



## Unique closed-loop cuttings vacuum system eliminates site contamination

### Dry gas well operator takes closed-loop cuttings management to the next level

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Managing drilling cuttings is an expensive process that can cause considerable disruption to the landscape, threaten the environment and saddle the operator with short- and long-term liabilities. Over the years, there have been steady advances in cuttings management that maximize drilling mud recovery and improve the handling and disposal of waste solids. The process started with reserve pits and has progressed to closed-loop management systems.

**Reserve Pits** – Oil and gas drilling produces waste drilling fluid and cuttings that have traditionally been deposited in onsite reserve pits. Reserve pits have several shortcomings in that they:

- Cause massive surface area disruption;
- Must be constructed before drilling can begin and require the use of heavy earthmoving equipment;
- May have to be lined;
- Must be properly remediated when the drilling project is completed. Remediation could require the removal and offsite disposal of the waste materials and liner, backfilling the pit and re-vegetating the disturbed pit area.

In addition, there are health, environmental and financial risks caused by the potential of leaks and runoffs or improper handling, which could release potentially toxic liquids into surface or groundwater. All of this adds considerable costs and potential long-term liability.

**Closed-loop cuttings system** – Many operators have turned to closed-loop cuttings management systems that eliminate reserve pits in favor of screen shakers, centrifuges and storage tanks that separate liquids and solids. This approach increases drilling mud re-use while segregating the cuttings that require disposal. The solid wastes separated out by the dewatering process still contain some liquid that must be treated with a solidifying agent before the material is loaded in dump trucks or roll-offs and sent offsite for disposal at oilfield waste disposal facilities.

Closed-loop cuttings systems:

- Eliminate the cost and complexity of building reserve pits;
- Minimize surface disturbance;
- Significantly reduce the cost and safety risk of deploying heavy earth moving equipment;
- Eliminate environmental risk of storing materials onsite;
- Reduce water and drilling mud use;
- Reduce liability;
- Deliver environmental and public relations benefits.

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**Closed-loop vacuum cuttings management systems** – Typical closed-loop cuttings systems still fall short of offering a completely closed system that eliminates environmental risk and maximizes returns. The onsite transfer of cuttings from dewatering equipment to storage and transport containers requires the use of excavators or loaders that inevitably spill some material as they move about the site. Moving heavy equipment also increases the risk of accidents.

Typical closed-loop systems use solidifying agents, such as sawdust or fly ash, that must be transported to the site, mixed and then shipped for offsite disposal, complicating the process and significantly increasing the volume of disposed material. It also adds costs - operators are forced to pay to buy and transport solidifiers, only to pay again a few days later to dispose of the material as hazardous waste.

Similar to cuttings management on marine drilling platforms, land-based vacuum cuttings management uses integrated pipe systems to move the material from the dewatering process to the storage/transport containers. It eliminates the need for open bins and loaders/excavators, keeping the material within the closed-loop process from beginning to end.

As an environmental, energy and industrial services company, Clean Harbors is in a unique position to deliver a turnkey, closed-loop vacuum cuttings management system that processes the cuttings from the time they enter the dewatering process through proper disposal in a landfill.

Combining its expertise and resources from its different divisions, Clean Harbors designed and built a cuttings management system that integrates vacuum containers that have long been used in its environmental operations with dewatering and cuttings management shakers, centrifuges and other equipment to create a turnkey, truly closed-loop process.

Clean Harbors begins by intensifying the dewatering process through the use of secondary high G drying shakers to further reduce cuttings liquid content. The solids are then moved by piping and hoses directly from the dewatering process to sealed containers for transport. Open air bins and storage, as well as the use of loaders, can be completely eliminated. The sealed containers provide secure over-the-road shipment to a Clean Harbors or other contractor's disposal facility. No solidification is necessary since the sealed containers ensure against leaks and spills during transportation and the material is landfill-ready.

In addition to the benefits of typical closed-loop systems, the Clean Harbors approach:

- Eliminates the cost, as well as the safety and environmental risks, of using loaders or excavators to mix and move materials;
- Increases drilling mud capture for re-use;
- Greatly reduces or eliminates the need for solidifiers, some of which may require hazardous materials handling procedures;
- Significantly lowers total waste volumes, decreasing transportation and disposal costs;
- As a self-contained process, can be quickly relocated to new well sites;
- Reduces manpower;
- Saves money through reduced site remediation costs.

The Clean Harbors vacuum cuttings management system is the next generation of closed-loop cuttings processing.



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Clean Harbors has deployed the cuttings vacuum system at several locations. A typical installation example is a deployment for a dry natural gas operator in the Marcellus Formation in Pennsylvania.

### Situation:

The operator was using a standard closed-loop system to process about 550 gallons a minute of liquid cuttings. It was trucking in about 300 tons of lime kiln dust solidification agent per well and was using an excavator to move and mix the cuttings. Dump trucks hauled an average of 1,200-1,400 tons of solidified cuttings for disposal per well.

### Response:

Clean Harbors proposed and installed its turnkey cuttings management system that used a high volume vacuum system to move the drill cuttings from the dewatering process collection area directly into sealed bins. Clean Harbors was also prepared to use a reduced amount of solidifying agent if it proved necessary. Based on the operator's past experience, Clean Harbors projected that it would be able to reduce per-well cuttings for disposal to about 1,000 tons.

### Results:

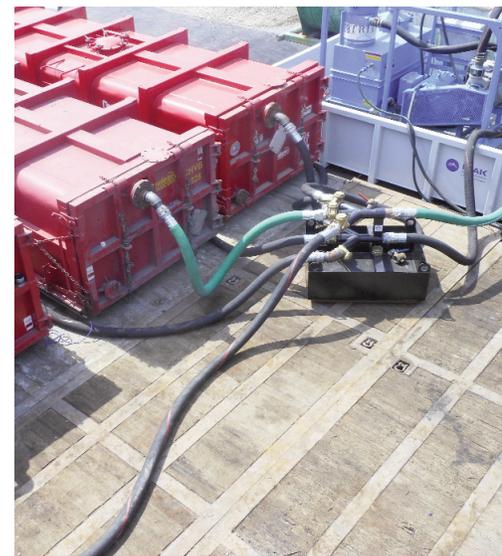
The results have been impressive. The operator reduced the need to have heavy equipment (loaders and excavators) moving around the drilling site, saving money and improving safety. The process also virtually eliminated the use of lime ash, which was a significant cost and had the potential to be hazardous. Following drilling, the sites now require less restoration or mitigation; moves between drilling locations have also been expedited since the integrated vacuum unit and vac boxes can be quickly relocated and put back into operation at other locations.

The waste stream has been reduced by over 30% and exceeded the projected reduction. Solidification has been virtually eliminated with only 3-4 loads on the first well requiring mitigation at the disposal site. The rest of the loads consisted of untreated cuttings solids with minimal liquids that were shipped directly to the landfill and were evaluated as adequate for disposal without further remediation. Over-the-road traffic has been significantly reduced with no inbound shipments of lime kiln ash and outbound vacuum box truck traffic dropping to once every six hours (on average), improving road safety and reducing liability. The net result is that transportation and disposal costs were reduced by an estimated \$4/foot, which exceeded the customer's expectations.

Clean Harbors has delivered measurable business results for the gas operator and, as a result, has expanded its vacuum cuttings management business with the customer.

### Clean Harbors' Vacuum Cuttings Management Results:

- Reduced onsite heavy equipment use;
- Virtually eliminated lime ash solidification;
- Reduced cuttings to landfill by 30%;
- Reduced cuttings disposal costs by 30-35%;
- Significantly cut over-the-road traffic;
- Improved overall safety.



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