

Marcelo Jo & Claudio Loyola

CONSULTORES DE PROCESOS

Jo y Loyola Process Consultants

Prepared for: Alan Clegg
Metaleach

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Jo y Loyola Process Consultants Spa. Partnership Presentation

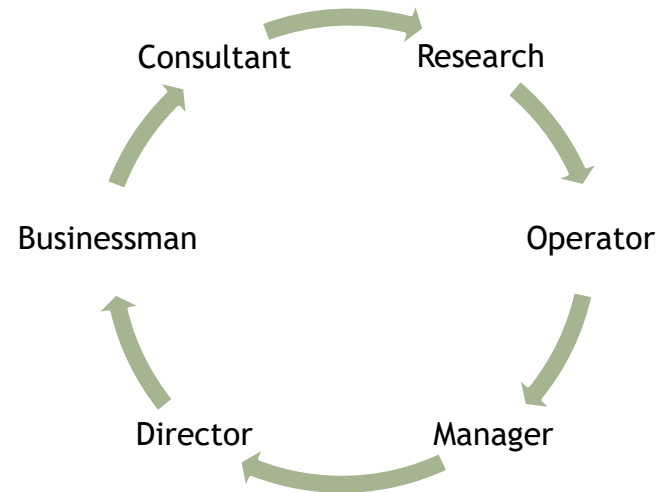
Marcelo Jo

1984 1986 CIMM
 1986 1996 Sociedad Minera Pudahuel
 1996 2002 Cerro Colorado
 2002 2008 Lomas Bayas
 2009 2013 Xstrata Copper
 JV Collahuasi and Antamina
 2013 Jo & Loyola P. Consultants

Claudio Loyola

2000 2008 Lomas Bayas
 2008 2009 Xstrata Copper Norte de Chile
 2009 2103 Xstrata Copper Joint Ventures
 2013 2014 Teck
 2014 Jo & Loyola P. Consultants

Clients



Jo & Loyola Process Consultants Staff

Vitacura 2909 Piso 3 Oficina 305 - Las Condes - Santiago Chile

Jo & Loyola Process Consultants



Marcelo Jo



Claudio Loyola



Daniel Eyzaguirre



Luis Bondis



Rodrigo Yunge



Emmanuel Herrera



Belén Pincheira



Sebastián Bustamante



Gustavo Cabello



Denise Jorquera



Sandra Loyola

Associated Members



Javier Jofré



Sergio Godoy



Rubén Inostroza

Examples of Modelling and Analysis Works Exceeding our Client's Expectations

More than 15,000 MH of sold consulting and modelling. Clients include: Spence, Minera Escondida, Minera Cerro Colorado, Collahuasi, AMSA, Centinela, ALXAR, CODELCO, Marimaca, Anglo American

1. Modelling of SX EW leaching process with secondary sulphates in chlorine environment. Works developed for BHP Billiton: Spence, Escondida and Cerro Colorado.
2. Dynamic modelling for the start-up of the Spence sulphates chemical leaching project
3. Crusher plant modelling for the expansion of the process plant and operational analysis for the change in screen mesh configuration. Collahuasi and MEL.
4. Modelling for secondary sulphates bacteria leaching. phenomenological model with the effect of the relevant variables: temperature, pH, nutrients, impurities. Collahuasi
5. Modelling for the medium- and long-term production planning. Pampa Norte: Spence and Cerro Colorado.
6. Modelling for solvent extraction, multiple configurations, selection of reagents. Several companies.
7. Modelling for the transference of impurities to EW, chlorine effect. Several operations.
8. Water balances and analysis of opportunities in the leaching area.
9. Integrated modelling from the Crusher process to Flotation.
10. External peer review of leaching projects CODELCO

Services Rendered by Jo & Loyola Process Consultants

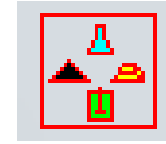
1. Process plant consulting
 - ▶ Identification of improvement opportunities and process deviations
 - ▶ Support in process optimization plans
 - ▶ Metallurgical balance including inventories
 - ▶ Water, reagents and impurities balances
 - ▶ Trade Off studies and business cases
 - ▶ Production and reagent consumption forecasts
 - ▶ Process models per area integrating key process parameters

2. Metallurgical testing
 - ▶ Laboratory scale studies, pilot plant
 - ▶ Industrial plant tests
 - ▶ Metallurgical balances and interpretation of the results
 - ▶ Process chemistry and determination of key parameters

3. Consulting in Sustainability and/or Brownfield Projects
 - ▶ Trade-Off studies and identification of process alternatives
 - ▶ Conceptual engineering
 - ▶ Flowsheet and material balances
 - ▶ Start-up analysis
 - ▶ Production Plans
 - ▶ Process simulations in stationary and dynamic states

4. METSIM – PROWARE Representation
 - ▶ Representative for PROWARE for the sale of METSIM licenses
 - ▶ Professional training on process modelling
 - ▶ Technical support for the development of process models
 - ▶ Construction of process models in conjunction with the client's technical staff

Process Modelling METSIM Software



Main features of the METSIM software

- More than 25 years in the market. 12 new versions per year.
- Integration of the different unit operations. Management of all phases of materials, components and elements, chemical process, energy balance and control logics. Stationary and dynamic state modelling.
- Modules for processes, mining, maintenance, costs, engineering and automated control.
- Matrix architecture with detailed sub-routines for unit operations, mass and efficient management of data. APL Language and is programmable.
- Subroutines of confirmation of balance coherence, presentation of results, data export/import.
- Auditable models that allow successive development at different stages. Promote team work.

Advantages of working with Jo y Loyola in process modelling

- 15 years of experience in process modelling with METSIM
- In-depth knowledge on process control and planning.
- Modelling of hundreds of plants and processes.
- Integrates the knowledge available and retains it in the organization.
- Integrates mining plan details in the process models
- Experience in training on the use of the software
- Capacity to program “what can be described in a logical manner”

PROWARE METSIM Representatives

- Direct assistance with the owner and creator of METSIM Sr. John Bartlett.
- Authorized by PROWARE for the sale of software licenses

Value Proposal

Jo & Loyola Process Consultants

- ▶ Key technical support for your project.
- ▶ Team member's experience through all business cycles: research, development, operations, planning, management and board of directors.
- ▶ Renowned experience in R&D.
- ▶ In depth knowledge of the industry.
- ▶ Broad network of technical contacts throughout the industry and universities.
- ▶ Expertize in industrial process simulations through the METSIM software. Capacity to program "whatever can be described logically".
- ▶ Works in conjunction with the client's technical staff.

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