

US EPA ARCHIVE DOCUMENT

# THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM



U.S. Environmental Protection Agency



Concurrent Technologies Corporation

## ETV VERIFICATION STATEMENT

<b>TECHNOLOGY TYPE:</b>	<b>WATER REUSE</b>	
<b>APPLICATION:</b>	<b>METAL FINISHING WASTEWATER</b>	
<b>TECHNOLOGY NAME:</b>	<b>Lobo Liquids Rinse Water Recovery System</b>	
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The United States Environmental Protection Agency (EPA) has created the Environmental Technology Verification (ETV) Program to facilitate the deployment of innovative or improved environmental technologies through performance verification and dissemination of information. The goal of the ETV Program is to further environmental protection by substantially accelerating the acceptance and use of improved, cost-effective technologies. ETV seeks to achieve this goal by providing high-quality, peer-reviewed data on technology performance to those involved in the design, distribution, financing, permitting, purchase, and use of environmental technologies.

ETV works in partnership with recognized standards and testing organizations, stakeholder groups consisting of buyers, vendor organizations, and states, with the full participation of individual technology developers. The program evaluates the performance of innovative technologies by developing test plans that are responsive to the needs of stakeholders, conducting field or laboratory tests (as appropriate), collecting and analyzing data, and preparing peer-reviewed reports. All evaluations are conducted in accordance with rigorous quality assurance protocols to ensure that data of known and adequate quality are generated and that the results are defensible.

Concurrent Technologies Corporation operates the ETV Metal Finishing Pollution Prevention Technologies (ETV-MF) Program, one of 12 technology focus areas under the ETV Program, in cooperation with EPA's National Risk Management Research Laboratory. The ETV-MF Program has evaluated the performance of a wastewater treatment system for processing of wastewater from metal finishing operations. This verification statement provides a summary of the test results for the Lobo Liquids Rinse Water Recovery System.

## VERIFICATION TEST DESCRIPTION

The Lobo Liquids Rinse Water Recovery System (Lobo Liquids system) was tested, under actual production conditions, processing metal finishing wastewater, at Gull Industries in Houston, Texas. The verification test evaluated the ability of the treatment system to remove regulated contaminants from the wastewater and recover the wastewater for reuse.

During the test, the Lobo Liquids system was used as a stand alone treatment/water recycling technology. The test consisted of monitoring the ion exchange (IX) system operation for an entire cycle of the ion exchange process, which lasted 15 production days. During testing, the system was operated during production hours, which consisted of one shift per day. It was used to process and recycle wastewater from the electroplating line. Samples were collected of the raw wastewater, final treated wastewater, and ion exchange regenerant. Chemical usage, electricity usage and labor data were collected to perform the cost analysis.

## TECHNOLOGY DESCRIPTION

The Lobo Liquids Rinse Water Recovery System consists of three skid-mounted, ion exchange pressure vessels, with interconnecting piping and control valves. The system is configured with one cation exchange column and two anion exchange columns. It is also equipped with a PC-based control system that automates the recycling process. The Lobo Liquids system is designed to treat and recover for reuse wastewaters generated by metal finishing processes. Most of the wastewater generated from metal finishing comes from rinsing, which is performed after each process step to remove chemicals. Used rinse water contains dissolved metals and other chemicals that are associated with plating baths. To provide good rinsing and prevent contamination of the plating solutions, recycled water must meet a certain level of purity, often based on two related factors, total dissolved solids and specific conductance. In operation, wastewater from the electroplating line is pumped to the Lobo Liquids system and is processed sequentially through the cation and two anion columns. The treated water is returned to the electroplating line and reused for rinsing. The ion exchange system automatically regenerates itself when the ion exchange columns are exhausted.

## VERIFICATION OF PERFORMANCE

Verification testing was performed from January 14 – March 1, 2002. The Lobo Liquids system was evaluated with respect to key operating and performance criteria. The results of these analyses are summarized below.

**System Operation.** The Lobo Liquids system was operated for 15 days for an average duration of 9.2 hours (hrs)/day. The total operating time was 137.5 hrs. The total volume of water processed was 472,476 L (124,828 gal). The average flow rate was 58.19 L/min (15.37 gpm). Throughout the test period, the Lobo Liquids system operated automatically, without any stoppage for maintenance.

**Pollutant Removal Efficiency.** Average pollutant concentrations and removal percentages measured during the ETV test for the Lobo Liquids system is shown in **Table i**. The parameters listed in this table are regulated under current metal finishing effluent standards (40 CFR 433) and/or are found in the proposed Metal Products and Machinery (MP&M) rule (66 FR 424). The Lobo Liquids system removed 99.9 percent or greater of each pollutant parameter found in the influent above detection limits.

**Ability to Meet Metal Finishing and Proposed Target Effluent Levels.** The results from each set of analytical data were compared to the applicable Metal Finishing and Proposed MP&M limitations to determine if the Lobo Liquids system achieved these standards. Sampling was performed on four separate operating days. The Metal Finishing limitations and proposed MP&M limitations were met for all parameters for each day sampling was conducted (see **Table i**).

Parameter	Avg. IX Influent mg/L	Avg. IX Effluent mg/L	Average % Removal*	Effluent Meets Metal Finishing and MP&M Standards? (Yes/No)
Sulfide	ND	ND	-	-
O &G (HEM)	ND	ND	-	-
TOC	5.5	ND	100.0%	Yes
Cadmium	ND	ND	-	-
Chromium (T)	3.23	<0.01	99.9%	Yes
Chromium +6	3.92	ND	100.0%	Yes
Copper	0.362	ND	100.0%	Yes
Lead	0.147	ND	100.0%	Yes
Manganese	ND	ND	-	-
Molybdenum	<0.13	ND	100.0%	Yes
Nickel	15.6	0.01	99.9%	Yes
Silver	ND	ND	-	-
Tin	<0.023	ND	100.0%	Yes
Zinc	0.55	ND	100.0%	Yes

ND = not detected

\*Percent removals are calculated only for pollutants found above detection limits in the raw or influent wastewater.

**Table i. Averaged Pollutant Concentrations and Removal Percentages for Lobo Liquids System**

**Reusability of Treated Wastewater.** The reusability of the treated wastewater as process water was determined by comparing the results of the specific conductance and total dissolved solids (TDS) analytical tests of the Lobo Liquids system effluent to standards used by Gull Industries for water reuse. Treated water meeting these standards was deemed reusable. The Gull Industries standards are:

- Specific conductance: maximum of 500 µS
- TDS: maximum of 250 mg/L

The Lobo Liquids system met the Gull Industries water reuse criteria throughout the entire IX cycle. The specific conductance of system effluent samples was measured at or below 10.5 µS for operating days 1 to 3 (15-day operating cycle), and the highest TDS measured was 56 mg/L. On day 14, the specific conductance of the system effluent increased to 426 µS. The system automatically went into regeneration mode on day 15. It was observed that Gull Industries reused all water produced by the Lobo Liquids system as rinse water on their electroplating line during the test, and that no wastewater except after IX regenerant treatment, was discharged to the city sewer system.

**Regeneration.** The Lobo Liquids system is regenerated after the ion exchange resin beds are chemically full. Passing dilute hydrochloric acid through the cation exchange column and dilute sodium hydroxide through the anion columns, and subsequently rinsing the columns with water regenerates the IX columns. The liquid from these steps is collected into a storage tank. The quantities of chemicals used during regeneration were 901 L (238 gal) of concentrated hydrochloric acid and 1,154 L (305 gal) of caustic (50 percent). These chemicals were diluted with water prior to being used for regeneration. The total volume of wastewater produced during regeneration, including that from rinsing the columns, was 9,690 L (2,560 gal).

**Additional Pollutant Removal.** The additional pollutant removal of the Lobo Liquids system installed at Gull Industries was measured by determining the quantity of regulated pollutants removed beyond the level required by the current metal finishing regulations (40 CFR 433). The additional pollutant removal from use of the Lobo Liquids system is a reduction of 3,812.4 g (8.4 lbs) of regulated metals for the test period. On an annual basis (260 days/year), assuming 31,498 L (8,322 gal) of wastewater treated per day, the additional pollutant removal is a reduction of 66,082 g/yr (145.6 lbs/yr) of regulated metals discharged from Gull Industries.

**Energy Use.** The power consumption of the Lobo Liquids system is 0.43 kWh/1,000 L (1.63 kWh/1,000 gal) of wastewater processed. The power is by operating pumps and electronic instrumentation.

**Operation and Maintenance.** The following parameters were considered in the cost analysis: chemical reagents, electricity, and labor. The non-labor operating cost for the Lobo Liquids system, excluding labor, was \$1.50/1,000 L (\$5.69/1,000 gal) and \$2.22/1,000 L (\$8.42/1,000 gal), including labor. The cost savings from water/sewer cost reduction at Gull Industries is \$1.72/1,000 L (\$6.50/1,000 gal). Operation of the Lobo Liquids system requires approximately one hour of labor per day, which is for starting and stopping the system and periodically checking on its progress. No maintenance tasks were performed during the verification test.

**SUMMARY**

The effluent produced by the Lobo Liquids system meets all existing and proposed effluent standards for the metal finishing industry. The removal rate for all regulated parameters found in the Gull Industries influent was 99.9 percent or greater. The effluent from the system had a consistently high quality and it met Gull Industries recycle criteria.

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