Dewatering

APPLICATIONS

Offshore and onshore rigs running water-base systems where there are limited or zero-discharge regulations, where there is a scarcity of water, and/or where it is necessary to drill with a low-density or extra-clean system.

PROBLEMS

Colloidal-size particles build up in the fluid system, requiring dilution and creating excessive waste volumes. These ultra-fine particles, less than 3 to 5 microns in size, cannot be removed via centrifuge alone. The excess waste volumes add to drilling costs and increase environmental liability.

SOLUTIONS

The dewatering systems from M-I SWACO use a combination of chemical treatment and centrifugation to separate these micro-fine particles from the fluid system effectively and economically.

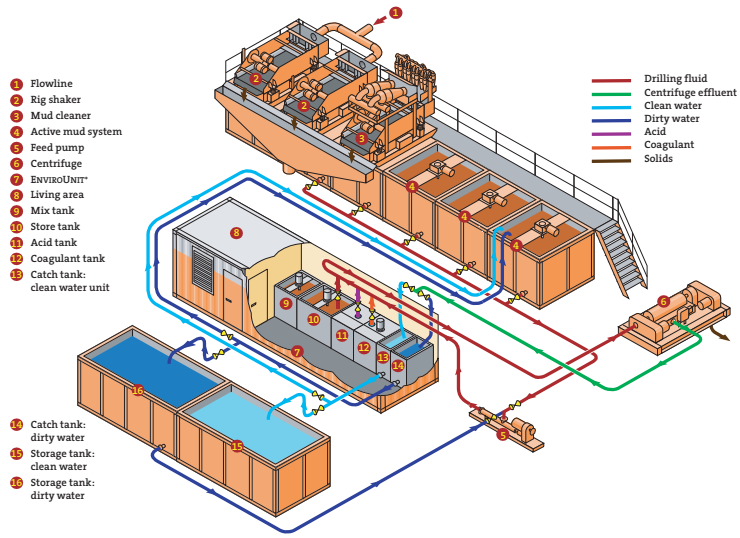
ECONOMICS

The system gives operators a powerful tool for maintaining optimum drilling-fluid properties for faster drilling, while minimizing drilling-fluid waste and reducing cleanup, treatment and disposal costs. Significant cost savings can also be realized through reductions in the rig footprint.

ENVIRONMENTAL

For limited- and zero-discharge situations, the dewatering unit plays an important role in closed-loop systems and the dry-location concept. By helping to keep the mud system clean, it greatly reduces the amount of drilling waste that must be sent for treatment or disposal.

Typical setup for land rig dry location



It is a known fact that the presence of colloidal-size particles can degrade the performance of water-base drilling fluids, requiring costly dilution to maintain the proper density and rheological properties. This in turn results in greater volumes of waste that must be treated and sent for disposal.

The portable, containerized dewatering systems from M-I SWACO remove these fine particles through a process of chemically enhanced centrifugation that is significantly more effective and economical than a high-speed centrifuge alone. This gives operators a powerful tool for maintaining optimum drilling-fluid properties, while minimizing drilling-fluid waste and reducing cleanup, treatment and disposal costs. Several designs of dewatering units are available to fit any onshore or offshore rig requirement.

The chemistry and physics of dewatering

Colloidal particles are ultra-fine, generally less than 3 to 5 microns in size. They are stable, and uniformly dispersed in the drilling fluid. In solution, they normally have a negative electrostatic charge, and it is this like-charge nature that imparts stability and maintains them as discrete particles that will not settle out, even with the increased G-forces in a centrifuge.

To overcome this problem, M-I SWACO uses chemicals to destabilize the particles and make them aggregate into larger units called “flocs” which are easier to remove by centrifugation. Successful flocculation can involve up to four steps in the dewatering process:

- **pH adjustment.** Most drilling fluids are maintained in alkaline conditions, in the 9.0 to 10.5 pH range. Some coagulants work best in a narrow pH range, around neutral pH 7.0, so an acid is added to the feed mud to adjust the pH to the optimal range for the coagulant.
- **Coagulation.** Cationic, positively charged polymers and inorganic salts such as aluminum sulfate, form the two main types of coagulant. These are used to reduce the electrostatic charge of the particles and enable them to stick or bond together when they make contact with each other. At higher concentrations, the inorganic salts can form large precipitates, called sweep flocs that also envelop the colloidal particles.

- **Flocculation.** The next step in the process involves the addition of a special polymer flocculant to the coagulated fluid. The polymer forms bridges between the coagulated particles, enabling them to physically join together into larger, porous, three-dimensional structures know as "flocs." Compared to the original colloidal-size particles, these larger flocs are relatively easy to remove as a moist sludge.
- **Centrifugation.** The final step in the dewatering process is the removal of the flocculated solids, using a fully variable, high-speed centrifuge to generate a solids free, usable recovered fluid.

Features and Benefits

- In limited-discharge areas, the system is significantly more economical than haulage, treatment and disposal
- For zero-discharge situations, the dewatering system plays an important role in closed-loop systems
- Allows cut point to be reduced below normal solids-control equipment operating parameters
- The system's water recycling capability makes it easier to keep the mud system in good condition at all times and is a valuable feature where water is scarce
- Recycling of the fluid phase reduces the mud and disposal costs
- The fully contained unit has a small footprint for installations where space is at a premium
- The integral magnetic flowmeter accurately records the volumes processed as well as water usage
- The computerized dosing system reduces chemical costs
- High-capacity, fully adjustable centrifuge
- Certified lifting eyes

How it works

A. Fluid from the active system or storage is transferred to the dewatering unit. If the fluid is weighted, it would normally be fed first through a barite-recovery centrifuge to remove the high-density solids for return to the mud system.

B. As the fluid passes through the flow loop in the dewatering unit, it is chemically treated to enhance flocculation. The chemical treatment depends on the type of fluid being treated and the required quality of the recovered fluid. This may include acid treatment to produce the desired pH, and the addition of coagulants and flocculants. Each treatment requires separate storage capabilities and injection pumps as well as mixers. With dry products, additional mixing tanks are required. The mixing and injection process is fully PLC-controlled. Coagulants require a high-shear mixer to ensure dispersion throughout the feed mud, whereas the flocculant polymers require a low-shear mixing action to prevent the flocs from being torn apart.

C. The flocculated fluid is then fed through the dewatering centrifuge, where the flocked solids are removed in the solids discharge to generate a clean reusable recovered fluid.

Dewatering process flow