

# MUD Split 2



Refinery acceptance of crude oil is normally less than 1% Basic Sediments & Water (BS&W)



## MUD SPLIT CHEMISTRY

The theory is that Mud Split chemistry alters the wettability on the fine particles in the sludge from being oil wetted to water wetted. This alteration allows for significant enhanced recovered oil that can become products at the refinery. MUD SPLIT chemistry effectively separates the different components of the sludge, namely oil, water and solids.

## Separation and recovery for re-use of Oily Sludge

The production and disposal of oily sludges are considered as one of the most critical environmental issues in the petroleum industry, particularly in the petroleum producer countries.

Annually, large quantities of oily sludges (more than 60 million tons) are generated and more than 1 billion tons of oily sludge has been accumulated worldwide.

### OILY SLUDGE IN REFINERIES

In particular, the sludge generated during the petroleum refining process has received increasing attention in recent years. It has been estimated that one ton of oily sludge is generated for every 500 tons of crude oil processed. Oily sludge is a complex and variable hazardous waste depending on the quality of crude oil as well as the processes used for water-oil separation. In general, oily sludge is composed of 40-52% alkanes, 28-31% aromatics, 8-10% asphaltenes, and 7-22.4% resins by mass. In addition, the oily sludge contains the heavy metals such as Zn, Cd, Pb, Cr, Cu, Ni and V.

Because of variations in the chemical composition of oily sludges, its physical properties such as density, viscosity, and heat value can vary significantly. Based on the integrated waste management strategy, three approaches including source reduction, oil recovery and disposal using different technologies such as thermal processes and biodegradation have been reported for oily sludge treatment.

### ECONOMICAL AND GOOD NEWS FOR THE ENVIRONMENT

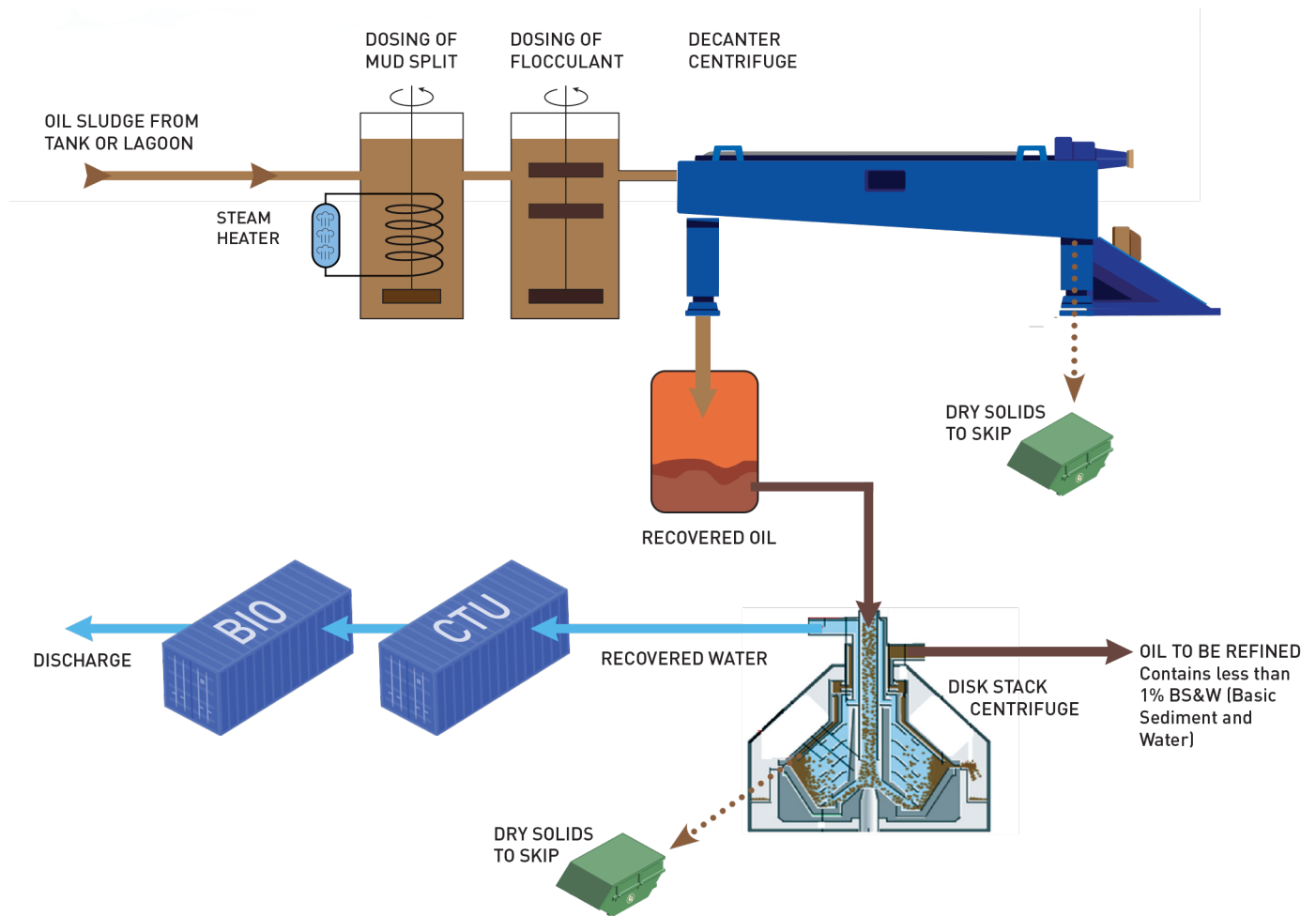
The development of environmentally friendly and economical technology for oily sludge management and treatment has for years been on the agenda of being a necessary achievement of sustainable development in the petroleum industry

## Enhanced Oil Recovery with Mud Split from Norwegian Technology AS

The oily sludge treatment with the Norwegian Technology solution allows for the separation and recovery for reuse of the different components of the sludge, namely oil, water and solids. The process takes place at ambient and heated temperature with the use of proprietary chemicals.

Oily sludge is a complex emulsion of various petroleum hydrocarbons (PHCs), water, heavy metals, and solid particles. Due to its hazardous nature and increased generation quantities around the world, the effective treatment of oily sludge has attracted widespread attention. Many methods deal with PHCs in oily sludge either through oil recovery or sludge disposal.

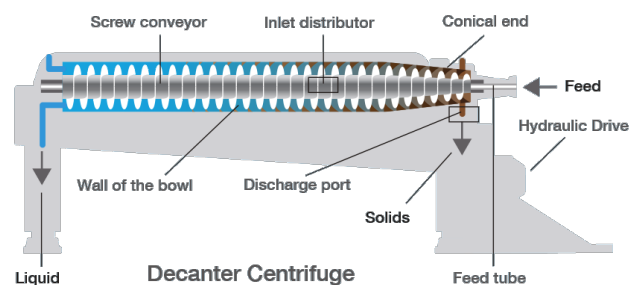
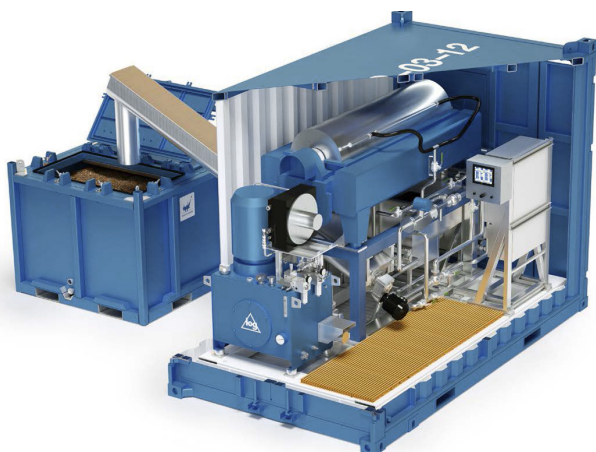
### Mud split and mechanical separation with mixers, heaters and centrifuges



### A complete treatment package from Norwegian Technology AS

Norwegian Technology AS can provide our clients with a complete treatment package included necessary mixing tanks, heater, the STU (sludge treatment unit) contains a Hiller decanter centrifuge with possibility to dose mud spit and flocculants. The disc stack centrifuge is a separate skid.

Mechanical centrifugation uses centrifugal force generated by high-speed rotation of centrifugal equipment to separate the components with different densities such as crude oil, water and solid impurities in the oily sludge.



## Mongstad Refinery - Case study Highlights

Norwegian Technology AS has been participating in a project at Mongstad together with Norsk Gjenvinning AS.



### Description

The customer - Equinor Mongstad Refinery - introduced new exacting regulations. Oil from the sludge can no longer be sent away for disposal (it is "red listed" by the Directorate for Nature Management) meaning that the oil has to be used at the refinery. The oil cannot contain more than 1% water and particles - to prevent steam explosions. Without Mud Split it was not possible for Norsk Gjenvinning AS using heater, decanter and disc stack centrifuge to attain less than 40% at best case.

New Equinor Mongstad Refinery requirements in 2020: less than 1% water and solids in the oil to become products at the refinery.

By adding Mud Split before the heater they managed less than 0.3% water in the oil. Results without MUD SPLIT: 40% water and solids in the oil.

Technology set-up: mixers for homogenisation in storage tanks, mixing-tank with heater dosing of chemical, decanter (for separation of solids), Disc stack centrifuge (separation of oil from water)

### Results

Volume treated in one batch: 17 000 bbl Dosing of Mud Split: 0,08 litre/bbl After dosing and centrifuge the sludge separated into:

- Dry solids separated: 1 700 bbl
- Crude oil to the refinery: 5 100 bbl
- Water to the treatment facility: 10 200 bbl

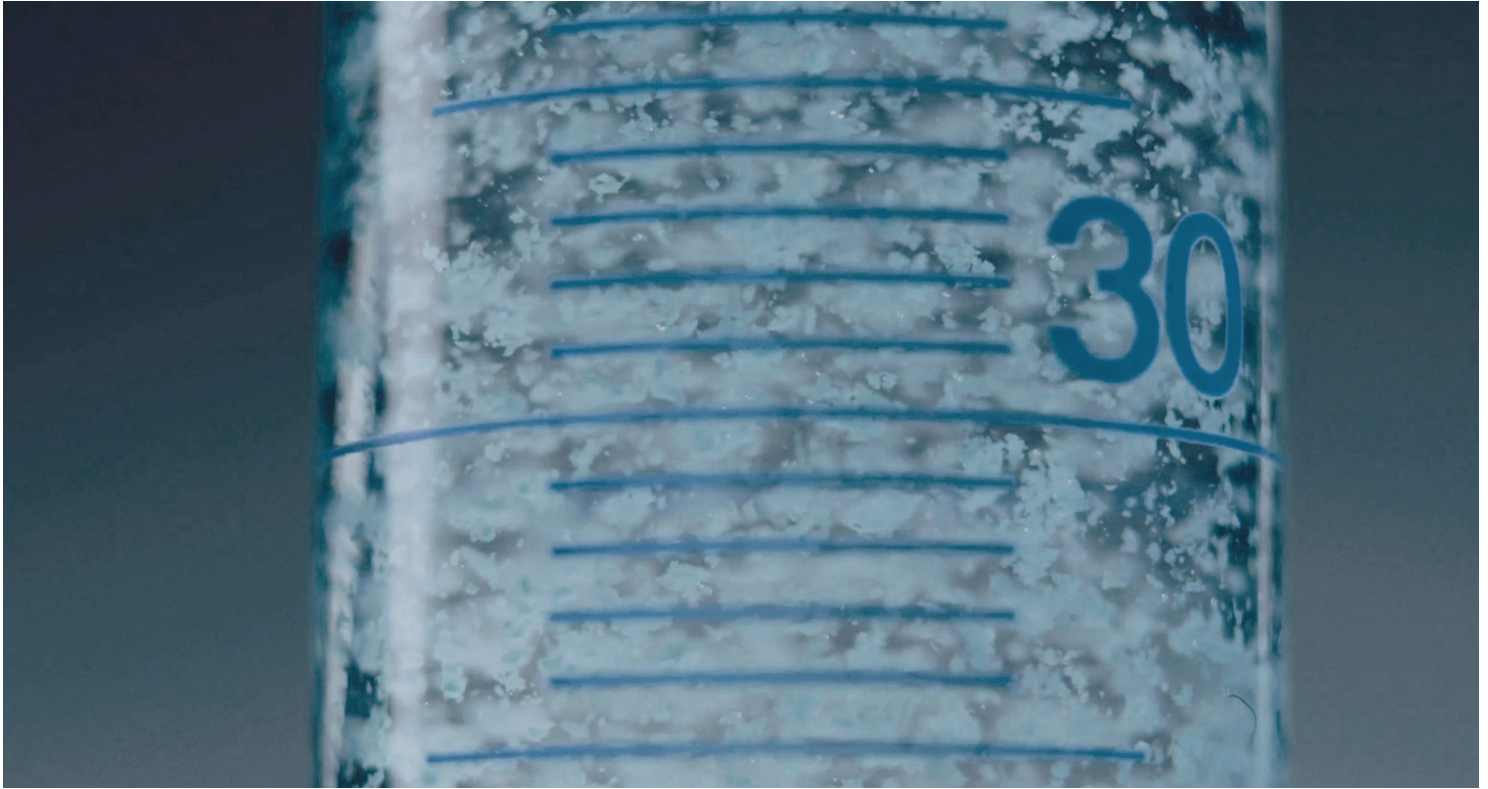
Value of the oil: 280 000 USD (oil price December 2020)

Estimated cost of delivery of the 17 000 bbl as hazardous waste in Norway: 95 USD/bbl totalt 1 600 000 USD



Recovered water treatment for discharge

Most refineries have water treatment equipment implemented as part of their daily operations. In the event of limited treatment capacity or at remote locations, Norwegian Technology can provide mobile separation equipment for separation of suspended particles, heavy metals and residues of oil.

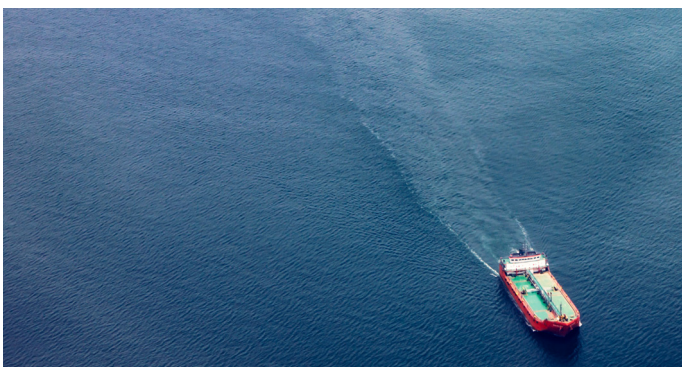


Lab tests

Norwegian Technology conducts a lab test with representative samples in order to accurately identify the most appropriate mud split chemicals, to optimize their dosing, to evaluate the reaction time relative to temperature and, last but not the least, to draw a technical proposal highlighting the consequent cost savings for the Customer.

Shipping

Norwegian Technology "Oily Sludge Split" chemicals can be shipped all over the world on Customer request.



HSE

Each Mud Split product comes with its own Safety Data Sheet (SDS) important component of the product stewardship, occupational safety and health, and spill-handling procedures. The SDS information include instructions for the safe use and potential hazards associated with the product. The SDS includes instructions related to storage requirements, protective gear, and physical, chemical and environmental data. Norwegian Technology AS "Oily Sludge Split" chemicals can be used both offshore and onshore.

The different dosing procedures are determined by the characteristics of the sludge, the chemicals dosing usually varies between 0.5 and 2 litres per m<sup>3</sup> of sludge.