

# Fluids Environmental Services

Effective, environmental  
waste management solutions



At Baker Hughes we firmly believe that protecting the environment for future generations is paramount to the success of the oil and gas industry. We offer innovative, cost effective solutions that uphold the industry's environmental responsibilities.



## Solids control

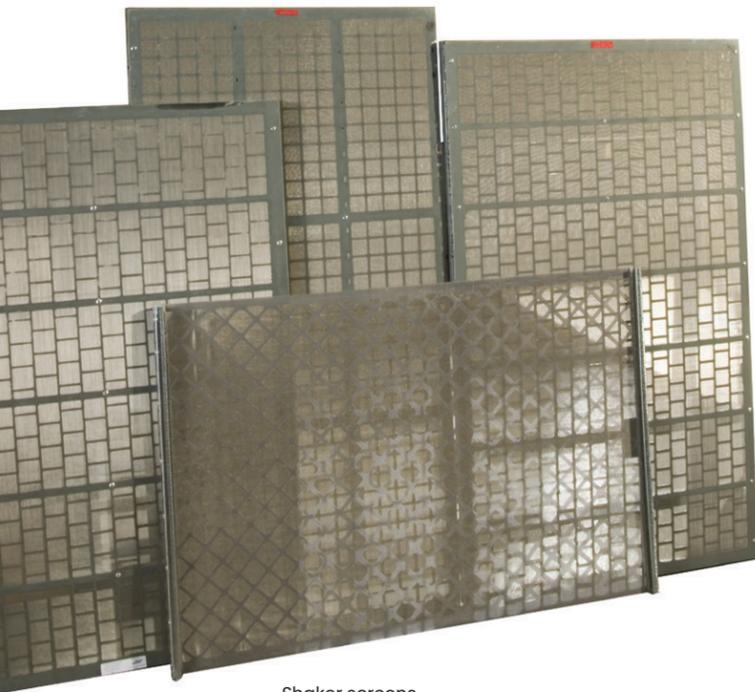
Solids control plays a key role in responding to the environmental and economic pressures the drilling industry faces today. From improved drilling fluid properties and lower mud dilution rates to cuttings drying, our solids control equipment delivers quality performance in every project.

Baker Hughes Fluids Environmental Services (FES) offers reliable, field-proven technology for every drilling application and specializes in providing high-capacity equipment with small footprint features that are ready for rapid deployment to meet any technical challenge.

Our thorough training program and extensive knowledge base ensure that our services exceed expectations and, more importantly, never compromise quality or productivity in our continuous drive to provide optimal rig efficiency.

### Shale shaker screens

FES includes a complete portfolio of shale shaker screens for most commercial shakers currently used in the oil industry. Our screen offerings include both pre-tensioned and hook-strip screens with metal or plastic backing.



Shaker screens

## Centrifuge technology

The FES centrifuge technology portfolio includes fixed and variable speed centrifuge models that can be used for any application: barite recovery, WBM dewatering, high-speed low gravity solids removal, and slops processing.

All the centrifuges in our fleet are selected to provide customers with:

### Flexibility

Adaptable to any operational condition – volume requirements, material characteristics, electrical classification, field application – and capable of responding to changes to those conditions.

### Reliability

Built with high-strength, corrosion-resistant alloys, enhanced feed and discharge parts for superior wear resistance, and torque and temperature sensors for reliable machine protection under the harshest conditions.

### Capacity

Bowl geometries that maximize capacity for each model with gearbox, motor and control panel selections that allow operators to achieve optimum solids removal every time are fully enclosed and automated with minimum involvement of personnel.

## Baker Hughes FES Centrifuge Portfolio Data Sheet

Centrifuge model	Capacity (gpm)	Drive	Bowl size (LXD, in)	Maximum G-force
1655 H	265	Fixed	16 x 55	2255
Lynx 300	230	VFD	14 x 59	3549
Lynx 400	530	VFD	17.3 x 69.3	3550
Lynx 500	660	VFD	20.1 x 88.5	3011
1854 FHD	270	FHD	18.1 x 58.2	3000
HH 5500	230	VFD	16 x 55	2100
BJ500	500	VFD	19 x 67	2100
OFM40	440	VFD	18 x 80	3118



FES 1854H centrifuge

# Cuttings conveyance and re-injection

## Bulk cuttings transfer

For those projects where returning cuttings to shore or having temporary storage onboard are a necessity, our bulk cuttings storage and transfer systems offer the most effective solution. It provides twice the storage capacity in the same footprint as competing options while at the same time offers unparalleled reliability based on a unique tank-emptying mechanism that does not require pressurized air and can be adjusted to match cuttings properties and operational requirements. Dense phase pneumatic units can transfer the cuttings to transport vessels or to existing treatment systems onboard the rig, eliminating the HSE risks involved in filling out and moving numerous cuttings skips.

## Skip and ship

Conventional containment and waste handling equipment is designed to optimize movement of large quantities of drill cuttings and mitigate the customer's risk of environmental exposure. FES processes are designed to deliver project performance objectives with low maintenance equipment throughout all operations. Our quality service efforts are focused on optimization and planning of the project lifecycle by providing specialized equipment for transporting drill cuttings with purpose-built augers, vacuums, and dense phase blower units.



Bulk storage tanks

Our auger systems have a field-proven, reliable track record and are fully enclosed and automated with minimum involvement of personnel. They range from 6 in. to 24 in. for conveying the entire cuttings load and are engineered with low power consumption requirements. FES has readily-available fixed and variable speed drive systems for rapid callouts, and custom units can also be designed for challenging applications.

FES offers the most powerful modular vacuum system (150 HP) on the market, able to handle high penetration drilling

rates in all hole sizes. This modular system can be adapted to fit specific site footprints, transporting high volumes of waste over extended conveyance ranges and challenging layouts. Our reliable vacuum units save customers critical rig time, leading to greater reduction in overall operating costs.



150 HP vacuum unit

## Cuttings re-injection

In environmentally-sensitive locations or remote exploration areas, cuttings re-injection (CRI) offers the best alternative to handling drilling waste disposal by mitigating the project impact without compromising its development goals. CRI is the only technology available with the capability to fully dispose of all E&P drilling waste generated at the rigsite into a subsurface geological formation. The FES group has focused its efforts on using CRI as a permanent, eco-responsible waste disposal solution. Since 1989, FES has been a global leader in CRI technology.

In conjunction with the Baker Hughes geoscience group, FES provides the expertise to develop and test a geomechanical model to ensure project feasibility and asset integrity. Our engineers are trained and experienced in adjusting the rheological slurry properties to maintain continuous injectivity throughout the project.

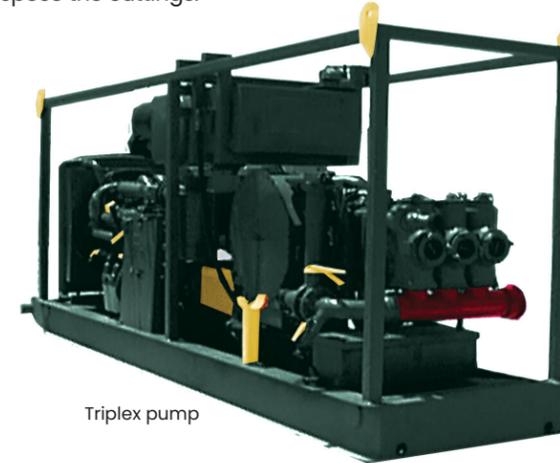
The surface process involves breaking down drill cuttings using grinding equipment, mixing them with water to degrade the particles into an acceptable size, and preparing and injecting a slurry down a wellbore into the selected formation that will ensure a safe and sustainable operation.

Our cuttings injection system, with the smallest footprint in the industry, is capable of processing over 30 tons per hour. The CRI process can be engineered to meet all global standards, including BS 12079, LOLER & PUWER, CE markings, and ATEX certification (mechanical and electrical).

The FES CRI includes provides high-pressure triplex pumping units specifically-designed to inject the drill cuttings slurry into the predetermined disposal formation. The triplex pumps deliver rates between 3 bpm and 9 bpm (477 lpm and 1430 lpm) at pressures ranging from 1700 psi to 5000 psi to meet most injection project requirements. In extreme applications, FES engineers can custom design our mixing and pumping equipment to meet any technical environmental or safety requirements.

# Cuttings processing

A major challenge in processing drilling cuttings is the diverse nature of the waste produced. The treatment method selected for each drilling project is based on the characteristics of the waste material, the local environmental regulations, and the available infrastructure. In most areas of the world, cuttings and drilling fluid discharges offshore are strongly regulated. The restrictions vary from the controlled of discharges (quality and quantity), to complete zero discharge. Each situation requires a different approach to convey, store, treat, and dispose the cuttings.



Triplex pump

## Cuttings dryers

The FES cuttings dryers are engineered to provide maximum fluid recovery for recycling expensive drilling fluids at the source and discharging the solids phase overboard to sea or into cuttings boxes.

FES offers both vertical and horizontal units that will meet or exceed fluids separation requirements while using synthetic-based mud (SBM) systems. Our dryer units provide a large basket surface area and a high-torque rotating assembly to meet the most challenging processing requirements during drilling operations.

## Small footprint, high-performance vertical dryer

In drilling projects with limited power supply and footprint, FES offers a small footprint, high-performance (SFHP) vertical dryer to fit the most demanding operator requirements. The SFHP dryer provides a compact solution without sacrificing separation performance. The unit is capable of handling 20 to 30 tons of wet cuttings per hour. It has a split water cone cover that allows easy access to the rotating and separating components during repair and maintenance activities.

## Vertical dryer

For field-proven reliability, our vertical dryer is capable of processing 40 to 60 tons per hour. Back plugging issues are eliminated with the dryer's patented dual internal discharge auger mechanism which rapidly removes the dried drill solids. The low profile dryer unit sits directly on the deck, offering reduced height benefits that eliminate the need for an additional dryer stand.

## Horizontal dryer

Our largest and most powerful dryer is a horizontal unit that processes up to 100 tons per hour. This dryer unit has been engineered specifically for deepwater applications characterized by high cuttings generation rates. It has the highest processing capacity, combined with the largest screen surface area and highest torque capacity, to handle high ROPs in all borehole sizes. It also has a low height profile, eliminating the need for space-consuming stands used to accommodate cuttings transfer equipment for overboard discharge. Variable speed drive systems allow operators to operate the dryer at optimum speed to handle, silt, sand, salt, and other challenging formation returns in order to avoid screen out during critical high profile deepwater applications. Our revolutionary technology, unmatched in the industry, results in maximum fluid recovery while removing damaging solids and enabling discharge in permitted areas.



SFHP dryer



Horizontal dryer

# Fluids processing

By taking advantage of existing technology and introducing new and innovative equipment, FES is constantly working to reduce the volume of waste fluids generated in drilling operations and their associated environmental risk. Our technologies focus on effective reintroduction of valuable components back into the drilling process, and then on the efficient handling of the residue left after the treatment is completed.

## Dewatering

FES dewatering units are designed to minimize waste volumes and allow maximum recycling of the water phase back into the drilling operation. Our dewatering system achieves exceptional separation of solids from water-based fluids by combining our FES expertise in fluid centrifugation with the Baker Hughes drilling fluids product line's expertise in chemistry.

Our self-contained, skid-mounted dewatering unit can be easily transported to any drilling location. It includes state-of-the-art mixing and polymer agitating tanks, metering and transfer pumps, and static mixers. To ensure real-time control of the process, the unit has a single control panel, quality check points, and a work platform for fluid sampling and equipment maintenance purposes. The acid injection system is separated from the work areas to eliminate the exposure of operators to hazardous risks.

FES uses a variable speed centrifuge that adds flexibility to a process that requires continuous adjustments of chemical and physical parameters to deal with the wide-ranging properties of water-based drilling fluids.

## Closed loop mud system

Our goal for closed loop systems is to reduce overall well costs by removing most drill solids while minimizing fluid loss. However, the needs of every project are different. Multiple factors affect the number and type of equipment required: existing solids control equipment, environmental regulations, well characteristics, solids treatment infrastructure, and logistics.

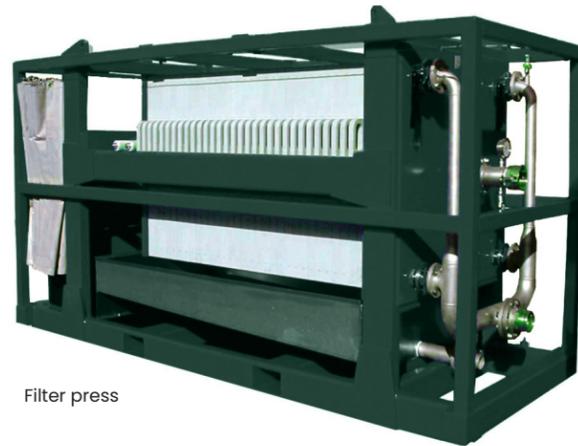
The FES closed loop technology is designed with specialized separation equipment to maximize effluent recovery while removing damaging solids. Each system can be configured to facilitate solids separation according to individual well needs using drying shakers, mud cleaners, and centrifuges. For solids handling, the FES closed loop systems provide auger tanks or standard tanks to capture the discarded materials before they are transported to their final disposal site.

## Filtration systems

Our filtration process equipment package consists of a filter press, pre-coat slurry tank, powder handling unit, and cartridge filter unit to provide continuous filtering of solids-free completion fluid. The system has a small footprint designed for operational efficiency while offering a safe working environment.



Dual pod cartridge filter unit



Filter press

The Baker Hughes offshore slops treatment unit safely and efficiently treats large quantities of contaminated water or "slops" on location. Taking this solution to the source reduces costs and risks associated with transporting and handling waste at onshore treatment facilities.

The offshore unit processes oil-contaminated brines, seawater, surfactants, rainwater, and other wastewater generated during drilling and completion operations. It doesn't require any chemicals to meet the most strict water discharge regulations.

The unit consists of four mechanical treatment stages assembled inside a 20 ft x 8 ft container and weighs approximately 12.5 metric tons, minimizing the required rig space and making it compatible with most offshore rigs.

The unit requires 105 kW power to be supplied by rig equipment or a dedicated generator.

A large offshore oil rig is shown at night, illuminated by its own lights against a dark blue sky. The rig's complex structure of towers and cranes is reflected in the calm water below. The scene conveys a sense of industrial scale and operational activity in a remote environment.

Responsible waste management.  
Optimal rig efficiency.

