COMO ENGINEERS

MECHANICAL & MINERAL PROCESS ENGINEERS

SPECIALIST EQUIPMENT

'CLIENT SATISFACTION IS OUR SUCCESS'

PERTH MELBOURNE JAKARTA

AGNICO EAGLE MINES Iteè, QUEBEC CANADA
LARONDE DEEP MINE ELUTION, REGENERATION & GOLDROOM

www.comoeng.com.au

Como Engineers

- Established in 1986 – currently 32 years servicing the mining industry
- A team of 40 permanently employed and experienced Engineers (process, mechanical, electrical, civil, structural), Draftspeople (3D SolidWorks & AutoCAD) and Construction Managers
- Work closely with clients to ensure successful outcomes
- Small enough to provide direct access to senior staff members (owners)
- Large portion of our projects are repeat business with existing clients
- Specialise in cost effective innovative solutions utilising new, refurbished and relocated plant and equipment
- Provide lump sum pricing & fixed schedule, removing project risk from the client
- Keen to be involved in all projects ranging from minor maintenance improvement projects through to major capital expansion & greenfields projects

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

MODULAR ELUTION PLANTS

Modular Elution Plants

Modular Elution Plants are available with the following circuit designs:

- Atmospheric Zadra Circuit (AZ)
- Pressure Zadra Circuit (PZ)
- Integral Pressure Strip Circuit (IPS, on request)
- AARL or Split AARL Circuit (on request)

Major Modules available:

- Elution Circuit, including Electrowinning Recovery Module
- Carbon Regeneration Module
- Goldroom Module

Optional Modules Available include:

- Fresh Carbon Conditioning (as part of Carbon Regeneration)
- Fine Carbon Handling and Recovery
- Transfer Water Recovery System
- Gold Sludge Processing (as part of Electrowinning Recovery)

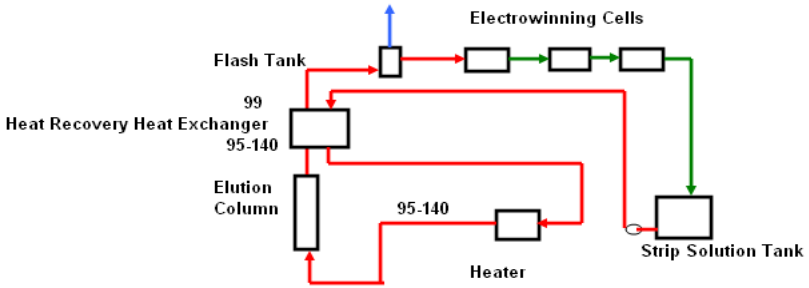
COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

ELUTION PROCESS REVIEW

Zadra Circuits

Como Engineers most popular circuit design, utilising Como's proprietary system process design criteria:

- Electrowinning and desorption are processed in series
- Atmospheric Zadra is a non pressurised desorption (95 ºC) with an atmospheric cell electrowinning (1 bar, 85 ºC)
- Pressure Zadra is a pressurised high temperature desorption (120 ºC to 140 ºC) with atmospheric cell electrowinning
- Strip times 7-12 hours for Pressure Zadra, 12-18 hours for Atmospheric Zadra



Zadra - Advantages and Disadvantages

Advantages

- **High pressures and temperatures** promote the AuCN complex desorption from activated carbon.
- Very simple **low maintenance design**.
- Considerable heating **power and water savings** over comparative AARL strips (30%), leading to **reduced capital** (30-40%) and **lower operating costs**.
- **Low total water usage** and poorer quality waters suitable (<1000 ppm TDS) compared with AARL.
- Can obtain very **low barrens** (<50ppm) on the loaded carbon and < 5ppm on eluate (Strip time dependent).
- The higher the pressure and temperature, the faster the strip and **improved electrowinning performances**. Hence Pressure Zadra will perform far superior to Atmospheric Zadra.

Zadra - Advantages and Disadvantages

Dis-advantages

- Slower Elution Rate when compared to AARL.

  When comparing the additional electrowinning circuit process with AARL occupying pregnant tank volumes does it matter?

- Recirculated impurities can build up in the Zadra circuit.

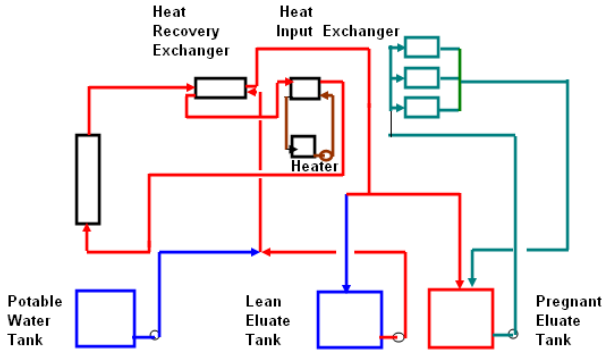
  This is reduced by effective changeover of reagent usage over three strips, as one third of volume of solution is discarded and then replenished per strip.

- Duplication of circuit required for increased tonnages compared with AARL.

Anglo American Research Laboratories (AARL) Circuits

Como Engineers utilises the AARL patented design process:

- Desorption involves and solution soak with high caustic solution followed by high purity water single pass plug flow desorption.
- Electrowinning is a separate event to desorption, circulating solution through the cells from the desorption pregnant tank.
- AARL available in standard design or split AARL. Split AARL utilises the low grade elution waters from the previous strip to start the next, reducing overall water consumption.



AARL - Advantages and Disadvantages

Advantages

- AARL is the fastest elution (Strip) of any circuit…….but you still need to complete your electrowinning!
- No recirculation of contaminants.
- Solution grades in pregnant solutions are high grade and contain all the precious metals allowing substitution of electrowinning for Merril Crowe (zinc precipitation).
- Electrowinning can be stopped without affecting the barren carbon grades.
- Expandable by additional eluate tanks, carbon vessels and electrowinning, only to the detriment of strip times.

AARL - Advantages and Disadvantages

Dis-advantages

- Heating System is **considerably larger** than Zadra hence higher operating and capital costs. **40% higher capital costs** compared with Zadra systems.
- Single pass design of elution relies heavily on plug flow design of columns, resulting in columns being twice the height of Zadra/IPS, **increasing structural support costs** and access. Especially a problem for indoor installations of large systems.
- Single pass design means if you don't elute properly you **risk high barren carbon levels** and you will need to start again!
- **High water quality** needed (often RO water treatment necessary).
- **High water consumption** compared with Zadra.
- Modularisation difficult on larger systems due to size and **increased number of tanks** required to hold eluate solutions.
- **System more complex**.

Why go Modular?

- Como's plants are designed based on **proven track record** in leading design and technology – no need to pay someone to design for you.
- Equipment is **fully trial assembled and wet commissioned** before being dismantled into (primarily) 40' sea containers.
- Off site construction and testing using proprietary proven designs **reduces site capital construction costs**.
- Equipment is pre-integrated providing **rapid installation and commissioning**. Simply erect, re-terminate electrics and terminate your services to the plant.
- The system can be installed **towards the end** of a greenfields mine construction project or retrofitted to an existing operating plant.
- **COMPLETE VENDOR PACKAGE** - Considerably reduced project management and procurement and logistics management time and expense.
- Are **tailored to your site layout** and specific needs, or take one of our standard compact package plants.

Workshop Wet Commissioning and Packaging

- Como's plants are full assembled and wet commissioned to temperature prior to being dismantled and shipped.
- Plants are designed to fit into 40' High Cube Containers.

Site Installation

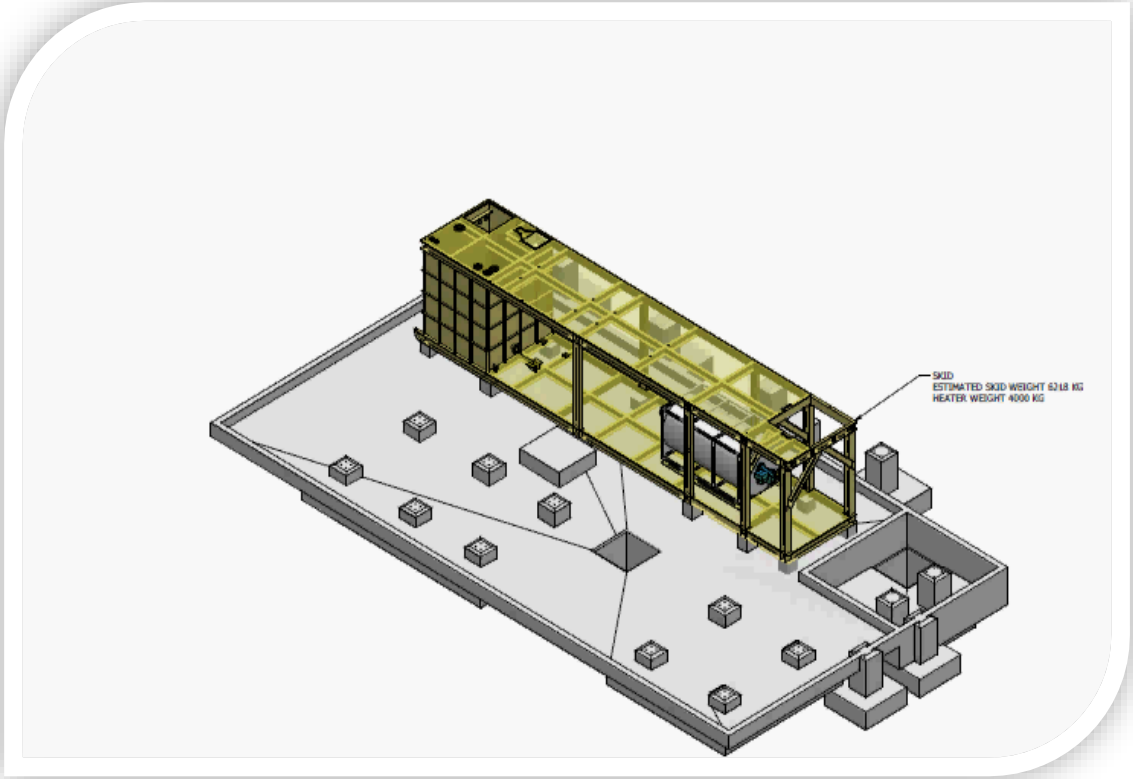
- Designed to be readily removed from the transport sea containers and assembled in several easy steps.
- Erection of most plants can be achieved within 2 weeks, with services and electrical terminations remaining.



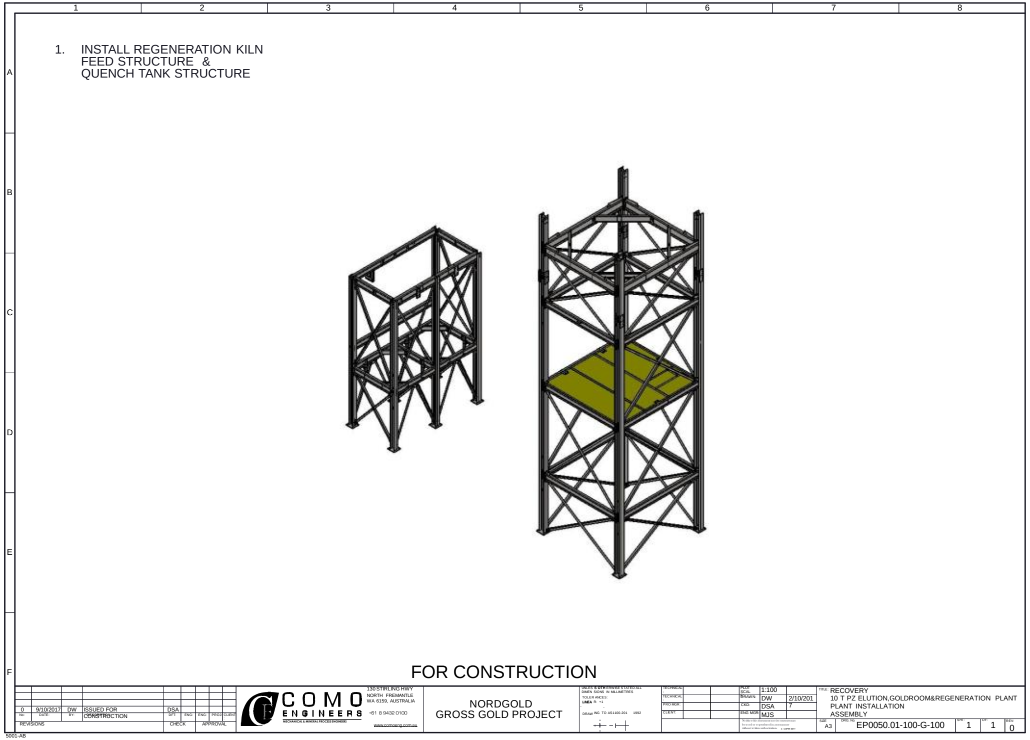




1 to 4 Tonne Installation



10 Tonne Installation



Commissioning

- Once installation and assembly complete, commissioning can commence.
- Commissioning on site normally takes no more than 1 week from commencement of point-to-point checks and confirmation of actuated valves operation to pouring the first bar of gold.

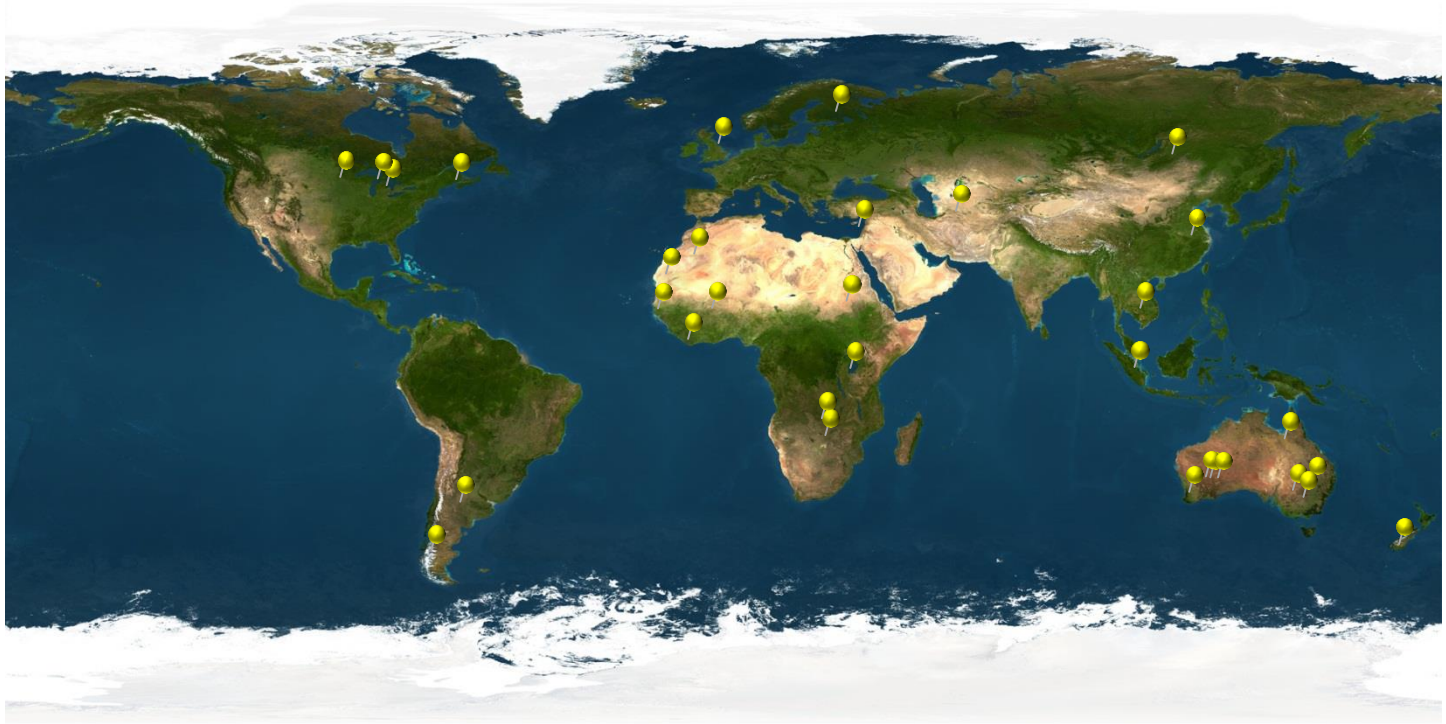
Barren carbon loading	< 70ppm (Como Engineers regularly achieves <40ppm)
Regenerated carbon activation	> 95% activity (normally achieve 98%)
Total elution cycle time	< 16 hours total Estimated breakdown of individual times: • Acid Wash = 25 minutes • Acid Soak = 30 minutes • Acid Rinse = 120 minutes • Transfer to Elution Column = 20 minutes • Elution Pre-Heat = 2 hours (from cold) • Elution & Electrowinning = 8-10 hours • Barron Carbon Rinse = 1 hour
Barren Eluate loading	< 10ppm (normally achieve 5ppm)

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

MODULAR ELUTION PLANT EXAMPLES

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

Worldwide Projects



- La Ronde Gold 8t
- Lapa Gold 4t
- San Gregorio
- Guemassa Gold 2.4t
- Sissingue 4t
- Burkina Faso Gold
- Morocco 2t
- Metso Nordic 6t
- Kansanshi Gold 1t
- Hellenic Copper 1t
- Atlantic Gold 6t
- Phoc Son 2t
- Copper Chem 2t
- Sudan 2t + 4t
- CPL UK 4t
- Tabakoto
- DRA Rangold Kibali
- El Toqui
- Darlot 2t
- Agnew
- Nippon Pilot Plant
- Fosterville 4t
- Twangiza 2t
- Tomingley Gold
- Nordgold 10t

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

Nordgold Gross Project, Russia

10t modular gold stripping plant.

RUSSIA

NORDGOLD GROSS PROJECT- MODULAR GOLD STRIP PLANT

PROJECT:
Gross Gold Project

LOCATION:
Sakha Republic, Russia

CLIENT:
Nordgold

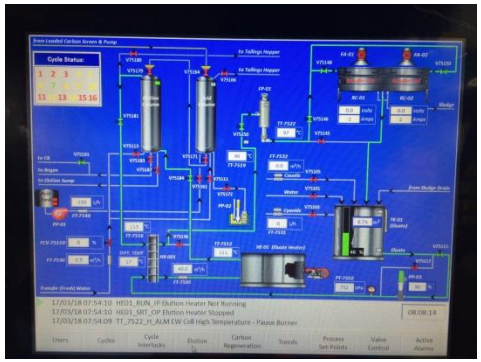
- **Supply of a 10 tonne PLC automated Pressure Zadra System with 500kg/h Carbon Regeneration**
- **All engineering, design, fabrication and construction of the modular gold strip plant were completed in Perth, WA**

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

Manub Gold Project, Sudan

4t modular gold stripping plant.

SUDAN



MANAGEM GROUP, SUDAN - MODULAR GOLD STRIP PLANT

PROJECT:
Manub Gold Project

LOCATION:
Sudan

CLIENT:
Managem Group

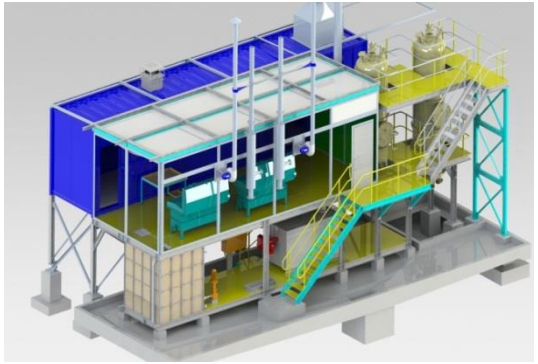
- **Supply of a 4 tonne PLC automated Pressure Zadra System with 250kg/hr Carbon Regeneration**
- **All engineering, design, fabrication and construction of the modular gold strip plant were completed in Perth, WA**

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

SUDAN

Sudan North Gold Pilot Project, Sudan

2t modular gold stripping plant.



SUDAN MODULAR GOLD STRIP PLANT

PROJECT:
Sudan North Gold Pilot Project

LOCATION:
Northern Sudan

CLIENT:
Managem International

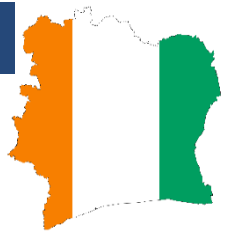
- **Design, construct and supply delivered 2.0 tonne manually operated Pressure Zadra Stripping System with integral goldroom.**
- **Constructed in Perth and was pre-tested with a hot temperature run**
- **Commissioning was undertaken on-site in Sudan**

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

Sissingue, Cote D'Ivoire

4t modular gold stripping plant.

Cote D'Ivoire



LYCOPODIUM FOR PERSUS MINING - MODULAR GOLD STRIP PLANT

PROJECT:
Sissingue Gold Project

LOCATION:
Cote D'Ivoire

CLIENT:
Lycopodium, for Perseus Mining

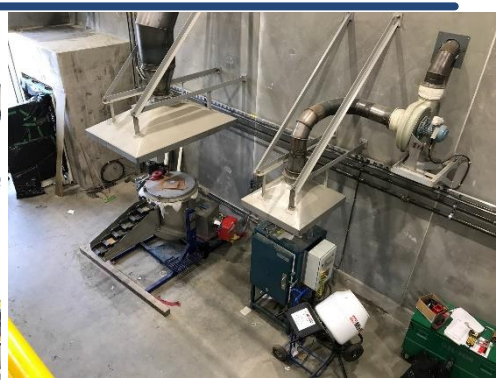
- **Supply of a 4 tonne PLC automated Pressure Zadra System with 200kg/h Carbon Regeneration**
- **All engineering, design, fabrication and construction of the modular gold strip plant were completed in Perth, WA**

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

Moose River, Canada

6t modular gold stripping plant.

CANADA



AUSENCO, FOR ATLANTIC GOLD - MODULAR GOLD STRIP PLANT

PROJECT:
Moose River Consolidated Gold Project

LOCATION:
Nova Scotia, Canada

CLIENT:
Ausenco, for Atlantic Gold

- **Supply of a 6 tonne PLC automated Pressure Zadra System with 300kg/h Carbon Regeneration**
- **All engineering, design, fabrication and construction of the modular gold strip plant were completed in Perth, WA**

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

CYPRUS

Hellenic Copper Mines, Cyprus

1t modular gold stripping plant.

HELLENIC COPPER MINES- MODULAR GOLD STRIP PLANT

PROJECT:
Hellenic Copper Mines

LOCATION:
Cyprus

CLIENT:
Hellenic Copper Mines

- **Supply of a 1 tonne PLC automated Pressure Zadra System**
- **All engineering, design, fabrication and construction of the modular gold strip plant were completed in Perth, WA**

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

Metso Minerals, Laiva Finland

6t modular gold stripping plant.

FINLAND

METSO MINERALS SWEDEN FOR NORDIC MINES - MODULAR GOLD STRIP PLANT

PROJECT:
Nordic Mines Gold Project

LOCATION:
Laiva in Finland

CLIENT:
Metso Minerals Sweden, for Nordic Mines

- **Supply of a 6 tonne PLC automated Pressure Zadra System**
- **All engineering, design, fabrication and construction of the modular gold strip plant were completed in Perth, WA**

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

CANADA

Laronde Deep Mine, Canada

8 tonne Elution and Carbon Regeneration System.

LARONDE DEEP MINE FOR AGNICO EAGLE - 8 TONNE ELUTION AND CARBON REGENERATION SYSTEM

PROJECT:
Agnico Eagle Laronde Deep Mine Project

LOCATION:
Cadillac Quebec, Canada

CLIENT:
Agnico Eagle

- **Supply of a 8 tonne Elution and Carbon Regeneration System**
- **Detailed engineering design of the elution, regeneration, goldroom and carbon recovery systems**

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

CANADA

Lapa Gold Project, Quebec Canada

2t Modular Gold Stripping Plant

LAPA GOLD PROJECT - MODULAR GOLD STRIP PLANT

PROJECT:
Lapa 2t Elution and Regeneration System

LOCATION:
Quebec, Canada

CLIENT:
Agnico Eagle Canada

- **2 tonne PLC automated Pressure Zadra System**
- **150kg/h LPG fired carbon regeneration kiln**
- **All engineering, design, fabrication and construction of the modular gold strip plant were completed in Perth**

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

Phouc Son Gold, Vietnam

2t modular gold strip plant.

VIETNAM

PHUOC SON GOLD MINE - MODULAR GOLD STRIP PLANT

PROJECT:
Supply of a 2t PLC automated Pressure Zadra System with 100kg/h LPG fired carbon regeneration kiln and integral goldroom

LOCATION:
Vietnam

CLIENT:
Olympus Pacific Minerals

- **Supply of a 2 tonne PLC automated Pressure Zadra System**
- **All engineering, design, fabrication and construction of the modular gold strip plant were completed in Perth, WA**

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

Morocco, Guemassa Gold Plant

2.4t modular gold stripping plant.

MOROCCO

GUEMASSA GOLD PLANT- MODULAR GOLD STRIP PLANT

PROJECT:
Guemassa Gold Plant

LOCATION:
Guemassa, near Marrakesh, Morocco

CLIENT:
Compagnie Tifnout Tigharimine

- **Design, construct and supply delivered a modular 2 tonne capacity carbon elution plant**
- **Constructed in modular fashion**
- **The modular design allowed for minimal dismantling**

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

Tiouit Gold and Silver Project, Morocco

2t modular gold stripping plant.

MOROCCO

TIOUIT GOLD AND SILVER PROJECT MODULAR GOLD STRIP PLANT

PROJECT:
Tiouit Gold and Silver Project

LOCATION:
Boumalne Dades, Morocco

CLIENT:
Co. Company

- Supply of a 2 tonne Modular PLC automated Pressure Zadra Elution System with modular goldroom.
- The system included a 500kW Direct Eluate Heating system with full PLC control of all elution and electrowinning process steps.

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

Kansanshi Gold, Zambia Africa

1t modular gold stripping plant.

ZAMBIA

KANSANSHI MODULAR GOLD STRIP PLANT

PROJECT:
Kansanshi Gold

LOCATION:
Zambia, Africa

CLIENT:
First Quantum Minerals

- **Supply of 1t Modular Gold Stripping Circuit**
- **Construction of the elution plant were completed in WA for project in Zambia, Africa.**

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

AUSTRALIA

JX Nippon Gold Plant, Perth Australia

Modular IPS Gold Stripping Plant.

N-CHLOR TECHNOLOGY DEVELOPMENT MODULAR IPS GOLD STRIPPING PLANT

PROJECT:
N-CHLOR Technology Development

LOCATION:
Canning Vale WA

CLIENT:
JX Nippon Mining & Minerals

- **Design, manufacture and supply a 150kg Modular IPS Elution System.**
- **The system included a 30kW Direct Eluate Electric Heating system.**
- **The plant was built very compact, specifically to fit into client's available location.**

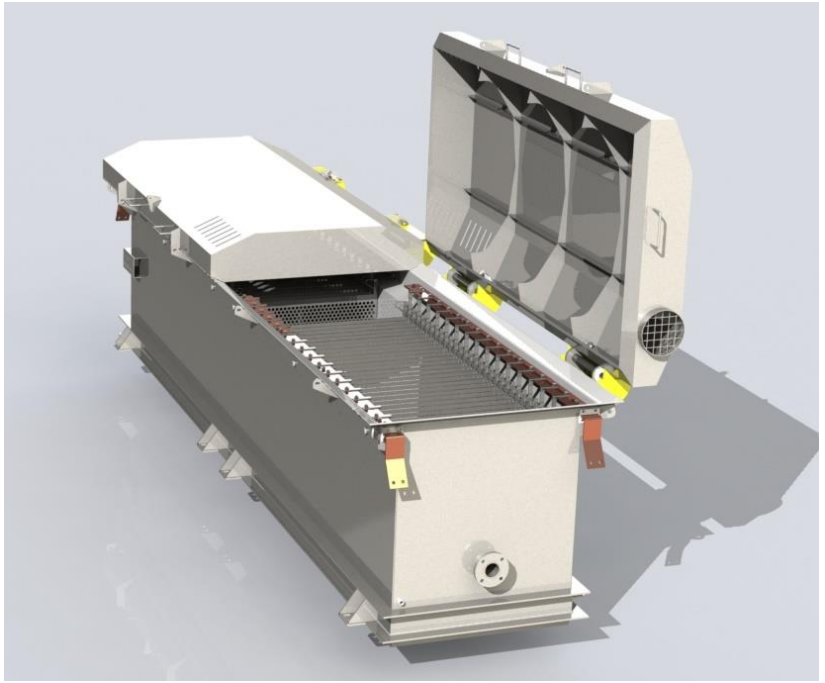
COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

MODULAR PLANT DESIGN

Elution Circuit

- Suited for 1-20 tonne Pressure Zadra systems
- Pressure Vessels available as either AS1210, CE or ASME designs
- Additional Loaded Carbon Vessels available to suite forward loading of carbon
- Direct NG, Electric, LPG, Propane or Diesel fired elution boilers
- Strip times available 8-12 hours (site dependent)
- Allen Bradley PLC standard, but can accommodate all other brands including Schneider, Siemens, etc. and allow for client interface via communication protocols.
- Electrical installation completed to AS3000, European IEC and Canadian CSA standards.
- Completely modelled in SolidWorks 3D with all 2D drawings generated from that.
    - Navisworks 3D model can be exported for viewing by Client
- Concrete design completed as part of plant design with a full set of Construction drawings issued for installation by others.

ES Series Cell – High Temperature, Non Drip Design, High Security



ES Series Cell – High Temperature, Non Drip Design, High Security – Workshop Commissioning

Regeneration

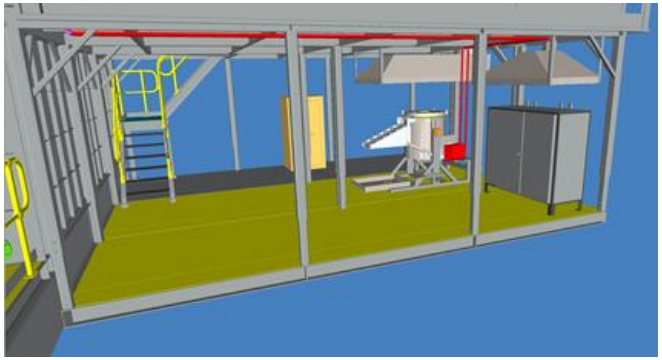
- Regeneration capacity from 50-1500kg/h
- Complete with Feed Hopper and Pressure Rated dual quench tanks to AS1210, CE or ASME
- Available as either floor mounted with quench hopper, or fully elevated structural design with pressure vessel quench tank
- Fully automated kiln start/stop/carbon transfer operations
- LPG/Propane, NG or Electric

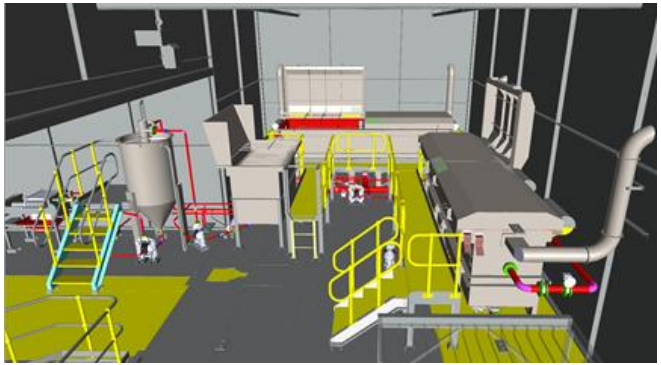
Regeneration

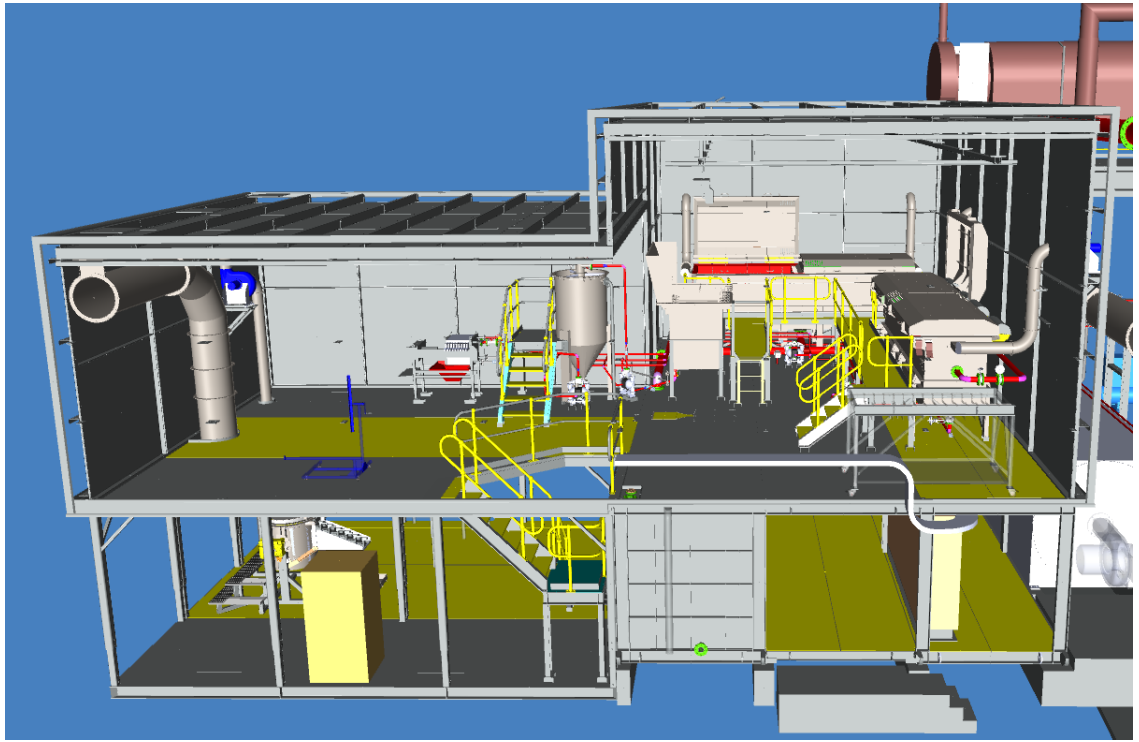
Goldroom

- Available for secure indoor installation or can be fully clad as stand alone building.
- Structurally verified for most seismic and wind load conditions.
- Fully equipped 'spacious' goldroom building or containerised goldroom complete with everything needed to operate the gold room and produce doré bars – even down to the PPE and tooling used by operators.
- 2 floor design with upper floor for electrowinning cells and gold recovery and lower floor for drying oven and furnace.
- Upper floor designed as 'wet area' – any spillages directed back to elution tank.
- Ground level skids expandable in height to give higher ceiling space.
- Full mesh security screens with custom made steel security doors, security system inclusive of door and motion sensor and video cameras linked back to DVR.

Example Goldroom Layout

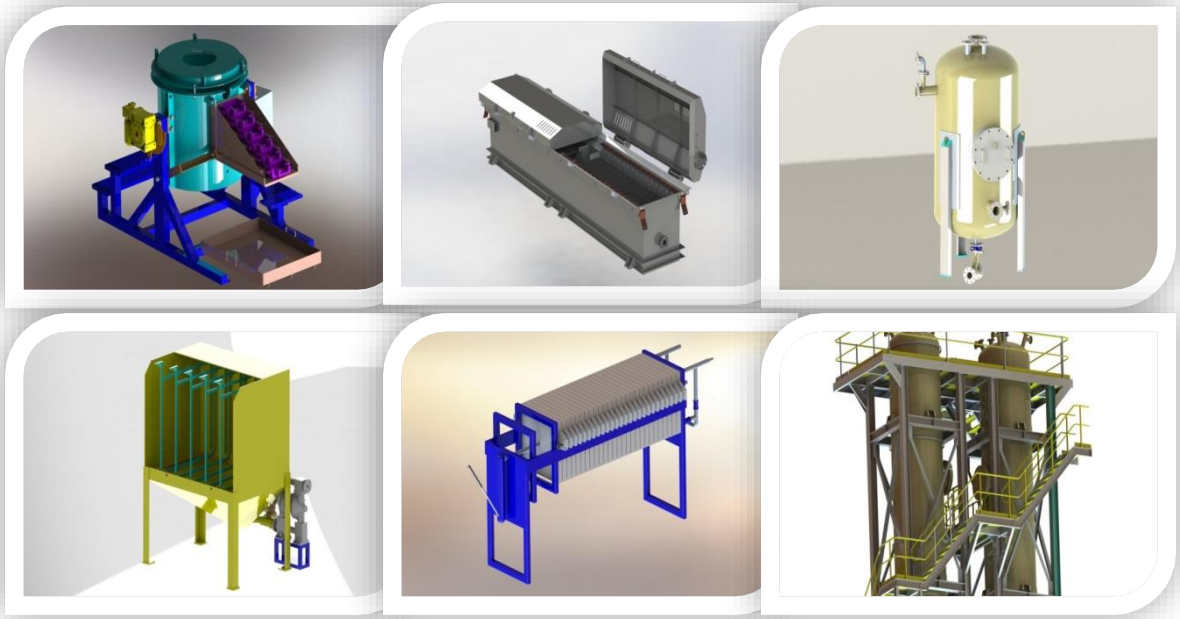






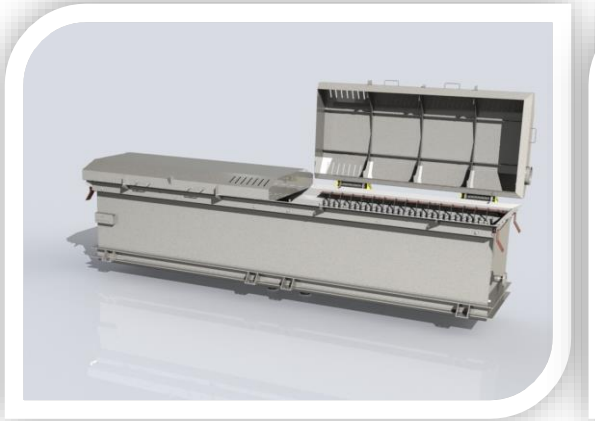
COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

Designed Gold Equipment, Supplied and Installed



COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

ELECTROWINNING CELLS



Electrowinning Cells

- Como Engineers Pty Ltd supplied heavy duty 304 Stainless steel, rubber lined electrowinning cells.
- Available cathode sizes: - 600 x 600mm; 800 x 800mm; 1000 x 1000mm; 1250 x 1250mm.
- Standard designs - 12 cathode, 13 anode arrangements, but these can be extended or shortened as required (up to 40 cathodes).
- Centre feed (for large cathode units) and end feed (for standard cathode numbers).
- Custom sizes are also available upon request.
- Cathode systems:
    - Stainless Steel woven wire for sludging cells and
    - Mild steel wool systems for calcine or acid digest systems
- Cathode winders available).
- Anodes are stainless steel punched plate.
- Como Engineers use a solid termination system, whereby electrodes are directly fastened to the busbars by stainless steel nuts. This eliminates the common cause of gold room fires is dirty 'quick release' type clips and frayed insulation on cables.

Advantages of Stainless Steel Electrowinning Cells

The **advantages** of stainless steel cells over other cells include: -

- **Long life**: unlike plastics such as polypropylene, stainless steel does not become brittle after a few years.
- **Robust**: steel cells will not readily break like plastic units.
- **Ease of repair**: mine sites are more likely to have equipment to repair steel and rubber than plastic.
- **Lightweight**: due to the strength of steel, the actual weight of stainless steel cells (due to wall thickness) is comparable with plastic cells and much lighter than concrete units.
- **Easy to relocate**: due to the manageable weight and robustness of the units, these cells can be relocated time and again. Concrete cells can seldom be relocated and re-used.
- **Fire resistant**: a common occurrence at Australian gold mines has been for plastic cells to burn and melt due to hot connections or interrupted solution flow. Stainless steel does not burn.

Advantages of Electrowinning Cells Continued

- Integral lid / fume extraction: Como Engineers cells come complete with a lockable hinged stainless steel lid which serves both as a fume hood and to prevent unauthorised access to the cathodes.
- The lids can be connected to a suitable fan and ducting (also available from Como Engineers) via flexible duct.
- Optional lid lifting systems available include: -

Compact Spring Assist (standard)

Pulley system

Counterweights

Bi-fold lid c/w gas struts (ESL)

ESF Series Cell – High Temperature, Non Drip Design, High Security, Front Mounted Busbars

- Front mounted busbars.
- Anodes and cathodes an supported on both front and rear supporting lips.
- An isolation switch is integrated into the lid such that when it is opened the rectifier is interlocked inactive.
- Optional addition of ESF series is that cathode and anode connectors can be copper, so anode/cathode connection to busbar connections optimised for electrical copper/copper connection.
- All other cells have a stainless/copper connection.
- ESF series is also available with a dual purpose anode/cathode puller which enables every second anode/cathode or all of a set to be removed at once from the cell.
- This allows the cathodes or anodes to be removed and taken to either a separate wash bay or storage bay in different configurations depending one the goldroom preferred means of operation.

ESF Series Cell – High Temperature, Non Drip Design, High Security, Front Mounted Busbars

Options for all ES Series Cells

- Split cell configuration:
  Essentially two cells within one body. Each cell is fed from the side of the body with a common launder for return eluate to the tank. Each cell compartment has it's own busbar lids/extraction. Saves up to 1.5m of space between adjacent cells

- Spring Mechanism:
  With all ES series lids other than the ESL, Como recommend lids be opening with either a winch or counterweight system to balance the lid load. Alternatively we can offer a compact lid spring mechanism which allows the lids to be opened by a single operator to any position using just their own strength.

- Choice of cell sludging design:
  Sludge can be removed from the cell in a number of options, such as centre V bottom draining, left or right draining or rear sludge draining.

Electrowinning Cell Options

- Cathode Winder
- Stainless Mesh
- Mild Steel Wool
- Sludge Recovery Systems
- Sludge Pressure Filters
- Cathode Wash Box
- Crating
- Cathode or Anode Puller

Other Designed Gold Equipment

- Switch Mode Rectifiers
- Carbon Transfer / Quench Vessels
- Carbon Conditioning Tanks
- Fine Carbon Transfer Water Tanks
- Plate and Frame Filters
- Sludge Settling Cones
- Cathode Wash Bays
- Gold Barring Furnaces
- Calcine Ovens
- Modular Switch Rooms
- Spares Sales

Other Designed Gold Equipment

Other Designed Gold Equipment

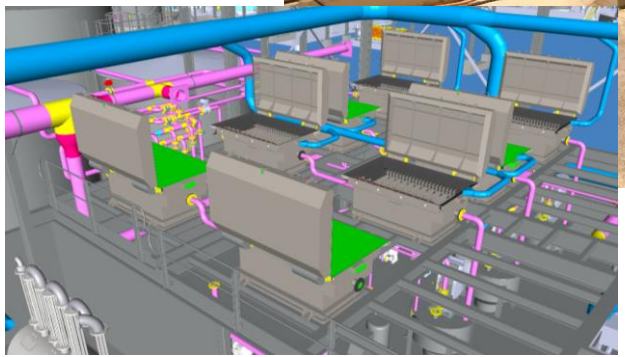
Other Designed Gold Equipment

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

INDONESIA

Tujuh Bukit, Indonesia

6 off ESF Series Electrowinning Cells & Rectifiers



TUJUH BUKIT GOLD ROOM EQUIPMENT

PROJECT:
Tujuh Bukit Gold Plant

LOCATION:
Indonesia

CLIENT:
PT Bumi Suksesindo

- **Supply of gold room equipment**
- **900x900x10 Cathode ESF Series electrowinning cells**
- **Cathode/anode lifter**
- **6 x 1500A 0-8VDC rectifiers in cabinets**

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

CHILE

El Toqui, Chile

Supply of Gold Room Equipment

EL TOQUI GOLD ROOM EQUIPMENT

PROJECT:
El Toqui

LOCATION:
Chile

CLIENT:
Sociedad Contractual Minera El Toqui

- Supply of gold room equipment
- 1000 x 1000 x 19 Cathode ES Series electrowinning cells
- Cathode winder, puller and wash bay
- Sludge setting tank
- Plate sludge filter
- Barring Furnace

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

DRC

Kibali Gold Mine, DRC

ESF Series Electrowinning Cell and 2000A 0-8VDC Rectifiers (13 off)

KIBALI GOLD MINE

PROJECT:
1000X1000X12 ESF SERIES ELECTROWINNING CELL AND 2000A 0-8VDC RECTIFIERS (13 OFF)

LOCATION:
Kibali Gold Mine, DRC

CLIENT:
Randgold

- **Supply of 1000x1000x12 ESF Series Electrowinning Cells**
- **Supply of 2000A 0-8VDC SCR Rectifiers (13 off)**
- **Torsion Spring Loaded Cell Lid Hinge Retrofit (13 off)**
- **Included Site Installation and Commissioning Supervision at Kibali Gold Mine, DRC**

COMO ENGINEERS
MECHANICAL & MINERAL PROCESS ENGINEERS

AUSTRALIA

Gruyere Project, Western Australia

6 x Electrowinning Cells & Rectifiers, 1500kg/h Kiln

GARDEN WELL ELECTROWINNING CELLS

PROJECT:
Garden Well

LOCATION:
Eastern Goldfields, Western Australia

CLIENT:
Regis Resources

- **Supply of 6 E style 600x600x12 ES series electrowinning cells**

Elution Plant Overview

The elution plants are available in either manual valved operation or full PLC operation and include:

- Acid Wash Column with injection manifold and acid dosing pump
- Thermally lagged Elution Column with integral carbon filters
- Direct eluate heating circuit (indirect available as option only to 120° C operation) in LPG, Natural Gas, Diesel or Electric
- Skid mounted thermally lagged reagent tank(s)
- Control system (Basic controls or PLC for automated plants)
- Electrowinning cells located in secured electrowinning room
- SCR or Switch Mode Rectifiers
- All Piping and Instrumentation

Available in sizes from: 1 tonne – 10 tonne carbon capacity

Regeneration Plant Overview

The regeneration plants are available in either manual valved operation or full PLC operation and include:

- Custom Furnaces horizontal regeneration kiln (LPG, NG, Diesel or Electric fired)
- Coded (ASME,BS or AS) pressurised carbon quench tank
- Elevated regeneration kiln support structure (floor mounted system available on request)
- Carbon feed hopper
- Barren carbon dewatering screen
- Dry or wet carbon sizing screen
- Local relay based control system with optional PLC module and touchscreen
- All Piping and Instrumentation

Available in sizes from: 50kg/h to 1500kg/h

Regeneration – Custom Furnaces

- Como Engineers is proud to have a long history as distributor for the class leading carbon regeneration kilns from Custom Furnaces.
- Available in LPG, Diesel, Natural Gas or Electrically fired



Goldroom Plant Overview

The goldrooms are containerised or optionally can be fabricated resulting in secured goldrooms providing all the required equipment for gold barring and include:

- Tailored pendant controlled gold barring furnaces (LPG, NG or Diesel) complete with extraction system
- Calcine Ovens with extraction system
- Gold Safe
- Work and scales benches
- Gold Barring equipment
- Tooling (needle guns, polishing/buffing equipment/drill presses etc.)
- Optional security monitoring system prefitted

Barring furnaces available in sizes from A100-A400

Optional Equipment Overview

The Fine Carbon System, Carbon Transfer System and Sludge Processing System provide enhancements to the operation of your Como elution/regeneration plant.

Fresh Carbon Conditioning

Comprises an agitated conical bottom vessel with transfer eductor, fresh carbon feed chute and electric monorail for supply of the carbon to your elution system. Gentle agitation reduces the carbon fines introduced into your CIL/CIP system

Transfer Water Recovery System

Como's pressurised hydraulic transfer for carbon movement reduces attrition by other recessed impeller pump methods. The transfer water recovery system incorporates a large transfer water vessel (settling design) with a transfer water pump system providing the motive water for carbon transfer around the plant.

Optional Equipment Overview cont

Fine Carbon Handling System

Used in conjunction with the Transfer Water System, this design bleeds a constant stream of recovered transfer water through a plate and frame recovering a high proportion of the gold bearing fine carbon (up to 50g/t loss) developed through the CIL plant.

In the Agnico Eagle 2 tonne elution installation, recovery of up to 80kg/day of fine carbon was recovered in this installation alone.

Gold Sludge Processing

Incorporating sludge recovery equipment to assist in the processing of gold sludges developed when stainless steel mesh cathode wire is used in the electrowinning cells rather than the traditional mild steel wool where gold is plated to the wool.

Who to Contact?

Barry Cloutt
Managing Director
Como Engineers
barry.cloutt@comoeng.com.au
+61 8 9432 0100

Martin Smith
Manager - Engineering
Como Engineers
martin.smith@comoeng.com.au
+61 8 9432 0100

Our People Making It Happen