DOWNLOAD PDF DESIGN OF SLURRY TRANSPORT SYSTEMS

Chapter 1 : Mine Slurry Transport - International Mining

of the extent to which slurry transport is presently employed, the theoretical basis for pipeline design, the practicalities of design and new developments. Each chapter is self-contained, thus the reader requiring information on a particular.

Mine Slurry Transport Posted by Matrix on 1st April Climate change and the need for environmentally responsible, cost effective and efficient methods of ore and tailings transport place great demands on the industry. 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 â€" optimising handling techniques and developing and deploying new engineering solutions. Numerous long distance slurry pipelines world-wide rely on Weir Minerals division heavy duty pumps, including Warman centrifical slurry pumps and Geho piston diaphragm slurry pumps. Low and moderately abrasive slurries are economically handled by these crankshaft driven piston pumps. Also crankshaft driven are the highpressure piston diaphragm pumps â€" the three cylinder single-acting TZPM pump and the one or two-cylinder double-acting ZPM pumps. Oil sand mining is a sector where there is really no alternative to slurry pipeline transport. A key to this mining becoming more cost effective has been the development of equipment that is more efficient and more resistant to the extremely harsh conditions imposed by the process. GIW industries has been involved in oil sands mining and processing for nearly 25 years, and its technical and engineering expertise has allowed it to become a leader in the industry. In the mids, most oil-sands plants used rubber-lined pumps to transport their tailings â€" the mix of water, sand and clay left over once the bitumen has been extracted. However, in transporting this extremely abrasive material, rubber-lined pumps could provide only about 2, hours of operation before they needed to be replaced. The operations began considering all-metal pumps instead of rubber-lined pumps and asked several pump manufacturers to bid on the project. GIW designed and laboratorytested a new pump that proved highly successful, delivering 4, hours of operation. The successful tailings application led the industry to consider using all-metal pumps for hydrotransport, a new technology that aimed to reduce the costs of mining oil-sands deposits. As mines grew larger and ended up farther away from the processing plants, hydrotransport became a more cost-effective option than conveyor systems. Implementing the use of hydrotransport proved to be highly successful. Hydrotransport by long-wearing pumps allows the processing plant to collect oil sands from as far away as 40 km. GIW played a critical part in the development of the Jackpine mining facility through the design, construction and installation of pump trains to move oil sand and its products from the mine site and through the production facility. Planning for the Jackpine mine began in , and GIW was involved from the start, providing input into design requirements. A total of 34 pump trains were developed. All of the pump trains, each consisting of a pump, gear reducer, motor, couplings, oil cooler and foundation pad, were developed specifically for the operation. The largest pump provided by GIW has a 1. Because the pump trains could not be assembled and tested at GIW labs before shipment, GIW had to update its quality assurance QA procedures and create extensive, detailed documentation to ensure that all parts were developed to specification and went together perfectly. GIW assembled the pump trains in and , and the facility was opened for production in September. GIW currently maintains the pump trains by providing spare parts that are delivered and replaced at Jackpine on a regular maintenance schedule. GIW keeps about eight weeks of spare parts on hand in Fort McMurray, Alberta so they will be ready for any scheduled or unscheduled downtime that may occur. Goulds Model is the result of many years of experience designing and building severe duty slurry pumps. This is helped by a heavy duty bearing frame and shaft, extra thick wall sections and easily replaceable wear parts. The extra thick wet end components offer extended wear life and the replaceable wear liner lowers maintenance cost. The heavy duty power end should provide increased mean time between failures. To date Larox Flowsys has provided solutions for highwear and aggressive applications in more than 30, mining and minerals installations around the world. Larox valves and pumps have proven their reliability among others in flotation, thickening, filtration, tailings, and additional systems such as sampling, dosing and water treatment applications. Larox high performance pinch valves have a completely sealed stem assembly

which prevents slurry or particulate from penetrating into the screw mechanism from both inside the valve and from the external environment. This ensures that when the valve is opened or closed it is as easy as the very first time it was operated. New progressive cavity pumps are designed for the most demanding abrasive, corrosive and other industrial pumping applications. They require less energy and maintenance and are easy to install. There are longer service intervals and better pumping reliability at an expanded temperature range, resulting in very low Total Cost of Ownership, Larox reports. They ask us to come up with new ways to fix their problems. Other times, we approach customers with a new product. At first they might claim that their current product works just fine, but when we start asking questions about downtime, maintenance and installation, and explain how our solution works, it makes them think. At that time when they start analysing the costs, they realise just how much money KWH Pipe can save them. These products all have some things in common: Therefore, in our FPS products, most of the pipe wall is made up of polyethylene, and the functional polymer layer is just as thick as it needs to be. The WehoSlurry pipe is designed to absorb this type of stress and offer optimal durability by combining the flexibility and corrosion resistance of polyethylene with an extremely wear-resistant inner layer. Also, instead of being hard, the inner polymer layer is soft since abrasion tests in laboratory as well as full-scale tests clearly indicate less wear for softer materials in most cases. This is how KWH Pipe can prolong the life span of a piping system using functional polymer layers. In the crushing and preparation plant, crushed ore is mixed with water into slurry and then transported in pipelines to hydrocyclones where valuable minerals are separated from waste gangue. The pipe used for slurry transport has to be highly resistant to wear, especially at the points of fastest flow speed â€" such as bends, branches and fittings for pumps. The company was using steel alloy pipes, but they were not able to withstand the aggressive wear and required frequent maintenance. Steel pipes are popular in Russia, as they can be joined by normal welding, but in this case they were simply not sufficiently wear resistant. WehoSlurry was the solution. Use of this section began on April 7, and was monitored on a regular basis. Ten months later, February 7, , an inspection was made after 6, hours of continuous operation. No visible signs of erosion of the inner layer were detected. Additionally, no changes in the condition of the pipe had occurred even at the most exposed section immediately after the slurry pump. After more than 8, hours there was still nothing to detect indicating abrasion of the surface. Over the same period, two sets of steel pipes have been completely replaced in other sections of the slurry line. According to the inspection record, the estimated operational life for the trial pipeline is going to be five to ten years compared to the six months replacement intervals for steel pipe. Wear-resistance was not the only benefit of WehoSlurry here. The system offers several different pipe jointing methods, each with their own advantages but all developed to ensure optimal performance even in harsh abrasive conditions. At Karelsky Okatysh, flange joints were found most suitable. Other methods available include butt fusion welding, electrofusion and mechanical couplings. Robor Pipe Systems is a leading supplier of conveyance systems for mining applications. Various linings and coatings are available, from high-density polyethylene HDPE to epoxy coating, meeting any requirements mines may have in the conveyance of slurry, water, gas or corrosive fluids. Supported by an installation and maintenance services business unit, the company offers the southern African mining industry value-added steel pipe and complete pipe systems, delivering comprehensive solutions by utilising the latest technology in addressing wide-ranging conveyance needs. This high-performance pipe system, ranging in size from 50NB to 1,NB, is ideal for the reliable and efficient conveyance of corrosive fluids and abrasive slurries, especially where service conditions cannot be adequately satisfied by traditional piping materials alone. With low resistance to flow, reduced friction loss and lower operating costs, HDPE lining helps to reduce down-time and replacement expenses, presenting an opportunity for the cost-effective refurbishment of existing pipelines. Transvaal Rubber Co Truco supplies a lot of mines in South Africa, including hoses and reusable split flange couplings to a platinum mine, in the Western Bushveld Complex in the Northwest Province. According to Mike Stuart, Hose Director, the reusable Truco split flange coupling is a unique item that is especially helpful and cost-effective in applications where the required length of the pipes is not known. The use of these couplings also assists in reducing plant downtime. If a hose fails, a new one can simply be cut to length and installed. From a cost saving point of view, if the hose needs to be replaced, the couplings can be taken off and reused on the new section of hose.

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The versatile reusable Truco aluminium split flange couplings have been designed to handle pressure up to 1, kPa and are ideal for slurry hoses. They can connect hose to hose, hose to steel pipe, or rubber hose to HDPE pipe, and are corrosion resistant. Among its many achievements in slurry pipeline system design is the Anglo Ferrous Minas-Rio project in Brazil, which is now under construction. The project includes a km, and mm diameter iron ore pipeline, which when complete will be the longest and largest tonnage iron concentrate pipeline in the world. Two pump stations have been provided for the pipeline with the provision to add additional pumps later should iron ore transport capacity increase as the mine develops. The system also includes its Pipeline Simulator for simulating steady-state operation, batch operation, pipeline start-up and shutdown; operator training and operations planning; and Pipeline Advisor for process optimisation and leak detection. The project is planned for completion in The Da Hong Shan pipeline is another innovative iron ore installation. It is one of the longest in China and has the highest operation pressure of any pipeline there. It is one of the few slurry pipelines in the world that pumps steeply uphill over most of its length and it has the largest total lift of any pipeline. This state-of-the-art pipeline system uses three high-pressure pump stations with a maximum discharge pressure of 25 MPa. The company also provided a supervisory control and data acquisition SCADA system, including system integration, programming and field installation; a fibre optic telecommunications system; and Pipeline Advisor for process optimisation and leak detection. In early , the company was selected to perform a feasibility study for expanding the existing pipeline from 2. This expansion involved modifying three existing pump stations and the terminal as well as adding two new pump stations. Since that time, the company has performed basic and detailed engineering for the project as well as construction supervision. The expansion project and tailings system were completed at the end of last year. The company is currently working on the basic engineering for the Da Hong Shan third expansion project, which will transport 5. Andean operations lend themselves to these systems â€" making the most of the gravity advantage. In , the company commissioned the km, mm diameter multi-product Minera Antamina pipeline in Northern Peru. The thickness of each pipe is 10 mm and the thickness of the polypropylene cover: It is made from reinforced steel â€" inside and outside. It is normally subject to a pressure of 70 bar, but is designed to withstand up to bar. The different sections are joined by electric welding. The average trench depth is 1. Antamina says the advantages of an ore pipeline over hauling the ore overland are: The system also includes the proprietary software solutions â€" Pipeline Simulator and Pipeline Advisor. Also, the pipeline includes parallel-laid fibre optic cable that sends data about the ore flow through the pipe and which is digitally interfaced with the main offices.

Chapter 2 : Slurry pipeline - Wikipedia

This book benefits users, manufacturers and engineers by drawing together an overall view of the technology. It attempts to give the reader an appreciation of the extent to which slurry transport is presently employed, the theoretical basis for pipeline design, the practicalities of design and new developments.

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Chapter 3 : Slurry Transport - ATC Williams

Summary This book benefits users, manufacturers and engineers by drawing together an overall view of the technology. It attempts to give the reader an appreciation of the extent to which slurry transport is presently employed, the theoretical basis for pipeline design, the practicalities of design and new developments.

It was obvious that a change needed to be made. Primary wet screening was selected to remove the fines which caused plugging of the secondary and tertiary crushers and blinding of the tertiary screens in The primary screen feed consists of minus 6 in. Ore is delivered to two sets of 2 8 ft. Two trains each have a 1, dmtph capacity, and the capacity of the third original train is 1, dmtph. Many primary screen sizes and types have been tested. The following polyurethane screen panels are used: Crusher Slurry Transport Systems Primary screen undersize slurry gravity flows from the 4 8 ft. Alternatively, one of the four 8 ft. By-passing secondary screening is conducted only when the crusher slurry pumps or secondary wet screens are being serviced. All process variables are controlled with stand alone programmable logic controllers. The 4 constant speed slurry pumps two per tank and two in stand-by are 10 in. The system requires each pump to produce ft. Two gasite â€" white iron â€" BHN impellers and casings are replaced monthly. An automatic slurry water flush system was installed to purge the slurry pump suction and discharge lines before start up and after shut down of the pumping systems. Secondary Wet Screening Secondary screening addressed two main concerns: The apertures of the poly urethane panels are 2 mm x 16 mm restricted flow with 5 rows of 1 in 25 mm dams. Concentrator slurry systems The original concentrator receives slurry by gravity from the 6 ft x 16 ft 1. The new concentrator receives only secondary screen undersize slurry. Both concentrator facilities have a rubber lined slurry tank distribution box that distributes slurry to 2 urethane lined slurry tanks â€" four total, two in standby. Tank levels are maintained with recirculation lines from the crusher slurry cyclone overflow distribution boxes. Each tank is retrofited with two slurry constant speed slurry pumps â€" 10 in. The materials for the concentrator pump components are identical to the crusher slurry pumps. Pump size and horsepower vary to supply a constant pressure of 10 psi 0. Cyclones are constructed with natural rubber liners and rubber apex inserts. The total ore flow rate averages 1, dmtph.

Chapter 4 : Abrasion ResÄ±stant Steel Piping Systems for Slurry Transport in Mining Applications | Docum

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These enhancements include induction hardening of the interior pipe wall, in addition to utilizing pipe wall materials consisting of varying chemistries, such as encountered with bi-metallic, di-clad, and double wall piping systems. The proper selection of component accessories, including the various configurations and alternate materials can provide the ultimate total system wear life expectancy. Section 1 Typical Mine Applications Steel piping systems are widely used in mining to convey the product, ore, and tailing slurries to the processing plant, as well as to recycle the debris medium back to the mining area. Slurries are a mixture of solid particles in a liquid medium. Steel piping systems are also utilized for backfilling the mine excavation areas utilizing sand fill, classified tailings, or paste fill. Section 2 Types of Wear Unfortunately, the conveying of mineral products often causes the piping systems to wear. There are two basic ways material is removed from the surface: Abrasive wear is produced by hard particles forced against and sliding along the wall of the pipe. The loss of material is the result of the hard, sharp angular edges producing a cutting or shearing action on the pipe wall. In abrasive erosion the loss of material is due to the relative motion between the pipe wall and a fluid containing solid particles. At close to 90 degree impingement angles impact abrasion , the erosive wear rate is highest in brittle materials and lowest in ductile materials. In ductile materials, the repeated impinging particles plastically deform the surface to generate wear debris. Brittle materials are less wear resistant than ductile materials in an impact erosion condition. At low angles of impingement abrasive erosion , the reverse is the case. Harder materials better resist the gouging or plowing action of abrasive particle flow. Section 3 Hardness Hardness can be defined as the resistance to penetration. Early methods used to measure hardness consisted of comparing a known object to an unknown. A scratch test would indicate whether one element is harder than the other. The hardest material known to man is the diamond, which was assigned a value of All other materials were rated relative to the diamond hardness. April 30, Page 3 of 3 Current hardness measurement technology utilizes an indenter of a specific configuration with an applied load of known value. The softer the material, the larger the diameter and the deeper the indentation. By measuring either the depth of penetration the Rockwell Scale or the diameter of the indentation the Brinell Scale , the hardness of a given object can be determined. These are the two most common field measurement systems. Additionally, the Knoop or Vickers hardness system is often utilized in laboratory environments for measurement of very hard materials, such as carbides. There is an approximate relationship between hardness and the ultimate strength of the material see table below. To resist abrasion, the piping system must be harder than the material being conveyed. Selecting a pipe material considerably harder than the conveyed material offers no wear advantage and typically costs more. For instance, if the material being transported is limestone, there is no advantage in using ceramic lined pipe over an ordinary steel pipe. When the mineral is harder than the pipe, there is a very sudden and steep rise in the abrasive wear rate. These piping systems range from the simple high strength low-alloy steels to the latest in bimetallic and metallurgically bonded materials. By considering these materials with the appropriate system design parameters and piping configurations, system performance can be significantly enhanced. Material enhancements take three different approaches: April 30, Page 4 of 4 Material Alloying Strength and wear resistance can be improved by the addition of alloying elements to the steel during the manufacturing process. Typically the addition of higher levels of carbon and manganese increases the ultimate strength over mild steel by 70 percent, from 55,psi ultimate strength to the , psi range, and increases the as rolled hardness to Brinell. This material is commonly referred to as AR piping. Both carbon and manganese are relatively inexpensive elements. Other alloying elements, such as chrome, nickel, vanadium, etc. Modifying the Material Microstructure Strength and wear resistance can also be increased with secondary processing of the steel, such as cold working or heat treating. Cold working produces a stronger, tougher material, but this improvement will not match a heat-treated product. The heat

treating of piping materials is accomplished either by flame or by induction hardening. Flame hardening is a centuries old process of heating the material surface to the austenitizing temperature and rapidly quenching to produce the desired martensitic microstructure. Although flame-hardening torches, fuel gases, and quenchants have improved over the years, the application of this technology for long lengths of pipe is limited. To obtain the maximum benefit, the pipe should be quenched on the inner surface. Induction hardening utilizes magnetic fields to induce a current in the steel pipe wall. This current rapidly changes direction, causing the heating of the product by eddy currents. Unfortunately, any increase in material hardness is accompanied by a loss in ductility. This brittleness is unacceptable for most material conveying systems. Piping systems are constantly flexing and moving as a result of pressure surges and spikes, as well as mechanical and physical contact at the mine site. It is imperative in all hardening processes to very accurately control the depth of hardness.

Chapter 5 : Design of Slurry Transport Systems - CRC Press Book

This book gives the reader an appreciation of the extent to which slurry transport is presently employed, the theoretical basis for pipeline design, the practicalities of design and new developments.

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Chapter 8 : Africa - Paterson & Cooke

Avoid settling of solids in slurry transport systems with flow velocities above certain levels Sponsored Links A suspension of solid particles in a liquid, as in a mixture of cement, clay, coal dust, manure, meat, etc. - with water is often called a slurry.

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Integrated slurry pipeline systems. Hydraulic transport in slurry pipelines is common mining industry practice and we have the expertise, technology and equipment to help create efficient slurry transport systems.