

AMC Surface Solid Removals UnitTM reduced water usage by 80%

CASE STUDY

An AMC customer set a challenge to reduce water consumption, environmental impact and costs of managing waste drilling fluid at its Horse Canyon exploration site located in Crescent Valley, USA. After signing three suppliers for a trial period, AMC Surface Solids Removal UnitTM (AMC Surface SRUTM) excelled in reducing costs and risks associated with handling fluids.

Background

AMC's customer had a number of environmental challenges at its Horse Canyon exploration site located in Crescent Valley. The site, located in the Cortez mountain range, is regularly monitored for spills and accidental fluid release by the Bureau of Land Management. The customer had exhausted its original permits for drawing ground water. In order to complete the exploration program for the year, the company had to apply for increased permits.

Waste drill fluid handling also presented challenges. Waste drill fluid was typically hauled to large central sumps. Fluids were then pumped from the sump and solids were spread on roads where possible. This practice did not work well when temperatures were below freezing – consequently the sumps were reaching capacity and the mine was limited in the number and size of sumps.

Initial trials were completed using several suppliers waste management solutions for comparison. The AMC Surface Solids Removal UnitTM (AMC Surface SRUTM) was selected as the best unit and used during the 2014 drilling program at the Horse Canyon Exploration site.



Results

- Up to \$7,600* savings per rig per day
- 75% reduction in mud volume
- 80% reduction in water usage
- 75% less waste cartage.

*Rental is not included as rates may vary depending on the terms of the contract.

AMC SURFACE SRU™ CASE STUDY

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TRIAL OVERVIEW

Date	October – November 2013
Activity	Exploration and water well drilling
Location	The exploration site is approximately 400 acres and includes valleys, hills and mountains. Strict environmental policies apply. The AMC Surface SRU™ was utilised at three separate locations within the site
Access / drill pads	There are three principal access roads that loop the valleys and hills, allowing access to drill pad locations. The pads range from large with ample room to small congested sites cut into hills. Most of the sites do not have space for sump pits for solids separations
Mud information	The program included a basic bentonite system augmented with PAC, PHPA and lubricants
Water	Carted to site by water trucks
Geology	An initial layer of sands gravels and cobbles. Casing was installed through the unconsolidated sands and gravels until it advanced into rock. Once through the upper layer, a mud stone formation was often encountered
Minerals	Gold exploration

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Drill Rig 1

When the AMC Surface SRU™ arrived at the first drill rig, the crew had just finished drilling out a cement plug. The mud was dumped to combat cement contamination in the fluids.

Previously the crew was forced to dump 3,500 gallons of fluids twice a shift. This process involved several hours downtime mobilising trucks, assisting with the vac-out of the tanks and sump, then remixing new mud before recommencing drilling. 1 – 2 loads of water also needed to be carted to site, which took approximately 1 – 2 hours depending on availability of trucks and traffic at the water site.



Set-up on rig site 1

Rig and AMC Surface SRU™ Set-up On Site

- Rotary core rig – exploration drilling
- Drilling in reddish brown mud rock
- Mud tank volume 3,500 gallons, plus sump volume of 500 gallons
- Waste fluids were set up to drain into existing sump pit
- AMC Surface SRU™ set up to receive fluids from existing sump pit
- Fluid was pumped into AMC Surface SRU™ centrifuge with a Seepex pump – at approximately 18 gallons per minute
- The cleaned fluid flowed into the AMC Surface SRU™ mixing tank, then it was pumped back into the rig fluids tank
- For ease of operation two gas trash pumps were used. The first fed fluid from the sump pit into the AMC Surface SRU™ shaker tank. The second pumped fluid from the AMC Surface SRU™ mixing tank back to the drill rig fluids tank
- Employees were provided with a AMC Surface SRU™ induction and experienced crews were quick to make the equipment run at optimal performance.

Following a shift of operation with the AMC Surface SRU™, the drillers were impressed with the unit's performance – particularly its ability to reduce their time spent dumping fluid and carting water.

After four days of 24 hour operation, the drill was still using the same base fluids. During that period, approximately 2,000 gallons (less than one water truck) of fluid were added to account for hole volume. Under similar conditions, eight truck loads of water would have been required. Polymer top-ups were also added to replace lost polymers on cuttings.

"We are still using the same mud after four days. That has never happened out here before. We have used only four bags of mud over the past few days – typically we would have used 18 bags per day."

– Driller



SCENARIO 1 – \$2,397 SAVINGS PER DAY

One load dumped per shift for four days	Estimated cost (US\$)
Cost without AMC SRU™ – including: vac truck, water haulage, remixing fluids and downtime	\$10,520
Cost of utilising AMC SRU™ – including: water haulage and mixing fluids	\$931
Total savings	\$9,589*

SCENARIO 2 – \$5,027 SAVINGS PER DAY

Two loads dumped per shift for four days	Estimated cost (US\$)
Cost without AMC SRU™ – including: vac truck, water haulage, remixing fluids and downtime	\$21,040
Cost of utilising AMC SRU™ – including: water haulage and mixing fluids	\$931
Total savings	\$20,109*

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Drill Rig 2

At the second drill rig, the crew had previously been dumping one load per shift to avoid drilling complications.

Rig and AMC Surface SRU™ Set-up On Site

- Rotary core rig – exploration drilling
- Drilling in zones of mudstone and rock
- Mud tank volume 3,500 gallons, plus sump volume of 500 gallons
- Waste fluids draining into existing sump pit
- AMC Surface SRU™ set up to receive fluids from existing sump pit
- Fluid was pumped into AMC Surface SRU™ centrifuge with Seepex pump – the pump was set to run at a very slow speed to match the processing rate of the Seepex pump
- Cleaned fluids were pumped from the AMC Surface SRU™ mixing tank back to the drill rigs supply and mixing tanks. Once in the rig mixing tank, drilling fluids were added before being pumped into the rig feed tank
- The drilling crew were now familiar with the AMC Surface SRU™ and did not encounter any problems running or maintaining the unit.

The drilling crew found it very easy to maintain levels in the tanks and would periodically shutdown the AMC Surface SRU™ to let sump volumes build back up to prevent running the feed and Seepex pumps dry. These shutdowns also allowed the crew to carry-out routine maintenance on the unit.

DRILL FLUID MEASUREMENTS TAKEN AT RIG 2

Date	Dirty Viscosity	Dirty Weight	Clean Viscosity	Clean Weight
29/10/13	42	8.9lbs / gal	41	8.7lbs / gal
30/10/13	64	9.0lbs / gal	60	8.8lbs / gal
01/11/13	66	9.4lbs / gal	62	8.8lbs / gal
02/11/13	65	9.4lbs / gal	61	8.8lbs / gal

After four days of drilling the hole was terminated. The drilling crew foreman planned to keep the AMC Surface SRU™ on site for the next hole; however the decision was made to move the unit to a new location. The drilling crew regularly asked for more AMC Surface SRU™ units for use on their other drill sites.

“I like the AMC Surface SRU™. I would rather spend time walking over to look at tank levels than standing on top of a mud tank mixing sacks of fluids. It saves us time and helps us drill more.” – Drill Hand

Drill Rig 3

At the third rig, the drilling crew were experiencing bit balling and were unable to advance the hole for a week. Fluids were laden with cuttings of red mudstone. The resource company were forced to either dump the complete volume of mud from the rig and remix fresh mud, or try cleaning the fluid with the AMC Surface SRU™.

Rig and AMC Surface SRU™ Set-up On Site

- Large diameter flooded reverse rig – water well drilling
- Limited space as the drill pad was on a steep hill
- AMC Surface SRU™ was set up behind the rig close to the mud tanks
- AMC Surface SRU™ received fluids from the rig mud tanks
- Fluid was pumped into AMC Surface SRU™ from the centrifugal pump on the mixing tank. As the fluid has already been through the rig shakers and hydrocyclones, the AMC Surface SRU™ shaker was bypassed.
- After processing, the clean fluid from the AMC Surface SRU™ mixing tank was pumped with a 2" trash pump back to the rig mixing tank
- The rig has a surface volume of 7,000 gallons and approximately 36,000 gallons in the hole
- The mud weight in the rigs clean fluid tank was 10.1lbs per gallon.



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'The Little Centrifuge That Could' – piles of cuttings.

"I want an AMC Surface SRU™ with each of our rigs. The AMC Surface SRU™ keeps the mud in like new condition and it saves us man hours. Our crew can focus on drilling and our men can attend to drilling activities instead of running for water and mixing mud."
– Drill Hand

Initially the mud was very aerated as the rig hands had been instructed to add detergents to assist in dropping the clays.

After 24 hours of AMC Surface SRU™ operation, the mud weight had dropped to 9.5lbs per gallon and the AMC Surface SRU™ was still removing a large amount of cuttings. Fluid exiting the centrifuge measured 8.8lbs per gallon consistently and the Seepex pump remained set at 18 – 20 gallons per minute.

Following 36 hours of circulating the hole volume and conditioning the fluids with the AMC Surface SRU™, the rig was able to slowly advance the bit. The performance and effectiveness of the AMC Surface SRU™ was obvious. Volleyball size lumps of cuttings regularly fell from the unit's cuttings discharge chute and filled a large wheelbarrow within 30 minutes of operation. Due to limited space on site, the 'cutting balls' were shovelled or thrown by hand into piles. By the end of the operation the cuttings were stacked over six feet deep.

DRILL FLUID MEASUREMENTS TAKEN AT RIG 3

Date	Dirty Viscosity	Dirty Weight	Clean Viscosity	Clean Weight
07/11/13	-	10.1lbs / gal	-	8.8lbs / gal
08/11/13	47	9.5lbs / gal	40	8.8lbs / gal
08/11/13	46	9.5lbs / gal	40	8.8lbs / gal
09/11/13	48	9.5lbs / gal	42	9.2lbs / gal
09/11/13	48	9.5lbs / gal	42	9.2lbs / gal
10/11/13	47	9.4lbs / gal	41	9.1lbs / gal
10/11/13	47	9.4lbs / gal	41	9.1lbs / gal
11/11/13	42	9.4lbs / gal	40	9.2lbs / gal
11/11/13	42	9.4lbs / gal	40	9.2lbs / gal

Notes:

1. Dirty weight is taken in rig mud tank. Clean weight is taken under centrifuge.
2. Rig circulating volume of 42,000 gallons.
3. Circulation of 24 hours between check one and two.
4. Mud in first 3 checks was very aerated with detergents.

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Project Outcome

AMC provided two proposals utilising its AMC Surface SRU™. The first proposal utilised 1 – 2 AMC Surface SRU™ units located at the central sump. The second utilised an AMC Surface SRU™ at each drill location and significantly reduced water usage and costs associated with handling the fluids – other benefits included:

- Reduced mud usage and cost
- Fewer vac-trucks in the mine site
- Fewer water truck trips
- Reduced road maintenance
- Reduced risk of road accidents
- Reduced dust generation, which helps the company meet environmental regulations
- Increased drilling time – less time spent mixing mud and emptying pits
- The trial demonstrated a significant reduction in the environmental footprint including water usage, clearing of vegetation and digging of earth sumps.

The trial demonstrated the AMC Surface SRU™ is an efficient and cost effective solution for the customer's drilling and waste management challenges. Summary of savings concluded the average day's costs were reduced by \$7,600, and reduced downtime and water haulage easily made up for any additional cost of the AMC Surface SRU™ on site.

Replacing fluids vs utilising SRU™	Estimated savings (US\$)
Cost to replace one circulation of mud (one day)	\$7,600*
Cost to replace one circulation of mud (six days)	\$45,600*

Award-winning Technology



AMEC ENVIRONMENT AWARD



WA INNOVATOR OF THE YEAR AWARD

The performance of the AMC Surface SRU™ was so effective the customer requested an additional two units on site – despite signing all drilling fluid suppliers to a one unit trial project.

Key Benefits for Drilling Company

- Saved time managing and mixing mud
- 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
- Reduction in drill downtime, no mechanical failures experienced
- Reduced fluid waste and transport costs
- Reduced manual handling and labour required
- Improved on-site health and safety, reducing slips and hazards due to mess, mud and water.

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
- Improved relationships with land owners.

Further Information

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

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