

# **SNC • LAVALIN - EMS**

**PROJECT MANAGERS FOR**

**BILLITON ALUMINIUM PROJECTS  
(PROPRIETARY) LIMITED**

**PROJECT : BILLITON ALUMINIUM EXPANSION PROJECT**

**MOZAL ALUMINIUM SMELTER EXPANSION  
PROJECT NUMBER 6362**

**SPECIFICATION TITLE : ENVIRONMENTAL  
MANAGEMENT PROGRAMME  
for The Design, Construction  
and Pre-Commissioning of  
The Mozal Aluminium Smelter  
Expansion Project**

**TECHNICAL SPECIFICATION NO. : MDS-0000-G-005**

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## 1.0 **INTRODUCTION**

The purpose of an Environmental Management Programme (EMP) is to ensure that, in implementing a new development, negative environmental impacts are managed and monitored, that positive impacts are maximised and affected areas are rehabilitated. The EMP described here follows on from the Environmental Assessments (EA's) that have been conducted for the Mozal Smelter and Harbour Terminal and serves to ensure that:

- a) Recommendations contained in the EA's are effected during the implementation of the project.
- b) Outstanding issues from the EA's are addressed.
- c) Assumptions contained in the EA's are tested and verified.
- d) Provision is made for the evolving nature of the project without compromising on the environmental management requirements defined in the EAs.

The purpose of this document is to describe both the EMP and its implementation within the context of the full ambit of environmental management requirements for the Aluminium Expansion Project .

## 2. **CONTEXT AND SCOPE**

### 2.1 **ISO14001**

In addition to the above the internationally recognised ISO 14001 standard is extremely important in respect of developing and implementing an EMP. For this reason the EMP has been structured to address all the requirements of ISO14001 explicitly most notably the following:

#### **ENVIRONMENTAL POLICY-**

The purpose of an environmental policy is to have the organisation state its intentions and commitment to environmental performance

#### Planning –

The purpose of planning is to ensure that the environmental impact of its operations (activities) are well understood and properly defined and that suitable mitigation is proposed in response to the activities that may lead to impacts.

#### Implementation and operation

Implementation and operation involves the development and putting into practise of processes that will bring about environmental goals and objectives. In other words putting the planning described under 2.1.2 into practise.

#### Checking and corrective action

Checking and corrective action requires monitoring and measurement of environmental indicators to ensure that goals and objectives are being met.

#### Management review

Management review is the last of the ISO14001 requirements but arguably the most important. The requirement dictates that the performance of the EMP be reviewed by the

organisation's top management, to ensure its continuing suitability, adequacy and effectiveness and continual improvement

## **2.2 THE STRUCTURE OF THE EMP**

Against the backdrop of the requirements of ISO14001, the overall structure of the EMP is illustrated schematically in Figure 1. As shown in the figure planning requires listing all the activities that make up the construction, pre-commissioning, commissioning, operations and de-commissioning of the Aluminium Expansion Project, listing the commensurate environmental aspects and/or impacts and specifying mitigation. The reason that 'design' is shown under operations is because the infrastructure needed to mitigate impacts during operations needs to be included in the design of the smelter.

Implementation and operations involves specifying how mitigation will be implemented. This is a critical element of the EIA, because resultant environmental management performance will be based on the degree to which mitigation is successfully implemented. Objectives and targets as a measure of environmental management performance are also specified as a component of Implementation and Operation.

Checking and Corrective Action includes the details of environmental quality monitoring that must be executed during the project and reporting of that environmental quality relative to the objectives and targets. If the monitoring results conform to the objectives and targets set then no revision is required, but if there is non-conformance then each step of the EMP should be reviewed to determine what should be improved. Ongoing capacity building, environmental awareness and education, and regular feedback to interested and affected parties all supplement the efficacy of the EMP. Finally, external audits can be used to provide independent verification of the performance of the EMP.

## **2.3 SCOPE**

At the same time it is necessary to point out that the EMP described here does not address all the environmental management requirements of the Aluminium Expansion Project. This is because the EMP has been developed by the Engineering, Procurement and Construction Management (EPCM) contractors whose scope of work is restricted to the design, construction and pre-commissioning of the Aluminium Expansion Project. The EMP presented here directly reflects that same scope of work and as such is referred to as EMP-DCP (Environmental Management Programme – Design, Construction and Pre-Commissioning).

On completion of the project, the EMP-DCP will be superseded by the EMP-COD (Environmental Management Programme-Commissioning, Operations, De-commissioning) as the completed project is progressively handed over to the Mozal Operations Team. Within the two EMPs, the bulk of the environmental management requirements for the Mozal Smelter are met, but there are several requirements that do not fall within the direct scope of the two EMPs. These requirements relate principally to community development and upliftment initiatives, which are managed through the Mozal Community Development Trust.

In addition each principal contractor on site will be required to submit, and have approved before being allowed on site, an EMP that governs the construction activities of the Contractor and sub-contractors. A guideline for the preparation of the Contractor's EMP (EMP-C) has been drawn up as part of this EMP to ensure that the content of the EMP-Cs is consistent with the overarching EMP and its objectives.

Readers requiring an indication of the full extent of the Mozal environmental management function are referred to MSD-0000-G-001 'Guideline for the Preparation of

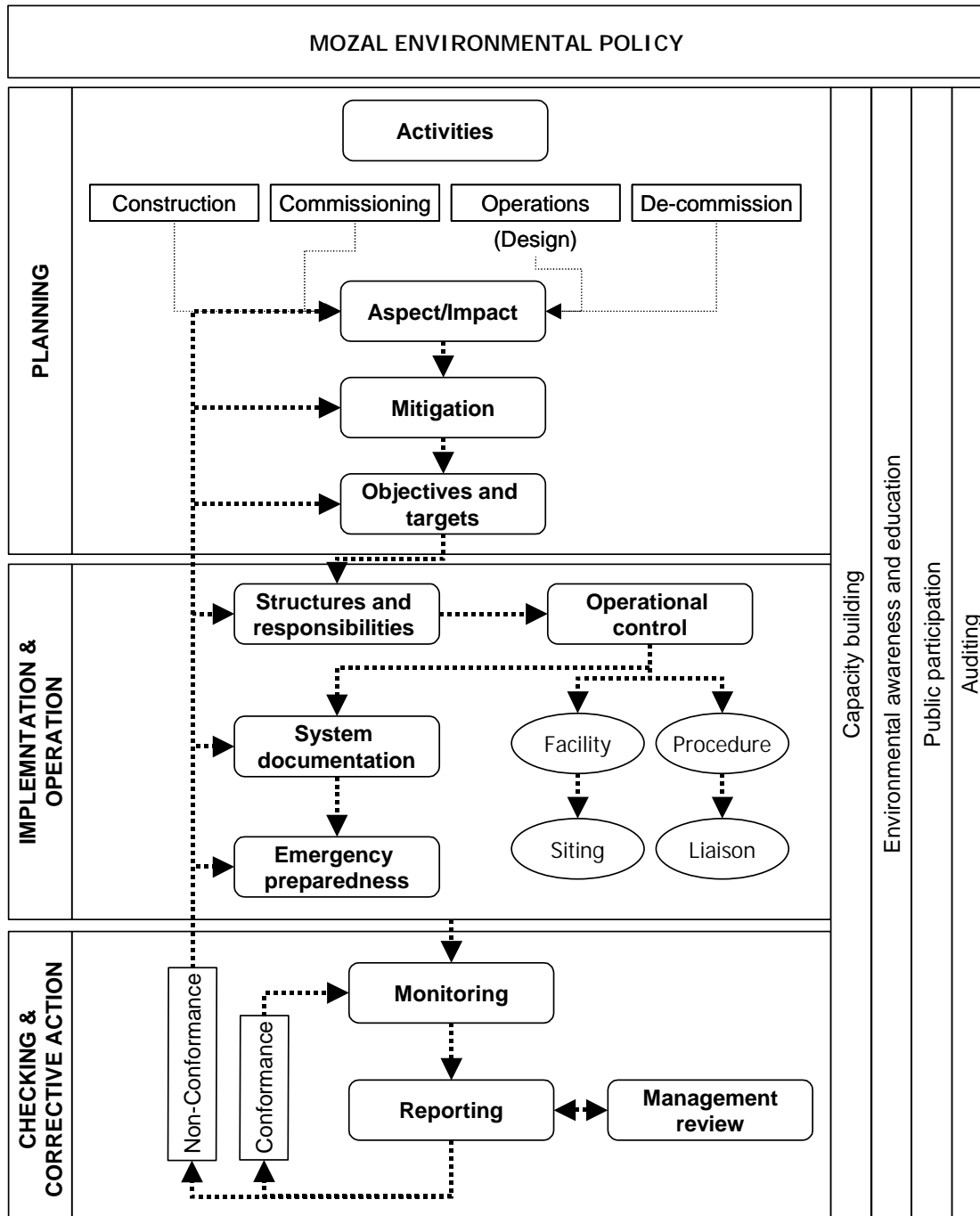


Figure 1: Schematic illustration of the Environmental Management Programme (EMP) for the Aluminium Expansion Project. For a detailed description of the figure, please consult the text.

an Environmental Management Programme for the Mozal Aluminium Smelter Phase 2 Expansion and Co-ordination of Related Initiatives' which contains a description of the full scope of the environmental management function on the Mozal Smelter.

### **3.0 ENVIRONMENTAL POLICY**

As described earlier, an environmental policy provides a statement of intent regarding environmental management.

The environmental policy for the Mozal Project is presented below:

The Management of the Mozal Smelter Expansion Project has an obligation towards the environment and recognises that:

The project exists within a physical and socio-economic environment in Mozambique which must be respected.

All interested and affected parties have the right to information relating to the environmental impacts of the project.

All environmental impacts of the project should be addressed responsibly.

Community support is essential for the successful completion and subsequent operation of the smelter

In pursuance of these values, Management shall:

Implement an environmental management programme based on the environmental impact assessments and in compliance with the relevant environmental legislation, regulations and standards

Enforce line management responsibility within the project to ensure compliance with the environmental management programme

Minimise adverse impacts on the site environment and on the surrounding communities during all project phases

Monitor and report fully to interested and affected parties upon the effectiveness of the project environmental management programme on an ongoing basis

Through the Mozal Community Development Trust continue to invest in the local communities by supporting education, security, health and agricultural programmes

## **4. PLANNING**

### **4.1 ACTIVITIES, ASPECTS AND IMPACTS**

Planning involves the identification of all the possible impacts of the design, construction and pre-commissioning of the Mozal Smelter Project. Impacts associated with the Mozal Smelter have been identified in a series of Environmental Impact Assessments (EIA) conducted for both phases of the smelter and the Matola Port Facility. The impacts relevant to the Aluminium Expansion Project are summarised in Table 1, together with suitable mitigation, an indication of the project phase and the mechanism whereby the mitigation will be effected. Additional aspects/impacts relevant to the construction phase have also been drawn from the experience gained on the Hillside Smelter and Phase 1 of the Mozal Smelter.

Table 1: Summary of all aspects/impacts identified for the various project phases together with the mitigation required and the mechanism whereby the mitigation will be effected .

<u>Aspect/Impact</u>	<u>Mitigation</u>	<u>Project phase</u>	<u>EMP</u>
Building rubble	Bury on site – screening berms	C	EMP-DCP, EMP-C
Packing crates	Distribute timber locally	C	EMP-DCP, EMP-C
Non-hazardous waste	Municipal solid waste site	C	EMP-DCP, EMP-C
Hazardous waste	Handling by specialist waste disposal company	C	EMP-DCP, EMP-C
Construction dust	Water spray	C	EMP-DCP, EMP-C
	Dust palliatives	C	EMP-DCP, EMP-C
Fauna and flora	Power to construction village	C	
	Rapidly re-establish vegetation on construction terraces	C	EMP-DCP
Construction village	Aggressive preventative care programmes	C	
	Access to basic medical treatment	C	
	Provision of entertainment centres	C	
Local labour	Promote training	C/O	EMP-DCP, EMP-C
	Encourage employment of local labour		EMP-DCP, EMP-C
Spillage of HFO and other petroleum or pitch products	Bund walling for all storage facilities	D,O,C	EMP-DCP
Pet coke and alumina dust	Coke coating	O	EMP-COD
	Dust control at all transfer points	D,O	EMP-DCP, EMP-COD
	Good housekeeping	O	EMP-COD
Laboratory waste chemicals	Disposal by specialist company	O	EMP-COD
Dross	Recover aluminium, sell cooled dross	O	EMP-COD
Spent pot linings	Safe storage	O	EMP-COD
	Investigate appropriate disposal technologies	O	EMP-COD
Visual impact of the smelter	Suitable matt colouring of structures	D	EMP-DCP
	Suitable lighting	D,O	EMP-DCP
	Earth berms and tree shelter belts	D,C	EMP-DCP
Benefits to Mozambican economy	Active identification and realisation of opportunities aimed at improving the development of the wider economy	O, CD	
Fluoride contaminated solid waste	Composition of all fluoride containing wastes to be verified and appropriate disposal method determined	O	EMP-COD
Hazardous waste disposal	Treatment or disposal of class G and H:h wastes in mono-cells at the temporary land fill site in Matola once it has been permitted	O	EMP-COD
	Continue discussions aimed at establishing a permanent waste disposal site for Class H:H and H:h waste	O	EMP-COD
	Pent pot linings to be stored in special purpose buildings until recycling methods determined	D,O,C	EMP-COD
	Stay close to developments in respect of Hillside SPL recycling via the cement industry	O	EMP-COD
Fluoride emissions	Monitor	O	EMP-COD
Sulphur dioxide emissions	Campaign measurements to establish baseline	O	EMP-COD

<b>Aspect/Impact</b>	<b>Mitigation</b>	<b>Project phase</b>	<b>EMP</b>
Fluoride contaminated storm water management	Implement the 3-step storm water management strategies as recommended	O	EMP-COD
	Monitor	O	EMP-COD
	Controlled mixing of storm water and cooling water blowdown	O	EMP-COD
Congestion as a result of increased traffic	Traffic authorities to monitor road intersections	O	Authorities
	Review effectiveness of traffic signals	D, O	EMP-COD
Decrease in traffic safety	Speed control	O,C	EMP-COD
	Improved visibility	O	
	Lane demarcation and forwarning	O	
	Enforcement of traffic rules and roadworthiness	O	
	Mozal drivers to attend safe driving programme	O	EMP-COD
Noise from construction equipment in the port	All equipment in good working order	C	EMP-DCP, EMP-C
	Operate equipment within its specification and capacity	C	EMP-DCP, EMP-C
	Operate equipment with appropriate noise abatement accessories	C	EMP-DCP, EMP-C
	Operate equipment in diversified manner	C	EMP-DCP, EMP-C
	Turn equipment off when not in use	C	EMP-DCP, EMP-C
	Position equipment in sheltered locations	D,C	EMP-DCP, EMP-C
	Utilise partly finished buildings to accommodate equipment	C	EMP-DCP, EMP-C
	Carefully select times for equipment use	C	EMP-DCP, EMP-C
Noise from increased haulage operations	Technical solution viz noise barrier	D	EMP-DCP
	Voluntary relocation	C	N/A
	Monitoring	C	EMP-COD
Cumulative noise	Disable exhaust brakes	O	EMP-COD (operations only)
	Maintain vehicles to ensure that noise abatement devices are in good working order	O	EMP-COD
	Educate truck drivers	O,C	EMP-COD
Cumulative vehicle emissions	Keep vehicles well maintained	O,C	EMP-COD
	Encourage authorities to enforce stricter roadworthiness control of vehicles	O	EMP-COD
	Authorities should also ensure that motor vehicle emission legislation be strengthened and enforced	O	Authorities
	Investigate, together with the Mozambican government the possibility of monitoring CO and NO <sub>x</sub> (Coordinate with TRAC)		EMP-COD, Authorities
Job opportunities, improvement in skills base and business opportunities for local Mozambican companies	Give preference to local Mozambican workers	C, O, CD	EMP-DCP, EMP-C
	Provide training for workers	C, O, CD	EMP-DCP, EMP-C
	Improved procurement empowerment strategy for Expansion Phase	CD	
	Monitoring	O, CD	
Increase in HIV/AIDS and sexually transmitted diseases and malaria	Continue with malaria control programmes and HIV/AIDS awareness on site	C, O, CD	EMP-DCP, EMP-C, EMP-COD
	Continue with malaria control programmes and HIV/AIDS awareness in surrounding communities	CD	

<u>Aspect/Impact</u>	<u>Mitigation</u>	<u>Project phase</u>	<u>EMP</u>
Secondary impacts such as land alienation, an increase in conflict in households and a reduction in levels of poverty	Work with Mozambican government to ensure that the Boane District Planning Framework is communicated and implemented to ensure that secondary impacts are mitigated	CD	
	Initiate a programme to support NGOs that can support vulnerable community groups		
Resettlement for the Beluluane Industrial Park	Support Mozambican Government to continue to implement agricultural development and village management programmes.	CD	
	Continue with 4 year monitoring and evaluation programme	CD	

Key:           EMP-DCP -     EMP – Design, Construction and Pre-Commissioning  
                   EMP-COD     EMP – Commissioning, Operations and De-commissioning  
                   D -            Design  
                   C -            Construction  
                   O -            Operations  
                   CD            Community development

#### 4.2 MITIGATION

The mitigation of potential negative effects and/or the enhancement of positive impacts may be effected in one of four ways viz.

- a) Through a facility. This may be a dedicated facility, such as a vehicle refuelling facility during the construction phase, or may be the suitable design of a plant facility such as the Gas Treatment Centres (GTC). Wherever a facility is recognised to have a potential environmental impact, or where that facility may be used to mitigate or manage an environmental impact the following is described:
  - i. Mitigation
  - ii. Design requirements
  - iii. Design criteria
  - iv. Contract link (i.e. which contract will effect the requirement?)
  - v. Design review (i.e. Who should review the design)
  - vi. Standards (either legal or derived)
  
- b) Through a procedure or specification. Procedures would specify appropriate actions regarding certain activities such as the disposal of construction waste and will also be linked to facilities where appropriate (e.g. a waste sorting facility). Contractors will also be expected to submit EMP's in respect of their own activities to ensure consistency in approach and execution. All procedures or specifications should be developed to reflect:
  - i. Objective
  - ii. Scope/Applicability/Circumstance
  - iii. Requirements
  - iv. Facility link (i.e. where the procedures relate to a specific facility.)
  - v. Procedure (i.e. Link to an established project procedure.)
  - vi. Reporting
  
- c) Through suitable siting. For the most part siting issues have already been addressed but there are several outstanding issues where siting will be critical. The construction village is one such example. The following needs to be specified:

- i. Responsibility
  - ii. Criteria
  - iii. Review
- d. Through ongoing liaison with authorities and communities. Typically this would take the form of pro-active information sharing or the setting up of mechanisms to deal with complaints handling etc. Liaison should specify:
- i. With whom
  - ii. What
  - iii. How
  - iv. Frequency

### 4.3 OBJECTIVES AND TARGETS

In order to ensure that environmental management performance follows from the environmental policy and planning, objectives and targets must be specified which provide the basis for monitoring of that performance. It is important to recognise that objectives and targets can (and should) be specified for both environmental aspects as well as the implementation of the EMP and associated procedures and practises. In other words objectives and targets can be specified for both the activities and the performance of those activities, as well as the outcomes or results of those activities (Fig. 2). In table 2 objectives and targets are specified as a function of the policy, that will form the basis of performance reporting during the execution of the project.

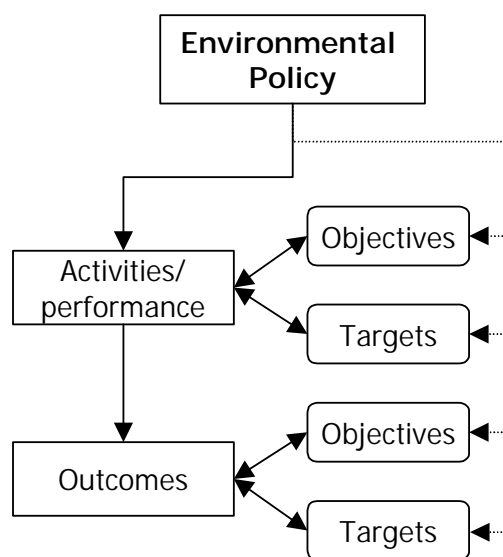


Figure 2: Schematic illustration of the structure of objectives and targets for environmental management performance.

#### **Environmental objective**

*'An overall environmental goal, arising from the environmental policy, that an organisation sets itself to achieve, and which is quantified where practicable'*

#### **Target**

*'A detailed performance requirement, quantified where practicable, applicable to the organisation or parts thereof, that arises from the environmental objectives and that needs to be set and met in order*

*in order to achieve those targets'*

Table 2: Objectives and targets for environmental management during the design, construction and pre-commissioning of the Aluminium expansion project

POLICY STATEMENT	OBJECTIVES	TARGETS	
		Variable	Target value
Implement an Environmental Management Programme (EMP) based on the Environmental Assessments (EAs) and in compliance with the relevant environmental legislation, regulations and standards.	Ensure that all activities during construction and pre-commissioning, that could result in impacts on the environment are identified, and appropriate mitigation specified.	EA (Phase 1 and 2) assumptions and recommendations	All
		Learning from Hillside and Mozal 1	All
	Ensure that all facilities that will be established for smelter operations are governed by suitable environmental design requirements and criteria	EA (Phase 1 and 2) assumptions and recommendations	All
		1998 World Bank guidelines	All except where exemption obtained from IFC
		Mozambican Regulations and other international standards adopted	All
		Aluminium Pechiney environmental guidelines	All

POLICY STATEMENT	OBJECTIVES	TARGETS	
		Variable	Target value
Enforce line management responsibility within the project to ensure compliance with the environmental management programme	Ensure Contractors understand the potential environmental impacts of their activities and are able to minimise those effects	SLE approved Contractors EMP.	All before going on site
		Compliance audit on Contractor's EMP	3 during contract period (mobilisation, middle, end)
	Ensure that engineering packages include necessary design requirements and criteria	Engineering packages	All
		Review of engineering packages	All
	Ensure that the mechanisms needed to effect regular review and dictate further action as may be required are in place.	ECC	Monthly meetings
		Contractors meeting	Monthly meetings
		Senior construction managers meeting	Monthly meetings
	Ensure that an appropriate inspection, review and audit regime is in place to monitor the efficacy of the EMP and its implementation	Inspections	Weekly
		Internal audits	Monthly
		External audits (PEC)	Quarterly
		Management review	Half-yearly

POLICY STATEMENT	OBJECTIVES	TARGETS	
		Variable	Target value
Minimise adverse impacts on the site environment and on the surrounding communities during all project phases	Prevailing environmental quality will not be significantly degraded as a result of construction and pre-commissioning activities	Dust	Maximum dust class 3
		Noise	Not to exceed 70 dB(A) at plant boundary
		Erosion	No visible soil erosion (viz. slumps or slides) Erosion to be repaired as soon as possible. Rehabilitated areas not to show visible erosion at end of project.
		Suspended solids	2,5 mg/l (suspended solids)
		Spillage of petroleum products	2.5 mg/l (oil and grease)
			No evidence of fuel or oil spills. Minor spills to be contained and cleaned-up.

POLICY STATEMENT	OBJECTIVES	TARGETS	
		Variable	Target value
Minimise adverse impacts on the site environment and on the surrounding communities during all project phases	Waste generated during construction and pre-commissioning will be effectively managed and suitably recycled internally, externally and or disposed of.	Hazardous waste	All hazardous waste disposed of in suitable containers/bins Certified disposal by waste management contractor
		Domestic waste	All domestic waste disposed off in bins/containers
		Building rubble	All building rubble dumped in demarcated areas
		Packing crates	All packing crates divided between useable timber and firewood
		Scrap metal	All scrap metal to appointed scrap metal contractor
		Minimise adverse impacts on the site environment and on the surrounding communities during all project phases	Impacts on infrastructure services and society will be managed and minimised
Traffic safety	No road accidents caused by SLE staff		
	Enforced speed control		
Possible benefits to local communities during construction and pre-commissioning will be maximised		Local labour	65%
		Local contracts	
		'Empowerment' contracts	
		Malaria control	

POLICY STATEMENT	OBJECTIVES	TARGETS	
		Variable	Target value
Liaise openly with all interested and affected parties on environmental matters.	Ensure that ample opportunity is provided for interested and affected parties to raise issues, concerns and queries and to receive suitable responses on the same.	Public meetings	2 per annum
		Environmental Task Group Meeting	3 Monthly meetings
		Web-site	< 24 hour response time
		Fax number and hotline	< 24 hour response time
Monitor	Ensure that all parameters relevant to the objectives and targets specified in the EMP are monitored	Dust	Twice daily
		Waste management	Daily
		Storm water	Daily and after every rain event
		Ground water	Monthly
		Meteorology	Daily
		Noise	6 - monthly
Social surveys	Social surveys		

POLICY STATEMENT	OBJECTIVES	TARGETS	
		Variable	Target value
Minimise adverse impacts on site environment and on the surrounding communities during all phases of the project	Improve the awareness of project employees regarding malaria	Industrial Theatre plays	Quarterly
		Campaigns	Quarterly
		Internal Monitoring	Monthly
		Third party monitoring	Ad hoc
	Improve the awareness of all project employees regarding HIV / AIDS	Industrial Theatre plays	Monthly
		Reporting from Mozambican Centre for Control of Disease	Monthly
		STD's incidence rate	Monthly
		STD's prevalence rate	Monthly
Report fully upon the effectiveness of the project environmental management programme on an ongoing basis.	Ensure that all stakeholders with an interest in environmental management during the construction of the smelter are kept fully informed of developments in that regard	Publications	Monthly
		Public meetings	Six-monthly
		Annual Monitoring report for IFC	Annually
		Reports	Monthly

## **5.0 IMPLEMENTATION AND OPERATION**

### **5.1 IMPLEMENTATION**

The effective implementation of the mitigation described above is the key to the success of the EMP. Implementation is best ensured through integration with recognised, existing project execution activities. Wherever possible environmental management requirements have been linked to project execution activities (e.g. packages, technical specifications, etc.)

### **5.2 ROLES AND RESPONSIBILITIES**

Effective environmental management during the design and construction of the Aluminium Expansion Project will be critically dependent on a number of project personnel. The purpose of this section is to define roles for personnel and to detail concomitant responsibilities in the execution of the Environmental Management Programme.

Before doing so it is also necessary to define the various parties that bear environmental management responsibilities for the Aluminium Expansion project.

**Mozal S.A.R.L.:** Mozal S.A.R.L is a registered Mozambican company that owns and operates the smelter. Accountability and responsibility for environmental management during smelter operations and ultimately de-commissioning, rests with the Mozal Operations Team (MOT). The MOT also has a communications department that is responsible for ongoing communication to interested and affected parties of all aspects of operations of the smelter including ongoing public meetings

**Billiton Aluminium Projects (Pty) Ltd (BPT):** Billiton Aluminium Projects is the principal project driver and overall custodian of the design, construction and pre-commissioning of the smelter. Overall accountability and responsibility for environmental management rests with BPT during these project phases. BPT has a communications group that ensures ongoing and timeous dissemination of information and appropriate liaison with authorities and communities alike.

**SLE:** A joint venture between SNC-Lavalin, a Canadian company, and Engineering Management Services (EMS) a South African Company. SLE have been appointed by Mozal as the engineering, procurement and construction managers for the Mozal Project.

**Contractors:** Throughout the construction of the Mozal Smelter, various contractors will be appointed to execute components of the project. It is estimated that between 50 and 60 main contractors will be appointed who in turn may appoint a number of sub-contractors.

#### **5.2.1 Project Environmental Consultant (PEC) - Reporting to: HSE Manager. The role of the PEC is to ensure the successful implementation of the EMP through:**

- a. Continuous review of the suitability/effectiveness of the activities described in the EMP and presentation for management review.
- b. Overseeing the execution of the activities described in the EMP.
- c. Ongoing liaison with appropriate project personnel.
- d. Review of engineering specifications
- e. Overseeing auditing and inspection procedures
- f. Overseeing the review and approval of Contractor's EMP
- g. Interested and affected party consultation.
- h. Chair of the Environmental Co-ordination Committee (ECC).
- i. Ad hoc consulting on environmental matters pertaining to the project.
- j. Public participation and consultation

5.2.2 Project Environmental Officer (PEO) - Reporting to Health, Safety and Environmental Manager (HSEM) in a functional manner and to the Construction Manager (CM) in line . The role of the PEO is to support the successful implementation of the EMP through:

- a. Review and approve Contractor's EMPs
- b. Investigate and report on major environmental incidents
- c. Audit the implementation of Contractor's EMPs
- d. Review pre-commissioning procedures submitted by Contractors for possible environmental incidents
- e. Overseeing the execution of the activities described in the EMP.
- f. Ongoing liaison with appropriate project personnel.
- g. Maintenance and management of the monitoring programme.
- h. Monthly reporting
- i. Participate in the Environmental Co-ordination Committee (ECC)
- j. Provide liaison on environmental issues between SLE and Contractors.
- k. Provide input on environmental issues at HSE Advisory Committee Meetings.

5.2.3 Health, Safety and Environmental (HSE) Advisors – Reporting in a functional manner to the safety superintendent and the area Superintendent in a line manner:

The role of the HSE Advisors is to provide support to the PEO in monitoring the execution of the EMP by maintaining a permanent presence on the site. Specific activities include, but are not limited to:

- a. Routine site inspections and provision of information to PEO and Safety superintendent.
- b. Monitoring activities as specified by the PEC/PEO.

5.2.4 Community Liaison Officer (CLO) - Mozal project employee reporting to Mozal management. The role of the CLO is to ensure free flowing information to, and continuous liaison with communities affected by the project. Specific activities include, but are not limited to:

- a. Formulation of a community liaison plan in which affected communities are identified and regularly visited.
- b. Participation in reporting exercises.
- c. Participation in the ECC.

5.2.5 Engineering Manager (EM)

The role of the EM is to ensure that environmental requirements and restraints are passed on to the design engineers and to check that the plant is designed to meet all specified environmental parameters and to contractual and legal requirements.

5.2.6 Construction Manager (CM)

The role of the CM is to ensure that all contractors on site abide by the requirements of the EMP and that the plant is constructed in such a manner that meets all specified contractual and legal environmental requirements.

5.2.7 Environmental Co-ordination Committee (ECC)

The role of the Environmental Co-ordination Committee is to review on a monthly basis the environmental management performance of the Mozal Project. The ECC should consist of:

- a. PEC

- b. PEO
- c. CLO (when ECC meetings are on site)
- d. CM (when ECC meetings are on site)
- e. EM
- f. Client (BPT) representative

In addition the minutes of the ECC will be copied to the SLE Project Manager and to the Laboratory and Environmental Manager at MOT.

Although the exact format of the meetings can be refined and modified as the project unfolds, at least the following should be addressed:

- a. Monthly monitoring results. It is proposed that these be tabled as a monthly report.
- b. Non-conformance issues and response.
- c. Feedback reporting to Mozambican authorities.

Health, Safety and Environmental (HSE) Advisory Committee

The role of the HSE Advisory Committee is to ensure ongoing liaison between the Contractors and SLE. Feedback is provided to the Contractors during these meetings ..?

### 5.3 SPECIFIC FACILITIES

The following facilities will be established during the execution of the Mozal Smelter project. The facilities are either dedicated to environmental management requirements or will be established as a component of the project.

#### 5.3.1 Refuelling facility

- a. Impact and Mitigation  
During the construction phase of the project on-site spills of fuel may contaminate soil, ground and surface water. Such spills in turn can lead to a variety of potential impacts. Mitigation is to be effected through the establishment of on-site refuelling facilities for all contractors at the smelter site. Fuel requirements at the harbour terminal will be effected through the established fuel facility at the Harbour terminal. .
- b. Design requirements  
The refuelling facility should be surfaced and bunded so that stormwater and washwater can be collected in a sump. Provision shall be made for the removal of oils and fuels before the stormwater is discharged into the stormwater reticulation. Diesel storage tanks shall be placed above ground.
- c. Design criteria  
Diesel tanks above ground in bunded area.  
Petrol tanks underground, to have bak test carried out after installation  
Refuelling area to have concrete slab sloping to drain.  
Bunded areas and drains to have oil traps.
- d. Design review  
PEC for SLE facility
- e. Contract link  
The facility will be contracted out to a nominated fuel supplier who will take full responsibility for the establishment and maintenance of the facility.

T 7025 – Construction fuel supply.

- f. Standards (either legal or derived)  
Soap, oil or grease <2,5 mg/l (South African Water Quality Standards)

#### 5.3.2 Vehicle and machinery servicing and washing facility (Smelter Site)

- a. Impacts and Mitigation  
During the construction phase of the project on-site spills of lubricants (principally oils) may contaminate soil, and ground and surface water. Such spills in turn can lead to a variety of potential impacts. Mitigation is to be effected through the establishment of an on-site vehicle servicing facility. Contractors may construct their own servicing and washing facilities, which must meet the requirements and criteria below.
- b. Design requirements (already in place)  
The service facility must consist of a demarcated area surfaced and bunded so that stormwater can be contained and managed. An oil trap is to be provided before stormwater is discharged into the stormwater reticulation so that oil is removed.
- c. Design criteria  
Main facility to be 100 m<sup>2</sup> (10m x 10m) viz. Large enough for two heavy vehicles to be parked there simultaneously. Contractors facilities must be large enough for their largest vehicle to be serviced or cleaned.
- d. Design review  
PEC  
PEO – Individual Contractor's facilities
- e. Contract link  
Already established
- f. Standards (either legal or derived)  
Soap, oil or grease <2,5 mg/l

#### 5.3.3 Stormwater management facility

- a. Impacts and Mitigation  
During the construction phase of the smelter a large construction area will be stripped of vegetation. In the time before buildings, other infrastructure and vegetation is established and re-established on the construction terrace, the terrace will be susceptible to erosion. This erosion will lead in turn to a high sediment loading in the stormwater runoff, which can lead to a variety of impacts. Mitigation will be effected through the rapid stabilisation of the construction terrace and flow velocity inhibitors on stormwater channels.
- b. Design requirements  
Stone gabions where necessary along the length of the stormwater drainage course. Early revegetation of embankments and other areas where building will not take place.
- c. Design criteria  
Silt traps to prevent silt entering the Matola River at the Smelter Site and at the Harbour Terminal

- d. Design review  
PEC
- e. Contract link  
Package: C-5410 M (Earthworks and stormwater) .  
C-8102 - Harbour Terminal (Import Yard)  
C-8120 – Harbour Terminal (Export Yard)  
T-5930 M (Liquid pitch facility)
- f. Standards  
Sediment loading <2,5mg/l

#### 5.3.4 Construction village

- a. Impacts and Mitigation  
The construction village may lead to several impacts on the socio-economic environment. Of principle concern is the effect of the male-only characterisation of the village. Impacts may be manifested in the spread of sexually transmitted diseases (STDs) especially HIV.
- b. Design requirements  
Housing for male expatriate workers designed to reduce the 'dormitory' effect.  
Recreation facilities to be provided.
- c. Design criteria  
Refer to DD –0440-C-001
- d. Design review  
PEC
- e. Contract link  
Package C-6030 M (Construction Village).
- f. Standards (either legal or derived)  
N.A.

#### 5.3.5 Informal trading facilities (Smelter Site)

- a. Impacts and Mitigation  
Experience has shown that a large construction project such as Mozal has the potential to attract large numbers of informal traders to the area. In the case of the Hillside smelter, informal trading established quickly on the site perimeter and initially was not well controlled leading to potential impacts on the socio-economic environment. Mitigation to be effected should take the form of the pro-active establishment of informal trading facilities. The Administrator of Boane will be responsible for managing the facility.
- b. Design requirements  
Design requirements are to be agreed upon by SLE, Mozal, the Administrator of Boane and the traders. Decisions must be made as to who will construct the facilities, their form and extent, who will pay for them, whether or not they will be permanent and finally, how they will be allocated.
- c. Design criteria  
Established in consultation with all parties.

- d. Design review  
N.A.
- e. Contract link  
S 7045 M (Informal trading)
- f. Standards (either legal or derived)  
N.A.

#### 5.3.6 On-Site waste facilities

- a. Impacts and Mitigation  
During the construction phase of the project various waste types is generated. Each waste type requires a different approach to ensuring its safe and /or potentially advantageous disposal (e.g. packing timber to be given to local community). Although some waste types will be immediately removed from site, others may need to be temporarily stored before disposal. Facilities to stockpile certain waste have been established on the smelter site.

The Waste Management Contractor is responsible for managing the collection and appropriate disposal of all types of construction waste from the smelter and harbour terminal sites except for hazardous waste, which is the individual contractor's responsibility.

- b. Design requirements  
The following facilities are envisaged:
  - i. Stock pile area for waste packing
  - ii. Stock pile area for scrap metal
  - iii. Single storage point for waste oils and other hazardous waste.
- c. Design criteria  
Waste management specification
- d. Contract link  
Package S9116
- e. Design review  
PEC
- f. Standards (either legal or derived)  
South African Water Quality Guidelines.

#### 5.3.7 Health Care Facilities

- a. Impacts and Mitigation  
Health care and preventative care are both recognised as important in reducing the potential socio-economic impact of the Mozal Smelter. It is expected that some of those requirements will be translated into health care facilities but the exact nature and extent of such facilities is still to be negotiated.
- b. Design requirements  
To be specified in consultation with the SLE Human Resources Manager.

- c. Design criteria  
Refer to ST 9319-C-001.
- d. Design review  
PEC.
- e. Contract link  
Package S-9047 (Health Services).
- f. Standards (either legal or derived)  
N.A.

#### 5.3.8a Secondary Access Road to the Smelter Site

- a. Impacts and Mitigation  
A temporary access road was constructed as part of Phase 1 of the project. This road is not to be used during the Aluminium Expansion Project unless absolutely necessary e.g. for abnormal loads that may be restricted from using the main access route. Possible impacts related to the use of the road relate to impacts on the communities living in the area. Mitigation lies in ensuring that all traffic that is related to the Aluminium Expansion Project and that uses the road, is well controlled and managed.
- b. Design requirements  
N.A.
- c. Design criteria  
N.A.
- d. Design review  
N.A.
- e. Contract link  
N.A.
- f. Standards (either legal or derived)  
N.A.

#### 5.3.8b Matola Harbour Terminal Access Road

- a. Impacts and Mitigation  
The access road from the EN2 to the Matola Harbour Terminal has been upgraded during Phase 1 to carry the heavy vehicles that will be travelling between the terminal and the smelter site. The use of this road has the potential to impact negatively and positively on the environment. Such impacts include, but are not limited to, noise, road safety, improved access to the harbour and infrastructure –. Mitigation lies in ensuring that the use of the road is appropriately managed and controlled so as to minimise these potential impacts .
- b. Design requirements  
N.A.
- c. Design criteria  
N.A.
- d. Design review

N.A.

- e. Contract link  
N.A.
- f. Standards (either legal or derived)  
NA

#### 5.3.8c Maputo Harbour Facility Access Road

- a. Impacts and Mitigation  
The use of this road has the potential to impact negatively and positively on the environment. Such impacts include, but are not limited to, noise, road safety, improved access to the harbour and infrastructure – these impacts relate principally to smelter operations but any use of the road for construction purposes should be governed by the same mitigation. Mitigation lies in ensuring that the use of the road is appropriately managed and controlled to minimise these potential impacts.
- b. Design requirements  
N.A.
- c. Design criteria  
N.A.
- d. Design review  
N.A.
- e. Contract link  
N.A.
- f. Standards (either legal or derived)  
N.A.

#### 5.3.9 Concrete Batch Plant

- a. Impacts and Mitigation  
The concrete batch plant is a critical component of the construction phase. Potential impacts relate to spillage of cement and concrete, the cleaning of concrete mixers and the suitable disposal of waste concrete mixes. In all cases impacts may be manifest through soil contamination or through percolation of chemicals in the cement through to the groundwater. Waste concrete to be disposed of at the concrete rubble site.
- b. Design requirements  
The batch plant should indicate a surfaced area where filling of concrete mixers can take place. If the vehicle washing facility cannot accommodate concrete mixers, then a dedicated wash facility must be established at the batch plant.
- c. Design criteria  
Established by package engineer – Sven Bambus.
- d. Contract link  
Package: **T-6180 M** (Concrete Batch Plant).
- e. Design review  
PEC

- f. Standards (either legal or derived)  
 N.A.

5.3.10 Gas Treatment Centres (GTCs)

- a. Impacts and Mitigation  
 The GTCs are critical to both the aluminium reduction process and to effective control of gaseous and particulate fluoride ( $F_g$  and  $F_p$ ) emissions. The function of the GTCs is to remove fluoride from the exhaust gas stream and to fluorinate the incoming raw alumina. Thus the GTC's in themselves constitute important mitigation.
- b. Design requirements  
 Control of fluoride ( $F_g$  &  $F_p$ ) in the exhaust stream to the atmosphere  
 Control of dust  
 Control of sulphur dioxide emissions (indirect)  
 Minimised visual impact.
- c. Design criteria

All figures shown here are per individual GTC.

<u>Maximum emissions:</u> Gaseous fluoride ( $F_g$ ) Particulate fluoride ( $F_p$ ) Sulphur dioxide ( $SO_2$ )	12 tpa 6 tpa 2800tpa
Minimum stack height	40 m above ground level*
Minimum exit temperature	393K (120°C)
Minimum exit velocity	19.0 m/s

\*Note: A stack height of 50m was modelled in the EIA. A minimum stack height of 40m has been determined to be acceptable by modelling. A stack height of 47m will be constructed.

- d. Contract link  
 Package: T-1740 M (G.T.C.'s).
- e. Design review  
 PEC

Standards

Ambient  
 0.4F  $g/m^3$  (Annual average-ambient )  
 26 F  $g/m^3$  (maximum 24-hr average - ambient)  
 Emissions  
 Particulate matter - 30mg/ $Nm^3$   
 Hydrogen fluoride -1mg/ $Nm^3$   
 Total fluoride - 2mg/ $Nm^3$

5.3.11 Fume Treatment Centre (FTC)

- a. Impact and mitigation  
 Due to the recycling of used anode stubs, fluoride is liberated during the anode baking process. As a result it is necessary to scrub the exhaust fumes from the anode baking process. This scrubbing is effected by a Fume Treatment Centre (FTC) which operates on the same principle as the previously described GTC. In a similar manner to the GTC, the FTC is both an important part of the aluminium reduction process as well as an important impact mitigation facility.
- b. Design requirements  
 Control of fluoride ( $F_g$  and  $F_p$ ) in the exhaust stream to atmosphere  
 Control of dust  
 Control of  $SO_2$  emissions (indirect)  
 Minimised visual impact  
 Control of tar emissions

c. Design criteria

Maximum emissions	
Gaseous fluoride ( $F_g$ )	4,6 tpa
Particulate fluoride ( $F_p$ )	nil
Sulphur dioxide ( $SO_2$ )	452 tpa
Tar(T)	0,5 tpa
Minimum stack height	40 m above ground level
Actual stack height	41m above ground level
Minimum exit temperature	373K (100°C)
Minimum exit velocity	18.0 m/s

- d. Contract link  
 Package: T-3720 M (F.T.C.'s)
- e. Design review  
 PEC
- f. Standards  
 Ambient  
 $0.4F \text{ g/m}^3$  (Annual average-ambient )  
 $26 F \text{ g/m}^3$  (maximum 24-hr average - ambient)  
 Emissions  
 Particulate matter -  $30 \text{ mg/Nm}^3$   
 Hydrogen fluoride -  $1 \text{ mg/Nm}^3$   
 Total fluoride -  $2 \text{ mg/Nm}^3$   
 VOCs  $20 \text{ mg/Nm}^3$

Sewage Treatment Plant

a. Impacts and mitigation

Sewage effluent contains the discharge from the kitchens, latrines and bathrooms on site and the staff village. The effluent from the sewage treatment plant is being discharged into a tributary of the Matola River. The sewage treatment plant will be run by a company contracted to SLE for about 30 months before being handed over to the authorities and during this time the performance of the plant will have to be monitored to ensure that there is no impact on the environment.

- b. Design requirements  
 N.A. (the facility has already been built)
- b. Contract link  
 Package S-9098 M
- c. Review  
 PEC
- d. Standards

Constituent	Standard	Units	Source
pH	6-9		World Bank
BOD's	<30	mg/l	Mozambique
COD	<150	mg/l	Mozambique
Total Susp. Solids	<20	mg/l	Mozambique
Total Viable Org.	0-157	mg/l	World Bank
E-coli	Col/100	ml	World Bank
Chlorine, total res.	1.0	mg/l	World Bank
Oil and grease	10	mg/l	World Bank
Heavy metals, total	10	mg/l	World Bank
Arsenic	0.1	mg/l	World Bank
Cadium	0.1	mg/l	World Bank
Chromium, total	0.5	mg/l	World Bank
Copper	0.5	mg/l	World Bank
Lead	0.1	mg/l	World Bank
Mercury	0.05	mg/l	World Bank
Nickel	0.5	mg/l	World Bank
Selenium	0.1	mg/l	World Bank
Silver	0.5	mg/l	World Bank
Zinc	2.0	mg/l	World Bank
Ammonia	50	mg/l	World Bank
Cyanide, total	1.0	mg/l	World Bank
Fluoride	20	mg/l	World Bank
Phenols	0.5	mg/l	World Bank
Phosphorus	5	mg/l	World Bank
Sulphides	1.0	mg/l	World Bank
Aluminium	0.2	mg/l	World Bank

#### 5.4 GENERIC DESIGN REQUIREMENTS - OPERATIONS

Apart from the facilities previously described that are dedicated to environmental management requirements, there are a number of generic design requirements that apply to facilities across the plant. These are described below.

##### 5.4.1 Dust

- a. Impacts and Mitigation

Dust will be generated during smelter operations primarily in the handling of raw materials including alumina, petroleum coke and solid pitch. Recycling operations may also be a source of dust. Although mitigation resides in dust extraction facilities a clear distinction must be drawn between occupational health requirements (essentially indoor requirements) and environmental requirements (essentially outdoor). The specifications listed here address environmental requirements. Occupational health aspects should conform to a recognised regulatory requirement such as the South African Occupational Health and Safety Act (1994) (OHS Act).

- b. Design requirements  
Dust extraction facilities at all points where dust can be generated capable of ensuring that no visible dust is exhausted to atmosphere.

Design criteria  
30 mg/Nm<sup>3</sup>

- d. Design review  
PEC

- e. Contract link  
Packages: C-8100 (Port Storage Silo)  
C-8103 (Truck Loading Station)  
T-8109 (Ship Unloader)  
C-3004 (Carbon Plant Dedusting System)  
C-3005 (Pneumatic fines system)  
C-1650 (Lining shop ventilation and dedusting)  
C-3800 (Anode rodding shop – main installation)

- f. Standards  
30 mg/Nm<sup>3</sup> ('98 World Bank)

#### 5.4.2 Spillage of Oil-Based Substances

- a. Impacts and Mitigation  
Spillage of oil-based substances may impact on surrounding water courses if allowed to enter plant drainage/water collection facilities. These materials include pitch, oil, heavy furnace oil (HFO) and heat transfer fluids. Mitigation lies in providing spillage control measures at source, wherever potential spillage could occur.

- b. Design Requirements  
Bund walls around all storage tanks and oil traps on storm water/wash water discharge channels from these bunded areas. Oil/tar traps at all points of access to storm water reticulation

- c. Design Criteria  
The capacity of the bund walling must equal the potential spill from the largest single source within the bunded area. Drainage of the bunded area to stormwater reticulation via a valve.

- d. Design review  
PEC

- e. Contract link  
Package : T-3745 M (New HFO)  
T-5930 M (Liquid pitch facility)

- f. Standards  
Soap, oil or grease : <2,5 mg/l (S.A. Water Quality Standards)

#### 5.4.3 Spillage of Fluorinated Product, Bath and Aluminium Fluoride

- a. Impacts and Mitigation  
Spillage of fluorinated product (also referred to as fluorinated alumina/electrolyte) may impact on surrounding water courses if allowed to enter plant drainage/water collection facilities. Fluorinated product presents a significant threat to the quality of water that will be discharged from the site and facilities must be provided to effect good housekeeping regarding spillage.

Areas where fluorinated product may be spilt have been identified. These areas will be covered or bunded to prevent spills being washed away by rain.

- b. Design Requirements  
Portable vacuum cleaning facilities.  
Fixed vacuum cleaning facilities.  
Areas to be under cover, bunded or protected to prevent fluorinated product contaminating the stormwater
- c. Design Criteria  
To be specified
- d. Design review  
PEC
- e. Contract link  
Package: P-1415 (Alumina handling and HDPS)
- f. Standards  
Fluoride maximum 20mg/l (World Bank)

#### 5.4.4 Visual

- a. Impacts and Mitigation  
The visual impact of a large industrial complex such as the proposed Mozal Aluminium smelter can be significant. The impact of the visual intrusion may be lessened by aesthetically pleasing architecture and by optimal use of landscaping to conceal the smelter where possible. In addition lighting around the smelter should be carefully designed to minimise glare.
- b. Design Requirements
  - i. All components of the plant are to have aesthetically pleasing architecture.
  - ii. Landscaping to follow the principles of both mass and amenity-type planting.
  - iii. Smelter lighting to have minimum glare.
- c. Design Criteria  
All components of the plant to meet the architect's design criteria  
Planting to be of appropriate height relative to the building and structures on site and to complement architecture.
  - i. Planting to be compatible with surrounding indigenous vegetation. Screen-type planting to limit views of the smelter
  - ii. No direct light to shine outside of the smelter (i.e. all flood lighting to point inwards).

- d. Contract link  
Package : C-5440 M (Final Roads)  
Package : C-5460 M (Landscaping)
- e. Design review  
PEC
- f. Standards  
N.A.

#### 5.4.5 Air Conditioning

- a. Impacts and Mitigation  
The principal concern in respect of air conditioning across the plant is ensuring that no refrigerants, which have been phased out under the conditions of the Montreal Protocol and subsequent amendments, are used in air conditioning systems on the plant.
- b. Design Requirements  
Air conditioning to be free of CFCs that have been or will be phased out.
- c. Design Criteria  
To be established as a standard mechanical specification.
- d. Contract link  
Packages: C-5100 M (Construction Offices)  
C-3002 M (Carbon Offices)  
P-1651.01 M (PTA Supply)  
C-5651 M (Changehouse extension)  
T-5930 M (Liquid pitch facility)  
C-3003 M (Sub-stations)  
C-4110 M (Switchyard)  
C-1012 M (GTC)  
C-1969 M (  
C-1711 M (  
e. Design review  
PEC
- f. Standards  
NA

#### 5.4.6 Cooling Water Blowdown

- a. Impacts and Mitigation  
Although aluminium reduction is a dry process, water is used for cooling in several areas of the plant. As water is recycled within these systems evaporation occurs and there is a build up of total dissolved solids (TDS). After several cycles the water is discharged as "blowdown". It is important to ensure that contaminants such as oils and pitch cannot enter the cooling system. At the same time chemicals that need to be added to the water should be environmentally acceptable.
- b. Design Requirements  
Cooling water systems are to be designed in such a way that corrosion inhibitors and biocides are environmentally acceptable. Corrosion inhibitors should not be heavy metal (zinc) based and biocides should be bio-degradable.

- c. Design Criteria  
To be established in respect of environmental standards or guidelines.
- d. Contract link  
Contract P 3832 M (Anode rodding shop)  
T 2321 M (ingot line cooling water system)  
T-1970 (Supply and install compressors)
- e. Design review  
PEC
- f. Standards  
World Bank  
pH 6 – 9  
BOD's 50mg/l  
Chemical oxygen demand 150mg/l  
Total suspended solids (TSS) 50mg/l  
Heavy metals, total 10mg/l  
Zinc 2,0mg/l  
Cyanide, total 1mg/l  
Phosphorous 5mg/l  
Sulphide 1,6mg/l  
Coliforms <400/100ml  
Temperature - max 3°C above ambient  
Residual Chlorine 1.0mg/l  
Fluoride 20mg/l

#### 5.4.7 Noise

##### 5.4.7.1 Site and Port

- a. Impacts and mitigation  
The noise assessment conducted for the Mozal Smelter and Harbour Terminal EA assumed an acoustical prototype in the Hillside Smelter. On that basis it was concluded that the noise impact of the smelter was not significant. Mitigation, such as it is lies in ensuring that the Mozal Smelter does not deviate from Hillside acoustically.
- b. Design requirements  
Consideration be given to noise in the design of all mechanical and electrical facilities.
- c. Design criteria  
Maximum  $L_{eq}$  of 70 dBA at the boundary.
- d. Contract link  
All facilities.
- e. Design review  
PEC
- f. Standards  
Maximum  $L_{eq}$  of 70dBA at the site boundary (World Bank).

##### 5.4.7.2 Port Access Road

- a. Impacts and mitigation

The increased haulage operations between the port and the site will lead to exceedance of noise standards for the small residential area adjacent to the port access road. Mitigation involves establishing a noise barrier on that section of the road and failing that the possible relocation of the people living in that area.

- b. Design requirements  
Noise barrier
- c. Design criteria  
55 dB(A) at the boundary of the first row of houses.
- d. Contract link  
To be established
- e. Design review  
PEC
- f. Standards  
Maximum day-time (07:00 - 22:00) allowable level is 55 dB(A).  
Maximum night-time (22:00 - 07:00) 45 dB(A)

## 5.5 PROCEDURES

In addressing procedures the purpose of the section that follows is not to detail the procedures themselves but rather to spell out the requirements of the procedures. At the outset it should be noted that overall construction procedures will be drawn up by the CM and must include a section on environmental protection. Within this latter section the following be addressed:

- a. top soil stockpiles
- b. waste management
- c. vehicle maintenance and refuelling
- d. spraypainting and sandblasting
- e. dust management
- f. stormwater management
- g. cooling water flushing
- h. dredging and blasting
- i. noise management
- j. pedestrian safety.

### 5.5.1 Waste Management Procedures

- a. Objective  
To ensure that all waste generated during the construction and pre-commissioning of the Aluminium Expansion Project is suitably and safely disposed of.
- b. Scope  
The procedure must apply to all construction and pre-commissioning activities that may lead to the generation of waste. Construction waste is typically made up of:
  - i. Domestic waste (non-hazardous)
  - ii. Building rubble and waste concrete
  - iii. Packing timber (including crates, pallets and cable drums)
  - iv. Hazardous waste (paints, oils, solvents, etc.)
  - v. Scrap metals
- c. Requirements  
In order to met the above objectives the procedures must specify:  
Arrangements for and location of areas on site where building rubble can be safely buried.  
How waste timber will be collected and distributed to local communities.  
How scrap metal will be collected and disposed of and how returns, where possible, will be distributed.  
How domestic (non-toxic) waste will be collected and disposed of.  
How hazardous waste will be collected and disposed of.  
How all of the above will be monitored and controlled.
- d. Facility link  
Waste sorting facility
- e. Procedure  
Site Operations Procedures SOP-030.  
Annexure G of Contractor's Conditions
- f. Reporting

See monitoring and reporting programme

#### 5.5.2 Vehicle Maintenance and Refuelling Procedures (during Construction)

- a. **Objective**  
To ensure that vehicle refuelling and maintenance takes place only at a single dedicated facility where spillages of fuel and oil can be properly managed. Note that provision should also be made in the procedure for maintaining and refuelling large, stationary equipment such as piling rigs, cranes and the like.
- b. **Scope**  
The procedure will apply to all refuelling, lubrication and oil changing requirements on all vehicles and machinery requiring the same.
- c. **Requirements**  
In order to meet the above objective, the procedures must specify:  
The location of the refuelling facility.  
Scheduling arrangements to ensure that the facility will not be swamped with vehicles.  
How the facility will be managed.  
That vehicle maintenance and refuelling will not be allowed elsewhere on site.  
The de-emulsification, removal and safe disposal of waste oils and fuels from the collection sump.  
How the above will be monitored and controlled.
- d. **Facility link**  
Vehicle refuelling facility.
- e. **Procedure**  
Site Operations Procedures SOP-030.
- f. **Reporting**  
See monitoring and reporting programme

#### 5.5.3 Vehicle and Equipment Washing Procedure

- a. **Objective**  
To ensure that all vehicle and equipment washing takes place at dedicated facilities so that washwater containing detergents and oils can be properly managed.
- b. **Scope**  
The procedure must apply to all vehicle and equipment washing requirements bar concrete mixers that will be washed at the batch plant.
- c. **Requirements**  
In order to meet the above objective the procedures must specify:  
The location of the washing facility.  
A scheduling arrangement to ensure that the facility is not overloaded.  
The proper management of the facility.  
That vehicle or equipment washing elsewhere on site is prohibited.  
That the facility is for routine maintenance only.  
The removal and safe disposal of waste oils and fuels from the collection sump.  
How the above will be monitored and controlled.
- d. **Facility link**  
Vehicle and machinery washing facility.

- e. Procedure  
Site Operations Procedures SOP-030.
- f. Reporting  
See monitoring and reporting programme

#### 5.5.4 Spray Painting and Sandblasting Procedures

- a. Objective  
To ensure that any spray painting and sandblasting on site is done in a controlled manner where appropriate measures are taken to prevent paint contamination of the soil and to ensure that sandblasting grit/media is properly disposed of.
- b. Scope  
All spray painting and sandblasting on site.
- c. Requirements  
In order to meet the above objective the procedures must specify:  
That spray painting and sandblasting is generally not allowed on site.  
That touch up painting will be via wire brushing and hand painting.  
That spray painting will only be allowed on sanction of a fully motivated request to SLE site management.  
How the above will be controlled and monitored.
- d. Facility link  
None
- e. Procedure  
Include in "site procedures"  
Painting specifications  
Corrosion protection (SS.0000.G.003)
- f. Reporting  
See monitoring and reporting programme.

#### 5.5.5 Dust Management Procedures

- a. Objective  
To ensure that dust is properly managed during all stages of the project.
- b. Scope  
Control of dust on the smelter site and access roads.
- c. Requirements  
In order to meet with the above objective the procedures must specify:  
Soil loads on construction vehicles to be kept covered during transit.  
Topsoil stockpiles to be covered or some other form of erosion protection applied such as calcium chloride, ligno sulphate or bitumous products should this prove practicable.  
Suitable dust palliatives to be applied in problem areas.  
All parts of the construction terrace not earmarked for future plant to be re-vegetated as rapidly as possible.  
Loose soil from excavations to be suitably managed.  
How the above will be controlled and monitored.
- d. Facility link

None

- e. Procedure  
Contractors EMP  
Site instructions
- f. Reporting  
See monitoring and reporting procedure

#### 5.5.6 Storm water and Dewatering Management Procedures

(Smelter Site, Access Roads and Harbour Terminal)

- a. Objective  
To ensure that storm water and dewatering drainage across the site happens in a manner that will negate contamination by oils, fuels, litter and other waste and that will prevent erosion of the construction terrace.
- b. Scope  
All dewatering activities  
All arrangements for stormwater management
- c. Requirements  
In order to meet the above objective the procedures must specify:  
That temporary drainage will be established sitewide.  
That contractors maintain that temporary drainage in their areas.  
That contractors provide secondary drainage that prevents erosion.  
That contractors effect good housekeeping in their areas to prevent contamination of drainage water.
- d. Facility link  
Stormwater monitoring facility
- e. Procedure  
Include in "site procedures".  
General Environmental Requirements (Appendix 5 – Annexure G).
- f. Reports  
See monitoring and reporting programme.

#### 5.5.7 Rehabilitation and Revegetation Procedures

- a. Objective  
To ensure that all areas affected by the project are appropriately rehabilitated and re-vegetated in a manner congruent with the surrounding biophysical environment.
- b. Scope  
All areas affected by the project.
- c. Requirements  
In order to meet the above objective, the procedures must specify:  
Effect re-vegetation as soon as possible after completion of earthworks.  
Reclaiming ditch bed areas to limit possible erosion of land.  
Plant robust tufted fast growing grass species (such as Panicum maximum) on bare areas to stabilise soil.

Plant fluoride-resistant trees indigenous to the Maputo area.  
Avoid fruit bearing trees.  
How the above will be controlled and monitored.

- d. Facility link  
None
- e. Procedure  
Package : C-5460 M (Landscaping)  
Technical specification : ST 0460 A 002  
Standard specification : SS 0000 A 002

#### 5.5.8 Environmental Awareness Training Procedures

- a. Objective  
To ensure that all site personal have a basic level of environmental awareness training.
- b. Scope  
All site personnel
- c. Requirements  
In order to meet the above objective, the procedures must specify:  
Understanding of how their activities may impact on the environment.  
Understanding of what they can do to prevent these impacts.  
How the previously mentioned procedures will be communicated and displayed in respect of their activities.  
Areas to be avoided especially the "Kapahlene" graveyard  
How the above will be monitored and controlled.
- d. Facility link  
None
- e. Procedure  
Site instructions (included in the Environmental Standard)  
Contractors EMPs.  
Induction Programme
- f. Reporting  
See monitoring and reporting programme.

#### 5.5.9 Industrial Relations Procedures

- a. Objective  
To ensure minimum negative impact and enforced positive impact on the socio-economic environment by:  
Ensuring a peaceful, harmonious and contented labour force.  
Maximising job opportunities for local inhabitants commensurate with availability of appropriate skills.  
Ensuring that squatting and informal trading is properly controlled.
- b. Scope  
The entire labour force  
Surrounding communities

- c. Requirements  
In order to meet the above objective, the procedures must specify:  
How local labour recruitment will be maximised and managed  
How the influx of a job seekers will be managed  
How informal trading will be managed  
How the above will be monitored and controlled
  
- d. Facility link  
Informal trading facility.
  
- e. Procedure  
Industrial relation procedure (**SOP-020**)
  
- f. Reporting  
SLE's industrial relations manager  
  
Procedures for the Safety of Pedestrians  
  
Objective  
Procedures to ensure the safety of community members using Mozal's access roads.  
  
Scope  
Access roads to the smelter site and the Harbour Terminal.  
  
Facility Link  
Secondary access road to the smelter, Matola harbour terminal access road, Maputo harbour facility access road  
  
Procedure  
Site Operations Procedure.  
  
Reporting  
HSE Advisors to monitor  
  
Noise Management Procedures (Matola Harbour)  
  
Objective  
To maintain construction noise at Matola Harbour Terminal within World Bank limits.  
  
Scope  
Construction activities at the Matola Harbour Terminal.  
  
Facility Link  
None
  
- g. Procedure  
Site Operations Procedure SOP-030.
  
- h. Monitoring  
HSE Advisors to monitor

#### 5.5.10 Cooling Water Flushing Procedure

- a. Objective

To ensure that on pre-commissioning of cooling water systems, that the first flush of cooling water blowdown is appropriately managed.

- b. Scope  
Pre-commissioning of all cooling water systems
- c. Requirements  
In order to meet the above objective, the procedures must specify  
That attention be given to chemical contaminants of the flushed water  
That in the event of the water not being of acceptable quality, that alternative arrangements for disposal of the same  
How the above will be monitored and controlled
- d. Facility link  
All cooling water facilities
- e. Procedure  
Pre-commissioning and commissioning procedures
- f. Reporting  
See monitoring and reporting programme.

#### 5.5.11 Review of Pre-commissioning Procedures

- a. Objective  
To ensure that pre-commissioning procedures are formulated with due cognisance of the potential impacts of pre-commissioning.
- b. Scope  
All pre-commissioning procedures
- c. Requirements  
In order to meet the above objective, the procedures must specify:  
How to ensure that high fluoride loading during pot pre-commissioning will be kept to the absolute minimum possible.  
How to deal with accidental spillages or leakages  
How the above will be monitored and controlled
- d. Facility link  
All facilities
- e. Procedure  
To be established
- f. Reporting  
See monitoring and reporting programme.

Siting

#### 5.6 **TOPSOIL STOCKPILES**

- a. Responsibility  
Construction Manager
- b. Criteria  
Siting has taken into account:

Minimising any dust effects on both the site and the surrounding environment  
Minimising potential erosion of the stockpile and loss of the topsoil  
Enhancing the aesthetics of the site.

- c. Review  
PEC

## 5.7 **LIAISON**

Throughout the project ongoing liaison should be maintained with authorities and communities alike to ensure that the following is effected:

- i. Timeous advanced warning of any project activities that may have some impact on surrounding communities, e.g. plant pre-commissioning
- ii. Ongoing feedback on the environmental performance of the project

That a continuous conduit is established whereby complaints are speedily and efficiently resolved.

Given that there is an operational smelter, there is also a need to coordinate between public meetings that are related to operations and those related to construction activities in a seamless manner (i.e that the public are not confused by the different groupings within the entire Mozal structure). It is envisaged that 6 monthly public meetings will be held to provide updates of project progress and environmental management performance in terms of design, construction and pre-commissioning, whereas MOT will hold similar meetings once a year. Thus early in the year a combined meeting will be held, with a later meeting focussing just on design, construction and pre-commissioning.

## 6.0 **CHECKING AND CORRECTIVE ACTION**

### 6.1 **MONITORING**

A series of environmental variables to be monitored will then be specified together with objectives and targets to be met during the execution of the approach. Monitoring procedures specify:

- i. What
- ii. Procedure
- iii. Instrumentation
- iv. Maintenance
- v. Calibration
- vi. Variables
- vii. Data recording
- viii. Reporting
- ix. Responsible person

Monitoring results must also be reported regularly to assess whether or not objectives and targets are being met. Reporting structures should be in a position to address non-conformance by revisiting and possibly modifying any of the elements described previously. The monitoring programme is given in Appendix A.

Reporting and corrective action

The reporting structure is illustrated in Figure 2. The PEO and HSE Advisors are responsible for drawing up a monthly report, which must be tabled at the ECC. The monthly report will also draw from the Contractor's monthly report. The ECC will review the consolidated monthly report and decide on an appropriate corrective action where this is deemed

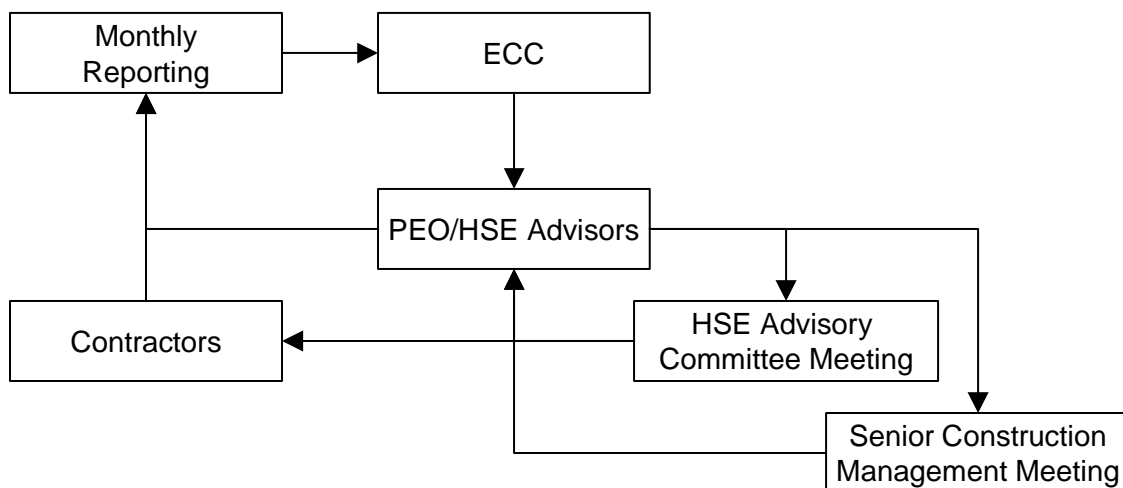
necessary. That corrective action can be immediately tasked to the PEO, or can be taken to the monthly HSE Advisory Committee Meeting. As a final resort the corrective action can also be tabled during the Senior Construction Managers Meeting.

It is important to note that corrective action can also be effected immediately without necessarily going the route of reporting to the ECC. Corrective action can be instructed immediately where this is deemed necessary and formalised through a site directive issued by the construction manager should that be required.

## 7.0 MANAGEMENT REVIEW

In keeping with the ISO14001 requirements, a formal management review will need to be conducted regularly. The purpose of the review will be to critically examine what is working and what is not in respect of the EMP and its implementation and to decide on modifications to the EMP as necessary.

The process of management review is in keeping with the principal of continuous improvement which is the commitment expressed here. Given the period of construction it is envisaged that at least three management reviews will take place at less than 12 monthly



intervals over the entire project period.

Figure 2: Schematic illustration of the mechanism for reporting and corrective action

**APPENDIX A: MONITORING REQUIREMENTS AND DATA RECORDING  
PROFORMAS**

Note: The monitoring requirements and data recording proformas are shown as an appendix so that any procedure may be used as an independent working document.

## APPENDIX A1: STORMWATER MONITORING REQUIREMENTS

### a. Procedure

Stormwater runoff must be monitored for every rain episode using the following procedure. Every rain event needs to be properly described by recording the onset time of the rain, the duration of the fall and the rainfall total. This information will be obtained from the weather station. With this information estimates of the amounts of runoff water will be possible. The observer should also make a qualitative estimate of the runoff amount by observing the streamflow in the drainage channel on the eastern side of the site. One of the following four streamflow classes must be used:

Class 1: No discernable streamflow - All rainwater soaked into the ground.

Class 2: Streamflow discernable - Small rivulets of water flow in the drainage channel.

Class 3: Moderate streamflow - A continuous flow of water is maintained in the drainage channel.

Class 4: Strong streamflow - A high volume of turbulent water flows down the drainage channel.

A sample of the runoff water must be taken at the lower end of the drainage channel by filling the prescribed sample bottle. The sample bottle must be clearly marked with the date, the time and the name of the observer. The sample should also contain a reference number. The reference number is derived from the reference number on the top of the data recording sheet and is ended with the observation number. For example the reference number on the first stormwater monitoring proforma is EMP/CP/SMP/1/01. If the sample is the third sample on the proforma the reference number on the sample bottle should read EMP/CP/SMP/1/01/3.

The sample must then be forwarded to a laboratory where total suspended solids will be determined.

### b. Instrumentation

NA - visual monitoring

### c. Variables

- i. Rain onset time
- ii. Rain duration
- ii. Rainfall total
- iii. Stormwater runoff
- iv. Total suspended solids

### d. Data Recording

The above variables together with the date and time of the measurements as well as the name and signature of the observer are to be detailed in the data recording proforma shown overleaf.

### e. Reporting

A monthly summary report is to be submitted to the PEO.

### f. Responsible Person SECO.

**STORMWATER MONITORING PROFORMA**

NO	RAIN EVENT					SUSPENDED SOLIDS mg/l	RUNOFF CLASS	NAME	SIGN
	DATE	TIME	ONSET TIME	DURATION (mins)	RAIN-FALL (mm)				
Eg	35938	14:30	13:20	120 min	14 mm	230 mg/l	Class 4		
1.									
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10.									

**RUNOFF CLASSES**

Class 1	No discernable runoff	Class 3	Moderate streamflow
Class 2	Discernable runoff	Class 4	Strong streamflow

Note: Rain events to be cross-referenced with data from the meteorological station

## APPENDIX A2: DUST MONITORING REQUIREMENTS

a. Procedure

**Dust generated on site must be monitored on a daily basis using the following procedure. Use the fence posts around the site over a distance of 100 metres. At about 15:00 the observer should assess how many of the pegs can be seen from a predefined observation point. The observer must simply record a dust class, which is derived from the number of pegs that can be seen.**

Class 1:	No visible dust (all pegs clearly visible)
Class 2:	Dust just visible (all pegs visible but dust also visible)
Class 3:	Dust easily visible (furtherest peg may be obscured)
Class 4:	Very dusty (more than 1 peg obscured).
Class 5:	Extremely dusty (all pegs obscured)

In addition to the above the observer must record the date, time and affected area of all dust spraying episodes.

Finally any dust episodes, i.e. dusty conditions occurring outside the monitoring times should be recorded.

b. Variable

Dust generated on site.

c. Data Recording

Visual classes together with details of the date, time and observers initial are to be recorded on the monthly data sheet shown overleaf.

d. Reporting

i. Monthly data sheets are to be forwarded to the PEO at the end of every month

e. Responsible Person

SECO

**DUST RECORDING PROFORMA**

FOR THE MONTH OF: \_\_\_\_\_ Ref no: EMP/CP/AQ/\_\_\_\_\_/01

WEEK	DATE	TIME	DUST CLASS	WEATHER	NAME	SIGNATURE
Eg	35933	15:00	Class 3	OC, WM, R	J. Public	
1						
2						
3						
4						
5						

**DUST CLASSES**

Class 1	No visible dust
Class 2	Dust just visible
Class 3	Dust easily visible
Class 4	Very dusty
Class 5	Extremely dusty

**WEATHER DESCRIPTIONS**

Sunny	S	Overcast	OC	Wind moderate	WM	Raining	R
Partly cloudy	PC	Calm	WC	Wind strong	WS	Rained earlier	RE

Note: Weather data to be verified from the meteorological station



### APPENDIX A3: NOISE MONITORING REQUIREMENTS

a. Procedure

Background levels in residential areas

In order to monitor whether background noise levels have been increased by more than 7dB(A) as a result of construction activities biannual noise measurements are to be conducted. These measurements are to be conducted at selected sites around the site. For each location continuous A weighted sound pressure level is to be measured over a 24 hour period with the meter response time set on 'slow', and sound levels averaged over 15 minute intervals.

b. Instrumentation

To be specified

c. Variable

The variable measured was the A weighted sound pressure level expressed in dB (A). The average sound pressure level is to be calculated using the relationship:

$$L_i = 10 \log_{10} \left( \frac{\sum t_i 10^{L_i/10}}{\sum t_i} \right)$$

where  $L_{Aav}$  = average A weighted sound pressure level  
 $t_i$  = exposure time  
 $L_i$  = continuous sound pressure level

d. Data recording

The metrosonics db-308 Sound Level Dosimeter data logging facility is to be used and data sheets printed.

e. Reporting

Data sheets are to be forwarded to the PEO after each six monthly measurement.

f. Responsible Person

SECO

**APPENDIX A4: MONTHLY DATA REPORTING PROFORMA**

The Project Environmental Officer  
SLE (Pty) Ltd  
PO Box 585  
Bedfordview  
2008

Dear Sir

**MONTHLY ENVIRONMENTAL DATA**

Enclosed please find copies of the following data recording sheets for the month of \_\_\_\_\_ 200\_\_.

PARAMETER	REFERENCE	SIGNATURE
Stormwater	EMP/CP/SW/____/01	
Groundwater levels	EMP/CP/GW/____/01	
Dust	EMP/CP/AQ/____/01	

The following section to be filled in by the PEO

REFERENCE	DATA COMPLETE	DATA CAPTURED	DATE	SIGNED
EMP/CP/SW/____/01				
EMP/CP/GW/____/01				
EMP/CP/AQ/____/01				
EMP/CP/FF/____/01				

**APPENDIX A5: SIX-MONTHLY DATA REPORTING PROFORMA**

The Project Environmental Officer  
 SLE  
 PO Box 585  
 Bedfordview  
 2008

Dear Sir

**SIX-MONTHLY ENVIRONMENTAL DATA**

Enclosed please find copies of the following data recording sheets for the six-monthly monitoring ending \_\_\_\_\_.  
 (day/month/year)

PARAMETER	REFERENCE	SIGNATURE
Groundwater analysis	EMP/CP/GW/___/01	
Noise	EMP/CP/NO/___/01	
Infrastructure etc.	EMP/CP/IS/___/01	
Visual	EMP/CP/VI/___/01	

The following section will be filled in by the PEO

REFERENCE	DATA COMPLETE	DATA CAPTURED	DATE	SIGNED
EMP/CP/GW/___/01				
EMP/CP/NO/___/01				
EMP/CP/IS/___/01				
EMP/CP/VI/___/01				

## APPENDIX A6: WASTE MANAGEMENT MONITORING REQUIREMENTS

a. Procedure

It should be recognised at the outset that the efficacy of waste management is extremely difficult to quantify. The assessment will be based to a large degree, therefore, on 'gut-feel'. In broad terms any area where waste is seen to be poorly managed should be included in the data report.

- i. The assessment is conducted fortnightly and involves driving around the site checking on the state of the contractors lay-down areas, their satellite lay-down areas and the site in general.
- ii. If any of the waste described in the monitoring proforma is seen to be poorly managed then the waste type, where it is evident and the responsible contractor (where possible) must be included in the data sheet. As much information as possible to be included in the 'Additional Comments' column.
- iii. Check on bins to ensure that where bins are demarcated 'Hazardous Waste' they contain such hazardous materials only.
- iv. Use the plot plan to ensure that transgression areas can be correctly described.

b. Instrumentation

N.A. Visual monitoring

c. Variables

Variables to be monitored include waste oil, building rubble, domestic waste, scrap metal and hazardous waste such as paint and paint tins and bitumen.

d. Data Recording

All data is to be filled in using the attached data reporting proforma.

e. Reporting

The data reporting proformas are to be forwarded to the PEO for inclusion in the monthly environmental reports.

f. Responsible Person

SECO

