

Murray & Roberts Cementation

World Class Implementers of Mining Projects

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SAFETY COMES FIRST AT MURRAY & ROBERTS CEMENTATION

No-one would dispute the fact that mining is a hazardous activity. Added to this is the unpredictability of human behaviour.

Murray & Roberts Cementation has introduced the Enterprise Wide Risk Management programme to mitigate these risks and introduce a proactive approach to safety.

Dr Koos Oosthuizen, risk executive at Murray & Roberts Cementation, says the programme is aimed at transforming the workplace to protect both the people and the business.

"This objective will be achieved through training, education, systems, policies and procedures. Once employees have been empowered with knowledge, they can be held accountable to deliver the job properly and safely," Koos says.

A safety pledge has been signed by all managers, who have committed themselves to achieving zero incidents and therefore zero accidents. ISO 9001, 14001 and OHSAS 18001 is the support basis for the Murray & Roberts Cementation Business Management System.

Koos says the company's strategy is to integrate the risk management and the ISO management systems into the routine strategic and operational decision making process.

"In essence, the strategy aims to create the conditions in which an informal risk adverse culture can be enhanced through management intervention," Koos explains.

"The first step is the realisation that risks belong to all employees, with line managers taking responsibility for risk management."

"Ongoing identification and risk assessment systems are also vital to the success of the programme. This process starts in the design and tender phase of projects and is facilitated by the risk coordinators and subject matter experts."

Koos says continuous risk management goes hand in hand with good project management and will become a normal aspect of all project managers' daily routines.

Open communication lies at the heart of all stages of any successful risk management programme and this is heavily emphasised at Murray & Roberts Cementation.

The Risk Service Department analyses risks and incidents to assess the likelihood of recurring; how often they are likely to recur and what is the likely impact should they recur. Risk management has evolved from being a back office function to the CEO-level concern that it is today.

Eight key elements have been put in place for effective risk management:

1. Acceptance of a risk management framework as the focal point and common language - this includes everyone in the organisation, including board members;
2. Senior management commitment - management buy-in is essential;
3. Risk management owner - a risk executive will work with each business unit to implement the programme;
4. Communication - the compelling need for an evolution to an integrated risk management framework must be communicated throughout the organisation;
5. Training - staff must be mobilised with effective training and education;
6. Reinforcement through human resource mechanisms - effective behaviour needs to be rewarded;
7. Process - there must be a risk management process in place;
8. Monitoring - this will take place through internal audits, inspections, planned task observation and job analysis, process, product and service monitoring and management review.

With commitment from all levels of employees, "zero accidents" is certainly achievable within the mining environment.

DESIGN/BUILD PACKAGE FROM MURRAY & ROBERTS CEMENTATION

A step backwards in the value chain by Murray & Roberts Cementation is a major step forwards for the mining industry.

The company's service offering has officially expanded to encompass a full design/build capability. Tim Wakefield, technical director at Murray & Roberts Cementation, says this decision will have far reaching benefits for customers.

Commenting on the rationale, Tim says the company's business had traditionally been about tendering at risk, but by entering the value chain earlier it not only presents an opportunity to reduce some of those costs, but will also add further value to projects.

"Being a mining contractor means that we often bring expertise to the table that will make projects more viable.

By being involved at a much earlier stage of a project we can add "smarts" that traditional consultants are unable to." Tim is quick to explain by "smarts" he does not mean high-tech gimmicks, but rather applying fitness for purpose in practical matters on a project.

"By offering a design/build package we are effectively taking away the contractor/consultant interface. It is around these interfaces that most issues arise on a project," he says. "It is also a destroyer of value."

Tim explains it is not ideal to have someone design a mine with several shafts, and go out to tender for the shaft sinking. More often than not, it is necessary to modify and even redesign the shaft. These steps add costs to a project. This is why it makes sense to include appropriate levels of mining contractor expertise and experience in the early planning stages.

"By going this route, projects can be accelerated simply by bringing the contractor expertise aboard from the beginning of the value chain," Tim says.

Murray & Roberts Cementation has a strong belief in the Alliance Model for project development and implementation. Tim says it makes good business sense to form alliances with companies best suited to carry particular areas of risk.

"We were recently selected as an alliance partner for De Beers' Finsch drop down, and will be intimately involved in the design "smarts" for this project.

Another current reference is the Kroondal project where company personnel are intimately involved in the day to day planning of the mine.

1000 ACCIDENT FREE SHIFT AWARD FROM DME FOR DWARSRIVIER



"It is accepted that each person is responsible not only for his own, but for every other person's safety as well. Management has encouraged the active reporting of all incidents which could jeopardize a safe working environment for all."

With all sub-standard practices being reported immediately, these are dealt with on a daily basis by Doug at the morning briefing meetings, and it is apparent that the process is working as the results speak for themselves. Training also plays an important role and all employees are inducted in full of ground competency training, irrespective of their job requirements.

Murray & Roberts Cementation is undertaking a shaft and underground development project at Dwarsrivier. The mine is converting from an open pit to an underground operation with the surface section being phased out by the end of 2005.

Work being done by the company includes three declines as well as some development work over a fixed term of about two years. This is the company's first contract in the chrome mining sector, and it is currently ahead of its contractual obligations for Phase I.

Development of the three 6 metre by 2.2 metre declines began in 2004, and decline development and stopes establishment are well underway at Dwarsrivier.

Two 5 metre diameter raisebored vertical ventilation shafts were also recently completed. One of which will serve as a downcast ventilation shaft and the other an upcast ventilation shaft. Both shafts were sunk by Murray & Roberts Cementation's Mining Services Division underscoring the company's full mining service capability.

The operation at Dwarsrivier is highly mechanised with an extensive fleet of equipment including LHDs, drill rigs and utility vehicles.



Murray & Roberts Cementation's Dwarsrivier contract received the DME 1000 Accident Free Shift Award in September 2005, after notching up a record eight months injury free.

Doug Sammons, contracts manager for Murray & Roberts Cementation, says this can be attributed to the dedicated approach to safety by all personnel on site.

"From the point of entry onto Dwarsrivier there is a strong focus on safety, and this has germinated into a culture of abiding to the rules and procedures considered so necessary to ensure a safe working environment for all," Doug says.

SAFETY FIRST APPROACH BRINGS ADVANTAGES AT TURFFONTEIN

Work is progressing well on the cluster decline development at Turffontein, as this project is fast approaching its completion.

The contract being undertaken by Murray & Roberts Cementation is on schedule and within budget.

In addition to this, the Turffontein project is tracking 145 days without any injury and has had no reportable injuries for 2005.

Eric Vascotto, business manager at Murray & Roberts Cementation responsible for the Turffontein project, says behaviour based safety was introduced to the project a year ago and the rewards are now being reaped.

The project scope includes a cluster of decline sinking and auxiliary development on the levels. The cluster comprises a material, conveyor, chairlift and RAW decline at 9° and are in general 4.5 x 4 metres in dimension. The scope was recently extended to include the raiseboring of silos as well as OPEX development. The OPEX development will comprise haulages, cross-cuts, development raises and box holes.

Eric says the original scope of contract called for the drop raising of the silos, however poor ground conditions would not accommodate this method, and the decision was made to raisebore, slip and line.

Four silos will be raisebored to depths of 37 metres. Three of the silos will have a final lined diameter of 4

metres and the last, which is a ventilation and escape route, will have a 1,06 metre diameter and will be unlined.

Drilling is being done using hand-held machines, with mucking done using LHDs. A dump truck has recently been introduced because the tramming length was becoming too onerous for LHDs with a resultant reduction in the mining cycle.

Eric says another unique equipment addition to the fleet has been a portable rock breaker. This was introduced as a dual purpose tool; firstly, to break rock on the tip, and secondly, to assist in the barring of the high hanging walls.

Considerable effort is being placed on equipping the cluster declines in order to hand over completed levels for production. This will include chair lift installations, conveyor belts for ore movement, permanent services and track-bound materials declines.

Eric says the physical condition audits done on individual ends run at an average of between 95 and 98% compliance, and this he, again, attributes to the behaviour based safety approach. These audits are done under normal operating conditions and take physical condition factors such as safety, general tidiness, good housekeeping and adherence to standards into account.

Another interesting, and unusual aspect, of this contract is the employing of a permanent training officer on site.

Eric explains the initial requirement was to assess the mine's safety procedures and revise and adjust these to suit the mining environment at Turffontein. In the process all critical tasks where the personnel need to be retrained in the correct procedures have been identified and this programme is currently underway.

"An underground development end has been established on Turffontein as the formal training area for this initiative and we expect this to further improve the safety statistics on this contract," Eric says.

Commenting on why this step was taken, Eric says it was found that training received previously through other avenues was contradictory, and there were discrepancies in procedures which needed to be aligned. "This will be an ongoing initiative, and the training officer at Turffontein is definitely a permanent position."

In addition to this initiative, previously disadvantaged individuals who are currently in the employee of the company have been identified and are being skilled for promotion within the organisational structure. This forms part of the company's skills development programme.

Work on the Turffontein contract started in 2002 and is expected to be completed early in 2007 after which Phase 3 is likely to commence. This will take the cluster declines from 35 Level down to 40 Level.

ERPM STILL GOOD FOR ANOTHER SIX YEARS THANKS TO WATER MANAGEMENT PROGRAMME

Less than a year ago, the future of East Rand Proprietary Mines (ERPM) Limited hung in the balance, with all indications pointing to the closure of the now 113 year old mine's underground operations at Boksburg. Careful planning and management, together with State assistance, is turning around the operation, with the prospect of extending the life of mine to 2011.

As part of its turnaround strategy, the mine has implemented an underground water management programme with the installation of five new high pressure mortar intruded water retaining plugs and the upgrading of three existing plugs at the South East and Far East Vertical Shafts respectively.

The project, which will cost R29,1 million, is being undertaken by Murray & Roberts Cementation. Work started in December last year and is expected to take 46 months to complete. The State has funded the first and second phase of the installation of the plugs.

Phillip Watters, general manager of ERPM, explains that as the last operational mine in the Central Rand Basin, ERPM has had its fair share of challenges. One of the primary difficulties facing the mine in recent years being underground water management.

Explaining the rising underground water level, Phillip says that in September 2004, the Central Rand Basin was already flooded above 24 Level, whilst the adjacent Hercules and South East Vertical Basins were flooded up to 50 Level.

"Mining activities in the Far East Vertical section were at risk with the influx of additional volumes of water. This called for the installation of five new high pressure water retaining bulkhead plugs on 42 Level at the South East Vertical shaft," Phillip says.

Murray & Roberts Cementation has previously installed bulkhead plugs on 58 and 68 Level at Far East Vertical, the only operational section of the mine, as part of the mine's water management programme.

This project includes the upgrading of the previously installed 14 metre long bulkhead plug on 68 Level and two bulkhead plugs, one of 6 metres and one of 8 metres, on 58 Level.

Despite previous preventative measures, Watters explains the mine has been pumping out water from the Central Rand Basin's Rose Deep compartment from the

South West Vertical shaft to prevent water cascading into adjacent shafts. This exercise will continue until construction of the bulkhead plugs on 42 Level at South East Vertical and on 58 Level and 68 Level at Far East Vertical is complete.

Even with this water management programme in place, the Far East Vertical Basin is experiencing an inflow of water of 1.6 Ml per day of extraneous water. Some 3.5 Ml per day of water is used for mining purposes. This water is being pumped into the South East Vertical Basin.

"Pumping costs are in the region of R 1,5 million per month and although this is subsidised to the extent of R1,0 million per month by the Department of Minerals and Energy, this figure does not take into account the costs of replacing pumps, an overhead which the mine is expected to carry," Phillip says.

"Once the bulkhead plugs are installed, the mine will stop pumping water altogether, resulting in massive long term cost savings."

Construction, by Murray & Roberts Cementation, of the five 22.5 metre long bulkhead plugs on 42 Level at South East Vertical shaft is being undertaken simultaneously to the upgrading of the two bulkhead plugs on 58 Level and the one bulkhead plug on 68 Level at Far East Vertical.

The high pressure water retaining bulkhead plugs have been designed to retain the inflow of water into underground working sections and secure future mining in areas that would otherwise be inaccessible. Plug installations vary from 21 up to 40 metres in length. The plug on 68 Level, once completed, will be subject to the highest head in the mining sector. This bulkhead plug will withstand a maximum head pressure of 2841 metres (28,41 MPa).

Pete Ferreira, general manager mining services at Murray & Roberts Cementation, explains the installation of bulkhead plugs is highly specialised construction work, and position, design and quality of plugs is critical.

A code of practice stipulates the acceptable area in which water retaining bulkhead plugs can be installed. According to this code, the site of the work should be situated in an area of homogenous rock. This infers that the ground for a distance of three plug lengths is free of structural weaknesses such as faults, fissures, shales, shists, friable or soft material or other mining excavations.

This is to ensure safe anchoring of the plug and water tightness. The effect of stress changes as caused by mining should also be carefully assessed.

Once the bulkhead plug site has been prepared, a 500 mm wide, 30 MPa strength concrete retaining wall is erected at the wet side of the bulkhead plug. The bulkhead plug is packed from the footwall up to the hanging wall with quartzite rock plums. This structure also contains a number of positioned intrusion and tightening pipes. The tightening pipes will be required to seal the rock/plug concrete interface once the structure is complete and cured. Pressure rated 316L stainless steel pipes and valves can also be installed in a plug construction for future dewatering requirements.

The plug's front shutter is erected simultaneously with the construction and pipe installation. After construction mortar is intruded into the constructed plug via the intrusion pipes up to the last high point pipe.

The mortar used for intrusion is mixed locally at an underground plant which is especially erected for the duration of the bulkhead plug construction. The plant comprises an aggregate conveyor, high shear mixer, pumps and storage tanks.

Mortar cube samples are taken for compressive strength testing throughout the mortar placing. Pete explains that water retaining bulkhead plugs must withstand and hold their design static heads and careful calculation of their length is a critical aspect of installation. Bulkhead plugs are constructed in sections of no longer than 8 metres.

"This is a time consuming process and can take up to four months, depending on underground conditions," Pete says. "The bulkhead installation process typically includes clearing of the plug site, construction, mortar intrusion, curing time and tightening (consolidation). The curing process alone takes 28 days."

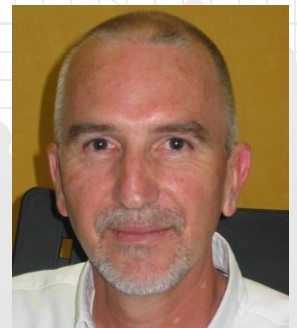
After construction and curing, the structure is tightened by means of pre-positioned tightening pipes, ensuring its permeability.

Installation of the bulkhead plugs is expected to help ERPM continue operations into the future. The exercise is expected to contribute to the cost effective running of the operation.

FOCUSING ON RELATIONSHIP BUILDING

Allan Widlake joined Murray & Roberts Cementation as business development director in July 2005 Allan has extensive experience in the gold, base metals and platinum sectors having spent 28 years in the service of Anglo American. Significantly, most of that time was on capital projects.

While Allan's major focus will be client development and relationship management, he will also focus on assessing new opportunities with all mining houses, from juniors to majors, and developing future markets on the African footprint.



BELOW 120 LEVEL PROJECT - SAFER, BETTER, FASTER WITHIN BUDGET

TauTona Mine is situated on the eastern side of the Western Deep lease area. The scope of Murray & Roberts Cementation's project is to sink a twin decline system from 120 Level (3467 metres below surface) to 128 Level (3700 metres below surface). This will allow mining of the carbon leader reef and extend the life of the mine by seven years.

According to Freddie Geldenhuys, business manager at Murray & Roberts Cementation responsible for this project, the objective is to complete the sinking of what will be the deepest mine without incurring any fatalities and within the contractual programme.

"Our slogan is "safer, deeper, faster within budget," Freddie says.

The shaft systems comprise a twin decline system 5 metre wide and 3.8 metre high with five inter levels and an incline distance of 596 metres to hoist rock and transport man and material. The declines will be sunk at 26°, which is the same as those recently sunk by the company at Selibi Phikw, in Botswana..

"After visiting the site in Botswana, AngloGold Ashanti changed the layouts to mirror the mine design at Selebi Phikwe," Freddie says.

A total of 11 000 metres of access development will be done concurrent with the sinking of the shafts. The hoist chambers are situated on 120 Level which is approximately 3.5 kms from the three vertical shaft systems.

Freddie says that 1, 8 metre raise bore holes were drilled in the rope raises and top portion of the decline shafts and slipped to speed up the programme. The decline shaft down to below 120 Level is situated in the Pretorius fault zone and extensive support will have to be installed.

Sinking and support of the shafts will be done by means of drill rigs fitted onto sinking vehicles, and the anticipated sinking rate will be 36 metres a month. A single track will be installed in the man and material decline shaft and a double track in the rock decline shaft. The man and material shaft will lead and hoist most of the waste from the level development. Support in the shaft will consist of long anchors and gunite.

Access development will be done using pneumatic hand-held rock drills and cleaning by track bound compressed air loaders.

Site establishment started in January 2004 and mining operations in March 2004. Problems were experienced as a result of insufficient compressed air pressures and

the availability of ventilation, with the result that the development of some of the ends was delayed. There was also no transport available for workers and this had a major influence on available face time.

Freddie says the focus is on safety in the work place and this has improved from a reported 38 accidents in the first ten months in 2004 to 28 for the same period in 2005.

"Although this is a year on year improvement, it is still not acceptable and our target is to become accident free," Freddie says. "Production has also increased to 160 metres per month for the past two months which is the highest it has been since start up."

Project completion is scheduled for January 2012, and Freddie says this target must be achieved to ensure that TauTona mine maintains its gold profile.

IMPALA 20 MAIN AND VENT SHAFTS

The Impala No 20 Shaft project is located north of No 12 Shaft on the north-west corner of the Impala mining lease area.

The scope of Murray & Roberts Cementation's project covers the sinking and equipping of a main downcast shaft, an upcast ventilation shaft, service infrastructure on surface and all ancillary excavations and access development necessary to establish the footprint for 185 ktpm of Merensky and UG2 reef production.

Safety is the primary focus on the project, and the teams sinking the two shafts have excellent track records. The team on the main shaft recently completed the sinking, equipping and commissioning of the deepest single hoist shaft in the world (South Deep), while the team for the ventilation shaft completed a shaft at Black Mountain fatality free.

Freddie Geldenhuys, business manager responsible for this sinking contract says Murray & Roberts Cementation has been on site for the past year, and three Lost Time Injuries (LTI) have been recorded. The commitment is to finish the project without any further accidents.

The shaft system comprises an 8.5 metre diameter downcast shaft to a depth of 1051 metres, and a 6.5 metre diameter man, material and rock shaft together with an upcast ventilation shaft to a depth of 977 metres.

The pre-sink was completed to a depth of 99 metres on the ventilation shaft and 80 metres on the main shaft. This work was completed with a single sinking crew, completing the one shaft and then moving to the other shaft. A Scotch Derrick headgear was used for the pre-sink on both shafts. A single deck stage was utilised and cleaning of the shaft bottom done using 630 loaders. 4.5 and 6 ton capacity kibbles were used for the pre-sink. All drilling of the bottom shotholes and support of the sidewalls for the pre-sink was done with hand-held rock drills.

Sidewalls are supported by means of cladding and splitsets on an overlapping system. The shaft concrete lining is placed from the sinking stage concurrently with sinking operations, with the exception of the breaking and lowering of the curb ring, during which time there are no activities at the shaft bottom.

During the pre-sink, the permanent sinking kibble and stage winders were installed. The main shaft headgear and kibble winder was supplied and installed by the client. All other winders and ventilation shaft headgear were supplied, installed and commissioned by Murray & Roberts Cementation.

The main-sink for the shafts is being carried out using multi boom shaft drill rigs for the main and ventilation shafts. The shaft bottom advances at a rate of 3 metres

per blast with concrete lining being done concurrently at a distance of 18 metre to 24 metres from the shaft bottom. Both the ventilation and main shafts are being cleaned by means of cactus grabs loading into 10 ton and 12 ton kibbles respectively.

Site establishment started in November 2004. The main sink on the ventilation shaft commenced in July 2005 and on the main shaft in August 2005. The ventilation shaft is currently 400 metres below collar while the main shaft is 260 metres below collar.

Both shafts are beating planned cycles. In the production month of October, both achieved more than 100 metres for the month.

The shaft bottom in the ventilation shaft will be reached in May 2007 and the main shaft bottom in August 2007. On completion of the sinking, the main shaft equipping will commence and shaft bottom loading arrangements will be installed in the ventilation shaft. After this, Phase 1 access development will begin from the ventilation shaft, with concurrent equipping of the main shaft.

On completion of the development, the permanent loading arrangements for the main shaft system will be commissioned. Handover of the 20 Shaft project is planned for October 2008.

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