

# Mining & Metals Refining Solutions

Sustainability Through Resource Recovery and Reuse



 **KOVALUS**  
Separation Solutions™

# The KSS Advantage

## Proven, Innovative, and Unique Solutions

KOVALUS SEPARATION SOLUTIONS™ (KSS) is transforming the landscape of separations by leveraging synergistic technology such as membrane filtration, ion exchange, evaporators, and dryers. Our solutions are tailored to improving product quality, increasing process efficiency, and driving down costs in dairy, food, beverage, life science, and industrial markets around the world.



## Mining & Metals Refining

Mining and metals refining are resource-intensive operations with high capital and operating expenses. From the chemicals used to the water produced, KSS offers membrane and ion exchange technology for recovery, recycle, and purification applications. Miners and refiners around the world trust KSS' solutions to drive down costs and promote sustainability throughout this demanding market.

## Applications

- Copper refineries
- Primary metal plants
- Metalworking & machining operations
- Stamping & rolling operations
- Plating facilities
- Chemical leaching processes

# Major Applications

## Ion Exchange Solutions in Hydrometallurgy

Ion exchange is a proven method of contaminant removal in process streams based on particle charge. Our ion exchange solutions employ Recoflo® fine mesh resin technology to remove metal impurities in electrorefining and electrowinning operations for high-purity copper production. Recoflo relies on a compressed shallow resin bed and short cycles of loading and counter-current regeneration for a smaller footprint and resin volume, lower costs, and longer resin lifetime.

## Acid Purification in Copper Refining

Electrorefining and electrowinning operations can often be challenged by high levels of metal impurities in the electrolyte. Typically, contaminant levels are controlled by introducing an electrolyte bleed stream. This method, however, leads to significant chemical losses with increased waste neutralization requirements and therefore large quantities of waste sludge.

Our APU® Acid Purification Unit features Recoflo ion exchange technology to purify the bleed stream in order to recycle the electrolyte, typically sulfuric acid. Metal impurities are separated from the acid and treated with a chemical reagent to precipitate metal salts. The purified sulfuric acid is recycled to the copper tank house to lower contaminant levels and improve the electrolytic process by optimizing voltage and current efficiencies.



## Benefits

- Controlled, low contaminant levels in electrolyte
- Higher cathode purity
- Increased electrolytic process efficiency
- Reduced sulfuric acid and lime purchases
- Less waste and lower waste treatment costs

# Major Applications

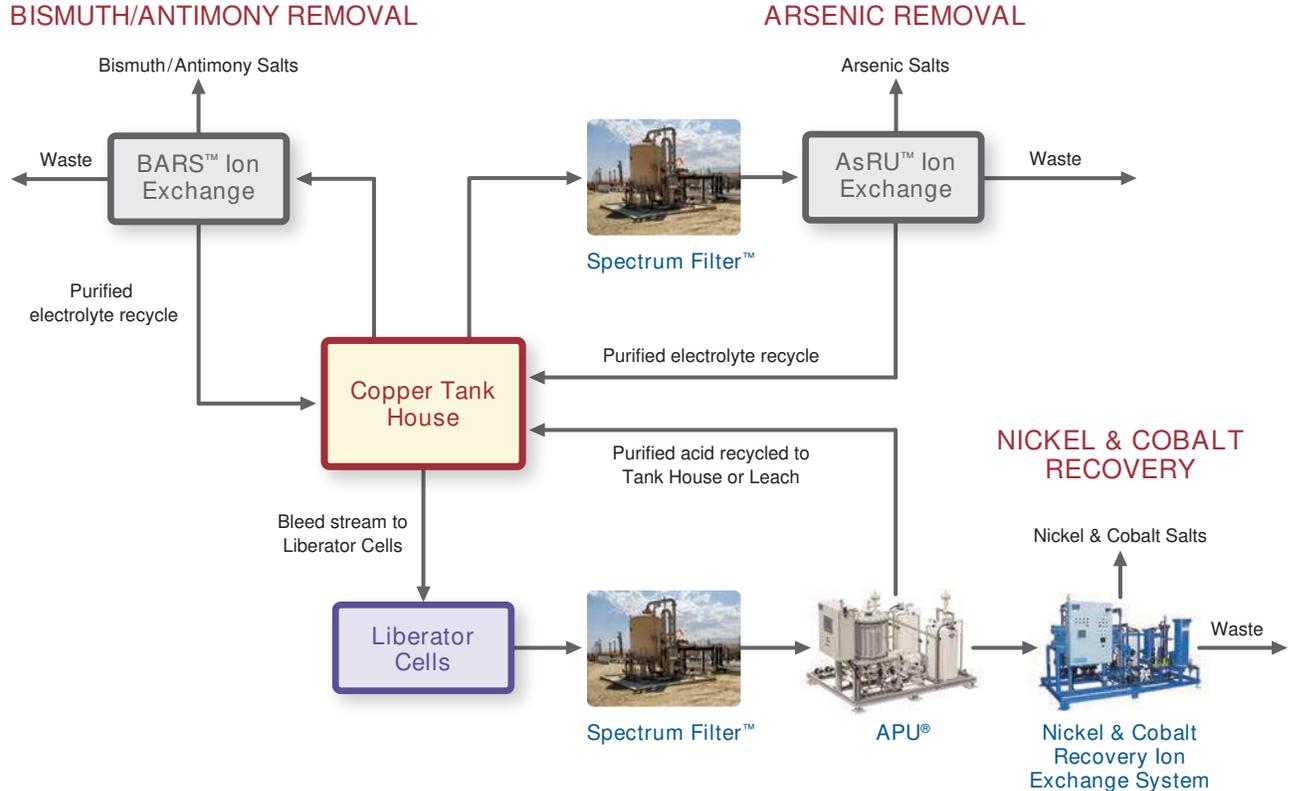
## Nickel and Cobalt Recovery

High purity nickel and cobalt salts can be recovered from the electrolyte purification process to produce marketable by-products. A Nickel & Cobalt Recovery System, featuring Recoflo® ion exchange resin technology, is incorporated downstream of the APU® ion exchange unit. The resin separates the nickel and cobalt salts stream and removes traces of copper to produce high-purity nickel and cobalt.

## Bismuth/Antimony and Arsenic Removal

Bismuth, antimony, and arsenic are often present in copper electrolyte. In certain concentrations, the metals produce slimes that are beneficial for controlling impurities in the copper. Higher concentrations, however, can present challenges to copper refining operations. The BARS™ Bismuth & Antimony Recovery System and AsRU™ Arsenic Recovery Unit feature Recoflo ion exchange technology to selectively remove bismuth/antimony and arsenic, respectively, from the copper electrolyte.

These systems operate by treating a bleed stream from the copper tank house and preventing cross-contamination of the electrolyte with the resin regenerant solution which contains chloride, a potential electrolytic contaminant. Purified electrolyte is recycled back to the copper tank house and the resin is regenerated periodically to produce a concentrated, dissolved salt stream. The BARS system treats the salt stream to precipitate bismuth and antimony, and the AsRU system reduces the amount of waste for off-site disposal.



# Major Applications

## Salt Separation

The SSU™ Salt Separation Unit employs a unique ion exchange resin with a high affinity for chloride to effectively remove the salts during the leaching step and eliminate build-up in mineral processing. It consists of two basic steps: loading and elution. The feed solution containing mixed salts is introduced to the ion exchange column during the loading step. Chloride is preferentially loaded onto the resin compared to other anions present in the solutions. During the elution step, water is passed counter-currently through the column to remove the chloride and regenerate the resin. The SSU ion exchange unit is a simple and inexpensive way to lower contaminants and prolong equipment life.



## Pretreatment with Multi-Media Filtration

The Spectrum Filter™ skid is our dual media filtration solution for pretreatment prior to ion exchange separations. The Spectrum Filter skid removes suspended solids through an automated filtration process which includes a patented backwash process. It consists of a coarse upper layer and a proprietary, very dense fine polishing lower layer to provide both depth filtration of larger particulates and surface filtration for smaller particulates.

# Major Applications

## Membrane Filtration in Mining

The global mining industry faces a variety of water and wastewater related challenges requiring innovative, economical, and sustainable solutions. KSS membrane filtration products and systems are built on decades of experience treating the world's toughest streams and achieving consistent high-quality water and wastewater.

### Process Water & Drinking Water

Mining operations often take place in the corners of the world facing moderate to severe levels of water scarcity. Miners routinely struggle to not only find sources of process water, but of suitable drinking water as well. KSS offers a range of membrane systems designed to treat water for these various uses around the mining camp. Our systems are available as pre-engineered packaged plants equipped with all the necessary ancillary equipment, or as custom or modular systems to meet specific operation parameters.

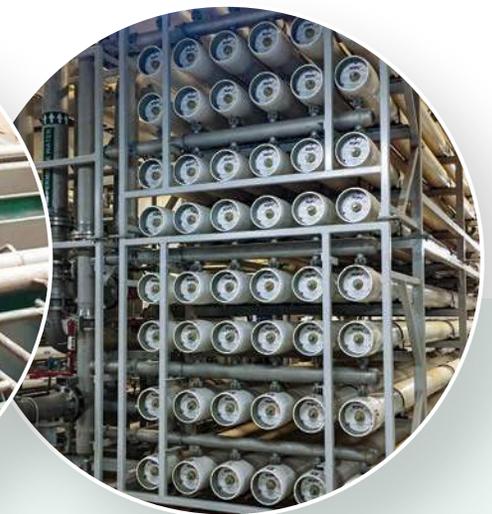
- **Seawater desalination & pretreatment:** Where feasible, seawater can be used as a source of mining camp and process water, once desalinated. Desalination requires the use of high-pressure reverse osmosis (RO), such as our FLUID SYSTEMS® RO spiral systems. Our systems offer proven performance at an affordable cost. This intensive process can further be optimized with the implementation of PURON® MP ultrafiltration (UF) membrane systems. These systems are ideal for pretreatment prior to desalination, with recoveries of over 95% and the production of high-quality water.
- **Process water conditioning:** KSS offers cost-effective and reliable membrane filtration solutions to treat a variety of process water to be used in different mining operations. Our PURON HF systems feature our virtually unbreakable UF hollow fiber product and offer high flux and solids tolerance properties that improve cleaning requirements while producing high-quality water that meet or exceed customer requirements.
- **Water softening:** Our FLUID SYSTEMS NF spiral membrane systems are designed for water softening and organics removal. Built to handle high flowrates at low pressure operation, these nanofiltration (NF) elements easily remove hardness using fewer chemicals while significantly reducing total organic carbon in process streams.



PURON MP



PURON HF



FLUID SYSTEMS NF & RO

# Major Applications

## Resource Recovery and Wastewater Treatment

Without reliable wastewater treatment technology in place, mines are vulnerable to the economic and environmental implications caused by the loss of valuable resources and discharge of untreated wastewater. KSS provides the mining industry with robust, durable membrane systems to remove heavy metals and other impurities from wastewater streams for a high-quality effluent that can be reused in the process or safely discharged.

- **Metal recovery:** Mining process water often presents challenges related to high concentrations of precipitated metals. To reduce these concentrations, our KONSOLIDATOR™ UF system features industry leading FEG PLUS® tubular membranes designed to handle streams high in suspended solids. Metals are recovered while the wastewater volume is reduced, leading to more efficient treatment downstream. The KONSOLIDATOR system comes available in seven standard sizes or a customized design to meet unique process specifications.
- **Wastewater treatment:** Wastewater from mining operations as well as mining camp sewage contains organic material that requires a combination of biological treatment with membrane filtration. KSS offers the PURON® MBR and PULSION® MBR to address these needs through the removal of solids and particulates, including bacteria, from wastewater using low-energy patented submerged hollow fiber modules where the fibers are fixed only at the bottom to allow for improved aeration and the elimination of clogging from buildup of hair, fibrous material, and sludge solids.
- **Wastewater reuse:** To maximize sustainability at mining camps, treated wastewater can be further polished to allow for water reuse in the mining process or at the mining camp, or to meet stringent discharge requirements. KSS achieves effective RO polishing of UF permeate through our FLUID SYSTEMS® RO systems. Our spiral RO membrane systems are designed to offer high-rejection purification to produce high-quality effluent within a compact, skid-mounted package plant, complete with all necessary equipment for quick and easy installation.



PURON MBR



PULSION MBR



KONSOLIDATOR



## KOVALUS SEPARATION SOLUTIONS

KOVALUS SEPARATION SOLUTIONS™ (KSS) is a global leader in separation technologies.

With best-in-class domain expertise, technologies and systems, KSS is uniquely positioned to help customers purify and recover valuable process streams and achieve sustainability goals across food and beverage, life science, and general industrial markets.

### Services & Support

After-Sales Services & Maintenance Programs • SepTrac™ Smart System



[www.kovalus.com](http://www.kovalus.com) • [getinfo@kss-sep.com](mailto:getinfo@kss-sep.com)

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