

# **Compendium of Commercial Plants Designed and Built by H2GM Personnel and Associates**

- 1. CCR Gold and PGM Refinery, Montreal**
- 2. Chambishi COSAC & ISEP Plants, Zambia**
- 3. Magnola Magnesium Plant, Danville, Quebec**
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- 7. Kennecott Dust Leach Plant, Salt Lake City**
- 8. Porters Grove Copper Powder, New Jersey, USA**

Glencore (Noranda)

CCR Gold Plant

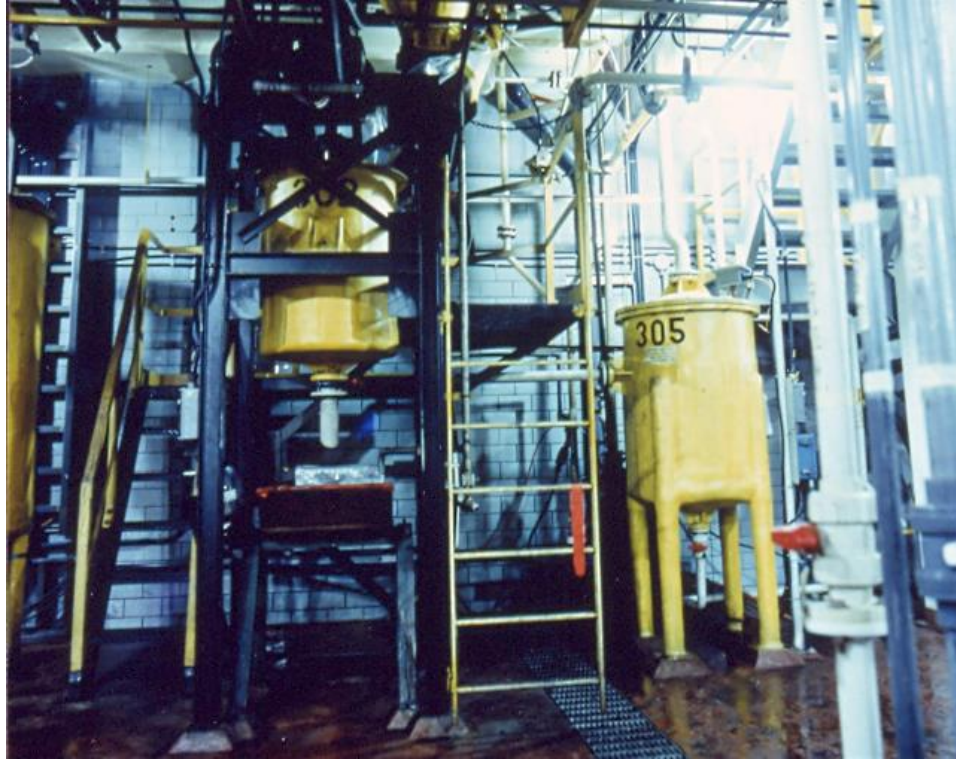
Montreal, Canada

# **GLENCORE CCR**

## **GOLD AND PRECIOUS METALS PLANT**

In the early 1980s, precious metal (Pd, Pt and Rh) inputs to the traditional (originally developed in the 1870s), classical CCR gold refining process Refinery were increasing so as to make its operation impractical. New processes, entirely hydrometallurgical, were developed for refining gold to  $\geq 99.99\%$  purity, and for recovering silver and the precious metals.

The new refinery was engineered and built entirely in-house, and commissioned in 1985. The capital cost was recovered within five weeks of operation. Unlike other traditional gold refineries, such as the Rand in South Africa and the Royal Canadian Mint in Ottawa, CCR can accept any type of gold and/or silver-bearing feedstock. It is equally adept at processing base metal anode slimes as it is gold mine bullion and jewellery scrap. It is by far the most efficient and versatile refinery in the world, continues to operate today, and is capable of processing  $>1$  million ounces of gold annually.





Magnola Metallurgy

Magnesium Metal Plant

Danville, Quebec

Canada

# MAGNOLA METALLURGY

## MAGNESIUM METAL PLANT

Prior to the advent of electric vehicles, magnesium and its alloys were seen as the future way of improving fuel efficiency and reducing carbon emissions in the automotive industry due to its light weight. In the Eastern Townships of Quebec, there are literally mountains of asbestos tailings from the now-defunct and vilified asbestos industry. These tailings contain >20%Mg, and a process was developed to recover magnesium metal from them. Noranda (now Glencore) through its subsidiary Magnola (**M**agnesium, **N**oranda, **L**avalin, the engineer and equity partner) subsequently engineered and built a 65,000 tpa plant at Danville in the Eastern Townships.

The plant operated very successfully for three years. However, it had a disadvantage in that it had only one product, namely magnesium metal. In this day and age, being so does not allow for fluctuations in the market, and Magnola, along with the Dow and Norsk Hydro N. American found themselves under severe price pressure from a much cheaper, and although significantly inferior, especially from an environmental perspective, more voluminous

Pidgeon Process magnesium from China. This resulted in the these plants eventually incurring losses that did not make economic sense, forcing them to shut down. The plant was subsequently bought and shipped to China by a state owned magnesium company to be reconstituted.





Anglo Vaal Mining

COSAC & ISEP Plants

Chambishi, Zambia

# **ANGLO VAAL MINING**

## **COSAC AND ISEP PLANTS, CHAMBISHI**

The Chambishi Cobalt in Zambia was originally built in the mid-1970s. The plant was acquired by Anglo Vaal Mining in the 1990s, at which time its capacity was expanded through treatment of existing slag dumps which were rich in cobalt (COSAC). Ironically, considering its importance today, cobalt was considered an unwanted and nuisance impurity when copper mining first started in Zambia in the early twentieth century. This was a novel process which had originally been conceived and piloted, but not implemented, for the nearby Nkana Cobalt Plant in the 1970s. Simultaneously, the cobalt electrowinning tankhouse was expanded, and a novel nickel ion exchange removal process (ISEP) introduced, which had originally been developed at Noranda (now Glencore) in the early 1980s.

Chambishi Metals was acquired by Eurasian Resources in 2010, and remains one of the world's largest cobalt plants, with a nominal capacity of 6800 tpa.















Royal Canadian Mint

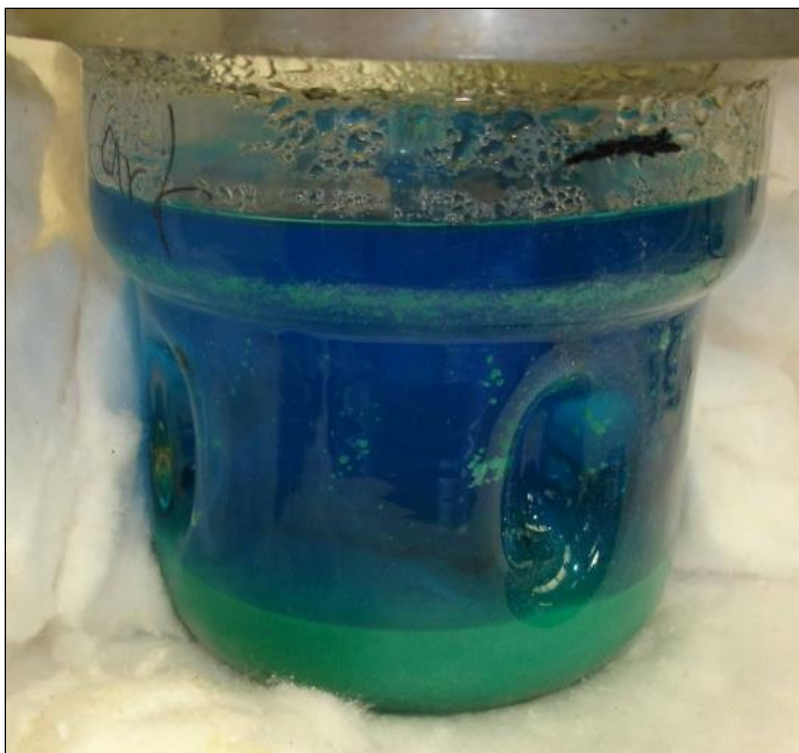
Copper Removal Plant

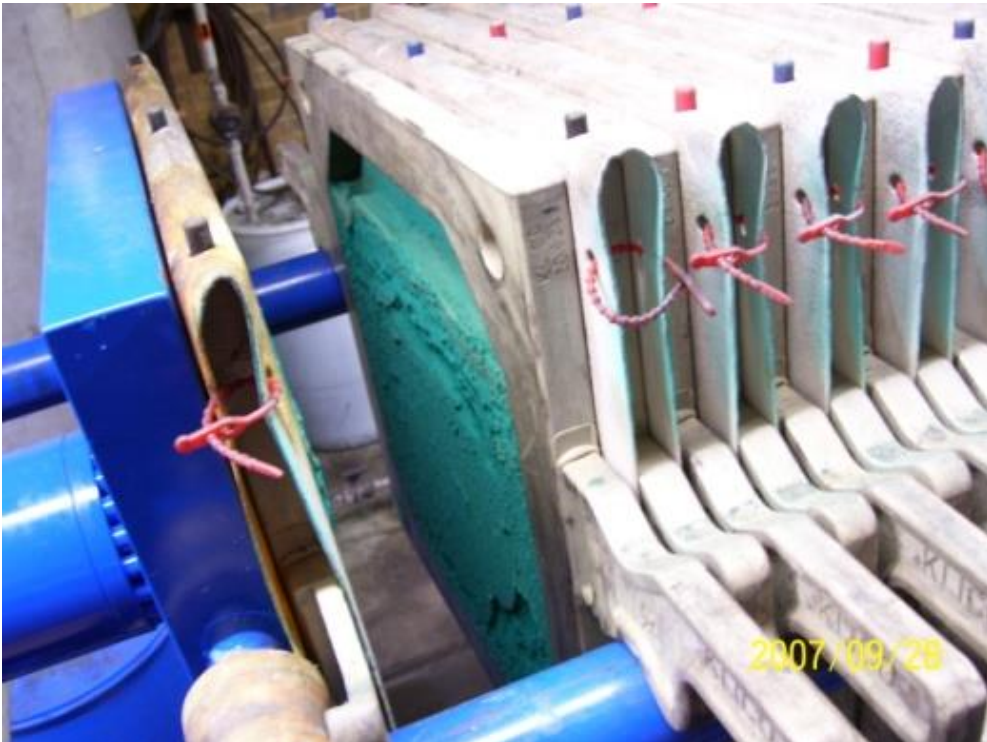
Ottawa, Canada

# **ROYAL CANADIAN MINT**

## **SILVER REFINERY COPPER REMOVAL PLANT**

The Royal Canadian Mint had purchased a new silver refining process from an overseas vendor. The process did not work as advertised, causing a large build-up of copper in the silver nitrate electrolyte, severely compromising the refining of silver. A new process was developed and successfully commissioned, based on comparable chloride technology, wherein basic copper nitrate was recovered as an easily-filtered precipitate, with simultaneous recovery of high-strength nitric acid for recycle.





5N Plus

Solar Panel Recycling Plant

Eisenhüttenstadt, Germany

# 5N PLUS

## SOLAR PANEL RECYCLING PLANT

In conjunction with First Solar at the time (2005/2006), 5N Plus was a producer of CdTe Solar Panels. The company wished to recycle spent panels, to recover the cadmium and tellurium in a highly-pure (>5N purity) metallic form, and commissioned the development of a process for doing so. A novel, highly-efficient process was developed, comprising a sulphuric acid leach, followed by selective ion exchange and electrowinning of cadmium. Tellurium was recovered from the IX barren solution by conventional SO<sub>2</sub> precipitation, which had previously been developed at CCR Copper Refinery.

A plant was built, based on the designed process, by the Gütling Division of Veolia at Eisenhüttenstadt in Germany, and commissioned in mid-2007. The plant is still operating.







Alberta Sulphate

Carbonate Removal Plant

Metiskow, Alberta

Canada

# **ALBERTA SULPHATE**

## **CARBONATE REMOVAL PLANT**

Alberta Sulphate was a solution mining operation, producing high quality sodium sulphate from the brine lakes in western Alberta. As the operation approached the end of its life, the carbonate levels in the brine began to rise to unacceptable levels, both inhibiting the crystallisation of the Glauber's Salt (sodium sulphate decahydrate), but also its purity. In order to prolong the operation, a process was conceived and developed wherein waste gypsum from a nearby operation was used to treat the brine to remove the carbonate and replace it with sulphate via a metathetic reaction, creating solid calcium carbonate which was easily removed from the brine.

The development was very successful, and a process plant was built and operated for several years which allowed the main plant to continue in operation until the deposit was mined out.

Rio Tinto Kennecott

Smelter Dust Leach Plant

Salt Lake City, UT

USA

# **RIO TINTO KENNECOTT**

## **SMELTER DUST LEACH PLANT**

The Copper Electrorefinery at the Rio Tinto plant in Salt Lake City was experiencing increasing inputs of impurities, especially bismuth, causing off-spec copper to be produced. HG Engineering (HGE) were contracted to solve this issue, and as part of their team, in conjunction with Rio Tinto (UK) metallurgists, a site-specific process was developed to handle the bismuth. The process devised was based on work that had been carried out previously in both Zambia, and for the Noranda (Glencore) Horne Copper smelter, which had a co-operation agreement with Kennecott, the latter having purchased three Noranda copper smelter reactors.

HGE built the plant which has operated successfully, albeit on an intermittent basis as required.

Porters Grove Metal  
Recovery Inc.

Copper Powder Plant

Bridgeport, CT

USA

# **PORTERS GROVE METAL RECOVERY**

## **COPPER POWDER PLANT**

Copper electroplating operations generate spent electrolyte from which it is desirable to recover the copper. These solutions are generally dilute, which makes efficient recovery difficult. A process was developed wherein copper powder could be effectively and efficiently recovered from these spent solutions. A similar process was also developed at Noranda (Glencore) for the recovery of platinum and palladium powders.

A copper plant was built at Bridgeport in Connecticut, which operated for several years until the company went out of business. The precious metal plants were never built, since Noranda amalgamated with Falconbridge, which already had an operating PGM refinery in Norway, albeit using traditional processing.