Environmental Technology Verification for Metal Finishing Pollution Prevention Technologies (ETV-MF) Program

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The U.S. Environmental Protection Agency (EPA) and Concurrent Technologies Corporation (*CTC*) have completed a program for the metal finishing industry called the Environmental Technology Verification for Metal Finishing Pollution Prevention Technologies (ETV-MF) Program. This Program conducted performance verification testing of innovative, commercial-ready technologies designed to improve industry performance and achieve cost-effective pollution prevention in metal finishing operations.

This paper will summarize the results of the 10 technology verification tests conducted by the ETV-MF Program, and provide the EPA web site where the detailed test reports can be reviewed.

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Introduction

Concurrent Technologies Corporation (*CTC*) in partnership with the U.S. Environmental Protection Agency (EPA) established the Environmental Technology Verification for Pollution Prevention (P2) Metal Finishing Technologies (ETV-MF) Pilot Program in June 1998. The ETV-MF Program was established to accelerate the entrance of new metal finishing related environmental technologies into the domestic and international marketplace, by providing technology buyers, consulting engineers, states, and EPA regions with high quality data on the performance of new technologies. The concept was well received by the metal finishing community and quickly developed into an internationally recognized program of the highest standard.

From the inception, the ETV-MF Program worked closely with industry user groups including the American Electroplaters and Surface Finishers (AESF) Society, National Association of Metal Finishers (NAMF) and Metal Finishing Suppliers' Association (MFSA) to identify industry needs and establish a metal finishing technology verification program within the ETV framework. Numerous ETV-MF stakeholders representing a cross section of high technology sectors continue to play a collective role in forming industry vision and government relations. The ETV-MF Program has been a means of actively supporting the metal finishing community in verification of innovative, commercial-ready technologies designed to improve industry performance and achieve cost effective P2 solutions.

The ETV-MF Program prepared solicitations that were issued through the Commerce Business Daily, the EPA ETV Internet website, trade journals, and direct mailings, requesting technology suppliers to volunteer their technology for testing. As a result of these solicitations, technology suppliers for 23 different technologies formally applied for verification testing. Of these 23 technologies, the ETV-MF Program completed 10 different technology verification tests. When initiating a technology verification test project, technology specific verification test plans were developed cooperatively between *CTC*, EPA, stakeholders, certified analytical laboratories, and the technology supplier. These test plans incorporated rigorous quality assurance/quality control (QA/QC) requirements specified in American National Standard *Specification and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs,* [1] and the EPA ETV Program Quality Management Plan [2]. Contents of the test plans included:

- Description of the technology,
- Theory of operation,
- Operational characteristics of the test site,
- Test goals and objectives,
- Experimental methodology,
- Critical and non-critical measurements,

- Operational characteristics of the technology,
- Sample collection and handling procedures,
- Analytical methods,
- Laboratory QA/QC requirements,
- Calculations,
- Quality audits to be conducted, and
- Project management requirements.

Technology verification tests were conducted according to the test plan in metal finishing shops under actual operating conditions. The ETV-MF Program tested metal finishing P2 technologies in the areas of:

- Energy Conservation,
- Water Use Reduction and Recycling,
- Sludge Reduction,
- Aqueous Cleaner Maintenance, and
- Chromate Conversion Coating Solution Maintenance,

and evaluated additional technologies for testing in the areas of:

- Electroless Nickel Bath Maintenance,
- Metal Recovery and Recycling, and
- Mineral Acid Bath Maintenance.

The technologies tested are shown in Table 1, along with a summary of the test results. Following the verification test, verification test reports were prepared that included the following information:

- Verification statement (executive summary) signed by EPA,
- Description of technology as installed at the test site,
- Technology set-up and operation during the test,
- Results of laboratory QA/QC calculations,
- Analytical results,
- Process measurements,
- Evaluation of results, and
- Performance of technology during the test.

Verification test plans and test reports are available for review at the EPA Environmental Technology Verification Program web site www.epa.gov/etv [3].

Technology Backlog and Partnering

Efforts to verify the performance of the backlog of 13 technologies centered on establishing future partnering arrangements, which was a topic of discussion at the last two ETV-MF stakeholder meetings held in June 2001 and January 2002. Partnering arrangements were sought in an effort to enhance information diffusion and promote cost sharing necessary to verify a backlog of innovative technologies in states with a direct stake in a particular technology. During the final phase of the program, state, local, and other organizations such as technical associations, the Department of Defense (DOD), and the Department of Energy (DOE) were contacted along with the EPA in an attempt to obtain continued support for future verification testing and enhance information dissemination. In addition, two memorandums of agreement (MOA) are in place between the EPA ETV Program and the Department of Defense [4], and the State of Massachusetts [5] to encourage joint technology verifications. It is envisioned that memorandums of agreement at the Federal and state level can be utilized to leverage common agency resources and objectives.

As the highlight of the partnering efforts at the state level, the ETV-MF Program discussed a $50,000 matching grant opportunity for a P2 Technology Demonstration with the Michigan Department of Environmental Quality (MDEQ). While this grant was specifically intended for chemical manufacturers in the state of Michigan, future supplemental funding opportunities were discussed that would be suitable for program objectives. The MDEQ expressed an interest in partnership with the EPA and *CTC* on the ETV-MF Program and provided a formal letter of partnering intent. Although the QVF Process Systems, Inc., evaporator technology was an excellent candidate suitable for verification testing at Plastic Plate Inc., in Grand Rapids, Michigan, the state of the domestic economy made the required level of participation unrealistic for this technology supplier.

The Alabama Department of Environmental Management (ADEM) and Arizona Department of Environmental Quality (ADEQ) also made efforts to explore grant opportunities and other funding vehicles for the Biomin, Inc., organoclay technology at Gulf Plating in Mobile, Alabama, and BASX Systems microfiltration technology at METCO in Phoenix, Arizona. Work was initiated to identify project scope and possible areas of collaboration with the two agencies.

The Florida Department of Environmental Protection (FDEP) furnished valuable time and effort to explore and discuss grant opportunities and other funding vehicles. A draft proposal was prepared that identified potential projects and areas of collaboration with the FDEP. The FDEP stated that the current area of interest was the reduction of municipal solid waste streams, and that recycling grants had been issued in the past.

Additionally, the ETV-MF Program explored the use of the existing EPA ETV Program / Massachusetts MOA for a collaborative effort in testing the CASTion® Corp. technology at Columbia Manufacturing, in Massachusetts. The State of Massachusetts initially showed an interest in this project based on the value to metal finishers within the state; however, the

technology was faced with a substantial prove-in period, which impacted foreseeable partnering efforts.

In general, much interest was voiced by state agencies in support of collaborative environmental technology testing, verification, and technology transfer activities with emphasis on P2, waste minimization, and on-site recycling for metal finishers. Mutual efforts between the ETV-MF Program and state organizations showed promise regarding partial funding of joint P2 projects. Working together with state organizations helped the program to leverage valuable science, technology, and regulatory resources, which have led to the establishment of a high quality environmental technology verification testing center.

Due to an industry awareness of the ETV-MF Program through effective outreach efforts, suppliers continued to submit unsolicited applications to be verified. American Plating Power met with *CTC* in Largo, Florida, to discuss their desire to have the performance of their innovative reverse pulse plating rectification technology verified by the ETV-MF Program. American Plating Power has a large number of units installed in the printed circuit board manufacturing industry, and is interested in verification to help enter the general plating industry market. In October 2001, American Plating Power formally submitted an application to be verified by the ETV-MF Program.

Upon the completion of the five-year mission the ETV-MF Program has succeeded in establishing a fully functioning center for verification testing of technologies applicable to the metal finishing industry. Quality criteria have been established at the process and program levels to ensure EPA ETV Center integrity.

Credits and Closing

The ETV-MF Program thanks the quality staff of the U.S. EPA Office of Research and Development as well as partners, stakeholders, and technology suppliers for contributing valuable time, experience, and vision during the successful five-year program. The program would also like to thank AESF, NAMF, and MFSA. These technical organizations have been integral in providing a platform from which to disseminate key program information to the metal finishing and supplier community. A list of invaluable partners and stakeholders is provided to recognize key individuals for countless in-kind contributions. Be sure to talk with these stakeholders and suppliers for their views on the value of this program to the metal finishing industry.

CTC looks forward to future efforts that assist the metal finishing industry in facing the new challenges of a dynamic global economy and continues to have a vested interest in regulatory compliance, quality, process improvement, efficiency improvement, safe facilities, pollution prevention, and resource conservation.

For additional information or related expertise please contact either George T. Moore Ph.D. (EPA) or Mr. Donn W. Brown P.E. (*CTC*).

References

[1] American National Standard Specification and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs, ANSI/ ASQC E4-1994.

[2] EPA Environmental Technology Verification Program Quality Management Plan, EPA Report No: 600/R-03/021, December 2002.

[3] EPA Environmental Technology Verification Web Site, www.epa.gov/etv, November 2003.

[4] MOA between EPA and DOD for Collaborative Environmental Technology Verification, July 1999.

[5] MOA between EPA and State Of Massachusetts for Collaborative Environmental Technology Verification, August 2001.

Table 1. Metal Finishing P2 Technologies Tested

VENDOR	TECHNOLOGY NAME	TECHNOLOGY TYPE	TEST RESULTS
BioClean USA, LLC	BioClean System	Biological Degreasing System	Employed microbes to consume oils from aqueous cleaning baths. Reduced frequency of bath replacement. Payback period was calculated to be 6 months.
Hydrometrics, Inc.	HERO™ (High Efficiency Reverse Osmosis)	Reverse Osmosis	The system achieved a very high recovery of water treated (94 %) and a high membrane flux rate (1.6 times higher than the conventional norm).
Davis Technologies International	Industrial Wastewater Treatment Plant	Hybrid Dissolved Air Floatation / Flocculation	Removed oils and metals to near proposed Metal Products & Machinery limits.
Lobo Liquids, LLC	Lobo Rinse Water Recovery System	Ion Exchange	Met all existing and proposed effluent standards with removal rate of 99.9 % or greater. Treated water met test site recycle criteria.
Kaselco	Electrocoagulation	Electrocoagulation	The system in combination with an ion exchange polishing system effectively removed regulated contaminants from the wastewater, which was recovered for reuse.
USFilter Corporation	RETEC Separated Cell Recovery (SCR) or Purification (SCP)	Electrodialysis	Extended the bath life of chromic acid anodize solution, reducing liquid waste generation without removing the anodizing constituents of the bath.
USFilter Corporation	Silverback Aqueous Cleaner Recycle System	Microfiltration	Removed oil & TSS from alkaline and acid cleaning baths, extended bath life, reducing liquid and solid waste generation without removing the cleaning constituents of the bath.
KCH Services, Inc.	Energy Conservation System	Tank Cover & Exhaust Control System	The technology when placed on a tank system with ventilation and heating requirements resulted in a reduced need for ventilation and energy demand.
Hadwaco, US	Mechanical Vapor Recompression Evaporator	Evaporator	The technology concentrated an acidic copper solution sufficiently enough to reclaim the copper, recycle the sulfuric acid back to the pickling bath, and recycle purified water back to the rinsewater tank.
The MART Corporation	MART EQ-1 Wastewater Treatment System	Coagulation	Reduced off-site hazardous waste disposal by 93% by removing contaminants allowing alkaline cleaner to be recycled without significantly removing cleaner constituents.

ETV-MF Partners and Stakeholders

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