PROCESS

BHR Group
EXPERTS IN FLUID ENGINEERING

Moving slurries through pipework
OUR EXPERT OPINION

Whether your industry works with slurries, sludges, slips or suspensions, pumping these complex materials poses several challenges and problems. By characterising the slurry properties correctly, ensuring effective hydraulic pipeline design, and fully considering equipment selection, you can experience many years of worry-free, cost-effective operation.

There's a number of decisions you need to navigate that will impact your operational efficiency, timescales and budget when pumping and storing slurries.

Nigel Heywood, Senior Consultant explains how best to decide whether you need to use a pump to move your slurry.

Think you know the most important things to consider when moving slurries through pipework?

Basic pump components, such as the impeller or rotor/ piston size and design, materials of construction, and discharge configurations must all be considered to ensure the pump and pipework will hold up against the wear caused by an abrasive slurry. It's also important to:

- Choose several representative slurry samples for upfront lab test work to get the required design data on physical properties.
- Measure their rheological properties (which will affect pump selection and sizing and pipeline friction).
- Carry out a rigorous hydraulic pipeline design, including consideration of several standard pipe diameters.
- Choose an optimal slurry concentration, if it can be adjusted.
- Calculate power required for pumping.

To pump or not to pump? How do you know whether you need to use a pump to move your slurry?

Various types of slurry such as ore concentrates, tailings and other solid-liquid mixtures are routinely transported through pipes.

The lengths of these pipes range from a few tens of metres within chemical production plants, to more than 500 km for long distance hydraulic conveying of ore concentrates from mine to processing plant.

So how do you know what's best for you and your operation?

Whether your slurry is in a reactor, crystallizer, centrifuge feed tank or a pipeline, its properties need to be considered carefully. Slurry differs from normal liquids as it has a longer list of physical attributes. Particle size, size distribution and shape, with the applied shear and gravity settling must be understood in order to handle it effectively. A lack of understanding of these factors can impact a project substantially.

There are a number of ways you can assess your options, but the key is to spend some time thoroughly assessing your requirements before committing to your approach.

Getting it right first time operationally after careful planning will provide measurable time and cost benefits.

Not many organisations need a full time slurry handling expert to help optimise their processes. It's a specialist area, and one that can cause a real headache if it's not understood properly.

If in doubt, ask an expert who has worked extensively with slurries. The combination of practical experience with technical know-how is important, as any advice will be robust and based on experience.

Sibelco – a client case study

Working with global mined materials company, Sibelco, we undertook a desk study to scope their options before they invested in the right solution for their Devon (UK) site.

What are the benefits of a desk study?

Desk studies are a low cost, high value service, which has the potential to improve all aspects of your project, particularly time and cost. Working with a specialist who understands the complexities that need to be considered when planning to move slurry efficiently gives you the confidence that you're making the right choice, and the process allows you to review different variables and options without impacting on operations. Other benefits include:

- Mitigation/minimisation of risk.
- Outputs that provide clarity of information regarding potential variations in approach, affording an easier decision-making process.
- Identification of potential economies in design.
- Reduction in the likelihood of unforeseen operational challenges.
- Reduction in the chance of project delays.
- Tangible outputs that enable an accurate operational and budgetary forecast.

Sibelco's Challenge

The Sibelco team wanted to determine if clay slurry could be transported using gravity alone from a thickener to the screens, without the necessity for a pump, through a 3000m long pipeline at a volume flowrate of between 40 and 50 m^3/h.

Our approach

We undertook a series of rheological measurements on clay slurry samples, using a co-axial cylinder viscometer with two different slurry concentrations.

Flow assurance was a key factor in ensuring the reliable operation of the complete clay production system. We assessed key factors such as the shear rate range, turbulent pipe flow and slurry density to enable Sibelco to understand fully the options open to them.

If you're interested in the detail behind the study, including key calculations and explanations, please email:

marketing@bhrgroup.com

Our findings

The initial desk study showed that a 22% by weight clay slurry will flow under gravity through a pipe of ID 130mm, length 3000m and net elevation change of -71m at a volume flowrate in excess of the target flowrate of 50 m^3/h.

In contrast, the 29.5% clay slurry will flow in the same pipe but at a much lower volume flowrate which is considerably less than the target flowrate.

This enabled our client to make an informed decision as to what would provide the best solution for them.

The right solution for Sibelco

The desk study showed that under gravity flow alone, volume flowrates for the clay slurry could be achieved well in excess of the initial target flowrate of 50 m^3/h at low clay concentrations.

However, at high clay concentrations the static head available was insufficient to provide the clay slurry flowrate required.

Because of the variability of the clay slurry in terms of both concentration and particle size distribution, a progressive cavity pump was installed.

This was chosen to ensure that the transport of clay from the thickener to the screens never failed due to inadequate available static head, or because the slurry flow was too low, which could lead to particle settlement in the pipe and consequent pipe blockage.