over the monitoring period is shown in Figure 6. The following conclusions after the fifth year of monitoring are pertinent:

- the highest Fe$_2$O$_3$ flux occurs at the Port with a decreasing gradient of Fe2O3 flux from the ship loaders to the TNPA Office block in Saldanha Bay;

- a gradient of decreasing Fe$_2$O$_3$ flux is also evident in the stations aligned with the ship loaders on the southeasterly wind trajectory to Duferco and further to the Airport;

- measured Fe$_2$O$_3$ flux in 2009, 2010 and 2011 at the on-site monitoring stations decreased from relatively high values in 2007 and 2008, despite a steady increase in the volume of ore being handled;
• decreases in Fe$_2$O$_3$ flux was observed at the off-site monitors from 2009 to 2011;

• the ship loader and associated activities at the iron ore quay are a larger source of Fe$_2$O$_3$ dust than the stockyard and the associated stacking and reclaiming; and

• the higher elevation of Vredenburg and its relative location to other industrial sources on the main wind trajectory between the BTS and Vredenburg suggests that these sources contribute to the measured Fe$_2$O$_3$ flux.

The inclusion of an indicator that is specific to the activities at the Port, i.e. Fe$_2$O$_3$ implies that the sampling method provides representative information on the relative measure of iron ore dust in the atmosphere as well as on trends. While this information is valuable, there are a number of shortcomings in the sampling method, namely:

• the coarse temporal resolution (monthly) and the considerable turnaround time for reporting of results due to laboratory analysis (three to five weeks after collection) ensure the information cannot be used for proactive management of operations at the Port;

• the coarse measurement resolution cannot be related to incidences of dust emission at the Port, or periods of unusual weather; and

• there is no measured relationship between the measured Fe$_2$O$_3$ flux and the visible red soiling.

Recommendations are therefore:
• continuation of the dust flux monitoring programme according to the expanded monitoring network, reporting total flux and the Fe$_2$O$_3$ content to monitor trends;

• investigate flux monitors with a higher collection efficiency; and

• investigate the relationship between the measured Fe$_2$O$_3$ flux and the observed red soiling.

7.5 OPERATIONAL DUST MONITORING

Operational dust monitoring, opposed to ambient monitoring, may be used to monitor the emission of dust from a specific activity or piece of equipment. With real-time measurement being available to the operations manager the activity can be stopped if a predetermined dust threshold is exceeded. The cause of the exceedance can be identified and addressed before the activity commences. Operational monitoring has significant benefits in reducing dust emissions and limiting the impact beyond the operation. Such monitoring is however not conducted at TPT Saldanha.

Recommendations are therefore to:

• investigate the technical feasibility of installing, operating and maintaining real time dust monitors on the feasibility on main sources of dust generation, i.e. the stacker-reclaimers, transfer points and the ship loaders

• investigate the feasibility of real time reporting of dust measurements to the Control Room;

• investigate a dust emission threshold value at which a process will be stopped if exceeded.

7.6 NATURE OF THE IMPACT

The flux monitoring indicates that the dust control measures at the Port have reduced dust emissions (uMoya-NILU, 2011). However the offsite soiling impacts appear to continue. A large red zone is apparent downwind of the facility. It is at its worst immediately adjacent the facility, where significant staining of structures and vegetation is visible on fencing and other infrastructure and vegetation. The intensity appears to tapers off generally northwards and is confirmed by the flux monitoring (uMoya-NILU, 2011), but at Vredenburg which is approximately 14 kilometres from the facility, red staining can be regularly seen on houses, fences, and other structures.

Photographs 8 to 13 show examples of staining.

Observations of the site and surrounds and comparison to the monitoring data suggest that it is the finest fraction of dust from the facility that causes the
wider spread of dust. Accumulated dust under the conveyor belt and on the iron ore quay has significantly high silt content. The accumulation of silt here is between 1 275 and 2 104 g/m² (SGS, 2012). Silt has a particle size between 0.002 and 0.05 mm in diameter and is readily entrained by wind. Accumulated dust under the conveyor belt and on the iron ore quay has significantly high silt content. Dust samples collected at these sites during the site visit contained more than 55% silt, i.e., a significant fraction that may be picked up and dispersed by the wind.

It is further apparent that small quantities of dust can cause staining. While the staining mechanism is unclear, the outcome is obvious, i.e. staining of structures, surfaces and vegetation. Plausible mechanisms for the staining are:

- house staining is likely due to longer term deposition of dust on roofs and flat masonry surfaces, which, during rain or washing, mixes with water and flows down the walls of structures, causing significant staining (Photographs 10, 11 and 13 for example); and that

- staining of timber and steel structures (notably galvanised steel fences, posts and electrical transmission tower members) is due to episodic dust events, possibly due to the porous nature of timber and zinc galvanising and the possible electrical charge provided during dry windy periods (see Photographs 9 and 12).

It is useful to note that other iron ore facilities report similar staining of houses and vegetation. Fortescue Metal Group’s Pilbara (2009) in Western Australia prepared a dust management plan that listed the following main issues for their operations in a similar climate to Saldanha:

- impact on outside comfort;
- soiling of clothing on washing lines;
- deposition on vegetation;
- dust build up on structures and cars; and
- staining of surfaces.
8 DUST MANAGEMENT PLAN

8.1 CORE OBJECTIVE

TPT Saldanha Environmental Management Programme (TPT, 2010) aims to be consistent with the requirements in terms of NEMA (Act No. 107 of 1998), the aims of the Transnet SHEQ Policy and the BTS Environmental Charter, which includes a commitment to continual improvement in the environmental performance of the operations at the bulk terminal. As such, the core objective of the dust management plan at TPT Saldanha is:

"TPT Saldanha will act responsibly with due regard to the effects of its operations on the environment by reducing and controlling dust emission, minimising the risk and visual impact and complying with its legislative requirements."

8.2 GOALS

The core objective will be achieved through the realisation of five goals. These are:

Goal 1: Emission Reduction for Legal Compliance and Continuous Improvement

This goal aims to reduce emissions from the significant sources at TPT Saldanha. Various measures are proposed focusing on best available techniques, engineering solutions, as well as policy implementation and research. Some measures are the continuation of existing dust control practices; while other propose changes or additions, while some extend only as far as feasibility studies. In terms of legal compliance, the national ambient air quality standards are an important consideration influencing emission reduction plans as well as the visual impacts in the surrounding environment.

Goal 2: Monitoring for Assessment of Dust Control and Impact

This goal aims to ensure that monitoring in the surrounding environment provides a means to measure the efficacy of the dust reduction and control measures, provides real time information to operators, as well as providing a measure of the impact.

Goal 3: Sound Operation and Regular Maintenance of Equipment

Operation and maintenance as a goal of the dust management plan is concerned largely with the improvement and availability of dust control equipment at TPT Saldanha. It also provides direction for continued emphasis on maintenance, including the environmental audit system.
Goal 4: Increased Understanding of Dust Management amongst TPT Saldanha Simuma Employees and Contractors

Awareness and training are included as a goal to drive behavioural changes by all site personnel at TPT Saldanha. The goal has two objectives, to improve general awareness of air quality as an issue of concern, and to increase the uptake of management practices aimed at reducing dust emissions at the Port.

Goal 5: Improved Cooperation with Authorities and Civil Society

This goal is aimed at fostering a cooperative working environment between TPT Saldanha, the regulatory authorities and surrounding communities. The existing environmental forum is used as an education and discussion platform for the dust management plan.

8.3 IMPLEMENTATION PLAN

The dust management plan exists for the life of the operations at TPT Saldanha and its success is realised through its systematic and measured implementation. The implementation plan therefore defines specific objectives for each of the goals, with specific actions defined for each objective. In turn, each action is assigned an implementation timeframe; responsibility is assigned for its implementation as well as an indicator to manage progress and to measure success. The implementation plan is detailed here with the following time frames:

- Short: Immediate -12 months
- Medium: 1 to 5 years
- Long: 5 years or more
- On-going: for the life of the operation
**Goal 1: Emission reduction for legal compliance and continuous improvement**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Action</th>
<th>Timeframe</th>
<th>Responsibility</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reduce dust emission from tippler</strong></td>
<td>• Operate the tippler according to the procedure in the EMP when the DEP is not operating</td>
<td>Immediate</td>
<td>Operator</td>
<td>Log of incidences&lt;br&gt;Report on ‘up’ time</td>
</tr>
<tr>
<td><strong>Reduce dust emission from conveyors</strong></td>
<td>• Install belt cleaner with residue capture mechanism at transfer points&lt;br&gt;• Install belt cleaner with residue capture mechanism at belt scrapers&lt;br&gt;• Install wind shields at belt cleaner points</td>
<td>Short term</td>
<td>Env. Manager</td>
<td>System installed&lt;br&gt;Shields installed</td>
</tr>
<tr>
<td><strong>Reduced dust from the ship loaders</strong></td>
<td>• Investigate the source of dust at the ship loader and mitigate to prevent spills on loader and quay&lt;br&gt;• Revise loading protocol in emergencies to prevent dumping ore on the quay&lt;br&gt;• Install mist sprayers on the loading chute</td>
<td>Long-term</td>
<td>Chief ops Manager</td>
<td>Re-engineered ship loaders&lt;br&gt;Revised protocol&lt;br&gt;Sprayers installed</td>
</tr>
<tr>
<td><strong>Reduced emissions from screening split ore</strong></td>
<td>• Revise procedure for screening split ore in winter only under strict supervision and discontinue screening in the event of dust creation or change in weather conditions</td>
<td>Immediate</td>
<td>Chief ops Manager</td>
<td>Revised procedure</td>
</tr>
<tr>
<td>Objective</td>
<td>Action</td>
<td>Timeframe</td>
<td>Responsibility</td>
<td>Indicator</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>--------------</td>
<td>-----------------</td>
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</tr>
<tr>
<td>• Reduced dust from vehicles and housekeeping</td>
<td>• Install tailgate on ADT used for spill haulage</td>
<td>Medium-term</td>
<td>Chief ops Manager</td>
<td>Tailgate installed</td>
</tr>
<tr>
<td></td>
<td>• Restrict vehicle movement on unpaved areas, e.g. that stockyard</td>
<td>Medium-term</td>
<td>Chief ops Manager</td>
<td>Revised procedure</td>
</tr>
<tr>
<td></td>
<td>• Revise road cleaning procedure to limit sweeping and use wetting or vacuum methods</td>
<td>Medium-term</td>
<td>Chief ops Manager</td>
<td>Revised procedure</td>
</tr>
<tr>
<td></td>
<td>• Develop procedure for contractors to cover truck loads to and from the multi-purpose jetty</td>
<td>Medium-term</td>
<td>Chief ops Manager</td>
<td>New procedure</td>
</tr>
<tr>
<td></td>
<td>• Vegetate bare non-operations areas</td>
<td>Medium-term</td>
<td>Env. Manager</td>
<td>Vegetated areas</td>
</tr>
<tr>
<td>• Increased ore moisture content</td>
<td>• Determine the dust extinction factor for all the ore products</td>
<td>Medium-term</td>
<td>Chief ops Manager</td>
<td>Investigation report</td>
</tr>
<tr>
<td></td>
<td>• Investigate potential to increase ore moisture levels with clients</td>
<td>Medium-term</td>
<td>Chief ops Manager</td>
<td>Investigation report</td>
</tr>
<tr>
<td></td>
<td>• Investigate potential to install real time moisture monitors</td>
<td>Long-term</td>
<td>Chief ops Manager</td>
<td>Investigation report</td>
</tr>
<tr>
<td>• Emergency dust control equipment and procedures</td>
<td>• Investigate sources of dust in emergency situations and measures to reduce resultant dust</td>
<td>Long-term</td>
<td>Chief ops Manager</td>
<td>Investigation report</td>
</tr>
<tr>
<td>• Automation of dust management system</td>
<td>• Investigate feasibility of integrated automation of the dust control systems</td>
<td>Long-term</td>
<td>Chief ops Manager</td>
<td>Investigation report</td>
</tr>
</tbody>
</table>
### Goal 2: Monitoring for assessment of dust control and impact

<table>
<thead>
<tr>
<th>Objective</th>
<th>Action</th>
<th>Timeframe</th>
<th>Responsibility</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>• PM$_{10}$ monitoring</td>
<td>• Continue current monitoring and reporting&lt;br&gt;• Repair or replace aging monitors&lt;br&gt;• Install monitors upwind and downwind boundary with live data to Control Room&lt;br&gt;• Develop procedure to stop operations when downwind concentration exceeds a set threshold</td>
<td>On-going&lt;br&gt;Short-term&lt;br&gt;Medium-term</td>
<td>Env. Manager&lt;br&gt;Env. Manager&lt;br&gt;Chief ops. Manager</td>
<td>Monitoring reports&lt;br&gt;Repaired/replaced monitors&lt;br&gt;Installed monitors</td>
</tr>
<tr>
<td>• Dust fallout monitoring</td>
<td>• Continue current monitoring and reporting at existing monitoring sites&lt;br&gt;• Expand current network to Port boundary in the 8 cardinal wind directions, where possible&lt;br&gt;• Analyse fallout dust for Fe$_2$O$_3$ content and report</td>
<td>On-going&lt;br&gt;Short-term&lt;br&gt;On-going</td>
<td>Env. Manager&lt;br&gt;Env. Manager&lt;br&gt;Env. Manager</td>
<td>Monitoring reports&lt;br&gt;Expanded network&lt;br&gt;Monitoring reports</td>
</tr>
<tr>
<td>• Dust flux monitoring</td>
<td>• Continue with current monitoring and reporting&lt;br&gt;• Investigate replacement of monitors with improved collection efficiency</td>
<td>On-going&lt;br&gt;MEDIUM-term</td>
<td>Env. Manager&lt;br&gt;Env. Manager</td>
<td>Monitoring reports&lt;br&gt;Alternative monitors identified</td>
</tr>
<tr>
<td>Complaints register</td>
<td>Continue with current procedure</td>
<td>On-going</td>
<td>Env. Manager</td>
<td>Current record</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------------------</td>
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</tr>
<tr>
<td>Environmental incident register</td>
<td>Continue with current procedure</td>
<td>On-going</td>
<td>Env. Manager</td>
<td>Current record</td>
</tr>
<tr>
<td>Red zone delineation</td>
<td>Research the spatial extent of red staining</td>
<td>Short-term</td>
<td>Env. Manager</td>
<td>Research report</td>
</tr>
<tr>
<td>Mechanism of off-site staining</td>
<td>Research the relationship between staining and the measured Fe₂O₃ flux</td>
<td>Medium-term</td>
<td>Env. Manager</td>
<td>Research report</td>
</tr>
</tbody>
</table>
### Goal 3: Sound operation and regular maintenance of equipment

<table>
<thead>
<tr>
<th>Objective</th>
<th>Action</th>
<th>Timeframe</th>
<th>Responsibility</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency wetting before tippler</td>
<td>• Continue current wetting procedure</td>
<td>On-going</td>
<td>Operator</td>
<td>Operation log</td>
</tr>
<tr>
<td>Control dust emission from tippler</td>
<td>• Continue in-stack emission monitoring and reporting</td>
<td>On-going</td>
<td>Operator</td>
<td>Monitoring record</td>
</tr>
<tr>
<td></td>
<td>• Report any malfunction</td>
<td>On-going</td>
<td>Operator</td>
<td>Operation log</td>
</tr>
<tr>
<td></td>
<td>• Continue procedure for chemical dosing plants</td>
<td>On-going</td>
<td>Operator</td>
<td>Operation log</td>
</tr>
<tr>
<td></td>
<td>• Continue dust plant maintenance according to design specifications.</td>
<td>On-going</td>
<td>Env. Manager</td>
<td>Maintenance log</td>
</tr>
<tr>
<td></td>
<td>• Revise procedure to avoid dust spills during filter maintenance, focus on options for disposal</td>
<td>Immediate</td>
<td>Spill product Admin.</td>
<td>Revised SOP</td>
</tr>
<tr>
<td></td>
<td>• Clean up promptly in the event of spills using vacuum cleaner.</td>
<td>On-going</td>
<td>Spill product Admin.</td>
<td>Spill log</td>
</tr>
<tr>
<td>Objective</td>
<td>Action</td>
<td>Timeframe</td>
<td>Responsibility</td>
<td>Indicator</td>
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</tr>
</tbody>
</table>
| Control emissions from the stockyard | • Continue current procedure for water cannons on static stockpiles  
• Continue to use mist sprayers during stacking  
• Revise procedure for reclaiming to include spot spraying of areas of stockpile to be reclaimed prior to reclaiming  
• Continue to use mist sprayers during reclaiming  
• Prevent unauthorised vehicle access to stockyard | On-going  
On-going  
Short-term  
On-going  
Short-term | Operator  
Operator  
Operator  
Chief ops Manager  
Operator Environment. Manager | Operation log  
Operation log  
Operation log  
Operation log  
Access control |
<table>
<thead>
<tr>
<th>Objective</th>
<th>Action</th>
<th>Timeframe</th>
<th>Responsibility</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control emissions from the conveyor system</td>
<td>• Continue procedure for spraying in the transfer chute</td>
<td>On-going</td>
<td>Operator</td>
<td>Ore moisture record</td>
</tr>
<tr>
<td></td>
<td>• Continue procedure for the atomising sprays in transfer chute</td>
<td>On-going</td>
<td>Operator</td>
<td>No visible dust emission</td>
</tr>
<tr>
<td></td>
<td>• Continue current wetting procedure on live conveyor loads</td>
<td>On-going</td>
<td>Operator</td>
<td>Ore moisture record</td>
</tr>
<tr>
<td></td>
<td>• Clean existing spills at transfer points</td>
<td>Immediate</td>
<td>Ops Crew</td>
<td>Clean transfer area</td>
</tr>
<tr>
<td></td>
<td>• Clean spills existing at belt scraper</td>
<td>Immediate</td>
<td>Ops Crew</td>
<td>Clean scraper area</td>
</tr>
<tr>
<td></td>
<td>• Clean spills existing at belt turn-over</td>
<td>Immediate</td>
<td>Ops Crew</td>
<td>Clean turning area</td>
</tr>
<tr>
<td></td>
<td>• Revise housekeeping procedure to prevent dust build-up under conveyor belt, at transfer points, at belt turn-over point and scraping by through clean-up</td>
<td>Immediate</td>
<td>Chief ops Manager</td>
<td>Revised procedure</td>
</tr>
<tr>
<td></td>
<td>• Continue procedure for dust cover maintenance</td>
<td>On-going</td>
<td>Env Manager</td>
<td>Maintenance log</td>
</tr>
<tr>
<td></td>
<td>• Revise procedure to make ore moisture information at Kumba sampling site available to the Operator</td>
<td>Short-term</td>
<td>Env Manager</td>
<td>Revised procedure</td>
</tr>
<tr>
<td>Emergency dust control equipment and procedures</td>
<td>• Continue procedure for emergency wetting</td>
<td>On-going</td>
<td>Operator</td>
<td>Ore moisture record</td>
</tr>
<tr>
<td>Objective</td>
<td>Action</td>
<td>Timeframe</td>
<td>Responsibility</td>
<td>Indicator</td>
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<td>----------------------------</td>
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<td>-------------------</td>
</tr>
<tr>
<td>Iron ore quay (ship loaders)</td>
<td>• Revise procedure for cleaning ship loaders by vacuum&lt;br&gt;• Revise procedure for belt loading to match ship capacity to prevent ore dumping&lt;br&gt;• Clean spills existing on iron ore quay and avoid future build-up by prompt clean-up</td>
<td>Short-term</td>
<td>Chief ops Manager&lt;br&gt;Chief ops Manager Operational Crew</td>
<td>Revised procedure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Short-term</td>
<td></td>
<td>Revised procedure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Immediate &amp; On-going</td>
<td>Env. Manager Operational Crew</td>
<td>Routine inspection</td>
</tr>
<tr>
<td>House keeping</td>
<td>• Revise procedure to improve road cleaning using water hoses or vacuum&lt;br&gt;• Revise procedure to increase wetting frequency using the water truck&lt;br&gt;• Revise procedure for spill handling to limit physical handling of spill material</td>
<td>Short-term</td>
<td>Env. Manager&lt;br&gt;Env. Manager&lt;br&gt;Env. Manager</td>
<td>Revised procedure</td>
</tr>
</tbody>
</table>
### Objective

<table>
<thead>
<tr>
<th>Objective</th>
<th>Action</th>
<th>Timeframe</th>
<th>Responsibility</th>
<th>Indicator</th>
</tr>
</thead>
</table>
| Improve awareness of dust management issues | • Conduct Port-wide awareness raising activities to drive responsible behaviour, including contractors  
• Revise induction procedure for contractors to include dust management awareness | Short-term & On-going | Env. Manager   | Improved awareness          |
| Increase use of management practices | • Conduct training on relationship between activity at the Port, dust management and consequence, i.e. impact (staining) | Short-term & On-going | Env. Manager   | Improved port wide dust mangt |
**Goal 5: Improved cooperation with authorities and civil society**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Action</th>
<th>Timeframe</th>
<th>Responsibility</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular consultation with authorities</td>
<td>Continue to use the Saldanha Bay Form to engage on dust management issues</td>
<td>On-going</td>
<td>Env. Manager &amp; Chief Ops. Manager</td>
<td>Routine engagements</td>
</tr>
<tr>
<td>Stakeholder engagement</td>
<td>Conduct stakeholder meetings and share monitoring results, progress with dust management, investigation and of complaints, etc</td>
<td>Short, on-going</td>
<td>Env. Manager</td>
<td>Record of stakeholder engagements</td>
</tr>
</tbody>
</table>
8.4 Monitoring, Evaluation and Review

8.4.1 Monitoring and Evaluation

Targets are set for each Goal to monitor the progress of implementation of the dust management plan. In turn, the indicators included in the implementation plan are to monitor progress with the implementation of the individual activities. This is roughly in line with the environmental management system, allowing the dust management plan to easily be incorporated into that system.

Evaluation is to measure the performance of the dust management plan, where the successes and shortcomings in implementing activities, of the relevance of the implementation plan, and the overall success of the dust management plan in achieving the goals. Revisions may be made to the plan during the evaluation where needed.

The monitoring and evaluation must be done together and conducted by the Chief Operations Manager, the Environment Manager and SHE department. Consultation and engagement with other departments and operational levels should be conducted where needed. Monitoring should be done monthly and evaluation every three months.

Table 8.1 Targets for AQMP

<table>
<thead>
<tr>
<th>Goal</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emission reduction for legal compliance and continuous improvement</td>
<td>• Dust emissions reduced to a level where no complaints are received</td>
</tr>
<tr>
<td>Monitoring for assessment of dust control and impact</td>
<td>• Monitoring provides a measure of the efficacy of the dust control measures</td>
</tr>
<tr>
<td>Sound operation and regular maintenance of equipment</td>
<td>• Well-operated and maintained plant with little or no environmental impact</td>
</tr>
<tr>
<td>Increased understanding of dust management amongst TPT Saldanha</td>
<td>• TPT Saldanha personnel and contractors are trained to minimise emissions from Port activities</td>
</tr>
<tr>
<td>employees and contractors</td>
<td>• Established relationships between TPT Saldanha managers, air quality authorities and communities</td>
</tr>
<tr>
<td>Improved cooperation with authorities and civil society</td>
<td></td>
</tr>
</tbody>
</table>

8.5 Review

A 3-year review period is proposed for the dust management plan. The monitoring and evaluation records will be used to inform the review exercise. All relevant and affected departments will be involved in the review, with the Environmental Manager responsible for producing the reviewed document. The review will be incorporated into the environmental management system programme for TPT Saldanha, consistent with the review of other documents comprising the system, and considerate of the findings of audits carried out at the Port.
REFERENCES


Westco, (2011); Saldanha Bay IDZ Feasibility Study.
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Annex A

Photo Log
Photograph 1
Rail wagon tippler enclosure.

Photograph 2
Tippler dust extraction plant (DEP).

Photograph 3
DEP filter bank.

Photographs
Transnet Port Terminals - Dust Management Study Bulk Terminal Saldanha, South Africa
Photograph 4
Ore stockyard.

Photograph 5
Enclosed transfer.

Photograph 6
Belt scraper.
Photograph 7
Water cart on main roadway.

Photograph 8
Stained vegetation north of facility.

Photograph 9
Stained fence post.
Staining on car dealership in Vredenburg.

Stained steel fencing near Vredenburg air sampling station.

Photograph 11

Photograph 12

Stained steel fencing near Vredenburg air sampling station.
Photograph 13
Staining in Mykonos house.

Photograph 14
Rail wagon showing no evidence of spillage.

Photograph 15
Rail wagon coupling showing no spillage.
Dust near DEP.

Photograph 16
Railway showing no evidence of spillage.

Photograph 17
Dust near DEP.

Photograph 18
Dust underneath DEP.

Photographs

Transnet Port Terminals - Dust Management Study Bulk Terminal Saldanha, South Africa
Photograph 19
Ore reclaiming in operation.

Photograph 20
Dust leaking from enclosed transfer.

Photograph 21
Product spill at enclosed transfer.

Photographs
Transnet Port Terminals - Dust Management Study Bulk Terminal Saldanha, South Africa
Carry back build up on members under conveyor.

Faulty sprays near belt scraper.

Photograph 22
Product spill on conveyer.

Photograph 23
Carry back build up on members under conveyor.

Photograph 24
Faulty sprays near belt scraper.
Photograph 25
Carry back build up on ground.

Photograph 26
Carry back build up under conveyor.

Photograph 27
Carry back build up under conveyor.
Photograph 28
Spill clean up process.

Photograph 29
Rehabilitation trials near breakwater.

Transnet Port Terminals - Dust Management Study Bulk Terminal
Saldanha, South Africa