



Using Electrowinning to Reduce Cost in a PCB Waste Treatment System

Scott Bryan, Director of Engineering / Environmental, Health & Safety, Sierra Circuits, Inc. scottb@protoexpress.com
Hai Duong, Process Engineer, Sierra Circuits, Inc. haid@protoexpress.com

Summary:

Sierra Circuits was looking for a cost-effective way to remove copper and other metals from the Sulfuric Acid used to regenerate ion exchange (IX) columns. In August of 2014, Sierra Circuits installed an IonnetX™ electrowinning system from Precious Metals Processing Consultants (PMPC). The amount saved is projected to be greater than \$80K per year.

Background:

Sierra Circuits is a quickturn printed circuit board shop located in Sunnyvale, California. We offer a fully-contained wastewater treatment department as part of our environmental, health, and safety department. In line with our green initiative and our environmental policy of continuous improvement, pollution prevention, and regulatory compliance, we are always looking for methods to reduce cost and waste.

System:

This ion exchange system uses a macro-porous polystyrene-based chelating resin, with iminodiacetate groups designed for removal of heavy metals from waste water. The resin is used in processes for the extraction and recovery of metals. An example of such a resin is the S930Plus from Purolite of Bala Cynwyd, PA. After all the sites of the resin are used, the resin needs to be regenerated using an acid. The acid gets broken down and the hydrogen replaces the metal that is on the resin. The metal is flushed out with the acid and water.

Before the IonnetX™ system, Sierra Circuits was removing metal from the acid using a conventional waste treatment system. This involves a batch system that that uses Caustic, Ferrous Sulfate, Sodium Sulfide, and a polymer to form sludge that is pressed into a filter cake. This filter cake sludge is then sent off site for further treatment that typically involves metal recovery, burning, and disposal in a landfill.

Figure 1—System Performance

The curve displayed in Figure 1 is an empirical representation of the copper concentration diminishing as a function of time on a daily basis. **This has been repeated each weekday for six months, with slight variation.**

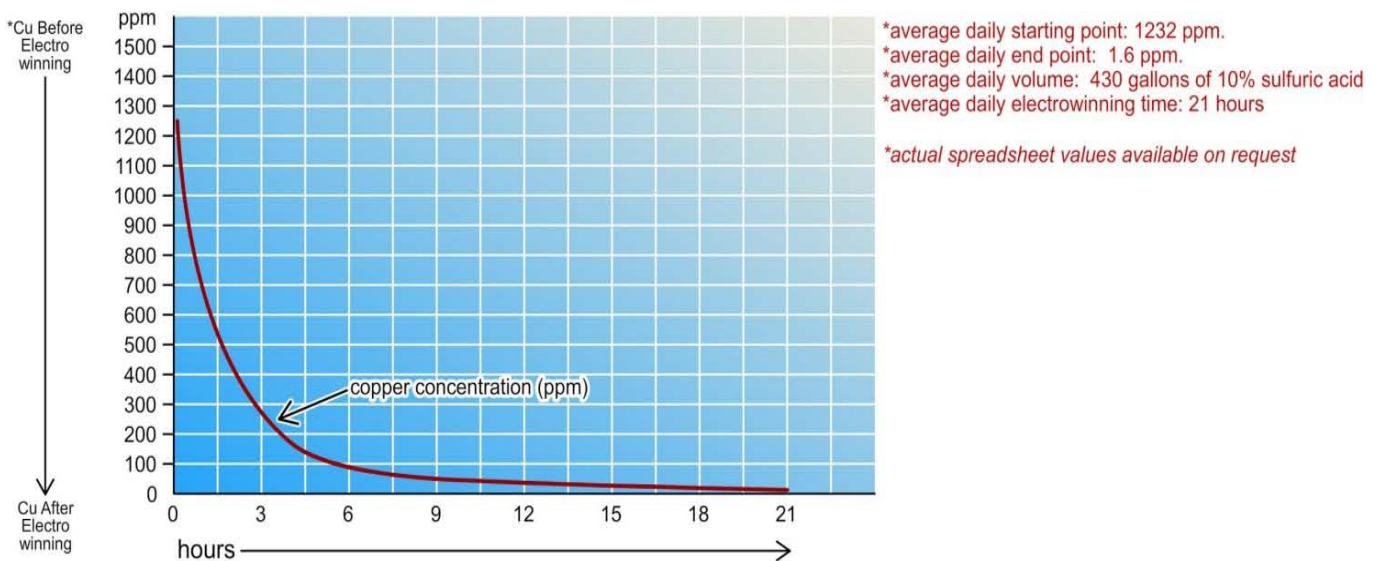


Figure 2—lonnetX System

The lonnetX™ system uses electrowinning to remove the copper. The copper-laden acid solution is pumped through the system and plated onto cathodes that can be sold for scrap metal.



2A: Copper electrode build-up



2B: lonnetX™ system has a 2' x 4' footprint



2C: Samples before and after electrowinning

Top View of lonnetX™ System



2D: Beginning of cycle



2E: End of cycle

Analysis of savings as a result of electrowinning project at Sierra Circuits

Weekly gross savings comes from the following areas:

- Sulfuric Acid 50% – 350 gallons
- Ferrous Sulfate – 250 lbs.
- Sodium Sulfide – 15 lbs.
- Copper filter cake, which no longer is produced – 300 lbs.
- Sodium Hydroxide 50% – 75 gallons
- 4 hours of labor
- Energy savings from filter cake processing

Cost:

- 21 hours per day of power consumption for pump = 12 KWH
- 21 hours per day of power consumption for rectifier = 25.2 KWH
- 37.2 KWH @ .15 per KWH = \$ 5.58 per day or \$30 per week

Consumable cathode cost = scrap value sales

Total net savings per week = \$1,664

Total net savings per 50 week year = \$83,200

For further information contact Randy Epner at PMPC
430 Bergen Blvd., Palisades Park, NJ 07650 (201) 944-8053 fax, (201) 944-8003
email: info@preciousmetals-pmpc.com

