ENVIRONMENTAL AND SOCIAL PERFORMANCE ANNUAL MONITORING REPORT (AMR)

Mozal S.A.R.L.
MOZAMBIQUE

REPORTING PERIOD: 1 JULY 2001 – 30 JUNE 2002

AMR COMPLETION DATE: SEPTEMBER 2002

PREPARED FOR: INTERNATIONAL FINANCE CORPORATION

ANNUAL MONITORING REPORT
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MOZAL CERTIFICATION

AMR Certification
IFC Project Identification: Mozal
IFC Project Sponsor: Mozal S.A.R.L.
IFC Investment Number: 7764 & 10323
AMR reporting period: 1 July 2001 – 30 June 2002
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We certify that to the best of our knowledge and belief:

1. the data contained in this AMR completely and accurately represents the environmental and social aspects of Mozal's activities during this reporting period (other than aspects directly related to the Phase 1 RAP); and
2. the analytical data summaries incorporated into Section 5 are based upon data collected and analysed in a manner consistent with the World Bank Group's Pollution Prevention and Abatement Handbook, Monitoring where appropriate.

Date 25.09.02

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ACRONYMS AND ABBREVIATIONS

AdM	Agua de Mozambique
ADPP	'People helping people' – NGO
AMR	Annual Monitoring Report – Environmental and Social Performance
APDF	African Project Development Facility
BHP Billiton	The principal shareholder in Mozal
BIP	Beluluane Industrial Park
BOD	Biological oxygen demand
BPT	BHP Billiton Projects Team
CBT	Computer based training
CCA	Copper chrome arsenate
C-EMP	Contractor's Environmental Management Programme
CFM	The Mozambican ports authority
COD	Chemical oxygen demand
CPI	Centre for the promotion of investment
CTA	Mozambican Confederation of Employers
CTA	Common Terms Agreement - Between the lenders (including the IFC) and Mozal
CTPV	Coal Tar Pitch Volatiles
DBSA	Development Bank of Southern Africa
EC	Empowerment coordinator
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
EPCM	Engineering, Procurement and Construction Management
ETG	Environmental task group
FTC	Fume Treatment Centre
FTIR	Fourier transform infrared spectrometer – instrument used to measure gaseous fluoride
GTC	Gas Treatment Centre
HFO	Heavy Furnace Oil
HSEC	Heath, Safety, Environment and Community
I&APs	Interested and affected parties
IFC	International Finance Corporation
IPA	Investment Project Authorisation
IR	Industrial relations
ISO 14001	Environmental Management Systems standards
JV	Joint venture
LTI	Lost-time injury
LTIFR	Lost-time injury frequency rate
MCDT	Mozal Community Development Trust

MICOA	Mozambican Ministry for the Coordination of the Environment
MOT	Mozal Operations Team
Mozal Dois	'Mozal 2' – the project newsletter
Mozal S.A.R.L	The full title of Mozal as an operating entity in Mozambique
MPN	Most probable number
MSDS	Material Safety Data Sheets
ODS	Ozone Depleting Substance
OHSAS 18001	Occupational Health and Safety systems standard
PEA	Project Environmental Advisor
PLA	Project labour agreement
PM_{10}	Particulate matter in the size range < 10 microns
PTA	Pot Tending Assembly
RSA	Republic of South Africa
SABS	South African Bureau of Standards
SINTICIM	Mozambican trade union
SLMR	A joint venture between SNC Lavalin – Murray and Roberts Engineering Services – EPCM Contractors for the Smelter Expansion Project
SME	Small or medium enterprise
SPL	Spent pot lining
STDs	Sexually transmitted diseases
TCE	Total control of epidemics
TDS	Total dissolved solids
tpa	Tonnes per annum
TSS	Total suspended solids
TVM	Mozambican television station/channel
ULV	Ultra low volume
VOCs	Volatile organic compounds
WBG	World Bank Group

1 INTRODUCTION AND PURPOSE

As part of its reporting commitments Mozal S.A.R.L (Mozal) is required to submit an Annual Environmental and Social Monitoring Report (AMR) to each of the Mozal lenders including the International Finance Corporation (IFC). The purpose of the AMR is to describe the degree to which the requirements specified in the Common Terms Agreement (CTA) have been met and to describe non-compliance and what is being done to address such non-compliance. Before describing that performance it is necessary to differentiate among the following three organisational groupings within Mozal:

a. Mozal Operations - the operational smelter
b. The Aluminium Expansion Project - the extension of the Phase 1 smelter from 253 000 tpa to 506 000 tpa
c. The Mozal Community Development Trust (MCDT).

Each of the three components is reported on separately in the AMR but common headings and sections as prescribed by the IFC have been used to structure the report. The report has also been independently verified to ensure that the reporting is factual and accurate and that a fair description of Mozal's overall performance in meeting the CTA requirements has been provided.

1.1 Scope and timing

The scope of the AMR includes all activities associated with Mozal, including operations, the project and the MCDT and covers the financial year from 1 July 2001 to 30 June 2002. In reviewing the recommendations made in the expansion project EIA, it became evident that each of the three would be responsible for implementing different recommendations. Accordingly a single document was developed that listed the EIA recommendations (both Phase 1 and Phase 2) and ascribed responsibility for the implementation of each recommendation to either Mozal Operations, the Aluminium Expansion Project or MCDT (this document is entitled *Guideline for the Preparation of an Environmental Management Programme and Coordination of Related Initiatives* - MSD0000-G-001).

This document was then further expanded to include the experience gained during the first phase of the Mozal Smelter and at a later stage the IFC's AMR requirements. In this manner the overarching document became a single reference source for all components of Mozal's environmental management requirements to ensure that such requirements were not overlooked or unnecessarily duplicated.

In response to these requirements each entity developed a suitable management programme. Mozal Operations and the Aluminium Expansion Project each have Environmental Management Programmes while the MCDT have a strategic plan entitled *Management of Social and Community Issues Arising from Mozal Phase 1 and Phase 2 Environmental Assessments*. To all intents and purposes the three management programmes contain all the requirements specified in the CTA, and to this end it is really the performance of each of the three entities relative to these management programmes that is described in the AMR.

2 REPORT ON SIGNIFICANT EVENTS AND ISSUES

2.1 Mozal Operations

2.1.1 Disruption of emissions or effluent treatment

In September 2001, corrosion was noted on the cooling tower of the Fume Treatment Centre of the Bake Furnace. As a result the cooling tower had to be repaired and during that time the FTC was run on by-pass during which time there was no scrubbing of fluoride emissions. A full incident report is provided in Appendix 3. Given that the incident was deemed a level 2 incident[1] – using the BHP Billiton, consequence severity ranking – the incident was not reported beyond Mozal.

2.1.2 Chemical and/or hydrocarbon spills

There was one hydrocarbon spill during the reporting period, where oil drained from a transformer in temporary storage. A full incident report is provided in 45. Given that the incident was deemed a level 2 incident[1] – using the BHP Billiton consequence severity ranking – the incident was not reported beyond Mozal.

2.1.3 Fire and/or explosion and/or unplanned releases

There were no fires and/or explosions during the reporting period. The downtime of the FTC during which time there were unplanned releases of fluoride has been described in the incident report given above.

2.1.4 Industrial injuries

The following industrial injuries occurred during the reporting period.

a. Lost time injuries	7	(3 Mozal employees and 4 contractors)
b. Restricted workday cases	4[2]	
c. Other injuries on duty.	228	

2.1.5 Fatalities including road accidents

There were no fatalities during the reporting period.

2.1.6 Ecological damage or destruction

There were no events during the reporting period that resulted in ecological damage or destruction.

2.1.7 Local population disruption

There were no events during the reporting period that resulted in local population disruption.

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[1] Defined in Appendix 1

[2] Not representative of full year as reporting of this parameter only commenced during last quarter on request by BHP Billiton

2.1.8 Legal/administrative notice of violation

No legal or administrative notices of violation were received during the reporting period.

2.1.9 Penalties and/or fines

No penalties or fines were incurred during the reporting period.

2.1.10 Negative media attention

Media coverage of Mozal is summarised in Table 1.

Table 1: Summary of media/press coverage given to Mozal during the reporting period.

Media	Number of articles	Assessment		
		Positive	Neutral	Negative
Sept – Oct 2001				
Press	102	20%	65%	15%
News Agency	52	60%	30%	10%
Radio	231	30%	60%	10%
Television	35	30%	60%	10%
Dec 2001				
Press	31	65%	35%	0
Jan 2002				
Press	30	60%	30%	10%
Feb 2002				
Press	14	70%	20%	10%
April 2002				
Press	9	64%	26%	0
May 2002				
Press	3			100%
June 2002				
Press	6	83%	17%	0

Bad press during the September-October 2001 period was related to the strike and subsequent dismissal of the 40 workers. Disappointingly, the three press articles that followed the May 2002 I and AP public meeting were negative and directly related to Mozal's environmental performance. In planning for the November 2002 public meeting, an attempt will be made to have direct dialogue with press people attending so that misperceptions can be addressed.

2.1.11 Labour unrest or disputes

In October 2001, a strike took place at Mozal operations following a deadlock in negotiations between Mozal management and SINTIME, the local trade union. The issues that resulted in the deadlock were the annual increase, shift allowances, the discrepancy between the local Mozambican and expatriate worker's salary, housing and medical aid.

The strike was illegal because the union did not follow the Mozambican labour law and neither did it honour the company agreement that had been signed in late 1999. The illegal nature of the strike eventually resulted in 40 of the striking workers being dismissed. The strike lasted 26 days but had no effect on production. The 40 workers who were dismissed are currently engaged in legal action claiming unfair dismissal and these cases are currently being heard.

2.2 Aluminium Expansion Project

2.2.1 Chemical and/or hydrocarbon spills

There were no significant chemical or hydrocarbon spills during the reporting period. As is typical of a large construction project there were a number of very minor hydrocarbon spills across the site, principally oil leaking from vehicles and machinery. These were all rehabilitated and measures put in place to prevent a repeat spill (these are described in more detail later in the report –Section 4.2.9).

2.2.2 Fire and/or explosion or unplanned releases

There were no fires or explosions or uncontrolled releases during the reporting period.

2.2.3 Industrial injuries

The following injuries occurred during the reporting period:

a.	Lost time injuries	10
b.	Restricted work day cases	107
c.	Other injuries on duty	203

2.2.4 Fatalities including road accidents

The following fatalities occurred during the reporting period:[1]

a.	Controlled incidents	0 fatalities
b.	Monitored incidents	5 fatalities (the incident is described in detail in Appendix 5)

2.2.5 Ecological damage or destruction

There was no ecological damage or destruction during the reporting period. There were a number of incidents involving venomous snakes, but in almost all cases the snakes were captured and relocated to areas of natural habitat.

2.2.6 Local population disruption

Apart from the disruption that is typical of a large-scale construction project, viz. increased traffic, labour force presence and so forth, there were no events that disrupted the local population during the reporting period.

[1] Defined in Appendix 2 – classification of activities and incidents

2.2.7 Disruption of effluent treatment

During an excavation in early May 2002, the main east-west sewer line was ruptured resulting in a minor spill of raw sewage. Because the pumps were stopped quickly the spill was estimated to have been no more than 3-4 m^3. The pipe was immediately repaired, the spill cleaned up and the area rendered safe.

2.2.8 Legal or administrative notice of violations

No legal or administrative notices of violations were received during the reporting period.

2.2.9 Penalties and/or fines

No penalties and/or fines were received by the project during the reporting period.

2.2.10 Negative media attention

There was no discernable negative media coverage of the expansion project activities, but several newspaper articles did appear describing the project in general and events such as the public meetings. As the media often may not discriminate between the various components of Mozal it is possible that general issues raised in the coverage described in section 2.1.10 may have relevance for the expansion project.

2.2.11 Chance cultural finds

There were no chance cultural finds during the reporting period. All construction work has taken place on sites previously occupied during the development of the Mozal first phase.

2.2.12 Labour unrest and disputes

There was no labour unrest during the reporting period and no formal disputes were registered. Labour grievances were dealt with quickly and pro-actively, which ensured that such grievances did not become formal disputes or lead to industrial action. The industrial climate on the expansion project has been excellent with no lost time hours recorded in a total of 7.64 million hours worked as at the end of June 2002.

2.3 MCDT

2.3.1 Local population disruption

The activities of the MCDT resulted in no local population disruptions but on the contrary resulted in general improvements in the quality of life of the local population.

2.3.2 Negative media attention

The MCDT received no negative news coverage during the reporting period. MCDT projects are aired several times on *Ver Moçambique*, a weekly magazine programme on the local TVM.

2.3.3 Labour unrest or disputes

The MCDT experienced no labour unrest or disputes during the reporting period.

3 PROCEDURES AND POLICIES

3.1 Mozal Operations

3.1.1 Audits/inspections

a. Self-audits

In June 2002, a self-assessment of Mozal Operation's conformance to the BHP Billiton HSEC Management Standards was conducted. This was a formal process involving a cross-section of the organisation and was performed in accordance with BHP Billiton requirements. An overall score of 84% conformance to BHP Billiton HSEC Management Standards was achieved. Assessment categories requiring further improvement include 'Awareness and Competence', 'Suppliers and Contractors' and 'Behavioural Safety'. A Performance Improvements Plan is currently being developed to address findings of the self-assessment.

b. External audits

An external audit of Mozal's environmental management systems was conducted during August 2001. The audit was initiated by MICOA who commissioned a representative of the Environmental Protection Agency of Victoria, Australia to lead the audit team. Representatives of MICOA and other governmental departments participated in the audit in order to gain experience in the audit process. Findings from the audit were addressed through the development of a corrective action plan, which has been implemented throughout the remainder of the year.

The environmental performance of the smelter was deemed satisfactory by the audit team and a number of recommendations presented for improving the environmental performance including[1]:

a. Better formalised reporting arrangements with MICOA
b. Increasing the availability of monitoring results internally
c. Increasing the knowledge and understanding of the local community about smelter operations
d. Continued surveillance of Interwaste (Mozal's Waste Management Contractor)
e. Repeating the baseline study of the Rio Matola
f. Development of procedures to formalise the operation of the impoundment dam
g. Updating water sampling procedures
h. Developing procedures to contain hydrocarbon spills better
i. Developing standard systems for managing and updating Material Data Safety Sheets (MSDSs)
j. Developing procedures for the notification and cleanup of raw material spills at the harbour.

[1] These recommendations are currently being addressed by Mozal.

3.1.2 Investigations/risk assessments

A Baseline Risk Register is currently under development for all plant processes and tasks, scheduled for completion by 31 December 2002. A risk assessment process is already in place for all capital expenditure projects. Formal incident investigations are completed and corrective actions implemented for all HSE non-conformances.

3.1.3 Documentation standards

Mozal Operations is in the process of implementing ISO 14001 and OHSAS 18001 Health, Safety and Environmental Management Systems. The findings of the most recent self-assessment conducted against these specifications verified 86% conformance. Areas for improvement for ISO14001certification included legal and other requirements, operational control and emergency response and preparedness. A Performance Improvement Plan is currently being developed with the objective of certification to ISO 14001 by December 2003. Areas for improvement on the OHSAS 18001 include legal and other requirements, competence and operational control.

3.1.4 Environmental awareness

Environmental awareness training is conducted for Mozal employees, contractors and visitors. Main training modules include:

a. Environmental Awareness of Mozal
b. Waste Management
c. Management of Hazardous and Toxic Waste
d. General Health, Safety and Environmental Awareness
e. General Safety Measures for Contractors
f. HSE Management Systems Overview.

In addition, to formal training modules, toolbox talks and articles published in the weekly Newsflash and in the *Ndlophu* newsletter are used to address topical environmental issues. Events used to celebrate days such as World Environment Day focus on addressing topical environmental concerns.

3.2 Aluminium Expansion Project

3.2.1 Internal audits and inspections

Audits and inspections formed a key element of the implementation of the Project EMP. Inspections are conducted on an ongoing basis by Health, Safety and Environmental (HSE) Advisors, using a predefined inspection template on a weekly basis. The inspection template contains reference to a range of indicators identified in the EMP including waste management, spills, soil erosion, availability and use of covered eating areas, provision of drinking water, vehicle and equipment maintenance and washing, toilets, materials storage, painting and toolbox talks.

In addition, to the inspections, regular internal audits have been conducted by the Project Environmental Advisor (PEA), on the various contractors across the site with the aim of conducting at least one audit per contractor. Some 29 audits have been conducted during the reporting period. General problems that have been identified in the audits include:

a. Insufficient eating facilities
b. Contractors eating in the work areas
c. Contractors not removing domestic waste from the laydown area timeously.

3.2.2 Supplementary audits

A number of supplementary audits were also conducted, during which time the Project Environmental Consultant (PEC) accompanied the PEA during the formal audits on the contractors. The principle of these supplementary audits was to provide additional perspectives on the auditing process and to ensure that the auditing approach was consistent with the requirements of the Project EMP. In general the key findings of the supplementary audits were to provide greater emphasis on auditing the implementation of the Contractor EMPs (C-EMP) by asking contractors to show records of inspections and other relevant information as had been specified in their C-EMPs.

3.2.3 Parallel C-EMP assessments

At an early stage in the project, parallel assessments were conducted on a series of Contractor's EMPs. Again the purpose here was to check on the assessment process to ensure that it was being implemented in a sound manner. Comments and additional guidelines were issued from these parallel assessments to improve the rigour of the ongoing C-EMP assessments. Ten parallel assessments were conducted on the C-EMPs during the reporting period. The overall finding of the parallel assessments was to focus on how the contractors had defined the *implementation* of their environmental controls, as this component had been consistently weak in the C-EMPs assessed.

3.2.4 External audit

In addition, the Mozambican Ministry for Environmental Co-ordination (MICOA) conducted a formal audit on the project during June 2002. The audit was conducted over a three-day period and during concluding discussions the following general findings were revealed:

a. Although education and environmental awareness of workers, emergency response and control of risk situations and management of water and effluent are all being effected on the project, the items are not explicit in the EMP
b. Oil and grease monitoring does not take place at individual potential sources (only in the impoundment dam) rendering source identification difficult if an anomaly were to be detected in the dam
c. There is no formalised procedure for stormwater management (although stormwater management is effected through a variety of mechanisms – see Section 4.2.7.)
d. Dust monitoring has been conducted once a day and not twice a day as stipulated in the EMP

e. General waste in the building rubble dump should be minimised and should be allowed only if it is unavoidably included in the building rubble
f. Some warning signs in and around the site are in English only and not in Portuguese
g. It is not evident how the efficacy of awareness and education programmes is assessed
h. A stand-alone procedure for minimising water use on the project must be implemented
i. There is no evidence that the noise mitigation requirement of checking the noise levels of construction machinery and vehicles against manufacturer's specifications has been met.

The final report has been received from MICOA, and steps already put in place to address the items described above.

3.2.5 Investigations/Risk assessments

Investigations

All incidents other than minor ones are reported and investigated. In addition, because all incidents requiring more than first aid treatment are reported to the site clinic, a comprehensive record of all incidents is available from the project labour management system.

Serious incidents are investigated by a joint investigation team consisting of representatives of the SLMR (SNC Lavalin – Murray and Roberts Engineering Services) as well as the contractor involved in the incident. Investigations are chaired by the contractor, senior project and construction management who, in association with the aluminium expansion project team, review investigation reports. The objective of the investigation is to identify all root causes and contributing management decisions that lead to the incident. Controls to reduce the risk associated with the incident are identified and follow-up inspections and investigations are conducted to ensure the controls have been effectively implemented. Depending on the seriousness of the incident, a supplementary investigation by senior project management personnel may also be undertaken.

Risk assessments

Contractors are required to submit a pre-emptive risk assessment of all potential environmental and occupational health and safety risks with their tender documentation. These are scrutinized by the project team to ensure all minimum controls as stipulated in the contract documentation have been identified and are addressed before the contract is awarded.

Once contractors have been mobilized, a baseline risk assessment is conducted to ensure all risks associated with the scope of work are addressed and mitigated to a level as low as reasonably practicable. The main focus of the baseline risk assessment is to ensure that employees are familiar with the risks and mitigation controls. The process also allows for employees to provide input on the effectiveness of the controls identified. This ensures buy-in from workers as the 'experts' on the floor.

The risk assessment process is dynamic and assessments are updated on a regular basis. Changes in the work process, environment, new equipment, methods and out of scope work require that the risk assessment for that particular work must be revisited to reflect the changed circumstances.

As part of their contractual requirements, contractors must train their employees in the risk assessments particular to their tasks. Records of training are checked during audits conducted by the project HSE Advisors.

Project risk management process

The project has adopted a cradle-to-grave approach in the management of all project related risks. In addition, to the contractors being required to submit all environmental and occupational health and safety risk assessments prior to a contract being awarded, the project risk management process started as early as the feasibility study.

Risk management is a line function responsibility, integrating time, schedule, cost, quality, as well as health, safety and environmental matters. Management and accountability of risk are administered at the area and functional levels.

Threats associated with the particular project or functional area are identified during brainstorming sessions involving the members of the department. A similar approach is used to identify controls to mitigate the threats. Although the risk evaluation process is subjective it does tap into the expert knowledge of the teams and clearly identifies relative probability and impact of risks. In addition, progress in the implementation of identified controls is tracked. Risk evaluation sessions are facilitated on a monthly basis by the area or functional manager. The process is dynamic and allows for the identification of new threats. All information is captured on a database and updated monthly by the database administrator.

3.2.6 Documentation standards

The EMP was structured to reflect the requirements of the ISO14001 Environmental Management Systems standard. The ISO14001 standard provides a robust and logical structure for the EMP that is well-recognised and consistent with environmental management approaches used elsewhere. In addition, the project maintains a strict document control function in which all documents are registered and logged together with any revisions. Electronic copies of all documents are available to all staff that need to access the documents.

3.2.7 Environmental awareness

Environmental awareness has been promoted through the induction process, crew[1] and toolbox talks and special events such as activities surrounding World Environment Day. In addition, the project newspaper, *Mozal Dois,* that is published fortnightly, carries articles on the environment and environmental awareness.

[1] Crew talks and toolbox talks are regular talks held with the contract workers to promote health, safety and environmental issues. Toolbox talks are held once a week and focus on a particular theme whereas crew talks are held every day and focus on the day's activities and items to consider in respect of those activities.

During contractor audits it was found that contractors were emphasising heath and safety to a far greater degree than the environment and one of the reasons for this was a lack of experience by the contractors on environmental management issues. In order to address this problem, a series of information sheets were developed and distributed amongst the contractors for use in crew and toolbox talks. Feedback from the contractors indicated that these information sheets had proved useful in improving the emphasis on environmental awareness amongst contractors.

Industrial theatre has also been used widely during the project to highlight a range of issues including safety, malaria and HIV/AIDs. Industrial theatre has proved highly effective in communicating the risks and consequences of these three aspects. The plays are presented in either Portuguese or English as is appropriate to the audience. Industrial theatre plays are presented several times a week.

4 PERFORMANCE (ACTIVITIES)[1]

4.1 Mozal Operations

4.1.1 Improved empowerment (procurement) strategy

Mozal Operations have exceeded their set targets for local spending for the financial year that ended in June 2002 (Figure 1). Mozal Operations have engaged in discussions with the African Project Development Facility (APDF) and the SME department of the World Bank to explore the different options with regard to local supplier development and support. Draft proposals have been discussed and the focus is to ensure that there is a coordinated approach to the development of local businesses. Discussions in this regard are progressing.

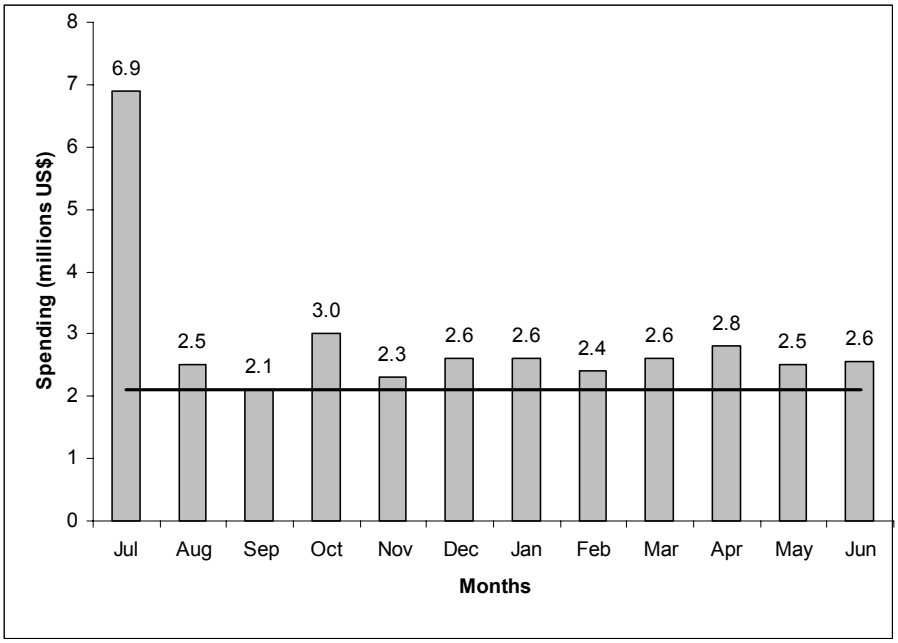


Figure 1: Local spending by Mozal Operations (millions of US$) for the reporting period. The dark horizontal line shows the internal target for local spending at US$ 2 million per month.

[1] Please note that this section is principally a description of the activities that have taken place to manage environmental or social issues. Where relevant, supporting performance data has been included but the bulk of the performance data is shown in Section 5.

4.1.2 Employment generation

There is a range of initiatives run by Mozal to maximise the employment of local Mozambicans on the smelter. Performance in this regard is shown in Figure 2. Given that there is a fixed number of employment opportunities on the smelter (there will be a 40% increase in employment with commissioning of the second phase of the smelter) employment generation efforts are geared towards the personal growth of Mozal employees. These efforts are rooted in a range of training programmes, each of which is briefly described below:

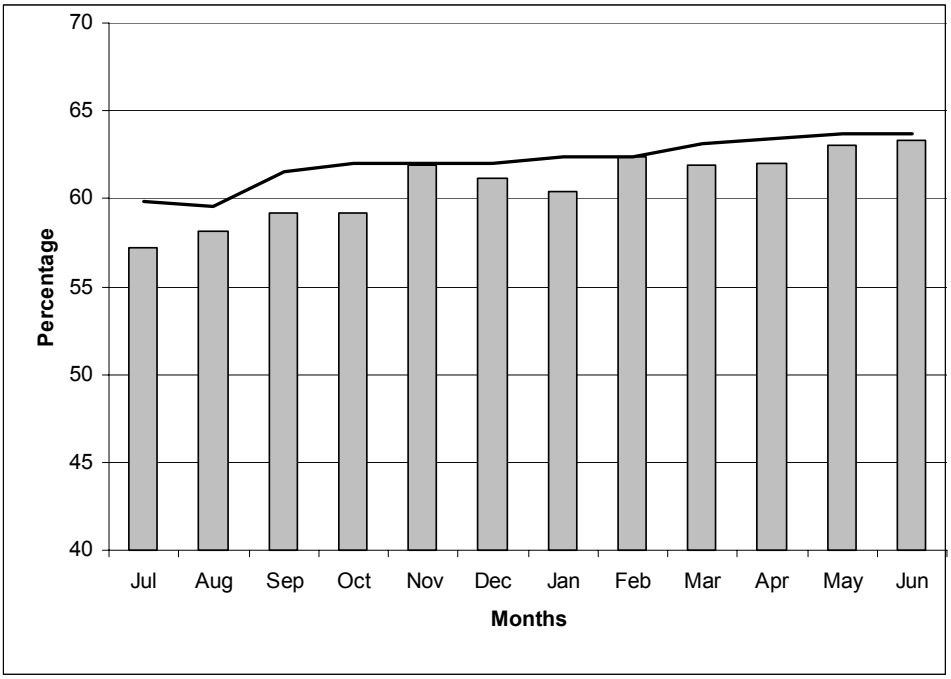


Figure 2: Positions occupied by local Mozambicans (%) for levels 4-6 (superintendent, supervisor, specialist and managers). The internal target is shown by the dark horizontal line. Note that all the positions in levels 1-3 are held by local Mozambicans.

a. Graduate Development Programme

The Graduate Development Programme is geared towards recruiting new graduates and providing 12-month 'internship' programmes that expose the graduates to the functions and activities of the smelter. At the same time Mozal is afforded the opportunity of retaining those graduates with the greatest potential and moving them into a functional post (within an appropriate technical area) at the end of the programme.

b. Maintainers Development Programme

The Maintainers Development Programme is geared towards accelerating the growth of level 1 employees toward level 2 competence. A key element of this programme is the use of expatriate personnel to provide coaching and mentorship to the level 1 employees in the programme. These expatriate personnel are employed on a full-time basis for periods of 12 to 13 months to provide such coaching as a dedicated function. The principle of that coaching and mentorship is to transfer the *experience* necessary to supplement the technical skills that are taught as part of the programme – collectively providing the capability to move to the next employment level.

c. Capacity Building Programme

The Capacity Building Programme is a 12-month programme geared towards building supervisory capacity in level 2 employees (viz. moving from level 2 to level 3). This is effected through direct training by in-house (internal) trainers.

d. 'My Development' Programme

The 'My Development' Programme is a self-driven programme that serves to progress level 3 (supervisor) employees to levels 4 and 5 (superintendent). The 'My Development' Programme is CBT based with a capability/capacity profile that is continually updated as new skills are learned.

e. Assisted Education Programme

The Assisted Education Programme promotes the pursuit of higher-level education such as MBAs, amongst upper level employees, with a view to ultimate progression towards senior management functions.

All of the above training is supported by the maintenance of an overall training measurement for Mozal that measures both direct training, viz. number and content of training courses as well as the (demonstrable) competence that has been developed as a result of that training. In addition, employees may also be selected for external assignments on smelters elsewhere is the world most notably South Africa and Brazil. The overall purpose of the training regime is to maximise the local labour content with a gradual progression towards reducing the expatriate labour content as local Mozambicans are trained for higher-level functions. A specific goal in this respect is to reduce the number of expatriate employees over time.

4.1.3 Social services

Social services are driven directly through the Mozal Community Development Trust (MCDT) (see description of the MCDT in Section 2.3).

4.1.4 Impact on the Mozambican economy

The two phases of the Mozal smelter project have had a significant impact on the Mozambican economy, in respect of the construction activities and the ongoing operation of the smelter. These elements deserve quantification.

In response to this, Mozal Operations has reached agreement with the Mozambique Ministry of Finance whereby financial information emanating from Mozal Operations and the expansion project is provided to the Ministry of Finance on a quarterly basis. The data provided is analysed and processed and it is intended that on a quarterly basis the Ministry will report on the macro impact on the Mozambican economy.

The data provided to the Ministry of Finance include financial data resulting from the Mozal Operations and Aluminium Expansion Project empowerment initiatives which are also reported on independently in this report and includes other financial data of a more general nature associated with the operation of the smelter. The empowerment initiatives are carefully monitored by Mozal Operations and the Aluminium Expansion Project, as they have specific targets against which progress is measured (these targets are set at the beginning of the reporting period).

The first reports forthcoming from the Ministry of Finance were received during the last quarter of the reporting period and due to the complexities and skewed nature of the Mozambican economy and uncertainty regarding the secondary economic impacts the validity of the results has been questioned. This issue is currently receiving attention by the Ministry of Finance and it is expected that a report with more defendable information will be available for release in the not too distant future.

4.1.5 Occupational health and safety

The dual emphasis on behaviour and management systems has been instrumental in Mozal steadily improving health and safety performance. Close alignment with the BHP Billiton HSEC standards form the core of the management system and ensure that activities geared towards continued improvement in occupational health and safety performance are properly identified and effectively implemented. Behavioural emphasis is consolidated around near miss reporting and job safety observation systems, again in close alignment with the BHP Billiton behavioural safety management programmes. In addition, the risk assessment process roll-out continues, which will be followed by the development of a risk reduction process targeting high and extreme risks.

An occupational hygiene exposure assessment programme in accordance with Operations Procedure PRO111 has been implemented. Baseline exposure profiles have been completed for all potential exposure agents and all tasks and annual review against this baseline is ongoing. This includes exposure to chemical agents and physical agents. In addition, to personal exposure assessment, a noise survey of plant and equipment has been conducted for the plant and an additional survey completed to assess noise levels in the environment surrounding the plant. An illumination survey has recently been completed for the plant and harbour areas.

4.1.6 Harmonious labour relations

Despite the industrial action described earlier (see Section 2.1.11), labour relations remain harmonious. An important contributor to these harmonious labour relations is the labour agreement which remains in force and which is valid until 31 December 2003. Further evidence of harmonious labour relations lies in the successful amendment of conditions of employment, which occurred in January 2002. The principal changes to the employment conditions have been the introduction of medical scheme benefits (essentially a hospital plan for employees) and the introduction of a housing allowance.

Mozal has also played an active role in the formation of a labour dispute arbitration system for the first time in Mozambique. The Mozambican Confederation of Employees (CTA) is the custodian of the system, which provides an independent labour dispute arbitration mechanism.

4.1.7 NGO interaction

Mozal interacts through the MCDT, with the following NGOs:

a. ADPP- Partnership on the HIV/AIDS programme (TCE) over three years
b. CARE International - Partnership in the construction of 10 dams to prevent floods in the north of Mozambique
c. World Vision - Partnership on HIV/AIDS awareness programme (Cycle against AIDS).

In addition, efforts are ongoing to build a relationship with a local environmental NGO called *Livaningo* that has taken an active interest in Mozal's environmental performance. More recently it has been decided to extend the function of the Environmental Task Group (ETG) to move from being simply an authority liaison forum, to being a stakeholder liaison forum. In that process a number of environmental NGOs (including Livaningo) will be identified and encouraged to participate in the ETG.

4.1.8 Government interfacing

The Investment Project Authorisation (IPA) Steering Committee has been functioning on a monthly basis and representatives from both government and Mozal have attended as planned. The relevant committees have been functioning as required at the correct level of interface and good cooperation has been achieved in these teams. Meetings are held between various ministers and the relevant functional heads of smelter operations. For example, the Mozal General Manager meets with the Minister of Industry, the Human Resources Manager with the Minister of Labour and so forth. Such structured interfacing with government is perhaps unusual but highly relevant in the context of Mozambique, especially in light of the Mozambican Government's 4% shareholding in Mozal.

4.1.9 Public relations efforts

Mozal has a well-developed external communications strategy, which is based on the vision of establishing Mozal as the model of primary aluminium production and corporate responsibility. The strategy is aimed at projecting and maintaining the image of Mozal to target audiences and building the both the Mozal brand and the smelter's image of being a good corporate citizen. Amongst a range of objectives, environmental performance, pro-active communication, building positive relationships with stakeholders and implementing information/education campaigns are those most relevant to the nature of the AMR. The implementation of the strategy results in a range of activities, which are listed and briefly described below:

a. I&AP meetings every six months
b. Media visits (international and national once a year, with a view to extending this to twice a year, from next year onwards)
c. School visits (from July 2002 a different local school will be invited to visit the smelter every week)
d. General interest visits. These visits occur typically about three times a week and include:

   - Stakeholders
   - General interest groups
   - Technical groups
   - Government
   - Students
   - Teams from other BHP Billiton operations

e. Participation in the annual trade fair – FACIM – both a specific Mozal stand as well as a shared stand with CFM (the Ports authority)
f. Support of National holidays through the media (Independence day, Worker's day etc.)
g. Advertising in local magazines such as:

   - Stimela
   - Ipex Export Directory
   - Top 100

h. Media releases

   - Graduate programmes
   - Significant events such as the strike action
   - General education

i. Website (which is updated monthly).

4.1.10 Complaints management

A number of formal communication channels have been established to ensure that HSEC complaints/concerns/suggestions/requests for information are received and addressed by the relevant Mozal person (includes Mozal Operations, Aluminium Expansion Project and MCDT activities). These include:

- Webpage: www.mozal.com
- Email: enviro@mozal.com
- Voicemail: + 258 1 735 556
- Postal address: Specialist Environment, Mozal, P.O. Box 1235, Maputo, Mozambique
- Suggestion Box at the Posto Administrativo da Matola Rio
- Complaints Book (Livro de Contacto com a Mozal) at the Posto Administrativo da Matola Rio
- The I&AP public meetings and environmental task group meetings also provide platforms for interfacing with Mozal.

To date, the most popular medium has been e-mail. Some requests for information have also been lodged telephonically. Records of all contact made with Mozal are filed in accordance with Procedure 242 HSEC Record Management. Complaints, requests for information, comments and suggestions are submitted to the Superintendent HSE who is responsible for forwarding the request to the appropriate person. Once a response has been formulated, it is forwarded to the Environment Specialist who will then forward the responses to the inquirer. Hardcopies of queries and responses are filed in accordance with procedure PRO242 HSEC Record Management. No direct complaints have been received to date but the complaints hot line has been used quite frequently to request information from Mozal (such as copies of reports and minutes). The ongoing contact with the community also provides a direct mechanism for the raising and addressing of issues and complaints.

4.1.11 Air pollution emissions

The key pollutants from the smelter are fluoride (gaseous and particulate), sulphur dioxide, particulate matter, carbon dioxide and tar. The sources of these pollutants are summarised in Table 2.

Table 2: Monitored air pollution emissions from the Mozal smelter.

Pollutant	Gaseous fluoride	Particulate fluoride	Sulphur dioxide*	Particulate matter	Carbon dioxide*	CTPV
Gas Treatment Centre	X	X	X	X	X	
Fume Treatment Centre	X	X	X	X	X	X
Roof vents	X	X	X	X	X	
Casthouse			X	X	X	

* *Calculated on the basis of material composition.*

The Gas Treatment Centre (GTC) and Fume Treatment Centre (FTC) are the principal mechanisms of air pollution control on the smelter. In both, fluoride is scrubbed from the gas stream by being brought into contact with the incoming raw alumina. The alumina is then captured in a series of bag filters, which also have the effect of removing particulate matter (particulate fluoride and alumina dust) from the exhaust stream.

Figure 3: Photograph showing fume treatment centre at carbon plant with second unit under construction in background

Within the potroom the hoods on the reduction cells periodically have to be removed for maintenance purposes. When this happens the fumes generated in the pot are vented into the potroom from where they are emitted into the atmosphere via roof vents in the potroom roof. The roof vent monitoring system is shown in Figure 4. The monitoring of these pollutant emissions is shown in Table 3.

Figure 4: Photograph showing potroom roof vent monitoring system.

Table 3: Monitoring points, frequency and duration of the various air pollution emissions from the smelter.

Source	Pollutant monitored	Frequency	Duration
Gas Treatment Centres	Gaseous fluoride Particulate fluoride	Every second week (*viz*. 2 per GTC per month)	24 hours
Fume Treatment Centre	Gaseous fluoride Particulate fluoride	1 per month	24 hours
	CTPV	2 per month	2 hours
Roof vents	Gaseous fluoride Particulate fluoride	2 per week	32 hours (4 shifts)
Casthouse	Particulate matter	2 per month	2 hours

The environmental sampling team has undergone significant training to enhance technical skills, while the sampling and analytical procedures have been subject to audit by external parties throughout the course of the past year. Carbon dioxide equivalent emissions are not measured but are calculated as a function of the use of petroleum coke, pitch and fuel oils and also taking into account the variety of greenhouse gasses evolved during in the aluminium smelting process. Sulphur dioxide and nitrogen dioxide emissions from the process are not measured, as there are no direct abatement controls for these gasses. Total sulphur dioxide emission is, however, managed by targeting sulphur content of raw materials and fuel oils as low as practicably possible.

4.1.12 Ambient air pollution concentrations

During April 2002, ambient air pollution concentrations were measured in the vicinity of the smelter, including sulphur dioxide, nitrogen dioxide, fine particulate matter (PM_{10}) and particulate and gaseous fluoride. The measurement programme included active continuous samplers (capable of real-time measurements in the field) and passive samplers, which provided integrated measurements over the two-week monitoring period. These sampling techniques are summarised in Table 4.

Table 4: Sampling techniques and apparatus used during the Mozal ambient air quality measurement campaign.

Pollutant	Sampling technique	Apparatus
Gaseous fluoride	Continuous sampling	FTIR
Particulate fluoride	Bergerhoff method	Dust fallout buckets
Particulate matter	High volume sampling	Minivol Portable Air Sampler
Sulphur dioxide	Passive sampling	Ogawa passive samplers
Nitrogen dioxide	Passive sampling	Ogawa passive samplers

4.1.13 Material spillage

Material spillages across the site are logged as incidents and investigated by area supervisors in the relevant department according to Procedure PRO 158 Incident Recording and Investigation. Material that is not contaminated is collected and recycled on site. Contaminated materials are disposed of in the relevant bins. Several initiatives have been pursued during the reporting period to reduce the risk of material spillages. At the harbour, for example, measures have been put in place to ensure that the belts are not overloaded, dust collection has been improved and modifications have been effected to the conveyor chutes to prevent spillage from conveyor transfer points. Petroleum coke, prior to shipment from the suppliers, is treated with a mist oil spray to minimise the material's affinity for dusting during all subsequent handling operations. In terms of spillages of fluorinated material, the handling of bath has been identified as the key source, and improvements made to bath handling and bath tanker operations.

4.1.14 Stormwater and cooling/blowdown water management

There are two principle wastewater streams from the smelter, namely stormwater that falls on site, and cooling/blowdown water from the various cooling water circuits across the smelter. The cooling/blowdown water has an accumulation of salts (dissolved solids) as the cooling water is cycled and possibly some oil contamination, but no other contaminants. Local oil traps are installed and then the cooling/blowdown water is discharged to a central holding/balancing facility, also equipped with a back-up oil trap, from where it is directed to the Matola river estuary.

Figure 5: View of the impoundment dam inlet structure (stormwater enters the inlet from the far side). The inlet provides for sediment trapping and oil skimming. The complete impoundment dam can be seen in the cover photo of the entire smelter site.

Figure 6: View of the south dam, one of two that provide for the impoundment of stormwater containing fluoride from the smelter site. The complete dam can be seen in the cover photo of the entire smelter site.

Stormwater on the other hand, can be contaminated by fluoride that either falls out of the atmosphere (although this is generally a small effect) or through spillages of fluorinated material on the site, which may come into contact with the stormwater. The principal stormwater management mechanism is the impoundment dam (Figs. 4 and 5) to which all stormwater drains. The impoundment serves to provide a buffer against a discharge of high fluoride concentrations that may follow a prolonged dry spell (during which time fluorinated material can accumulate on site). The impoundment dam is then used to contain or impound the first flush of stormwater (± 35mm rainfall), which may potentially contain a high fluoride concentration. Cooling water blowdown is mixed with the retained stormwater to manage the fluoride concentrations to within the target levels. Water quality monitoring in respect of the above is shown in Table 5.

Table 5: Water quality monitoring by Mozal Operations.

Where	What	Frequency
Dam outlet	Fluoride	Twice-daily during dam discharge
	Temperature (at mixing zone), total residual chlorine, TSS, pH.	Weekly
	BOD, COD, aluminium (above intake water quality), ammonia, cyanide (free and total), phosphorous, sulphide.	Monthly
Dams 1, 2 and inlet	Fluoride	Daily
	pH, oil and grease, TSS, chlorine, temperature.	Weekly
	BOD, COD, aluminium, ammonia, cyanide, phosphorous, sulphide.	Monthly
	Heavy metals (total), copper, iron, lead, mercury, nickel, selenium, silver, zinc, phenols and coliforms.	Half-yearly
Monitoring boreholes	pH, BOD, COD, oil and grease, TSS, TDS, aluminium, zinc, ammonia, total cyanide, fluoride, chloride, phosphorous, sulphate, conductivity, total alkalinity, sodium, calcium, potassium, magnesium.	Monthly
	Heavy metals (total), arsenic, cadmium, chrome (hexavalent and total), copper, iron, lead, mercury, nickel, selenium, silver, zinc, phenols and coliforms.	Half-yearly
Potable water inlet	Bacteria	Weekly grab sample

4.1.15 Groundwater

Groundwater is monitored on an ongoing basis with monthly samples being taken from each of the 16 boreholes as shown in Table 4, section 4.1.14. The sixteen boreholes are made up of 8 pairs located at specific areas around the smelter site. Each pair of boreholes consists of one that has been originally drilled to intersect with 'fresh' water, which on occasion at some boreholes has since proved to be dry, and a second borehole drilled to intersect with 'brackish' water associated with the Rio Matola River, which has seawater tidal influence relatively close to the site.

4.1.16 Waste management

General waste management

Mozal's philosophy on waste management follows best international practice and the hierarchy shown below, together with continuous improvement and waste reduction strategies, is exercised at all times.

a. Create no waste
b. Recycle internally
c. Recycle externally
d. Dispose in a safe manner as a last resort.

For waste that eventually must be disposed of, strict segregation is followed and the details of the waste emanating from the plant and the quantities realised are detailed in section 5.1.6. Owing to the lack of access to a hazardous waste facility in Mozambique, Mozal has with the approval of MICOA and the local Matola Municipality, treated the bulk of the fluorinated waste with cement to totally immobilize the fluorides and render the waste suitable for disposal at the Matola Municipal landfill. Approximately 12% cement is added during the process and regular samples of cemented material undergo accelerated acid leaching tests to ensure that no risk of long-term contamination is possible. Samples from boreholes at the municipal waste facility and from the nearest watercourse are regularly taken as a precautionary measure to validate the fact that no contamination is taking place. Other hazardous waste materials arising, which are small in quantity, are currently safely stored on site.

The treatment and disposal or storage of these wastes in the manner described, has always been viewed as an interim measure. The urgent need to end this practice has been one of the main drivers in actively pursuing the development of the regional Hazardous Waste Facility, which is described in more detail below.

Spent Pot Lining (SPL)

Spent Pot Lining (SPL) is the material that is removed from aluminium smelting electrolytic cells after they have reached the end of their useful life which is on average 5 to 6 years. The material, which consists mainly of carbon and refractory components, contains fluorides and some traces of cyanide rendering it hazardous.

The EIA conducted for Mozal Phase 1 required that any SPL arisings would need to be stored in a specially constructed building and within a 5-year period Mozal would be required to investigate and implement alternative methods for recycling or disposal. The building, which was constructed during Phase 1, is large enough to provide a suitable window for investigation for 5 years and beyond. BHP Billiton's Hillside Smelter in Richards Bay, South Africa, has successfully developed recycling opportunities for the two components emanating from spent cells in conjunction with the South African cement and lime manufacturing industry.

Based on this model, Mozal entered into an agreement with *Cementos do Mocambique* (CDM), who have supplied cement for the expansion project, to investigate and then carry out some pilot studies related to the possible recycling of SPL in the Mozambique cement industry. Hardness evaluations of material have taken place, which will be followed by off-site crushing of pilot test quantities, during the next reporting period, for testing and evaluation at CDM. In parallel with this work, an interest has been shown in the Mozal SPL by the South African Cement industry and should the CDM option not materialize this alternative avenue will be pursued by Mozal.

Hazardous waste management

Mozal smelting operations produces hazardous waste that requires to be disposed of in a properly constructed and licensed hazardous waste facility as recommended in the EIA for the smelter expansion. No such facility exists in Mozambique and the current practice of cementation and disposal of fluorinated waste at the Matola Municipal landfill is a marginal practice that should cease as soon as possible. Following a long period of interaction with the Mozambique Ministry of Environmental Co-ordination (MICOA) the Mozal Board approved funds in July 2001 for a study, which was to define the scope and cost for the construction of such facility to be provided to MICOA on behalf of the Government of Mozambique. MICOA accepted the responsibility as interim owner and would be required to appoint a private sector operator to manage the facility and in due course create a parastatal body, which would assume ultimate ownership of the facility.

The facility would handle all Hazardous Waste, with the exception of SPL, arising from Mozal and expected waste from elsewhere in the region and further afield in Mozambique. Mozal would consequently not get involved in the day-to-day management of the facility but could participate in an advisory forum that would be created to represent the interests of users and other interested parties who would interact with the facility owner, operator and MICOA. The facility study, which was carried out by the expansion project team and in close co-operation with MICOA, resulted in the following:

The facility would be located on portion of a 50ha site approximately 10km north west of the Mozal Smelter. The facility will consist of basic on-site infrastructure to support an estimated annual waste volume of 7 200 tonnes for a 10-year time horizon, or more, and a single landfill cell, based on capacity for 5 years. Ongoing development would be the responsibility of the owner/operator. The preliminary layout allows for additional cells and waste treatment facilities to provide 20 years of capacity at the annual tonnage utilising approximately 20% of the 50ha available. Supply of power, water, telephones and an appropriate access road is included. The facility will be designed and constructed to internationally accepted standards.

An EIA would be required which would be managed by MICOA, as a prerequisite for construction activities. The EIA follows on from a rigorous site selection process involving public participation. Due process would be followed.

Following the approval of funding for the project by the Mozal Board in May 2002 detailed engineering has commenced which will be followed by a procurement phase, limited site investigation and preparatory work to support the EIA leading up to commencement of construction during the last quarter of 2002. The facility is expected to be completed and available for operational duty by the middle of 2003, about the time that the expansion phase of the Mozal smelter comes on line.

An agreement was entered into between Mozal and MICOA setting out the terms and conditions by which Mozal would assist in the funding and construction of the facility and the ongoing access which would be afforded to Mozal for the disposal of waste at the facility in accordance with commercially viable, yet fair and equitable, treatment and disposal rates. The expansion project team on behalf of MICOA is carrying out the execution of the project.

4.1.17 Environmental noise

An environmental noise survey was carried out in December 2001 by an independent consultant to determine noise levels as a result of smelter and harbour operations. The noise levels generated by the smelter facility and processes were surveyed using the SABS (South African Bureau of Standards) COP0103 standard for industrial areas. Specific objectives of the noise survey were to:

a. Measure the noise levels emitted by the smelter and harbour operations and transport between the two facilities
b. Compare the measured noise levels with noise rating levels specified by the SABS and the World Bank requirements (as stipulated in the Pollution Prevention and Abatement Handbook)
c. Assess the possible impact of the noise on the surrounding communities at both locations during both the day and night.

Sound level measurements were performed at the smelter just inside the perimeter fence at 11 positions selected to measure noise from specific processes or events (taking wind direction into account). Readings were taken just outside the perimeter fence and at several residences on the harbour access road.

4.1.18 Transport

Weekly meetings are held with the transport contractor where safety is discussed as a standard agenda item (minutes of these meetings are kept on record). A zero tolerance approach applies to all safety transgressions by Mozal Operations and drivers found contravening any safety rule are immediately barred from entering Mozal's property. The contractor then follows disciplinary or other procedures to correct the behaviour. Daily vehicle inspections are performed by the contractor together with daily toolbox talks at shift change by the contractor's supervisor. A weekly transport plan is discussed and the previous week’s adherence to plan evaluated at the weekly meeting. All reported incidents and/or near misses are investigated and corrective action implemented. The contractor adheres to their company's incident reporting and investigation procedure with Mozal personnel always being part of investigations that may be conducted.

A contractor performance agreement between Mozal operations and the contractor has been established with regular audits against a checklist being undertaken by Mozal personnel. In terms of the agreement the contractor is penalised for any safety transgressions. The contractor has an appointed full-time safety and training officer who attends a number of Mozal's internal safety training modules. The contractor manages vehicle maintenance and Mozal monitors this. A maintenance plan is controlled and adhered to by the contractor with vehicles being maintained on a bi-weekly basis. The contractor employs an advanced driving specialist to evaluate driver skills and retrain drivers on an annual basis. All drivers attend a driver medical test as required by law.

Continuous improvement

Stabilisers have been fitted to all trailers to improve their stability and daily inspections of specific failure points on the trailers implemented to assess the rate of failure. Finite element analysis has been performed and engineering recommendations to alter the trailer design are currently being reviewed for possible implementation. Three trailers have been removed from service and substitute vehicles are being rented. All exhaust brakes have been disconnected to ensure that noise levels remain within acceptable limits and the project is continuing to explore suitable mitigation for ensuring that noise levels do not exceed required noise levels on the harbour access road.

All vehicles drive with headlights on at all times and as far as practically possible, vehicle movements are planned for two shifts so that late night vehicle operations are limited to emergencies only. Driver monitoring systems (tachographs) are installed on all vehicles and speeds and vehicle performance monitored regularly. Vehicle speeds are also governed to 70 km/h by the hauler's electronic engine control system. Vehicle refuelling takes place at Mozal's service station where oil and fuel traps are installed. Oil spillage at the loading/offloading stations are contained by means of peatsorb, which is then collected and disposed of in the correct waste bin.

There has been a significant reduction in the severity and frequency of incidents/accidents involving the transport contractor. Incidents recorded by the haulage contractor were thoroughly investigated and are summarised in Table 6.

Table 6: Summary of Transport related incidents during reporting period.

DATE	NO	DESCRIPTION
Various	9	Minor incidents at Port & Smelter
21-09-01	1	Private car struck rear trailer at CMC traffic light
28-12-01	1	Pedestrian hit by haulage truck on Abel Batista Road (fatality)
19-01-02	1	Pneumatic brake failure caused trailer rear wheels to lock

Figure 7: Photograph showing one of the alumina tankers that transports alumina from the harbour to the smelter.

Finally, the upgrading of the EN4 (so called Maputo Corridor) has dramatically reduced traffic congestion. The congestion and resultant delays that characterised the road networks prior to the completion of the EN4 upgrading, no longer prevail. As a result it is considered that the additional haulage vehicles that will be brought on-line following the commissioning of the Phase 2 expansion, will have little if any impact on congestion.

4.1.19 Public consultation and disclosure

Ongoing public consultation is carried out using a variety of mechanisms. Public meetings with Interested and Affected Parties are carried out every 6 months in the Mozal Auditorium. The meeting in the first part of the year focuses principally on Mozal Operations (with input from the project team) with the second meeting focussing principally on the Aluminium Expansion Project (with input from the operations team). The public meetings are attended by an average of 120 participants from government, the public and private sectors as well as members of the surrounding communities[1] where feedback on smelter operations, environmental management and MCDT activities is presented. In addition, to these, quarterly meetings are held with the *Chefe* do Posto Administrativo da Matola Rio to discuss concerns affecting the local community.

4.1.20 HIV/AIDS awareness - Industrial theatre

Internal HIV/AIDS awareness initiatives have been conducted through a range of communication media, e.g. toolbox talks, newsletter articles, posters etc. The main awareness initiative for the year was held to recognize International AIDS Day. During the week leading up to the event on 1 December, a local Industrial Theatre group presented two performances of their HIV/AIDS awareness play to employees in the site auditorium. T-shirts printed with the slogan 'Play Safe with a Condom' were distributed to all employees along with booklets and leaflets providing general awareness information on prevention, living positively with HIV/AIDS and the availability of support and counselling in the local community. Condom dispensers are placed throughout the plant with condoms freely available.

4.2 Aluminium Expansion Project

4.2.1 Improved procurement/empowerment strategy

In order to maximise sustainable benefits to the local community requirements, several key objectives were set by the project, including:

a. Maximising the use of local labour
b. Providing skills training for local labour
c. Actively encouraging the use of local contractors
d. Actively encouraging establishment of joint ventures between international and local contractors
e. Allocating selected work packages, solely for execution by local small and medium enterprises (SMEs)

[1] Transport is provided for those groups who do not have direct access to the venue.

f. Promoting SME training programmes to enable local SMEs to be competitive and successful
g. Involving stakeholders in the empowerment process
h. Establishing systems for the monitoring and reporting of the project's empowerment progress.

The empowerment strategy for the Mozal 1 project was reviewed and areas of success and weakness identified. Successful initiatives from Mozal 1 have been re-implemented on the expansion project with minor modifications where required. Where initiatives from Mozal 1 were considered less successful, new initiatives were developed.

Use of local labour

Local labour proved to be willing and, with training, competent to execute the work required. There have been no industrial relations incidents as a result of a policy of fair and equitable treatment for all employees. This fair treatment was achieved using a centralised recruitment system, a project labour agreement, a centralized wage bureau and intensive management of all IR related activities. Communications channels with labour, unions and contractors (employers) have been maintained at all times.

Skills training

During Mozal 1 over 5000 people were trained in category A and B (unskilled general labour and semi-skilled labour) occupations using a centralized training establishment managed by the project. This initiative was extremely successful and, after the project, Mozal-trained workers have become highly employable in the Maputo area. The only major weakness of the training scheme was that upon project completion, the scheme was not sustainable.

For the expansion project, a centralized training programme has been implemented again to re-qualify employees from Mozal 1 and to train new employees as required, with preference given to those employed on Mozal 1. The scope of the training scheme has also been expanded to provide limited category C and D (skilled labour) training, thereby increasing the skills level of the local workforce. In addition, to the training scheme, the training contractor has been compelled to work with the Mozambican Departments of Labour and Education in an effort to ensure that local training centre staff are capable of keeping the training centre viable after project completion. To date some 3000 contract workers have gone through the training centre.

Use of local contractors

The use of local contractors resulted in mixed success during Mozal 1. The strategy employed was to package the work in the same manner as would be done for any smelter, anywhere in the world and to invite local contractors to bid on packages wherever feasible. No extraordinary measures were put in place to manage this process for success and results ranged from several well-executed service packages (generally with strong support and assistance from SLMR) to several less successful purchase packages, which in some instances had to be cancelled at considerable cost and inconvenience. In response, a special initiative has been developed to actively promote the use of local contractors through the following initiatives:

a. The Mozal 1 experience identified that some of the existing work packages were suitable for execution by local contractors and that competent contractors exist. Wherever this circumstance was identified local contractors have been invited to tender, often in competition with South African contractors
b. During Mozal 1, relatively few contractors had companies or branches registered in Mozambique. This has now changed and in many cases, contracts are being placed with the Mozambique registered entity rather than the South African parent company. This has resulted in the strengthening of the Mozambique entity, developing it towards being a genuine operating enterprise rather than a 'flag of convenience'
c. As part of the procurement process, all packages have been examined to determine if a local contractor could be included in the tender list. Also, during the bid clarification process, all international vendors have been examined on their proposed use of local sub-contractors and encouraged by SLMR to consider local sub-contractors.

Use of joint ventures

Joint ventures are considered one of the better arrangements for empowerment, where an exchange of information between the joint venture partners is almost an empowerment programme in its own right. Mozal 1 produced several very successful joint ventures between international contractors and local companies. For the expansion project and joint ventures have been fostered vigorously. The process has been actively encouraged by SLMR during the tender evaluation process and through working closely with CPI in Maputo.

Allocation of work packages to SMEs

The review of Mozal 1 identified that in general, the work packages were too large, complex and time critical to be executed successfully by local SMEs. As a result it was decided that 25 work packages would be developed by extracting scope from other packages for the expansion project. These packages have been structured to suit the technical and commercial capabilities of the intended target SMEs. The tender list for these packages has been restricted to local SMEs only.

SLMR, together with CPI, has undertaken an extensive programme of SME identification, assessment and pre-qualification. CPI has provided a database of potential SMEs and each has been visited by an SLMR delegation to assess technical and commercial ability, prior to being included on a tender list.

SME Empowerment and Linkage Programme (SMEELP)

Experience on Mozal 1 showed that SMEs faced a number of hurdles when working for the project, which were often insurmountable. Firstly, local contractors often lacked the ability to successfully submit a tender largely due to problems of language (all documents were issued in English), complexity and experience (SMEs had little idea of what was involved in working on a large project). This resulted in a frequent failure to submit a bid at all. Secondly, even when bids were submitted, the pricing often showed a complete lack of understanding of the scope of work and pricing was inevitably not competitive. Finally, on a number of occasions when local contractors were awarded contracts, they failed due to a lack of technical and commercial expertise. Even when local contractors were relatively successful, a disproportionate amount of support from SLMR was required.

As a result, a training initiative for SMEs has been implemented on the expansion project in an effort to ensure that all 25 SME packages are successful. A joint venture has been established between the project, the CPI, the African Project Development Facility (APDF) of the International Finance Corporation and Mozal Operations Team in order to implement a training initiative for SMEs. The initiative has support from the Mozambique Government and the Empremo, the local contractor organization. The training initiative has three main components:

a. Training in preparation of tenders.

   This formal training is being presented to SMEs that have been pre-qualified as described above. The objective of this training is to ensure that all local SMEs on tender lists are capable of submitting a compliant tender.

b. Training in preparation for contract execution.

   This training is being presented to local SMEs who are awarded a contract with the objective of ensuring that all contractors are properly prepared for executing the contracts before commencement of the contract.

c. Mentorship

   Each SME is assigned a technical mentor. The mentors have been specifically employed to provide on-the-job assistance and support to the SME contractor to ensure that the contract is successfully executed. A range of other skills mentors are also available, including business skills, industrial relations skills, health, safety and environment and so forth, to provide ongoing support to the SMEs.

All training material is available in Portuguese and English and training is presented in both languages. Additionally, certain key documentation has been simplified and translated into Portuguese to assist the SMEs. Finally, through APDFAND CPI's involvement, there is an ongoing effort to provide assistance and training in Autocad, planning/scheduling, quality control and welding.

A key element of SMEELP is to transfer the programme to CPI so that it is sustained beyond the Aluminium Expansion Project. It is recognized that successful SMEs on Mozal can provide role models for other SMEs as well as providing a nucleus of competence that can move on to other projects as these arise.

Figure 8: **Photograph of representatives of a range of SMEs displaying certificates awarded to them on successfully completing training offered by the Aluminium Expansion Project**

Stakeholder involvement

Based on the experience gained during the first phase of Mozal it became evident that it was desirable and necessary to involve a wider range of stakeholders in the empowerment effort. Accordingly, a strategy of engagement with Government (via CPI) contractor organisations, contractors, and other interested and affected parties was implemented, particularly, during the launch of the empowerment programme.

Reporting systems

The accuracy of reporting on empowerment expenditure for Mozal 2 has been enhanced relative to Mozal 1. All contractors have been compelled to provide a detailed monthly breakdown of local expenditure and a new reporting format for the project has been established.

Empowerment co-ordinator

In order to effect the necessary co-ordination between the project team, MOT, local and foreign agencies, an Empowerment Coordinator (EC) was appointed in order to:

a. Liase between the project team and the successful SMEs as well as acting as a facilitator between the various parties. The EC has ensured that the directives from the various teams are understood and corrective measures implemented as required, while at the same time assisting the SMEs to comply with contracting and procedural matters
b. Co-ordinate between local SMEs and Contract Administrators during the pre-award and execution period
c. Monitor the monthly progress in terms of manufacturing and expeditors as related to the 'Purchase' contracts
d. Measure the 'Empowerment Commitment' of prime contractors relative to construction packages in terms of actual local labour and material contents against contractual commitments

e. Jointly promote and encourage participation of SMEs with private organizations
f. Provide services to multinational companies seeking to subcontract part of their work to local SMEs.

Targets

The following key internal targets have been set for the expansion project:

a. Local spend of US$ 80 million
b. 70% Mozambican labour. (IPA agreed target is 65%)
c. Train or re-qualify > 3800 workers
d. Minimum of 25 specific SME packages targeted across the project
e. Deliver a sustainable SME training scheme
f. Conclude with Mozal Operations Team (MOT) an agreement on involvement of successful local suppliers and contractors in ongoing smelter operations support.

Performance relative to targets

The empowerment components of all contracts for the reporting period are shown in

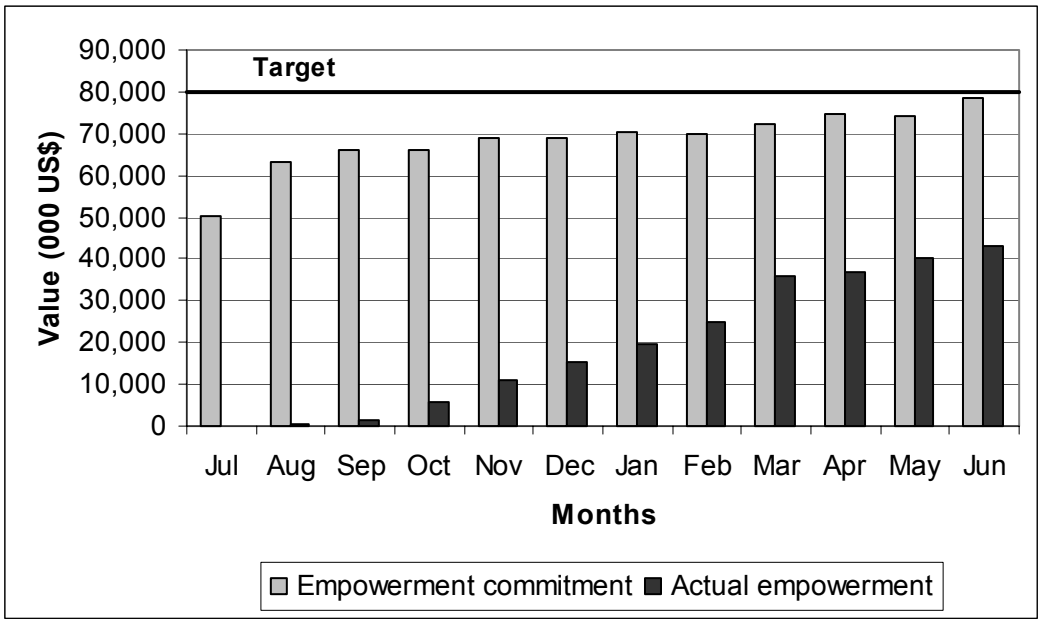


Figure 9. It can be seen from the graph that the project is well on track to meet its empowerment target of US$80 million.

Figure 9: Empowerment component contract value for the project during the reporting period (empowerment commitment refers to orders that have been placed, actual empowerment refers to money that has been paid over).

The empowerment components of contracts that have been placed take a variety of forms as shown in Figure 10. It can be seen from the graph that the dominant empowerment component is the use of a Mozambican sub-contactor (53%), followed by the use of Mozambican labour (20%) and then joint ventures with Mozambican companies (13%).

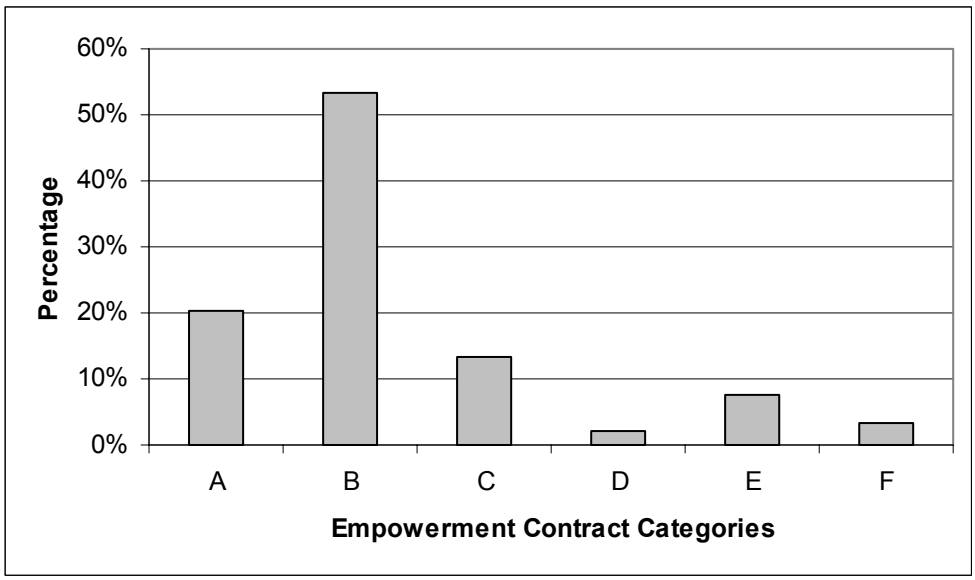


Figure 10: Breakdown of contract types and the relative percentage contribution to the overall empowerment effort.

Key to categories:

A	**Use of Mozambican labour**
B	**Use of Mozambican sub contractor**
C	**Joint ventures with Mozambican companies**
D	**Direct contracts with Mozambican subsidiaries**
E	**Direct contracts with Mozambican companies**
F	**Direct contract with a Mozambican SME**

Overall project manpower and direct manpower (viz. manpower deployed on site) are shown in Figure 11. It can be seen from the graph that manpower peaked during April with 4348 men on site and that the ratio of local labour has consistently exceeded the IPA requirement of 65%. The project internal target of 70% has not been met but efforts continue to try and meet this target.

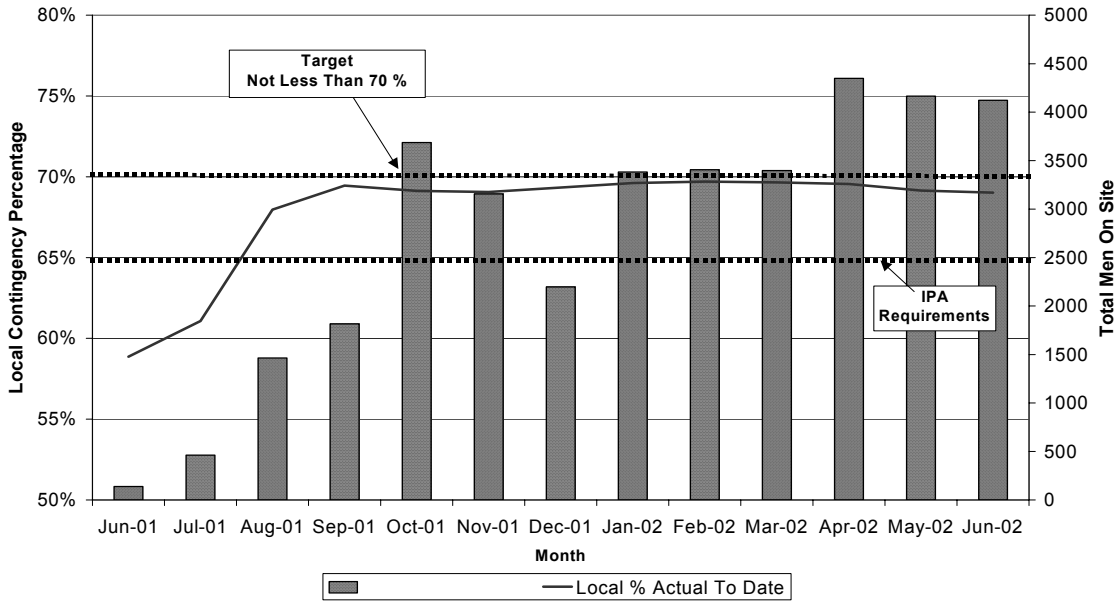


Figure 11: Graph showing percentage local labour on site together with the total number of men on site.

4.2.2 Occupational health and safety

The major effort in terms of occupational health and safety is ensuring that the contractors take all necessary steps to ensure the health and safety of their employees while working on the site (the South African Occupational Health and Safety Act is used as the minimum standard to supplement such legislation in Mozambique[1]). Occupational health and safety management systems have been developed in accordance with the guidelines of British Standard 8800 – *Guide to Occupational Health and Safety Management Systems* (BS8800). Management systems developed for Mozal 1 were reviewed and strengthened for the Aluminium Expansion Project in the spirit of continuous improvement.

An area of particular focus was to specify more clearly the contractor's obligations in the tender documents. These were subsequently reviewed during tender evaluation and at the contractor 'kick-off' meeting to ensure that the contractor's procedures were in place prior to starting work in the field. Contractors have also been compelled to report regularly on health and safety related activities, In addition, to the normal progress reporting requirements and have been monitored and audited regularly under the umbrella project HSE plan. The project Health and Safety Strategy includes the following components:

a. Occupational Health and Safety Policies for the project
b. The specification of minimum requirements in terms of the risk assessment process
c. Requirements in terms of contractor structure and responsibilities
d. Training and competence requirements for contractor employees
e. Communication and consultation forums and requirements
f. Minimum requirements in terms of operating procedures and standards (based on the South African Occupational Heath and Safety Act)
g. Emergency preparedness and response plan
h. Monitoring and reporting procedures
i. A process for management review of the implementation of the Health and Safety Management Plan.

All potential employees on the project are taken through pre- and post-medical screening (expatriate workers in South Africa and local workers on site). The purpose of the medical screening is not to discriminate against work seekers but to ensure that employees are medically fit to perform the tasks required by the job. In more specific terms contractors have been monitored for the integrity of their health and safety planning at pre-award, mobilisation and kick-off and continually through their construction activities.

In addition, worker participation has been actively sought through various contractor and EPCM supported initiatives, such as safety awards and consultative forums. A Lost Time Injury Frequency rate (LTIFR) was initially targeted at 2 but later revised downward to 1.5 and then again to 1.25 as safety performance improved. Most recently project LTIFR has been reduced to 1.00. No fatalities have been suffered. One of the keys to achieving these targets has been the introduction of critical task analysis, which the contractors perform before starting any new on-site activities.

[1] The BHP-Billiton standards are progressively being implemented by the Expansion Project as the overriding framework for Occupational Health and Safety.

In addition, to the above, training has been provided to promote Health and Safety management competence. All contractor supervisors have been required to complete an examination on the supervisory training material in basic Health and Safety management principles. This examination must be successfully completed before the supervisors are allowed on site. Elements included in this training material are:

a. Fundamentals of risk management and risk assessment
b. Legal requirements
c. Accident and incident investigation
d. Industrial Relations policy and dispute resolution.

A booklet has also been issued to all supervisors as a reference guide for use in the field. The booklet contains examples of the various processes (for example how to do a risk assessment) illustrated with simple examples such as changing a flat tyre on a vehicle.

In a similar vein, senior contractor management, as well as the project and operations team have attended safety training courses to qualify for access to the site. The course content has included background material for training supervisors as well as the roles and responsibilities of the various key players within the EPCM management system. The training has been effected as an extension of the general site induction process. Overall project health and safety performance is shown in Figure 12. In addition, to the safety performance evident in the figure, the following safety milestones have also been achieved. One million manhours worked without a LTI, have been achieved on 4 October 01, 30 January 02, 3 April 02 and 4 June 02.

More recently a HSEC management module data management system has been implemented on the project as part of the labour management system. The purpose of that system is to identify any trends in health and safety incidents that could be used to proactively identify further possible management interventions.

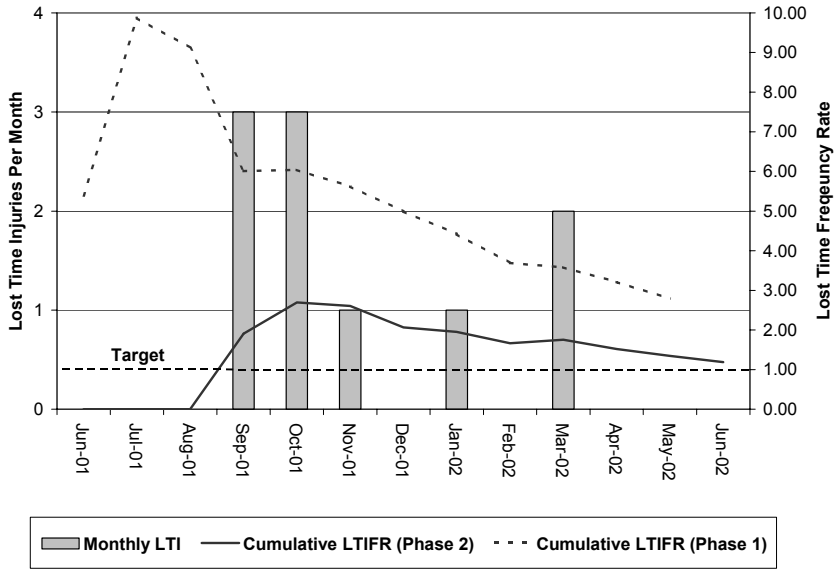


Figure 12: Lost time injury (LTI) statistics for the Aluminium Expansion Project.

4.2.3 Industrial relations

Industrial relations management is encompassed in a project Industrial Relations management system. The management system is based on an IR policy that has been signed by top management of both Billiton Aluminium Projects and SLMR. A key component of the system is the formalised Joint IR Coordination Committee, which serves to develop joint strategy between the project and operations, specifically a joint strike handling procedure and reducing the risk of conflict that may arise from the different IR environments (viz. project and operations). The committee is chaired by the Mozal GM and includes senior representation from the project, operations and Billiton Aluminium Projects teams.

Each contractor is compelled to submit an IR management plan, which is reviewed weekly in a meeting with SLMR. The contractors are also compelled to appoint a full time IR Practitioner. Monthly IR meetings are also held which are attended by the Contractor Site Managers in which issues and upcoming events in the project calendar are discussed to ensure that there is common action and adherence to the Project Labour Agreement (PLA). Not a single hour has been lost to date as a result of industrial action.

Training

Three levels of training are offered in support of maintaining good industrial relations, including:

a. General Induction – This is aimed at the worker level and uses video and facilitation to go through the PLA content and the procedural aspects relating to discipline and worker rights in submitting grievance and dispute resolution. In addition, wage payment and understanding the payslip is also addressed
b. Supervisory Training – This is part of a one-day course covering HSE and IR and culminates in an examination that must be passed to obtain an access card to enter the site. The IR input covers the same ground as the general induction, adjusted to focus on the supervisor's responsibilities, actions and responses in terms of his management of IR in his working environment
c. Management Training – Similar to the supervisory training but geared towards a higher management level.

Cornerstone arrangements

Cornerstone arrangements are arrangements geared towards the maintenance of harmonious labour relations. These include:

a. A Wage Bureau – Initiated during Mozal 1, the wage bureau has had a significant impact on the controlling of employee remuneration conditions across the site
b. Provision of office space - office space has been provided for the SINTICIM officials (Local Mozambican construction labour union which effectively is the only recognised union on the project) near the IR office to facilitate interaction with members. The induction video also features union officials to convey their role as stakeholders in ensuring the success of the project

c. Representatives of South African unions have also been seconded to the project to work under SINTICIM to represent the interests of the expatriate employees covered by the PLA. Although South African unions have no authority in Mozambique and are not encouraged to participate, SINTICIM maintains regular contact with the RSA unions and Federations and the secondment helps support this contact. A full-time expatriate union representative is active on site facilitating links with all the major SA construction affiliated unions
d. Similarly, an office has been provided for the Contractor's Associations to house their IR Co-ordinator. The role of the IR Coordinator is to ensure an integrated approach by all contractors in their dealings with the union in Mozambique and compliance with the PLA, as well as the monitoring of compliance with Labour Agreements and Legislation of their country of origin
e. Management Forums have been mentioned above and other forums exist to ensure effective and timely communication between all the project stakeholders
f. SLMR audits the contractors for implementation compliance and to gather specific information as necessary from time to time.

4.2.4 HIV/AIDS awareness

The project has recognised HIV/AIDS is an international social problem of enormous dimensions with supportive intervention being a necessity. The duration of individual employment of both expatriate and local workers typically averages about four months. Efforts to measure the trend of a campaign throughout the project are therefore thwarted by a changing study population and as a result it has not proved possible to create any meaningful data on the decrease or increase in the prevalence of these diseases as a result of project programmes.

The expectation on which these programmes have been developed is that the itinerant expatriate workforce has a higher exposure and therefore incidence of STDs and HIV than the local population it will come into contact with. Thus the risk of contracting these diseases is higher for the local population than the expatriate workforce. Also, local construction workers generally live and work from home, a condition favouring a lower exposure. Finally, international delivery truck drivers form another high exposure group. This was revealed by an increase in sex workers which became evident during Mozal 1, particularly along the trucking routes at roadside cafes and adjacent to the construction village.

Given that HIV/AIDS has an eight-year development curve it was also anticipated that a group of infected persons could be up to three years further down that development curve than when Mozal 1 was started. Against this background, and because many of the Phase 1 construction workers have been re-employed, provision has been made for a possibly higher infection incidence on the Aluminium Expansion Project.

A key HIV/AIDS related health risk in Mozambique is the reduced capacity to survive malaria. However, given that it is unconstitutional in both Mozambique and South Africa to discriminate on the grounds of HIV infection, and that at least at an earlier stage in the project, any form of testing was illegal in Mozambique, it was concluded that no testing would take place but increased efforts would be made in the fight against malaria and expatriates would be warned about the added danger of malaria to HIV positive persons. A warning to this effect has been added to the secondment contract (prescribed for expatriates in the Project Labour Agreement) and during the pre-employment medical screening that takes place prior to leaving South Africa, each expatriate is advised of the dangers of malaria should the person be HIV positive. For those workers seeking counselling, contact details of South African centres nearest their homes have been provided.

Persons suffering from STDs are more susceptible to contracting HIV. A significant strategy in the fight against HIV is the fight against STDs and indeed, all opportunistic infections. Accordingly local clinics have been stocked with the necessary drugs to fight such diseases. The expansion project has also contributed to the voluntary Counselling and Testing Centre (VCT) centre in Boane (Fig. 13). The building in which the testing centre is housed was renovated and a 4-wheel drive vehicle supplied for the services of the centre to access remote rural areas, where people ordinarily do not have access to the central location.

Figure 13: Photograph of the HIV/AIDS voluntary counselling and testing centre at Boane on opening day.

4.2.5 Industrial theatre

Industrial theatre and other communication media employed for malaria combating have been extended to cover awareness and avoidance of these diseases. Slightly more than 10 000 people have attended the various industrial theatre presentations that have been presented since the start of the Aluminium Expansion Project out of 8 574 employees registered by the end of the reporting period. The plays have focused on occupational health and safety, malaria prevention and HIV/AIDs awareness (Fig. 14).

Figure 14: Photograph showing the presentation of an industrial theatre play to a group of local workers during their lunch break.

4.2.6 Community liaison

Interaction with communities

The interaction with the immediate community is effected to varying degrees by the three Mozal components of project, operations and MCDT. Constant contact is happening with weekly visits to the different community agglomeration points, clinics, markets, schools, police station, agriculture centre and Administrative post of Matola-Rio. At a broader level several types of meetings take place, such as the local Administrator's fortnightly meeting, the Provincial Governor's meeting, the National Government liaison committee meeting and various task groups.

The Administrator's meeting originated from the early days of the resettlement programme and has been effectively in place since August 1997 (dependant on project presence in Mozambique). Similarly the high level meetings with the Provincial Governor and National Government also initiated at that time, continue on a monthly basis or as needed. The Chairman of Mozal also meets on a six-monthly basis with the Mozambican Prime Minister.

The project newsletter is distributed to the local community, where health and safety articles and project progress are part of the communication strategy aimed at educating the local community regarding the broader Mozal activities. The community has little means to buy the local newspapers and they always show an eagerness to receive some free reading material featuring articles in both English and Portuguese.

NGO interaction

The project interfaces with only one NGO, ADPP, which is supported financially by the expansion project in the running of the HIV/AIDS Voluntary Counselling and Testing Centre at Boane.

General

Life has changed for the community around Mozal. Since Mozal's inception people are more exposed to urban life with the advent of a tarred road, more means of transport and with a new bridge across the Matola-Rio people are more mobile. After suffering for years from a lack of water, or illegal connections to the existing water line, new water pipes are being installed and most of the community will get water from those. The project built a *fountenaire* for the Beluluane people and MCDT linked the Market, Police Station, Clinic and Beluluane School to the existing water line.

A number of community members have found work amongst the service providers particularly in gardening, laundry, food preparation and cleaning both on site and at the smelter. The spraying of all community residences in a buffer zone around site and the support of the local clinics with drugs to reduce the number of carriers in the vicinity of site has diminished the malaria incidence in the area by at least 40%.

Transport in the area was non-existent and with the advent of a new, tarred road and a bridge over the river, transport is no longer a problem. The Beluluane Industrial Park has started being occupied by new tenants, who are building facilities which also creates employment in the area.

4.2.7 Dust management

Dust management has formed an important component of the project environmental management function. As described earlier, a dust management strategy was developed and implemented for the project. The objective of the dust management strategy was not to eliminate dust entirely but rather to effect due diligence through a pragmatic and sustainable management approach. The dust management strategy also provided for the judicious use of water because of the large quantities of water that are typically required for dust control.

The total greenfields area on the project amounted to some 80 hectares which consisted in turn of the physical construction areas (new potline and ancillaries, new bake furnace and FTC, extension of the carbon area and of the casthouse) the contractor's laydown areas, the concrete batch plant, the waste transition area, waste concrete dump and temporary and permanent roads. Owing to the differing nature of the activities in these areas, five different dust management approaches were identified. These were ongoing consolidation of the construction area, use of gravel in especially the contractor's laydown areas, water spraying in the construction areas, the use of a dust palliative on the construction roads and finally, in extreme circumstances, stopping construction activities.

Ongoing consolidation of the construction area is obviously a direct function of the ongoing implementation of the project. As the various smelter facilities get built these have the effect of reducing the areas of exposed soil that are the source of the dust. Added to this process was a decision to tar the temporary construction road adjacent to the rectifiers (because of the vulnerability of that facility to dust) and to grass the various embankments and temporary stormwater channels to prevent erosion. More recently the landscaping has commenced, resulting in further consolidation of the greenfields area.

Owing to the transient nature of activities in the areas of physical construction, it is difficult and impractical to try and consolidate the surface in these areas and as a result water spraying has been the dominant form of dust control. In an attempt to reduce the amount of water used for dust control, water spraying was largely avoided at midday due to high evaporative loss of sprayed water. In addition, a rudimentary forecasting approach was used to try and anticipate those areas across the site that would need to be sprayed as a result of forecast wind velocity. In practice, though, all principle construction roads were treated as a source of dust and addressed accordingly.

The sector related risks were only apparent in the very early stages during earthworks and at that time all excavated earth was watered and general watering implemented as part of the general construction needs as well, thus also benefiting the formalised dust control. Because the prevailing wind directions are predominantly from the SE, initially dust suppression commenced from the southern areas of the Bake Furnace, and continued to work round to the remaining areas of site. Watering in the early evenings has been a contributing factor to reducing dust during the hot working day.

Undoubtedly the dust management approach with highest water conservation potential is the use of a dust palliative. To this end a ligno-sulphonate palliative was applied to the project construction roads during October 2001 (Fig. 15). The principle here was to apply the palliative to the construction roads in order to free up water for spraying in the construction areas. Initially the dust control was very effective but due to the heavy traffic on the road the effectiveness of the palliative was very quickly reduced (over a period of some three weeks). As a result a new strategy for the application of the palliative has been developed and is in the process of being implemented.

To date dust has been well managed, resulting in no complaints being received from the construction site and no dust related incidents either in terms of possible contamination of the metal (through higher silica presence) or through concerns raised in the surrounding community.

Figure 15: Photograph showing construction road treated with dust suppression palliatives.

4.2.8 Stormwater management and sediment control

Expanding an aluminium smelter presents some difficulties in terms of stormwater management and sediment control. Apart from the direct requirement of ensuring that there is no uncontrolled runoff of stormwater with high sediment loading from the construction area, operations of the smelter present the risk of fluoride contamination of the sediment. This risk is brought about by the channelling of stormwater from the greenfields area into the existing stormwater reticulation of the brownfields operation. Spillages of fluorinated product in the brownfields area are thus mixed with the sediment that is washed in from the greenfields area. Although the sediment is trapped in the inlet structure of the impoundment dam, that sediment must still be disposed of and because of the presence of the fluoride, is deemed hazardous waste.

Given the above, the stormwater and sediment management philosophy has been one of consolidating areas vulnerable to erosion and establishing primary and secondary silt traps across the site. The primary silt traps have been established in all areas where stormwater enters the stormwater drainage in the greenfields area and the secondary silt traps (Fig. 16) prior to the stormwater entering the existing brownfields stormwater reticulation. The design of the silt traps makes provision for the impoundment of stormwater, which must then overflow in order to enter the stormwater reticulation. In this manner the sediment settles out of the stormwater reducing the sediment load to the impoundment dam. Sediment captured in the silt traps is returned to the site to rehabilitate areas where soil has been lost through erosion.

Areas vulnerable to erosion include the road embankments and these, together with the temporary stormwater channels, have been grassed to reduce the risk or erosion (Fig. 17). In addition, the points at which stormwater enters the temporary stormwater channels contain stone gabions to prevent the inlet areas from being scoured and to provide some rudimentary filtering of the incoming stormwater. Excavations pose a risk of high sediment loading and as a result the C-EMP guideline dictates that spoil from excavations must be placed on flat ground away from terraces or embankments.

Figure 16: Photograph showing secondary sediment traps on construction site.

Figure 17: Photograph showing stabilisation of water channels and road embankments with grass

4.2.9 Noise management

The major noise management focus has been on the requirement to mitigate against the noise that will be generated by the additional haul vehicles on the harbour access road in the vicinity of a small, isolated group of houses that were constructed many years ago within the confines of the Matola harbour/industrial area. Four mitigation options have been investigated in this regard, namely improving the silencers on the haul vehicles, implementing improved driver operating procedures/driving regimes, establishing a noise barricade along the length of the road section where the noise impact may be manifest and sound proofing the houses closest to the road. Following well documented consultation with the residents and other affected parties which was conducted by the property owners, the Mozambican Railways and Port Authority (CFM), the planned mitigation includes the first three of the four mentioned above which will effectively permit compliance with the World Bank Standards for noise levels at the perimeter of an industrial site. Detailed design is under way which will be followed by implementation on or before the advent of production commencing from the expansion project.

In terms of managing noise from construction activities at the main site, contractors were compelled to ensure that their vehicles and/or equipment met the noise limits established by the manufacturers. In practice the requirement was impractical and difficult to enforce – an issue highlighted during the MICOA audit as well. In addition, it was found that the noise monitoring that was effected was difficult to interpret within the context of the World Bank requirements of 70 dB(A). As a result, a consultant was appointed to define a suitable noise monitoring procedure, which has recently been completed for implementation from July 2002 onwards. In general, however, noise emanating from the construction process has not exceeded the target levels at the site boundary and has certainly not resulted in any complaints from any of the surrounding communities, which are generally far removed from the smelter site.

4.2.10 Spillage management

Experience has shown that frequent small-scale spills of oil and fuel occur during construction projects and as a result it is necessary to ensure continuous vigilance. Sources of spills are many and varied and include leaking vehicles and equipment, painting, vehicle refuelling and maintenance, vehicle and equipment washing (especially concrete vehicles) and handling of fuels, oils, paints and other potentially hazardous compounds. Measures to prevent or reduce spills have included the establishment of:

a. A single refuelling facility
b. Two dedicated wash bays for vehicle and equipment washing
c. A facility for the cleaning of concrete trucks that includes a settling tank for cleaning water which is then later recycled

and compelling contractors to:

a. Properly store hazardous materials that could be spilled in the event of a container being ruptured
b. Establish proper maintenance facilities that include hard surfaces with correct drainage and a sump and oil trap and only service and maintain vehicles at that facility

c. Only refuel at the dedicated refuelling facility – where plant or equipment requires refuelling bowsers are allowed on condition drip trays are used
d. Immediately remove soil contaminated by spills and report such incidents to the project management
e. Prohibit the use of detergents in washing vehicles or equipment
f. Minimise on-site painting and the use of plastic sheeting where on-site painting has been unavoidable.

Dedicated refuelling station

The establishment of a dedicated refuelling facility ensures good management of fuel and oil spill potential. The facility includes a concrete base on which refuelling takes place that is drained to a collection sump. In the event of a spill, the spilled products are collected in the sump for removal and disposal. The diesel storage tanks have been established in tanks above ground, that are bunded to contain the quantity of diesel that could be spilled in the event of a tank rupture. The refilling of these tanks takes place within the bunded area. An underground storage tank with a capacity of 95 000 litres is used for petrol storage.

Concrete batch plant

In terms of waste concrete, the material is disposed of at a dedicated building rubble dump (described in more detail under waste management). Once the waste concrete has been dumped the concrete vehicles are cleaned in a special facility. The cleaning water is dumped onto a sloped concrete slab from where it drains into a series of settling tanks. The settling tanks allow for the waste cement and sand to settle in the tanks before the clean water is captured in a sump. That clean water is then used for spraying the stone and sand stockpiles to control dust. Residue water from that spraying is captured in a sump and then returned to the settling tanks for re-use.

Leaking vehicles and equipment

Spills from leaking vehicles and equipment are ubiquitous across the site requiring a special effort to identify the same and address the problem. In many instances it is simply not possible to fix all these leaks and so contractors are compelled to use drip trays to capture the leaks (with the captured oil taken to the used oil facility in the waste transition station). In addition, some vehicles and equipment have been fitted with plastic ‘nappies’ (diapers) – essentially pieces of plastic sheeting fastened below the area where the leaks existed to capture minor oil leaks. Finally, as contractors complete their contracts they are compelled to submit rehabilitation plans for their laydown areas. These laydown areas are then inspected before the contractors are allowed to demobilise. Final payments are not authorised until the laydown area has been inspected and signed off by the PEA. As an example, the piling contractor was forced to return to the site and rehabilitate a small oil spill that was identified in the laydown area.

4.2.11 Waste management

Waste types

Various types have been generated by the project. These waste types include non-hazardous waste made up of domestic waste, sewage, scrap steel, wood and building rubble, and hazardous waste, including used oil, contaminated soil, sludge from oil traps, cathode ramming paste, infectious waste, waste paint and sewage sludge.

Waste transition station

A dedicated waste transition station has been established on the site to ensure effective waste management on the project (Fig. 18). The waste transition station provides for the segregation of waste into required categories prior to suitable disposal. An important change in waste management occurred between Phases 1 and 2 of the Mozal smelter project. Whereas for Phase 1 the waste management contractor fetched the waste from the contractors, for Phase 2 the contractors were compelled to take their waste to the waste transition station. Although many contractors use the appointed waste management contractor to effect that function the change in onus has seen a major improvement in waste management from Phase 1 to Phase 2.

In terms of waste disposal, domestic waste (including plastic and cardboard wrapping, waste food and food containers, paper and so forth) is compacted and disposed of at the Matola landfill site. Waste timber is sorted into useable timber, which is taken to the Selesians College where it is used in furniture making, or as firewood (Fig. 19). The waste management contractor distributes the firewood to local communities. Some of the waste timber (especially the cable drums) has been treated with copper chrome arsenate (CCA). This timber is not distributed and is crushed and mixed with concrete for disposal on the building rubble site to prevent it being scavenged by the local community[1]. Scrap metal is sorted into aluminium, copper and steel from where it is sold to scrap metal merchants.

Figure 18: Photograph showing the waste transition station established during the Aluminium Expansion Project to provide for the segregation and safe disposal of waste generated during the project.

[1] Firewood is highly sought after and this is simply a precautionary measure to ensure the wood treated with CCA is not burned.

Figure 19: Photograph showing distribution of firewood from packing crates to local communities.

Hazardous waste

Hazardous waste disposal presents a problem in that there is no hazardous waste facility in Mozambique. As a result disposal of hazardous waste occurs as follows: Waste paint is deposited in a skip in which it is allowed to solidify. The skip will be stored in the SPL storage area until the hazardous waste site has been completed. More problematic perhaps is the waste cathode ramming paste, which is a carbon/coal tar pitch mixture. During the cathode sealing process some of the ramming paste becomes contaminated with soil and cement rendering it unusable for further sealing.

For Phase 2, stricter controls have been put in place to try and reduce the quantities of contaminated ramming paste generated. Waste ramming paste that is generated will be safely stockpiled until the hazardous waste facility is completed. All hazardous waste accumulated during the project will be disposed of at the hazardous waste site once it has been completed around the middle of 2003 (see 4.1.16).

Infectious waste

While there is obvious intent by the Mozambican Government to establish a facility for the disposal of infectious waste (two medical waste incinerators are currently mooted) none exists at present. As a result, the project has been forced to stockpile infectious waste, which obviously presents further potential health problems. Given the nature and quantities of the infectious waste, it has been considered feasible to establish a small-scale incinerator (6kgs an hour) on the site for the disposal of infectious clinic waste.

The incinerator procured for this purpose is one designed for the incineration of medical waste at rural clinics and has been evaluated by the Regional Collaborative Centre for Cold Chain Management of the World Health Organisation (WHO). In addition, a strict segregation regime will be implemented at the clinic to minimise quantities of plastic in the waste that will be incinerated. The incinerator is a temporary measure until a central facility for medical waste disposal is established in Mozambique. An application for the use of the incinerator has been submitted to MICOA and approval for its use was received recently. Operations of the incinerator will commence during August 2002.

4.2.12 Ongoing public consultation and disclosure

Public meetings

The principle method of ongoing public consultation and disclosure has been through a series of public meetings. Two public meetings are held per annum, the first of which focuses principally on smelter operations (with a short slot on the project) and the second focuses principally on the expansion project (with a short slot on operations). The meetings are generally well attended[1] and two have been held in the reporting period. Minutes of the meetings are available and will be lodged with the World Bank Information Shop.

Environmental Task Group (ETG) meetings

Started during Phase 1 of Mozal, Environmental Task Group meetings have been re-convened for the expansion project and are held every two months. The ETG is made up of a range of authorities that have an interest in and/or are affected by the project such as Ara-Sul (National Mozambican Water Authority), MICOA CFM and others. Meeting participants are afforded the opportunity of raising issues of concern, which can then be addressed. The meetings held thus far have included visits to the smelter, the construction site and to the relocated communities and agricultural extension programme. The proposed hazardous waste facility site will be visited during the next ETG meeting. The ETG meetings have started developing good momentum with regular participation and have provided an excellent means of promoting two-way communication between Mozal and a number of the key parties with whom Mozal interacts.

Social survey

In addition to the above and as part of the public consultation and disclosure process, a social survey is currently being planned. The social survey is geared towards ascertaining the perceptions that exist around Mozal amongst a broad group of stakeholders including business, labour, the general public, school children, NGOs and so forth. The outcome of the survey will be used to determine areas of possible improvement in the current processes, including communication related to ongoing public consultation and disclosure.

[1] Transport is provided for those groups who do not have direct access to the venue

4.2.13 Malaria Control

The malaria control programme has been structured to address the circumstances of three recognized groupings on the project, namely Mozambican labour who typically have poor access to malaria prevention but are semi-immune, and expatriate labour and management who have no immunity. To reduce the risk of contracting the disease in the three groups a series of interventions have been effected, each of which is listed below and briefly described:

Provision of malaria treatment facilities

The project has maintained a clinic fully staffed and equipped to diagnose malaria and to treat uncomplicated forms of the disease. Clinical services, which are available to all project personnel, include:

a. Testing and treatment of persons suffering from Malaria. Treatment is through the prescription of co-artimicin drugs, which have proved to be extremely effective with no parasite resistance to treatment being experienced to date and short recovery durations (approximately 3 days)
b. Provision of prophylactics to expatriate employees which are issued free of charge
c. Follow-up consultations with persons recovering from Malaria to monitor the progress of recovery and to ensure no further complications.

Malaria vector control programme

The project, in conjunction with MOT, has embarked on a malaria vector control programme aimed at minimizing the number of malaria vectors (anophaline mosquitos) within the project site, construction village and surrounding areas. The vector control programme includes:

a. Residual insecticide spraying of all on-site offices
b. Residual spraying of all accommodation units within the construction village and EPCM project management camps as well as units installed within the project caravan park
c. Weekly surveillance of water bodies in and on the periphery of the project site, construction village and associated areas to identify sites of mosquito breeding
d. Systematic treatment of all identified breeding sites to prevent emergence of adult mosquitoes
e. Monitoring of the effectiveness of the vector control programme through:
    - Installation of window traps in the construction village and the daily monitoring thereof
    - Monthly searches and knock-down spraying of identified units within the construction village to determine residual mosquito populations
f. ULV knock-down spraying of areas on site where after-hours activities are being undertaken.

In addition, standing water has been minimized to prevent the formation of additional breeding area on the site.

Health education and malaria awareness campaigns

Awareness of the risks associated with malaria and the education of people with regard to minimizing their risk of contracting malaria, play an important role in preventing and controlling the incidence of malaria. Education and awareness have been achieved through the following mechanisms:

a. Site induction material
b. Counselling all employees, particularly expatriates, on the risks of malaria amongst imuno-depressed individuals (HIV positive individuals)
c. On-site industrial theatre
d. Regular awareness talks by the project health officer, both on site and in the construction village, with regard to malaria prevention
e. Availability of mosquito repellents through the project clinic to all site personnel and the provision of large volume repellent dispensers on site and in the construction village
f. Poster and leaflet distribution on site
g. Awareness articles in the project newspaper.

Bed net campaigns

Bed nets have been provided at an affordable price to all persons working on the project (approximately $2:00 per bed net). The use of bed nets has been promoted through several mechanisms including specific campaigns, and advertising through the site newspaper, industrial theatre and IR and labour forums. All beds in the construction village have been provided with bed nets. During campaigns bed nets have also been provided at no cost to Mozambican personnel.

Medical evacuations

All contractors have been compelled to provide medical evacuation cover for all expatriates employed on the project so that, in the event of a malaria-related emergency, which cannot be adequately treated at the on-site clinic, the individual can be promptly evacuated to a centre of excellence in South Africa. Mozambican project employees suffering complicated malaria or requiring medical attention for a malaria-related condition, which cannot be adequately treated at the site clinic, have been transferred to suitable local hospitals.

Community assistance

The project has also provided assistance to community based health care facilities in the area surrounding the project in the form of:

a. Use of health care staff from local hospitals on a ‘locum’ basis at the project clinic thereby exposing these individuals to the processes and procedures used on site
b. Provision of top-up drug supplies to local clinics for the treatment of malaria
c. Provision of training and equipment for the diagnosis of malaria in the local clinics
d. Inclusion of local health care personnel on workshops and discussions on best practice methods of malaria treatment and protocols
e. Provision of support to local clinics in the diagnosis methods for malaria and monitoring diagnosis procedures
f. Assisting in difficult diagnoses.

4.3 MCDT

Before describing the activities of the MCDT during the reporting period, it is necessary to describe the framework within which the Trust operates. In listing the individual projects conducted by the MCDT, the programmatic nature of the Trust may not be obvious, and it is important to emphasise at the outset that projects are not implemented in isolation but rather within a programmatic framework. The principles of the Trust provide the best indication of that programmatic framework and these principles are:

a. Align development initiatives with those of national, provincial and local government
b. Adopt a catalytic and facilitative role in setting up pilot projects to be replicated
c. Form partnerships to achieve a sustainable result
d. Involve all relevant stakeholders from all levels of government, NGOs, community structures and private sector partners as well as our own employees.

All the projects are continually reviewed to assess the degree to which they meet these principles.

The planned activities of the MCDT are addressed in some detail in the document *Management of Social and Community Related issues arising from Mozal Phase 1 and Phase 2 Environmental Assessments*. This document outlines the high level initiatives together with the business plan and budget for 2002. The discussions following in section 4.3.1 to 4.3.9 describe some of the highlights during the reporting period and a detailed status report on the main individual projects is shown in 4.3.10. It should be noted that the planning year for the MCDT is based on a calendar year and hence not synchronised with the reporting period for this report.

In summary, the activities against the plan is reflected as follows:

To June 2002:

31	Projects completed out of 44
12	Projects in progress and planned for completion in second half of 2002
1	Project cancelled.

Expenditure to date is approximately US$ 1,5 million against a budget of US$ 2,4 million.

It is evident that the activities and achievements of the MCDT have made a significant impact on the quality of life on the local community and further afield. A survey is to be undertaken in the second half of 2002 in an effort to quantify the impact.

Figure 20: Photograph showing drinking water provision in rural areas.

4.3.1 Resettlement for the Beluluane Industrial Park (BIP)

The four-year monitoring programme on the welfare of the people relocated for the establishment of the BIP has continued through the reporting period. Initially the frequency of such monitoring was conducted quarterly but more recently that frequency has been increased to bi-monthly to provide more current reporting (discussed with and agreed to by the IFC). The reports (of which the executive summary of the last one conducted during the reporting period is shown in Appendix 6) continue to reflect a high level of professionalism and diligence by the service provider (Acer Africa). The monitoring reports are submitted to the MCDT for initial review, whereafter they are distributed to the Governor, the Administrator and the *Chefe de Posto* for information and follow-up.

In the most recent report, the following issues were highlighted:

a. The sustainability of water supply is a concern. In response AdM is currently installing a potable water line
b. Maize production has increased from its previous levels of 300-400 kg a hectare to 1.9 tonnes a hectare
c. Title deeds for the agricultural areas have been finalised in February 2002. The title deeds have been issued in the name of the Farmer's Association rather than individuals to prevent the sale of the title deeds
d. Title deeds are also being processed for the 80 houses. To date four of these title deeds have been issued with the remaining 76 expected shortly.

4.3.2 Small and micro enterprise programme

A machine for making bricks was facilitated for a local businessman who is established in the Djuba area. With this new machine the businessman increased his production from 800 to 1800 bricks a day, thereby increasing his daily income. This businessman began to supply bricks not only to the local population but also to the construction companies, which develop their businesses in the area.

Seventeen ladies who run their business in the Chinonanquila market benefited from a sewing course and four sewing machines as a way of improving their skills and income. They have also attended a small business management course to help them with the basic rules of how to run a business.

The ladies have also benefited from a converted shipping container to develop a wholesaling business in order to supply drinks and food to the surrounding areas. This new business will also enable them to earn income that will improve their living conditions.

4.3.3 Enterprise development

MCDT built a market in Beluluane area, with 50 stands to be used for different kind of business and 30 stands for vegetables (Fig. 20). The Development Bank of Southern Africa (DBSA) is providing support for a further 20 stalls to be built. The market has brought benefits to about 80 families. With the construction of Phase 2 and the development that is taking place in the area, business is intensifying in the community.

MCDT believes that training is a key to the success of the project. The sellers at the market also benefited from the following courses:

a. Small business management – a total of 50 people attended the course
b. Poultry farming – a total of 10 people attended.

A group of 20 ladies will also be offered a course in carpet making.

Figure 21: Photograph showing informal market development.

4.3.4 Programme to support NGOs that can support vulnerable community groups

TCE Programme

The Total Control of Epidemics (TCE) is a programme implemented by ADPP (the Mozambican chapter of an international organisation called 'People Helping People'), financed by MCDT and approved by the health authorities. The TCE 1 was initiated in the Boane/Matola area in November 2000 and was expanded in September 2001 with TCE 2 to Costa de Sol/Polana Canico area. To run a TCE programme costs UD$1 per person per year. MCDT expends US$200 000 per year on AIDS Prevention for the 200 000 people targeted in both areas: Boane District and downtown Maputo city.

The main actor in the TCE Program is the TCE field officer employed and trained to cover a TCE field of 2000 people within the TCE Area. A total of 100 field officers have been trained with additional financial support from the IFC.

The field officer has the task to talk to, inform, seek out every member of the community, organise campaigns of information and change attitudes and behaviour, get people tested, think up and arrange action to care for the sick and orphaned during the 3 years of the programme until TCE compliance is reached and the HIV/AIDS epidemic is in the hands of the people of the area.

Parallel to the TCE programme, ADPP is also running a Voluntary Counselling Centre in the Boane area in order to get people mobilised and tested for HIV/AIDS. In Table 7, statistics from the May 2002 TCE report are shown to illustrate the extent of the programme.

Table 7: Statistics from the May TCE Report.

Description	Boane & Matola (Troop1)	Polana Caniço & Costa de Sol (Troop 2)
People registered for the 1st time	97,717	83,757
Revisited people	76,781	28,114
HIV tested people	302	850
TCE passionate	3,176	1,442
Number of condoms distributed	63,978	3,369

Dams

The Trust is also financing the construction of ten dams in the north of the country through CARE International, another NGO in Nampula Province. These dams are to reduce disaster effects, which are very common due to floods. The dams also serve to increase food supply to the population of the Northern Province of Mozambique.

4.3.5 Poverty reduction

As a way of reducing poverty, i.e. improving the living conditions of the community, the Trust has been developing projects in education, health and environment, small business, sports and culture. For example, in the field of education the Trust has built and upgraded 5 schools with a total of 25 new classrooms. In the health sector, a maternal child health care centre was built in Beluluane and a malaria laboratory established in the Clinic.

Figure 22: Photograph showing sporting tournaments sponsored by the MCDT.

4.3.6 Agricultural development programme

MCDT is supporting the Agriculture Development Programme (ADP) since its launch in March 2000. The ADP is part of the small business development programme of MCDT. Its aim is to assist farmers who were resettled from the area allocated to Mozal. The objectives of the Agriculture Development Programme are to:

a. Bring more land under sustained cultivation
b. Improve agriculture production and promote sustainable subsistence food production
c. Encourage the sale of surplus produce, thereby fostering a commercial attitude to farming
d. Promote commercial service provision.

For the 2001/2002 season the goals of the agriculture programme were to:

a. Encourage cultivation of more land
b. Promote improvement in crop yields
c. Promote an agriculture service to the farmers
d. Encourage contribution towards future crop input.

Farmers training and capacity building

Farmers training and capacity building is the key to successful project performance. During the 2001/2002 season, farmers received training in key areas of farming from qualified and experienced trainers from the *Instituto Nacional the Investigacao Agronomica*. The courses covered the following areas:

a. Management of farmer's associations
b. Land preparation
c. Farming systems soil/plant nutrition
d. Use and application of fertilisers
e. Pest/weed control
f. Crop marketing
g. Farm records
h. Finance and budgeting
i. Harvesting and storage.

In addition, a select number of farmers have received training on the operation and management of agricultural machinery recently purchased by the programme.

The registration of the farmer's association known as Bematchome Farmer's Association is of highest priority. The process of legal registration has been initiated and a lot of work done to register the association formally. A group title deed for the land on which the farmers are located has been issued and all relevant fees and lawyer's dues have been paid. Only the certificate is still to be released by the Ministry of Justice.

The farmers located in area 2 of the machambas resettlement at Mavoco had experienced great difficulties in transporting their seed and fertilisers from the Beluluane Centre (a distance of over 10km by road). Accordingly, it was decided to construct a small warehouse at the farmer's centre at Mavoco to serve the farmers from the Mavoco area. The MCDT also funded a tractor and trailer to help with the transport of farmer's goods to the bus station. A small milling machine has also been bought and is run by the farmer's association for the benefit of the broader community.

The year average production is as follows:

Year 1999 (before ADP)	400 kg/year/family
Year 1 of ADP (2000/2001)	1,5 tonnes/year/family
Year 2 of ADP(2001/2002)	1,9 tonnes/year/family

4.3.7 Malaria programme

The spraying programme to control the incidence of malaria in the area around Mozal is conducted by the South African Medical Research Council under the Lebombo Spatial Development Initiative. The programme started in December 2000 and from the beginning of the spraying to date there has been a 40% reduction in malaria cases (according to local clinic statistics as well as the Provincial Directorate of Health). To have a successful and effective spraying programme the staff is trained at every level, including field staff and supervisors. The main training focus has been on the following areas:

a. Environmental hazards
b. Toxicity
c. First aid and safe handling/disposal of insecticides.

The malaria control programme consists of spraying all the structures inside a 10km radius around Mozal (designated by Zone 1A) using Bendiocarb insecticide (Fig. 23). At the same time window traps are placed in some houses inside the spraying zone to collect mosquitoes to be analysed.

Figure 23: Photograph showing malaria control unit.

4.3.8 Beluluane maternity child health care centre

The MCDT has built and equipped a maternity child health care centre in Beluluane clinic (Fig. 24). This health care service is to benefit people from Beluluane and the surrounding communities. A total of 17 000 families are living in the 10km radius around Mozal and they will benefit from this service. The construction of these facilities will also help to reduce the number of mother-child deaths and will improve assistance to pregnant women and also provide assistance during the birth.

Figure 24: Photograph showing the Beluluane maternity child health care centre.

4.3.9 Education

MCDT is also supporting education through the construction and upgrading of buildings and the donation of school material (Fig. 25).

In terms of primary education, MCDT has built:

a. 8 classrooms for Beluluane School
b. 8 classrooms at Jonasse School
c. 4 classrooms for Djuba School
d. 3 classrooms at 1 de Junho School
e. 2 classrooms at Tchonissa school.

MCDT has equipped and donated a classroom with 10 computers to the biggest high school in Mozambique (about 8 000 students). MCDT has also donated welding equipment and books for a library to the industrial school in the Matola area to support the upgrading of the student's skills.

Given the concerns regarding the implementation of the Beluane District framework, the MCDT also provided for the training of Mozambican officials in town and regional planning. This has taken the form of the identification of six officials who are in the process of being trained in town and regional planning principles. The training is both theoretical and practical.

Figure 25: Photograph showing primary school development.

4.3.10 Project summary

The status of the main projects that were planned for the reporting period are shown in Table 8.

Table 8: Main projects included in the MCDT planning period and the status of the same at the end of June 2002.

CATEGORY	PROJECTS	STATUS AT END JULY 2002
Community infrastructure	Clinics upgrading	Ongoing
	Formal market	Completed
	Police station Beluluane	Completed
	Police station Matola	Completed
	Schools (3 projects)	Completed
	Ceremonial place	Completed
Education and training	Bursaries: Universities	25 Issued (viz. completed)
	Bursaries: Journalist	2 Issued (viz. completed)
	Schools: High (3 projects)	Completed
	Schools: Primary	Completed
	Street children	Completed
	Teacher training	Completed
	UEM	Completed
Health and environment	Aids: awareness programme	Ongoing
	Aids: Malaria plays	Ongoing
	Health Programme: Clinics	Completed
	Malaria: LSDI control	Completed
	Malaria: Mosquito nets	(2000 nets distributed thus far) completed
	Environmental awareness	Completed
	Maputo elephant research	Completed
	M & E resettlement programme	Ongoing
	Flood relief	Redirected to Heart Institute and food and blankets to the train accident survivors
	Old age home project	Ongoing
	MAD group projects	Ongoing
	Water supply project	Ongoing
Small business development	Agriculture development	Ongoing
	Small business centre (2 projects)	Completed
	Small business training	Ongoing
Sports and culture	Basketball	Completed
	Football	Ongoing
	Golf	Funds redirected
	Swimming	Completed
	Volleyball	Ongoing
	Sports facilities Maputo	Completed
	Sports facilities '10 km'	Completed
	Crafts programme (2 projects)	Completed
	Culture groups	Ongoing
Other projects	Mozal Employee Forum	Not yet started

5 ANNUAL SUMMARY SAMPLING AND MEASUREMENT REPORTS

5.1 Mozal Operations

5.1.1 Emissions to atmosphere

Emissions to atmosphere from the Mozal smelter are summarised in Table 9, relative to the WB emission limits. It can be seen from the table that all the WB limits have been met during the reporting period.

Table 9: Summary of air pollution emissions from the Mozal smelter.

Source	Emission type	Emission [1] (95% of year)			WBG/IFC limits [2]
		Mg/Nm^3	tpa	kg/t Al	
Gas Treatment Centre (GTC)	Gaseous fluoride (F_g)	0.533	12.4	0.046	1 mg/Nm^3
	Particulate fluoride (F_p)	0.063	1.4	0.005	1 mg/Nm^3
Fume Treatment Centre (FTC)	Gaseous fluoride (F_g)	0.24	0.14	0.0005	1 mg/Nm^3
	Particulate fluoride (F_p)	0.043	0.03	0.0001	1 mg/Nm^3
	Coal Tar Pitch Volatiles (CTPV)	12.7			20 mg/Nm^3 (for VOCs)
Roof vents	Gaseous fluoride (F_g)	0.553	125.7	0.467	
	Particulate fluoride (F_p)	0.115	27.2	0.101	
Casthouse	Particulate matter [3]	26.19			50 mg/Nm^3
Smelter	Greenhouse gases		4220860 CO_2^{-eq} (Calculated)		

1. *Presented relative to the commensurate reporting period viz. monthly mean and so forth.*
2. *There are no Mozambican emission limits – typically the World Band standards are used.*
3. *CTA concession – the WBG/IFC standard of 30mg/Nm³ will be implemented following the commercial availability of gas as a fuel.*

SO_2 and NO_2 emissions from the production process have not been measured. No abatement equipment is installed for these gasses, which are a function of raw materials and heating fuel used. Ambient concentrations shown in section 5.1.2 confirm that these emissions do not present a problem as was predicted in the atmospheric dispersion modelling conducted during the original EIA for the Mozal Aluminium Smelter.

Fluoride emissions to atmosphere are shown per month in Figure 26. It can be seen from the graph that during the early part of the financial year, emissions exceeded the target of 0.8 kg/t Al, but as production stabilised, fluoride emissions were progressively reduced and stabilised below 0.5 kg/t Al. In Figures 27 and 28 fluoride emissions from the Gas and Fume Treatment Centres and via the roof vents are shown respectively.

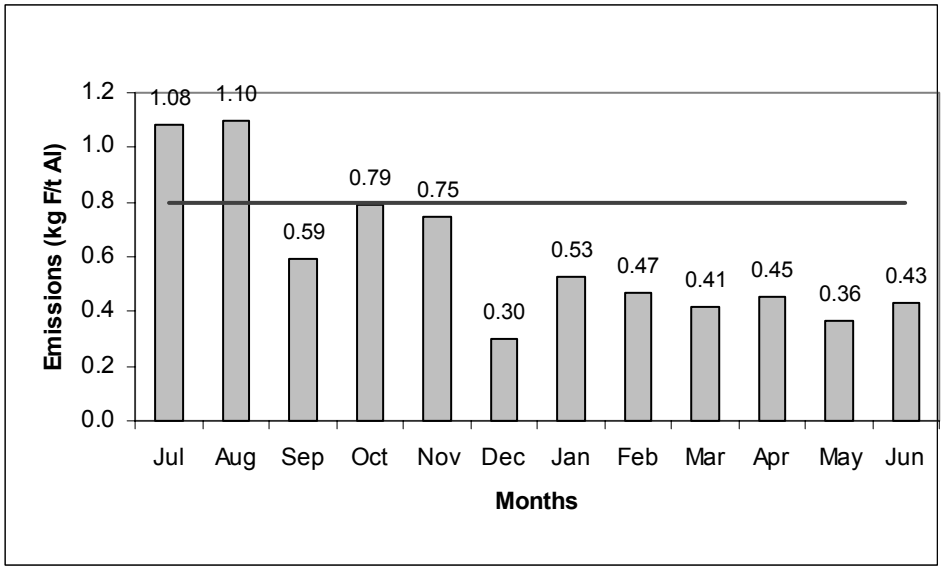


Figure 26: **Monthly total fluoride emissions to atmosphere (in kg/t Al) from the Mozal smelter. The target is indicated by the dark horizontal line.**

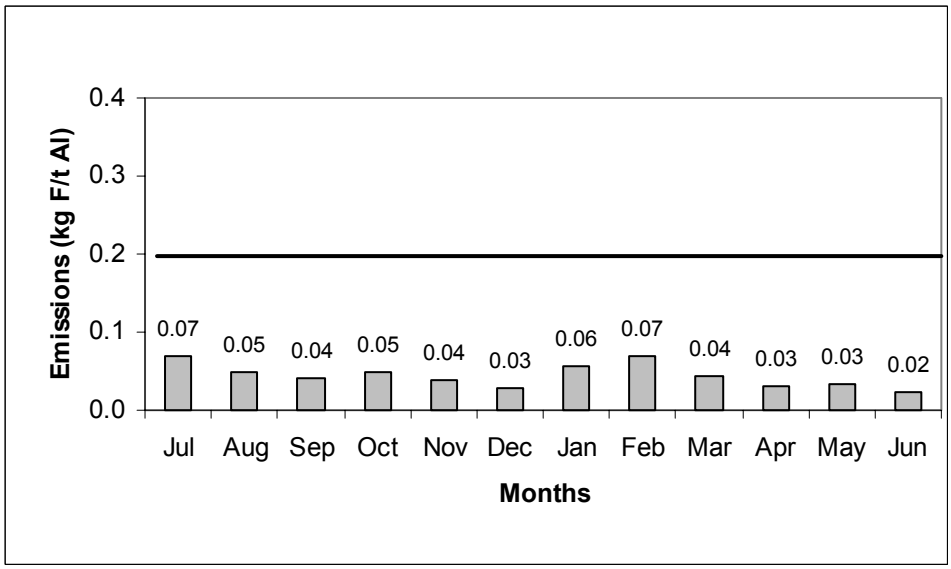


Figure 27: **Monthly fluoride emissions to atmosphere (in kg/t Al) from the Gas Treatment Centres (GTCs) and Fume Treatment Centre (FTC). The target is indicated by the dark horizontal line.**

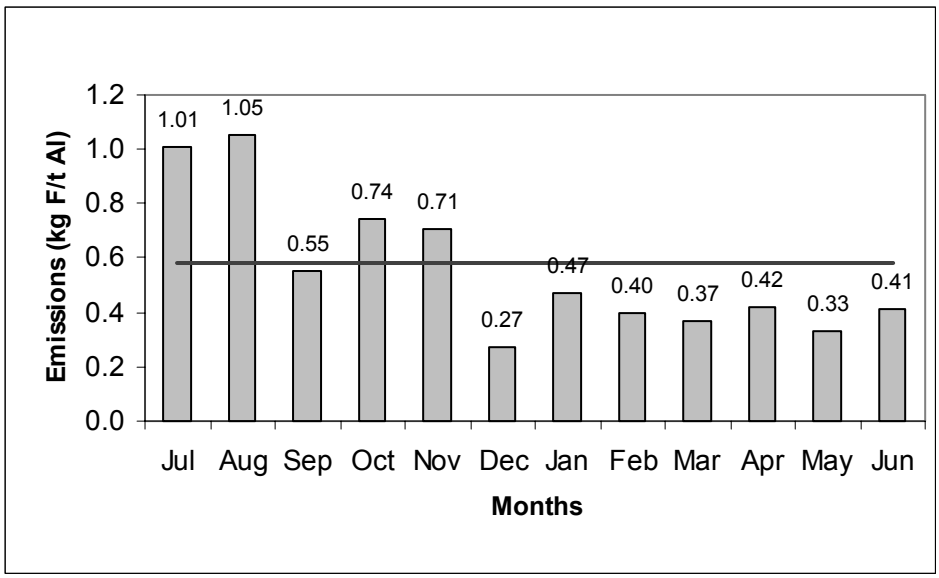


Figure 28: **Monthly fluoride emissions to atmosphere (in kg/t Al) from the roof vents. The smelter's internal target for roof vent emissions of 0.6 kg/t Al, is represented by a dark horizontal line.**

5.1.2 Ambient air pollution concentrations

Ambient air pollution concentrations as measured during the two-week campaign described earlier (see Section 4.1.12), are summarised in Table 10.

Table 10: **Summary ambient air pollution concentrations measured in the vicinity of the Mozal smelter.**

Ambient Air	WBG/IFC Maximum Levels	Mozal Performance in WBG/IFC Units[1]
Gaseous fluoride	Not specified	53 – 73 ppb
Particulate matter (PM_{10})		
Annual arithmetic mean	50 µg/m^3	56 µg/m^3
Maximum 24-hour average	70 µg/m^3	151 µg/m^3
Nitrogen oxides (NO_2) oil fired		
Maximum 24-hour average	150 µg/m^3	3 µg/m^3
Sulphur dioxide (SO_2)		
Annual arithmetic mean	50 µg/m^3	2 µg/m^3
Maximum 24-hour average	125 µg/m^3	5 µg/m^3
Ambient (fluoride fallout)	Not specified 150 mg/m^2/month (internal target)	1.5 mg/m^2/month

[1] *Please note that the results presented here are based on a two-week measurement survey. As such longer-term averages presented in the table have been extrapolated.*

[2] *The internal target specified here has been derived from a sister smelter operations in Richards Bay*

It can be seen from the table that the World Bank standard for maximum 24-hour average concentrations of particulate matter was exceeded during the measurement period. In addition, the mean PM_{10} concentration exceeds the annual arithmetic mean. The 24-hour averages measured during the two-week measurement period are shown in Figure 29. It can be seen from the graph that there were three exceedances of the 24-hour standard, but the remaining measurements were well below the standard. In addition, in order to get a suitable predominant wind direction transect the sampling points were established at the main entrance to the construction site (to the south of the smelter) and at the gate to the borrow pit (to the north of the smelter). Peak concentrations of PM_{10} were reportedly associated with heavy vehicle movement in and out of the site at the expansion project main gate.

On this basis it is considered unlikely that the peak PM_{10} concentrations measured during the campaign would typically prevail, and are most likely a function of intense vehicle movement and possibly dust generation by vehicles using the (unpaved) road verges to pass turning vehicles. As such it is considered that the exceedances of the World Bank standard do not reflect the average condition and that under normal operating conditions the standard is unlikely to be exceeded.

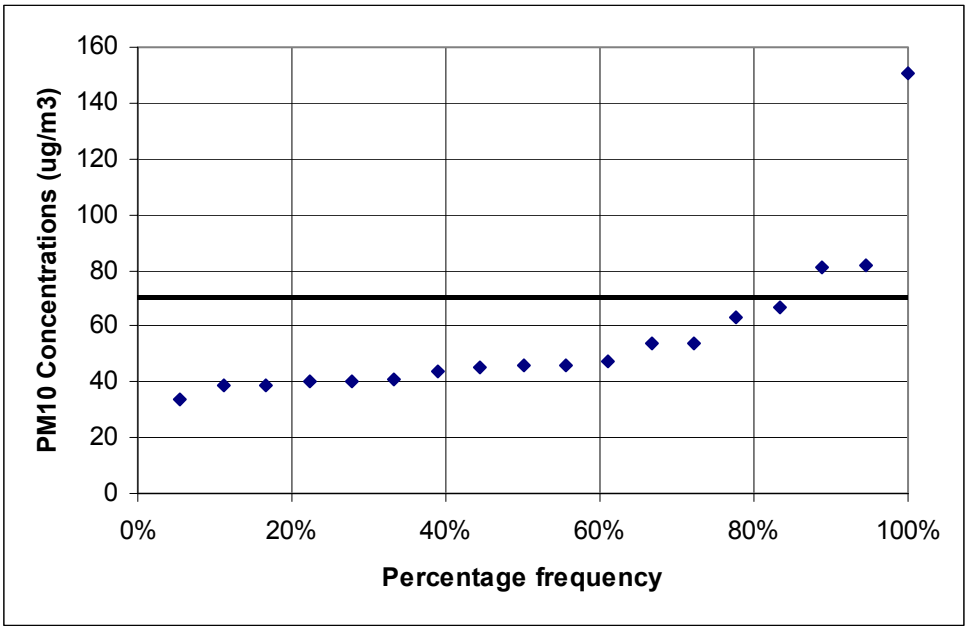


Figure 29: Frequency distribution of 24-hour PM_{10} measurements during a two-week ambient air quality survey in the vicinity of the smelter. The dark horizontal line represents the World Bank standard of 70 µg/m^3.

5.1.3 Ambient noise measurements

Ambient noise levels measured during the noise survey are summarised in Table 11.

Table 11: Summary of ambient noise levels as measured on the smelter perimeter and at the harbour.

Ambient Noise	WBG/IFC Maximum Levels	Maximum L_{eq} Measured
Smelter		
Day time Ambient Noise (07:00 – 22:00)	70 dBA	69.5 dBA
Night time Ambient Noise (22:00-07:00)	70.dBA	74.8 dBA
Harbour		
Day time (Campaign 1) Ambient Noise (07:00 – 22:00)	70 dBA	66.5 dBA
Night time Ambient Noise (22:00 - 07:00)	70.dBA	68.7 dBA
Day time (Campaign 2) Ambient Noise (07:00 – 22:00)	70 dBA	75.9 dBA

It can be seen from the table that the maximum L_{eq} values exceed the maximum specified levels of the World Bank during the night at the smelter, and during the day at the harbour. Measurements from the individual noise monitoring points are shown for the smelter and the harbour in Figures 30 and 31 respectively.

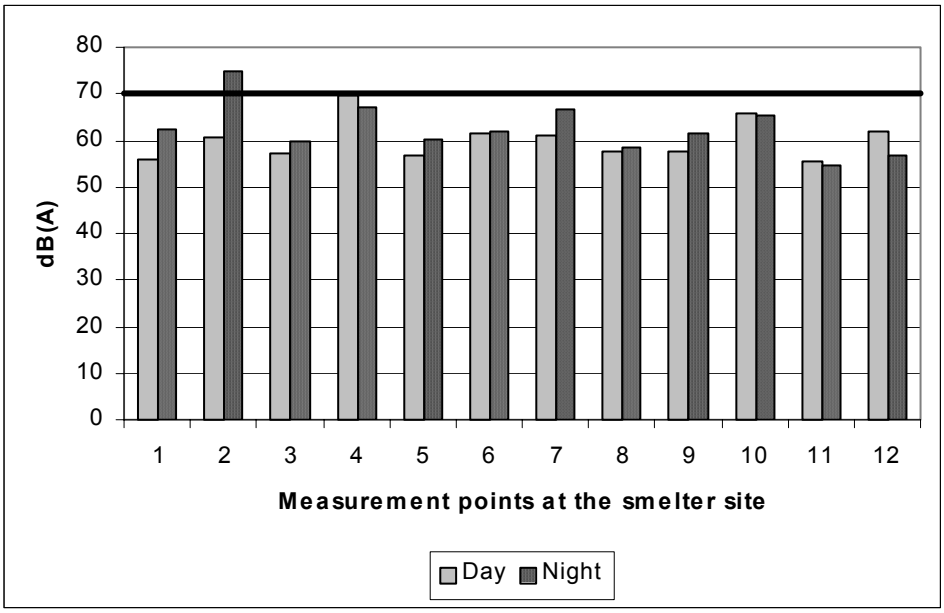


Figure 30: Night-time and day-time measurements of L_{eq} on the smelter perimeter. The applicable World Bank standard is 70 dB(A). Monitoring points are shown in Appendix 7.

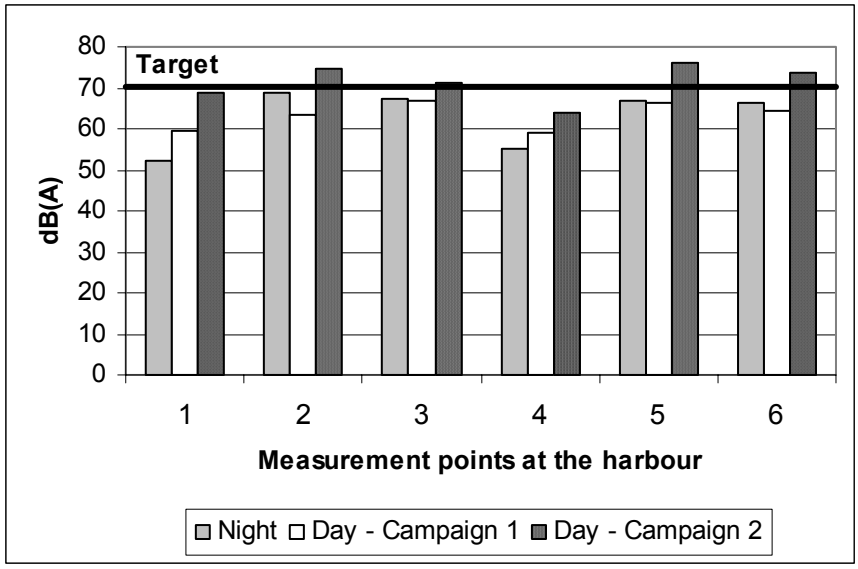


Figure 31: Night-time and day-time (with the ship offloader not being operated and with the ship offloader operating) measurements of L_{eq} on the harbour perimeter. Monitoring points are shown in Appendix 7.

It can be seen from the graphs that the exceedances of the World Bank standard are episodic and are not maintained consistently at any of the monitoring points, which implies that the causes of the noise exceedances are not as a result of the operation of equipment at either the harbour or the smelter. The exceedances evident at measuring points 2,3,5 and 6 at the harbour are related in all cases to the movement of vehicles outside of the harbour facility boundary and not from activities within the facility. It should be noted that the harbour access road is shared by many users other than Mozal. The noise measurements thus confirm the need for a noise barrier on the harbour access road as described in Section 4.2.8. All further noise mitigation efforts will also focus on reducing the noise from the vehicles involved in Mozal raw material haulage, including the use of improved silencers, disabling exhaust brakes and driving techniques.

5.1.4 Water quality

Stormwater/blowdown water

Fluoride concentrations in stormwater discharged from the impoundment dam/blowdown water are shown in Figure 32. It can be seen from the figure that the monthly average concentrations are within the World Bank requirements of 20 ppm. The maximum recorded fluoride concentrations are also included in the graph and there are several exceedances of the 20 ppm standard evident. Before water is discharged, the fluoride concentrations in each of the two dams is determined and used to determine the discharge rate from each dam to ensure that the combined discharge is less then 20 ppm. In other words the dam with the lower fluoride concentration will be discharged faster than that with the high fluoride concentration to ensure that the lowest concentration of fluoride possible is achieved in the water that goes to the Rio Matola.

During the discharge process the water is frequently tested and that testing occasionally reveals a concentration that exceeds the target. When that happens the discharge rates are adjusted (or even stopped if required) to obtain a fluoride concentration of < 20 ppm. That testing is included in the monitoring record and accounts for the exceedances evident in the data record. An exceedance would typically prevail for an hour or less, of which 7 occurred during the reporting period, with maximum concentrations as indicated in figure 32. The total discharge time from the impoundment dams averages between 150 and 200 hours per month. These exceedances, which occur as part of the routine storm water management, account for less than 1% of the time during which water was discharged to the Rio Matola (viz. ≥ 99% compliance). The management of the dams is a complex process and efforts continue to improve management of the discharge to a condition where there are no exceedances of the 20 ppm limit. Long duration non-conformances, of which there were none, would be the subject of a formal investigation and reported as such accordingly.

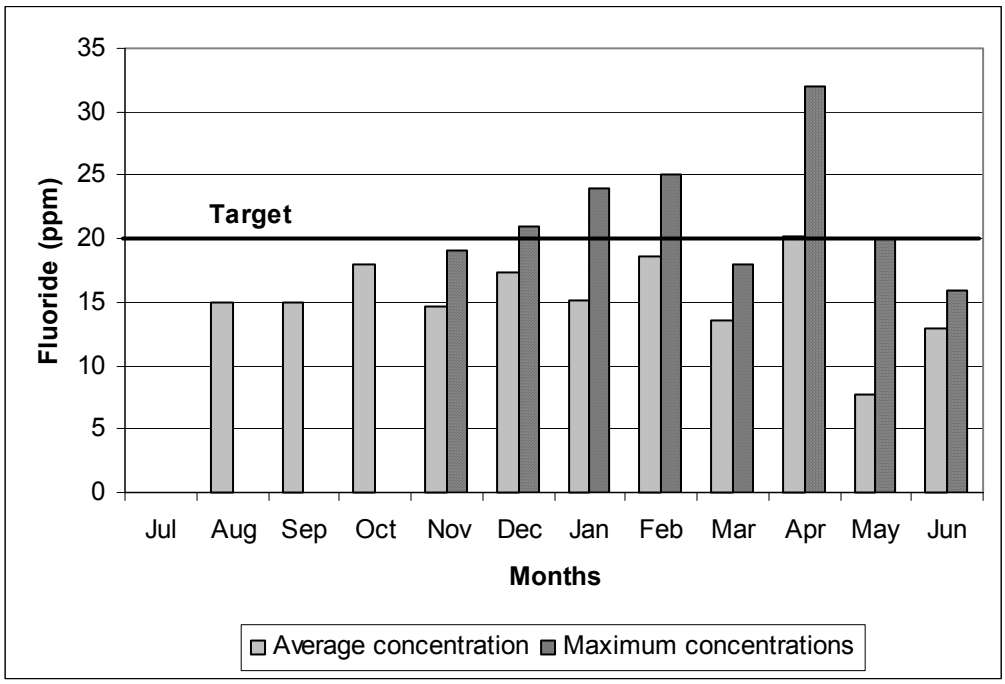


Figure 32: Fluoride concentrations in stormwater/blowdown water discharged to the Rio Matola. Note that there was no sample taken in July 2001.

Water quality monitoring from the impoundment dam outlet structure is summarised in Table 12. The water quality analysis is conducted by an independent water quality laboratory in South Africa and includes the parameters listed in the table. Several water quality parameters have not been monitored yet, including ammonia, residual chlorine, cyanides, coliforms and total hydrocarbons because the sampling process did not make provision for them.

An important development in terms of effluent management has been the recent completion of a second water quality study on the Rio Matola. The purpose of this study (which will be reported on fully in the next reporting period) has been to define key water quality parameters that must be monitored frequently to provide for the management of stormwater/blowdown water discharges into the Rio Matola. In other words, to identify (and monitor) those water quality parameters that can be directly influenced by Mozal operations. These water quality parameters will then form the basis of the water quality monitoring regime for the smelter. The full set of water quality parameters (as specified by the IFC/WBG) will then be measured on a 6-monthly basis inclusive of the parameters described above that will be monitored on a more frequent basis.

The sulphide and aluminium exceedances are currently under investigation. A consultant has been commissioned to determine the possible source of aluminium and investigations are currently underway to determine whether the sulphide exceedance is not a sampling error. If the sulphide is not a sampling error then further investigations will be conducted to determine the source and suitable management intervention.

Table 12: Summary of water quality parameters in stormwater/cooling water blowdown.

Parameter	Limits	Origin	Mean	Min.	Max[2]
COD (as O_2)	150 mg/l	MICOA [1]	43.40	19	79
pH	6-9	WBG	7.6	6.3	8.8
BOD (as O_2)	50 mg/l	MICOA [1]	2.0	1.0	2.0
TSS	30 mg/l	MICOA [1]	Discontinued due to repeated measurements of <1.		
Total coliforms	400 MPN/100 ml	WBG	Not monitored		
Chlorine (res.)	0.2 mg/l	WBG	Not monitored		
Oil and grease	2.5 mg/l	RSA	Not monitored		
Heavy metals	10.0 mg/l	WBG	Not monitored		
Arsenic	0.1 mg/l	WBG	<0.001	0.0007	0.0017
Cadmium	0.1 mg/l	WBG	<0.003	0	<0.01
Chromium (total)	0.5 mg/l	WBG	<0.05	0	<0.1
Chromium (hex)	0.1 mg/l	WBG	Total Chrome <0.05		
Copper	0.5 mg/l	WBG	0.01	0.01	0.01
Lead	0.1 mg/l	WBG	<0.05		
Mercury	0.01 mg/l	WBG		0.0003	0.0006
Nickel	0.5 mg/l	WBG	0.01	0.01	0.01
Selenium	0.1 mg/l	WBG		0.0004	0.0012
Silver	0.5 mg/l	WBG	<0.1	0	<0.1
Zinc	2.0 mg/l	WBG	0.04	0.02	0.06
Ammonia	10 mg/l	WBG	Not monitored		
Cyanide (free)	0.1 mg/l	WBG	<0.07	0	<0.1
Fluoride	20 mg/l	WBG	14.	8	32
Phenols	0.5 mg/l	WBG	<0.05	0	0
Phosphorous	2 mg/l	WBG	0.40	0.23	0.57
Sulphides	1.0 mg/l	WBG	11.12	0.17	31.73
Aluminium (as Al) above intake water	0.2 mg/l	WBG	0.57	0.06	0.98

[1] *Deviation from WBG guideline as proposed by MICOA*

[2] *Maximum recorded value during the reporting period*

Groundwater

As was described earlier, the principle underpinning groundwater monitoring is to ensure that there is no significant deviation from the baseline that was established prior to the commencement of smelter operations. In order to do so target water quality concentrations have been set for a range of water quality parameters. Of these parameters it is considered that any effects on groundwater as a result of smelter operations are most likely to be manifest in possible changes in pH and fluoride. Concentrations of these parameters in groundwater measured across the site are shown in Figures 33 and 34.

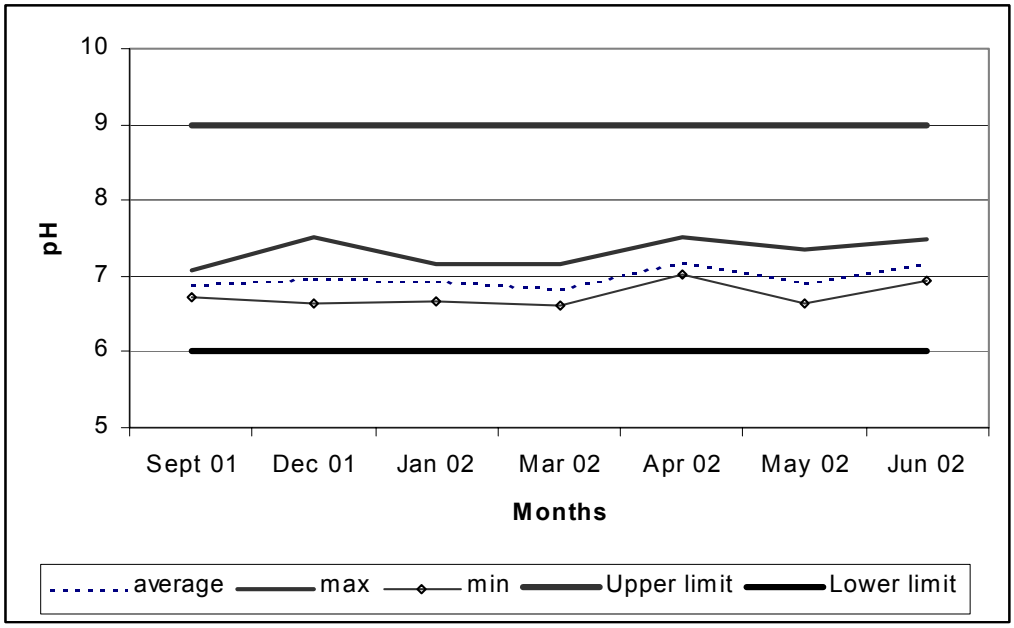


Figure 33: Changes in pH across the monitoring boreholes that are used to determine ground water quality. The average, maximum and minimum pH values for the suite of monitoring boreholes is shown per month in the figure.

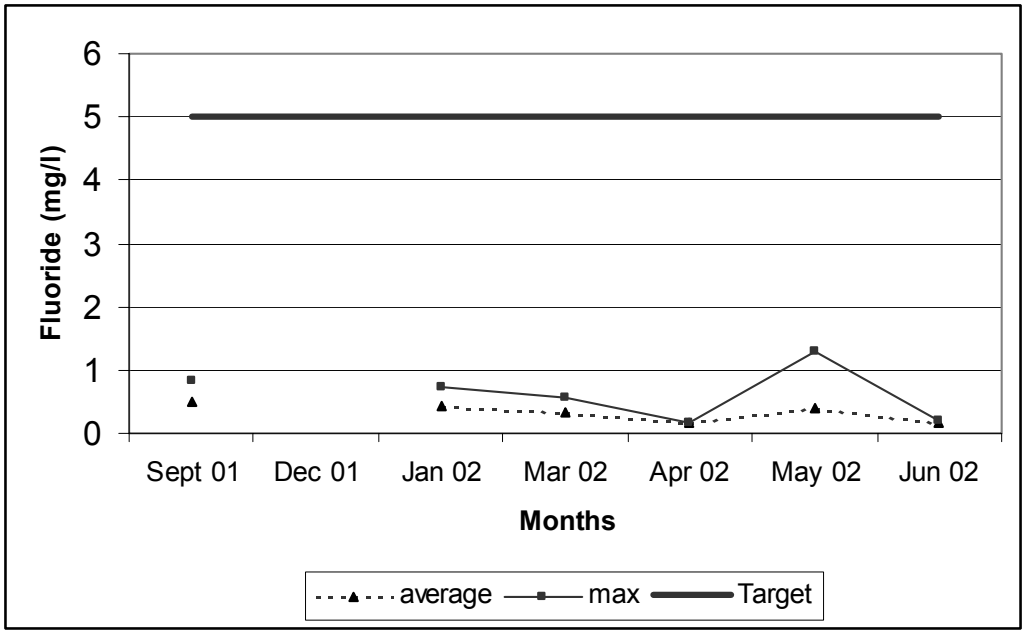


Figure 34: **Changes in fluoride concentrations across the monitoring boreholes that are used to determine ground water quality. The average and maximum fluoride concentrations are shown for the suite of monitoring boreholes per month.**

It can be seen from Figures 33 and 34 that the measured concentrations are well below the specified targets. Although a variability is evident in the graphs it is considered that this is a natural variability and does not indicate any potential impact as a result of smelter operations. Data on the groundwater quality parameters other than those shown above shows no areas of concern, as expected, in relation to the limited baseline information that was measured during the Phase 1 construction period. As more of this information becomes available in the next and subsequent reporting periods, more sophisticated interpretive techniques will be applied to provide for a better understanding of the groundwater dynamics.

5.1.5 Occupational health and safety incidents

Occupational health and safety incidents that occurred at Mozal operations are summarised in Table 13.

Table 13: Summary of occupational health and safety incidents for Mozal operations during the reporting period. Note that the incident details are given as: 1-date, 2-description of the incident and 3-action taken to prevent a recurrence of the incident.

Incidents.	No	Occupational Health and Safety Incident Details
Fatalities	Nil	NA
Total lost time accidents	1	1. 1 July 2001 2. A maintainer suffered a laceration to his left ankle when he was involved in a vehicle accident on the way to the harbour 3. The identified standardised routes to and from the harbour were reinforced and the driver counselled for not following them.
	2	1. 3 August 2001 2. While using compressed air to blow dust from an overhead crane, the air hose struck the holder on his leg causing him to lose his balance. His right leg slipped between the crane and a girder resulting in him twisting his knee and damaging his ligaments 3. A risk assessment was carried out, the outcome of which resulted in the reduction of the gap between the hoist and girder when parked.
	3	1. 4 September 2001 2. A supervisor suffered a soft tissue injury to the right knee when a bundle of ingots fell over after being bumped by a forklift 3. Bundle laydown areas were demarcated. A safety talk was given to heighten awareness regarding the loading of ingots.
	4	1. 12 October 2001 2. A supervisor suffered a fracture to his left foot after a ladle hook fell on same 3. Hooks re-designed to include wear saddles. Procedures to change hooks drafted and implemented.
	5	1. 3 December 2001 2. A contractor fell 3.5 meters resulting in him breaking his left wrist and nose after jumping between two straddle cars at the harbour 3. The contractor was disciplined for climbing over the handrail and jumping instead of descending via the fixed ladder.
	6	1. 9 April 2002 2. A Kempe-Metech sub-contractor stepped off the back of a flatbed and fell 1.2 meters while securing anode stems. He suffered a fractured femur. 3. Job safety analyses on task carried out on regular basis and modifications made to trailer to allow for easier access and egress.
	7	1. 12 June 2002 2. A Eurest employee lost the first digit of her left index finger while cleaning a mincing machine 3. Lock-out procedures to be enforced and employee re-trained.
Total man-hours worked.		3,401,167(Includes employees and contractors).

5.1.6 Waste

Waste quantities generated during the reporting period for Mozal Operations are shown in Table 14 together with the method of storage and or treatment and the ultimate disposal of the same. Composite monthly waste quantities generated are shown in Figure 35.

Table 14: Waste, quantities, storage and/or treatment and where disposed for Mozal Operations for the reporting period.

Waste type	Quantities	Method of Storage/Treatment	Where disposed
Non-hazardous			
Domestic (industrial)	867.95 tonnes	Compacted	Matola landfill
Scrap metal	411.36 tonnes		Sold to scrap metal merchant
Wood	156.1 tonnes		Distributed to communities
Paper	7.95 tonnes		Sold for recycling
Hazardous			
Fluorinated bags	9 tonnes	SPL building	Temporarily stockpiled
Silica gel	10 tonnes	SPL building	Temporarily stockpiled
Fluorinated waste	1621.6 tonnes	Cementation	Matola landfill
Fluorescent tubes	4 drums *	SPL building	Temporarily stockpiled
Oil contaminated waste	311.51	Cementation	Matola landfill
Used oil	117 860 (litres)	Temporary storage	Recycled to South Africa
Medical waste	21 drums	SPL building	Temporarily stockpiled
Carbon dust	286.75	Cementation	Matola landfill
Green poles	15.4	Cementation	Matola landfill
Induction furnace slag	186.443	Cementation	Matola landfill
Refractories	83.05	SPL building	Temporarily stockpiled
Toluene paper towels	9 drums	SPL building	Temporarily stockpiled
Spent pot linings	210 tonnes	SPL building	Temporarily stockpiled

**These are 210 litre drums.*

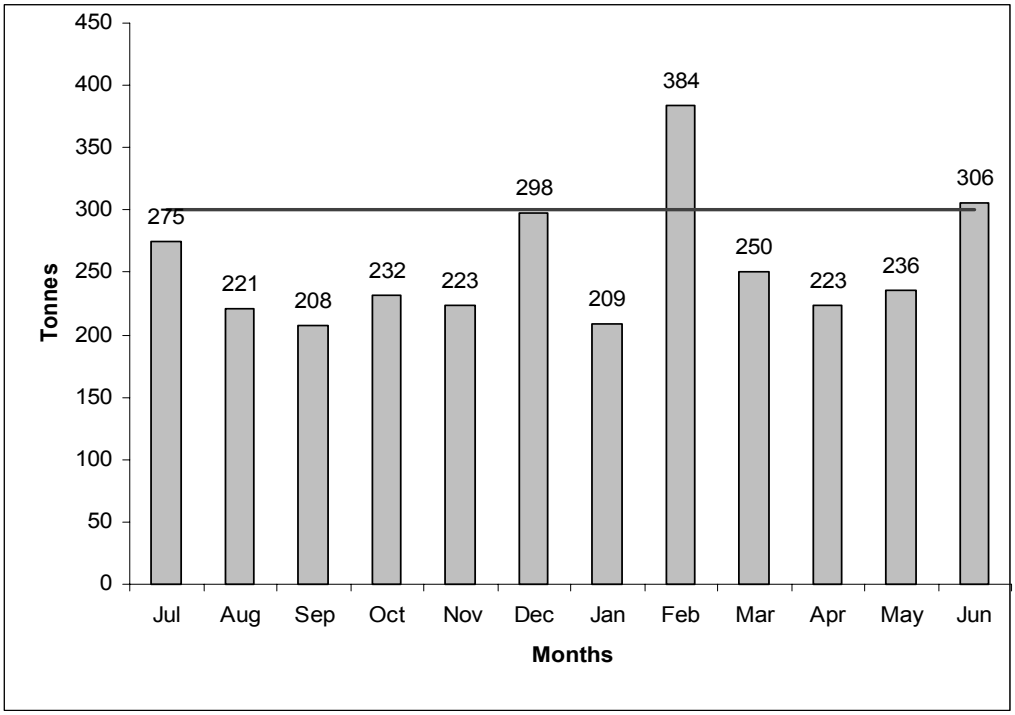


Figure 35: Monthly quantities of solid waste disposed during the reporting period. The smelter's internal target of < 300 tonnes per month is shown as a dark horizontal line.

5.2 Aluminium Expansion Project

5.2.1 Construction dust

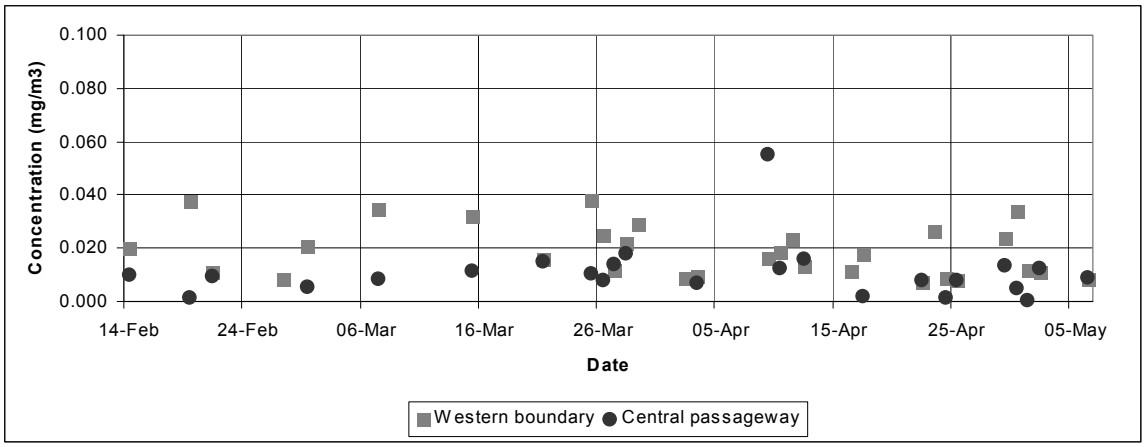
During Phase 1 construction dust was monitored using a visual monitoring technique where one of five possible dust classes was ascribed to the dust condition prevailing on a given day. Given concerns about construction dust impacting on the quality of aluminium an automatic dust monitor was procured for the purposes of dust monitoring. Seven dust monitoring points were then identified around the site to provide for the monitoring of the dust condition together with an indication whether dust was moving off the site or on to the site as a result of off-site activities. The dust monitoring results as recorded by the automatic dust monitor are shown in Figure 36.

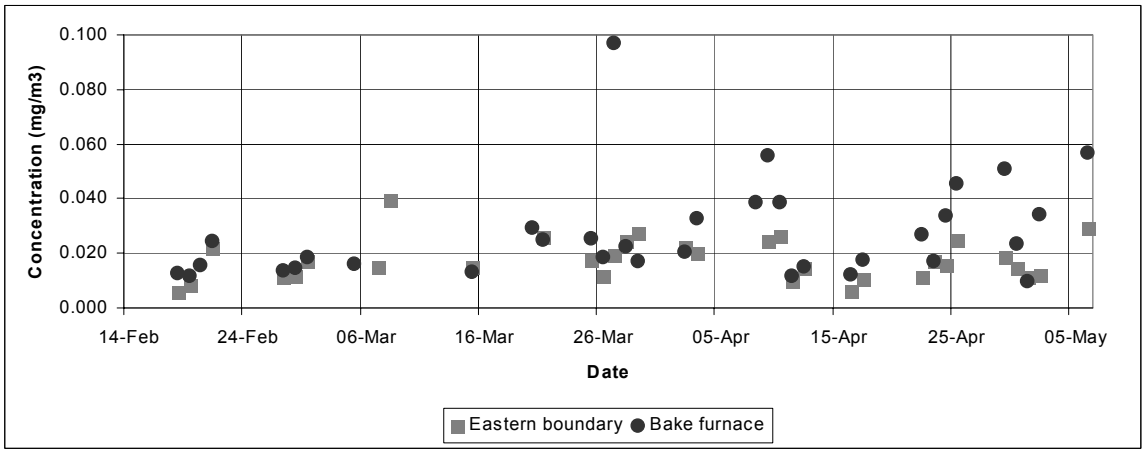
In each of the three graphs presented in the figure, measurements taken on the site perimeter (grey square in Fig. 36) are shown in comparison to dust measurements at an adjacent point close to the brownfields smelter (black circle in Fig. 36). Thus where a higher dust loading is evident at the measurement point close to the brownfields smelter, the suggestion is that dust was being generated in the greenfields area and potentially impacting on the smelter operation. Obviously a more detailed analysis would be required of such events taking into account the wind direction at the time, but the data provides a first indication of where such problems may have arisen.

Owing to the fact that a suitable standard does not exist for construction dust loading a target value of 0.075 mg/m^3 was derived for the project for the average dust loading condition (over the 15-minute measurement duration[1]). This value was linked to the objective of having no visible dust and was derived by using the automatic dust monitor to measure a given dust loading circumstance (essentially using a vehicle to generate dust and then measuring the concentrations). A target value of 0.4 mg/m^3 was also derived in this manner for maximum dust loading during the 15-minute interval during which dust monitoring took place (at each monitoring point). Average and maximum dust loading conditions as measured using the continuous dust monitor are summarised in Figure 37 and Figure 38 respectively.

As described earlier, ongoing dust measurements using the continuous dust monitor was prematurely terminated after problems were encountered with the monitor. To ensure a continuous dust record, daily visual monitoring has continued. The data from the visual recording is shown in Figure 39.

[1] The target so derived should not be confused with the WBG standard for particulate matter of 70 µg/m^3 which applies for a 24 hour averaging period.





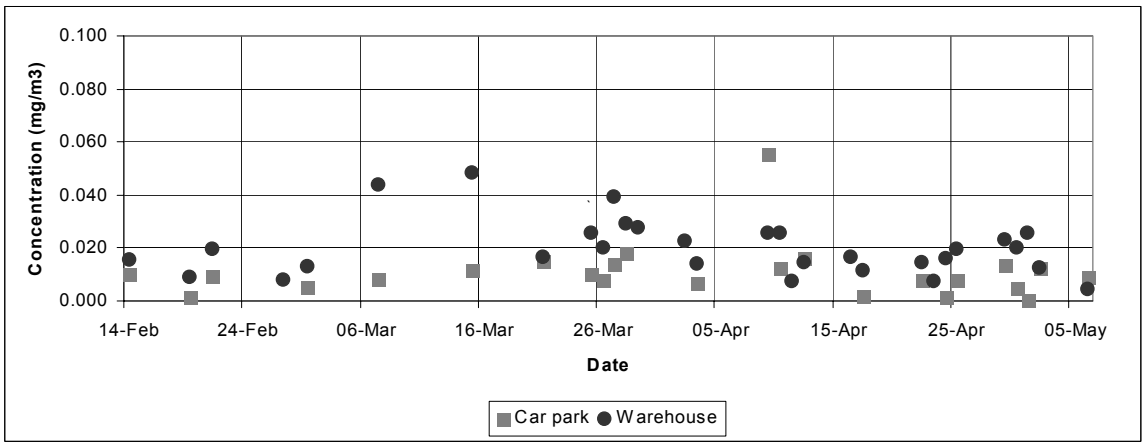


Figure 36: **Dust measurements on the site perimeter and adjacent to the brownfields operation, to determine dust loading in general and the possible impact of dust generated in the greenfields area on the aluminium production process. For a description of the figure please consult the text.**

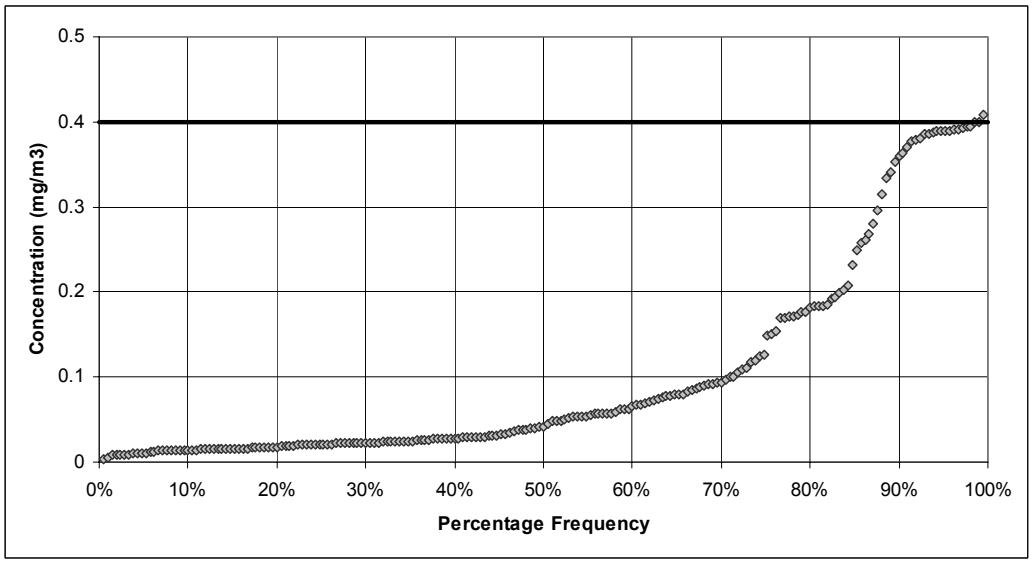


Figure 37: **Probability plot of maximum measured dust concentrations using the continuous dust monitor. Target value is illustrated by a dark horizontal line.**

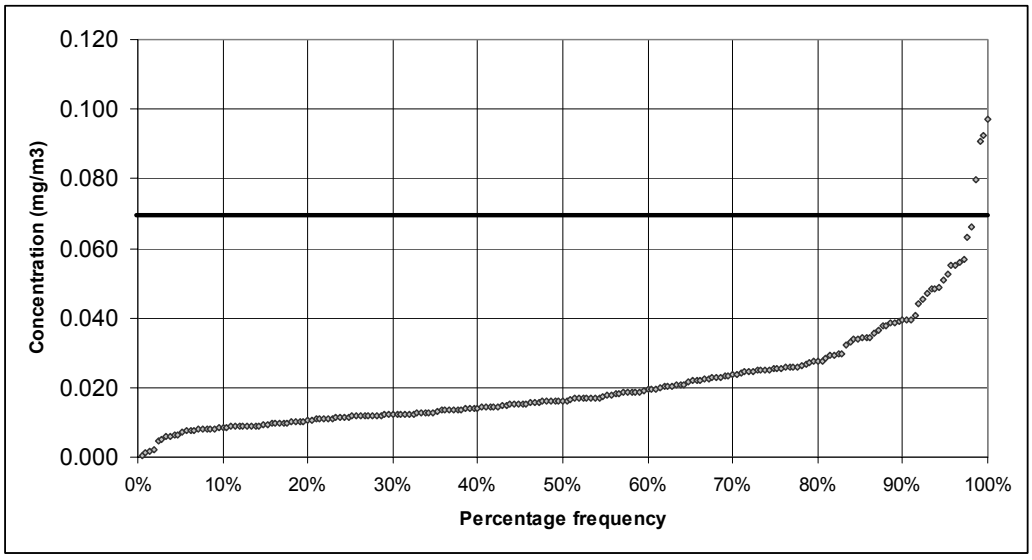


Figure 38: **Probability plot of mean measured dust concentrations using the continuous dust monitor. Target value is illustrated by a dark horizontal line.**

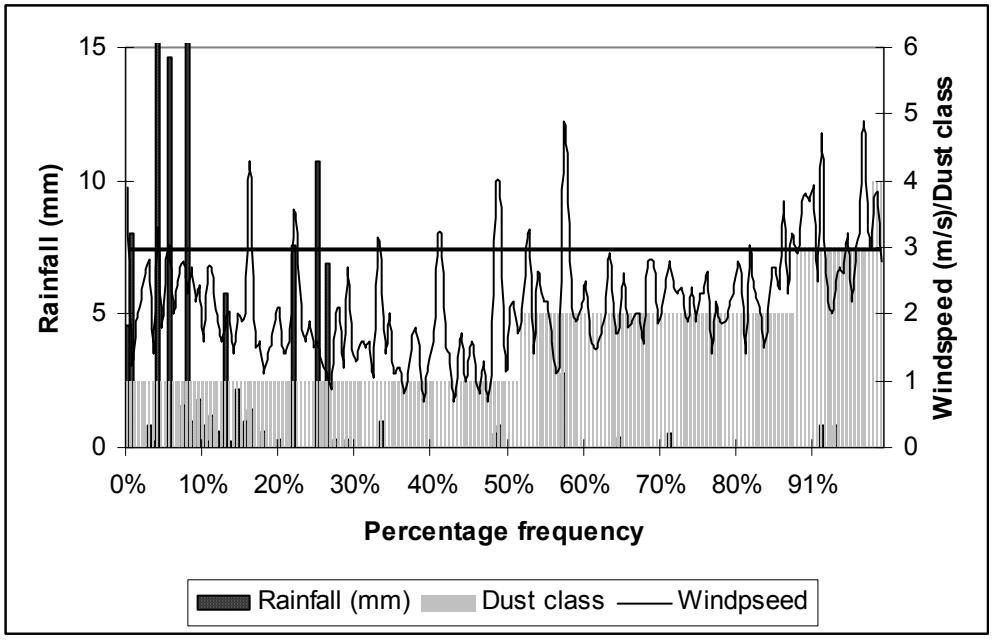


Figure 39: Probability plot of visual dust class, together with mean wind speed and rainfall. The dust class target of 4 is indicated by a dark horizontal line.

5.2.2 Construction noise

Construction noise monitoring was initiated in November 2001 and continued throughout the reporting period as a series of individual measurement campaigns. Data from these noise monitoring campaigns is summarised in Figures 40 and 41. The graphs shown in the figures reflect the mean L_{eq} for the entire monitoring record, as well as the maximum L_{eq}s that were measured at each of the sites during the campaign measurements. It can be seen from the figure that the maximum L_{eq}s measured exceeded the World Bank requirement at 8 of the 11 measurement sites. These maxima were all recorded during a noise measurement campaign in February 2002 with no further exceedances having been recorded since that time.

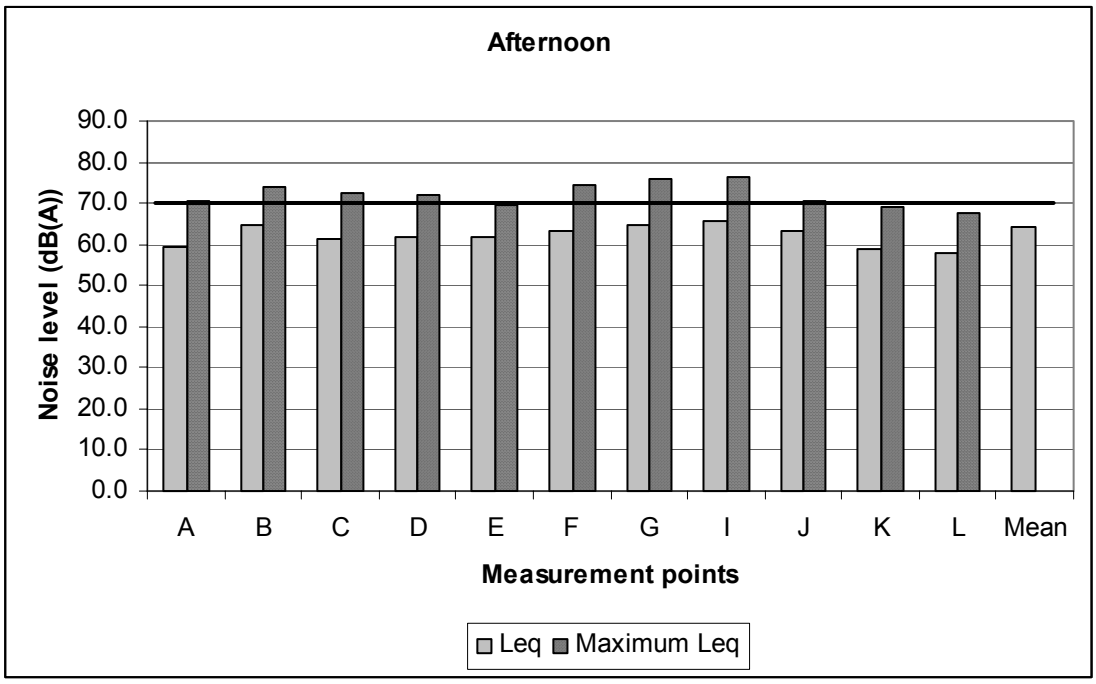


Figure 40a: Composite of all afternoon noise measurement campaigns conducted during the reporting period showing mean (Leq) and maximum (maximum Leq) noise levels measured for selected points across the construction site.

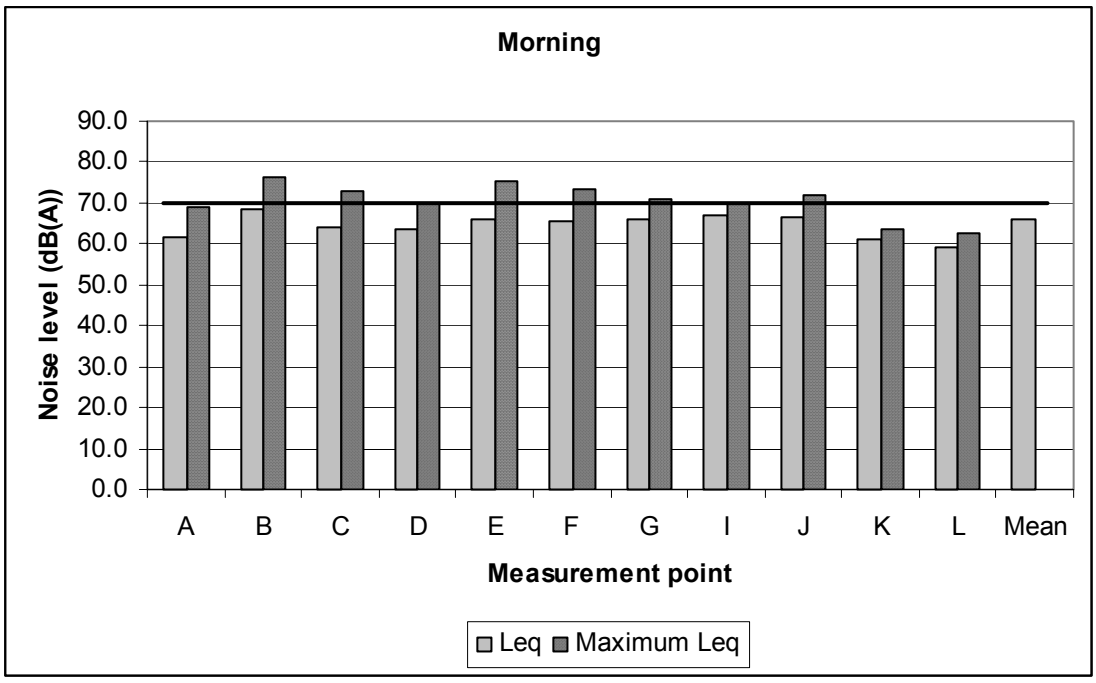


Figure 40b: Composite of all morning noise measurement campaigns conducted during the reporting period showing mean (Leq) and maximum (maximum Leq) noise levels measured for selected points across the construction site.

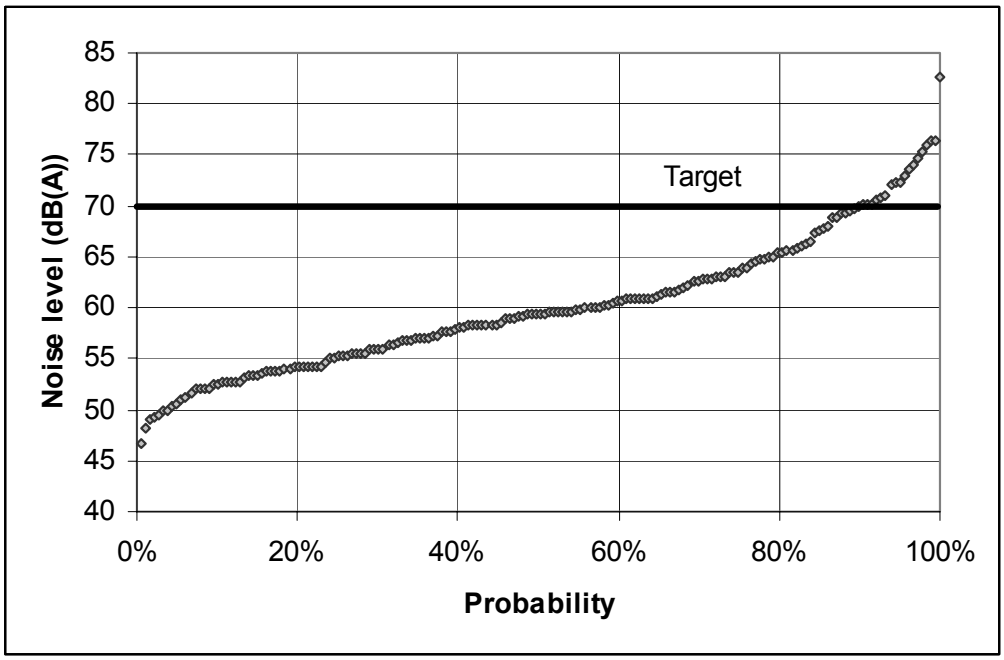


Figure 41: Probability plot of noise measurements taken on the construction site perimeter. The exceedances of the World Bank requirement of 70 dB(A) occurred during February 2002 and have not occurred since.

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In summary then, apart from February 2002 when a number of exceedances were noted, noise on the site perimeter has been within the World Bank requirement of 70 dB(A). With the introduction of a modified noise monitoring procedure, the conclusion that has been drawn that construction noise will not again exceed the World Bank requirement, will be confirmed over the next several months of monitoring. Certainly no disturbances to surrounding communities have taken place at all during the reporting period.

5.2.3 TSS in runoff water

Initially the monitoring target set for TSS in runoff water was to take a daily sample as well as a sample after every rain event. Taking a daily sample proved impractical and as a result a decision was made to conduct sampling only after rain events that generated sufficient runoff for a sample to be taken. On top of that there has been very little rain during the period and because conditions are generally dry, the few rain events that have been registered have resulted in little or no runoff and as a result only one TSS sample has been taken during the entire project period. The analysis from that sample is shown in Table 15:

Table 15: TSS analysis of stormwater runoff from the construction site.

Month	Constituent	Concentration (mg/l)
February, 2002	TSS	1989
	Fluoride	2.5

One of the difficulties faced in sediment management has been defining a pragmatic sediment loading target in the stormwater runoff. It can be seen from Table 15, that the 250 mg/l (which is a South African Receiving Water Quality Standard) that was initially set as the target was simply impossible to achieve for construction stormwater discharge into the existing stormwater reticulation. As a result, the target value was changed to 'all sediment abatement systems to be installed prior to the onset of the rainy season'. The primary silt traps were installed prior to the rains. The secondary silt traps were completed thereafter.

The infrequent sampling was recently reviewed and discussed during an Environmental Co-ordination Committee meeting. The low rainfall condition and the few stormwater runoff events was confirmed as the reason for the infrequent sampling (as well as the fact that some of the rainfall events that did occur, were at night when sampling was not done). It was also pointed out that during the entire project sediment has been removed from the sediment trap in the inlet structure of the impoundment dam only once. The quantity removed totalled some 90 m^3. There has been no further need to clean the sediment trap attesting again to the little sediment that has been washed off-site during the duration of the project. Overall, the sediment loading into the stormwater discharge from the construction activities has markedly reduced compared to the Mozal Phase 1.

5.2.4 Meteorological monitoring

A real time meteorological monitoring station was established on the main construction site in October 2001 in time for the onset of the rainy season. A second station was established at the harbour in April 2002. Monthly rainfall totals for the reporting period are shown in Figure 42.

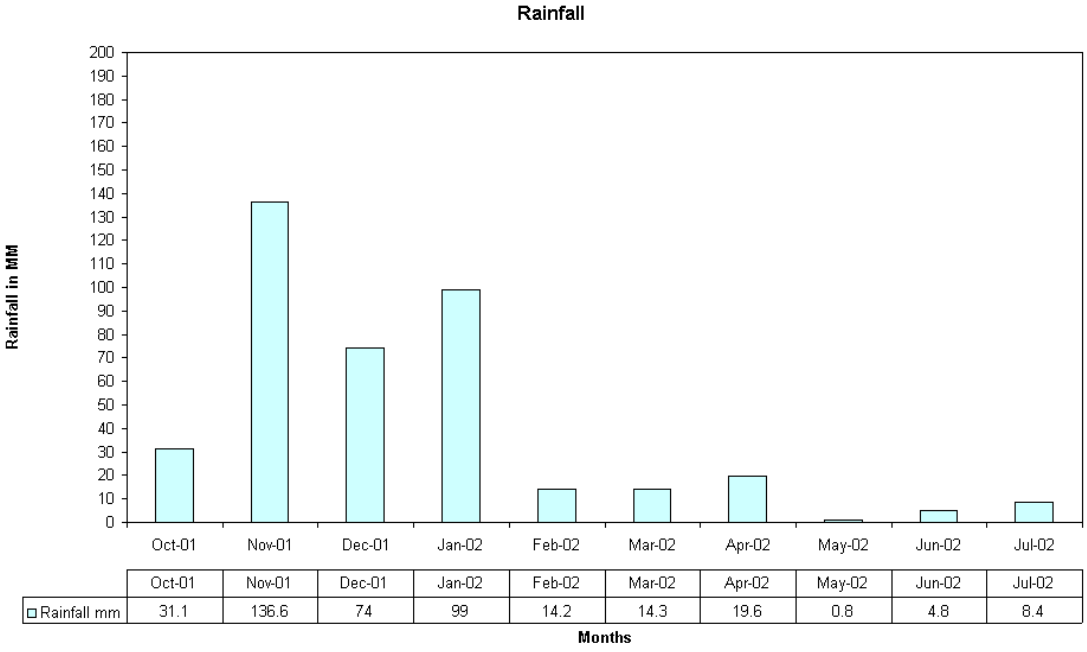

Figure 42: Monthly rainfall totals for the reporting period.

5.2.5 Inspection reports

A number of indicators of environmental management performance were monitored through ongoing inspections by the HSE advisors. As described earlier, the HSE advisors were given inspection templates to be filled in which were based on visual observations of defined indicators including spills, waste management, soil erosion, provision of covered eating areas and drinking water for construction workers, vehicle and equipment maintenance and washing, toilets (ratio to number of construction workers) and servicing, materials storage, painting and toolbox talks. The template was structured in such a way as to provide a daily inspection record per area, for each of the above indicators. The information was then submitted as a weekly report to the PEA. The results from the inspection reports are summarised in Table 16.

During the inspection any potential or actual transgressions of the above indicators would be logged as an 'observation'. Thus what is reflected in the table is the frequency of such observations as a percentage of the number of inspection reports. For example during the reporting period there were 3 observations of domestic waste management transgressions in Area 1, which is 3.2% of the number of inspections. Where no value is shown in the Table, there were no reported transgressions of that particular indicator. It is extremely important to emphasise that all the recorded observations were minor events (with the principle of the inspection reports being one of nipping minor transgressions in the bud, before they became major incidents[1]).

[1] Any major incidents would have been recorded as such using the incident reporting mechanism included in the EMP.

Table 16: Summary of inspection reports conducted by the HSE advisors. The numbers in the table reflect the percentage frequency of observations of the listed indicators (please refer to the text for a more detailed description).

Indicator		Area					
		1	2	3	4	Harbour	Total
Number of reports		**95**	**85**	**95**	**85**	**85**	**445**
General appearance							
Waste	Domestic waste	5.3%	5.0%	4.2%	4.7%	8.2%	5.0%
	Hazardous waste	1.8%	3.8%	3.2%	1.2%	9.4%	4.3%
	Building rubble	12.3%	7.5%	6.3%	4.7%	7.1%	5.5%
	Waste timber	8.8%			2.4%	7.1%	3.1%
	Scrap metal	5.3%	2.5%	2.1%	2.4%	7.1%	4.6%
Spills	Petroleum products	7.0%	6.3%	6.3%	7.1%	3.5%	5.8%
	Concrete	3.5%				3.5%	1.2%
	Other materials						0.2%
Soil erosion	Slumps or slides evident						
Covered eating areas?		2.1%	3.5%	1.1%	3.5%		1.9%
Drinking water provided?			5.3%		1.2%	1.2%	1.2%
Vehicles being maintained or washed?							
Toilets ratio and servicing		4.2%	12.3%			2.4%	3.1%
Storage	Materials sorted and neat	1.8%			5.3%	4.7%	1.2%
	Bunding provided	3.5%			1.3%	1.2%	0.7%
Spray painting	Blast media						
	Plastic sheeting	1.8%					0.2%
Toolbox talks							

The percentages shown in the table indicate the frequency of observations of the indicators (viz. wrongdoing by the contractors) that are listed in the inspection reports.

From the table, it can be seen that oil spills were the most frequently recorded observation. It is important to point out that these observations were principally oil leaks on vehicles and machinery and on no occasion constituted large scale spills. Observations included in this category also included an improper re-fuelling arrangement at the harbour that was subsequently rectified by BP, the refuelling service provider. Building rubble was the second most frequently reported observation (which would be expected on any construction project) followed by hazardous waste (proper segregation of used paint tins from other waste), domestic waste (mostly lunch packages) and scrap metal.

In almost all cases the observed transgression was resolved through an immediate discussion with the relevant contractor by the HSE advisor, but where necessary the PEA was advised and further action taken (for example, improving the re-fuelling facility at the harbour). In addition, when the inspection reports were first introduced on the project they operated on the principle of 'no news is good news'. In other words the HSE advisors only submitted inspection reports when there was an observation recorded. On review this arrangement was deemed unsatisfactory and the HSE advisors were later compelled to submit all inspection reports (and sign them off) regardless of whether or not there were any observations recorded.

5.2.6 Occupational health and safety incidents

Occupational health and safety incident details are summarised in Table 17 for the aluminium expansion project during the reporting period.

Table 17: Occupational health and safety incidents for the Aluminium Expansion Project. Note that the incident details are given as: 1-date, 2-description of the incident and 3-action taken to prevent a recurrence of the incident.

Incidents.	No	Occupational Health and Safety Incident Details
Fatalities	Nil	NA
Total lost time accidents	1	1. 12 October 2001 2. Whilst raking stone dust, the injured party slipped and fell 3. Hazard awareness training for the particular environment in which the injured fell, was conducted.
	2	1. 29 October 2001 2. The injured worker was carrying a length of steel channel when he slipped and fell on uneven ground 3. Access routes through and towards work areas were clearly demarcated and made safe.
	3	1. 31 October 2001 2. Whilst the worker was removing set concrete from a bucket a piece fell out and struck him on his right ring finger 3. A specific supervisor was assigned to the concrete team and all procedures and risk assessments pertaining to the cleaning of the concrete bucket were revised.
	4	1. 1 November 2001 2. The injured was erecting a shutter panel when a section of steel channel came loose, nipping his finger 3. Training methods for shutterhands were revised to include the use of angle iron. All risk assessments and training pertaining to the contractor's tasks were revised.
	5	1. 14 November 2001 2. Injured got his hand nipped between a pipe and a roller of a pipe bending machine 3. Guard rails were installed on the equipment involved to prevent the operator from accidentally getting his hand nipped in the rollers.
	6	1. 15 November 2001 2. The injured was standing between a load being lifted and a rebar cage when the load swung and trapped his foot 3. Crane operators and banksmen were re-inducted on the importance of positioning of personnel during lifting operations.
	7	1. 5 December 2001 2. Whilst ensuring the correct positioning of a shutter between two rebar cages, one of the cages fell and struck a worker on his ankle 3. Reinforcing cages were braced to prevent them from falling over. The work method was revised and broken down to ensure better planning of work activities.
	8	1. 23 February 2002 2. Whilst a worker was aligning the formwork for a tunnel, a shutter slipped through a gap in the formwork and struck the injured on his hand 3. The method of placing the shutters was revised through the facilitation of better communication and work practices.
	9	1. 17 April 2002 2. During the loading of structural steel on a truck, a piece of angle iron was placed on top of the load. The loose piece slid off when the load was lifted and struck the worker operating the tag line on his collarbone 3. The correct slinging methods were explained to the contractor's employees. Risk assessments and procedures were revised to allow for checking for loose material before lifting commences.
	10	1. 28 April 2002 2. The injured was struck on his lower leg by a load being lifted. This resulted in a fracture. 3. Positioning of employees in close proximity to lifting operations was revised.
Total man-hours worked.		7,638,887 man-hours (end July 2002)

5.2.7 Waste

Various types have been generated by the project. These waste types, together with the approximate quantities, are summarised in Table 18.

Table 18: Waste quantities generated during the reporting period on the Aluminium Expansion Project.

Waste type	Quantities	Method of Storage/Treatment	Where disposed
Non-hazardous			
Domestic	7420m³	Compacted	Matola landfill
Sewage	439m³/day	Sewage treatment plant	Discharged to environment
Scrap metal	272 tonnes		Scrap metal merchant
Wood	534m^3		Distributed to communities
Building rubble/ Waste concrete	20500 m^3	Recycled on site as part of the plant landscaping design.	On site
Hazardous			
Used oil	None to date	Temporarily stockpiled	Repatriated to South Africa
Contaminated soil	Minimal	Temporarily stockpiled	Will be disposed of on hazardous waste landfill
Sludge from oil traps	Minimal	Used oil store	Repatriated to South Africa
Cathode ramming paste	Nil (some will be generated during the next reporting period)	Temporary stockpile pending completion of hazardous waste facility	Will be disposed of on hazardous waste landfill
Infectious (bio-hazardous) waste	15 drums	Temporarily stored pending approval of incinerator – August 2002	Incineration – with bottom ash being stockpiled for disposal on hazardous waste landfill
Waste paint	None to date	Temporary stockpile pending completion of hazardous waste facility	Will be disposed of on hazardous waste landfill
Sewage sludge	2 ½ to 3m^3	Temporarily stored pending introduction of on-site composting during next reporting period *[1]	

*[1] *In recognising that there was no formalised disposal method for the dried sewage sludge, several possible disposal options were investigated before composting was decided on as the most suitable. A composting process is currently being implemented.*

5.2.8 Contractors EMPs

The status of Contractor's EMPs was tracked on an ongoing basis by simply recording the number of C-EMPs in each of the review categories together with the number of contractors mobilised. The status of C-EMPs is shown for the end of June 2002 in Table 19.

Table 19: Status of Contractor's EMPs at end June 2002.

Review category	No
Under review	1
Status A	4
Status B	4
Status C	16
Status D	Nil
Status F	61
Total	**86**

Please note that Status A is the lowest review category with Status F being the highest. A contractor is allowed to mobilise once the C-EMP is afforded a C status, but the C-EMP must reach Status F before it can be signed off. Some 89 contractors had mobilised at the end of the reporting period.

5.2.9 Sewage treatment plant

It should be noted that the sewage treatment plant was designed, built and commissioned during the Mozal first phase in accordance with World Bank general environmental guidelines of 1995. In the spirit of continuous improvement, the World Bank 1998 environmental guidelines were adopted together with the more stringent South African limit on oil and grease and faecal coliforms, for the ongoing operation of this plant during the Mozal Phase 2 expansion project. In summary, full compliance has proved difficult on all parameters, but in principle no negative impacts have been imposed on the physical environment. The performance of the plant is summarised in Table 20 followed by commentary on certain parameters falling outside of the target values.

Table 20: Summary performance data from the sewage treatment plant.

Parameter	Limits	Origin	Mean	Maximum	% compliance
COD	150 mg/l	MICOA[1]	26.81	48.00	100
PH	6-9 mg/l	WBG	7.08	8.6	88.9
BOD	30 mg/l	MICOA[1]	13.0	13.00	100
TSS	20 mg/l	MICOA[1]	3.34	10.40	100
Faecal coliforms	0 MPN/100ml	RSA	34.21	525.0	68.4
Chlorine (res.)	0.2 mg/l	WBG	0.56	0.9	0.0
Oil and grease	2.5 mg/l	RSA	8.68	23.0	5.3
Heavy metals	10.0 mg/l	WBG	0.29	0.47	100
Arsenic	0.1 mg/l	WBG	0.01	0.01	100
Cadmium	0.1 mg/l	WBG	0.05	0.10	100
Chromium (hex)	0.1 mg/l	WBG	0.03	0.03	100
Copper	0.5 mg/l	WBG	0.03	0.03	100
Lead	0.1 mg/l	WBG	0.05	0.05	100
Mercury	0.01 mg/l	WBG	0.00	0.00	100
Nickel	0.5 mg/l	WBG	0.03	0.03	100
Selenium	0.1 mg/l	WBG	0.01	0.03	100
Silver	0.5 mg/l	WBG	0.03	0.03	100
Zinc	2.0 mg/l	WBG	0.08	0.21	100
Ammonia	10 mg/l	WBG	6.07	59.0	92.9
Cyanide (free)	0.1 mg/l	WBG	0.03	0.05	100
Fluoride	20 mg/l	WBG	3.36	11.0	100
Phenols	0.5 mg/l	WBG	0.04	0.12	100
Phosphorous	2 mg/l	WBG	6.91	12.0	15.4
Sulphides	1.0 mg/l	WBG	72.17	208.0	23.1
Aluminium	0.2 mg/l[2]	WBG	0.11[3]	0.32[3]	94.7[3]

% compliance is simply a reflection of the number of times the specified limits were exceeded, expressed as a percentage of the number of analyses conducted.

[1] *Deviation from WBG guideline as proposed by MICOA. TSS at 20mg/l to be checked as this differs from TSS on Table 12*

[2] *Above intake water*

[3] *Value shown is a total value and represents a 94.7% compliance with a 0,2 mg/l actual limit*

It can be seen from the table that there were several parameters where compliance was less than 100%. The most important of these was faecal coliforms where the target of 0 was exceeded during the reporting period. The reason for the exceedance was related to a failure of the chlorine dosing system early in 2002. No further exceedances were evident in the monitoring record (Fig. 43). In a related manner the residual chlorine target of 0.2 was not met at all during the reporting period. The reason for this is that the plant was designed and built to meet the 1995 World Bank requirements where a residual chlorine target of 1.0 was specified. It seems unlikely that the target will ever be met, with the current configuration of the plant, and without compromising on the control of coliforms in the final effluent. This issue is to be addressed during the next reporting period.

The oil and grease target of 2.5mg/l was also not met adequately, although it remained within the World Bank Standard of 10mg/l on average. Investigations into the high oil and grease loading have revealed a possible source to be the kitchen in the construction village. Ongoing efforts will be made to reduce the oil and grease discharge into the sewer. It is not clear why there is a relatively high phosphorous loading, but it is expected that septic sewage (sewage contained in the pump chambers and conservancy tanks) is the source of the high sulphide loading. The minor deviations in respect of aluminium are considered to be a function of the variable quality of the intake water. This is to be confirmed during the next reporting period, together with further investigations into the phosphorous and sulphide exceedances.

A consultant has recently been appointed to conduct a thorough audit on the technical design and operation of the sewage treatment plant and to make recommendations for further improvements. A concerted effort will be made during the following reporting period to ensure that the plant can operate effectively and sustainably before being handed over to the authorities in mid 2003.

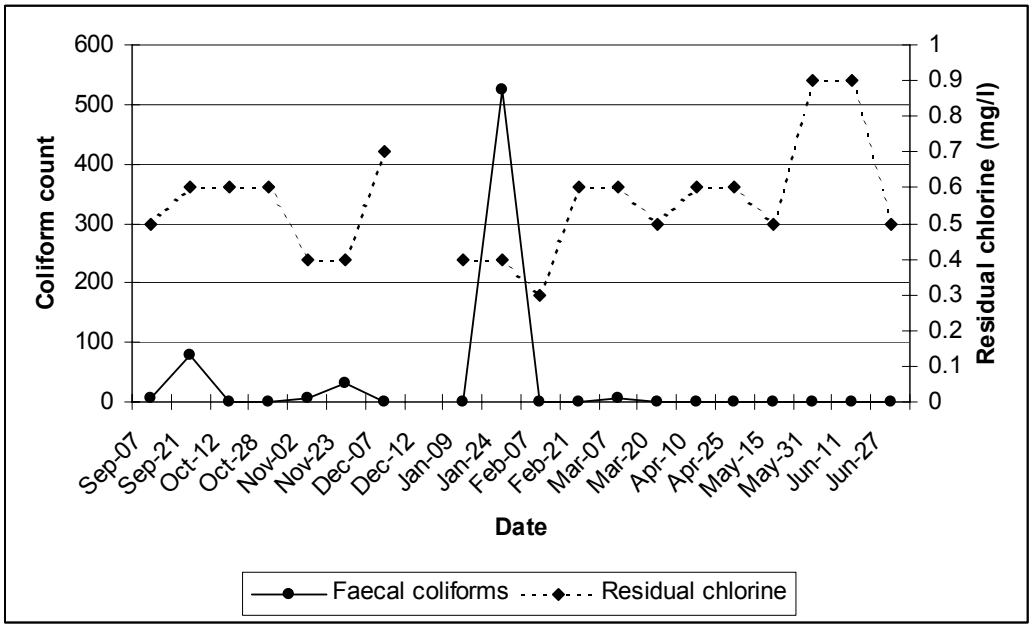

Figure 43: Relationship between faecal coliform counts and residual chlorine. Note the high coliform count during January when the chlorine dosing system malfunctioned and had to be repaired.

5.2.10 Malaria incidence

Malaria incidence on the Aluminium Expansion project is shown in Figure 44.

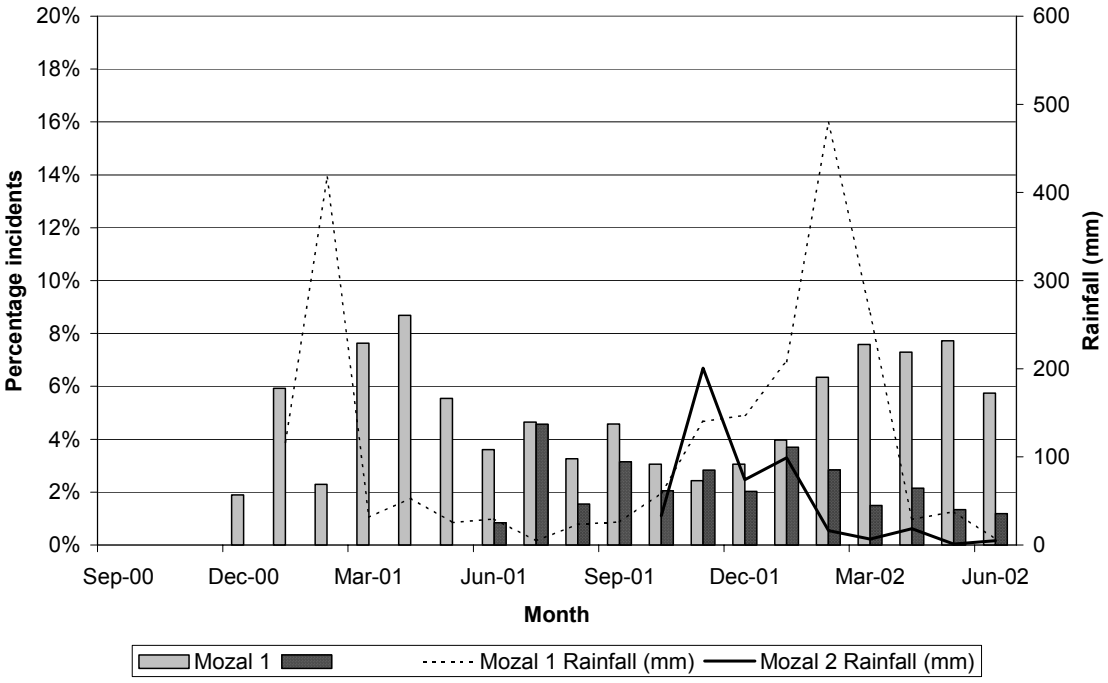

Figure 44: Malaria incidence on the Aluminium Expansion Project (Mozal 2) relative to malaria incidence during the first phase of the Mozal smelter (Mozal 1).

It can be seen from the figure that there has been a substantive reduction in malaria incidence from the first phase of the Mozal smelter project. This reduction can be attributed in part to the generally lower rainfall that has been experienced as well as heightened control measures. Malaria in the expatriate labour force has been dramatically reduced. No monthly incidence has exceeded 2% of the expatriate labour force for Mozal 2, whereas the incidence during Mozal 1 exceeded 18% on occasion. The knock-on effect has been a reduction in construction hours lost to illness and a consequent reduction in the number of construction employees engaged by contractors. This manifests itself in significant productivity gains as shown in Figure 45 where it can be seen that some 35 000 man days had been lost on Phase 1 compared to less than 5 000 man-days lost on Phase 2 so far.

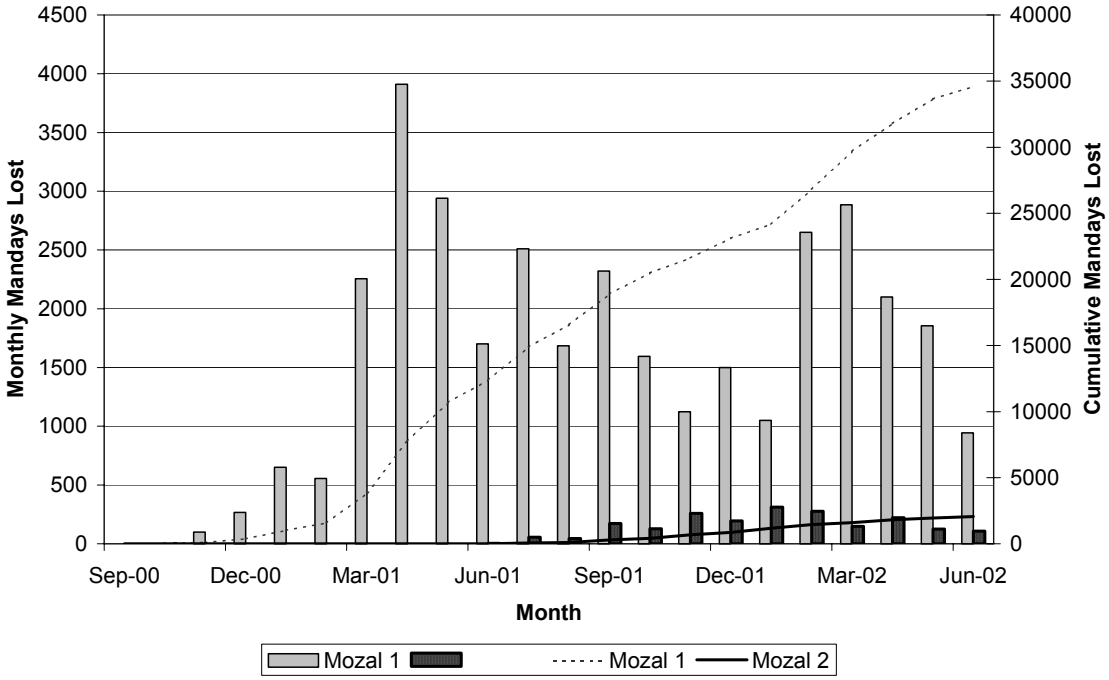

Figure 45: Malaria statistics comparison between Mozal 1 construction and Mozal 2 construction indicating the differences in man-days lost.

5.2.11 Engineering review

As described earlier, an important element of the environmental management function during the project was to ensure that the environmental management requirements of smelter operations were included in the design of the smelter. In Table 21, the relevant facilities are shown together with the environmental aspects that had to be incorporated and what has been incorporated into the design.

Table 21: Summary of facilities, environmental aspects, design criteria and engineering specifications.

Facility	Environmental aspects	Design requirements and criteria	Engineering specifications
Gas Treatment Centre	Gaseous fluoride	Emissions ≤ 1.1 mg/m^3	Emissions ≤ 1.1 mg/m^3
	Particulate fluoride	Emissions ≤ 0.5 mg/m^3	Emissions ≤ 0.5 mg/m^3
	Total dust	Emissions ≤ 5.5 mg/m^3	Emissions ≤ 5.5 mg/m^3
		Stack height 47.0 m	50m
		Exit velocity 19.0 m/s	20 m/s
Fume Treatment Centre	Gaseous fluoride	Emissions ≤ 0.35 mg/m^3	Emissions ≤ 0.35 mg/m^3
	Particulate fluoride	Emissions ≤ 0.6 mg/m^3	Emissions ≤ 0.6 mg/m^3
	Condensed soluble tar	Emissions ≤ 1.7 mg/m^3	Emissions ≤ 1.7 mg/m^3
	Total dust	Emissions ≤ 5.7 mg/m^3	Emissions ≤ 5.7 mg/m^3
		Stack height 40.0 m	45 m
		Exit velocity 18.0 m/s	20 m/s
Paste plant	Condensed soluble tar	Emissions ≤ 1.7 mg/m^3	Emissions ≤ 1.7 mg/m^3
	Total dust	Emissions ≤ 10.0 mg/m^3	Emissions ≤ 10.0 mg/m^3
		Stack height 39.55 m	45 m
Air conditioning ▪ Carbon offices ▪ PTAs ▪ Changehouse ▪ Liquid pitch plant ▪ Sub-stations ▪ Switchgear	ODS	Free of banned CFCs	All confirmed and governed by an overriding specification on Heating, Ventilation and Air Conditioning (HVAC) that specifies no refrigerants banned by the Montreal Protocol
Alumina handling	Spillage of fluorinated product	▪ Vacuum cleaning ▪ Areas under cover	A hard pipe 50mm vacuum line to service these areas with a 100mm connection for a Mobile Vacuum Truck at ground level has been provided. In addition, the design on

Facility	Environmental aspects	Design requirements and criteria	Engineering specifications
			the slide gate between the 325 Silo outlet and the conveyor inlet has been reviewed and changed to eliminate the alumina leakage
Materials handling ▪ Alumina silo ▪ Harbour raw materials handling ▪ Ship unloader ▪ Carbon plant ▪ Lining shop ▪ Anode rodding ▪ Bath cleaning	Process dust	Emissions ≤ 30.0 mg/m^3	All sources of process dust are specified in a standard specification (viz. applies to all facilities) on dust collectors that specifies *dust escaping after the filter units, not to exceed 10 mg/m^3*
Oil/pitch containing facilities ▪ Liquid pitch plant ▪ Harbour facilities ▪ Main substations	Oil spills	Bunding and oil traps	All potential sources of oil and or pitch spillage, including the facilities listed here, together with HFO storage and transformers across the site have spillage control facilities.
Landscaping	Visual	▪ Mass and amenity type planting ▪ Planting compatible with surrounding vegetation	Specification dictates all vegetation to be locally sourced. Landscaping effected site-wide based on an overall landscaping plan developed by a professional landscape architect
Cooling water ▪ Casthouse ▪ Compressors ▪ Anode rodding	Blowdown	Cooling water not to contain heavy metal based corrosion inhibitors and biocides to be biodegradable.	This is less of a design function and more an operations function. The corrosion/scale inhibitor is not zinc based but does contain molybdenum (a heavy metal). An oxidising

Facility	Environmental aspects	Design requirements and criteria	Engineering specifications
			biocide is used that contains chlorine and bromine but these do not prevail at concentrations higher than what would be acceptable in potable water
Sewage treatment plant	Discharge	Target is the 1998 World Bank effluent standards for operation of the plant	The Sewage Treatment Plant was built as part of Phase 1 and designed to meet 1995 World Bank standards
Entire Smelter Expansion	Noise	Maintain equivalent acoustical characteristics of Hillside Smelter.	The entire Mozal Smelter is an almost direct replica of the Hillside Smelter, but may well have a lower acoustical character than Hillside, given that it is spread over a slightly larger area
	Visual	Aesthetically pleasing architecture	Overarching architectural specification developed for the expansion project
Harbour access road	Noise	▪ Improved silencers ▪ Noise barrier	Noise abatement options of quieter haul vehicles, noise barrier (wall) and soundproofing of resident's houses have all been investigated
Construction refuelling station	Petroleum product spills	▪ Diesel tanks above ground ▪ Concrete floor, slope and drain ▪ Bunding ▪ Oil traps ▪ Leak tests on petrol tanks	All provided
Hazardous waste facility	Waste disposal	Meet international best practice for hazardous waste landfilling	Facility approved. EIA being concluded currently on the facility with construction

Facility	Environmental aspects	Design requirements and criteria	Engineering specifications
			expected to commence in October/November 2002
Infectious medical waste incinerator	Air pollution emissions, bottom ash	Small-scale incinerator that meets criteria for rural clinics as specified by the WHO Collaborative Centre for Cold Chain Management	Small scale incinerator (<6 kg an hour) identified and procured that meets these requirements
Silt control facilities	Silt loading in stormwater	Silt traps to prevent silt laden stormwater entering existing reticulation.	Primary and secondary silt traps designed to meet this requirement
Construction village	Social aspects	▪ Reduce dormitory effect ▪ Recreation facilities	The construction village, which was completed for Phase 1, consists of small dwellings, which sleep between 6 and 8 people. There is a soccer field, bar, and other entertainment facilities in the construction village.
Waste facility	Construction waste	Provision for segregation and safe temporary storage of construction waste	Dedicated waste transition station established that meets these requirements including a bunded waste oil storage container
Concrete batch plant	▪ Waste water ▪ Cement leaching	▪ Hard surface where filling of concrete vehicles can take place. ▪ Wash facility for concrete vehicles ▪ Water recycling system	Concrete batch plant specification contains these requirements In addition, to numerous others

6 SUMMARY AND CONCLUSIONS

As was described in the introduction to this report, the full suite of environmental management requirements has been summarised in a single overarching document. The purpose of this overarching document has been to ensure that each requirement has been allocated, for implementation, to either Mozal Operations, the Aluminium Expansion Project or the MCDT. In order to provide an overall statement on the environmental and social performance of Mozal SARL for the reporting period, those same environmental management requirements have been summarised, together with a statement on the degree to which the requirement has been implemented during the reporting period (Table 21) following section 6.5. For each requirement a reference has also been provided to indicate where in the AMR the particular requirement has been described.

From the table it can be seen that virtually every requirement has been addressed during the reporting period. Having said that, several items have been identified during the reporting period where improvements were deemed necessary. These are listed and described in the sections that follow.

6.1 Formalisation of reporting

During the first management review that was held in February 2002, it became apparent that environmental management reporting for the project was unconsolidated and thus inadequate in meeting the checking and corrective action requirements specified in the Project EMP. As a result, a process was initiated to compile a Monthly Environmental Report (MER) in an attempt to provide a single consolidated report on environmental management effectiveness on the project. The MER also contains a reporting matrix that provides a record of the reporting efficiency on the various environmental management functions.

At the same time the function of the Environmental Coordination Committee (ECC) was changed. The ECC had been principally a forum for coordination of environmental issues between the project and Mozal Operations but it was found that there was some duplication between that function and the Health, Safety and Environmental Co-ordination meeting. In addition, there was no regular review of the environmental management function. As a result, the function of the ECC is now to review the environmental management information presented in the MER and to decide on appropriate corrective action. It is felt that this change has brought about a far better formalisation of the environmental management function on the project.

6.2 Interaction with environmental NGOs

Despite considerable effort having gone into the preparation of the public meetings there are still negative perceptions amongst certain environmental NGOs and the media. One of several objectives of the social perception survey that will be undertaken in the next reporting period, will be to better understand where and why this negative perception prevails and based on that outcome to formulate a strategy for reducing the same. As a more proactive measure, it has already been decided to expand the Environmental Task Group meetings and to extend the current function of interaction with the authorities to include the participation of selected environmental NGOs. A second initiative will be to review the format of the public meetings to see how they can be improved so as to counter the negative perceptions.

6.3 Consistent monitoring

Measurement and monitoring at both the project and operations has not been as consistent as it needs to be. Although there has been extensive monitoring across the operations and project activities, there are gaps in the data record that render the monitoring incomplete. An example of this is the dust monitoring on the project, which was not properly formalised during the first several months of the project. Also the groundwater borehole monitoring at Mozal Operations has not been consistently effected. Both of these monitoring activities have since been addressed to ensure that they provide a reliable and consistent record in future.

In a similar vein, and as described in the AMR, the monitoring of the stormwater/cooling water blowdown quality at the point of discharge to the Rio Matola, is incomplete. A process is currently under way to improve this situation with a view to ensuring that the water quality parameters are reliably and consistently monitored. These results will appear in the next reporting period.

6.4 Sewage treatment plant

As has been described in this AMR, the operation of the sewage treatment plant has not been optimal. Although the plant has been reasonably well operated in terms of its design and principle function of treating sewage, there are range of performance requirements that have not been met consistently. At the same time not all the performance parameters were monitored: in particular, the sewage plant operating contractor assumed that faecal coliforms were an adequate representation of total coliforms and did not monitor the latter. This issue has been addressed with the contractor to ensure all applicable parameters are monitored. In addition, a consultant has been contracted to audit the current design and operation of the sewage treatment plant to determine the changes that need to be made to ensure that the plant continues to operate reliably and effectively. Owing to the remoteness of the plant from similar facilities, contingency plans will also be developed in order to cater for any malfunctions of critical treatment components such as the chlorination system. The principle is to ensure that by the time the sewage treatment plant is handed over to the regional Mozambique authorities in mid-2003, the plant will be fully functional and capable of meeting the relevant performance requirements.

6.5 Response to audit comments

During the verification audit by the independent consultants several issues were highlighted where further improvements in the environmental and social management function may be possible. Although not a direct reporting requirement, the issues have been considered and reviewed by Mozal and in response, it has been decided to investigate the following issues during the next reporting period with a view to possible implementation.

6.5.1 Media attention

Although media attention is tracked and recorded, there is currently no formalised mechanism for responding to and countering negative media attention.

6.5.2 Efficacy of the public meetings

Again there is no direct mechanism to assess the efficacy of the public meetings. The possibility of effecting this requirement as part of the social survey will be investigated during the next reporting period.

6.5.3 Community information and MCDT

The issue raised here is whether the interaction between the MCDT and the communities cannot be used to provide additional information on the status and welfare of that community. This happens informally currently, but may be improved and better formalised.

6.5.4 Sustainability of project social initiatives

The issue raised was whether initiatives such as the voluntary aids testing and counselling facility, which is currently supported by the project, would survive beyond the end of the project. Clearly this important social function will be reviewed in terms of sustainability and the necessary support provided if deemed appropriate.

6.6 General

Across the board, Mozal is satisfied that virtually every component of its environmental and social management planning has been implemented. During the course of the reporting period there has been ongoing review of Mozal's environmental and social performance with a view to ensuring that all of the commitments made in the Common Terms Agreement (CTA) have been met. This is not to say that the performance has been perfect and indeed the items described above have been presented in recognition of that fact. Mozal remains committed to the principle of continuous improvement and as such will continue to review rigorously, all components of its environmental and social performance in an ongoing pursuit of doing things better. It is sincerely hoped that the AMR report has been found to reflect this principle as well as presenting an informative account of Mozal's environmental and social performance for the reporting period.

Table 22: Environmental management requirements for Mozal SARL, together with an indication of the degree to which the requirement has been met during the reporting period and a reference to the section in the AMR where the requirement is described.

Aspect/Impact	Mitigation	Project phase	Status at end of July 2002	AMR reference
Building rubble	Bury on site – screening berms	C	Fully implemented and ongoing	4.2.11
Packing crates	Distribute timber locally	C	Fully implemented and ongoing	4.2.11
Non-hazardous waste	Municipal solid waste site	C	Fully implemented and ongoing	4.2.11
Hazardous waste	Handling by specialist waste disposal company	C	Certain hazardous waste types will be temporarily stockpiled for ultimate disposal on the hazardous waste facility that will be constructed during the next reporting period	4.2.11
Construction dust	Water spray	C	Water spraying has been the dominant form of dust control since the project's inception	4.2.7 5.2.1
	Dust palliatives	C	Dust palliatives have been used to good effect during the reporting period. A new palliative campaign has just been initiated	4.2.7
Fauna and flora	Power to construction village	C	Completed during Phase 1	
	Rapidly re-establish vegetation on construction terraces	C	Fully implemented and ongoing with the planting of vegetation of the embankments, temporary stormwater channels and with the commencement of the landscaping	4.2.8
	Capture and relocation of fauna	C	Some 31 snakes, many of which were venomous, have been captured and relocated	2.2.5
	Relocation of flora	C	Completed during Phase 1	
Relocation of inhabitants	Monitor and assist government programme	CD	Requirement of ongoing monitoring and evaluation (MER) continuing	4.3.1 Appendix 6
Construction village	Aggressive HIV/AIDS preventative care programmes	C	Fully implemented and ongoing	4.2.4

Aspect/Impact	Mitigation	Project phase	Status at end of July 2002	AMR reference
	Access to basic medical treatment	C	Fully implemented and ongoing	4.2.2
	Provision of entertainment centres	C	Fully implemented	5.2.11
Local labour	Promote training	C, O	Fully implemented and ongoing	4.1.2 4.2.1
	Encourage employment of local labour	C, O	Fully implemented and ongoing	4.1.2 4.2.1
Spillage of HFO and other petroleum or pitch products	Bund walling for all storage facilities	D,O	Incorporated in the design of all facilities where the risk of spillage exists. Also extended to operational requirements for the ongoing cleaning and removal of oil contaminated material from the bunded areas	4.2.10 5.2.11
Petroleum coke and alumina dust	Coke coating	O	Implemented and ongoing with mist oil spraying on petroleum coke at source to minimise dust during handling of the coke	4.1.13
	Dust control at all transfer points	D,O	Fully incorporated in the design of the smelter	4.1.13 5.2.11
	Good housekeeping	O	Implemented and ongoing	4.1.13
Laboratory waste chemicals	Disposal by specialist company	O	Temporarily stockpiled pending the completion of the hazardous waste disposal facility	5.1.6
Dross	Recover aluminium, sell cooled dross	O	Implemented during Phase 1 and ongoing	
Spent pot linings	Construct safe storage	D,O	Completed during Phase 1	4.1.16
	Investigate appropriate disposal technologies	O	Implemented and ongoing with discussions having been initiated with Cementos de Moçambique (CDM) for the possible recycling of SPL in their cement kilns	4.1.16
Fluoride deposition and spillage	Construct storm water retention dam	D,O	Completed during Phase 1	4.1.14

Aspect/Impact	Mitigation	Project phase	Status at end of July 2002	AMR reference
	Formulate stormwater management programme	O	Completed and implemented	4.1.14
Visual impact of the smelter	Suitable matt colouring of structures	D	Implemented and ongoing	5.2.11
	Suitable lighting	D,O	Implemented and ongoing	5.2.11
	Earth berms and tree shelter belts	D,C	Implemented and ongoing	5.2.11
	Appropriate alignment of power lines	D	Completed during Phase 1	
Benefits to Mozambican economy	Active identification and realisation of opportunities aimed at improving the development of the wider economy	O, CD	Implemented and ongoing	4.1.4 4.3.2
Fluoride contaminated solid waste	Composition of all fluoride containing wastes to be verified and appropriate disposal method determined	O	Completed as part of the conceptual design of the new hazardous waste facility	4.1.16 5.1.6
	Monitor collection and disposal of all waste	C, O	Fully implemented and ongoing	5.1.6 5.2.7
Hazardous waste disposal	Treatment or disposal of class G and H:h wastes in mono-cells at the temporary landfill site in Matola once it has been permitted	O	Fully implemented and ongoing for class G (general) wastes Dedicated disposal facility has been established at the Matola landfill for class H:h (hazardous) waste, which is cemented prior to disposal. This latter practice will be discontinued once the hazardous waste facility is completed	4.1.16

Aspect/Impact	Mitigation	Project phase	Status at end of July 2002	AMR reference
	Continue discussions aimed at establishing a permanent waste disposal site for Class H:H and H:h waste	O	Completed. Approval has been granted for the construction of a properly developed hazardous waste facility in Mozambique, which will be funded by Mozal	4.1.16
	Spent pot linings to be stored in special purpose buildings until recycling methods determined	O	Implemented and ongoing with discussions having been initiated with Cementos de Moçambique (CDM) for the possible recycling of SPL in their cement kilns	4.1.16
	Stay close to developments in respect of Hillside SPL recycling via the cement industry	O		4.1.16
Fluoride emissions	Monitor ambient concentrations	O	Ambient air monitoring campaign conducted during February 2002	4.1.12 5.1.2
Sulphur dioxide emissions	Campaign measurements to establish baseline and ensure compliance	O	Ambient air monitoring campaign conducted during February 2002	4.1.12 5.1.2
Particulate matter emissions	Monitor emissions	O	Fully implemented and ongoing	4.1.11
Nitrogen oxide emissions	Monitor ambient concentrations	O	Ambient air monitoring campaign conducted during February 2002	4.1.12
Fluoride contaminated stormwater management	Implement the 3-step stormwater management strategies as recommended	O	Fully implemented and ongoing	4.1.14
	Monitor liquid effluent	O	Fully implemented and ongoing	4.1.14 5.1.4
	Controlled mixing of stormwater and cooling water blowdown	O	Fully implemented and ongoing	4.1.14

Aspect/Impact	Mitigation	Project phase	Status at end of July 2002	AMR reference
Congestion as a result of increased traffic	Traffic authorities to monitor road intersections	O	This will be addressed during the next reporting period as the volume of materials increases with the commissioning of the Aluminium Expansion Project	4.1.18
	Review effectiveness of traffic signals	D, O	The haulage route between the smelter and the harbour has been fully upgraded with the necessary traffic signals, visibility and lane demarcation and forewarning	4.1.18
Decrease in traffic safety	Speed control	O	Fully implemented on Mozal vehicles, and ongoing	4.1.18
	Improved visibility	O	The haulage route between the smelter and the harbour has been fully upgraded with the necessary traffic signals, visibility and lane demarcation and forewarning	
	Lane demarcation and forewarning	O		
	Vehicle Roadworthiness	O	Fully implemented and ongoing	4.1.18
	Enforcement of traffic rules	O	Fully implemented and ongoing	4.1.18
	Mozal drivers to attend safe driving programme	O	Fully implemented and ongoing	4.1.18
Noise from construction equipment in the port	All equipment in good working order	C	The noise management philosophy during the Aluminium Expansion Project has been one of monitoring noise on the site perimeter, with a view to further implementing the requirements listed here should they have proved necessary	4.2.9 5.2.2
	Operate equipment within its specification and capacity	C		
	Operate equipment with appropriate noise abatement accessories	C		
	Operate equipment in diversified manner	C		
	Turn equipment off when not in use	C		
	Position equipment in sheltered locations	C		

Aspect/Impact	Mitigation	Project phase	Status at end of July 2002	AMR reference
	Utilise partly finished buildings to accommodate equipment	C		
	Carefully select times for equipment use	C		
Noise from increased haulage operations	Technical solution, viz. noise barrier	D	Investigation into the noise barrier has been completed. The noise barrier will be established during the next reporting period	4.2.9
	Voluntary relocation	C	Will not be pursued given the decision to establish the noise barrier	4.2.9
	Monitoring of noise and vibration	C	This was conducted as part of the investigation into the development of the technical solution	4.2.9 5.2.2
Cumulative noise	Disable exhaust brakes	O	Fully implemented and ongoing	4.1.18
	Maintain vehicles to ensure that noise abatement devices are in good working order	O	This will be implemented together with the implementation of the noise barrier.	4.1.18 4.2.9
	Educate truck drivers	O	Fully implemented and ongoing	4.1.18
Noise	Monitor ambient noise during smelter operations	O	Noise monitoring campaign conducted during December 2001.	4.1.17
Cumulative vehicle emissions	Keep vehicles well maintained	O	Fully implemented and ongoing	4.1.18
	Encourage authorities to enforce stricter roadworthiness control of vehicles	O	These requirements will be further investigated during the next reporting period. Please note that the requirement for stricter roadworthiness specified here applies to Mozambican road traffic in general and not to Mozal vehicles	
	Authorities should also ensure that motor vehicle emission legislation be strengthened and enforced	O		

Aspect/Impact	Mitigation	Project phase	Status at end of July 2002	AMR reference
	Investigate, together with the Mozambican government the possibility of monitoring CO and NO_x (Coordinate with TRAC)	O		
Job opportunities, improvement in skills base and business opportunities for local Mozambican companies	Give preference to local Mozambican workers	C, O, CD	Fully implemented and ongoing	4.1.1 4.1.2 4.2.1
	Provide training for workers	C, O, CD	Fully implemented and ongoing	4.1.1 4.1.2 4.2.1
	Improved procurement empowerment strategy for Phase 2	C,O	Fully implemented and ongoing	4.1.1 4.2.1
	Monitoring	O, CD	Fully implemented and ongoing	4.1.1 4.2.1
	Initiate a small and micro enterprise programme	CD	Fully implemented and ongoing	4.3.2
Increase in HIV/AIDS and sexually transmitted diseases and malaria	Continue with malaria control programmes and HIV/AIDS awareness on site	C, O, CD	Fully implemented and ongoing	4.1.20 4.2.4 4.2.5 4.2.13 4.3.7
	Continue with malaria control programmes and HIV/AIDS awareness in surrounding communities	CD	Fully implemented and ongoing	4.3.4 4.3.7

Aspect/Impact	Mitigation	Project phase	Status at end of July 2002	AMR reference
Secondary impacts such as land alienation, an increase in conflict in households and a reduction in levels of poverty	Work with Mozambican government to encourage the communication and implementation of the Boane District Planning Framework to ensure that secondary impacts are mitigated	CD	Efforts in this regard have been initiated to assist the Mozambican government in enhancing district planning skills within the relevant authorities	4.3.9
	Initiate a programme to support NGOs that can support vulnerable community groups	CD	Fully implemented and ongoing	4.3.4
	Maintain ongoing community liaison	C, O CD	Fully implemented and ongoing	4.1.10 4.1.19 4.2.6
Resettlement for the Beluluane Industrial Park	Support Mozambican Government to continue to implement agricultural development and village management programmes	CD	Fully implemented and ongoing	4.3.7
	Continue with 4-year monitoring and evaluation programme	CD	Fully implemented and ongoing	4.3.1

Aspect/Impact	Mitigation	Project phase	Status at end of July 2002	AMR reference
Significant events	Report on all environmental and social events that may have caused damage; brought about injuries or fatalities or other health problems; attracted the attention of outside parties; affected project labour or adjacent populations; affected cultural property; or created Mozal liabilities	All	Fully implemented and ongoing	Section 2
Occupational health and safety	Occupational health and safety programmes	C,O	Fully implemented, ongoing and reviewed with a view to continuous improvement	4.1.5 4.2.2
	Monitor, record and report occupational health and safety incidents and workplace conditions	C,O	Fully implemented, ongoing and reviewed with a view to continuous improvement	4.1.5 4.2.2 5.1.5 5.2.6
	Monitor total lost time accidents	C,O	Fully implemented and ongoing	2.1.4 2.2.3 5.1.5 5.2.6
	Monitor total manhours worked	C,O	Fully implemented and ongoing	2.1.4 2.2.3
Ongoing public consultation and disclosure	Track print or broadcast media attention given to Mozal	C, O	Fully implemented and ongoing	2.1.10 2.2.10
	Track interactions with NGOs or public scrutiny of Mozal	C, O	Fully implemented and ongoing	4.1.7 4.3.4
	Pursue training and management initiatives	C, O	Fully implemented and ongoing	4.1.2 4.2.1

Aspect/Impact	Mitigation	Project phase	Status at end of July 2002	AMR reference
	Effect public relations	C, O	Fully implemented and ongoing	4.1.9 4.2.6
	Complaints register	C, O	Fully implemented and ongoing	4.1.10

APPENDIX 1

BHP BILLITON HSEC CONSEQUENCE SEVERITY RANKING TABLE

APPENDIX 1

Significant Incident Reporting & Distribution Procedure

Low	Minor	Moderate	Major	Critical
Level 1	**Level 2**	**Level 3**	**Level 4**	**Level 5**
Injury and Disease				
Low level short- term subjective inconvenience or symptoms. No measurable physical effects. No medical treatment.	Objective but reversible disability/impairment and/or medical treatment **injuries** requiring hospitalisation.	Moderate irreversible disability or impairment (< 30%) to one or more persons.	Single fatality and/or severe irreversible disability or impairment (> 30%) to one or more persons.	Short or long term health effects leading to multiple fatalities, or significant irreversible human health effects to >50 persons.
Environmental effects				
No lasting effect. Low- level impacts on biological or physical environment. Limited damage to minimal area of low significance.	Minor effects on biological or physical environment. Minor short- medium term damage to small area of limited significance.	Moderate effects on biological or physical environment but not affecting ecosystem function. Moderate short- medium term widespread impacts (eg. oil spill causing impacts on shoreline).	Serious environmental effects with some impairment of ecosystem function (eg. displacement of a species). Relatively widespread medium- long term impacts.	Very serious environmental effects with impairment of ecosystem function. Long term, widespread effects on significant environment (eg. unique habitat, National Park).
Social/cultural heritage				
Low- level social or cultural impacts. Low-level repairable damage to commonplace structures.	Minor medium- term social impacts on local population. Minor damage to structures/ items of some significance. Minor infringement of cultural heritage.	Ongoing social issues. Permanent damage to structures/items of cultural significance, or significant infringement of cultural heritage/sacred	On- going serious social issues. Significant damage to structures/items of cultural significance, or significant infringement and disregard of	Very serious widespread social impacts. Irreparable damage to highly valued structures/items/locations of cultural significance. Highly offensive infringements of

	Mostly repairable.	locations.	cultural heritage.	cultural heritage.
Community/government/media/reputation				
Public concern restricted to local complaints. Ongoing scrutiny/attention from regulator.	Minor, adverse local public or media attention and complaints. Significant hardship from regulator. Reputation is adversely affected with a small number of site focused people.	Attention from media and/or heightened concern by local community. Criticism by NGOs. Significant difficulties in gaining approvals. Environment credentials moderately affected.	Significant adverse national media/public/NGO attention. May lose licence to operate or not gain approval. Environment/management credentials are significantly tarnished.	Serious public or media outcry (international coverage). Damaging NGO campaign. Licence to operate threatened. Reputation severely tarnished. Share price may be affected.
Legal				
Low- level legal issue. On-the- spot fine. Technical non-compliance. Prosecution unlikely.	Minor legal issues, non-compliances and breaches of regulation. Minor prosecution or litigation possible.	Serious breach of regulation with investigation or report to authority with prosecution and/or moderate fine possible	Major breach of regulation with potential major fine and/ or investigation and prosecution by authority. Major litigation.	Investigation by authority with significant prosecution and fines. Very serious litigation, including class actions.
Operational impact (safety, health environment related incidents)				
Easily addressed or rectified by immediate corrective action. No loss of production. No damage to equipment.	Minor or superficial damage to equipment and/or facility. No loss of production.	Moderate damage to equipment and/or facility. Loss of production <one week.	Major damage to facility requiring significant corrective/ preventative action. Loss of production <six months.	Future operations at site seriously affected. Urgent corrective/ remedial action. Loss of production >six months.
Total Estimated Cost (inclusive of all safety, health and environment related costs eg: potential clean- up, corrective actions, fines, liabilities)				
<US$ 10 000	US$ 10 000 to $100 000	US$ 100 000 to $1M	US$ 1M to $10M	>US$ 10M

Shaded areas describe actual or potential outcomes of *Significant HSEC Incidents* under this procedure

APPENDIX 2

BHP BILLITON REQUIREMENTS FOR CLASSIFICATION OF ACTIVITIES AND INCIDENTS

APPENDIX 2

BHP BILLITON REQUIREMENTS FOR CLASSIFICATION OF ACTIVITIES AND INCIDENTS

Activities have been divided into 3 separate categories: controlled, monitored and uncontrolled. The following provides details of each category and their respective requirements for reporting.

CONTROLLED ACTIVITIES

Controlled Activities shall be recorded in BHP Billiton Statistical performance. These are activities where BHP Billiton can set HSEC standards and directly supervise and enforce their application. Incidents are reported and investigated in accordance with BHP Billiton requirements.

Examples include:

- Work-related activities within site boundaries
- Transfer of plant and equipment whilst on direct hire to BHP Billiton inside and outside Site Boundaries (e.g. rig moves)
- Aircraft chartered by the Company or a nominated Contractor
- Company provided transport carrying out work related activities outside site boundaries
- Company employees and contractors participating on Company sponsored work-related training courses outside site boundaries
- Company employees working at locations, which are outside site boundaries (e.g., visiting contractors office).

MONITORED ACTIVITIES

Monitored Activities are reported and investigated in accordance with the company requirements but are not included in the statistical safety performance of BHP Billiton. These are activities where BHP Billiton can influence but cannot set HSEC standards and cannot directly supervise and enforce their application.

Examples include:

- Contractor and sub-contractor activities outside site boundaries
- Contractor and sub-contractor crew change activities outside site boundaries
- Contractor and sub-contractor transfer or delivery of goods to site
- Contracted marine management services, where provided under an internationally recognised form of agreement
- Non-work related activities within site boundaries (e.g. gym).

UNCONTROLLED ACTIVITIES

Uncontrolled activities are not reported, investigated or monitored. These are activities where BHP Billiton does not set or influence HSEC standards and does not supervise HSEC performance.

Examples include:

- Non-work related activities outside site boundaries.
- Contracted marine freight services, where provided under internationally recognised form of charter party.

APPENDIX 3

INCIDENT REPORT
FAILURE OF THE MOZAL FUME TREATMENT CENTRE COOLING TOWER

APPENDIX 3

PART 1 NOTIFICATION

Description of Incident: *(Who, what, how, when)*
A failure of the upper section of the Cooling Tower of the Fume Treatment Centre was detected. A hole of approximately one metre in diameter was observed with metal thinner than parent metal for an area of approximately 2 square metres of the tower in the vicinity of the hole.

Details of Injury/Damage/Impact: *(Nature and extent of injuries/damage/impact)*
The cause of the thinning of the steel shell was chemical corrosion. As the cooling tower is integral to the operation of the scrubbing process, the Fume Treatment Centre was on bypass for a period of 62 days.

Immediate Actions Taken:
A new 11 metre section of the tower was built to replace the affected area. The repairs were completed by 11/10/01 but the unit was not operational until 16:00hours on 16/11/01 due to an illegal industrial action.

Incident Date:	**5/09/01**			**Incident Time:**	**18:00**
CSG:	Aluminium	**Site:**	Mozal	**Country:**	Mozambique
Employee or Contractor Incident?	N/A				
Does a site standard or procedure exist to control this risk? Yes/No	Yes.				
Actual Consequence Severity Rating: *(Incident type and rating)*	2	**Potential Consequence Severity Rating:** *(Incident type and rating)*	3		

PART 2 INVESTIGATION FINDINGS

Status of Investigation? Preliminary/Final	Ongoing

Basic Causes: *(Why did the incident occur?)*	**Contributing Factors:** *(Additional causal factors)*
The cause of the thinning of the steel shell was chemical corrosion. Cooling water droplets reacted with baking furnace exit gas to create an acid solution that impacted on the vessel wall rather than be evaporated which is the requirement. The acid attack occurred rapidly after water rates were increased progressively in the preceding months in an attempt to achieve the desired gas outlet concentrations as per specification.	

Permanent Corrective Actions Taken: *(Actions taken to prevent a recurrence)*	**Key Learnings:** *(Summary of principal learnings from incident)*
Modifications were made to the gas inlet ducting (to improve the gas flow distribution) and an acid resistant coating was installed to the inside of the tower (to minimise the impact if further issues were to arise). Some minor action items include improved entry of part numbers for new stock items and gauge capability test for all condition monitoring equipment.	

Photographs: *(Insert photographs below)*

Figure 1: Corrosion on the damaged section affected the walkway structure as well as the shell.

Figure 2: The corroded area of the Cooling Tower.

Figure 3: Scaffolding structure erected to support the Cooling Tower once the corroded area was discovered.

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APPENDIX 4

INCIDENT REPORT
TRANSFORMER OIL SPILLAGE

APPENDIX 4

Transformer Oil Spillage in the former SLE Warehouse external lay-down area

PART 1 NOTIFICATION

Description of Incident: *(Who, what, how, when)*
Approximately 6,720 liters of oil leaked into the soil in the Mozal Phase 1 construction store compound (north east of the site) due to leakage from a damaged valve.

Details of Injury/Damage/Impact: *(Nature and extent of injuries/damage/impact)*
On approximately the 27 August 2001, a message was given that a spare 5MVA, 66/11-22kV transformer (T2633) had a damaged oil valve. An immediate investigation found that the main drain ball valve had been completely broken off and that a piece of cloth had been jammed into the hole to stop the oil from leaking. There was some sign of a spill, but, due to equipment being closely packed around the area, it was considered that the leak was minor.

Immediate Actions Taken:
On 30 August 2001, the broken valve flange was removed and the drainpipe blanked off to stop any further leakage. On 21st September 2001, the transformer was moved to another location to be used as a spare for Substation 23. It was discovered that there was considerable loss of oil from the unit. Some 6,720 were added to the transformer to refill the contents. It is assumed this was the quantity that leaked from the unit. By 23rd November 2001, all equipment had been removed from the area where the transformer was originally located. An area of 15m x 8m was contaminated by the spill.

Incident Date:	UNKNOWN			**Incident Time:**	UNKNOWN
CSG:	Aluminium	**Site:**	Mozal	**Country:**	Mozambique
Employee or Contractor Incident?	**Unknown**				
Does a site standard or procedure exist to control this risk? Yes/No	Yes				
Actual Consequence Severity Rating: *(Incident type and rating)*	2		**Potential Consequence Severity Rating:** *(Incident type and rating)*		3

PART 2 INVESTIGATION FINDINGS

Status of Investigation? Preliminary/Final	**Final**

Basic Causes: *(Why did the incident occur?)*	**Contributing Factors:** *(Additional causal factors)*
Oil valve at base of transformer was hit by another object such as a forklift or equipment which was moved close to the transformer.	

Permanent Corrective Actions Taken: *(Actions taken to prevent a recurrence)*	**Key Learnings:** *(Summary of principal learnings from incident)*
	(a) raise incident report immediately of any spill (irrespective of the extent) and investigate thoroughly (b) store goods containing fluids remote from other goods in an area that could contain spills (if they do occur) (c) ensure there is a MSDS for any fluids or gases used on site (d) clarify roles and responsibilities between BPT/SLMR and MOT for all shared areas

Photographs: *(Insert photographs below)*

Figure 1: The oil-contaminated area.

Figure 2: The site under rehabilitation.

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APPENDIX 5

MOZAL EXPANSION PROJECT
MONITORED INCIDENT

APPENDIX 5
MOZAL EXPANSION PROJECT MONITORED INCIDENT

Description of the Incident

At 19h10 0n 24 April 2002, a 7-ton Mercedes truck was being used to transport employees of John Sisk (a MSEP building contractor) from the project construction site. The truck collided with a section of ducting for the Gas Treatment Centre (GTC) which was being transported as an abnormal load, en-route from South Africa to the project construction site. The collision took place some three kilometres from the site entrance and occurred in conditions of darkness.

The Sisk truck was transporting 18 employees, including the driver, after an extended shift, from their workplace to their residence in the Matola area, approximately 10km away. It was fitted with bench seating and a canvas canopy. Fifteen of the employees were seated in the back of the vehicle.

The abnormal load vehicle was travelling in the opposite direction towards the site on the secondary access road and was escorted by a vehicle under police supervision. As a result of the shape of the load, a section of the duct was protruding 1.29m from the side of the vehicle and into the oncoming lane.

The driver of the John Sisk truck was unable to see the protruding section of the load early enough to take full avoiding action. Although the driver swerved, the protruding piece of the duct struck the wing mirror of the cab and the side of the truck. Six passengers who were seated on the right hand side, in the back of the vehicle, were also struck by the load. Three of the injured died at the scene of the accident. The three other injured were transported to the Maputo Central Hospital, where two died from their injuries. The third injured person suffered a dislocated collarbone and was taken for treatment to the Sommerschield Clinic in Maputo that night. The table below contains the names of the deceased.

Names of fatally injured John Sisk employees.

Name	Project Identification Number	Date of Birth
Costa Manual Nhoade	M20310419	1970-07-04
Bernardo August Tomocene	M20310446	1972-02-02
Nelson Isaque Machoma	M20106368	1952-06-02
Gondo Gambulene	M20310437	1956
Assuncao Maconde Cabudura	M20310444	1945

Findings

Immediate Cause

The immediate cause of the accident was the driver of the Sisk truck not seeing the section of duct that protruded from the abnormal load vehicle into the oncoming lane of traffic.

Contributing Factors

The following factors contributed towards the immediate cause of the accident and subsequent fatalities of the occupants:

- Moving the abnormal load in the dark and in an unilluminated condition.
- The escort vehicle that travelled directly in front of the abnormal vehicle failed to prevent the Sisk truck from hitting the protruding extremities of the load.
- The escort vehicle and the abnormal load vehicle failed to keep sufficient distance between them to facilitate road user response.
- The yellow flashing lights on both the escort vehicle as well as the abnormal load vehicle was associated with construction vehicles that frequent the secondary access road, and not an abnormal load.
- The Sisk vehicle structure did not protect the occupants in the back of the vehicle;
- The Project Emergency Response was not informed of the accident first. This may have prevented the deaths of two of the injured.

Organisational Factors

The basic or root causes in terms of poor management policies, processes and procedures have been identified as follows:

- As a result of a complex and bureaucratic system in order to obtain permits, shortcuts were agreed in the permitting procedures. This resulted in further shortcutting of the authorities when under time pressures.
- No guidelines on the transport and escorting of abnormal vehicles is available in Mozambique
- Tolerance from the driver to proceed in hazardous situations and blatant disregard for the principle 'If it is unsafe, don't do it'
- The decision to maximise off-site fabrication without specifying specific risk management mitigations for all contractors (including turnkey contractors).
- Constructability/transportability review did not or was not carried out to identify hazards associated with flange placement in the ducting system.
- Poor emergency procedures, planning and communication within the Southern African transport industry

Corrective Actions

Immediate Corrective Actions

Resulting from a preliminary enquiry on the 25 April and a project management meeting shortly thereafter, the following immediate corrective actions were taken.

- A complete risk assessment to be conducted on all abnormal loads before transportation commences from the point of origin:
- All abnormal loads are to be authorised and covered by a valid abnormal load transit permit which has to be in the possession of the driver at all times;
- All abnormal loads are to escorted by at least two escort vehicles which are to be suitably identified, one in front and one behind the load. These escorts are In addition, to any escort that may be provided by provincial or national government traffic agencies;
- No transporting of loads in hours of darkness or in inclement weather are allowed, unless specifically authorised to do so by SLMR;
- All projections from the side of the vehicle which may pose a risk to other road users and or pedestrians are to be suitably identified;
- A pre-dispatch vehicle and load inspection sheet must be completed before dispatch at point of origin and handed in at the Customs Department on arrival at site.
- As part of the risk assessment, transporting contractors have been requested to ensure contingency planning has been built into the risk assessment, taking cognisance of communication, emergency lights etc.
- Copies of correspondence, sketches and permits must be forwarded to the SLMR logistics department for review prior to a load being transported. This must be done at least 7 days prior to the load being shipped.

Recommendations

The following recommendations are derived from this enquiry. These recommendations are applicable to the Aluminium Expansion Project and could benefit other BHP Billiton operations and projects.

1. The current standard for transport of project personnel to be reviewed. This review is to include bussing and other contractor provided vehicles. As BHP Billiton does not currently have a standard for the transport of personnel, the project is to provide input for the development of a best practice.
2. Standards and Procedures for the escorting of abnormal loads to be reviewed along with the role and responsibilities of police with the objective of establishing a project wide standard as a minimum. This is to be done for RSA, Swaziland and Mozambique.
3. A risk management programme for abnormal loads to be implemented from source to destination. This needs to be integrated in the overall project risk management programme. South African and worldwide abnormal road transport best practices to be evaluated and used as required.
4. A co-ordination working group to be set up with Mozambican authorities to improve the effectiveness and safety performance of abnormal loads services delivery.
5. The adequacy of abnormal load permitting procedures in RSA, Swaziland and Mozambique to be investigated to establish a minimum project wide standard.
6. The procurement approach for subcontracting abnormal load transport responsibilities to turnkey contractors and suppliers to be reviewed.

7. A database for reporting and analyzing transportation incidents to be developed and maintained and action plans to be developed to address any highlighted issues.
8. Communicate clinic availability for emergency response and initial stabilization of Project related personnel prior to casevac or transport top local Mozambican health care facilities.
9. Accelerate implementation of additional safety initiatives programme to address Mozambican cultural/behavioural issues.

Significant Learnings

The following items are considered to be the key learnings from the investigation that could be used throughout the BHP Billiton Group to reduce the risks of similar accidents.

1. Transport of Project Personnel

The investigation highlighted the need for a review of project standards in relation to the transport of project personnel. It is debateable as to whether the use of a converted truck, rather than a bus, had any bearing on the level of injury sustained in this particular accident however, the investigation team concluded that the standards should be reviewed. It did not prove possible to find any BHP Billiton best practice guidelines for use in large projects.

It is therefore recommended that BHP Billiton establishes best practice guidelines for transport of project personnel which can be used by future projects. It is important that such guidelines take account of the third world environment in which many projects operate.

2. Transport of Abnormal Loads

The investigation highlighted the fact that the legislation applying to the transport of abnormal loads varies greatly from country to country and the application of safe working methods is also highly variable. This was particularly relevant in relation to escorting services and the role of the police.

It is therefore recommended that BHP Billiton establishes best practice guidelines for transport of abnormal loads which can be used by future projects. Again, it is important that such guidelines take account of the third world environment in which many projects operate.

3. Risk Management

Although the project has a well-developed risk management programme, the safety related risks of abnormal load transport had not been identified. This occurred mainly because the transport had been contracted outside of the normal project area of control.

It is therefore recommended that BHP Billiton ensures that abnormal load transport be included in the risk management programme for all future projects.

4. Area of Control of Project Management

Perhaps the most important of the learnings for the Group is in regard to deciding where in the contracting chain the management team of the project should exercise direct control.

In this particular event a decision was taken to include transport of material into all turnkey contracts and certain purchase orders. This is a normal contracting practice. As a result, the project relied on the contractor to implement safe working procedures which failed to happen. One of the positive outcomes of the investigation was that wherever the project was exercising direct control, appropriate procedures were in place and were being followed. This has resulted in the project team deciding to move the point of control for abnormal transport.

This philosophy of course applies to a wide variety of issues in any large project and the decision of where to exercise direct control and where to contract out a responsibility is very complex.

In the recent past the BHP Billiton Group appears to have widened its perspective in relation to HSEC incidents and common practices of the past may no longer be appropriate. Therefore, in order to assist future project teams in developing their project execution plan it is recommended that BHP Billiton establishes best practice guidelines for contracting strategy in relation to where in the contracting chain should direct control be exercised by project management.

APPENDIX 6

EXECUTIVE SUMMARIES FROM THE LAST TWO RESETTLEMENT EVALUATION AND MONITORING REPORTS

APPENDIX 6

EXECUTIVE SUMMARIES FROM THE LAST TWO RESETTLEMENT EVALUATION AND MONITORING REPORTS

Year 2 Field Visit 3.

Water supply to N'Kala Village and Mussumbuluco

Mozal water deliveries to N'Kala Village are continuing and residents appear to have sufficient water supply. However, as indicated previously, this only serves to address the symptom and not the cause of the problem.

Although it was previously reported that water supply to Mussumbuluco had improved, it has since deteriorated sharply to a point, where there are protracted periods of no supply. Residents in Mussumbuluco have no alternative but to purchase water from private well owners.

The problems of inconsistent water supply to N'Kala Village and Mussumbululo are perennial with Aqua de Mocambique seemingly unable to fulfil its mandate satisfactorily. Importantly, this problem is not unique to the two resettlement areas but one that is experienced throughout Maputo and, indeed, throughout the country.

The situation has not changed. If anything, the frequency of supply to Mussumbuluco has decreased as shown by an increase in expenditure on water purchased privately. In terms of N'Kala Village, water delivery by Mozal is commendable but unlikely to be sustainable. Hence, it is critical that Aqua de Mocambique fulfils its mandate, recognising that, as part of the redevelopment of the country's social infrastructure, this will probably occur in the medium- to long-term. Responsibility: Aqua de Mocambique.

Potential crop losses

Despite indications to the contrary, crop yields for the current summer period were not as low as expected (due to unfavourable weather (late and heavy rains followed by a hot and dry spell)). Indeed, unconfirmed preliminary field returns indicate an average yield of 1.9 tonnes/ha albeit it within a range of 100 kg/ha to 2.6 tonnes/ha. Where low crop yields were produced, this is not unique to resettled farmers. On the contrary, poor crop yields are affecting all farmers in Southern Mozambique. A serious consequence could be food shortages during winter. In terms of resettled farmers, measures to alleviate the potential food shortage are the planting of winter crops or crops with a short maturation period.

In discussions with members of the Bematchome Farmers' Association it was indicated that their yields were substantially better than elsewhere in the general area. Members of the Bemachome Farmers' Association appear to have reaped sufficient harvest to obviate the necessity of purchasing additional maize or groundnuts. Winter crops and late variety maize have been planted by farmers to supplement the poor yields. The planting of winter crops has been undertaken under the auspices of the Agricultural Development Programme of the MCDT from which extension support will be provided.
Responsibility: Bematchome Farmers' Association and Agricultural Development Programme.

Land re-occupation in Zone B

For the most part, the Mozal smelter occupies the original Zone B for which compensation has been paid and from which machamba users have been resettled. However, to the east of the primary access road is a small portion of the original Zone B which, for the past three years, has been lying fallow. In recent time, machamba farmers have moved onto the land and have commenced farming.

Further investigation revealed that the land being re-occupied is limited to the sloped area towards the Matola River. The area is not earmarked for development and part of it falls within the Green Belt buffer zone along the river. The Buffer Zone forms part of the Territorial Ordinance Plan for the area, the implementation of which is vested with the District Administration. Therefore, re-certification of land occupation within the Green Belt Buffer Zone is a matter deserving attention of the District Administrator.
Responsibility: Boane District Administrator.

Resettler sense of ownership

Resettled households in N'Kala Village have not yet received house title certificates for their homes. (This has occurred for Mussumbuluco residents). It would appear that the formalised sense of ownership plays a big role in households accepting responsibility for house maintenance. Indeed, residents in N'Kala Village still hold the perception that Mozal is responsible for maintaining their houses. Therefore, the issuing of house title certificates to N'Kala Village residents should be addressed soonest.

The issue has been raised with the MCDT who can only play a facilitative role with the Boane District Administrator. However, between Field Visits 3 and 4, there has been no progress.
Responsibility: Boane District Administrator.

Year 2 Field Visit 4

The four key issues arising from the Year 2 Field Visit 3 remain. These will not be repeated but, for completeness, are listed below:

- Water supply to N'Kala Village and Mussumbuluco.
- Potential crop losses.
- Land re-occupation in Zone B.
- Resettler sense of ownership.

For each of the above, commentary arising from Field Visit 4 is provided in italics.

In addition, during Year 2 Field Visit 4, a fifth key issue was identified. This is discussed below.

Land occupation in Mavoco

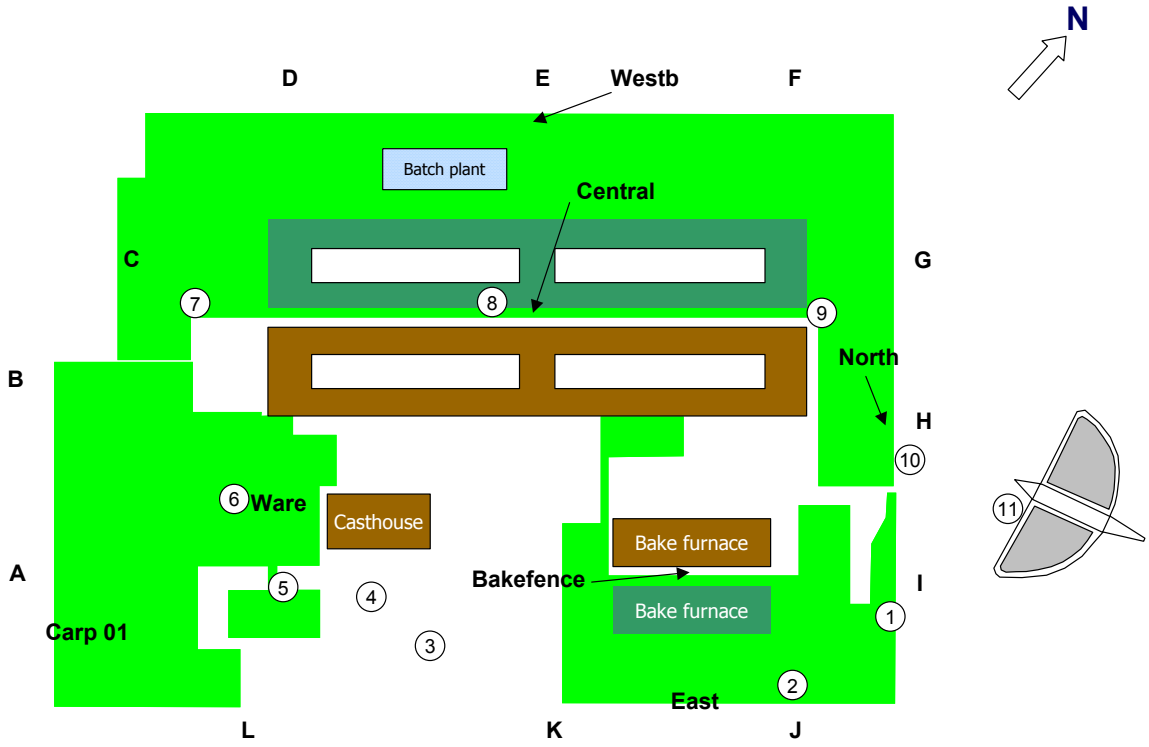
At present, approximately 70 machambas in Mavoco (Zone I (2)) are being farmed by people to whom the land was not allocated. These people have moved onto unoccupied land that was bush-cleared and roamed at the GOM's cost, for allocation to farmers who were displaced by Mozal activities. The matter has been brought to the attention of the Djuba Chefe de Posto and is being investigated. This is a serious matter as, should these people be allowed to continue their occupation and use of machambas to which they are not entitled, no tenure security will exist, thereby hampering any future proposed development of the Beluluane Industrial Park. Indeed, such a precedent could seriously hamper any future development and even call into question the tenure security of resettled people in Zones I (1) and I (2) legally occupying and farming machambas allocated to them by the GOM. Responsibility: Djuba Chefe de Posto, Boane District Administrator and Provincial Governor.

APPENDIX 7

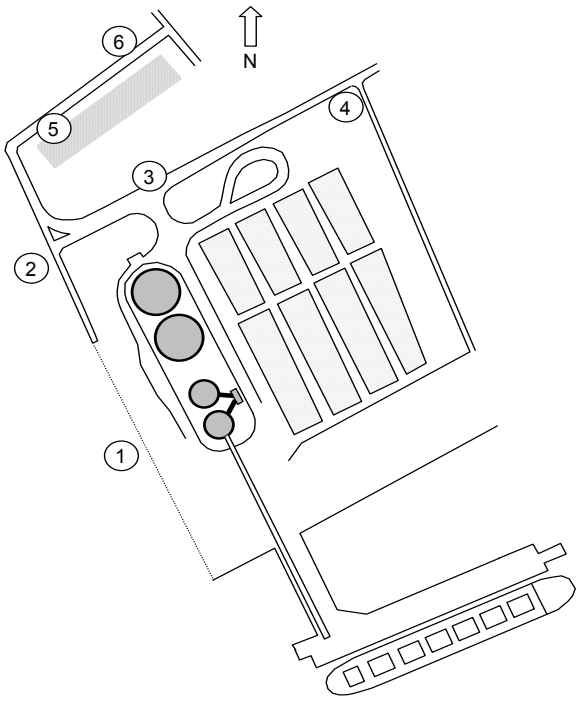
NOISE MONITORING POINTS AT THE MOZAL SMELTER SITE AND HARBOUR FACILITY

APPENDIX 7

Noise Monitoring points at the Mozal Smelter Site and Harbour Facility



Monitoring points at the smelter site – Numbers in circles indicate the noise monitoring ports used during the December 2001 campaign by Mozal Operations. The monitoring points indicated by a capital letter were used by the Aluminium Expansion Project.



Monitoring points at the Harbour – points 1, 2, 5 and 6 used by Mozal Operations. Points 3 & 4 used by the Aluminium Expansion Project.