Mike Rockandel
Principal Advisor Process

Qualifications: BSc Metallurgical Engineering (1974);
University of British Columbia

Languages: English

Career Background:

More than 40 years of process experience including, development, engineering design,design supervision, equipment specification and selection, Hazop analysis, commissioning and startup planning and supervision and operations supervision and technical team management.. Skilled in process modelling with tools such as Metsim, SysCad, HSC. The work has been broad based covering projects in the metallurgical, industrial minerals, chemical, and environmental industries. Currently hold ninepatents, six patents relating to soda ash processing, one relating to heavy metal recovery from waste and one related to mercury recovery from chlor-alkali waste and one of MAP inventors.

Career History:

January 1- Present
Mike Rockandel Consulting LLC

President

Technical advisor to Freeport McMoran for their Grasberg Indonesian Smelter Precious metals refinery and electro-refinery.

Providing process design to Rio Tinto Copper and Coal for their proposed primary copper sulphide heap leach demonstration project.

Preparing a smelter complex mass balance simulation (smelting, refining, anode casting, acid plant and precious metals recovery) for Rio Tinto Indonesia to assist with project evaluation.

Providing technical support to Rio Tinto Iron and Titanium for their Scandium recovery project.

Providing process design and order of magnitude economics to Ciner, Wyoming (formerly OCI) for a proposed non-calcining plant expansion.

November 2008 – December 2015
Rio Tinto, Technical and Innovation Group

Chief Advisor Process

Supervised and mentored two junior engineers and managed two senior engineers.

Participating in project planning and engineering reviews for copper smelter studies for Oyu Tolgoi and the Freeport (JV)

External Reviewer La Granja primary copper sulphide heap leach project.

Oyu Tolgoi integrated value chain evaluation member responsible for the flotation circuit.

Project lead on Kennecott Utah Copper (KUC) copper recovery from acid mine drainage. Various options were examined before settling on cementation using vibrating ball mills with consumable steel media.

Engineering manager for Phase 2 – Oyu Tolgoi (65,000 t/d) copper/gold concentrator in Mongolia. Duties included; project engineering, document review, development of; annual water balance, mass balance, design criteria, operating cost LOM development and final report write-up.

T&I representative for the detailed design of KUC Molybdenum Autoclave Project. Lead the development of modification of: Rhenium Continuous IX design, Molybdenum Oxide two-stage calcination, selenium removal and various other optimization studies. Coordinating the transition of the molybdenum flotation plant (52% Mo) to producing MAP grade concentrate (24% Mo). Numerous economic and trade-off studies. Developed and maintained the process mass and energy balance.

Project Lead for KUC smelter Continuous Ion Exchange (CIX) Rhenium recovery project. This culminated in a commercial installation.

Lead the study for KUC on slag concentrate leaching.

Participated in several projects in the KUC precious metal and hydromet plants, including the cessation of dust leaching, tellurium recovery, Au SX, etc,

T&I representative on KUC refinery cathode quality study.

T&I representative on the elevated temperature bio-heap leach SX/EW project (chalcopyrite/pyrite). Duties included technical reviews and consultation to the plant personnel.

Lead the development of an integrated mass/energy balance (Metsim) for KUC smelter, refinery, PMR, slag mill and Hydromet plant. This model has become the RTKUC tool to determine suitability of custom concentrates and to determine impurity fate. The model is being modified to simulate Oyu Tolgoi and Freeport (Indonesia) smelter studies.

Lead Iron Ore of Canada tailings flume modifications and re-optimization of the AG mill and spiral circuits. Supervised the development of an integrated concentrator/pellet plant mass balance.

Supported the US Borax design efforts to reduce sulfate in Owens Lake trona.

Evaluated the US Borax 5-Mole sodium borate production capacity. This included process modelling and evaluation of equipment capability and operating practices.

T&I representative to the Rio Tinto Minerals Jadar project – Lithium and Boron recovery in Serbia.

January 2008 – November 2008
Baja Mining

Manager of Process Engineer

Owner's Representative for process engineering related to the development of Baja Mining's proposed polymetallic plant that is being designed to produce 60,000 mtpa Cu, along with cobalt, zinc sulfate and managnese carbonate by processing 10,000 tpd of clay based oxide ore. Duties included; over-seeing AMEC's design effort, updating the mass/energy balance and design criteria, flow sheet optimization,

testwork development and supervision. The project which proceeded and is in start-up, is complex including; copper SX/EW, zinc SX and zinc sulfate crystallization, cobalt SX/IX/EW, double contact acid plant, thermal d-salination, oxidative and SO_2 reductive leaching and a 6 stage CCD.

2005 – December 2007
Aker Kvaerner

Senior Principal Process Engineer

Lead Process Engineer on Kennecott MAP molybdenum autoclave leach project

Assistant Process Engineer on Freeport McMoran Morenci copper pressure leach project.
Duties included preparation of specifications, vendor bid analysis, process simulation and equipment design

For Lihir, Papua New Guinea gold plant expansion feasibility study, included SAG mill and modifications to PAL and gold circuit

Developed material and energy balances for the Phelps Dodge high and medium temperature pressure leach processes.

Lead process engineer for the Gencor South Africa zinc pressure leach study.
Performed process simulation and debottlenecking calculations for the Lihir gold pressure oxidation plant.

2004– 2005
Rio Tinto Diavik Diamond Mine

Process Manager of Expansion Project

Coordinated data collection to identify process bottlenecks, managed the construction of a slewing conveyor as part of the process optimization and participated in several studies in the wash plant.

1996– 2004
Aker Kvaerner

Principal Process Engineer

Lead process engineer on numerous soda ash projects. My responsibilities included; management of the process team, design and test supervision, development of the Metsim based material and energy balances, PFD's, PID's, design criteria, specifications, bid analysis, start-up planning and commissioning/start-up supervision, etc. The soda ash projects that I lead included;

Rio Tinto – Kazan study

Park / ETI Bank - Beypazari study (1 mtpa). Worked with and educated the China engineering consortium that won the commercial contract for the solution mine.

Lake Magadi Pure Soda Ash study (350 ktpa). A novel flash calcination process and non-evaporative crystallization were developed and implemented commercially. Tata took this project through commercialization.

American Soda Ash (1 mtpa) – Nahcolite project (included start up supervision).

OCI Unit 6 expansion (1 mtpa) (included start up supervision)

IMC two-stage crystallizer expansion study at the Trona facility in which Burkeite and Borate would be recovered.

General Chemicals calcination optimization study.

Owens Lake study (1 mtpa) (this work continues to-date through US Borax but is now related to reduction of sulfate in the trona)

Texasgulf Solution mine study (1 mtpa)

Wold solution mine study

Botash – Botswana optimization study (focus was bicarbonate filters, calciners and plant ventilation)

Other projects;

Lead process engineer for Las Brisas, Venezuela, Copper/Gold definitive estimate.

Developed the mass and energy balances for the gas handling system upgrade at Inco's nickel smelter in Sudbury, Ontario.

Updated mass and energy balances for the Thai Copper Smelter.

1991– 1996
Universal Dynamics

Process Manager

Supervised Alcan Aluminum, Kitimat BC, Two Dry Scrubber replacement and upgrade projects for potlines 1-3 and then 7 and 8. This included the installation of alumina injection, reaction ducting, dust recovery and pneumatic conveying systems for product alumina

Developed and co-invented a hydrometallurgical process for the removal and recovery of mercury from chlor-alkali plant water treatment residues. Three commercial plants were constructed in the USA.

Supervised and provided process design for a fluid bed sodium chlorate drying, pneumatic conveying and truck/rail bulk load-out system at BC Chemical, Prince George, BC.

1988-90

Graeton Technology Ltd., Hong Kong

Plant Manger

Supervised a plant with 60 employees. The PVC additive plant produced tri-basic lead sulphate by an autoclave leach and stearate based one-pack additives by batch fusion and continuous flaking

1978-1987
Cominco / Teck

Metallurgist/Research/Development Engineer

Process engineer and start-up coordinator for Cominco's fume leach plant . This plant de-halogenated Lead slag fuming dust using a sodium carbonate leach allowing the residues to be leached in the roaster circuit.

For Cominco's zinc pressure leach plant (first commercial medium pressure sulphide concentrate leach project), I was the plant and start-up superintendent, coordinated the start-up plan, was involved in operating manual preparation, operator training and late stage project design.

The lead process engineer for the PFS of Cominco's proposed residue leaching plant based upon Akita Hematite technology.

Responsible for troubleshooting operating plants including bi-polar lead refining and lead refinery arsenic fluoride scrubbing.

Helped develop the Modbal program which was used to simulate Cominco's modernization plan. Responsible for the simulation of several plant areas including; the acid plants, fertilizer operations and Kivcet smelter.

Developed a dynamic simulation of an ammonium sulfate scrubber for the zinc plant. The system was installed and performed as predicted. Ammonium sulfate scrubbing in complicated because of the need to avoid smoke and fog formation.

Lead process engineer on the de-bottlenecking and modification of the former Cominco Con Gold Mine arsenic trioxide plant. Sale of the property which occurred was contingent on successful demonstration of the plant capacity..

1974-1978
Texasgulf

Research Metallurgist and Maintenance Engineer

Troubleshooting acid plant corrosion problems and leach plant pumping problems.

As a development engineer performed various assignments, tests and optimization studies in the Texasgulf copper/lead/zinc concentrator and gravity recovery tin circuit.

Was a team member on the unsuccessful development of a low temperature pressure leach process designed to treat low grade lead concentrate with substantial quantities of copper zinc and silver.

EMPLOYMENT HISTORY

2008 - Present	*Rio Tinto, Salt Lake City, UT*
2008	*Baja Mining, Vancouver, BC*
2005-2008	*Aker Kvaerner, Tucson, AZ*
2004-05	*Diavik Diamond Mines, NWT*
1996-04	*Kvaerner, San Ramon, CA*
1991-96	*Universal Dynamics, Vancouver, BC*
1990-91	*Residuals Management Inc., Denver, CO*
1988-90	*Graeton Technology Ltd., Hong Kong*
1987-88	*Mining Transactions, Walnut Creek, CA*
1978-87	*Cominco Metals Ltd., Trail, BC*
1974-77	*Texasgulf, Timmins, ON*