



ENVIROUNIT Offshore Slop Water Treatment System

The rig-based solution for reducing your drilling waste stream



ENVIROUNIT Offshore Slop Water Treatment System: The rig-based solution for reducing your drilling waste stream

Conventional management of offshore drilling slop is costly and wasteful. Whether it comprises contaminated drilling and completion fluids, cleaning residue from the rig pits, tanks, pipes and decking, or even collected rainwater, all slop typically must be shipped to shore for treatment and disposal, or else be re-injected offshore. Compounding high transportation costs, shipping to shore requires the vessel to be cleaned thoroughly after off loading, further increasing costs and the overall waste stream.

Whether installed on a new build or existing rig, the patented ENVIROUNIT⁺ offshore drilling slop water treatment system requires only one M-I SWACO operator, who is free to perform other services on the rig as well.

The only onsite slop water treatment system that recycles valuable drilling fluid



Features

- Nearly all slop types treated at source
- Two layouts available for different space, treatment requirements
- Designed with open or enclosed skids
- Capable of using existing pit and mixing systems if necessary
- Meets DNV 2.7.1, NS5820, NORSOK and ATEX certifications
- Complete pre-discharge testing of cleaned fluid for hydrocarbon content
- Treatment of well cleanup interfaces
- Three-step treatment process

Benefits

- Reduces offshore drilling waste stream by up to 90%
- Minimizes transportation requirements
- Recycles, reuses oil and synthetic-based drilling fluids
- Lowers land-fill disposal requirements, liabilities
- Minimizes personnel requirements
- Fully certified to applicable standards
- Allows for complete waste stream traceability
- Reduces supply boat down time for tank cleaning after slop water transport
- Reduces the need to clean supply boat tanks and eliminates waste production from cleaning

Conventional management of offshore drilling slop is costly and wasteful. Whether it comprises contaminated drilling and completion fluids, cleaning residue from the rig pits, tanks, pipes and decking, or even collected rainwater, all slop typically must be shipped to shore for treatment and disposal, or else be re-injected offshore. Compounding high transportation costs, shipping to shore requires the vessel to be cleaned thoroughly after off loading, further increasing costs and the overall waste stream. What's more, neither conventional shore-based treatments or re-injection are capable of recycling and reusing premium oil-base drilling fluids.

M-I SWACO, a Schlumberger company that pioneered the patented land-based ENVIROCENTER[®] water treatment system for treating slop and other offshore drilling and production wastes, brings its innovative, widely accepted waste-reduction technology directly to the rig with the modular ENVIROUNIT offshore drilling slop water treatment system. Like its ENVIROCENTER water treatment system predecessor, the fully certified, new-generation ENVIROUNIT water treatment system also recycles oil and synthetic-based drilling fluid for reuse, but does so at the source of origin. By managing most drilling slop on the rig, the easily operated ENVIROUNIT water treatment system significantly reduces the costs and risks of shipping liquid waste to shore, allowing the onsite discharge of clean and

fully compliant water, while treating and returning spent fluid into the active mud system.

We engineered four versions of the cost-effective ENVIROUNIT water treatment system to meet different rig space constraints and treatment requirements. Depending on the contamination level of the spent fluid, the ENVIROUNIT water treatment system has the capacity to process between 83 to 838 bbl/day (10-100 m³/day) of drilling slop. This unique offshore treatment system is field-proven to treat discharge quality drilling slop with oil-water ratios (OWR) higher than 20/80 with normal specific gravities from 1.1 to 1.4 sg and higher.

The ENVIROUNIT water treatment system is another crucial part of the M-I SWACO waste minimization pyramid that emphasizes "reduce, reuse, recycle and recover" as priorities and disposal of residue a last resort.



The straight forward, but effective ENVIROUNIT water treatment process

Fundamentally, the ENVIROUNIT water treatment system is designed as a relatively uncomplicated and easy-to-operate technology that begins with collecting and segregating the waste streams at their source and continuing through to the final flocculation and treatment. Typically, one tank is dedicated for collecting lightly contaminated and dischargeable liquids, such as rainwater and free water, while another tank stores heavily contaminated liquids, such as the sediments from tank cleaning. Because of different treatment methods, oil-base mud (OBM) and water and/or water-base mud (WBM) slop are collected and stored in separate tanks.

From there, operation of the ENVIROUNIT water treatment system follows a four-step process:

1

Separation Tanks:

The slop water is transferred from the slop water collection tank to the two emulsion breaking mixing and separation tanks in the lower part of the ENVIROUNIT water treatment system.

After the emulsion breaker has been added to the slop water, the recovered SBM/OBM settles out on the bottom of the two emulsion/separation reaction tanks. After the settling, the separated water is evacuated from the top by submersible pumps. The water phase is transferred to the water treatment tank on the top part of the ENVIROUNIT water treatment system (Step 2). The SBM/OBM can now be transferred to the active mud system after screening on the shakers.

After collection, the slop is pumped into 2 x 4.2 m³ circular stainless steel, sloped-bottom tanks for initial separation. Each tank is equipped with an agitator, feed and suction pump and a retractable air suction pump for collecting the now-separated fluids.



2 Flocculation Tank:

The recovered water phase transferred from the emulsion/separation reaction tanks is agitated in the water treatment tank and the specialized bentonite-based flocculant is added and mixed into the water. After the development of the flocculant and sufficient reaction time, the agitator of the mixing vessel is switched off and the flocculant (by then laden with hydrocarbon and other contamination) will settle on the ground of the mixing vessel.

The clear water phase is then evacuated with a submersible pump to the policing filter step (Step 3).

After the clear water phase has been evacuated to the policing filters, the flocculation sludge is pumped into the sludge collection vessel (Step 4), to allow a rapid filling of the water treatment mixing tank with more water for treatment

The slop then goes into the 4.2 m³ circular stainless steel and sloped bottom flocculation tank that likewise comprises an agitator, feed and suction pump and a retractable air suction pump for collecting the now-separated fluids.

3 Policing Filtration:

To ensure a continuous water discharge within regulatory limits, the water is directed from the water treatment tank to the policing filter steps.

The first filtration step is a 10-micron nominal solid filtration step. From there the fluid is directed to a polymer-based oil and grease absorbing filtration followed by an activated charcoal filtration.

The floc water filtration system has a maximum working pressure of 7 bar with a 7.5-bar safety relief valve.

4 Flocculation sludge de-watering:

Once the flocculation sludge storage tank is filled with enough sludge volume, the sludge is pumped from the sludge storage tank into the filter press.

The filter press will increase the dry substance volume from usually 2% in the sludge to up to 70%. By this, the overall waste volume will be reduced to below 90%.

The ENVIROUNIT water treatment system treats drilling slop at its source

Our shore-based ENVIROCENTER water treatment system set the standard for the treatment of drilling and production-generated slop and the recycling of premium drilling fluids. Since its inception, the ENVIROCENTER water treatment system has reduced overall waste streams by as much as 90% while recovering and reusing not only drilling fluids, but also some of the residue from vessel cleaning.

Recognizing the obvious importance and benefits of source segregation of the waste stream, we incorporated that basic concept into our modular ENVIROUNIT offshore slop water treatment and recycling systems. Isolating and treating operators' drilling slop on the rig effectively reduces the waste volume, risks and costs. What's more, treating directly at the rig site clears the way for complete traceability of the waste stream.

Slop is generated from a variety of sources, from spills and rainwater that must be collected to avoid overboard release of contaminants to residue from cleaning operations. Most of the more heavily contaminated slop sources, however, result from completion operations and drilling fluid interfaces that can include:

- Water contaminated with hydrocarbon
- OBM contaminated with water and/or WBM
- WBM contaminated with oil and/or OBM
- Completion fluids

The ENVIROUNIT water treatment system is designed to easily and thoroughly treat all Category 1 and Category 2 liquids, which have light to moderate contamination. Category 1 offers the mildest contamination with oil content less than 1,000 ppm and solids less than 1%, while the second category includes liquids containing between 1,000 ppm to 35% oil concentration with less than 5% solids. Slop arising from either of these groupings are fully treatable with the ENVIROUNIT treatment system, with the usable base fluid recovered for reuse.

The more heavily contaminated, or Category 3, liquid contains more than 35% oil and 10% solids content, along with polymers, surfactants and other additives. While this ultra-contaminated slop can be treated through the ENVIROUNIT water treatment system at low capacity, it usually is collected and shipped to the shore-based ENVIROCENTER water treatment system for further treatment.

An ENVIROUNIT water treatment system also can be configured to meet the distinct challenges of well cleanup interfaces, which require additional pre-treatment in the rig tanks. Here, the only requirement is that the rig has sufficient pit and tank capacity to allow extraction of the water phase from the interface slop before treatment. The ENVIROUNIT water treatment system has routinely demonstrated its capacity to reduce waste from interface treatments by up to 40%, and even higher if the well is displaced with seawater or brine.

Technical Specifications for the ENVIROUNIT water treatment system

- Skids: Open, grided or enclosed
- Power: 30 kW 440 V – 60 Hz
- Net Weight: 10.3 tons (9,400 kg) open
- Size (L x W x H): 19.3 ft x 8 ft x 17 ft (5900 x 2440 x 5180 mm)
- Tanks: 2 tanks (treat); 1 tank (flocculation)
- Filtering: 1 triple-pod filter unit, 1 filter-press

Put our ENVIROUNIT water treatment system to work for you

To find out more about how our ENVIROUNIT offshore slop water treatment system is performing for our other customers, contact your local M-I SWACO representative.

Field proven performance

Brazil: ENVIROUNIT water treatment system cuts intervention-generated slop up to 98%

The Situation

Typically, nearly all the slop water generated in offshore Brazil drilling and completion operations is shipped to shore and deposited in landfills, where leaching is a constant concern. To reduce the environmental risks, liabilities and costs, the operator needed an alternative collection and treatment solution for upcoming intervention operations with a range of slop waste sources, including produced water stored in the pump housing of a subsea production structure, separated water from the well cleanup interface, and deck drain water and cementing spacer fluids.

The Solution

M-I SWACO recommended installation of the ENVIROUNIT water treatment system for collecting and treating the various slop offshore, thereby reducing the waste volume destined for landfills.

The Results

The ENVIROUNIT water treatment system initially treated an average of 1,392 bbl (166 m³) of slop, recovering 519 bbl (62 m³) on average for reuse in the active mud system and achieving upwards of 98% reduction in the overall waste stream. The systems processed three divergent slop waste sources, including:

- **Produced water:** Initially treated 796 bbl (95 m³) of produced water stored in the pump housing of a subsea production structure. A cumulative 268 bbl (32 m³) of slop below the regulated 15 ppm level were discharged, while 486 bbl (58 m³) were treated and reused and 1.5 tons of solids waste were sent onshore for disposal. Compared to previous operations, the waste volume was reduced by 98%.
- **Separated water:** A total of 343 bbl (41 m³) of separated water from well cleanup interface was treated with 335 bbl (40 m³) of slop under 15 ppm discharged after passing all lab and regulatory testing for heavy metals PAH, BETX, TOG and TPH. Only 3 tons of solids waste were shipped to shore with comparable waste minimization of 90%.
- **Deck drain water and spacer fluids:** An initial volume of 251 bbl (30 m³) of deck drain water and cementing spacer fluids were treated and discharged after complying with all regulatory standards. A cumulative 33 bbl (4 m³) were treated and reused while two tons of solids waste were sent for onshore disposal. The process reduced the comparative waste stream by 93%.



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