A COMMERCIAL APPLICATION
OF VIROFLOW™ TECHNOLOGY

CASE STUDY: ADVANCE PLATING CORPORATION WORCESTER, MASSACHUSETTS, USA

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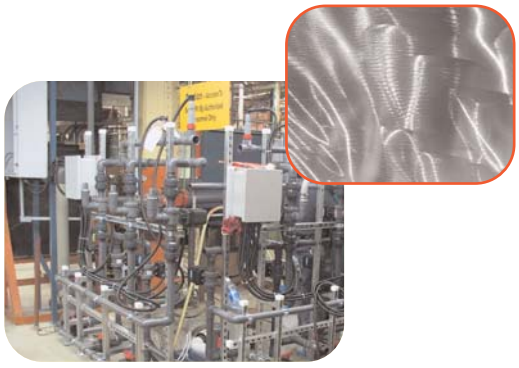

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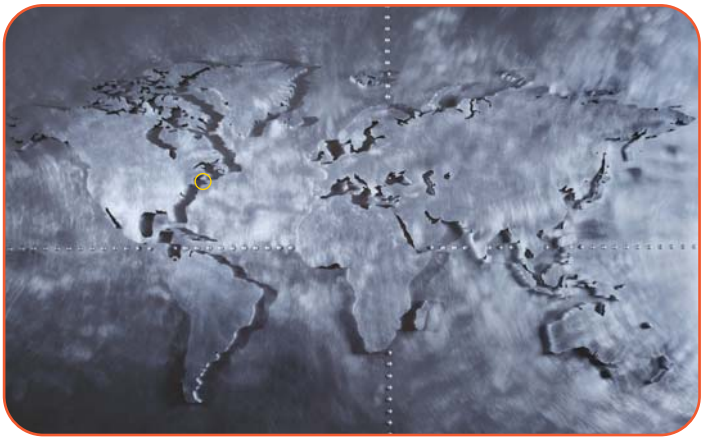

Advance Plating Corporation is in Worcester, Massachusetts

PROBLEM

Advance Plating Corporation, is a medium-scale electroplating company in Worcester, Massachusetts; it specializes in customized hard chrome finishes for specialized clientele including the food processing industry and the tool manufacturing industry.

Advance Plating was facing a new set of waste water discharge criteria that required installing a waste water treatment system. The management were not interested in conventional treatment systems due to their inherent cost of installation / operation, large footprint and the perceived failure of conventional systems to treat waste water to high quality standards.

Virotec was introduced to Advance Plating through the regional branch of the US EPA. Management at Advance Plating were open to the idea of new and innovative technology that would be low maintenance and would reduce residue disposal costs.

Advance Plating accepted the Virotec proposal over a conventional lime treatment system due to the associated cost savings and the inherent simplicity of the proposed system.

VIROTEC TOTAL SOLUTION

ViroFlow™ Technology, a total solution service that included proprietary ElectroBind™ reagent, technical support and liaison with regulatory authorities, was implemented with the following outcomes:

- Significant reduction in nickel and total chrome in water discharge. Full compliance with the Upper Blackstone Municipal Treatment Facilities discharge requirements.
- Very low personnel time for operation and maintenance.
- The influent parameters for the treatment system are more lenient than conventional systems allowing the client to be more flexible with their chemical processing solutions.

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- Significant reduction in the volume of residue generated during water treatment.
- No dewatering equipment.
- The lowest possible disposal cost at a hazardous landfill due to the inherent stability of the residue.
- Significant savings in chemicals used including acid, caustic and polymer.
- Potential for reclassification of the residue from US EPA F006 classification to non-hazardous classification.

View of pipe manifold and tanks behind

BACKGROUND

Advance Plating is a family operated company that has been operating for over 50 years. The company has consolidated its operations to concentrate on high quality nickel and chrome plating for specialized applications.

Advance Plating had been operating under a grandfathered regulatory order that required a pH adjustment and a per day effluent discharge limit without needing to meet total metal discharge criteria. The local sewage treatment plant contacted the company in early 2004 to impose new metal concentration discharge criteria for the facility. Virotec was aware of the new discharge requirements and contacted the company to determine if a ViroFlow™ Technology pelletized treatment system would be considered over conventional treatment technology.

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Overview of installed water treatment system

Advance Plating evaluated both the Virotec proposal and a proposal for a conventional lime neutralization/polymer flocculation system. The president of the company admitted that the known operational and maintenance disadvantages of available conventional systems had been one of the reasons for deferring the decision to install a treatment system in the past. However, the Virotec system is simple, easy to operate and can handle widely changing feed water chemistry. It can also be adapted to be modular, so that additional capacity can be easily added if the client's throughput rapidly increases.

Based on successful laboratory treatment evaluations of the company's typical wastewater and the client's receptiveness to the innovative nature of the ViroFlow™ Technology, Virotec was awarded the contract to install a full-scale treatment system for both the chrome and the nickel wastewater streams.

The system was installed during September 2004 and went online at the end of the month. Initial treatment results were excellent and the system has been operating ever since.

TREATMENT METHODS

There are two distinct treatment modules at Advance Plating. The nickel system consists of pH adjustment; predominantly using spent sodium hydroxide (to increase the rinse water effluent to a pH of approximately 4.5) and a series of pelletized ElectroBind™ reagent-filled reactor tanks. The chrome system consists of an equalization tank, a reduction tank (using sodium metabisulfite as the reductant), another equalization tank and a series of pelletized ElectroBind™ reagent-filled reactor tanks. Flow rates for the systems vary, but the flow rate for each system averages around 3,000 gpd (~11,000 Lpd).

The ElectroBind™ reagent adjusts the water pH and pulls metals out of solution by sequestration. This process results in extremely well bound metals that cannot be released from the reagent by TCLP or other leaching methods typically required by the regulatory community.

RESULTS

The treated water in the two wastewater streams is consistently below the discharge criteria mandated by the local waste water treatment facility.

Table 1 is a summary of the results obtained over a three to four month period for the nickel system. ViroFlow™ Technology produced a result for total nickel (mg/L) of over 16 times lower than discharge limit targets set by the US EPA. The pH was also increaesd from raw effluent at a range 1.6 – 2.6 to a range of 8.0 –9.0; well within the discharge limits.

TABLE 1 – TYPICAL TREATMENT RESULTS FOR THE NICKEL SYSTEM

Parameter	Raw Effluent	ElectroBind™ Reagent	Discharge Limits
pH	*1.6 - 2.6*	*8.0 - 9.0*	*6.0 - 10*
Total Nickel (mg/L)	*~250*	*0.01- 0.8*	*13.0*

Summary results for a three to four month period

Table 2 is a summary of the results obtained over a three to four month period for the chrome system. ViroFlow™ Technology produced a result for total chrome (mg/L) of over two times lower than discharge limit targets set by the US EPA. The pH was also increased from raw effluent at a range 2.5 –3.5 to a range of 6.0 – 7.5 within the discharge limits set by the US EPA.

TABLE 2 – TYPICAL TREATMENT RESULTS FOR THE CHROME SYSTEM

Parameter	Raw Effluent	ElectroBind™ Reagent	Discharge Limits
pH	*2.5 - 3.5*	*6.0 - 7.5*	*6.0 - 10*
Total Chrome (mg/L)	*350 - 400*	*0.0012 - 0.5*	*1.3*

Summary results for a three to four month period

Even after five months of operation the two systems continue to significantly reduce nickel and chrome concentrations even though the systems were designed to last only two to three months before the spent pellets had to be replaced by new pellets. The client submitted a composite sample from a full day's operation and the nickel system reduced the concentration from approximately 250 ppm to 11 ppm Ni and the chrome system reduced the concentration from approximately 350 – 400 ppm to 1.2 ppm as shown in Table 3.

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TABLE 3 – LONG TERM RESULTS

System	Influent	Efluent	Discharge Criteria
Nickel (mg/L)	*~250*	*11.0*	*13.0*
Chrome (mg/L)	*350 - 400*	*1.2*	*1.3*

Summary results after five months

SLUDGE ANALYSIS

The US EPA has determined that all residuals created from treating metal plating effluent are F006 designated wastes. The F006 designation requires that these residuals must be handled and disposed of as hazardous waste regardless of their physical and chemical stability. However, the EPA does evaluate applications for delisting specific products/residuals based on results of environmental stability tests. Virotec is pursuing the delisting procedure for the use and disposal of ElectroBind™ reagent in the metal plating arena.

Samples of ElectroBind™ reagent used to treat Advance Plating effluent were evaluated by a Canadian hazardous waste disposal facility that has a patented waste stabilization technology. Their laboratory reported that the residual material was stable, did not release metals and did not require any stabilization treatment before disposal. Therefore, the company gave Advance Plating the lowest possible quote for disposal of the waste treatment residue. Table 4 shows typical leaching data for treatment residues.

TABLE 4 – TYPICAL LEACHING RESULTS FOR THE ELECTROBIND™ REAGENT RESIDUE

Parameter	ElectroBind™ Reagent treated TCLP # 1	ElectroBind™ Reagent treated TCLP # 2	US EPA TCLP threshold values
Chrome (mg/L)	*0.183*	*0.989*	*5.0*
Iron (mg/L)	*<0.118*	*<0.118*	*No limit set*
Nickel (mg/L)	*<0.024*	*<0.024*	*No limit set*
Zinc (mg/L)	*0.054*	*<0.024*	*No limit set*

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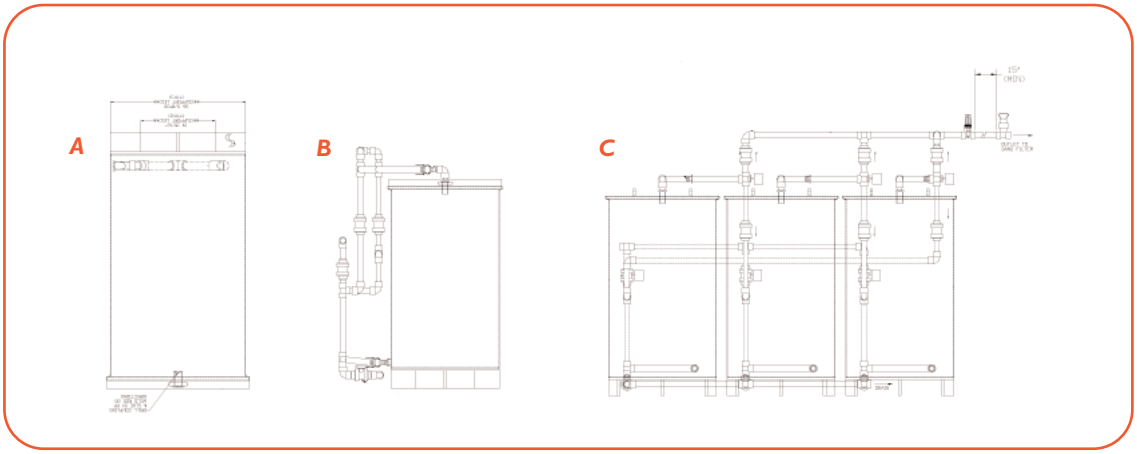

A. Schematic of distribution head inside flow-through cell.
B. Schematic of pipe manifold for a single flow-through cell.
C. Schematic of pipe manifold connecting three flow-through cells.

CONCLUSION

The use of a pelletized ViroFlow™ Technology flow-through reactor treatment system to treat electroplating effluent is a major advance – proving to be both environmentally sustainable and economically viable. The system has proven to meet the required discharge standards.

Advance Plating has reported significant savings in electricity, chemicals and operating time compared to conventional treatment systems. Additionally, the system is more robust, allowing throughput of complex solutions with different compositions, thereby providing operational freedom.

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