HIGH DENSITY SLUDGE (HDS) PROCESS

WATER SOLUTIONS FOR THE MINING INDUSTRY

The dissolution of soluble metal compounds from ore and waste rock (commonly known as acid rock drainage (ARD)) as well as the presence of contaminants in industrial process water can result in metal contaminated effluent. These dissolved ions are commonly precipitated using a lime neutralization process, which produces a low density (2-5% solids) sludge that is difficult to thicken and filter. The HDS process is a refinement on this low-density treatment method and acts to substantially reduce the sludge volume by greatly increasing its density.

When the HDS process is implemented, limestone/lime and recycled sludge are added to the lime-sludge mix tank at the beginning of the process and this lime becomes the main neutralization agent. Our HDS design and construction management experts are able to use this process to produce a concentrated sludge that minimizes storage requirements and maximizes sludge stability. We will ensure your HDS treatment project is designed to be affordable and effective in a manner consistent with industry standards and SGS global standards of excellence.

ADVANTAGES OF THE HDS PROCESS

The HDS process has many advantages over other lime precipitation systems. These include:

- A substantial reduction in sludge volume resulting from an increase in sludge density (an increase from 2% to 30% solids reduces the volume of sludge by over 95%)
- The resulting reduction in sludge disposal costs
- Increase in sludge stability, both chemically and physically (within several days of deposition, the sludge drains in excess of 50% solids and possesses enough physical stability to support the weight of people walking on the surface of the impoundment area)
- Long term effectiveness (following fifteen years of impoundment at one facility, there has been no contamination of the surrounding groundwater or any other evidence of metal reversion)
- A high quality effluent is produced
- The process is easily automated
- HDS is a proven technology allowing for the use of standard equipment

SGS is your expert HDS partner. We understand your need for a reliable, cost effective method of treating and stabilizing metals contaminated wastewaters. Our HDS experts have been involved with HDS plant designing, engineering and commissioning since 1998, and have an unsurpassed reputation for delivering quality HDS solutions. Work with us to ensure your project is developed in a responsible and sustainable manner.

HDS TECHNOLOGY

THE PROCESS

HDS processing is a proven technology that has been in use in the mining industry for since the 1980s. The process begins by mixing incoming effluent with a neutralizing agent (limestone/lime) and recycled sludge from a clarifier/ thickener unit. After neutralization, this mixture is fed to the main lime reactor where a combination of aggressive aeration and high shear agitation ensures optimum process chemistry and clarifier performance. The discharge from the lime reactor is then treated with flocculant in the flocculation tank to promote precipitation and sent to the clarifier/ thickener unit. The clarifier separates the treated effluent from the sludge, a portion of which is recycled to the head of the process.

CLARIFIER/THICKENER UNIT

The HDS clarifier/thickener is the "heart" of a high-density sludge system. Its purpose is to increase the solids content of precipitate metal and allow recycling of a portion of the sludge. Most of the overflow from the clarifier/thickener is discharged into a holding pond before being released into the environment. Underflow in the HDS thickener consists of sludge, which is either pumped to a sludge storage pond or is recycled to the head of the process. Settled sludge density increases from about 4% of solids to approximately 20% of solids. Sludge volume reductions in the order of 95% are not uncommon.

FACTORS INFLUENCING THE HDS PROCESS

The effective removal of base metals in a stable form in the HDS process is the result of the formation of a precipitate of calcium sulfate (gypsum) and a co-precipitate (metal hydroxide) with iron on the surfaces of recycled sludge particles. The stability of the precipitates is favorably influenced by a high iron to total metal ratio in the plant feed. Simple recycling is not enough to change metal ratios, and in extreme examples, iron may have to be added or the sludge storage site must allow for the possibility of longer term instability.

If the sulphate concentration of the wastewater is high enough, there will be sufficient gypsum produced to exceed its solubility and it will precipitate with the sludge. In fact, treated solutions are often supersaturated in gypsum. HDS technology is beneficial to operations that produce high sulphate from pressure oxidation and biooxidation processes.

The HDS process normally operates at a pH between 9 and 9.5, as most metals encountered precipitate at or below this concentration of hydroxide ions. Oxidation of ferrous iron (Fe^{2+}) to ferric iron (Fe^{3+}), the principal oxygen-consuming reaction, takes place quite rapidly at this pH, with atmospheric oxygen being the most common oxidizing agent. Efficient oxidation is an important consideration because sludges containing Fe^{3+} are chemically more stable than those containing Fe^{2+}. Additionally, design parameters must take into account your site's height above sea level since the dissolved oxygen in water decreases with an increase in elevation.

Design plant throughput is influenced by the volume of water to be treated. For example, seasonal changes can greatly affect site run-off, much of which may have to be treated. Increased flow may be accompanied by a dilution of contaminants, both acid and metal, and the resulting plant influent may require reduced oxidation and/or residence time, which may compensate for the increased flow.

Today, SGS leads the industry in the application of HDS technology for a variety of mining and industrial effluents. These include several arsenic removal projects where sludge stability and exceptionally tight water clarification specifications continue to be met. SGS will make certain that all factors affecting your HDS project are considered, and will ensure that the design and construction of your project meets all regulatory and environmental guidelines. Our top priority is working with you to affordably and effectively achieve heavy metal outflows below compliance discharge limits.

APPLICATIONS OF THE HDS PROCESS

Application of the HDS process is not limited to the mining industry. It can be applied to the removal of heavy metals from any wastewater stream. Industries other than mining which typically produce such effluents include:

- Metal finishing - electro-plating and galvanizing
- Site remediation of heavy metals
- Chemical industry applications such as pigment plants
- Metal fabrication plants
- Smelting and refining
- Metal molding and casting
- Coal preparation plants

SGS has been involved with HDS plant designing, engineering and commissioning since 1998. We have piloted and designed numerous water treatment plants and upgraded others to effectively control ARD and other effluent problems. Our extensive experience in pilot studies combined with our understanding of heavy metals contaminated wastewaters, enables us to methodically pilot and design efficient, cost effective water treatment plants to suit your needs. Our HDS projects have ranged from about 200 L/min at the low end to over 60,000 L/min at the high end with metals concentrations from several milligrams per litre to several grams per litre of total dissolved metals.

As your technical partner, SGS can help you maximize the effectiveness of your wastewater treatment capabilities and minimize the liabilities associated with heavy metals contaminated effluents. Partner with us and let our team of HDS experts help you manage your wastewater stream.

CONTACT INFORMATION

Email us at minerals@sgs.com
www.sgs.com/mining