

STANDER, M., SOLOMON, V.J., and MACNULTY, N. Converting Anglo Platinum mines from capped fuse and igniter cord blast initiation systems to shock tube based blast initiation systems. *Third International Platinum Conference 'Platinum in Transformation'*, The Southern African Institute of Mining and Metallurgy, 2008.

# Converting Anglo Platinum mines from capped fuse and igniter cord blast initiation systems to shock tube based blast initiation systems

M. STANDER\*, V.J. SOLOMON†, and N. MACNULTY†

*\*Anglo Platinum*

*†Victor Solomon and Associates*

Anglo Platinum has made the decision to convert to shock tube blast initiation systems from the capped fuse and igniter cord systems, at present in general use. Safety of persons is the main driver for this decision, with the overriding objective of eliminating fatal accidents and serious injuries that could be attributed to blast initiation systems.

This paper reviews the structured process followed to assess the significant technical and financial risks presented by a project of this magnitude

Safety and regulatory issues have taken precedence, followed by an evaluation of the financial implications and a comprehensive technical and commercial review of each of the potential suppliers; detailed technical and commercial reviews of each were undertaken and presented in the format of a 'balanced scorecard'. Shock tube technology has been available since the late 1970s and has been successfully implemented in most overseas mining operations. Although the benefits from the use of shock tube have long been recognized, the cost of conversion has been considered prohibitive, being more than double that of capped fuse and igniter cord. Changes in the international market have substantially lowered the cost of shock tube assemblies in relation to fuse and igniter cord to the extent that the difference is now less than 30% in unit costs and more economically viable to adopt.

## Introduction

Anglo Platinum has made the decision to convert to Shock tube blast initiation systems from the capped fuse and igniter cord systems, at present in general use.

Safety of persons is the main driver for this decision, with the overriding objective of reducing and, if possible, eliminating fatal accidents and serious injuries that could be attributed to blast initiation systems.

A third party consultant was commissioned by Anglo Platinum to undertake a 'due diligence' review and to provide a comprehensive evaluation of the intended conversion process.

A modular approach has been adopted and each of the main issues sub divided into relevant topics.

Safety and regulatory issues have taken precedence, followed by an evaluation of the financial implications and a comprehensive technical and commercial review of each of the potential suppliers. Finally, the change management process has been addressed to develop a structured and controlled implementation process.

The results of the detailed technical and commercial reviews of each of the suppliers are summarized and presented in the format of 'balanced scorecards'. Evaluation assessments presented on these scorecards were underpinned by the comprehensive 'technical files' compiled and submitted by the suppliers.

If it was considered necessary, follow-up visits to factories and meetings with suppliers were arranged, to resolve any outstanding technical or commercial details.

Some concerns were voiced as to the quantity of shock tube assemblies that would be available to Anglo Platinum in the short term. However, the capacities quoted by the suppliers in their tender submissions, indicate more than sufficient availability in the first year and possible oversupply thereafter.

Although only three major suppliers tendered at the time, indications are that the South African market is perceived as significant enough to be considered for major investment and establishment of manufacturing facilities for shock tube assemblies, by at least two more multinational corporations.

Shock tube technology has been available since the early 1980s and has been successfully implemented in most overseas mining operations. Suitable products for the local market were developed by local suppliers and have been available since the 1980s. Following the ending of the sanctions era in 1994, the local market for explosives has become exposed to the multinational explosives manufacturers and suppliers.

Previously the cost of shock tube assemblies was prohibitive, being more than double that of capped fuse and igniter cord, even though the benefits from the use of shock tube had been conclusively established. However, some disagreement exists by mining professionals on performance benefits of advance per blast and fragmentation.

Market forces have driven the prices for shock tube assemblies substantially lower, to the point of their being less than 30% more expensive than capped fuse and igniter cord systems. It is anticipated that this gap could be even

further reduced with the introduction of improved manufacturing facilities.

The effect of the above is to make the conversion from capped fuse and igniter cord systems to shock tube assemblies far more viable, taking into account the potential impact on safety and productivity.

### **Project mandate**

The project mandate handed to the project team was as follows:

- Convert Anglo Platinum to a safer explosives initiation technology that will contribute towards a step change in the reduction of misfires and a consequent reduction in risk to employee safety
- Contract with competent suppliers of shock tube assemblies, who comply with the Anglo Platinum user requirement specifications
- Develop an implementation strategy in consultation with all stakeholders with no disruption to safety or production

## **Review of explosives related safety issues and accident statistics**

### **Misfired detonators**

The safety of detonators in their 'manufactured state' is attested by the rigorous design and safety testing requirements and quality control programmes that are implemented by the major manufacturers and suppliers.

It can be clearly seen that the detonators are safe to transport, safe to handle and safe to deploy.

Misfired detonators, however, are in an unknown condition and must at all times be considered to be potentially in an extremely hazardous condition.

The prime objective therefore, must be to limit the number of misfires to an absolute minimum and reduce the probability of an accident while handling a misfire.

The probability of misfires is technology related and has been well characterized by the manufacturers on the one hand and the users' experience on the other hand.

Based on 38 million holes blasted per annum (base date 2006) on Anglo Platinum mines, the following number of misfires would be a conservative estimate:

- Capped fuse and igniter cord:
  - As quoted by manufactures—15 200 misfires (0,04%) 1:2500
  - As deployed—1.14 million misfires (3%) including cut offs.
- Shock tube assemblies:
  - As quoted by manufactures—780 misfires (0,002%) 1:50 000
  - As deployed—380 thousand misfires (1%) including cut-offs

From the above estimates and taking into account that these are not absolute statistics, a reasonable assumption would be that the potential number of misfires for capped fuse could be reduced by as much as 70% using shock tube assemblies.

### **Safety issues and statistics**

Safety of persons associated with the use of explosives and in particular, detonators and initiators is of paramount importance. This section of the paper is a review of the safety of detonators as manufactured and supplied into the

mining industry, together with an analysis of explosives related injuries and fatalities that have occurred over the past 10 years according to statistics supplied by the Department of Minerals and Energy for the period 1996 to 2006.

### ***Legal responsibilities of suppliers and employers***

In terms of the Mine Health and Safety Act (Section 21), suppliers have a legal obligation to ensure that their products are safe to use in or at a mine.

This implies that in the course of a legal investigation into an accident at a mine (fatal or reportable), it is found that the product of a supplier was defective and contributed to, or was the cause of the accident, the supplier could be prosecuted in terms of the MHSA.

### ***Risk assessments***

Section 11 of the Mine Health and Safety Act requires that a risk assessment of the product application be undertaken by the employer. This is normally a joint exercise by the mine and the supplier. In the case of Anglo Platinum, the issue based risk assessment process is employed.

In determining the risk to individuals, an important consideration taken into account is the training, qualifications and competence of the persons undertaking the task, as well as the specific experience of the person carrying out the work, and his awareness of the potential hazards, considering his qualifications and experience.

Bearing in mind the above, the principles of 'so far as reasonably practicable' (SFARP), 'as low as reasonably practicable' (ALARP) and 'as low as reasonably achievable' (ALARA) are taken into account.

### ***Safety of detonators***

In compliance with the above obligations, detonator assemblies are manufactured in accordance with stringent design and manufacturing processes to achieve the maximum safety and performance that can be provided by the technology of a particular product range.

Detonator and initiator assemblies must comply with a series of established testing procedures and must ultimately be approved by the Chief Inspector of Explosives<sup>†</sup> (in consultation with the Department of Minerals and Energy), before they may be used in or at a mine.

### ***Competence of supplied product: design and manufacturing phases***

Every supplier has a legal obligation in terms of Section 21 of the Mine Health and Safety Act (Act 29 of 1996) as amended. Compliance with this requirement, coupled with the CIE requirements for approval, ensures that detonators and initiator assemblies have been through a stringent process, first in the design and qualification phase, and then on a continuing basis to ensure ongoing quality control.

The following three processes are described in detail in the Manufacturers 'Technical Files'.

- Design and approval
- Safety and performance testing
- Quality control of the manufacturing process.

<sup>†</sup>In terms of the draft Explosives Act, 2003 (Act No. 15 of 2003)

### **Competence of supplied product: transport and deployment phases**

The Chief Inspector of Explosives issues a transport permit in the form of an official SAPS ZA-X certificate. Packaging must comply with the United Nations Dangerous Goods (UNDG) testing and classification specifications. This implies that as long as the detonator or initiator assemblies are transported in unopened packages, they comply with the UNDG classification.

Transportation to the shaft head and placing in approved explosives transport cars is covered by the MHSA and Mine Code of Practice. Transporting through the shaft system and to the underground working places is again subject to specific MHSA requirements and the mine's code of practice. The persons undertaking the transporting and delivery to the working places must be appointed as being responsible and competent.

### **Characteristics of misfires**

#### **Condition of the misfired detonator**

The detonator is now in an 'unknown state' and will have been exposed to severe damage inducing conditions during the blast. The integrity and stability of the explosives train may have been disturbed, substantially increasing the sensitivity to impact and mishandling, which would again be compounded by damage to, or penetration of the detonator tube.

The validity of the 'as manufactured' safety parameters may have been breached and can no longer be guaranteed.

#### **Sensitivity of detonators**

The explosives train composition of capped fuse detonators in relation to shock tube detonators is more sensitive by a factor of five, thereby exacerbating the potential hazard of a misfired capped fuse detonator.

#### **Location of misfires**

Examination of the blasted faces and the muckpile to identify misfires is comprehensively addressed in the MHSA and Mine's Code of Practice

A misfired detonator could be overlooked during the face inspection and remain in a shot hole, together with the full or partial explosives column or could be loose in the muck pile and subject to severe friction and impact, in addition to being in an unknown state.

The greatest hazard, however, is posed by misfired holes or detonators in the faces that are not identified during the course of inspection.

#### **Treatment and handling of misfires**

Again, this process is comprehensively addressed by the MHSA and the Mine's Code of Practice, but remains a very hazardous operation.

### **Explosives related accident statistics**

The following accident statistics have been derived by analysis of all explosives related accidents reported to the Department of Minerals and Energy for the 10 year period from January 1996 to July 2006.

The analysis has been divided into the following categories:

- Explosive and misfire related fatalities:
  - All mines
  - Gold mines

- Platinum mines.
- Explosive and misfire related injuries:
  - All mines
  - Gold mines
  - Platinum mines.

These have again been divided into total fatalities and fatalities caused by misfires.

The detailed base data from the DME records give a brief summary of each accident. The fatalities and injuries from misfires have been derived by examining these reports and extracting those that could be attributed to misfires. From Table I it is clear that 30–40% of all explosives related injuries and fatalities are caused by misfires.

### **Approval of explosives in terms of the new Explosives Act**

Amendments to the Explosives Act, require that all explosives must be approved and authorized by the South African Chief Inspector of Explosives (CIE), in accordance with generally accepted practice.

Up till now the CIE has issued ZA-X certificates, confirming that only particular explosives products comply with the UNDG (United Nations Dangerous Goods) tests and classifications and are fit to be transported in terms of this classification.

The new brief of the CIE includes inspection of each explosives product to confirm compliance with a defined list of internationally accepted test criteria. This 'library of tests' will be referenced in the Explosives Act, and the CIE will have the prerogative to decide which are appropriate and require compliance by the product under inspection.

During the sanctions era, South Africa was in effect isolated from free access to established international safety standards for explosives and any required compliance with these standards.

South African Bureau of Standards (SABS) standards are in existence for 'permitted explosives' and 'permitted detonators' used in coal mining, at present under the jurisdiction of the Department of Minerals and Energy and in terms of the Mine Health and Safety Act.

Following South Africa's reentry into the international arena, local manufacturers and suppliers are now being exposed to competition from major international manufacturers and suppliers. Applications from these suppliers to export their products into the South African marketplace, have created a need for the CIE to have a formal technical platform that can be referenced for making objective decisions about the approval of these products for use in South Africa. In addition, all explosives products manufactured in South Africa will in future also be subject to compliance with these standards.

**Table I**  
**Summary of fatalities and injuries attributable to explosives in total and to misfires as a percentage of this total, for the 10 year period 1996 to 2006**

Population	Fatalities			Injuries		
	Total	Misfires	% from misfires	Total	Misfires	% from misfires
Anglo Platinum	14	6	43%	55	22	40%
All Platinum	27	12	44%	122	55	45%
All Gold	42	9	21%	188	67	36%
All Mines	84	25	30%	455	156	34%

Core requirements of the safety and qualification tests are to demonstrate that the explosives are 'safe to transport', 'safe to store' and 'safe to deploy'.

### Approval of explosives

A viable mechanism for this review and approval process has been established, to enable the South African Chief Inspector Explosives to make decisions for the granting of provisional and final approvals for specific explosive products.

It is a prerequisite that at all times the approval process must be seen to be equitable and is required to meet the three cornerstones of: transparency, objectivity and impartiality

Once an explosive product has been inspected and approved in terms of the above process, and has been issued with a ZAX Certificate of Approval, it may be commercially distributed and sold in South Africa.

### Establishing south african standards

Local manufacturers and suppliers of explosives products have internally adopted many of the accepted methodologies for product design, quality and safety, but formal South African National Standards (SANS) have existed only for 'permitted explosives' and 'permitted detonators' used in coal mining operations.

Instead of referencing a suite of various international standards it has been decided to compile relevant South African National Standards (SANS), for 'detonators and initiators' and 'explosives'

A Standards South Africa Technical Committee (TC5140.04) has been established and is in the process of compiling South African national standards, with appropriate references to established international standards. In many instances, the international standard will be either accepted unaltered or will be adapted to suit South African conditions. It is anticipated that the draft standards will be published by November 2008.

In the interim, the CIE requires compliance with a suite of mainly EN standards and will be assisted by technical experts as and when required.

## Economic evaluation

The original directive from the Anglo Platinum executives was that safety is the overriding consideration in the decision to convert from fuse and igniter cord to shock tube technology.

A comparative cost-benefit financial model was constructed to assess the expected impact on costs. The model is compiled from actual baseline costs and is then fed with 'what if' variations in the main cost drivers. The cost-benefit analysis of the replacement of the current initiation system with shock tube was carried out using a spreadsheet based activity based cost model. There are quantifiable benefits from the use of the shock tube initiation system as a result of the sequential firing and greatly reduced misfire rate.

### Background to the cost model

The cost model is a comparative spreadsheet based model using the total working costs of the mine. From the use of activity based costing and by adjusting selected parameters the model can indicate the potential cost benefit of changes in the mining operation, mining layout or the introduction

of new technology.

Generally, mine working costs are structured around managerially defined responsibility areas. In this structure, for example, the direct mining costs associated with the production may be broadly divided into stoping, development and transport costs. The services costs associated with production, such as ventilation, pumping, refrigeration and engineering, are not considered as a direct charge to the production departments. Similarly, charges relating to labour are regarded as a general or management service cost.

The responsibility based structure is appropriate for operational control and the determination of the general overall costing parameters. However, the structure is not suitable for determining the true cost of the mining operations, which is required for the evaluation of change. An activity based structure is required, which acknowledges the activities in the mining operations rather than how the operation is managed. Figure 1 shows the responsibility costs for a typical mine.

The model redistributes the responsibility costs into the primary mining activities of stoping, development, transport, plant and overheads. Figure 2 shows the redistributed costs for the mining activities.

When comparing the responsibility costing with the Activity costing, mining made up 39% of the total, whereas stoping and development made up 64% of the total cost in the activity based costing.

The model consists of three parts;

- the mine model
- the cost analysis model and
- the redistribution model and the mine data.

The mine model is based on the current operating mine parameters and includes an ore account, survey factors, mine grade, mine layout, face advance, stope labour, development and stope equipment. The mine model is based on an incremental analysis approach, which is linked to the cost analysis model. This provides a rapid means to

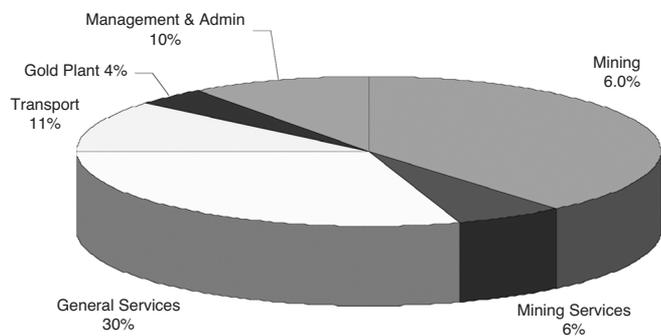


Figure 1. Responsibility costing

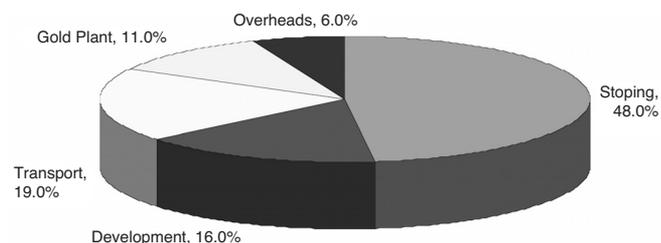


Figure 2. Activity costing

estimate the changes to the new system compared to the base case. The model assumes a ‘mill full’ condition, and does not consider any opportunity cost resulting from additional tonnage being processed.

The model allows the comparison of component parts of a new mining system, layout or new technology. Figure 3 shows the general structure of the model.

The model allows ‘what-if’ scenarios to be set up to determine the affect on profit and working costs of changes on selected parameters, such as changes in the stoping width and in the advance per blast. Sensitivity analysis can also be carried out on various parameters such as advance per blast, mining cycle, stoping width, lost blast rates and development ratios.

Application of the model to the shock tube conversion scenario

Initial predictions indicated that even by using very conservative improvements in the main cost drivers, the additional cost of shock tube could be covered by improved efficiencies.

For example, the following projected efficiency changes, in Table II indicated a significant improvement on break even costs.

The assumptions were used as input to the cost model. The advance per blast is changed from 0.8 to 0.95 metres per blast—an increase of 19%. The misfire rate has been reduced from 3% to 1%. The result of these changes is an increase in the monthly face advance from 9.4 metres to 11.3 metres—an increase of 20%. The changes in the advance and misfire rates are shown in Table III.

The financial results are shown in Table IV. It should be noted that no potential benefit arising from any improvement in grade were considered in the model, mainly because of the difficulty in calculating the potential changes in the ‘best cut’ used to determine the stope width. However, there will be some benefit, from the better stope width control that can be achieved with shock tube detonator assemblies; it has been assumed that this potential benefit will amount to at least 0.1 g/t (0.1 g/t gives a value of ±R23/t at a contained metal price of ±USD950/oz).

Also, the effect of fragmentation was not considered in the cost model. However, for completeness, it has been assumed that the better fragmentation profile could improve mill throughput by at least 1 %.

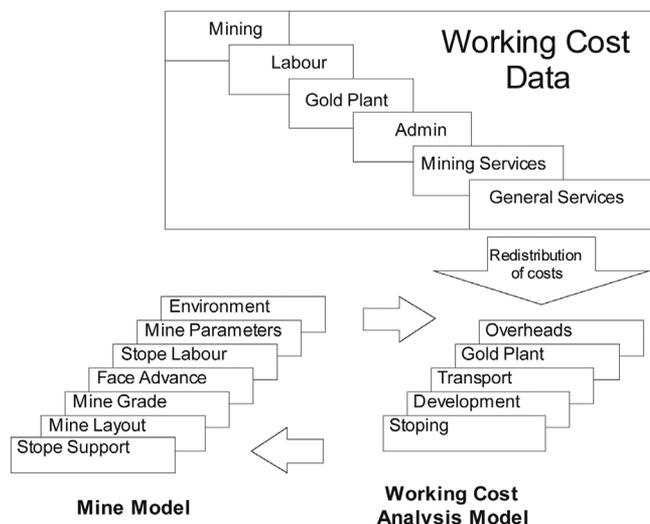


Figure 3. Typical structures and data flow of the cost model

The financial benefit from the grade and fragmentation assumptions are illustrated in Table IV.

## Techno commercial evaluation

### Introduction

The project as a whole was focused on three core aspects namely: safety and financial considerations; supplier evaluation; and the change management process.

One of the most important objectives was to ‘level the playing field’ and carry out supplier evaluations that were transparent and comprehensive, in relation to the manufacturing and supply processes. and which would provide a uniform platform from which objective assessments could be made by Anglo Platinum.

At the outset of the project, an orientation forum was arranged, to which all Anglo stakeholders were invited, as well as all suppliers of shock tube assemblies who would be interested in participating in this exercise. The rationale and detail of the project was presented and discussed, and modifications suggested by suppliers included in the final format.

An evaluation template was developed and designed to cover all relevant critical operations.

Table II  
Assumptions used to determine potential improvement

	Potential change
Face advance	Increase 0.8 to 0.95 m per blast
Lost blast rate	Reduction 3% to 1%
Stope width control	Reduction in support cost

Table III  
Changes in face advance and misfire rates

	Base	Change %	New
Blast cycle	0.50	0%	0.50
Metre/blast	0.80	19%	0.95
Lost blast rate	3%	-67%	1%
Lost blast factor	99%	1%	100%
Work days/month	24	0%	24
Metres/month	9.4	20%	11.3

Table IV  
Potential financial benefits

	Nett rand per tonne
Working cost FIC	
Working cost shock tube 1:1 replacement	2.00
Working cost with benefits	
Face advance	-5.00
Lost blast rate	-0.20
Support	-0.10
<b>Total nett working cost benefit</b>	<b>-5.30</b>
	Annual value (R)
Potential working cost change (38 million tonnes)	-125 400 000
Potential revenue change	
Assumed grade increase (0.1 g/t)	874 000 000
Improved fragmentation (1%)	304 000 000
Total revenue change	1 178 000 000
<b>Potential bottom line benefit (BIT)</b>	<b>1 303 400 000</b>

The template was made available to each of the suppliers who were invited to comment and contribute if considered necessary. Following several clarification meetings, the final document was accepted in principle by all of the major players.

As can be seen from the level of detail required in the section below, it was, in certain areas, necessary for the suppliers to 'bare their souls' and provide potentially sensitive information in relation to their manufacturing and marketing capabilities and intellectual property. Assurance was given and accepted that confidentiality would be respected by the investigation team.

Each of the manufacturers and suppliers who participated, was requested to compile a comprehensive 'technical file' to address all of the points in the supplier evaluation template, including provision of copies of the relevant detailed documents.

#### Supplier reviews: 'due diligence review of all 'supply side' role-players'

Each of the potential suppliers was visited by the Anglo Platinum project team made up of independent technical specialists, supply chain representatives and mine representatives.

The inspection process took the format of comprehensive presentations by the supplier and review of the key points listed in the evaluation document, followed by site visits to

the factories to view the actual manufacturing processes involved.

If further clarification and discussion was required, return visits and meetings were conducted.

In the case of one supplier, a delegation made up of representatives from the independent third party and Anglo Platinum visited and inspected the source factories of Q'inhua and Fushun in China.

#### Components of the evaluation template

The following are the main components of the evaluation process. As can be seen, the content is comprehensive and the supporting documentation in some cases comprised more than a hundred separate documents.

Results were recorded in the form of 'balanced scorecards', which summarize the results of the reviews conducted. Examples are given in Tables V and VI.

#### Manufacturing and supply

- Profile and history of the company
- Range of products and target markets
- Register of ZA-X approval certificates
- Test reports as per safety standards
- Continuity of supply and support
- Audit and evaluation the manufacturing process and equipment for ongoing acceptance

**Table V**  
Consolidated summary—shock tube due diligence review

Balanced scorecard	Company		
	(A)	(B)	(C)
<i>Manufacturing and supply</i>			
1.1 CIE(ZAX) Approval certificates			
1.2 Continuity of supply and support			
1.3 Specification and design process			
<i>Qualification and testing of products</i>			
1.4 Testing facilities			
1.5 Test reports as per safety standards			
1.6 Compliance with 3rd party 'due diligence' observation of tests			
<i>Technical review</i>			
1.7 Audit and technical review of the manufacturing process (factory)			
<i>Quality Control</i>			
1.8 Measures and procedures and systems			
1.9 Qualifications of quality control Inspectors:			
1.10 ISO 9001: 2000 and ISO 14001:2004 certification			
<i>Risk issues (supplier's risk assessments) product risk review</i>			
<i>Product risk review</i>			
2.1 Product as manufactured			
2.2 Product application			
<i>Business risk review</i>			
2.3 Capacity to maintain contractual obligations			
2.4 Logistics of the supply chain to customers			

#### Legend:

	Exceeds requirements
	Meets requirements
	Needs qualification

**Table VI**  
**Consolidated summary—shock tube due diligence review**

Balanced scorecard			
	Company		
	(A)	(B)	(C)
<i>Customer services</i>			
3.1 Technical support and training in the case of technology change			
3.2 Product application and blast designs			
3.3 Resolution of supply and delivery problems			
3.4 Investigation and resolution of product failures			
<i>Technical review</i>			
4.1 Review of detailed 'technical files' and all supporting documentation			

**Legend:**

- Exceeds requirements
- Meets requirements
- Needs qualification

- Technical review of the manufacturing facilities
- Quality control measures and procedures
- Qualifications of quality control inspectors: in-house training and certificates. Formal training and certificates
- SANS/ISO 9001-2000 certification.

**Risk issues and assessments**

- Supplier risk assessments
- Product as manufactured
- Product application
- Business risk issues:
  - Can the supplier meet the needs of the requirements and customer base?
  - Capacity to supply and maintain contractual obligations (3–5 year schedule required)
  - Logistics of the supply chain to customers.

**Customer services**

- Technical support and training in the case of technology change
- Training and implementation
- Fault analysis and resolution
- Acceptable spares procurement time
- Product application and blast designs
- Provision of hardware firmware and software upgrades as applicable
- Resolution of supply and delivery problems
- Investigation and resolution of product failures.

**Documentation**

- It was incumbent on the supplier, to provide comprehensive supporting documentation, that may be referenced by the evaluation process.
- Provision of training packs.

**Commercial issues**

- Evaluation of products on offer (in collaboration with supply chain)
- Pricing—pricing structure as tendered
- Product compliance—regulatory (CIE & DME) approvals.

**Change management process**

- Training programs and supporting documentation
- Structured collaboration in the implementation process.

**Change management process for the conversion from capped fuse to shock tube detonator assemblies**

**Technology transfer projects—background**

Most of the work which has been carried out on the process of technology transfer, has concentrated on the initial phases of field trials, to determine the suitability of the technology for a particular mine or group, followed by a decision to implement on a minewide basis if the initial trials were successful.

At this stage the technology will have been supervised by a team of focused, dedicated persons who are committed to ensuring successful performance of the technology, usually under the umbrella support and protection of a 'technology champion'.

In many cases it has been accepted that once the decision to implement has been taken, that the transition to the new system will become a matter of course and will continue to progress in a routine manner.

It is at this point that the implementation of many promising systems has failed to meet expectations and has been abandoned. This phenomenon is not confined to our mining industry and has been recognized as a problem occurring within many advanced technologies that have been developed worldwide.

**Strategy adopted for the capped fuse to shock tube conversion project**

Once the decision to continue with the project had been approved, the challenge was to convert up to 41 million shot holes (from a base of 38 million shot holes) per annum from fuse and igniter cord, to shock tube detonator assemblies, within a time frame of 36 months.

A structured change management process would be introduced simultaneously at all group mines. The prerequisite was that 'Buy in' and 'taking of ownership' from

group mines and all role players was absolutely essential. To this end, presentations were made to the Anglo Platinum executive and mine management committees, with face to face meetings held with individual mine managers, in order to review the project and confirm their acceptance and co-operation in respect of the implementation process.

Several workshops were convened and attended by all stakeholders. The process and general strategy was defined and action taken to address any apparent 'gaps' in the planned implementation process.

Resulting from these workshops, specific roll-out plans were designed, involving all the major players in the development of a coordinated change management programme and included for example:

- Mines: human resources training department; SHE and production departments. Mines were required to complete pre-launch orientation of management and workers in respect of the project
- Head office: supply chain; human resources training; safety and health department
- Members of the group project team
- Change management specialists already operating with Anglo Platinum on other projects
- Conversion specialists, from each of the three suppliers awarded contracts, who have well established conversion programmes that embrace collaboration with mine management, and direct involvement (underground teams) in the implementation process.

At each mine, steering committees at shaft, mine and group level (project management team) were appointed together with combined implementation/trouble shooting teams (supplier/mine).

#### **Commencement of the project and progress to date**

The project started on 1 April 2007 with an estimated time to full implementation of 36 months.

Regular progress meetings, attended by a representative from each mine, project team members, and suppliers, are held to review compliance with project plans and completion dates.

To date, after only 13 months from the start date of 1 April 2007, it is reported that approximately 65% of holes blasted in the Group had been converted to shock tube assemblies by July 2008.

#### **Conclusion**

The successful transfer of this technology could span two more years and very careful and detailed succession planning is needed to ensure that the goals are achieved and that the initial impetus is not lost.

#### **Explosives related accidents**

Since the inception of this project there have been no reported explosives related accidents involving shock tube detonator assemblies.

#### **Emerging benefits**

A structured monitoring programme has been implemented and the following benefits are being recorded:

- Reduction in the number of misfires
- Improved advance per blast
- Improved hangingwall condition
- More uniform fragmentation profile
- Blasting cycle times shortened
- Development
- Improved development end profiles.

#### **Monitoring and reporting of progress**

A structured monitoring programme has been implemented whereby mines are required to report monthly on a set of critical parameters that measure the main drivers influencing the performance of the conversion process. In addition, quarterly project meetings are held where representatives of the mine steering committees leading the project, supply chain representatives, suppliers and other interested parties are required to report against project plans agreed at the outset of the implementation process.

As can be seen from the progress reported above, the project is well on schedule, with visible results being achieved in the financial benefit drivers.



#### **Martin Stander**

*Anglo Platinum*

Most of my career was spend on Shafts and in a production environment, 10 years Section Manager and 9 Years as Production Manager (both Gold and in the Platinum Industry).

Since July 2006 I have been assigned to a new Shaft project (Styldrift) to be sunk at BRPM. I have been involved in two Group re-engineering initiatives.

In 1999 I was appointed to start up and build BRPM Mine; this included roads, offices, shafts, the plant and opencast mining. The mine is now in steady state, since 2005; an extension to the existing mine is already being carried out.

For the last two years I have been working on a big new mine adjacent to BRPM. The approval process is scheduled for this year. Currently the internal review is being conducted. The directors' review was at the end of May 2008. The Anglo Platinum, RBR and Anglo plc boards are due during June to November. The 300 000 ton capacity mine is expected to cost R7 bn (2008 money terms). Sinking is planned for July 09. Production starts in 2013.

Stander is married and has two sons age 25 and 22.