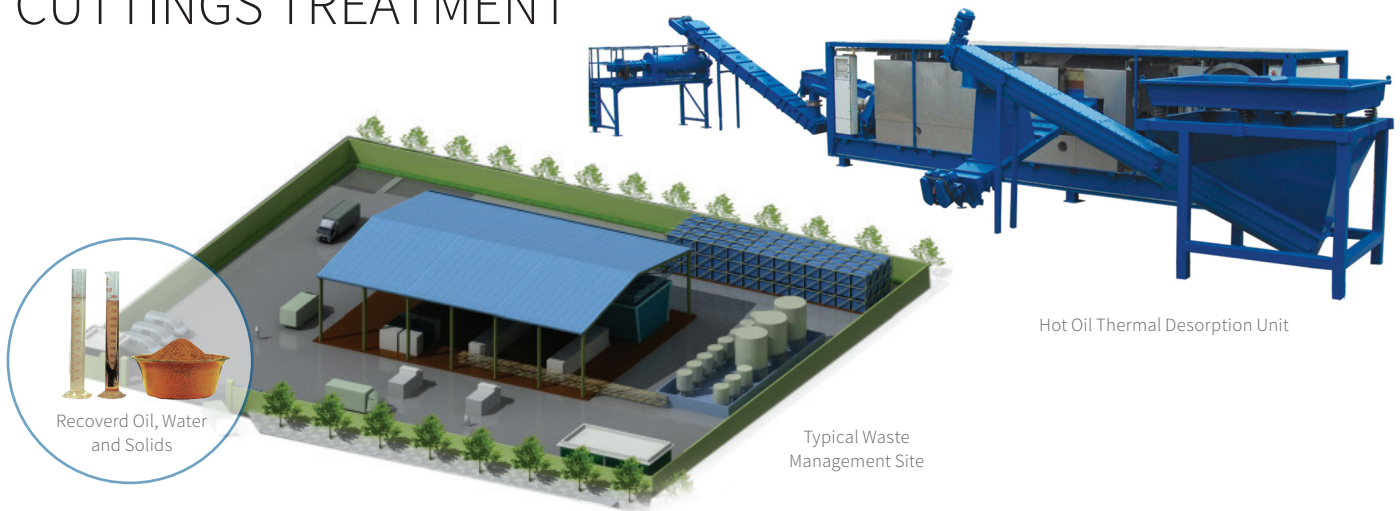


OIL-BASED DRILL CUTTINGS TREATMENT



An increase in global awareness of the need for environmental preservation has led the drilling industry to adapt to changes in environmental policies. Nation environmental laws are now being strictly enforced and companies must adapt their policies to abide by these regulations. The treatment of drill cuttings with thermal desorption provides an excellent option for meeting these standards. NOV has more than 20 years of experience in the thermal treatment of drill cuttings.

Benefits

The Hot Oil Thermal Desorption cuttings treatment provides users with the following:

- Total waste management system for the treatment of oil-based mud (OBM) drill cuttings
- Recovery of oil for reuse in OBM
- Recovery of water
- Recovery of solids with an oil residue of less than 0.5%
 - Meets the strictest legislation in the world
- Complete waste management site layout
- Handling and distribution systems for cuttings originating offshore
 - Rig to waste management site
- Complete QHSE system for control of the process
- Complete process energy balance of 50% and below
 - The process recovers more than double the accumulated energy consumed in the procedure



Waste Management Site

A typical waste management center designed by NOV contains locations for:

- In-weighing of received waste
- Discharge systems for waste containers (skips)
- Wash bay for skips
- Pits for cuttings
- Tank farm for recovered oil and water
- Tanks for water treatment
- Thermal desorption unit(s) (TDU)
- Storage and inspection area for full or empty skips
- Control center and laboratory
- Surface layer and sewage systems
 - Compliant with the strictest international standards
- Complete oil spill response systems and equipment

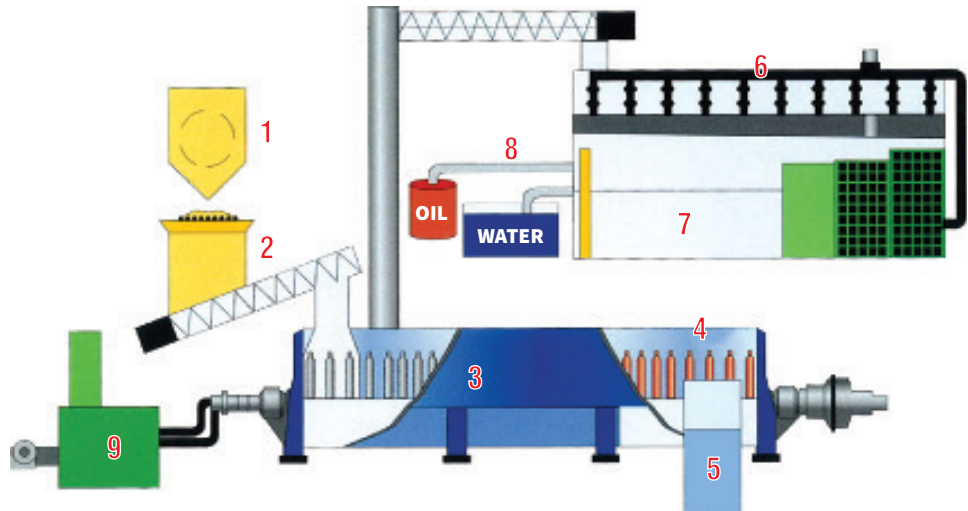
Typically, the waste management site operates 24 hours a day, 7 days a week, with a total staff of 10-15 people. Depending on the requirements of the application, the site can be designed for the treatment of drill cuttings anywhere from 6,000 to 48,000 tons per annum.

Erection of the site, including civil work, normally begins 6 months from the reception of the final treatment license. This license is typically issued by the operating country's national environmental agency. Upon arrival, the erection and commissioning of the processing equipment within the waste management site usually takes around 14 days. Additionally, the control center within the waste management site produces production reports for customers.

Hot Oil Thermal Desorption

Thermal Desorption Process

1. Pre-Treatment
2. Feed Hopper
3. Main Processor
4. High-Temperature Section
5. Discharge
6. Condenser
7. Separator
8. Oil/Water Discharge
9. Boiler for HTO



Technical Description

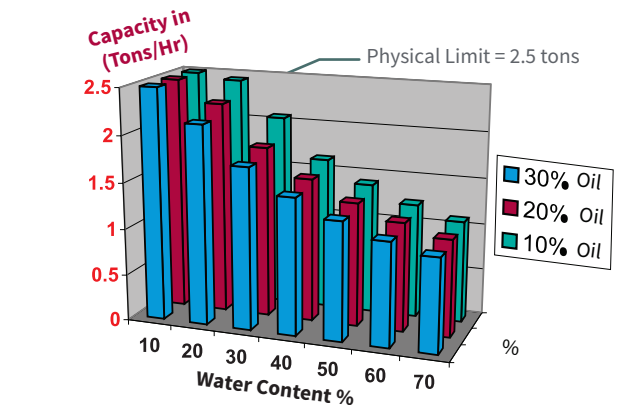
Drill cuttings are fed into the processing chamber of the TDU, where the rotating heat exchanger (rotor) heats up the cuttings via indirect heat. Indirect heating is accomplished through the circulation of heated oil, as well as by the use of electrical heating elements. This design avoids the possibility of direct fire exposure to the equipment.

The first section of the rotor evaporates water from the cuttings, while the subsequent section evaporates oil from the cuttings at temperatures up to 500°C. A condenser liquidizes the evaporated water and oil, which then flow into the water/oil separator. The solids are discharged at the end of the process, where they are then cooled and mixed with recovered water to avoid dust emissions when fed into solids containers (skips, etc.).

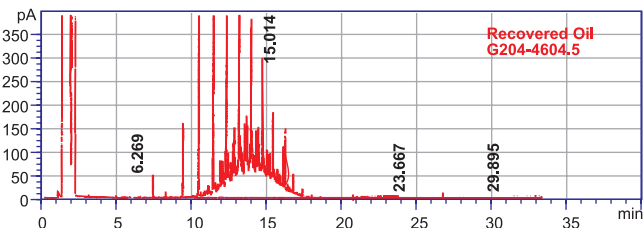
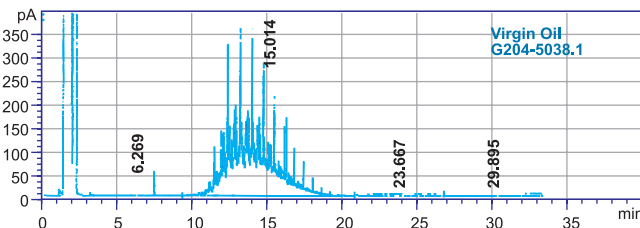
Base Oil Reuse

A typical waste management center designed by NOV In addition to drilling waste treatment, the waste management site provides a high-quality commodity: recovered oil for reuse in base mud and in the TDU's heating process. The TDU processes the oil in a manner that does not significantly alter the chemical composition of the base oil. As an option, odor treatment of the oil is also available.

Gas Chromatography and Mass Spectroscopy (GC/MS) scans are shown below. GC/MS scans routinely performed on base oil treated by the hot oil TDU demonstrate very little change in the oil's chemical composition. Frequently, the oil has been used to make-up new OBM. Recovered base oil from the TDU typically displays a clear yellow color.



Capacities Chart: The hot oil TDU is available in a variety of configurations to best suit the specific needs of the application. The capacity of the processor is dependent upon the total water and oil content of the cuttings. The chart above illustrates the relationship between the water content of the cuttings and the capacity of the unit. As the water content of the cuttings increases, the capacity of the unit decreases. It is very important to remove as much water as possible from the cuttings before they enter the TDU.



Gas Chromatography and Mass Spectroscopy (GC/MS) Scans