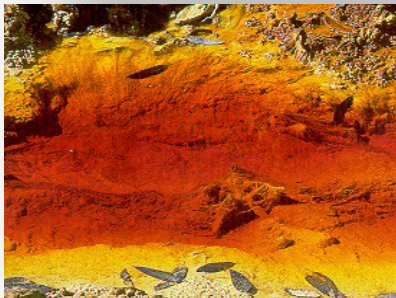


Commercial Water Treatment Experience in Metal and Sulphate Removal from Acidic Drainage

R.W. Lawrence
BioteQ Environmental Technologies Inc.



Presentation outline

- Selection of treatment technology for acid drainage
- BioteQ's technology for metal removal and recovery
- Commercial examples of technology
- Removal of sulphate from wastewater
- Integration of technologies
- Challenges in applying technologies for metal and sulphate removal



Selection of Treatment Technology - available methods

- Lime treatment
 - LDS
 - HDS
- Sulphide precipitation
- Membrane technologies
- Biological sulphate reduction
- Ion-exchange
- Passive methods



Selection of Treatment Technology - factors affecting selection

- Water chemistry
- Flow
- Treatment objectives
- Location
- Technical feasibility
- Costs
- Opportunities to offset costs through metal recovery
- Company know-how, culture and politics



Selection of Treatment Technology - Variations in Acid Mine Drainage

pH	Fe	Cu	Ni	Co	Zn	Ca	Mg	Al	SO ₄
4.0	0.3	0.2	<0.1	<0.1	10	200	25	30	1,120

Flow 27,250 m³/day

Recoverable metal value = \$260K/year

pH	Fe	Cu	Ni	Co	Zn	Ca	Mg	Al	SO ₄
5-7	<2	<0.2	3-50	<0.1	<0.1	10	40	<1	200

Flow 5,760 m³/day

Recoverable metal value = \$1.67M/year

pH	Fe	Cu	Ni	Co	Zn	Ca	Mg	Al	SO ₄
2-3	50	300	5	40	5	250	80	50	5,000

Flow 6,000 m³/day

Recoverable metal value = \$8.2M/year

pH	Fe	Cu	Ni	Co	Zn	Ca	Mg	Al	SO ₄
2	2,500	20	1	<1	15	400	100	200	10,000

Flow 7,500m³/day

Recoverable metal value = \$360K/year



BioteQ Technologies - who is BioteQ?

- BioteQ is an environmental operating company (BQE-TSX)
- We finance, build, own and operate water treatment plants that recover saleable metals and produce clean water for environmental compliance
- Commercially proven technologies
- We are working with some of the world's largest mining companies



BioteQ's Technologies

Metal removal and recovery
using sulphide precipitation

Biogenic Sulphide
(BioSulphide®)

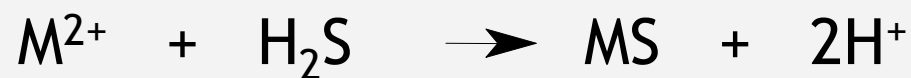
Chemical Sulphide
(ChemSulphide™)

Water treatment for the
removal of sulphate

Sulf-IX™ Process



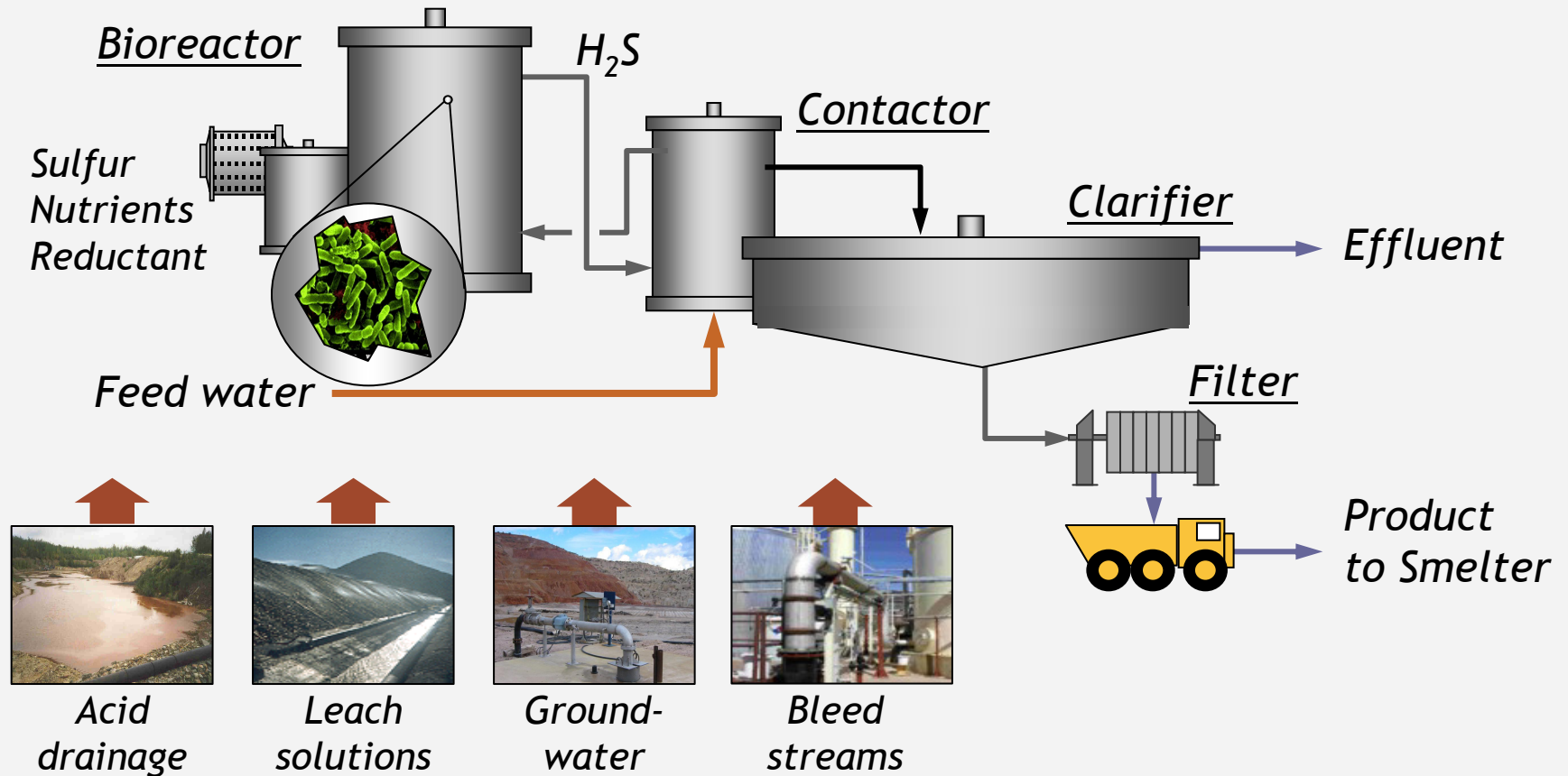
Metal Sulphide Precipitation



- Rapid and efficient reaction
- Metals can be recovered selectively into high-grade products
- Very good effluent quality
- Good solid-liquid separation
- Reduction or elimination of sludge
- Water treatment can be profitable



BioSulphide® Process Flowsheet





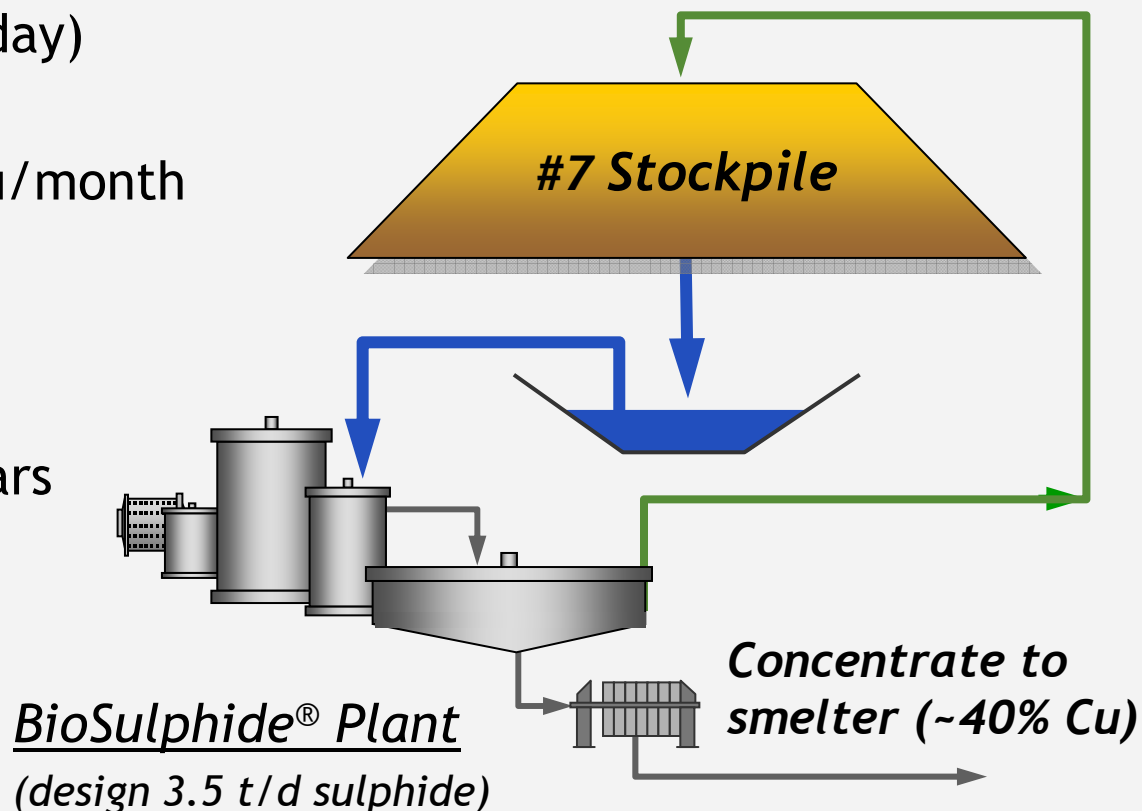
Bisbee Project, Arizona (50/50 JV with Phelps Dodge)





Bisbee Flowsheet

- 2000 gpm (10,900 m³/day)
- 220 - 400 mg/L Cu
- Currently 150,000 lb Cu/month
- >99.8% Cu recovery
- >98% plant availability
- Capex US\$3.2 million
- Capital repaid in <3 years

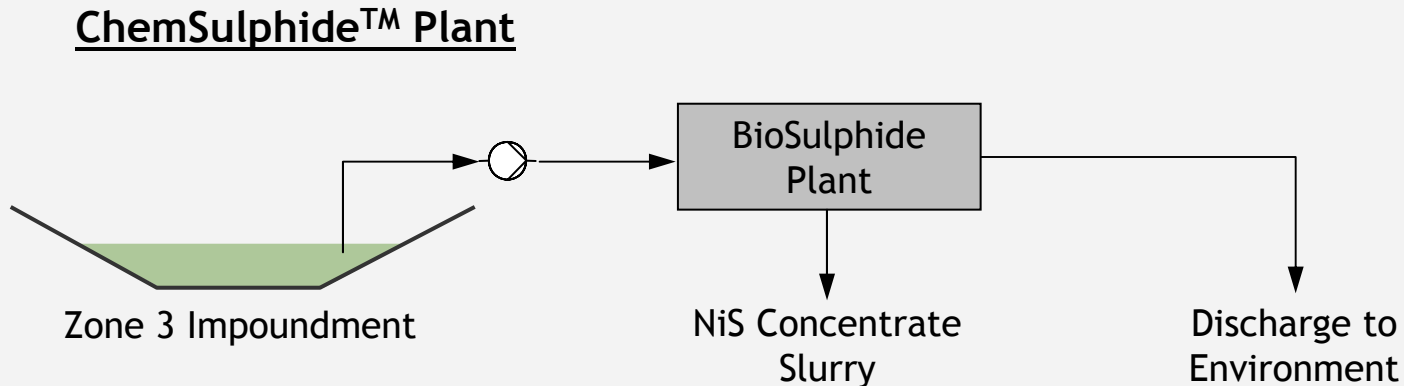
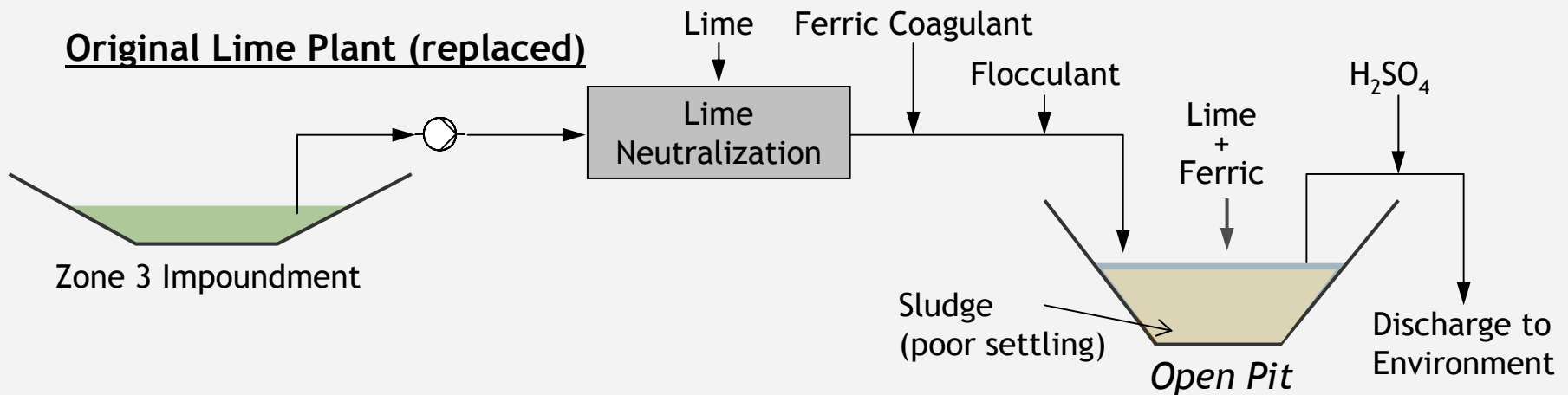


Bisbee BioSulphide® Plant



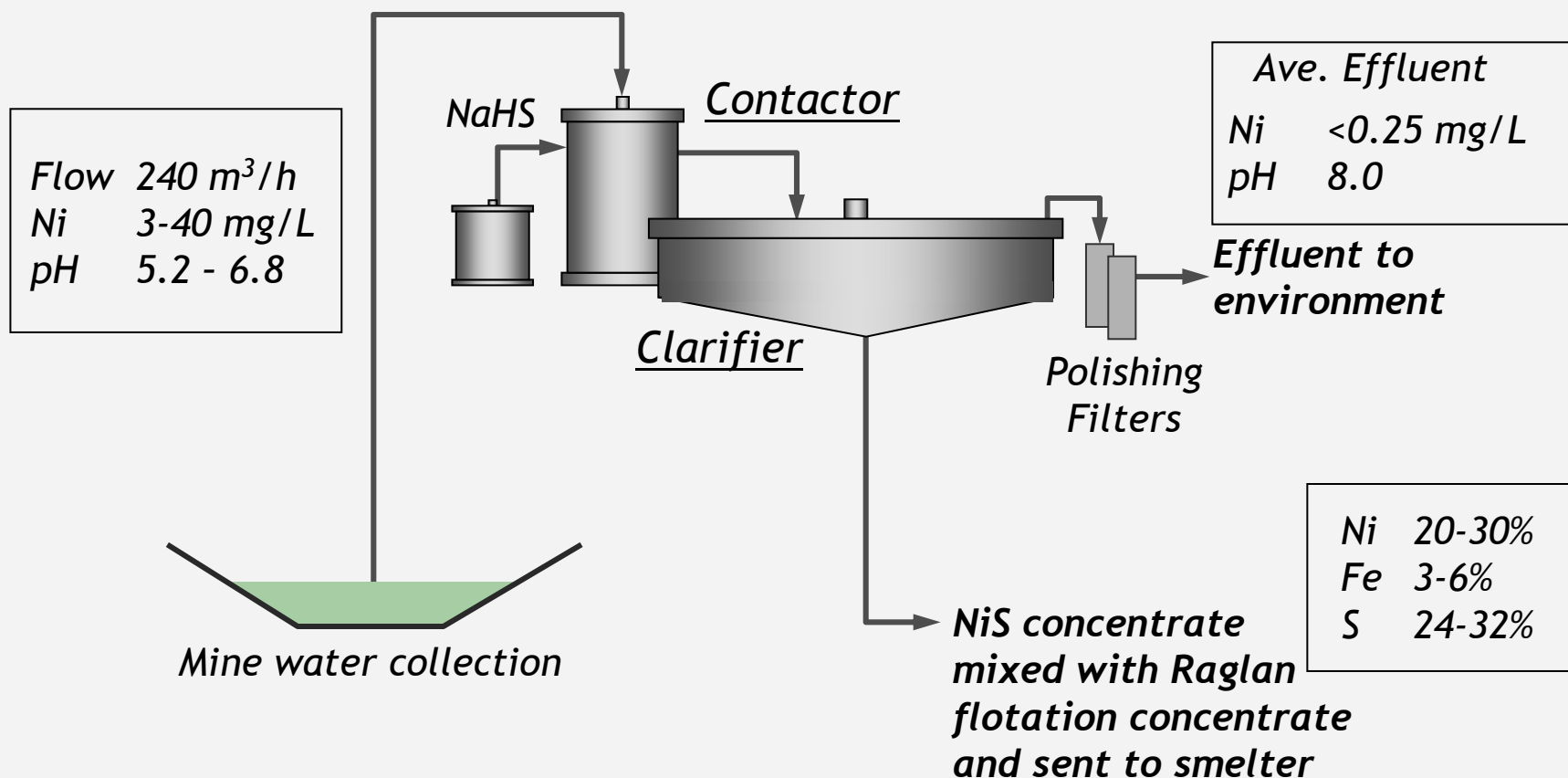


Water Treatment at the Raglan Mine





ChemSulphide™ Process at the Raglan Mine (Xstrata)





ChemSulphide™ Process at the Raglan Mine

- Built, owned and operated by BioteQ
- Operating since 2004
- Nickel sulphide product recovered with high efficiency from very low grade, cold minewater
- Replaced an existing lime plant
- 920,000 m³ water treated in 2007 (April to November)
- Direct discharge of effluent to sensitive Arctic environment
- Reduction in water treatment costs for Xstrata

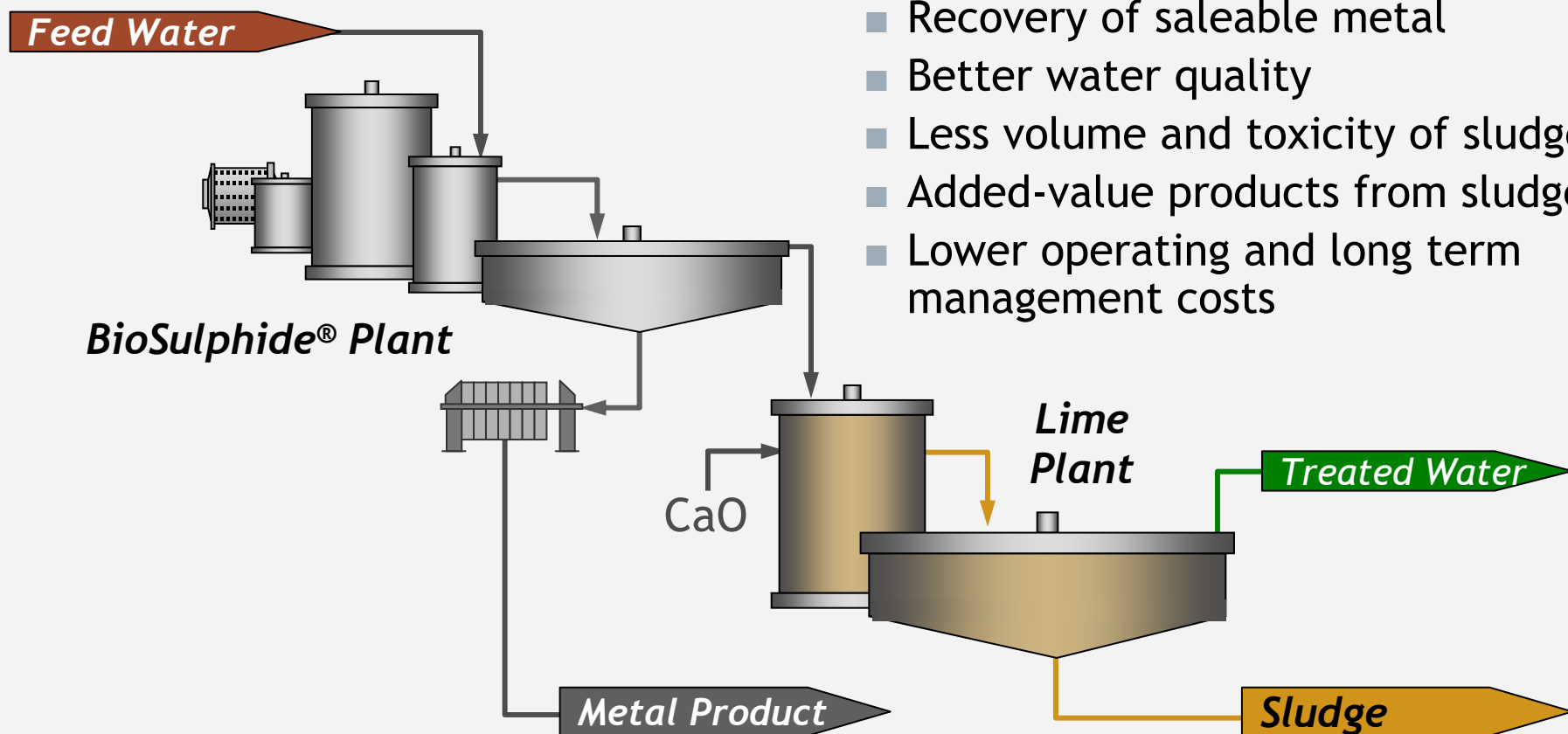




Integration of ChemSulphide or BioSulphide with a Lime Plant

Potential Advantages

- Recovery of saleable metal
- Better water quality
- Less volume and toxicity of sludge
- Added-value products from sludge
- Lower operating and long term management costs





Reduction of Sulphate

- The removal of sulphate from water is being regulated in an increasing number of jurisdictions around the world to meet standards for irrigation, domestic and animal water supply and environmental discharge
- BioteQ is in the advanced development of an ion-exchange technology to reduce sulphate:
 - technically very efficient
 - very cost effective method
 - particularly suitable for mining applications, e.g. for lime plant effluents

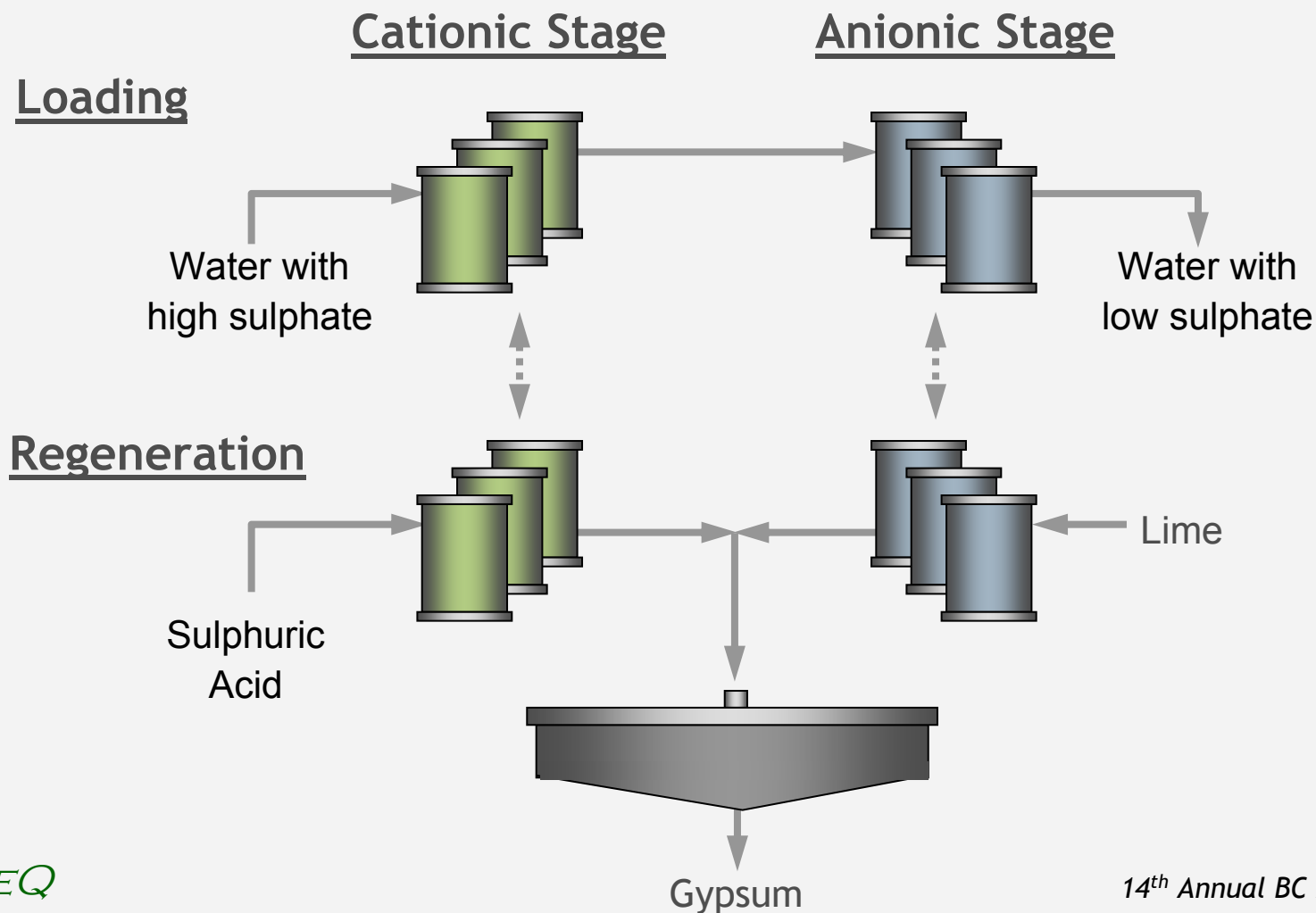


Process requirements for successful sulphate reduction

- Handle high flows
- Must be able to manage gypsum saturation
- Must handle solids in feed or produced by process
- Low cost of disposing secondary products
- Low capital and operating costs
- Simple and robust chemistry and physics
 - To minimize process upsets
 - To reduce monitoring and labour costs



Sulf-IX™ Process Schematic





Sulf-IX™: Key Features

- Simple chemistry and physics
- Capacity to treat high volumes of water
- Efficient management of solids and scaling
- Products are only clean water and clean gypsum
- Low operating costs - lime and sulphuric acid are used to regenerate resins; power costs are low
- Low capital costs
- Suitable for only partial sulphate removal - to that required to meet a specific regulation

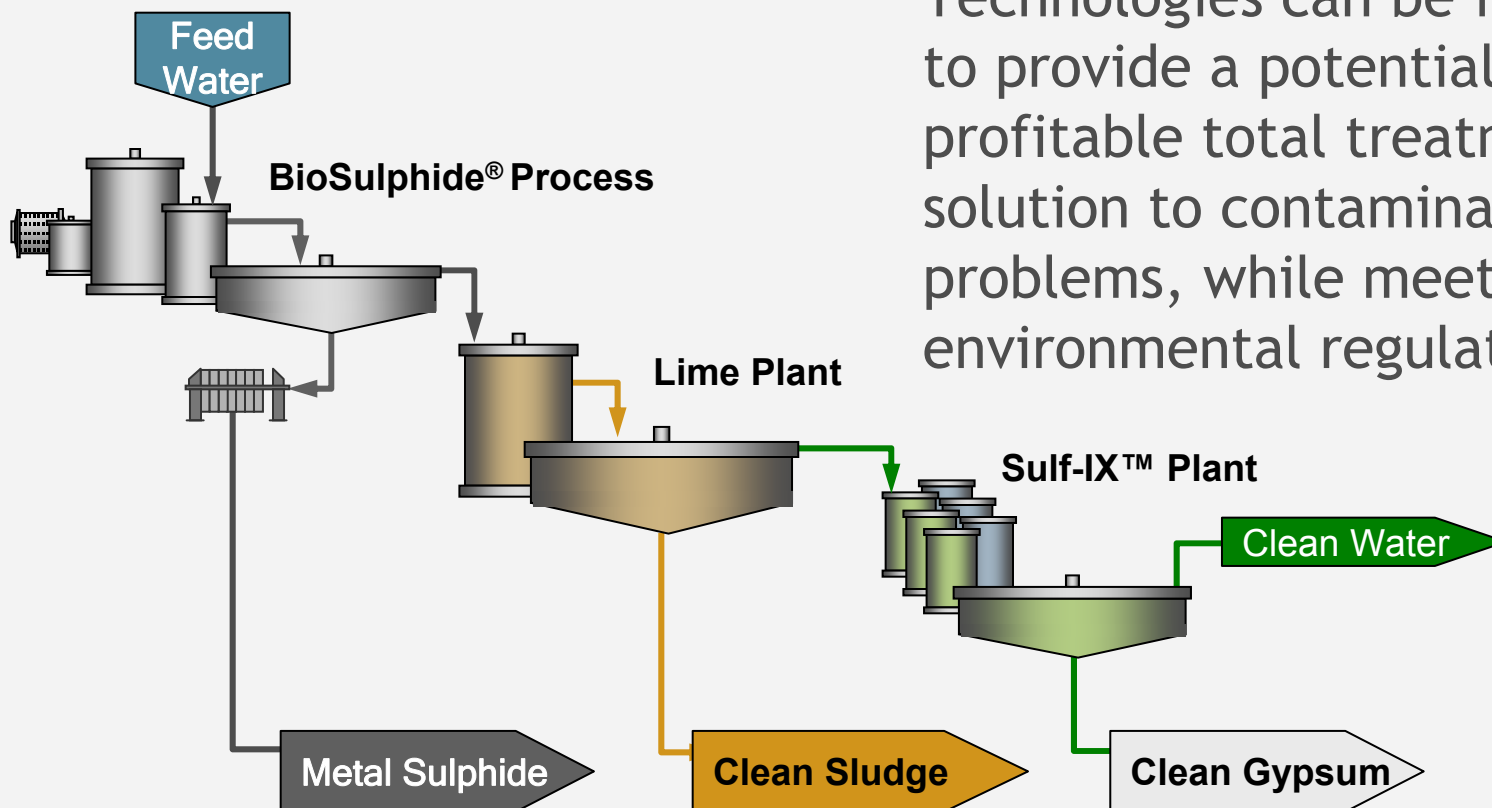


Status of Sulf-IX™ Development

- 2 pilot plants (0.2 m³/h) currently in operation in Vancouver and Santiago, Chile
- A demo plant is in construction (35 m³/h) for process demonstration at a mine site in the United States
- Development agreement with Molymet, Chile, for the commercial application of the technology to replace an existing reverse osmosis plant
- Other projects in various stages of development

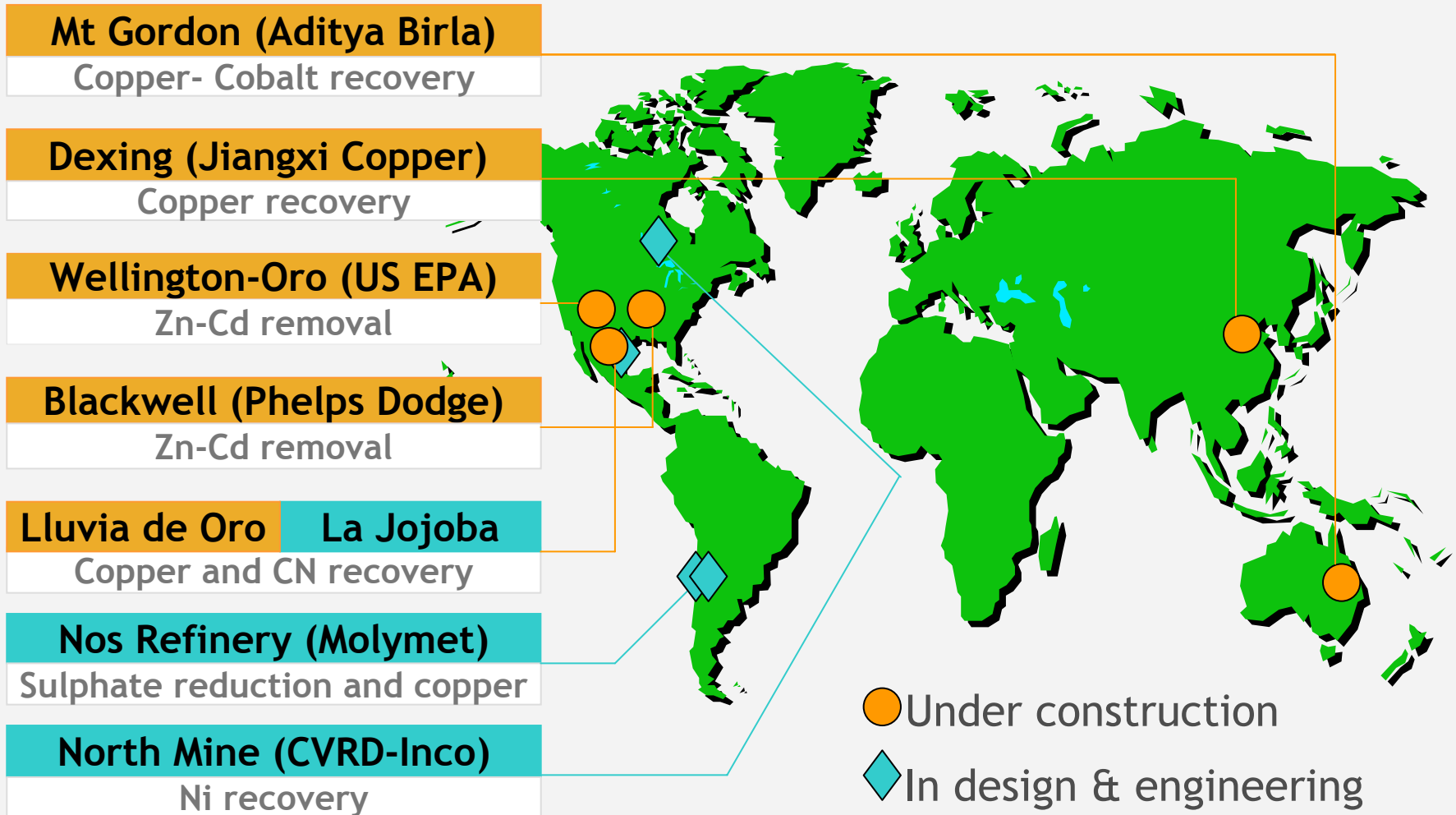


Total Water Treatment



Technologies can be integrated to provide a potentially profitable total treatment solution to contaminated water problems, while meeting environmental regulations.

Development Projects 2007 and 2008





Major challenges in applying new technology

- Not the technology! (now commercially proven)
- Overcoming barriers to technology adoption based on perceived risks rather than measurable risks (construction costs, operability, plant availability, operating costs, meeting process specifications)
 - Risks are reducing as operating experience is gained and risks become more measurable
- Location (remote, language, labour, costs, weather)
- Finding champions within a target company
- Acceptance of the business model



Conclusions

- Each treatment technology has its niche market
- BioteQ has developed and commercialized sulphide-based ChemSulphide™ and BioSulphide® technologies for metal recovery and environmental compliance
- Sulphide-based technologies can offer good water quality with revenues from sale of metal sulphide products to offset costs or have profitable operation
- The Sulf-IX™ technology is potentially the lowest cost and widely applicable method to remove sulphate from water



BIOTEQ
Environmental Technologies Inc