Arising from the underground goldmine in a non-operational mine using Geotube® Technology

The Challenge...

An underground goldmine in a remote area of Canada was undergoing a refurbishment of their tailings storage facility (TSF) and required the services of Geo-Dredging and Dewatering to manage treated groundwater that had high levels of arsenic. The mine could no longer use the present TSF because of compliance and permit issues. Surface water was constantly infiltrating the mine as a result of snowmelt, run-off and rain fall. When combined with groundwater, it necessitated the constant removal of this water from the mine shafts using pumps. The groundwater from the mine had excessive levels of arsenic from natural sources coming from deep geological formations. The naturally occurring arsenic was concentrated from backfilling of abandoned mine shafts. Before being released into the watershed, the mine water would have to be treated as per provincial water quality regulations. During spring thaw, arsenic levels sometimes exceeded 500 ppb with groundwater flow being above 1000 lpm.

The mine was using a specialized mobile water treatment system that constantly treated and filtered the groundwater. This water treatment system was remotely managed and had to be operated 24 hours a day. It used ferric chloride to remove arsenic, in the form of arsenate [As(V)], from the groundwater through absorption. The accumulation of sludge on the filters, due to the ferric coagulant, required constant cleaning of the filters. A backwash cycle cleaned the filters and sent the ferric/arsenate sludge into a mix tank which was then treated. This cleaning cycle occurred every 45 minutes and produced approximately 1900 litres of sludge.

The Solution...

Geo-Dredging and Dewatering were called in to find a better solution. They treated the backwash sludge from the mix tank in small batches using a portable VEPAS chemical treatment mixing system and an MDS Geotube® placed in a dewatering box. Jar testing in the lab determined a treatment using an organic polymer and polyamine coagulant would produce floc that would work well for a Geotube® application.

Raw ground water from mine

Treatment Trailer

• Treated water flows into the Geotube

Mix Tank

• Contained ferric/chloride backwash sludge

Polymer Treatment

• Mixed tank water to be treated by VEPAS

Dewatering box/Geotube

• Treated material was sent to geotube whilst filtrate was contained

Weir Tank

• Held filtrate for testing and final stage of water treatment before release

Raw mix tank sludge (left), treated sludge (center), Geo-tube filtrate (right)
The Performance...

A mix-tank with a capacity of 88 m³ was placed on-site to receive the backwash from the water treatment system. Every 12 hours the sludge in the mix tank was pumped into the Geotube®. The treatment took place inside the mine’s mill to keep the sludge contained and prevent any accidental releases. The two-stage chemical treatment involved the introduction of a polyamine coagulant followed by a polymer in the VEPAS mixing system to generate floc. The floc contained the adsorbed arsenic precipitate thereby making it simple to remove from the water with Geotube® filtration. The flocculated sludge was sent to a Geotube® placed in a dewatering box. The filtrate from the Geotube® was collected directly from the dewatering box into a weir tank. The weir tank was used to hold the filtrate while water quality tests were performed to confirm that arsenic levels would meet criteria for release into the watershed. The coagulation-flocculation treatment process would last for 2 hours. Afterwards, the Geotube® would dewater for several hours before the next batch. Testing performed by the mine environmental staff and the government verified that arsenic levels were reduced to <10 ppb. This meant the filtrate was suitable to be directly released into a nearby holding pond which emptied into a nearby creek.

How the Geotube® works...

Dewatering with Geotube® technology is a three-step process.

In the confinement stage, the Geotube® container is filled with dredged waste materials. The Geotube® containers unique fabric confines the fine grains of the material.

In the dewatering phase, excess water simply drains from the Geotube® container. The decanted water is often of a quality that can be reused or returned for processing or native waterways without additional treatment.

In the final phase, consolidation, the solids continue to densify due to desiccation as residual water vapor escape through the fabric. Volume reduction can be as high as 90 percent.