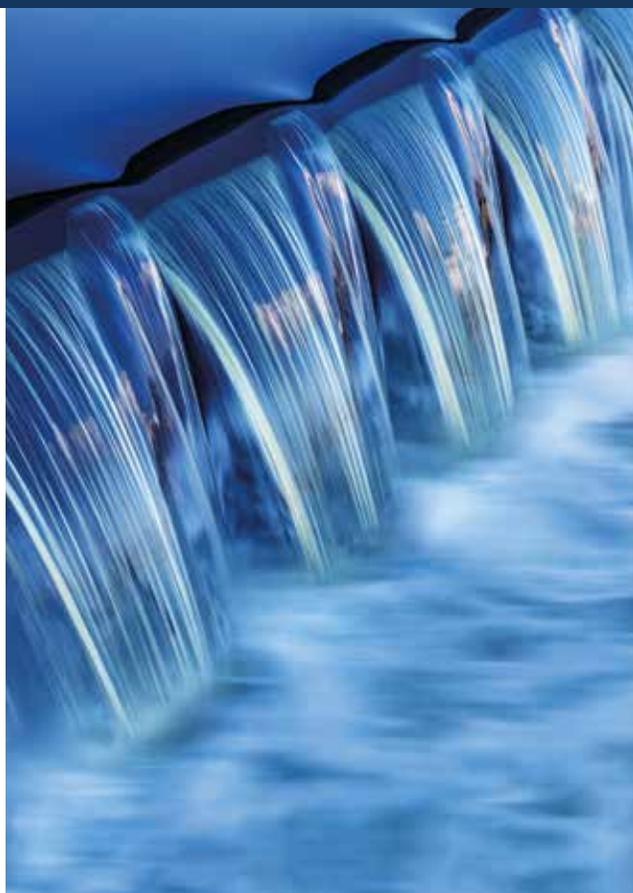


Equipment designed
to recover, recycle,
and minimize
chemical waste

- NiCycle
- CuCycle
- HexCycle
- CarboPure



MacDermid Envio Solutions & Technology



I Who we are

MacDermid Envio Solutions designs, develops, builds, and delivers equipment, chemicals and services that reduce our customers' environmental footprint. For nearly 50 years, we have been committed to economically preventing, remedying, or reducing the most difficult (waste)water problems.

As part of a multinational chemical corporation, **MacDermid Envio Solutions** not only knows chemical surface treatment processes like no other, but we also understand the delicate balance of chemistry, water, and equipment that the industry faces every day. This makes **MacDermid Envio Solutions** a partner that speaks our customers' language, understands our customers' challenges, and helps solve our customers' problems.

In addition to fully automated **wastewater treatment** plants, **water conditioning** plants and **water recycling** systems, our portfolio consists of several logical and complementary elements:

EnvioTECH - Equipment to easily treat your most difficult waste streams

EnvioCARE - Customizable Services to eliminate your concerns for wastewater management

WaterCARE - Water treatment chemicals that ensure discharge compliance at optimum cost

It's becoming increasingly cost effective to recycle both water and selected waste materials, particularly chemical wastes that contain valuable metals. It's estimated that 20% of global water usage is consumed by Industrial manufacturing. It's now both commercially and technically viable to reuse water for many industrial processes, including those used with Surface Finishing. We can also now effectively recycle metals like Nickel, Copper and Chromium in forms that can be reintroduced directly into surface finishing processes, significantly reducing the need to waste treat these materials whilst also providing significant cost savings.

MacDermid Envio Solutions **NiCycle**

I **NiCycle - Nickel Recovery System**

In decorative electroplating applications, nickel sulphate and nickel chloride are used to replenish drag-out losses. Both ultimately end up in the wastewater treatment plant (WWTP). By utilizing our **NiCycle** nickel recovery unit, customers can reclaim more than 90% of the nickel from their rinse waters, providing significant cost saving and waste reduction. Nickel solutions recovered by our **NiCycle** units are free of organics and sulphur compounds making them ideal for reuse in most nickel plating processes.

Our **NiCycle** system works effectively on most nickel electrolytes including Wood's nickel strike, semi-bright nickel, satin nickel, bright nickel, and microporous nickel. The highly selective Ion Exchange resin we have developed collects, concentrates, and purifies nickel in either sulphate or chloride form for immediate reuse. Our **NiCycle** units can switch between nickel chloride and nickel sulphate production on a batch-to-batch basis.

I **Features & Benefits**

NiCycle can reclaim more than 90% of nickel from typical electroplating rinse waters.

- Immediate positive "Return on Investment"
- Economically attractive if a moderate monthly tonnage of nickel salts are consumed
- Zero upfront equipment investment cost
- Substantial cost savings from nickel salts drag-out recycling
- Nickel sulphate or nickel chloride immediately available for reuse
- Reduced nickel sludge generation and external treatment cost
- Reduced overall environmental footprint
- Less dependency on fluctuating nickel prices
- Reduced waste volumes and associated treatment costs

I **Application**

NiCycle is operated by many leading nickel plating and plating on plastics companies, some of whom recover values in excess of \$400k per year.



MacDermid Envio Solutions **CuCycle** & **HexCycle**

I **CuCycle - Copper Recovery System**

In decorative electroplating applications, most sulphate-based copper electroplating processes consume copper sulphate to replenish drag-out losses that ultimately end up in the wastewater treatment plant (WWTP). By utilizing our **CuCycle** copper recovery unit, customers can reclaim more than 90% of the copper from their rinse waters, providing significant cost savings and waste reduction. Our innovative **CuCycle** design concentrates more than 90% of copper from plating rinses. Through the efficient removal of copper from the rinse water, **CuCycle** can reduce the copper content to less than 2 ppm, thus minimising waste treatment costs and reducing waste disposal volumes.

I **HexCycle - Chromic Acid Recovery System**

Our **HexCycle** chromic acid recovery unit uses a combination of technologies to concentrate chromic acid waste and reclaim up to 99% from chrome etch and hex chrome plate rinse waters, providing significant waste reduction and cost savings. Chromic acid is recovered to minimize waste and reduce wastewater treatment, significantly reducing operational costs.

HexCycle is the most durable and efficient chromic acid recovery system available globally for both chromic acid etches and decorative chrome plating processes.

Our **HexCycle** units can treat between 200-400 litres per hour of rinse water and return a concentration of 250 grams/litre chromic acid.

I **Features & Benefits**

Over 90% of copper in rinse waters can be recycled.

- Fully automated copper recycling system for recovery of copper salts
- Zero up-front equipment investment cost
- Economically attractive if a moderate monthly tonnage of copper salts are consumed
- Immediate cost reduction and ROI
- Reduced chemistry consumption
- Less dependency on fluctuating copper prices
- Reduced waste treatment costs
- Lower sludge generation
- Reduced environmental footprint



I **Features & Benefits**

95 - 99 % of chromic acid can be recycled from rinse waters following chromic acid etching or decorative electroplating.

- Zero upfront investment in equipment
- Immediate cost savings
- Less dependency on material availability
- Lower sludge generation in WWT
- Reduced environmental footprint



MacDermid Envio Solutions **CarboPure**

I **CarboPure - Carbonate Removal System**

Our innovative **CarboPure** carbonate removal units are specially designed for purification of sodium based alkaline electroplating processes. Their advanced features ensure they efficiently remove carbonates and sulphates without significant solution loss. The subsequent reduction in carbonates improves cathode efficiency, plating speed, deposit distribution, chemical consumption along with a reduction in waste generation. Our fully automated **CarboPure** units are proven to remove both carbonates and sulphates without any loss of production time.

- **CarboPure** effectively removes excess carbonates (and sulphates) from alkaline electrolytes including Alkaline Zinc, Alkaline Zinc Nickel, Cyanide Copper, Cyanide Bronze, and other highly alkaline electrolytes



I **Benefits**

- Reduced energy consumption
- Improved deposit thickness distribution
- Lower organic additive consumption
- Reduced waste volume and cost
- Eliminate bleed & feed actions
- Eliminate dependency on annual solution freezing (winter season)

I **Features**

- Unique air-drying cycle to dewater carbonate and sulphate solids
- Fully programmable automated solutions loading system
- Automatic indexing filter
- Automatic defrost cycle
- Automatic system washout at shutdown
- EasyConnect option



International Automotive Parts Manufacturer

I CASE STUDY

An international automotive parts manufacturer was searching for opportunities to recover valuable materials, reduce operational cost and minimise the amount of waste discharged.



I Challenge

The customer was pressured to meet the local discharge limits for nickel whilst recycling materials that would normally be sent for disposal. Providing a solution that also provided a significant cost benefit was highly attractive.

The customers yearly consumption of nickel sulphate was 48,000kg with a cost of **\$241,300**.



I MES Solution

After evaluating the client's challenges, **MacDermid Envio Solutions** found this customer to be an excellent candidate for our **NiCycle** Nickel recovery system. The system works effectively on most nickel electrolytes including Wood's nickel strike, semi-bright nickel, satin nickel, bright nickel, and microporous nickel. The highly selective Ion Exchange resin collects, concentrates, and purifies nickel in either sulphate or chloride form for immediate reuse.

Our team installed our state-of-the-art **NiCycle** system with enhanced automated controls and continuous nickel recovery. In this case, nickel was recovered as nickel sulphate and used directly in the customer's electroplating processes.

I Results

Our **NiCycle** unit yielded the following results for the customer:

- In this application, we recovered an average of 90% nickel from rinse water, yielding over 43,000kg nickel sulphate per year, saving \$204,100* per year
- Significant reduction in waste treatment cost by recycling nickel waste
- The nickel concentration in the waste was reduced, meeting the required discharge limits now

**The numbers were converted from Chinese Yuan Renminbi (RMB) to US\$ at an exchange rate of 0.157.*



EnvioCARE

I Design a service plan the way you need it

EnvioCARE includes on-site management, scheduled service visits and remote monitoring services. You select exactly what your business needs.

- From 24/7 support to annual system inspections
- From full time on-site engineers to routine analytical services
- From daily site checks to monthly audits
- Flexible service, when and how you need it
- Cover for staff shortages, emergencies & system start-ups

I EnvioCARE

Customizable Environmental Services tailored to match your needs

We aim to ensure your wastewater treatment system doesn't keep you awake at night.

EnvioCARE is our customizable service program that allows you to select from a range of wastewater and environmental systems support options, ensuring continued environmental compliance. Maintenance, supervision, engineering, training and routine analysis are all available to mix and match to your specific requirements. **EnvioCARE** ensures your wastewater treatment system is supported by professional experts in water management.

With **EnvioCARE**, you have support from experts in industrial chemical processes and wastewater engineering.

Regulations & operations may change, but MacDermid Envio Solutions will keep you in compliance.



I Service options include...

On-Site Service	Scheduled Service Visits	Data Services
5 days / week @ 8 hours / day	Plan your Date, Duration & Frequency	Real-time Environmental Analysis
Routine Site Support	Pre-Scheduled Support	TECHLink™ "live" Data
Experienced Specialists	On-Demand Experts	Expert Oversight and Monitor
Day to Day System Checks	Scheduled Check-ups	Data Dashboards
Chemical Checks and Analysis	On-Demand Analysis	Live Troubleshooting Support
Compliance Monitoring	Routine Maintenance	Compliance Tracker
Equipment Checks & Monitoring	On-Demand Service	Inspections Reports
Audits & Preventive Maintenance	Customizable Service Visits	Chemistry Use Tracking

MacDermid Envio Solutions **Global Presence**



MacDermid Envio Solutions (MES) is a business unit of Element Solutions Inc (NYSE: ESI). With over 5,000 people in operating facilities across more than 50 countries, Element Solutions has established a growing legacy of creating technological advances for customers around the globe. Our people and technical sales teams are located close to our key markets, allowing us to maintain strong customer relationships and accelerate our product innovation process.



MacDermid Envio Solutions has 3 manufacturing facilities located on 3 continents:

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SuZhou, JiangSu Province, China
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**Taking bigger steps...
to leave a smaller footprint**

NiCycle, CuCycle, HexCycle and **CarboPure** are all trademarks of ESI.

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