



## A COMMERCIAL APPLICATION OF VIROFLOW™ TECHNOLOGY

### CASE STUDY: BERETTA'S METAL FINISHING

*“We were particularly impressed with the fact that the Technology could work when applied to batches containing multiple metal and acid solutions, which were previously separated before treatment....”*



*Beretta's produce high quality electroplated products – including components for the aircraft industry.*

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*The pre-existing wastewater treatment plant at Beretta's Metal Finishing.*

### PROBLEM

Beretta's Metal Finishing, a specialist electroplating company located in Bethania, Queensland, Australia, was experiencing various problems associated with their wastewater treatment system. The electroplating effluent was characterised by high loadings and variability in metal concentration, requiring an assortment of chemical additives to ensure the company met its trade waste discharge limits.

The significant issues faced by the Company were:

- > Treatment of the effluent was not an exact science and required a different process and chemical cocktail for each batch, a very labour intensive process.
- > The excessive cost involved in transporting large volumes of unstable, contaminated sludge to a hazardous waste landfill.

### VIROTEC TOTAL SOLUTION

ViroFlow™ Technology, a total solution service which includes reagents, technical support and liaison with regulatory authorities, was implemented with the following outcomes:

- > A substantial reduction in heavy metal concentrations in discharge water resulting in full compliance with Gold Coast City Council trade waste discharge limits. All metals are now consistently below the required thresholds prior to discharge into the sewer.
- > Reduction of 50% in sludge volumes resulting in a direct landfill cost saving.
- > Potential re-classification of sludge as a non-hazardous residue, allowing for further cost savings.
- > Increased dewatering efficiency resulting in improved water quality and increased plant throughput.

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**BACKGROUND**

Beretta's Metal Finishing is a speciality electroplating service offering the highest quality electroplated finishings for a variety of products including various components for the aviation industry.

The variety of speciality jobs performed by Beretta's results in effluent that has a highly variable composition and includes a wide variety of metals.

It was necessary for Beretta's Metal Finishing to ensure that their wastewater systems were capable of effectively removing these high and variable metal loads. The existing treatment plant used at different times caustic soda, lime, magnesium oxide and a very expensive sodium-based complex breaker to adjust pH and remove metals from the process water. This process produced large volumes of toxic sludge which the company had to pay to have removed from site; because the sludge was considered a hazardous waste, the cost was high.

Previous work by Virotec had shown that ViroFlow™ Technology had a remarkable ability to remove heavy metals from electroplating process water – including copper, zinc, tin, iron, nickel and chromium – from electroplating process water down to very low concentrations. ViroFlow™ Technology, using the ElectroBind™ reagent, was applied at Beretta's Metal Finishing in a two-month trial and subsequently commissioned on an ongoing basis.

**TREATMENT METHODS**

ViroFlow™ Technology incorporates the use of ElectroBind™ reagent, a patented environmentally safe reagent. ElectroBind™ reagent properties include high acid neutralising capacity, fast settling rate characteristics, reduced sludge volumes, and high metal binding efficiency.

ElectroBind™ reagent was mixed with the electroplating process wastewater at a predetermined volume-to-mass ratio to ensure optimum contact time and treatment efficiency. This was accomplished by direct addition in a 1000L mixing tank.

ViroFlow™ Technology replaced the conventional alkaline treatment and produced a dense, stable sediment that was easily recovered and dewatered without the need for flocculant addition. ElectroBind™ reagent was provided to the electroplating company in both dry powder form and as a 45% slurry solution.



*After addition of ElectroBind™ reagent.*

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The integration of ViroFlow™ Technology with the existing treatment facilities required only minimal capital works and plant modifications.

**RESULTS****> Water Analysis**

Due to the highly specialized nature of Beretta's business, multiple waste streams of differing levels and types of contamination are generated. ViroFlow™ Technology was employed across this wide variance of effluent to assess its suitability in treating specialized waste.

During the application of ViroFlow™ Technology, heavy metal levels in the treated water were consistently below the Gold Coast City Council trade waste discharge limits.

*Table 1 - Shows the results were achieved when treating an effluent characterized by high phosphate, copper, nickel and cadmium.*

Parameter	Before treatment	After ViroFlow™ Technology Treatment	Trade Waste Limits
pH	2.46	8.56	6-10
PHOSPHATE (mg/L P)	26.5	0.13	10
AMMONIA (mg/L N)	10.0	2.67	50
ALUMINIUM (mg/L)	4.19	<0.01	100
MOLYBDENUM (mg/L)	11.3	7.15	10
CADMIUM (mg/L)	10.9	0.02	2
ZINC (mg/L)	16.6	0.005	10
COPPER (mg/L)	60.4	0.12	10
IRON (mg/L)	0.95	<0.01	100
NICKEL (mg/L)	22.9	0.36	10

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*Table 2 - Shows the treatment results for effluent characterized by high zinc and low pH.*

Parameter	Before treatment	After ViroFlow™ Technology Treatment	Trade Waste Limits
pH	1.11	7.21	6-10
AMMONIA (mg/L N)	3.63	2.66	50
ALUMINIUM (mg/L)	5.0	0.01	100
ARSENIC (mg/L)	0.17	0.007	5
COPPER (mg/L)	3.04	0.04	10
IRON (mg/L)	0.09	<0.001	100
NICKEL (mg/L)	6.98	0.81	10
ZINC (mg/L)	52.5	0.009	10

*Table 3 shows the treatment results for effluent characterized by high ammonia, phosphate, copper and nickel.*

Parameter	Before treatment	After ViroFlow™ Technology Treatment	Trade Waste Limits
pH	2.45	8.72	6-10
PHOSPHATE (mg/L P)	18.6	0.97	10
AMMONIA (mg/L N)	71.3	35.5	50
ALUMINIUM (mg/L)	20.8	0.28	100
COPPER (mg/L)	447.0	7.10	10
IRON (mg/L)	1.73	<0.001	100
NICKEL (mg/L)	34.5	0.40	10
SELENIUM (mg/L)	3.49	1.28	5
ZINC (mg/L)	8.41	0.01	10

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*Table 4 shows the treatment results for effluent characterized by high aluminium, copper and nickel.*

Parameter	Before treatment	After ViroFlow™ Technology Treatment	Trade Waste Limits
pH	5.75	8.56	6-10
PHOSPHATE (mg/L P)	6.71	0.45	10
ALUMINIUM (mg/L)	91.9	1.08	100
ARSENIC (mg/L)	0.12	0.04	5
CHROMIUM (mg/L)	0.19	0.01	10
COPPER (mg/L)	121.0	7.31	10
MANGANESE (mg/L)	2.20	0.38	10
NICKEL (mg/L)	26.0	1.01	10
ZINC (mg/L)	4.28	0.04	10



*A sample of waste water effluent before and after treatment with ViroFlow™ Technology. The sediment produced is classified as non-hazardous.*

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> **Sludge Analysis**

Leachability data for the sludge produced by direct addition of ElectroBind™ reagent are compared with the data for the sludge previously produced by Beretta's Metal Finishing in Table 5. The results compare favourably with the local landfill guidelines and it is recommended that Beretta's Metal Finishing contact local authorities to pursue re-classification of the solid waste.

*Table 5 - Direct Addition Sludge Analysis*

	<i>Beretta's Standard Sludge - TCLP</i>	<i>ElectroBind™ Reagent Treated Sludge TCLP</i>	<i>Landfill Guideline TCLP</i>
<b>SILVER</b>	<b>0.006</b>	<b>0.033</b>	<b>0.5</b>
<b>ARSENIC</b>	<b>0.008</b>	<b>0.008</b>	<b>0.5</b>
<b>LEAD</b>	<b>0.017</b>	<b>0.040</b>	<b>0.5</b>
<b>CADMIUM</b>	<b>0.376</b>	<b>0.214</b>	<b>0.5</b>
<b>CHROMIUM</b>	<b>0.420</b>	<b>0.073</b>	<b>0.5</b>
<b>COPPER</b>	<b>62.4</b>	<b>0.557</b>	<b>10</b>
<b>MANGANESE</b>	<b>0.359</b>	<b>0.126</b>	<b>-</b>
<b>NICKEL</b>	<b>197</b>	<b>0.318</b>	<b>0.5</b>
<b>ZINC</b>	<b>3.53</b>	<b>0.100</b>	<b>50</b>
<b>MERCURY</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.01</b>
<b>ALUMINIUM</b>	<b>3.81</b>	<b>2.63</b>	<b>-</b>

**CONCLUSION**

The use of ViroFlow™ Technology to treat electroplating effluent is a major advance – proving to be both environmentally sustainable and economically viable.

Treated water quality, after the application of ViroFlow™ Technology, complies with the stringent trade waste limits imposed by Water Authorities and heavy metals concentrations are several times below the regulatory limits.

ElectroBind™ reagent is non-toxic, non-hazardous and environmentally safe, and used ElectroBind™ reagent (the residual sediment) is not a hazardous or prescribed waste material.

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**TESTIMONIAL**

*“The wastewater produced from our metal finishing business is characterised by highly variable metal loadings. Wastewater treatment has never been an exact science and was labour intensive.*

*Looking to improve the overall performance and treatability of our wastewater system, Virotec were contacted to determine the effectiveness of ViroFlow™ Technology, using ElectroBind™ reagent. Over a period of two months, Virotec took ownership of our wastewater treatment system. The results obtained demonstrated that all metals could be effectively removed including phosphates and ammonium compounds. We were particularly impressed with the fact that the Technology could work when applied to batches containing multiple metal and acid solutions, which were previously separated before treatment.*

*Overall we were very happy with the performance of ElectroBind™ reagent, producing treated water of very high clarity and low turbidity. Beretta's Metal Finishing are now using ElectroBind™ reagent on a permanent basis.*

*We would recommend ViroFlow™ Technology, using ElectroBind™ reagent, to any other similar metal finishing and electroplating businesses.”*

**RAY BERETTA**  
**Director**  
**Beretta's Metal Finishing**