

# TECHNICAL REPORT

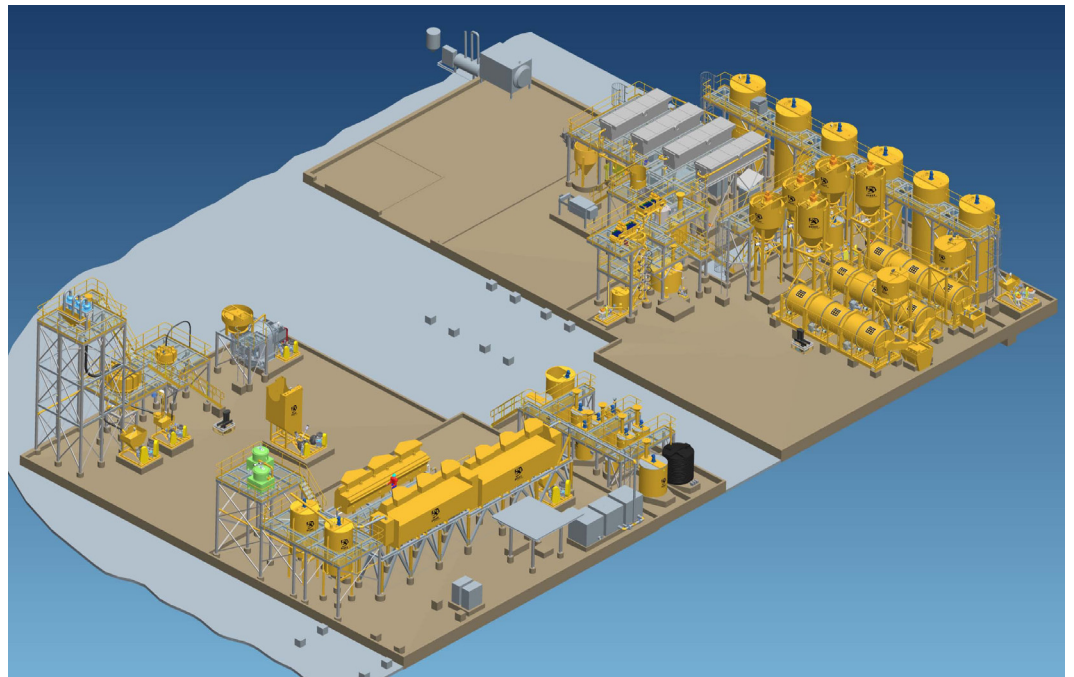
## Gravity Flotation Intensive Leach



### WHAT IS GFIL

Gravity Flotation Intensive Leach (GFIL) is a flowsheet developed by Gekko Systems that goes beyond traditional whole ore cyanidation processes (such as CIP & CIL) to provide gold recovery at a significantly reduced capital cost and minimal deleterious impact on the environment.

The process is relatively simple and has been made possible by Gekko's patented InLine Pressure Jig (IPJ), InLine Leach Reactor (ILR) and the Gekko Resin-Column that utilizes Aurix Resin technology. This flowsheet relies on gravity and flotation as the recovery devices followed by intensive leaching of the concentrates produced and then detoxification of the leach product prior to disposal. Gold is recovered from the Leach solutions using a Resin Column with the resin being stripped and the gold being recovered directly to electrowin from the stripping solution.



Our key philosophy is that no process can be viewed in isolation and each process step controls the next. As an example, the grinding of an ore prior to CIP will generally control the leach kinetics to the extent that the grind size is not always driven by leach recovery but by leach kinetics. Ores may liberate their mineral for recovery at a coarse size distribution but the low strength leach system downstream requires the ore to be ground very fine in order to achieve acceptable recoveries within the residence time of the leach circuit.

Gekko have sought to break the dependence of one process on the other or at least strengthen the interaction between processes to point where each process in the system is more robust. Interactions such as the grind size are less critical in that minerals can be recovered at far coarser size ranges with a combination of continuous gravity recovery and flotation. This will achieve mineral recovery across a far wider size distribution than direct CIP leach which requires fine particles for both the leach kinetics and agitation in the tanks.



Those ores which display any complexity can be far more efficiently treated if the gold can be recovered to a concentrate and subsequently treated in a highly controlled and aggressive leach environment. The gold concentrates are leached in an environment which can be as much as 10 - 40 times more aggressive than a CIP circuit.

The comminution system is simplified by the use of either Vertical Shaft Impactor (VSI) or High Pressure Grinding Rolls (HPGR). Both units have the ability to break gangue leaving the mineral particles in tact and radically reducing the over-breaking of minerals (sliming) such that it will be easily recovered by both gravity and flotation.

These are just a few of the interactions which have been strengthened in the GFIL flowsheet and allow for the most efficient cyanide compliant plant on the market today.

## WHY GFIL

The Cyanide Code was introduced recently to ensure users are operating under the same guidelines worldwide and although it is not currently compulsory to comply with this guideline it is certainly supported by the major gold producers. The GFIL circuit is code compliant from a physical construction and design perspective and we believe we have designed and will construct one of the first code compliant cyanide sites in the world. No other plant has achieved the status of code compliance as yet. Due to the simple design and small flows of "concentrate only" that are leached it is far simpler to comply with the physical requirements of the Code.

## ADVANTAGES OF GFIL

**Better Environmental Outcomes:** Gekko believes that GFIL technology is the stepping stone to cyanide free, efficient, low cost treatment of gold ores. This makes our gold process the leader in environmental advancement in this area. Producers have been searching for an alternative to cyanide use for many years and to date this has not been achieved in a cost effective package. Whilst not making the site totally cyanide free, the Gekko Process, Gravity, Float, Intensive Leach (GFIL) does greatly reduce the reliance on cyanide and brings us closer to the goals of cyanide reduction. Cyanide consumptions could be as much as 75% less than that of a conventional plant.

**Capital and Operating Cost Reductions:** The Gekko GFIL design is simple and modularized requiring less infrastructure and engineering on site. Using gravity at the front end also means that there is the potential to use a coarser grind, which will result in low power requirements and thus further reduce plant operating costs.

**Ability to Pre-Fabricate:** All components and systems fabricated for easy shipment and plant set up. Once built and pre-commissioned at the factory they are subsequently dismantled into container based components ready for quick and easy re-assembly on site and thus decreasing the time required for commissioning.

**Mobility:** Due to the compact design and minimal amount of equipment needed the plant has a small footprint and is therefore extremely mobile  
Other benefits you can expect with our design are as follows:

- Ease of transport
- Ease of assembly and operation
- High quality fully integrated components
- Simple design
- Full control monitoring systems and operational stability
- Process flexibility for other downstream recovery of minerals from the concentrate.
- Simple detoxification of cyanide tailings stream.
- Treatment of complex, semi-refractory and preg-robbing ores.
- Pre-packaged solution.
- Fast delivery time.
- Low energy consumption.
- Low maintenance.



## SAFETY

Gekko Systems' InLine Leach Reactor has been safely operated in over 50 gold mines worldwide. This is due to the mixture of its innovative design, effective operating and maintenance practices and the focus on safety and environmental issues.

In any operation where cyanide is present, safeguards must be put in place to ensure the safety of everyone working in and around the area. In order to prevent the generation of hydrogen cyanide gas, the pH level of any cyanide containing solution should be maintained above a pH of 10.5. The Gekko InLine Leach Reactor safeguards against the inadvertent generation of hydrogen cyanide gas through continual monitoring, alarming and interlocks with the solution pH. If the solution pH drops below a safe level the addition of cyanide or peroxide is prevented by control interlocks and alarms.

The ambient level of hydrogen cyanide gas has been measured at many of our installations and is below 1ppm within 1m of the ILR under normal circumstances. This level may rise to between 3 and 5ppm inside the open pump sump or in the event of a major leach solution spill. Where the ILR is installed indoors extra safeguards can be provided by gas extraction from the solution tank and from above the solution sump, however this is not essential in a well ventilated area. Fixed or portable HCN monitoring equipment is strongly recommended and can be provided by Gekko. Portable HCN monitors should be used before performing any maintenance work.

Exposure to cyanide solution is minimised by the ILR design; all storage vessels have lids and leaching takes place in an enclosed horizontal drum. Dedicated sampling points minimise operator handling. All solutions are at room temperature, reducing the safety impact of any skin contact which may occur.

Maintenance safety is also catered for in the design of the ILR. All moving parts are effectively guarded and all routine maintenance and lubrication points can be accessed from outside the guarded areas. High quality piping and pump design, including safety screens to catch fugitive oversize material, minimise breakdown maintenance requirements. Isolation and flush points are provided for all maintenance items, in particular the pump.

Recommended practice is to have a separate bunded area for the ILR with a dedicated spillage pump. This will allow any spills to be captured and directed to an appropriate area. All incompatible chemicals should be excluded from the ILR area.

## IS GFIL RIGHT FOR YOU

1. Do you have discrete mineral particles associated with the gold in your ore?
2. Can these particles be recovered to a concentrate by gravity and flotation?
3. Are there any recovery benefits and energy savings in a coarser grind size?
4. Are you in an environmentally sensitive area?
5. Will a lack of cyanide in your tails help with the permitting process?
6. Do you want to reduce your rehabilitation and total life of mine costs?
7. Do you want to be Cyanide Code Compliant?
8. Do you want to reduce capital and operating costs?
9. Do you want a fast construction time?
10. Do you want to come in on budget (fixed price)?
11. Do you want to head into the future or stay in the past?

If you answer Yes to any of these questions you need to discuss GFIL with Gekko. E-mail or Telephone us at any of our offices worldwide. Our staff can assist you to evaluate your opportunity to save money and time by investing in a GFIL plant. Please visit our website [www.gekkos.com](http://www.gekkos.com) for a profile of Gekko Systems and equipment information.

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