A.R.S - Heap Leaching Technology

Irrigation Mining Solutions Products For Leach Recovery Of Copper, Nickel, Gold And Uranium.

The best Uniform Percolation.

Heap Leaching Drip Irrigation System

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Heap Leaching Technology

Company Profile *Our Services*

A.R.S Limited established a company to provide Engineering solution technology to the Copper ,Gold, Nickel and Uranium Heap leaching Mines.

We offers creative, innovative and proven integrated sustainable engineering solutions to complex and challenging projects, customized to our clients', unique requirements based on process engineering and each of our clients' site specific needs All over Africa continents -DRC of Congo, Zambian , Namibia , West Africa regions , Europe, Central Asia ,Asia, North America and South America.

We manufacturer and offering Engineering, Consulting, Designs and provide the most latest developed irrigation systems for Heap Leaching solution to Mine fields , by maximizing metal extraction from the Copper, Nickel, Gold and Uranium Ore up to 90% recovery.

With Our Innovation, Creative, Professionalism and Experience of 25 years, We provide state of the art projects integrated solutions in the Mining fields.

Our Vision to provide quality services that exceeds the expectations of our esteemed customers and builds long term relationships with our customers and provides exceptional customer services by pursuing business through innovation and advanced Irrigation technology.

We believe in treating our customers with respect and faith. We grow through creativity, invention and innovation.
We integrate honesty, integrity and business ethics into all aspects of our business functioning.

Our Product & Services

- ***Drip Irrigation System.***
- ***Gyro Sprinklers Irrigation .***
- ***Nanobubble Generator.***
- ***Tailings Evaporation Floating System.***
- ***Floating Cover .***
- ***Plastic & Rain Cover.***

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Heap leaching

Heap Leaching is being done these days on relatively low-grade ores for Copper, Nickel, Gold and Uranium recovery. Typical operations take place for about One to Three months per heap and the recovery achieved is at least 60% and may be as high as 85% in some cases. Both oxide copper and sulfide copper ores are amenable to leaching with the rate of recovery being higher for oxide copper.
The new Drip Irrigation technology is changing the face of heap leach mining operations by maximizing metal extraction from the heaps.

Our new **technology has proven** itself to increase metal extraction up to 90% recovery while reducing the operating expenses .
With Our Innovation, creative , professionalism and experience we provide a wide choice of Engineering irrigation system designs and installation to the Mines.

We are one of the world's leading enterprises for heap Leaching Irrigation systems .

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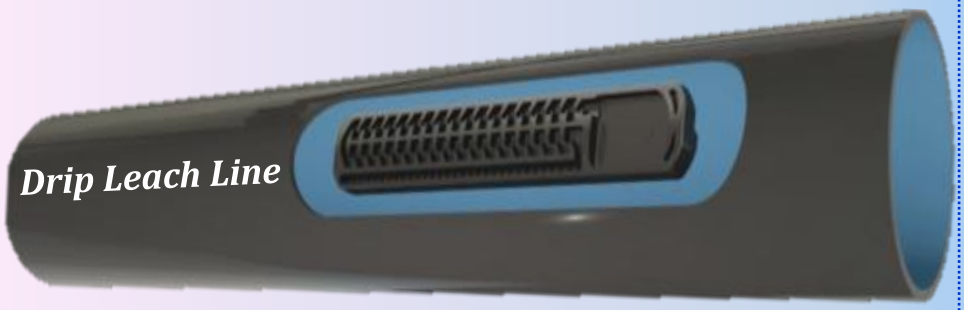
Drip Leach Line

Drip Irrigation Applied in Mining

- ARS Drip Leach Line was the pioneer in the application of drip irrigation to copper and gold mines in 1990's. Previously the Mines had used sprinklers which had many environmental and production limitations which were solved by the application of mining solution using Drip Leach Line systems. Today the use of drip on mines is standard on 90% of the copper, gold and uranium mines .It is without question **"the best practice"** method for heap leach mining worldwide.
- ARS provide and design the complete heap leach systems with the optimum components for maximum system performance. Everything from the main pipe to the end plug, we provide to make the most efficient system to use with the lowest labor costs and maximum hydraulic performance so the ore receives the designed solution application throughout the entire leach pad. It is our desire to provide the right system which will result in actual extraction equal to the predicted mine design performance.



Durable Multi-Mining Integral Dripline

- Drippers are welded into a wall of seamless tubing, providing added strength and durability.
- A big cross-section labyrinth, sharp and efficient.
- Outstanding resistance to clogging
- Double inlet filter.
- Flow rates at 1 Bar: 1, 1.6, 2, 3, 4, LPH
- Diameter : 16, 20 mm
- Wall thickness : 35 - 45 mil

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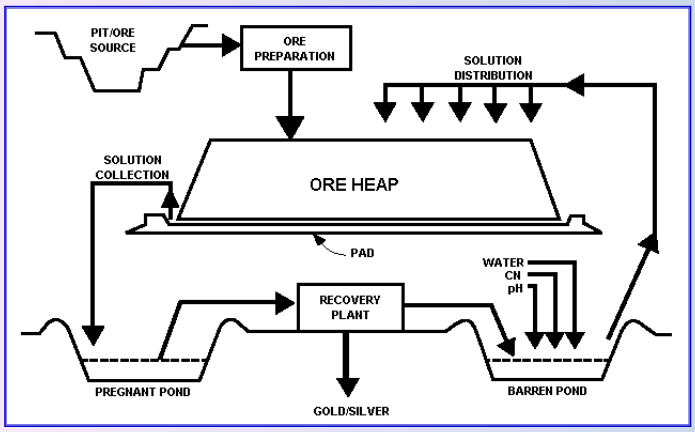
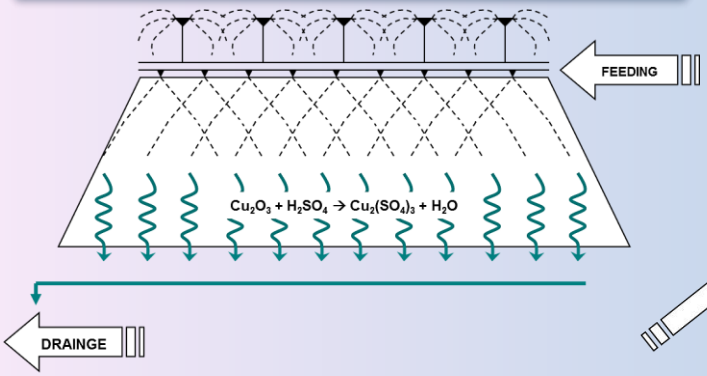
How Drip Applied in Mining

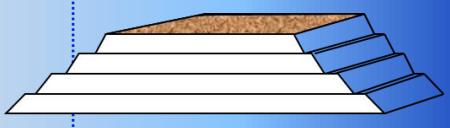
Leaching Process

This drawing illustrates the concept of a typical leach mine. The leach solution is applied on the top of the Pads, on the highest “lift”. As it gradually percolates through the layers of ore it chemically bonds with the ore. The solution which now has the ore in it called the “pregnant” solution flows by capillary action (ideally) to the bottom of the leach pile to the Geo-membrane liner. Then the solution flows by gravity to holding ponds for temporary storage. It is then pumped to the “tank house” which refines the solution and extracts the ore and then the solution is recirculated repeating the mining cycle.



Uniform Percolation All Over The Pad





PERMANENT HEAP

LEACHING HEAPS

DYNAMIC HEAP

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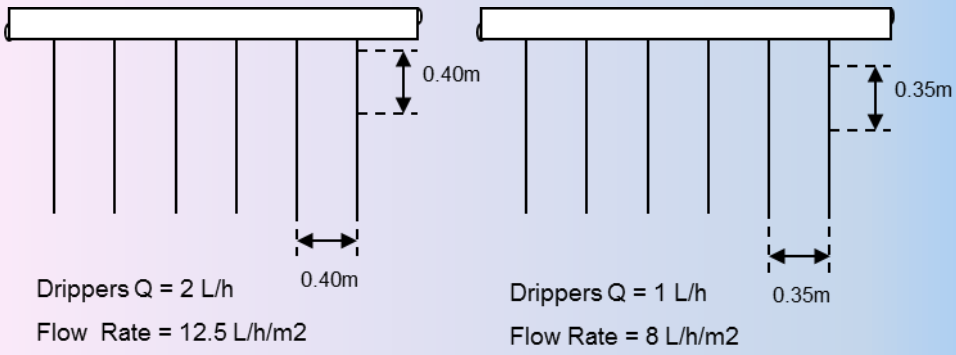
Drippers Network

How To Select The Dripper Flow Rate?



- Consider if the heap is permanent or dynamic.
- Consider the permeability of the ore.
- Consider the surface.
- Consider the length of the leaching cycle.
- Consider the side slope .
- Consider Agglomeration.
- More drippers per square meter improve the distribution uniform percolation.

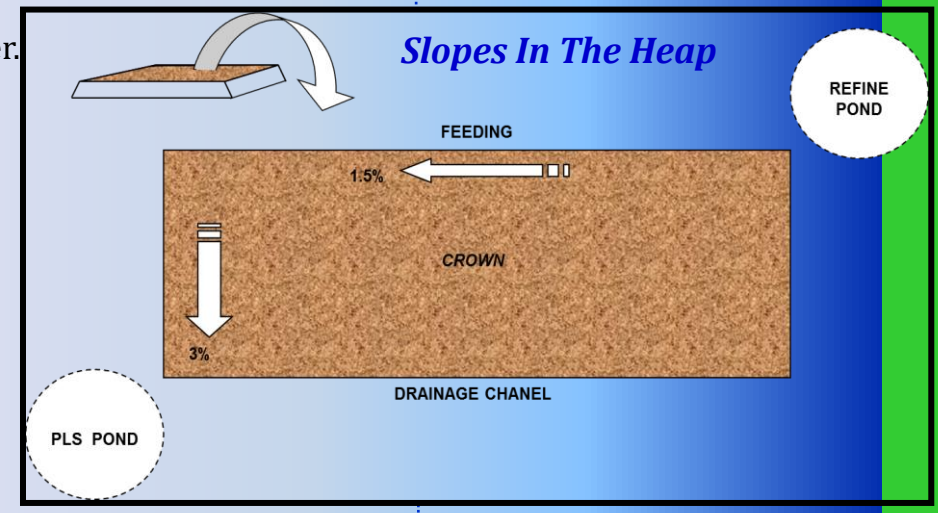
Drop Stopper

Side Slope Leaching

How We Achieve Good Uniformity Percolation?

The Solution uniformity distribution is essential to maximizing metals recovery for the ore . Drip Leach Line® technology with drop stopper with 95+% uniformity, is the most effective method for total solution contact with the aggregate surface.

- With excellent hydraulic design.
- With different emitters: 1,1.6,2,4, L/H
- With 5% CV in drippers.
- With Drop Stopper on each dripper.
- With big filters in the drippers.
- With self cleaning of the drippers due to the ***TURBOLNET***.
- With efficient flushing system and flushing the drippers lines.



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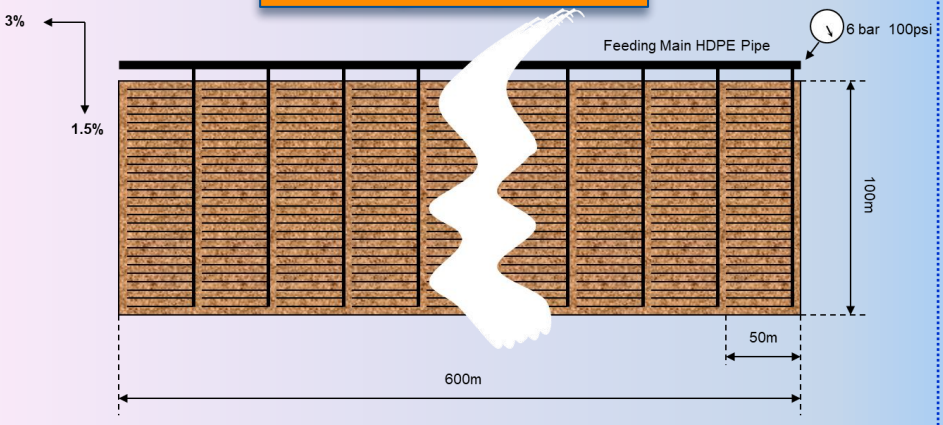
Design

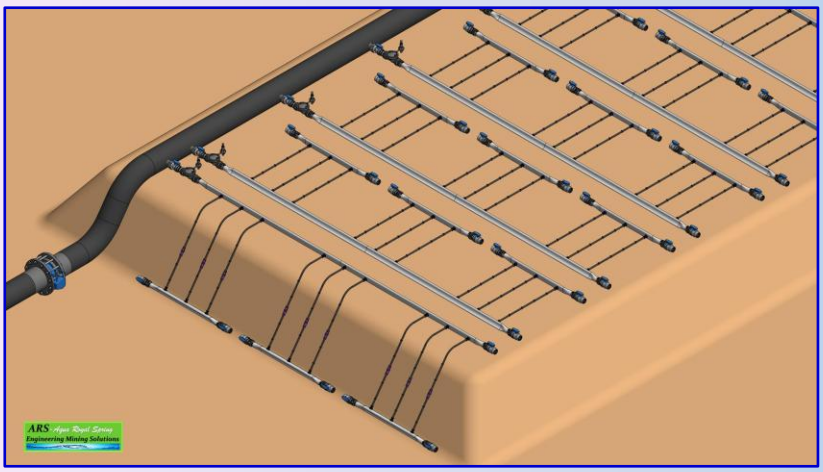
Good Design The Key For The Best Uniformity

When the drip solution is applied the surface area appears to be dry between drippers. What actually happens is the solution, moving by capillary action in the soil, flows both horizontally and vertically. In most soils the solution will spread up to 0.50 cm horizontally from the drip point. Furthermore it also moves vertically up in the soil so there are virtually no dry spot between emitters. It is very easy to test the movement of solution in your ore by taking one emitter and applying solution for an hour and then digging to find the perimeter of the moisture. However, if the solution spreads 0.5 cm remember this is the full diameter and when you have two emitters next to each other, the solution intersects at the radius so there is always plenty of solution overlap even with the widest spacing.

Side Slope Leaching

Designe Option





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Saturation

Over-Saturation of Leach Solution

Permeability

Insufficient heap permeability is one of the most common causes of failure of heap leaching projects. Poor permeability means slow solution flow and results in uneconomic leach cycle times. In addition to this, recovery is reduced due to incomplete wetting of the heap. Low permeability also limits air ingress, a necessity for bacterial leaching operations. If heaps are too permeable the solution-ore contact time will be insufficient also resulting in reduced or slow recovery.

One of the major contributors to low conductivity is fine particles and clays within the ore. Fines in the ore block the inter-particle pore spaces, reducing the overall void spaces and thus the permeability of the ore. In extreme cases heaps can 'plug' when fines are transported by the solution and packed into an impervious layer deeper in the heap.

Heap permeability problems also arise in heaps where the ore has been compacted due to careless or inadequate material placement practices. Consolidation of the heap material during the life of a pile will also lead to permeability issues. The internal precipitation of species like calcium and iron, if allowed to occur, can also significantly reduce permeability. In copper heap leaching a considerable proportion of the ore is dissolved during leaching. This degradation will also result in reduced permeability.

The best Uniform Percolation.

Permeability and Uniform Percolation.

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Nanobubble Generator

The ARS Nanobubble Generator is the most efficient aeration technology to transfer virtually any gas into any solution liquid. The generator produces trillions of nanobubbles, ~100nm in size, providing more than 200-times the interfacial surface area of conventional ultra-fine micro bubbles.

The ARS Generator transfers gas with greater than 90% efficiency, providing maximum utilization potential, improving the functionality of heap leaching solution , and enhancing the recovery processes. ARS Generator nanobubbles remain in suspension after saturation, creating a reserve of available oxygen/gas in the irrigation system-solution for heap leaching method.

Features & Benefits

- > 90% standard oxygen transfer efficiency (“SOTE”)
- ~ 100nm in size.
- Smallest size bubbles creating 200 x the interfacial surface area compared to micro bubbles.
- Highest concentration of bubbles per cm3 (>100M bubbles/cm3)
- Nanobubbles stay suspended in the solution after solution reaches saturation during the percolation.
- Increases solutions capacity to hold a given gas.
- Low-turbulent gas diffusion.
- Reduces the density of water, therefore reducing friction.

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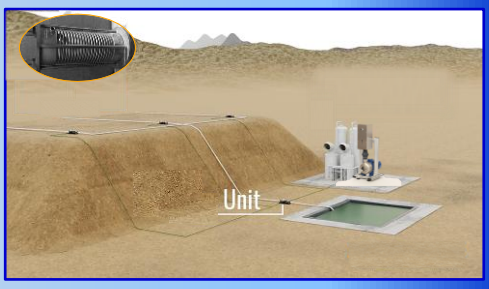
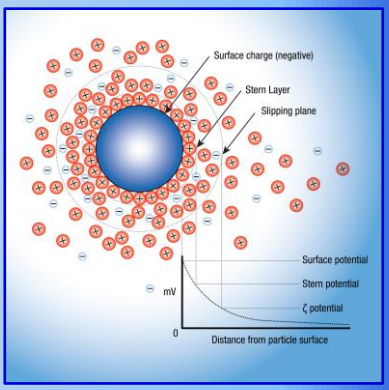
Nanobubble Technology Is Revolutionizing Heap Leaching

The ARS Nanobubbles significantly increase the surface area available for chemical reactions, accelerating the leaching process and improving extraction efficiency. By optimizing oxygen levels and enhancing mass transfer, Nanobubble technology offers numerous advantages in heap leaching operations.





How

When the Zeta potential of Nano bubbles and ore particles are opposite in charge, electrostatic attraction occurs. This interaction increases the likelihood of Nano bubbles attaching to the surface of the ore. As a result, the contact time between the leaching solution and the ore is extended, improving the efficiency of metal dissolution.

Enhanced Oxidation: Fe^{2+} to Fe^{3+} ,Accelerating redox reactions, particularly Fe^{2+} to Fe^{3+} regeneration.

During the leaching process, Fe^{3+} ions act as strong oxidizing agents, especially for refractory ores like chalcopyrite. As Fe^{3+} oxidizes the metal, it is reduced to Fe^{2+}, which needs to be reoxidized back to Fe^{3+} to sustain the leaching cycle.

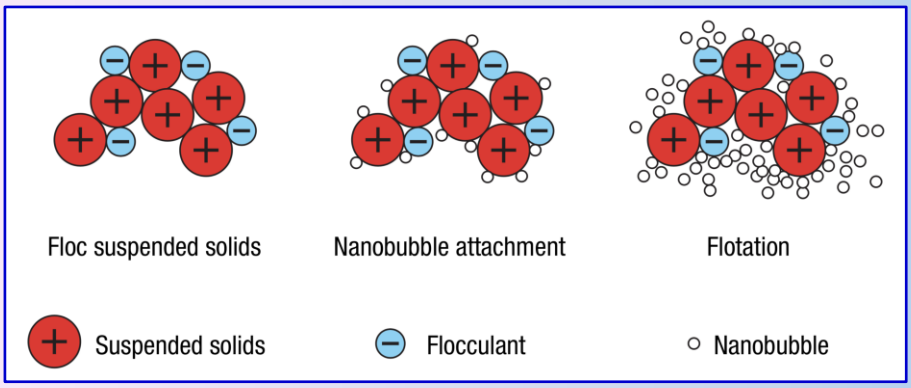
Nano bubbles play a key role in this redox regeneration by:

- Providing a high surface area for oxygen transfer.
- Enhancing oxygen dissolution in the leach solution Accelerating redox reactions, particularly Fe^{2+} to Fe^{3+} regeneration
- Possibly generating reactive oxygen species (ROS) that accelerate Fe^{2+} oxidation.

The presence of nano bubbles therefore promotes faster and more efficient oxidation of Fe^{2+} to Fe^{3+}, maintaining high oxidizing potential in the system.

Applications

- Sulfide & Chalcopyrite Heap Leaching -PLS/ILS & Raffinate.
- Bioheap bacterial leaching technology.
- Gold heap leaching.
- Floatation.



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Results &Benefits

- Reducing the operating expenses.
- Easy to install.
- Maximizing metal extraction from the heap up to 90%.
- Less evaporation.
- Is not affected by the wind.
- The best Uniform Percolation.
- The Highest Uniformity on the heap .
- Can be cover by plastic liner ,during the rainy season.
- Solves the problems with the environment.
- Safe to the operators, During the irrigation can be handled and walk on the pad no need to turn off the pump.
- Free design, Consulting ,including technical support as an after sales service free of charge on site.

More Copper & Gold

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High Quality Leaching Systems

More Production
More Copper
More Gold
More Uranium
More Money

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