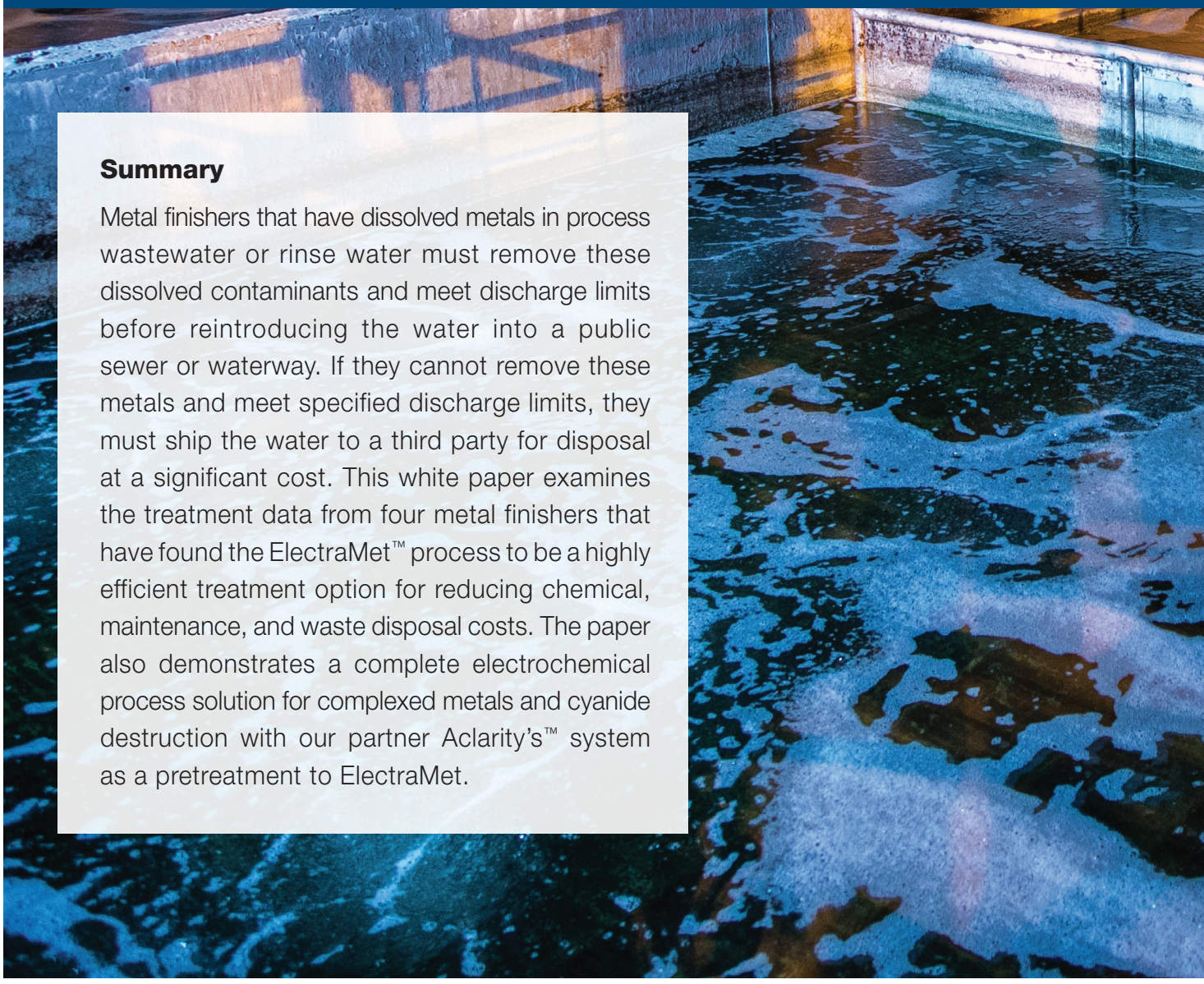
ElectraMet™

White Paper

Chemical-free removal of copper, zinc, chrome, and nickel with chelating agent and cyanide destruction in rinse water and wastewater



Summary

Metal finishers that have dissolved metals in process wastewater or rinse water must remove these dissolved contaminants and meet discharge limits before reintroducing the water into a public sewer or waterway. If they cannot remove these metals and meet specified discharge limits, they must ship the water to a third party for disposal at a significant cost. This white paper examines the treatment data from four metal finishers that have found the ElectraMet™ process to be a highly efficient treatment option for reducing chemical, maintenance, and waste disposal costs. The paper also demonstrates a complete electrochemical process solution for complexed metals and cyanide destruction with our partner Aclarity's™ system as a pretreatment to ElectraMet.

How ElectraMet™ Works

The ElectraMet process uses a small amount of electricity to apply voltage and pH changes inside a cartridge to remove dissolved metals from a solution. Clean water is sent to the drain or reused at the plant while the recovered metals are flushed out as a highly concentrated stream for recycling as non-hazardous waste or solids disposal.

Project Background

PowerTech Water and four clients worked together to evaluate the ElectraMet chemical-free metals separation process for wastewater metal removal. In some cases, we partnered with Aclarity to use their chemical-free process for chelating agents and cyanide destruction. For these clients, we demonstrated:

- ElectraMet achieved removal rates up to 99% for dissolved zinc, copper, nickel, and chrome, with 99% water recovery.
- Aclarity destroyed cyanide and chelating agents to meet treatment targets.

Test Setup

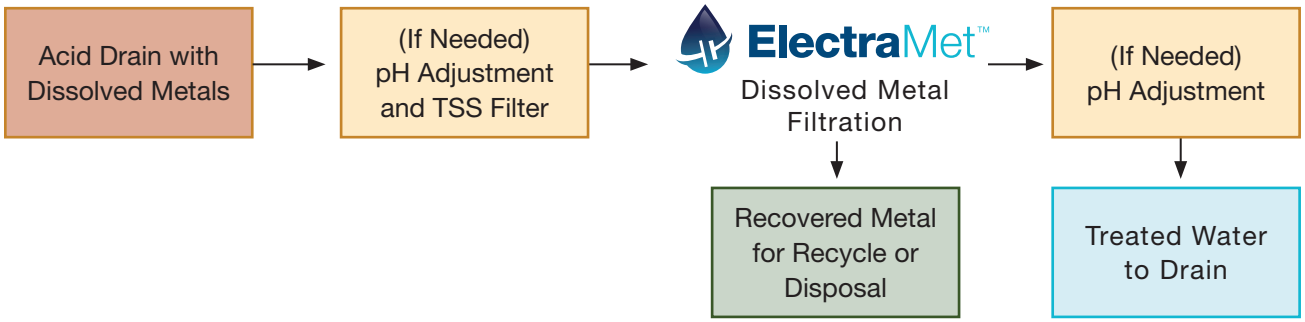
- A raw water sample was collected from rinse water and wastewater streams and sent to PowerTech Water for analysis.
- Inductively coupled plasma mass spectrometry (ICP-MS) was used to analyze the content of the water samples.
- Dissolved metals were quantified before and after ElectraMet treatment with Hach DR 3900 and ICP-MS.
- The ElectraMet cartridge was operated at less than 2V to separate metals from water samples.
- The Aclarity pretreatment system was operated at below 200W when cyanide and or chelating agent destruction was required.

Results

Customer	Contaminant	Wastewater Input (ppm)	Treated Output (ppm)	Discharge Limit	% Removed
1	Nickel Zinc	22.8 0.84	0.853 < 0.02	2.34 not given	96.3% 100.0%
2	Chrome (tot) Nickel Copper	182 4.00 1.80	0.149 0.02 < 0.001	1.71 2.38 2.07	99.9% 99.5% 100.0%
3	Cyanide Zinc Nickel Copper	30.0 3.60 2.40 1.90	< 0.003 0.16 1.36 0.016	0.65 1.5 2.4 2.1	> 99.9% 95.6% 43.3% 99.2%
4*	Nickel Zinc	356 1560	1.55 < 2	not given not given	99.6% > 99.9%

**Ammonia-based chelating agent present*

Process for Electrochemical Separation of Dissolved Metals



Process for Electrochemical Chelating Agent and Cyanide Destruction

Process Notes

- ElectraMet can replace or be installed as a post-treatment process to manufacturers' existing chemical treatment system, reducing overall chemical treatment cost and improving consistency to meet discharge requirements.
- Highly basic or acidic water may require pH adjustment for effective ElectraMet metals separation.
- A high concentration of chelating agents may require pretreatment for effective ElectraMet metals filtration. We partner with Aclarity for chemical-free cyanide and chelating agent pretreatment when required.

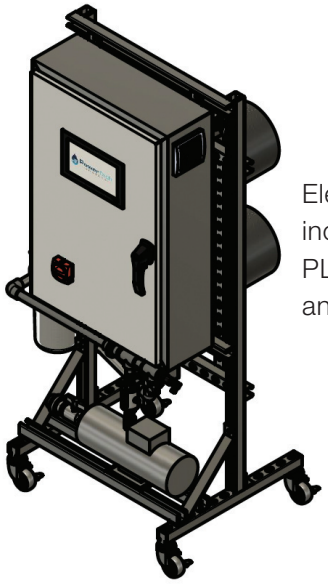
ElectraMet™ Dissolved Metal Filtration System—20 gpm

ElectraMet Metals Separation: Effective Regions

- Filtration systems designed to capture one or more dissolved ion species.
- Other dissolved ions pass through the filter for discharge.

1 H Hydrogen																	2 He Helium
3 Li Lithium	4 Be Beryllium											5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon
11 Na Sodium	12 Mg Magnesium											13 Al Aluminium	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon
19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon
55 Cs Caesium	56 Ba Barium	57 - 71 Lanthanoids	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium	78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium	82 Pb Lead	83 Bi Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon
87 Fr Francium	88 Ra Radium	89 - 103 Actinoids	104 Rf Rutherfordium	105 Db Dubnium	106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 Ds Darmstadtium	111 Rg Roentgenium	112 Cn Copernicium	113 Nh Nihonium	114 Fl Flerovium	115 Mc Moscovium	116 Lv Livermorium	117 Ts Tennessine	118 Og Oganesson

57 La Lanthanum	58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium	63 Eu Europium	64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium	71 Lu Lutetium
89 Ac Actinium	90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium



ElectraMet system shown includes filter cartridges, PLC box, 5 µm particle filter, and pump.

Aclarity™ Chelating Agent and Cyanide Destruction System—5 gpm

- Chelating Agent
- Cyanid
- Organics (COD)

To learn more about this and other ElectraMet applications, or to request a water sample evaluation, please visit our website **http://electramet.com** or contact an engineer at **sales@electramet.com.**

ElectraMet™

www.electramet.com