

AMC Surface SRU™ delivered \$20,700 of savings a month per rig in Pilbara, WA

CASE STUDY

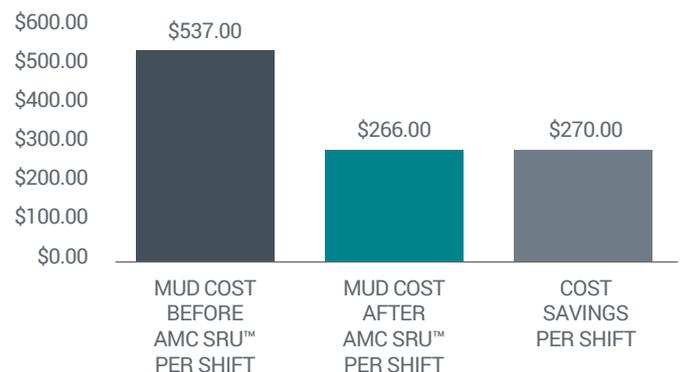
AMC's challenge was to reduce the customer's operational costs and environmental impact on site in the Sandy Desert, East Pilbara Western Australia. The AMC Surface SRU™ proved to be a financial benefit, not a cost, demonstrating savings in mud consumption, water usage and KPIs and benefiting the environment through the elimination of sumps and reduced site footprint.



Background

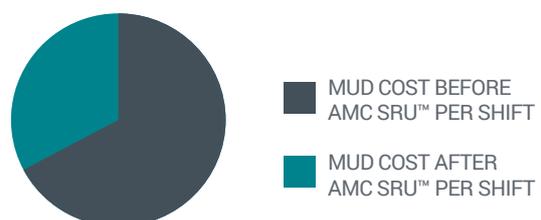
In Australia, AMC's customer received pressure from the community and government regulations to reduce the impact of their activities on the environment as well as reducing the cost of exploration drilling.

The AMC Surface Solids Removal Unit (AMC Surface SRU)™ was trialled to reduce the cost of exploration drilling and environmental impact on one of the rigs at gold-copper mines in the Great Sandy Desert in the East Pilbara region of Western Australia. Drilling is challenging as the type of stratification changes quickly over a few metres from soft clayish ground to hard glassy sandstone quartzite that has solidified.



50% Reduction in Mud Costs

Mud utilisation reduced by 50% (assuming 90 – 100% water circulation) when circulated through the AMC Surface SRU™ closed-loop system (3000L), as opposed to utilising mud sumps (approx. 21,600L). Data obtained showed potential savings of 30%, even if water circulation reduced to 70 – 80%, due to circulation losses caused by poor geology. Potential savings were \$16,200 per month or approximately \$540 per day.



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TRIAL OVERVIEW

Date	August – September, 2013
Location	East Pilbara Western Australia, exploration drilling – coring
Access / drill pads	Ample space, gravel access road
Drill hole information	Total depth – 1600m; PQ to 346m and NQ to end of hole
Mud information	Mud circulated from the sumps (3 available) into a 2500L surface mixing tank and refreshed with approx. 2 x 1kg AMC TROL™, 1kg AMC EZEE PAC R™ and 0.5kg AMC CR 650™
Water	Supplied from two bores pumped directly to the sumps, but dependent on mill activities. The water condition was hard to very hard with elevated chlorides (approx. 800ppm as Cl), which affected mud properties
Geology	Hard, yet unconsolidated. Burden pressure kept core intact but once relieved, collapsed into smaller pieces
Minerals	Gold.



Eliminated Need for Mud Sumps

The AMC Surface SRU™ replaced the need for 3 x ~7200L mud sumps. An external mixing tank (approx. 2000L) was used for rig suction, mud preparation and control of overflow from the AMC Surface SRU™. Savings associated with digging and re-mediating the sumps was estimated to be approximately \$1,000 (depending on ground and geology conditions).



Traditional sumps versus cuttings obtained from the AMC Surface SRU™.

Up to 80% Less Water Used

The trial demonstrated water could be reduced by 50 – 80% by replacing the sumps (21,600L) with the AMC Surface SRU™ (3000L) and an external mixing tank (2000L). Water was pumped directly from the bores to the sumps; therefore cartage costs were not incurred. From time to time water supply, and subsequently drilling activity, was interrupted due to maintenance at the mill. The SRU's unique closed-loop system retained optimal fluid levels and eliminated problems typically experienced with open sumps. As a result, the operator reduced downtime and associated costs.

Up to 98% Reduction in Cuttings Volume

The AMC Surface SRU™ reduced the overall volume of mud cuttings by up to 98%. The condition of the cuttings from the AMC Surface SRU™ chute was also dry and stiff (approximately 70% dry, with 30% water), which enabled simple removal from site and easy access to municipal disposal sites.

The dry and stiff consistency of cuttings removed via the waste chute allows simple and environmental removal of cuttings from site.

Smaller Site Footprint, Lower Environmental Risks

The AMC Surface SRU™ significantly reduced the site footprint by eliminating the need to dig sumps. It also reduced the risk of poisoning or drowning to wildlife. Less water was consumed and the risk of ground water or local waterways being contaminated from sump seepage was also removed.



Sumps on site before using the AMC Surface SRU™.



AMC Surface SRU™ on site.

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HSE Benefits Reduce the Risk of Injury

Every resource company would like to send operators home in good health and provide an injury free environment to work in. Fewer rod trips limits the crew's exposure to injury, heat exhaustion together with physical exertion in the dry hot conditions experienced in the Pilbara region.

Consistent Mud Properties Achieved

AMC recorded mud and rheological properties throughout the trial. The mud properties were kept relatively consistent and clean, indicating the unit did not remove polymer, only undesirable cuttings.

Plastic Viscosity

Plastic viscosity is a good indicator of solids control. If the volume of solids increases, due to an increase in cuttings concentration, or a reduction in particle size due to grinding at the drill bit face, the plastic viscosity will increase indicating that the mud is not cleaned properly.

Solids build up in a mud system causes stuck pipe, dirty or a clogged back-end assembly, an increase in Marsh funnel viscosity and wear and tear on equipment. During the trial, the plastic viscosity of the mud remained consistent over a four week period, indicating the mud was cleaned adequately.

Yield Point

Changes in the yield point indicate chemical contamination may occur due to an increase in smaller particles and causes instability in the rheological properties. The yield point remained stable throughout the trial, indicating the mud was running at optimal condition.

Anaerobic Biodegradation

The hot and dry environmental conditions in the Pilbara region can cause the anaerobic biodegradation of mud at the bottom of the sumps – the size of the sumps and slow flow rate exacerbates this problem.

When contaminated water is transferred from the sump to the mixing tank, the bacteria can also cause the mud to breakdown before it is used. The AMC Surface SRU™ closed-loop technology overcomes this problem as mud is kept at optimum condition and is continuously flowing.

Specific Gravity

The specific gravity reduced between the collar and centrate, indicating the AMC Surface SRU™ centrifuge was successfully removing heavy cuttings.

SUMMARY OF RHEOLOGICAL PROPERTIES OF MUD

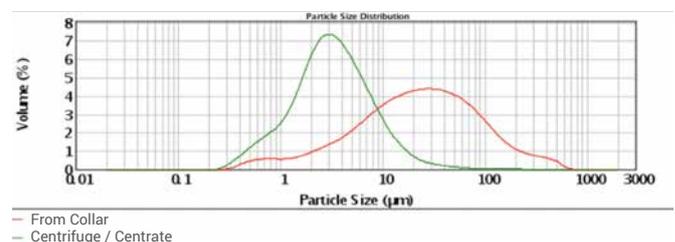
	Rheological properties of mud from collar	Rheological properties of centrate from AMC Surface SRU™
Viscosity	35 – 37 secs	35 – 37 secs
Rheology 600 rpm (cPs)	13 – 17	12 – 19
Rheology 300 rpm (cPs)	8 – 10	8 – 12
Plastic viscosity (cPs)	5 – 7	3 – 7
Yield point (lb / 100ft ²)	2 – 5	1 – 6
Specific Gravity (SG)	1.02 – 1.04	1.00 – 1.02
Filtrate (ml, 30 min)	12 – 16ml	12 – 16ml
Sand content	0.25 – 0.75%	Nil

Particle Size Reduced to Less Than 10 Micron

Clean mud in good rheological condition is essential for the successful and economic completion of a drill hole. The typical particle size of cuttings within drilling fluid pouring from the collar during diamond drilling is approximately 0 – 1000 microns. When utilising the AMC Surface SRU™, the particle size reduced to less than 10 micron (this includes the particle size of the drill fluid itself).

Cleaner mud containing smaller and fewer particles improves downhole utilisation of drilling equipment and reduces its wear and tear. As a result, replacement, maintenance and downtime costs are reduced.

Particle Size Distribution Indicating Reduction of Particle Size Between Collar and Centrate



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Project Outcome

The trial concluded that the AMC Surface SRU™ proved to be a financial benefit, not a cost, when calculating the potential savings for the Pilbara site. A calculated total of AUD\$20,700* savings were created by utilising the AMC Surface SRU™ per rig per month.

Feedback from drillers was positive, the AMC Surface SRU™ was compact and easy to use and operated well with minimal attention. The drillers noticed reduced mud usage, "There were shifts where little to no mud was added".

Using the AMC Surface SRU™ had a profound effect on the productivity of the drillers, "Mud preparation was replaced by mud checking – our guys had more time to monitor properties and fluid levels". Typical daily tasks included removing cuttings from the chute, check the water levels and daily maintenance. During this trial there were no stuck pipes, less friction on rods and hole, drill deeper without casing off, mud was kept clean by the unit and the drill bit lasted longer (saving reaming time of 1 – 1.5 hour and one rod trip of 4 – 6 hours when at 800m. The savings on man hours and reduced rod pull and reaming created a safer work environment. A 10% improvement in KPIs per shift per day meant a potential saving of \$18,000 per month.

Cost savings were principally generated from improved KPIs per metre, reduced mud usage, elimination of need for sumps, reduced cost of site preparation of sumps, reduced environmental impact and site re-mediation costs, reduced volume of cuttings (up to 98%), savings for the drill operator (equipment wear-and-tear and rig downtime due to maintenance), cleaner mud system, increased rate of penetration and reduced amount of water used or lost down hole.



Key Benefits for Drilling Company

- Reduced water consumption and cartage costs
- Reduced mud usage and associated costs
- Reduced slurry volume, waste cartage and disposal
- Improved productivity leading to extension of drill program
- Reduced wear and tear on drill components
- Reduced manual handling and labour required
- Improved on-site health and safety, reducing slips and hazards due to mess, mud and water
- Saved time managing and mixing mud.

Key Benefits for Resource Company

- Increased drilling productivity
- Reduced project costs, including water consumption and mud usage, and associated costs
- Minimised environmental contamination risk
- Drilling programs can expand to previously inaccessible areas
- Facilitated access to environmentally sensitive or remote drill sites
- Improved productivity extended drill program, additional 15 holes completed in project time frame
- Addressed community and government concerns on minimising environmental impact of mining activities.

Further Information

For more information about this case study, please contact amc@imdexlimited.com or your local AMC representative.

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