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Friction-Based Thermal Desorption Technology: Kashagan Development Project Meets Environmental Compliance in Drill-Cuttings Treatment and Disposal

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Abstract

Friction-based thermal desorption, with temperatures between 260 and 300°C, allows the oil and water phases to be volatilized and subsequently condensed and recovered, leaving dried and cleaned solids that can be disposed. Friction-based thermal desorption reduces the residual oil on the cuttings while recovering oil and other materials for reuse.

This paper presents the novel friction-based thermal desorption system currently deployed in the relatively hostile and remote Koshken area, located on the steppe escarpment above the eastern shore of the Caspian Sea, Kazakhstan. This project is expected to produce 50,000 tonnes of oil-based drilling fluid or “mud” (OBM) drill cuttings annually, which must be treated to below 1% TPH oil before disposal. Any treatment technology utilized in this environment faces operational and logistical challenges, including the severe climate and the need to transport the drill cuttings from an offshore facility to an onshore centralized location. Improvements in friction-based thermal desorption technology were developed specifically for the Koshkani project to ensure health, safety and environmental (HSE) compliance and allow a best-in-class system to operate in this harsh environment.

In this paper, the authors describe the three-year development process, from initial design and equipment construction through installation, commissioning and operation. Analytical data presented includes analysis of discharged material, recovered base oil and air emission analysis. A comparison is made between the application of thermal desorption technology and alternative technologies used in similar projects.

Friction-based thermal desorption met increasingly high performance expectations and technology advancements allowing them to be achieved with assured HSE performance. Given the environmental performance that the Kashagan project required, this technology has proven to be the simplest, easiest and most effective system to implement in this environment with assured success.

Introduction

Thermal desorption of drill cuttings was introduced to the oil industry in the early to mid 1990’s, following the successful treatment of contaminated soils from industrial activities. Since then, thermal desorption has evolved into an acceptable technology for treatment of drilling wastes from both from onshore and offshore operations.¹⁻³ Offshore discharge of oil-based drilling waste (drill cuttings and used drilling fluids) generally is not acceptable because of the environmental impacts. For a large fraction of the drilling operations, transport onshore for treatment and/or disposal is the only appropriate solution.

In thermal desorption, heat is added to a material resulting in a temperature rise above the boiling point of the volatile compounds in the material. By subsidiary cooling of the vapors, the volatile compounds can be recovered and fractionated. Sufficient vapour pressure is generated such that the volatilized compounds are separated from the host matrix. In oil-based drilling waste the main volatile compounds are the base oils and the water from the drilling fluid. For separation of drilling waste into reusable base oil, and in the same process reach a residual oil level in the solids that meets common standards for disposal or alternative use, thermal desorption has proven to be both environmentally and commercially acceptable.

The Kashagan drilling programme utilised oil-based fluid (OBM) for the Caspian Sea wells. The expected 50,000 tonnes of drilled cuttings contaminated with OBM not only required treatment to lower the discharged recovered solids to below 1% Total Petroleum Hydrocarbons (TPH), but also the recovered oil had to be of the highest standard available.