F.01

Solids Management

Introduction

Solids can occur naturally in the production of Oil & Gas. These solids enter production facilities and can cause a range of problems, including:

- Accumulation in Separators, Vessels & Tanks,
- Reduced production capability,
- Reduced separation performance of equipment,
- Level instrumentation failure,
- Erosion and damage to pumps, valves, etc.,
- Increased corrosion potential (e.g. SRB),
- Lost production during clean-out of solids.

In many production facilities, no consideration was made for solids in the original design of the process equipment. Consequently, solids settle by gravity and build up in the Inlet Separators, vessels and piping.

The solids are typically formation sand and silt, but can also include precipitated solids and corrosion products. These solids can range from low concentrations ($\leftarrow$1 ppm of gross fluids) to far higher concentrations (e.g. $\rightarrow$1%).

In most cases these solids settle out in the bottom of Separators & Tanks. These settled solids need to be removed at specific intervals to avoid some or all of the problems listed above.

In some cases, fine solids are flushed through the Separator with the produced water and carry through into the Water Handling system, where they can be readily removed (refer to Brochure D.02 for information on this application).

Petronas Angsi A Platform Sand Collection & Washing package
Location: Malaysia

Description

A typical Sand Management System will include a number of items of equipment and techniques to fluidise, transport, clean and dispose of the solids.

For each facility, a Sand Management scheme needs to be developed to identify the requirements and options available, along with the required outcomes, before any decision can be made about the best overall system approach.

There are 3 distinct stages of Solids Management that can be summarised as follows:

Stage 1: Solids collection & removal from the process,

Stage 2: Solids handling & cleaning,

Stage 3: Solids disposal.

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Any combination of the above activities may need to be provided for in the design of a scheme. A range of issues will need to be satisfied and catered for in order to provide a suitable outcome.

Process Scheme

Before designing a Sand Management Scheme, a few important issues need to be identified, namely:

1. Solids volumes/concentrations anticipated,
2. Solids size ranges and density,
3. Solids types (e.g. oil, scale, mercury, corrosion products, etc.),
4. Is solids removal to be continuous or batch?
5. Proposed solids disposal method and location?

In many production systems little clear information exists on solids production occurring, and estimates are often all that is available at the initial design stage. In addition, solids production changes over time and so some consideration must be given to future expectations of solids production.

Stage 1: Solids Collection & Removal

In many applications, the main Separator vessel will be horizontal and may have little or no flushing nozzles or sand removal capability. For any Sand Management scheme, a means of flushing/removing solids from the Separator is essential and if none is present a solids fluidising and removal system must be installed, usually via:

• Traditional jetting manifolds with flushing water, or
• Specialised fluidising & Eductor devices.

For either option, an external water source is required to provide the motive force to fluidise and transport the accumulated solids out through dedicated discharge lines, and into a collection vessel.

Stage 2: Solids Handling & Cleaning

Collected solids may contain oil, corrosion product, scale chemical residue and other contaminants.

The primary objective is typically to remove oil from the solids to allow the solids to be discharged within environmental limits. This is achieved by pumping a heated wash water stream into the Sand Management Package to fluidise and wash oil from the solids. This stream passes through a Desander Cyclone to recapture the solids from the wash water, which is then processed to recover the oil washed from the solids.

After one or more times being recirculated, the majority of the oil will have been removed and the solids can be discharged.

This combination of heat and washing water is a simple and effective method of oil recovery, which avoids the use of chemicals.

Stage 3: Solids Disposal

The final stage is disposal of the solids. In some regions the solids may contain hazardous contaminants including Mercury, Arsenic and NORM (Naturally Occurring Radioactive Material), which have discharge limits. Many of these contaminants pose health and safety issues for personnel and consideration must be given to any solid, liquid or vapour emissions that may occur from any handling.

Depending on the entrained contaminants, company policy and the prevailing regulations, the solids may be disposed of by:

• Re-injection into disposal wells,
• Sent to onshore landfill (hazardous/non-hazardous),
• Discharged to sea.

Technical

The design and success of a Solids Management Scheme depends on a number of parameters:

• Solids particle size & size range: solids $\leftarrow$20 micron are more difficult to handle and to remove oil from,
• Availability of clean wash water for the removal of oil from the solid particles.
• Solids sizes from 20 – 1000 micron, with a relative density of 1.6 – 2.65 S.G.
• Frequency of solids flushing from Separators and Solids Washing will be site-specific.

SUEZ provides a range of custom designed Sand Management Schemes to cover the range of conditions that may occur.

Applications

There are many varied applications for implementing a Solids Management Scheme, including the following:

• Continuous or batch removal of solids from Separators to avoid poor Separator performance,
• Allowing on-site disposal of solids,
• Solids removal for water reinjection to prevent formation blockage and damage to pumps, etc.