BHR Group

EXPERTS IN FLUID ENGINEERING

Climate change and the need for environmentally responsible, cost effective and efficient methods of ore and tailings transport place great demands on the industry. A growing number of operations are meeting the challenge by using more hydrotransport handling of solid/liquid mixtures in both short in-plant and long-distance pipelines.

This most basic of techniques combines a number of handling advantages with minimum maintenance and low environmental impact. But there is still potential for cost savings, innovative application and transfer of technology and knowledge – optimising handling techniques and developing and deploying new engineering solutions.

Mining Industry

Services to the Mining Industry

BHR Group can offer a range of specialist consultancy, critical to the effective operation of your processes through:

- Pipeline design for “non-settling”, fine particle, pseudohomogeneous slurries, including pipe sizing and total pressure loss estimation
- Pipeline design for settling slurries, including estimates of deposition velocity and total pressure loss
- Open channel flow of Newtonian and non-Newtonian slurries
- Selection and sizing, including deration, of both centrifugal and positive displacement pumps
- Estimation of pump power imparted to slurry and motor sizing
- Estimation of specific energy consumption (SEC) for hydraulic conveying of solids
- Selection of instrumentation for on-line measurement of slurry, pulp and tailings properties (flow, concentration, density, viscosity)
- Viscosity/flow curve measurement of non-Newtonian materials
- Mixer selection and storage tank design
- Troubleshooting of the operation of existing slurry feed/receiving tanks
- Slurry storage vessel design and operation

Experience

Founded over 65 years ago, BHR Group is an independent contract research, development and consultancy company. Dealing in all aspects of engineering with fluids, BHR Group is recognised as the world leading authority on mixing processes and slurry handling.

The global industry standard “Design of Slurry Transport Systems” by B.E.A. Jacobs, was compiled from work carried out over a period of time by BHR Group engineers. Twenty-four years on, BHR Group has retained its status as a world authority on the transportation and handling of complex fluids and fluid flow.

The services we provide range from detailed technical reports containing all results and applied methods, to the design and construction of test facilities.

Client Base

2H Offshore Engineering, UK

Anthony Bates Partnership,UK

Cemex, UK

Golder Associates, UK

Hatch Associates, Canada

Horizon Geotechnical Co., Dubai

IMASA, Spain

Nautilus Minerals, Australia

St Gobain (BPB Industries)

Sasol Technology, South Africa

Sibelco, UK

Case Studies in Minerals Slurry Handling

Pipeline Flow of Thickened Tailings at a Copper and Gold Mine

The feasibility of a pipeline was assessed to transport thickened tailings from a copper and gold mine to its disposal site. Flow curves of thickened tailings samples were measured using coaxial cylinder viscometry. Estimates of the frictional pressure gradients were made. It was found that the flow was in the turbulent regime for the 68% w/w tailings sample, but in laminar flow for the higher three tailings solids concentrations. Estimates of pressure losses and the determination of the pipeline flow regime were then used to select and size a pump for the tailings disposal. It also resulted in identifying the sensitivity of the pump discharge pressure requirement to changes in tailings properties.

Troubleshooting a Sand Slurry Pipeline

Since 2003, a 556m long, slightly inclined HPPE sand slurry pipeline failed to deliver the required solids throughput of 90 t/h. A desk study determined what equipment and / or operating conditions should be changed to increase the solids throughput. One option was to change the current rubber-lined impeller running at its limit of 1000 rpm with a hardened steel impeller. An impeller speed of 1200 rpm was selected in this study for hydraulic analysis to determine what the maximum solids throughput and the pump differential pressure, pump power, and probable minimum motor size would be required. The hydraulic analysis for sand slurry covered a range of “dry” solids throughputs of 60 to 120 t/h. Estimates of both deposition velocity and frictional pressure gradient were made using a Two-Layer model. From the total pressure loss and volumetric throughput for different solids throughputs, the power imparted by the pump to the slurry was calculated. Both pump head and efficiency were derated compared with that for water owing to the presence of solids using the ANSI/HI 2005 standard. This allowed the calculation of the pump discharge pressure, the pumping power required, and therefore the minimum motor rating required. It was concluded from the hydraulic analysis based on using a hardened steel impeller that the target 90 t/h of total “dry” solids is achievable if a minimum motor size of 113 kW is used.

Pipeline Flow of Settling Mica Waste Slurries

The pipeline hydraulics of waste mica slurry discharging from the underflow of a thickener were investigated for a 3-inch ID pipeline, 2050m long, with an overall elevation increase of 80m. For a specified mica solids throughput of 9.53 t/h, the pipe operating velocity was compared with the predicted deposition velocity over a mica slurry concentration from 20% to 50% w/w. Estimates were made of the total differential pressure, as well as the power imparted to the slurry by the pump, and the specific energy consumption (SEC). Two pipe diameters were assumed: 80mm when no mica wall deposit is present, and 70mm when there is a 5mm mica wall deposit. It was recommended that the pipeline be operated at 23% mica slurry on re commissioning, provided there is no mica wall deposit, and that the mica concentration be progressively increased to 30% as a wall deposit of up to 5mm in thickness is formed. These recommendations have been used to guide the client in the appropriate operation of the tailings thickener, and to select and size a suitable pump for the thickener discharge.

Chalk Slurry Transport 92-km Kensworth - Rugby Pipeline

Chalk slurry at 36% w/w moisture is pumped through a 92 km pipeline from a chalk quarry to a cement works. Following modifications to the quarry slurry make-up plant, there was concern over coarse particle settling in the line. The effect of chalk slurry properties and operational variables on pipe flow conditions had been investigated to optimise chalk slurry transfer through the pipeline. The combined effects of chalk slurry moisture content and options for different pipe diameters on the pump discharge pressure requirement were considered to assess the suitability of a given pipe diameter and moisture content combination. Chalk slurry flow curves were measured at 36% down to 29% moisture to predict frictional pressure loss. The work showed the minimum moisture content that the chalk slurry could be pumped at, while retaining turbulent flow conditions. It also successfully predicted the pump discharge pressure conditions.

Training

Tailored courses, chosen to meet your specific requirements, are available from our experienced engineers at our premises or at any venue world-wide. Please see the website for the full list of topics we offer and contact us to discuss the detailed content you might require.

We now also offer a series of webinars on www.bhrgroup.com aimed at anyone who has a requirement to understand the complexities of slurry transport and handling and are equally useful as a refresher course for those who deal with the design of systems infrequently.

Contact us

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