California Environmental Protection Agency

DEPARTMENT OF TOXIC SUBSTANCES CONTROL

POLLUTION PREVENTION PROJECT WITH THE METAL FINISHING INDUSTRY

SUMMARY REPORT OF PHASE 1: JULY 2007- MARCH 2010

APRIL 2013

Department of Toxic Substances Control

DEPARTMENT OF TOXIC SUBSTANCES CONTROL

The mission of DTSC is to protect California's people and environment from harmful effects of toxic substances through the restoration of contaminated resources, enforcement, regulation and pollution prevention.

Bob Gipson,
Project Lead

Jeff Wong, Ph.D.,
Acting Deputy Director

EXECUTIVE SUMMARY

This report summarizes activities of Department of Toxic Substances Control's (DTSC's) Metal Finishing Team (Team) in a pollution prevention (P2) project with the metal finishing industrial sector, commissioned by DTSC Director Maureen Gorsen and conducted between July 2007 and March 2010. The Project's three broad objectives were (a) to characterize, first-hand, this sector's P2 and source reduction accomplishments; (b) to identify challenges to P2 improvement; and (c) through hands-on assistance, to proactively encourage P2 improvements by the sector. This Project encompassed work performed by the Focused Industry P2 (FIP2) Project, and work performed by DTSC's Metal Finishing Model Shop Program during the time period covered by this report.

The Project met several logistics challenges at the outset, including: (a) establishing a statutory basis for conducting P2-assistance-type, non-enforcement site visits; (b) winning metal finishers' cooperation for such visits; and (c) establishing how to address minor violations if encountered during such visits. Such challenges were resolved through research, planning, Team meetings, and securing advice from Team sponsors. For the statutory basis for P2 assistance visits, the mandates of Senate Bill 14 (SB14) and Senate Bill 16 (SB1916) were selected. This same basis was employed as a strategy to win businesses' voluntary cooperation for visits. Procedures for addressing minor violations were based on existing policies of DTSC, the U.S. Environmental Protection Agency (USEPA), and the California Department of Industrial Relations, and on advice from Metal Finishing Team advisors. A later challenge to the Project was determining how to integrate DTSC environmental justice (EJ) objectives. This was resolved by mapping metal finishing facilities with respect to neighborhood demographics and proximities to sensitive environmental receptors.

Under the Project, P2 assistance visits to 15 metal finishing businesses were accomplished, as a result of which several businesses made operational improvements. For example, Electrochem Solutions, LLC, in Union City, California, implemented changes that reduced its water usage by two-thirds while maintaining constant production. Other businesses adopted Team recommendations that greatly reduced the potential for wet floors.

This report includes highlights of valuable P2 measures found in SB14 reports submitted by facilities, including testimony by a facility that credited its source reduction successes to SB14 requirements. This Report also includes a summary of Model Shop Program work during the time period covered by the Report.

Major findings of the Project include (a) A surprising number of metal finishing companies could benefit from simple, in-house changes, such as rudimentary drag-out reduction measures; (b) For many businesses, a large potential exists for source reduction—and monetary savings—through investment in measures such as ion exchange and improved waste treatment systems; (c) A need exists for raising awareness of the benefits of properly operating ion exchange systems; and (d) Some businesses have independently adopted strikingly innovative P2 measures.

Based on Project findings, final recommendations include (a) The regulated community, Certified Unified Program Agencies (CUPAs) and the environment could benefit from a continuation of this Project into Phase 2, and build upon successes described herein; (b) A need exists for a "tiered" Model Shop Program having has less stringent requirements than the current Model Shop Program; (c) Recognition should be given to businesses that adopted DTSC recommendations under the FIP2 project; (d) Recognition should be given to businesses for exemplary, independent P2 achievements; (f) A need exists for amending DTSC's recycling statutes for clarity; and (f) DTSC should create a web-based P2 information exchange for metal finishers.

TABLE OF CONTENTS

A Introduction: Project Origin, Authority, Mission, Goals and Objectives 1

B Summary of Tasks and Accomplishments 3

C Model Shop Program and Workshops 8

D FIP2 Site Visits 12

E Analysis of 2006 SB14 data 34

F Findings 41

G Conclusions and Recommendations 43

A. INTRODUCTION

Team Sponsors: Kim Wilhelm, Supervising Hazardous Substances Engineer II; and Pauline Batarseh, Assistant Deputy Director, Office of Pollution Prevention and Green Technology.

Team Leader: Bob Gipson.

Team Members: Nancy Carder, Joseph Cully, Natalie Marcanio, Evelina Rayas, Nabil Yacoub, Sarojini Balachandra, Patrick Movlay, Maya Akula, Ed Benelli, Robert Senga, Allison Saldana, Fereshteh Ebnesharashoob, Nirupma Suryavanshi and Kian Soleiman.

Project Origin: In 2007, DTSC Director Maureen Gorsen directed the Office of Pollution Prevention and Green Technology (OPPGT) to explore ways to induce certain industrial sectors to improve their performance in hazardous waste source reduction. In the metal finishing industry sector, groundbreaking P2 work had already been performed by DTSC's Model Shop Program. Additionally, metal finishers were the focus of a DTSC compliance (enforcement) initiative. In view of this, and with the understanding that enhanced P2 efforts by a company usually enhance regulatory compliance, Ms. Gorsen commissioned a new Metal Finishing P2 Project, and Metal Finishing Team, tasked with developing strategies to aggressively induce metal finishers to improve P2 and source reduction. This report summarizes the work of that Project from July 2007 to March 2010. It includes work performed under the Focused Industry P2 (FIP2) Project, which benefitted greatly from earlier experiences of DTSC's Metal Finishing Model Shop Program. Also, because Model Shop work performed during the period covered by this report was closely connected with the Project, summaries of Model Shop work during that period are included in this Report.

Authority: The project implemented the following:

1. Statutory mandates of SB14 and SB1916.
2. Two DTSC Strategic Plan objectives:
   - Objective 3.1: Environmental Justice. Beginning in 2008 and continuing, advance environmental justice in California by reducing the use of hazardous industrial chemicals in low income and/or minority communities, and in consumer products preferentially used by these populations.
   - Strategy 3.1.1: Industrial Operations: Expand programs targeting metal plating/finishing for input substitution and process improvement.
3. Three DTSC Performance Measures:
   - Measure 2.1.1: Number of entities adopting P2/Green Chemistry; Percentage of entities adopting P2.
   - Measure 2.1.2: Number of P2 measures and projects that advance Environmental Justice goals.
   - Measure 2.1.3: Percentage of P2 pilot projects that result in widespread application/implementation.

Mission: To measurably improve pollution prevention, source reduction and regulatory compliance by metal finishers through enhanced outreach and hands-on assistance.

Goals: The project was launched with three essential goals:

- To measurably increase P2, source reduction, and shift to green alternatives by California metal finishers.
- To increase compliance and eliminate wet floors.
- To increase participation in the Model Shop Program.

Objectives: To implement the above goals, several specific objectives were developed, which are summarized in Table I. Each objective, rather than corresponding to a particular goal, contributed to all three of the above goals equally. Table I also indicates a percent completion of each objective. Objectives 2-8 were 50 percent completed as they were predicated on the Team completing P2 site visits to 30 carefully selected metal finishing shops. Due to late-emerging resource challenges, only 15 site visits were completed in the first phase of the project (as of March 2010).

TABLE I PROJECT OBJECTIVES AND PERCENT MET

Project Objectives	Percent Met
Enhance P2 outreach to the metal finishing sector via educational workshops, presentations, and dissemination of printed and web information.	95%
Directly engage (partner with) 30 shops to provide, where feasible, hands-on P2 assistance and recommendations.	50% Based on 50% of planned site visits (15 of 30) completed
Identify notable P2 achievements of shops visited.	
Identify, on a case-by-case basis for 30 shops, changes in business practices most needed and attainable.	
Identify, on a case-by-case basis for 30 shops, barriers (economic and otherwise) to shops pursuit of available P2 opportunities.	
Identify technical problems shops have faced in implementing P2 measures.	
Recruit shops for the Model Shop Program.	
Produce an SB14 Source Reduction Assessment Report to publicize project findings.	

B. SUMMARY OF TASKS AND ACCOMPLISHMENTS

To implement the objectives, sixteen specific tasks were developed. Some were identified at the beginning of the project, others developed as the project progressed. These tasks, and the accomplishments from each task, are described below. For four of the more complex tasks (the Model Shop Program, FIP2 Site Visits, Data Analysis and Conclusions and Recommendations), more detailed descriptions are provided in later sections of this report.

1. Scheduling and holding regular Team meetings.

Accomplishments: Meetings were held to facilitate the development and implementation of the project. Meetings were originally planned to be bi-weekly. Due to several factors including challenges in scheduling meetings when all Team members were available, Team meetings became essentially bi-monthly. In meetings, consensus was sought, and in most cases attained, on many of the important issues described in subsequent sections of this Report.

2. Initial project planning.

The Team tackled the challenges of defining the universe of metal finishing businesses, defining criteria by which to select a number of shops that the team could realistically work with, and developing a strategy for approaching shops. A major strategy consideration was how to overcome reluctance of shops to participate in a voluntary P2 assistance program. Shops were afraid of DTSC visiting them for any reason, given that DTSC visits to plating shops historically resulted in high monetary fines. This reluctance of shops to participate in a voluntary program had also been recognized as a challenge for Model Shop Program enrollment.

Accomplishments: To address these challenges, the initial working solution developed to select program shops was to use available databases, such as the Hazardous Waste Tracking System (HWTS) and SB14 database, to identify metal finishing shops that were the largest generators, and to approach those shops first. To overcome shop reluctance to participate, the working solution developed was to use SB14 authority to approach shops; specifically, the authority granted DTSC in sections 25244.17 and 25244.17.1 of the Health and Safety Code. At the same time, the Team informed shops prior to visits that its purpose was P2 assistance, that the site visits were not “inspections,” and that Team staff DTSC would not cite any violations except any perceived as immediate threats to human health and the environment. Using this strategy, the Team successfully made arrangements with 22 shops for P2 assistance visits. By late 2008, the Team was in the process of making arrangements with eight other shops.

3. Distinguishing DTSC P2 efforts from DTSC Enforcement.

From the Project’s outset, the Team DTSC realized that P2 site visits under this Project were not Compliance Evaluation (enforcement) Inspections (CEIs). DTSC’s Enforcement Division does critical work. Serious violations must be addressed. Principal hazardous waste streams of metal finishers include heavy-metal-laden alkaline rinse waters, parts cleaning solvents [e.g., methyl ethyl ketone (MEK)], heavy-metal-laden plating baths, cyanide solutions and acid solutions, and hazardous solids such as metal sludges and buffing dust bearing heavy metals. Due to the potential for, and ample history of, releases of such wastes by metal finishing businesses, USEPA, DTSC, and other agencies have in the past been involved in enforcement initiatives focused on the metal finishing industry.

At the same time , DTSC and USEPA have recognized, through experience, that adoption of simple P2 measures by metal finishers has significant potential to prevent violations, especially when companies are made to realize the economic benefits of P2. For that reason, USEPA has for several years been aggressively promoted P2 with metal finishers , and DTSC has followed USEPA's example.

Accomplishments: For this Metal Finishing Project, particular needs were identified by the Team to clearly distinguish its P2 effort from Enforcement, both functionally and in the mind of industry. Those needs included:

a. The success of this project, as with the Model Shop Program, depended upon willing cooperation from industry, i.e., trust-building. Two former DTSC directors, Maureen Gorsen and Maziar Movassaghi, in high profile meetings with California's Metal Finishing Association, emphasized that DTSC sought to make as many businesses "Model Shops" as possible. That initiative underscored the need to functionally distinguish P2 from Enforcement.

b. P2 site visits necessarily differed from Enforcement inspections in that they demanded an entirely different focus of DTSC staff energies.

The Team engaged in considerable discussion concerning these needs, including but not limited to the following:

a. Review and discussion of policies of USEPA and the California Department of Industrial Relations, which agencies separate their respective industry assistance programs distinctly from their enforcement programs. Metal Finishing Team member Nabil Yacoub provided background information and his experience on this subject.

b. Recognition that P2 site visits do not meet the definition of "inspection" in California Health and Safety Code (H&SC) section 25165; and therefore, P2 staff were not legally obligated to cite companies for any minor violations observed during P2 visits. At the same time, it was clarified that Team staff would be obligated to report, to the appropriate local authority, any situations observed that posed, in staff judgment, an imminent threat to human health, safety, or the environment.

As a result of this review and discussion, during the fifteen P2 site visits conducted, P2 staff did not inspect drum labels, take samples, or perform other tasks associated with Enforcement's Compliance Evaluation Inspections (CEIs). Notwithstanding, in arranging all P2 site visits beforehand with shop officials, Team staff informed the officials that, although the P2 visits would not be CEIs, if during the visit Team staff observed any serious violation, the staff would be obligated to refer the observation to the local enforcement authority.

4. Initial data acquisition and analysis.

Data was needed to define the exact universe of metal finishing facilities that the Team would be working with.

Accomplishment: The Team performed research and analysis of manifest data and other databases to define the metal finishing universe. Team staff also performed database research to identify any possible metal finishing businesses that might be active but not in DTSC's hazardous waste manifest system, which circumstance would flag that such businesses might be disposing of electroplating wastes illegally. The Team also enlisted help from the Western States Hazardous Waste Project in this data analysis.

5. Selecting candidate metal finishing facilities.

After defining the metal finishing universe, it was necessary to strategically select facilities both for the Team's P2 assistance efforts and for purposes of conducting an SB14 assessment of the metal finishing industrial sector.

Accomplishment: Team staff conducted compliance (enforcement) background checks on a large list of initially selected shops. Fifty shops passed the compliance background checks. Those 50 became the initial working list of facilities for the Project. DTSC understood that some facilities, upon contact, might be unwilling to participate in a voluntary P2 project, and would be culled from the list. The ultimate goal was to secure a final selection of 30 willing candidates. The 30 selected facilities were sent "call-in" letters, i.e., registered letters officially requesting copies of their SB14 Plans for the SB14 reporting year 2006.

6. Assignment of facilities to Team members.

Because site visits to metal finishers were to be central to the Project, a determination was needed as to which, and how many, facilities would be assigned to each Team member.

Accomplishment: Because Team staff worked at different DTSC office locations, various facilities were assigned to staff geographically, i.e., based on each the facility's proximity a particular DTSC office. Proximity was determined by geo-coding facility locations. As a starting point, four facilities were assigned to each Team member to test how this number worked out as the Project progressed. SB14 Plans of assigned facilities were sent to the respective Team member for review prior to scheduling site visits.

7. Model Shop Program and Workshops. The Team was fortunate to have two DTSC staff who managed the Metal Finishing Model Shop Program (MFMSP), a program that pre-dated the Metal Finishing Project. Initiated in 2005, the MFMSP helped metal finishing shops reduce waste and emissions, reduce costs by improving production efficiency, and improve regulatory compliance and worker health and safety. Due to functional overlaps between the MFMSP and the Metal Finishing Project, the prior experience of MFMSP staff were a great benefit to the Project, and a summary of MFMSP accomplishments and Workshops are included in this Report.

8. Focused Industry Pollution Prevention (FIP2) Site Visits.

Under Phase 1 of the Project, Metal Finishing Team staff conducted site visits to 15 metal finishing facilities in southern and northern California. These visits had a dual purpose of providing P2 assistance and collecting information for completing an SB14 Source Reduction Assessment of the metal finishing industrial sector. FIP2 accomplishments are described in detail in a later section of this report.

9. Collaboration with trade organizations.

The relevant trade associations are the National Association of Surface Finishing (NASF), the Metal Finishing Association of Southern California (MFASC), and the Metal Finishing Association of Northern California (MFANC). DTSC collaboration with these associations is a mutually beneficial relationship since both have vested interests in promoting P2 and industrial regulatory compliance. In some respects, the trade associations serve as a neutral go-between between regulatory agencies and the industry.

Accomplishment: DTSC's collaborated with the associations to promote P2 and to keep industry abreast of new regulatory requirements, and initiatives such as DTSC's recent cyanide regulations, wet floor initiative, and Model Shop Challenge. Conversely, collaboration with trade organizations continues to help DTSC keep a pulse on the latest technical developments. Team staff participated in several MFANC and MFASC vendor showcases; delivered presentations at MFANC and MFASC meetings; and in June 2008, attended the National Association for Surface Finishing (NASF or SUR/FIN) conference in Indianapolis, Indiana.

10. Environmental Justice Sub-Project.

In mid-2008, DTSC management directed that the Metal Finishing Project develop and incorporate an environmental justice (EJ) component.

Accomplishments: This new direction from DTSC management necessitated a new round of planning to determine the most realistic and productive approach to EJ, and was the subject of several Team meetings. The approach the Team decided upon was two-fold: (a) to place special project emphasis on metal finishing shops located in previously identified EJ areas; and (b) to select, by geocoding (mapping), facilities based on demographic factors and proximity to key environmental receptors (e.g., schools, hospitals, drinking water wells), and give Project priority to those facilities. For the mapping, the Team DTSC coordinated with DTSC's its Office of Data Analysis and Environmental Indicators (ODEEI). The Metal Finishing Team's leader prepared and gave presentations to Executive Staff on the Team's EJ strategy. The Team coordinated with EJ initiatives of the California Air Resources Board (ARB), California Environmental Protection Agency (Cal/EPA), and DTSC's EJ Task Force headed by Florence Gharibian. The Team added two additional DTSC staff, Maya Akula and Patrick Movlay, who both had prior experience with EJ community-based projects. The Team also coordinated with Site Mitigation staff who were involved in past DTSC EJ-type projects involving heavy public participation, most notably the West Oakland Local Advisory Group (WOLAG) project. Those staff provided summary information on the WOLAG project to DTSC's EJ Task Force. The Team participated in an EJ Task Force's bus tour in Fresno.

11. Developing a formal Work Plan.

The Project was launched in 2007 without initially developing a formal work plan. There were two reasons for this. First, there was a strategic urgency to launch the Project as soon as possible, because one project objective was to produce a comprehensive SB14 assessment for the metal finishing sector based on P2 site visits to a minimum of 30 metal finishing shops. As discussed previously, strategy advantages were seen in approaching shops under the auspices of SB14, as opposed to an enforcement context. When the Project was launched in mid-2007, the time window for completing the SB14 assessment, and for completing 30 site visits, was short. For that reason, site visits needed to begin as soon as possible.

The second reason was that the Project work was already consistent with OPP&GT's existing general work plan, and the Project at its outset had a clear written charter, mission, goals, and key objectives by which to proceed. In late 2008, however, a decision was made by DTSC management that a formal work plan for the Project be developed.

Accomplishment: A comprehensive work plan for the Project was developed. The development of the work plan was the subject of many Team meetings. Several draft versions of the work plan was sent for comments by Team members and DTSC Management.

12. Team Leader Training.

Accomplishment: A two-week training class in project management was taken by the Team leader.

13. Contributing to Proven Technologies and Remedies (PT&R) Guidance Document.

Accomplishment: The Team leader provided input and comments for the PT&R Team's guidance document, Investigation and Cleanup of Plating Facilities.

14. Acquisition, collation and analysis of SB14 data.

Metal Finishing Team staff reviewed, sorted, and analyzed data from SB14 reports from several hundred metal finishing companies for the SB14 reporting year of 2006, including companies whose secondary business was metal finishing. This task exploited, for the first time, the wealth of P2 information stored in the narrative comment fields of the SB14 database, submitted by hundreds of metal finishers in their 2006 SB14 Summary Progress Reports (SPRs). Details on this task and accomplishments are in a later section of this report.

15. University Collaboration.

Accomplishments: This was a proposed collaborative project with universities to assist metal finishers with source reduction and efficiency. The collaboration was conceived as a solution to several issues including (a) limitations of DTSC staff and resources for providing one-on-one assistance to the many metal finishers in the state; and (b) the inability of universities to themselves attract businesses to their "industry assistance" programs, despite financial and technical resources available to the universities. Team members identified three prominent state universities having resources and interest in such collaboration, laid groundwork for such a project by conducting introductory feasibility conferences with university principals involved, and began drafting a formal feasibility study/grant proposal. Work on this collaboration was discontinued concurrent with a management decision to conclude Phase I of the Project.

16. Analysis of project findings, and developing conclusions and recommendations.

This analysis, and resultant recommendations and conclusions, are detailed in later sections of this Report.

C. METAL FINISHING MODEL SHOP PROGRAM AND WORKSHOPS.

The Metal Finishing Model Shop Program (MFMSP) is a voluntary pollution prevention program developed to help a metal finishing business run a cleaner and safer shop by assisting them in identifying possible pollution sources within their businesses, and in finding ways to eliminate or reduce the pollution, conserve energy and water, increase regulatory compliance and improve worker health and safety, and become more environmentally responsible. In this program, DTSC has partnered with several state and local agencies, and metal finishing industry associations. The MFMSP requires that interested metal finishing shops apply and meet certain qualifications before being accepted. Once accepted, a business must implement at least one new P2 strategy within its operations and have no current or pending compliance actions. Once a shop successfully completes all the steps in the program, the business will earn its "Model Shop" status and be awarded media recognition for the accomplishment. In addition, the MFMSP also organizes P2 and compliance workshops for metal finishers, and delivers presentations at various functions to promote the Model Shop Program. Following are details on both the Model Shop process and compliance workshops.

1. The Model Shop Process: For each metal finishing business (shop) that submits an application to DTSC for the MFMSP, DTSC's Model Shop staff performs the following tasks:

   a. Review the MFMSP application and background information relative to the facility, including but not limited to: compliance history; any permits the facility holds; SB14 documents (SB14 Plan, Summary Progress Report); and other information to characterize the facility's waste streams including manifest data from the Hazardous Waste Tracking System (HWTS).

   b. Perform a minimum of one or two facility site visits to:

      - Conduct a P2 assessment and formulate specific recommendations. This includes a walk-through of production and waste processing areas, and holding office conferences with facility officials. During the walk-through, Model Shop staff verify existing P2 measures and best management practices (BMPs), identify P2 measures and BMPs not currently implemented, identify innovative practices or tools, ask questions, and note any discrepancies with prior information. Office conferences are used to discuss operations observed; ask questions regarding P2 measures planned, attempted, or rejected; note any discrepancies with previous information; and request data on waste reduction normalization and operating costs.
      - Provide compliance assistance with hazardous waste management requirements, and facilitate assistance with local agencies regarding wastewater discharge and lower permitting requirements.
      - Provide training to company employees on P2 methods and hazardous waste management.

   c. Perform follow-up communications with the facility by email, phone, or follow-up visits to obtain information on any process changes or other relevant information.

   d. Based on all facility information acquired in the above tasks, characterize waste reductions achieved, waste reduction measures or alternatives implemented or planned, measures rejected and the reason for rejection; and provide recommendations to the facility.

   e. Promote, and process any applications for the Metal Plating Facility Loan Guarantee Program offered by the Business Transportation and Housing Agency. This loan program enabled facilities to purchase new P2 equipment to enable them to meet or exceed regulatory requirements. Due to a lack of industry interest, however, this program is no longer available.

f. Businesses that successfully complete the MFMSP are recognized for their pollution prevention efforts. A formal recognition of a business is conducted. DTSC coordinates closely with the business to determine the venue for the recognition. The recognition ceremony can be as simple as a formal DTSC presentation at a business or one that involves more planning such as a presentation before the city council. In addition, DTSC will prepare a press release and request inclusion of the business' success in DTSC's web site.

TABLE II THE MODEL SHOP PROCESS

Venue	No.
Applications for MFMSP received	5
Applications and background info on applicants reviewed	5
Site visits	6
Applications for Loan Guarantee Program submitted	1
Number of loans awarded	0
Number of shops completing Model Shop process	2
Recognition of shops for process completion	2

2. Model Shop P2 and Compliance Workshops/Seminars: These educational workshops/seminars for the metal finishing industry involved extensive planning and coordinating by Model Shop staff with multiple participating organizations. The workshops had large turnouts and significant positive feedback from industry participants. Table III provides an overview of tasks and accomplishments in these workshops for the time period covered by this report.

TABLE III OVERVIEW OF P2/COMPLIANCE WORKSHOPS, JULY 2007- MARCH 2010

Location & Date	Agencies Giving Presentations	Presentations Topics
SoCal 9/19/07 Attendees: 77	DTSC, South Coast Air Quality Management District, L.A. Bureau of Sanitation, City of Burbank Public Works, Sanitation Districts of L.A. County, Pacific Coast Regional Financial Development Corporation, L.A. Metropolitan Water District	Permit by Rule (PBR) Requirements; Common Hazardous Waste Generator Violations; Common Air Violations; Common Wastewater Pretreatment Discharge Requirement Violations; DTSC's Cyanide Regulations; Pollution Prevention Strategies for Metal Platers; Metal Finishing Model Shop Program; Loan Guarantee Program; Water Conservation Rebates and Incentives.
SoCal 9/17/08 Attendees: 123	DTSC; L.A. County Fire Dept.; South Coast Air Quality Management District, Sanitation Districts of L.A. County, Business, Transportation and Housing Agency, EPA Region IX, L.A. Metropolitan Water District, Sempra Utilities	PBR Requirements; Common Hazardous Waste Generator Violations; Common Air Violations; Common Wastewater Pretreatment Discharge Requirement Violations; DTSC's Cyanide Regulations Update; Pollution Prevention Strategies for Metal Platers; Metal Finishing Model Shop Program; Loan Guarantee Program; National Partnership for Environmental Priorities (NPEP); Water Conservation Rebates and Incentives; Energy Conservation.
NorCal 1/13/09 Attendees: 39	DTSC, Santa Clara County Dept. of Environmental Health	Permit by Rule (PBR) Requirements; DTSC's New PBR for Cyanide Treatment Regulations; P2 Strategies for Metal Finishers; Model Shop and Guaranteed Loan Program.
NorCal 2/18/09 Attendees: 45	City of San Jose, PG&E, USEPA	Water Conservation Rebates and Incentives – City of San Jose Program; Energy Efficiency Techniques and Incentive Programs; Pretreatment and Storm Water Compliance; USEPA National Partnership for Environmental Priorities (NPEP).

In an ongoing effort to improve future workshops, each of the four workshops distributed survey forms to attendees to complete voluntarily. Table IV is brief a summary of the survey results, as compiled from all four workshops.

TABLE IV: SUMMARY WORKSHOP SURVEY RESULTS

Number of surveys returned	164
"Most useful" topics to attendees	DTSC's Cyanide Treatment Regulations; PBR and Generator Requirements; Waste Water Discharge Requirements.
Percentage of attendees grading the workshop a "4" or "5" (on a scale of 1-5)	80% (Note: No attendee graded a workshop below a "3.")
Most frequent written comments	Presenters needed more time for topics; Attendees wanted more information and detail on topics.

The "most frequent comments" were identical for those grading the workshop a "4 or 5" as for those grading it a "3." This indicates keen interest in, and desire for, this type of educational outreach.

3. Industry/Public Outreach. Outreach to industry and the general public about the Model Shop Program was accomplished in the following ways: (a) through "boothing" and presentations at metal finishing industry vendor showcases; (b) through oral presentations at Metal Finishing Association events; (c) during FIP2 site visits, as discussed in Section D; and (d) as part of the Model Shop P2/compliance workshops, discussed above. Table V summarizes such outreaches for the period covered by this report.

TABLE V MODEL SHOP OUTREACH AND PROMOTION EVENTS

Metric	No.
At vendor showcases	6
At Metal Finishing Association events	4
During FIP2 visits	15
At workshops	4

In addition, since 2007, Model Shop staff developed and continuously updated a DTSC web page on the Model Shop Program.

D. FOCUSED INDUSTRY P2 (FIP2) SITE VISITS

Under the first phase of the FIP2 Project, Project staff conducted site visits to 15 metal finishing facilities in southern and northern California. Because FIP2 site visits needed to be voluntary on the part of facilities, it was necessary to clarify with facilities beforehand that the visits were P2 assistance visits under SB 14 authority, as opposed enforcement inspections. The facilities selected for P2 visits were those that passed thorough compliance background checks by Team staff; hence the Team's selection of a particular facility did not reflect compliance problems or a need for enforcement action.

The visits had four general sub-objectives: (a) fact finding; (b) providing information; (c) providing assistance; (d) "making a presence"; and (e) recruiting for the Model Shop Program. These sub-objectives are explained further below.

a. Fact finding: To gather first-hand information on a facility's P2 achievements, opportunities, and challenges including verifying information submitted by the facility in its SB14 Plans, and acquiring important information not listed in SB14 Plans. Acquiring this information first-hand better enabled DTSC to identify a facility's P2 opportunities as well as reasons the facility had not implemented P2 measures available to it. This revealed whether the facility was unaware of the opportunities, could not afford them, or was simply unwilling to change its operational status quo. The visits also inquired as to the success of P2 measures that a company had implemented, especially in terms of savings realized. Equally important, the visits documented problems companies encountered with P2 measures attempted.

b. Providing P2 information. Providing information to a facility that is relevant to its operations, including real-life examples of how P2 measures saved money for other businesses.

c. Where possible, providing P2 assistance or recommendations. The site visit enabled the Team to assess if and how it might be able to assist the company, either in P2 or compliance issues. In some cases, this required follow-up research by Team staff, and/or a follow-up site visit.

d. Making a presence. This is the power of "being there." For DTSC to make a presence at a facility, even if not in an enforcement role, nonetheless demands that facility's undivided attention. It focuses that facility's attention on P2 not just for the day of the site visit, but also on days leading up to and following the visit. Moreover, it demonstrates to the facility DTSC's seriousness about P2 , and DTSC's goodwill intentions of being a resource and "partner." It is not unusual for a facility to be interested in P2 possibilities yet unwilling to make the investments of time and money required. This occurs often, the Team found, solely because facility managers lacked the necessary motivation to "change the status quo." A site visit by DTSC positively influenced facilities to seriously consider changes.

e. Recruiting for the Model Shop Program. DTSC anticipated that interaction with shops under the auspices of FIP2 would encourage some shops to apply for the Model Shop.

General information on all visits. All visits were pre-arranged with the facility. The local Certified Uniform Program Agency (CUPA) representative was also notified and invited to accompany Metal Finishing Team staff on each visit. Circumstantially, no CUPA accepted DTSC's invitation. This was not unusual due to the fact that CUPAs are often short-staffed. Site visits took from two to three hours per facility. During each visit, Metal Finishing Team staff first held a 30- to 60-minute office briefing with facility officials, sometimes slightly longer in a few cases. In these office briefings, Metal Finishing Team staff explained DTSC's P2 assistance program and

established DTSC as a P2 resource for the facility, staff presented facility officials with information on DTSC's Model Shop Program, discussed information specific to the facility, asked questions, answered any questions officials had, and provided them with an informational packet ("toolkit"). This toolkit was further developed as the project progressed, and eventually included the following:

- Basic metal finishing P2 information, including USEPA publications and a USEPA digital video disk (DVD) on drag-out reduction.
- Model Shop brochure and checklist.
- DTSC's 1993 Hazardous Waste Minimization Checklist for Metal Finishing.
- List of resources for assitance in other environmental media including wastewater and air, publicly owned treatment works (POTW), household hazardous waste (HHW)].
- Information on utility rebate programs such as Santa Clara County's Water Efficient Technologies (WET) Program, which offers rebates of up to $50,000 to commercial, industrial, and institutional water customers for implementing process and equipment changes that reduce DTSC's water usage.
- Tutorial on DTSC's Envirostor database.
- Guidance on identifying illegal hazardous waste dumping and/or clandestine drug labs in the community.
- List of most common violations for plating shops.
- DTSC wet floor guidance document.

The office briefing was followed by a comprehensive production area (shop) tour, which involved more questions and answers, and note-taking. During most site visits, a second office briefing followed the shop tour.

Metrics for Site Visit: The Team Leader developed metrics for its accomplishments during each FIP2 site visit. The metrics continued to be developed as the project progressed and more visits were completed. After the first few visits, the Team was better able to determine what could be realistically accomplished since these types of P2 visits were rather new and exploratory. Eventually, eight metrics were developed; in each site visit, Team staff would:

a. Document successful P2 measures implemented by the facility that might be of interest to other facilities –especially novel P2 measures.
b. Document chemical replacements (less toxic alternatives) successfully implemented by the facility.
c. Document problems the facility encountered with P2 measures.
d. Document new P2 measures the facility is investigating the feasibility of.
e. Provide informational toolkit to the facility.
f. Make technical recommendations to the facility, where appropriate.
g. Document team recommendations acted upon or adopted by facility based on follow-up contact.
h. Perform follow-up research on questions (technical P2 or regulatory) asked by the facility of the Team.

The metrics are somewhat generic, in order to compare visits to a variety facilities. Each facility had different production processes, degrees of technical sophistication, and economic limitations. Consequently, some metrics applied better to some facilities than to others. Table VI provides a thumbnail sketch of which of the metrics listed above were met in each site visit. Shaded blocks marked with an "X" indicate that the metric was met; blank blocks indicate that it was not.

TABLE VI TEAM METRICS FOR 15 FIP2 VISITS

Metric	Which metrics were met in each facility visit (Facilities referenced by number. See list below *)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
a. Document successful P2 implementations	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
b. Document chemical replacements	X	X	X	X	X	X	X	X		X			X	X	X
c. Document problems with P2 measures	X	X	X			X	X		X	X	X		X		X
d. Document measures being investigated	X	X	X			X	X		X					X	X
e. Provided information to facility	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
f. Made recommendations to facility	X	X	X			X	X		X	X	X		X	X	X
g. Recommendations adopted	X	X	X				X							X	
h. Facility questions followed-up on	X	X				X			X		X			X	X

1 Sonic Plating Company
2 Electrochem Solutions, LLC
3 Coastline Metal Finishing Corporation
4 Alloys Cleaning Inc.
5 Crown Chrome Plating Inc.
6 Automation Plating Corporation
7 Alta Plating & Chemical
8 George Industries Inc.
9 Prime Wheel Corporation
10 Electro-Coatings of California
11 Valex Corporation
12 Industrial Plating Company, Inc.
13 Cirexx International Corporation
14 Dynamic Details Inc.
15 Merix

Blank blocks do not indicate incompleteness, but rather indicate when a given metric did not apply very well to a particular facility. Nonetheless, these metrics are useful for gross comparisons of facility visits, and may prove useful as a baseline for future visits under this or a similar P2 project. Details on the site visits follow.

DETAILS ON 15 FIP2 SITE VISITS

1. **Sonic Plating Co.** CAR000010975
   1930 West Rosecrans Ave., Gardena, CA
   Visited: 9/21/2007 by Gipson, Rayas, Suryavanshi
   Hosted by: Owner, Richard Granath; Production Manager, Tina McVay

   Synopsis of industrial processes: Small, old shop. Sonic performs parts cleaning, anodizing, cadmium plating, zinc plating, chromating, parts masking, painting, magnetic and dye penetrant inspection, and packaging. Its primary hazardous waste streams are plating rinse waters, filter cake, paint filters, and paint thinner.

   a. **Identification of successful P2 measures of possible use to other facilities:** (1) Sonic added a spray rinse to the soak cleaner step. (2) It changed spray rinse nozzles to finer, lower-volume spray. This decreased water usage, volume of wastewater to treat, and sludge volume. (3). It increased loading in its cadmium and zinc plating tanks by 25 percent to reduce rinse water usage.

   b. **Identification of chemical replacements successfully implemented:** None identified.

   c. **Identification of P2 problems experienced that could be of interest to other companies:** Sonic tried adding air agitation in tanks, but this failed. According to Sonic's production manager, the air agitation blew parts off the racks.

   d. **Identification of P2 measures facility is currently investigating:** None identified.

   e. **Information provided to facility by Metal Finishing Team staff:** (1) Information on DTSC's Model Shop Program. (2) Information on ion exchange systems.

   f. **Recommendations provided to facility:** (1) To install drip guards between tanks. (2) To use a drip timer (clock) on the hoist. (3) To clean up any liquid on the floor, or in tank secondary containment as soon as possible. (4) To investigate water recycling measures such as ion exchange. This would reduce water and chemical usage and disposal fees, and improve product quality.

   g. **DTSC recommendations adopted by facility, based on follow-up contact:** (1) Sonic installed drip guards between all tanks. (2) It implemented a drip timer (clock) on the hoist. (3) Currently, during plating operations, two men are dedicated to checking (either hourly or half-hourly) for any liquid in the secondary containment or on the floor. They vacuum any liquid found and transfer it to the wastewater treatment tank.

   h. **Identification of questions/issues for possible follow-up research by Team:** Sonic's problem with air agitation blowing parts off racks may have a fairly simple solution.

2. **Electrochem Solutions,** LLC CAR000020875
32500 Central Ave, Union City, CA
Visited 2/3/2009 by Gipson, Benelli
Hosted by David Rossiter, President & CEO; Chris Rossiter, Vice president; Yunas Khan, Production Manager; and Ross Lindell, a consultant

Synopsis of industrial processes: Large, fairly modern electroplating facility also performing anodizing, passivation, and parts cleaning services for high tech industries. Has "clean room" and well-equipped lab.

a. **Identification of successful P2 measures of possible use to other facilities:** (1) On site lab; bath chemistry checked several times per day. (2) Electrochem significantly reduced its CN waste volume and rinse volume primarily by returning drag-out to the plating tank, and using rinse water as make-up for the drag-out tank. (3) Electrochem reduced the volume of wastewater by a factor of 10 by focusing on more efficient precipitation. (4) It further reduced the amount of sludge that is landfilled by mixing the sludge 50/50 with the filter cake it sends to World Resources for metals reclamation. (5) Electrochem solved a problem of high nickel concentrations in its electroless nickel process waste water by pretreating the wastewater by plating out nickel on steel wool. This practice not only reduced nickel concentration from thousands of parts per million (ppm) to hundreds or slightly below 100 ppm substantially reducing the amounts of treatment chemicals and treatment time required. (6) Successes with ion exchange (see Recommendations provided to facility, below). (7) Electrochem implemented an electrowinning process using the "Gold Bug" system. Problems initially encountered with that system were resolved by Electrochem's silver supplier. (8) In addition to water savings, measures implemented by Electrochem netted energy savings of $15,000 to $20,000 per month.

b. **Identification of chemical replacements successfully implemented:** Due to customer demand for products compliant with the European Commission's Restriction of Hazardous Substances (ROHS) Electrochem replaced its non-ROHS-compliant electroless nickel plating line (which incorporated cadmium) with ROHS-compliant electroless nickel plating (replaces cadmium with bismuth), and replaced non-ROHS-compliant "Alodine" chemical conversion coating of aluminum (uses hex chrome) with hex-chrome-free Alodine.

c. **Identification of P2 problems experienced that could be of interest to other companies:** Electrochem initially experienced a number of problems with its Hydromatix ion exchange (IX) system , largely due to lack of tech support from the vendor or from the manufacturer. Electrochem eventually overcame these problems in part due to Metal Finishing Team assistance (see "Recommendations provided to facility").

d. **Identification of P2 measures facility is currently investigating:** Electrochem plans to completely retool its waste management system, including applying for authorization to treat cyanide waste under tiered permitting, rather than shipping cyanide waste for off site disposal, as they are currently doing at great expense.

e. **Information provided to facility by Metal Finishing Team staff:** (1) A Metal Finishing "Toolkit." (2) DTSC's 2002 report on the Hydromatix ion exchange system, and contact information for two ion exchange manufacturers. (3) Information on a Pacific Gas & Electric (PG&E) rebate program. (4) Information on county water savings rebate program that may benefit Electrochem.

f. **Recommendations provided to facility:** (1) Metal Finishing Team staff learned that Electrochem's expensive Hydromatix ion exchange system was off-line because it worked improperly despite a

consultant's help and Electrochem's efforts. Electrochem wanted to scrap the Hydromatix system. Ion exchange systems purify and recycle contaminated rinse water. Because electroplaters use enormous amounts of water, ion exchange is a particularly valuable source reduction technology. Metal Finishing Team staff recommended that there may be a relatively simple problem with the Hydromatix system, such as use of the wrong ion exchange resin(s), and that Electrochem should explore that possibility. Metal Finishing Team staff followed up this recommendation by emailing Electrochem a 2002 DTSC report on the Hydromatix system as well as contacts for both Hydromatix and a competitor, Puradyn. (2) Team staff recommended a county water rebate program for which Electrochem might be eligible.

g. **DTSC recommendations acted on by facility, based on follow-up contact:** Largely based on the Team's recommendation, Electrochem decided to not scrap its IX system, and hired a Hydromatix expert who found a major problem to have indeed been use of the wrong resins. Electrochem soon had the system fully operational and expanded it by adding additional IX columns, resulting in significant water savings. Electrochem now uses deionized water not only for process make-up water and final rinses, but for all rinses. Additionally, Electrochem added a reverse osmosis (RO) unit, and has continually fine-tuned and improved the efficiency of the combined RO/IX system. According to Electrochem's Vice President, Mr. David Rossiter, in a follow-up communication with the Team:

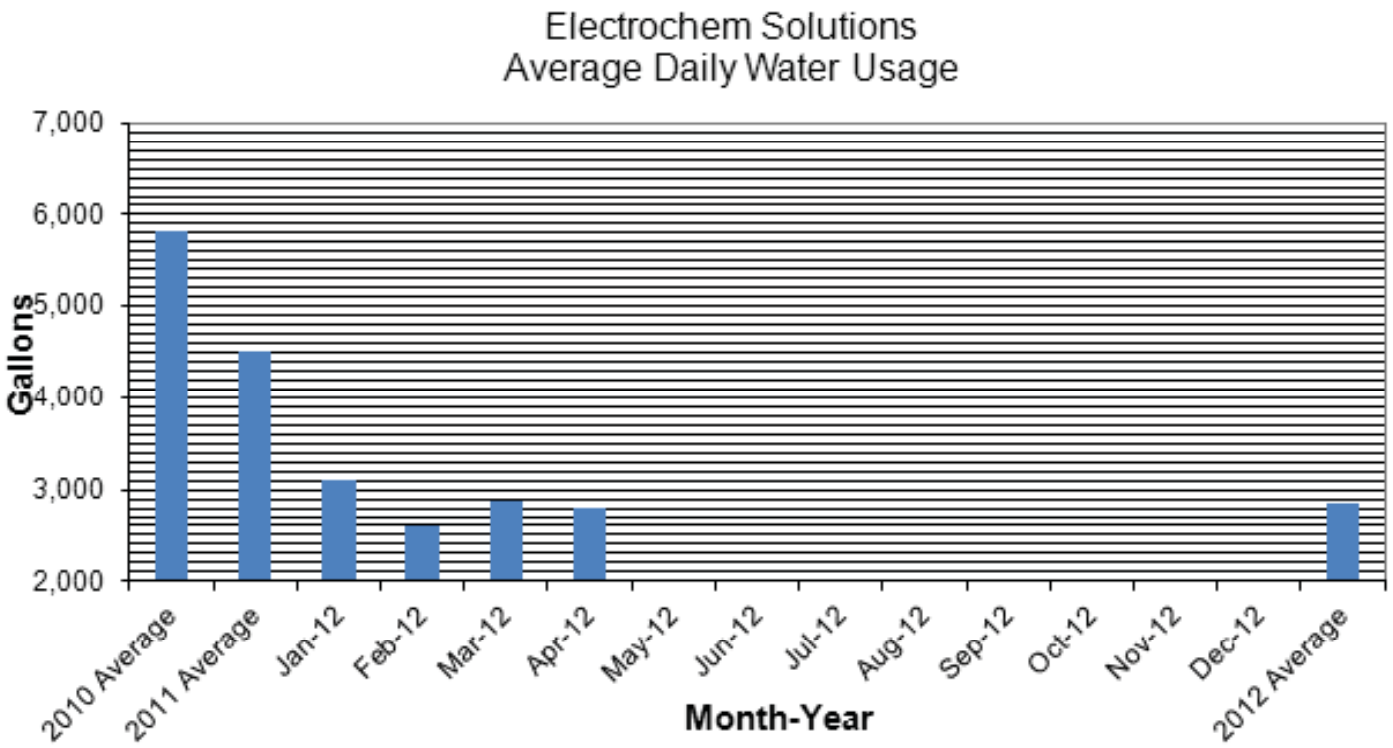
> *"Our production volume has remained level during 2010-2012. The decrease in water usage is to lower reject percentage on the new RO system (August 2011) and the increased uptime of the Hydromatix Ion Exchange System. The increased uptime on the Hydroxmatix means we can recycle more of our rinse waters."*

Below, courtesy of Electrochem, are a table and graph of water meter data illustrating Electrochem's dramatic reduction in water usage while production volume remained steady.

TABLE VII ELECTROCHEM SOLUTIONS WATER USAGE

Year	Avg. Gal/Month	Avg. Gal/Day
2010	176,686	5,818
2011	138,397	4,514
2012	66,952	2,839

Based on Electrochem's experience, Mr. Rossiter cited several mistakes that inexperienced plating shops can make with IX systems: (a) Using the wrong resins. (b) Cross-contamination of resins with materials (e.g., soaps) that quickly poison (irreversibly foul) the resins. Cross-contamination can result from plumbing the wrong tank to IX system, or other errors. (c) Not starting with good water. (d) Not using a carbon column first. (e) Overloading the IX system, which shortens resin life; and (e) Not analyzing influent water often enough. Mr. Rossiter also recommended that a company inexperienced with IX should bring their rinse tanks online one at a time, starting with the cleanest tanks first, then "ramping up," while frequently analyzing the water.



h. **Identification of questions/issues for possible follow-up research by Team:** Electrochem seeks to continuously optimize its OR/IX system. Notably, another company identified through review of SB14 reports (identified herein as Company A) also uses reverse osmosis in conjunction with IX. Meanwhile, Merix, a printed circuit board manufacturer, is currently seeking a reverse osmosis system to use in combination with its IX system. These circumstances present a possible opportunity for DTSC to conduct, with all three companies, a joint feasibility study on optimization of combined OR/IX systems. Propose. An additional circumstance favoring a joint study is that the three companies are not business competitors –two are captive shops and one is a job shop.

3. **Coastline Metal Finishing Corp.** CAR000010975
7061 Patterson Drive, Garden Grove, CA
Visited 3/14/2008 by Gipson, Rayas, Cully
Hosts: Allen Fowler, 2nd Vice President of Facilities & Engineering; and a private consultant.

Synopsis of industrial processes: Coastline Metal Finishing Corporation (Coastline) has a large variety of plating, anodizing, and other metal finishing lines, serving a variety of high tech industries from medical to satellite manufacturing. Coastline has an unusually large number of process tanks, for different process lines, located in one warehouse.

a. **Identification of successful P2 measures of possible use to other facilities:** (1) Coastline, a strong advocate of IX, uses deionized water for 100 percent of their rinses. Coastline has added more and larger IX units that return high purity water to the rinse tanks. This saves c. 19,000 gallons per day

(GPD), representing 30-40 percent reduction in both water usage and flow to the publicly owned treatment works (POTW). The IX unit added to their chromic acid line alone saves 10,000-12,000 GPD. Additional IX units are planned. Coastline contracts with Siemens Water Technologies to service its IX system, including resin regeneration. According to Allen Fowler, this is expensive ($56,000/year) but well worth it, and resin life is 2-3 months between regenerations, which is exceptional. (2) Coastline purchased an alkaline cleaner with longer life and higher soil loading capacity. (3) Waste segregation has been upgraded.

b. **Identification of chemical replacements successfully implemented:** Coastline is slowly replacing hex chrome with tri-chrome in its plating as more customers are calling for ROHS-compliant products. However, the bulk of Coastline's plating work is military/aerospace and subject to military specifications ("milspecs"), which call for the use of hex chrome.

c. **Identification of P2 problems experienced that could be of interest to other companies:** (1) Coastline initially encountered a problem with solenoid-type conductivity controllers for rinse tanks: the units required very high back pressure to operate. That problem was resolved by the solenoid manufacturer(2) Coastline had no success with the "PRO-pHx" acid extender product despite assurances from company representatives. Copper continued plating out. This was an expensive failed experiment since PRO-pHx cost several hundred dollars per 5-gallon bucket. Coastline's vice president stated that the problem may be Coastline's use of nitric acid while PRO-pHx may work for HCl-only processes. He mentioned that a large East Coast electropolisher reportedly uses PRO-pHx successfully with HCl. Currently, Coastline is evaluating an alternative to PRO-pHx – the "acid salts," that replace nitric acid for both the plating and anodizing lines. To remove copper, Coastline also tried a custom-built filter that it kept on a cart, and would operate when the plating operation was shut down at end of day. However, it was not successful in removing copper.

d. **Identification of P2 measures facility is currently investigating:** (1) Coastline also seeks eventually replace hex chrome in its "chem tech" (or "chem film") aluminum coating process. However, Coastline states that current tri-chrome products for this process have technical downsides that may not be solved for a few years. Coastline will continue to monitor developments in such products. (2) Coastline intends to apply for permit by rule (PBR) in order to increase on site treatment (batch neutralization) of anodizing wastewater, which change will reduce the amount of this waste that has to be shipped.

e. **Information provided to facility by Metal Finishing Team staff:** (1) "Toolkit" including information on DTSC's Model Shop Program. (2) Contact information for another plating company, Electrochem Solutions, Inc., who had found a solution to one of Coastline's problems, i.e., high nickel concentrations in wastewater. (As mentioned above , Electrochem Solutions, LLC successfully reduced their nickel concentrations by plating nickel out on steel wool.)

f. **Recommendations provided to facility:** During their site visit, Metal Finishing Team staff observed Coastline's plating line workers manually dipping, lifting and transferring plating racks from tank to tank , in the process allowing only a few seconds of drip time over a tank. This practice resulted in considerable drippage onto the working floor which consisted of plastic grating over a concrete subfloor having secondary containment. Also, in some cases workers had to manually carry racks from one tank for some distance across the shop to the next tank. Metal Finishing Team staff recommended to Mr. Allen that Coastline implement the following measures to achieve a dry floor: (1) Install drip racks and drip timers over tanks. This simple change would not only greatly reduce floor dripping, but also reduces tank-to-tank cross contamination, increases rinse efficiency, and reduces chemical use. (2) Install covers/splash guards between tanks. (3) To the extent possible, optimize process line tank layout

so that workers would not have to carry racks a great distance between tanks. (4) Regularly remove any standing water in secondary containment. (5) In follow-up communication, Metal Finishing team staff recommended that CLMF try plating out nickel on steel wool as a pretreatment method to reduce nickel concentrations, since this measure was used successfully by Electrochem Solutions, LLC.

g. **DTSC recommendations acted on by facility, based on follow-up contact:** Based on follow-up telephone and e-mail communications, Coastline adopted three of the four Metal Finishing Team recommendations to achieve a dry floor: (1) Increased drip times over processes tanks. (2) Installed covers/splash guards between tanks. (3) Assigned a dedicated maintenance person to vacuum out the secondary containment on a daily basis during the evenings.

h. **Identification of questions/issues for possible follow-up research by Team:** None identified.

Coastline Metal Finishing workers at different process tanks.

Photos by Metal Finishing Team staff Joseph Cully.

4. **Alloys Cleaning Inc.** CAL000141697
1929 East 64th Street, Los Angeles, CA
Visited 3/14/2008 by Gipson, Suryavanshi
Hosts: Roger Miller, Quality Control Manager

Synopsis of industrial processes: Alloys Cleaning Inc. (ACI) is not a plater or anodizer but performs specialty chemical milling, degreasing/cleaning, and pickling/passivating of titanium and other metals/alloys, including metal bar stock, parts, and scraps. An example of large parts processed, witnessed by Team staff, were large helicopter rotor blades, which are one-piece, solid titanium chemically milled from titanium bar stock. Process tanks are large, some over 40 feet long and seven feet deep. In addition to acids common to metal finishing, ACI uses hydrofluoric acid, for which they have an air scrubber and AQMD permit. ACI's degreasing operations are primarily for scrap metal, to prepare scraps for re-melting or recycling. Some of ACI's processes are unique and not comparable with most metal finishers.

a. **Identification of successful P2 measures of possible use to other facilities:** ACI performs considerable re-use of acid.

b. **Identification of chemical replacements successfully implemented:** ACI has replaced degreasing

solvents (trichloroethane, perchloroethane) with specially formulated soaps, both for environmental reasons and to meet customers' strict carbon limits.

c. **Identification of P2 problems experienced that could be of interest to other companies:** None identified.

d. **Identification of P2 measures facility is currently investigating:** None identified.

e. **Information provided to facility by Metal Finishing Team staff:** Information on DTSC's Model Shop Program.

f. **Recommendations provided to facility:** None.

g. **DTSC recommendations acted on by facility, based on follow-up contact:** Not applicable.

h. **Identification of questions/issues for possible follow-up research by Team:** None identified.

Alloys Cleaning titanium bar stock that will be chemically milled into one-piece helicopter rotors.

Photo by Metal Finishing Team staff Bob Gipson.

5. **Crown Chrome Plating Inc.** CAD072924103
14660 Arminta Street, Van Nuys, CA
Visited 3/12/2008 by Gipson, Rayas, Carder
Host: Akram Alawar, Chemist

Synopsis of industrial processes: Crown Chrome Plating Inc. (CCPI) is a large, clean plating facility performing chrome, nickel, cadmium and titanium-cadmium plating; abrasive blasting; degreasing; passivation; priming; and painting. It is a certified Federal Aviation Administration (FAA) Repair Station for aircraft parts; therefore, most of its work is subject to milspecs.

a. **Identification of successful P2 measures of possible use to other facilities:** (1) CCPI revamped its plating line for countercurrent rinsing. They now have three rinse tanks in series, each replenished with water from the next tank in line, and the last tank replenished with fresh water. This change alone saved substantial water and chemicals. (2) CCPI now uses deionized water for all its rinses and makeup water. Straight city water is only used for alkaline degreasing. (3) CCPI increased hang time to reduce drag-out. (4) CCPI implemented spray rinsing over heated plating tanks , thereby replenishing water lost to evaporation.

b. **Identification of chemical replacements successfully implemented:** (1) CCPI replaced vapor degreasing with an alkaline cleaner. (2) It replaced its cyanide copper strip and cyanide nickel strip lines with alkaline (NH3) copper and nickel strip. A major driving force for this substitution was difficulty treating cyanide wastewater from the strip operations because cyanide concentrations were high and the city discharge limits for cyanide extremely low (0.004 ppm). As a consequence CCPI has been forced to ship the cyanide waste off site rather than treat it. Another driving force for this change was employee safety considerations.

c. **Identification of P2 problems experienced that could be of interest to other companies:** None identified.

d. **Identification of P2 measures facility is currently investigating:** None identified.

e. **Information provided to facility by Metal Finishing Team staff:** Information on DTSC's Model Shop Program. Guidance on preparing SB14 reports and Plan.

f. **Recommendations provided to facility:** None.

g. **DTSC recommendations acted on by facility, based on follow-up contact:** None.

h. **Identification of questions/issues for possible follow-up research by Team:** None.

6. Automation Plating Corporation (APC) CAD008342784

927 Thompson Avenue, Glendale, CA
Visited 10/28/2008 by Gipson, Rayas, Carder
Hosts: Bill Wiggins, President; Pat Kinzy, Chief Operating Officer; and Steve Kelly, ISO and Regulatory Compliance Coordinator

Synopsis of industrial processes: Automation Plating Corporation (APC) performs primarily zinc plating on steel, on a variety of parts from computer chasses to very small hardware. It also does chromating/passivation and some acid cadmium plating. APC operates an impressive automated hoist/conveyor plating line, as well as rack and barrel plating lines. All plating lines have the following basic steps: Alkaline "soak" cleaning," hydrochloric acid cleaning, electro-cleaning, plating, and chromating, with countercurrent rinsing between steps. APC has two fixed treatment units for wastewater. Filter cake sludge is manifested to US Ecology, Inc., in Nevada, for metals recovery.

a. **Identification of successful P2 measures of possible use to other facilities:** (1) APC's automated hoist/conveyor system enables consistent control of drip times and other process parameters improving product quality control (Q/C) while reducing the level of employee exposure to hazardous chemicals. (2) Use of oil separators extends the life of the soak cleaner. (3) Reactive rinsing: Reuse of spent cleaners and acids in wastewater treatment. (4) Staff was trained in controlling part withdrawal rate and drain time to conform with the International Organization for Standardization (ISO); new software was implemented for barrel plating line; and drip time programming was implemented for the rack line. (5) Frequent bath analysis. (6) Baths are replenished not dumped. (7) Minimal metal concentrations are used in all baths. (8) Higher tank temperatures were implemented in 2003. (9) Flow restrictors are used, and rinses are turned off during employee break periods.

b. **Identification of chemical replacements successfully implemented:** (1) APC completely replaced its cyanide plating with acid-cadmium plating. (2) APC replaced hexavalent chrome passivates with tri-chromates, and found the tri-chromates outperformed hexavalent in corrosion tests (salt-spray protection hours). (3) It replaced solvents with aqueous cleaners. (4) It is experimenting with a non-sodium hydroxide pH adjuster product, "SLS45," which it hopes will reduce sludge volumes.

c. **Identification of P2 problems experienced that could be of interest to other companies:** (1) APC experienced sludge buildup problems in its aqueous cleaner tanks. This necessitated dragging the tanks every 4-6 weeks, and removing several hundred pounds of sludge that required disposal. APC found the problem was that the powdered cleaner did not fully dissolve. APC added a premix tank that solved the sludge problem and extended cleaning bath life. (2) It tried sludge evaporation, but without success.

(3) APC attempted re-use of effluent from the waste water treatment system, but the system did not remove the brightener, causing foaming and high chloride and total dissolved solid levels. (4) APC tried the acid extender product "PRO-pHx," and found it of no value. This is consistent with reports regarding PRO-pHx that DTSC has received from other metal finishers to date.

d. **Identification of P2 measures facility is currently investigating:** (1) Upgrading its chromating line to a barrel process, which has several efficiency advantages. (2) A nanotechnology method for chromating, close to market, that can add more than 50 hours to the salt spray protection standard. (3) APC is looking for a cheap reverse osmosis system to enable them to reuse a portion of its wastewater treatment effluent. (4) In the future, APC may try electrowinning, a technique for recovery of metals from waste rinse water if the price of zinc rises enough to make it worthwhile.

e. **Information provided to facility by Metal Finishing Team staff:** Information on DTSC's Model Shop Program.

f. **Recommendations provided to facility:** (1) APC uses DI water only for chromate make up, and final rinse on some lines. Metal Finishing Team staff recommended that APC investigate expanding DI use (e.g., for all process bath make-up water, and for at least the final rinse on all its process lines) if finances allow. (2) A suggestion to try plating zinc on steel wool, as another plater has done successfully with nickel.

g. **DTSC recommendations acted on by facility, based on follow-up contact:** None.

h. **Identification of questions/issues for possible follow-up research by Team:** In answer to a Team staff question, the Chief Operating Officer (COO) indicated that the reason APC could not have spray rinses on the automated line is that the plumbing would not work with (would get in the way of) the automated operation. However, Team staff have subsequently learned of a different plating company that does have spray rinses mounted on its automated hoist system. This information may be of interest to APC.

7. **Metal Finishing Group,** formerly **Alta Plating & Chemical (Alta)** CAD050214634
8290 Alpine Avenue, Sacramento, CA
Visited 8/20/2008 by Batarseh, Gipson, Marcanio, Brushia
Hosts: Scott Hickey, General Manager; and Páramo Hernandez, Production Manager

Synopsis of industrial processes: Alta is a medium-sized, relatively new metal finishing shop (its old Sacramento shop closed a few years ago) with varied process lines including (partial list) rack and barrel zinc plating, chromating, nickel chrome, and gold cyanide.

a. **Identification of successful P2 measures of possible use to other facilities:** (1) Alta has adopted more spray rinsing in its processes and Mr. Hickey shared the observation that effective spray rinsing "is an art" that requires careful employee training and keeping tanks clean. (2) Reuse of stagnant rinses. (3) Increased reuse of water. (4) Purification of spent solutions by precipitation of solids and decanting.

b. **Identification of chemical replacements successfully implemented:** (1) Alta replaced cyanide in several of its plating lines, switching to either the alkaline alternative; or in the case of cadmium plating, acid cadmium. (2) Alta does decorative chrome plating only, and proactively began switching from hexavalent to trivalent chrome several years ago – well before the current trend. It no longer does any hexavalent chrome plating. This has been a successful change. Alta noted that trivalent has a

technical advantage beyond the environmental/health advantage: Trivalent has more throwing power than hexavalent, enabling plating of more parts in one batch. The slight downsides are aesthetics (appearance) since trivalent is still not quite as lustrous as the hexavalent and is more expensive.

c. **Identification of P2 problems experienced that could be of interest to other companies:** (1) Alta could never get its expensive Hydromatix ion exchange system working efficiently, and so abandoned it. (2) The cyanide alternatives are not as efficient as cyanide, necessitating more in-house re-work of parts (approximately 20 percent more).

d. **Identification of P2 measures facility is currently investigating:** Alta will soon be pursuing a tiered permit for onsite treatment (neutralization) of wastewater.

e. **Information provided to facility by Metal Finishing Team staff:** (1) Information on DTSC's Model Shop Program. (2) A 2002 DTSC report on the Hydromatix ion exchange system. (3) Contact information for Electrochem Solutions, a company that successfully overcame its problems with the Hydromatix ion exchange system.

f. **Recommendations provided to facility:** In follow-up communications, Metal Finishing Team staff recommended that Alta reconsider consider putting its Hydromatix IX system back into operation, that it might work successfully if care were taken with control of operating parameters. Metal Finishing Team staff put Alta in contact with another plater, Electrochem Solutions, that also had problems with a Hydromatix system but successfully overcame them.

g. **DTSC recommendations acted on by facility, based on follow-up contact:** Alta expressed considerable interest in following up on the Teams's recommendation to re-commission its Hydromatix IX system indicating that it would be contacting Electrochem Solutions for more information.

h. **Identification of questions/issues for possible follow-up research by Team:** None identified.

8. **Valmont Coatings/George Industries Inc.** CAD008378887
4116 Whiteside St., Los Angeles, CA
Visited 3/14/2008 by Gipson, Suryavanshi
Host: Jim King, Plant Engineer

Synopsis of industrial processes: Valmont Coatings (George Industries, Inc.) is an old facility operating in several warehouses in a central Los Angeles industrial zone. It performs aluminum anodizing, painting, powder coating, and graphics applications of varied hardware and sporting goods items, and stripping of coatings. Valmont's routinely generated wastes are: (1) Waste nickel "seal" containing nickel acetate. (2) Waste solvent mixture containing acetone, MEK, toluene, isopropanol, paint, glycol ether, xylene, and paraffin. (3) Waste stripper containing methanol and sodium hydroxide. (4) Debris with metals containing cement, plastic, wood, and steel. (5) Dirt with metals containing dirt, nickel, zinc, and chrome. (6) Rags contaminated with acetone-based ink and paint (7) Filters contaminated with sulfuric acid and metals.

a. **Identification of successful P2 measures of possible use to other facilities:** (1) Valmont sought and acquired management's commitment to waste minimization resulting in a formal company policy. (2) Valmont formed a company "Hazardous Waste Source Reduction Team." For each waste stream, it considered various potential source reduction measures. Each measure considered the following factors: (a) Amount of hazardous waste generated. (b) Technical feasibility of waste reduction. (c) Economic evaluation. (d) Effects on product quality. (e) Potential employee health and safety effects.

(f) Impacts on permits, variances and compliance schedules. (g) Potential releases and discharges. (3) Valmont trained operators in improved rinsing techniques. (4) Implemented operational improvement for nickel seal process: Decant solution, and dispose of sludge every 5 weeks. (5) Implemented periodic filtering of the nickel seal process solution. (6) Implemented greater control of operating parameters in dye process, resulting in significant reduction of one raw material (black dye). (7) A unique source reduction achievement was that Valmont asked one of its major customers to modify its product's size, making it shorter in length, to reduce drag-in. The customer's compliance resulted in a sizable reduction in waste seal generated (reduction of 16,000 lbs. for 2006). (8) Valmont successfully experimented with using dip solutions longer before discarding, resulting in significant reduction in chemical use and waste without sacrificing product quality.

Anodizing lines at Valmont Coatings/George Industries.

Photo by Metal Finishing Team staff Nirumpa Suryavanshi.

b. **Identification of chemical replacements successfully implemented:** None. Several alternatives were carefully evaluated by the company, but no feasible alternatives were found for its particular processes.

c. **Identification of P2 problems experienced that could be of interest to other companies:** None identified.

d. **Identification of P2 measures facility is currently investigating:** None identified.

e. **Information provided to facility by Metal Finishing Team staff:** Information on DTSC's Model Shop Program.

f. **Recommendations provided to facility:** None identified.

g. **DTSC recommendations acted on by facility, based on follow-up contact:** None identified.

h. **Identification of questions/issues for possible follow-up research by Team:** None identified.

9. Prime Wheel Corporation CAR000162149
23930 & 24000 S. Vermont Avenue, Harbor City, CA
Visited 10/19/2009 by Yacoub, Rayas, Senga
Host: Wei Chen, Environmental Engineer

Synopsis of industrial processes: Prime Wheel is a large, high-volume plater with more than 400 employees, specializing in decorative chrome plating of automobile wheels (rims). They have six production lines: copper plating, chrome plating, stripping, polishing, washing, and painting. Prime Wheel's other plant

in Carson, California plant manufactures aluminum wheel rims which are plated at the Harbor City facility.

a. **Identification of successful P2 measures of possible use to other facilities:** (1) Installed a nickel recovery system that recycles up to 150 gallons of nickel solution per day, achieving 60 percent reduction of nickel (raw material) used per wheel and eliminating discharge of used nickel solution to the wastewater system. (2) A chrome drag-out recovery system achieved 48 percent reduction in chromic acid usage. (3) Implemented three energy savings measures netting a 32 percent reduction in electricity: (a) Installed air compressor monitoring software. (b) created daily inspection checklist and ongoing preventative maintenance program. (c) fixing air leaks immediately. (4) Achieved 25 percent reduction in filter cake by emphasizing greater quality control. This reduced rejects, thereby reducing stripping wastewater volume and metal concentrations in the wastewater treatment system. (5) Changed from administering an in-house Environmental Management System (EMS) to contracting a third party EMS; this change produced marked improvements in source reduction and energy savings. (6) Improved chemical inventory control. (7) Increased training. (8) Implemented spray rinses and cascading rinses. (9) Use more efficient paint filters that catch more contaminants. (10) Began removing paint residues manually to the extent possible. (11) For painting, installed high-pressure, low volume spray guns.

b. **Identification of chemical replacements successfully implemented:** None identified.

c. **Identification of P2 problems experienced that could be of interest to other companies:** Prime Wheel encountered significant problems with an ion exchange system that they purchased in 2004 with the intention of converting to "zero discharge." The system currently sits abandoned at the plant. According to a Prime Wheel spokesperson, neither the manufacturer nor two hired consultants were able to get it to work properly.

d. **Identification of P2 measures facility is currently investigating:** Prime Wheel plans to reduce concentrations used of MP40, a wastewater treatment chemical having appreciable toxicity, by December 31, 2011. While the company is well below its POTW discharge limits for MP40, it sees a possibility of reducing concentrations while maintaining effective sludge settling.

e. **Information provided to facility by Metal Finishing Team staff:** (1) Provided consultation and regulatory guidance on several of the facility's issues, including SB14 requirements, EPA identification numbers, recycling of F006 sludge (filter cake), recycling of rinse water, satellite accumulation and unit closure requirements. (2) Provided information on, and explained, DTSC's Metal Finishing Model Shop Program. (3) Provided information about common operational errors and troubleshooting of ion exchange systems; general information on ion exchange; and the names of ion exchange providers with whom other metal finishers have had good success.

f. **Recommendations provided to facility:** Prime Wheel uses a slightly toxic wastewater treatment chemical MP40. In follow-up communications, the Team recommended a less toxic alternative, aluminum sulfide, which may also save money based on feedback from Cirexx International Corporation, another metal finisher.

g. **DTSC recommendations acted on by facility, based on follow-up contact:** None yet identified.

h. **Identification of questions/issues for possible follow-up research by Team:** Prime Wheel is disenchanted with ion exchange after negative experiences. This is unfortunate because a properly operating system can save large quantities of water and reduce rejects. Based on information the Team currently has about the problems Prime Wheel experienced, it is highly probable that DTSC may be

able to assist with simple solutions. In follow-up phone and e-mail communications, however, Prime Wheel expressed that it is not interested in further DTSC P2 assistance at this time. It may therefore be productive to send Prime Wheel a package of information on possible solutions, and contact information for other companies that solved similar problems.

10. **Electro-Coatings of California** CAD009116211

893 Carleton Street, Berkeley, CA
Visited 3/26/2009 by Gipson, Benelli
Hosts: John Trigg; Joanna Cruz; Aaron Plechati, Production Manager

Synopsis of industrial processes: Electro-Coatings of California (ECC) specializes in hard chrome plating of large industrial rollers. Its largest clients are USS-POSCO Industries (UPI), and International Paper. ECC refurbishes (re-plates) worn rollers as opposed to plating newly manufactured rollers. Because these parts are non-decorative and depend upon hardness and durability, they are not amenable to the trivalent chrome alternative. ECC also performs electroless nickel plating, limited copper cyanide plating, and carbide work. It has a large non-metal-finishing line – rubber roller reconditioning. ECC has no wastewater treatment or discharge; all wastewater is shipped offsite.

a. **Identification of successful P2 measures of possible use to other facilities:** (1) Rather than disposing of hex chrome baths initially used for very high spec work, ECC re-used them for lower spec work. (2) At the request of the CUPA (City of Berkeley), ECC installed epoxy-lined pans under all active process tanks, amounting to tertiary containment.

b. **Identification of chemical replacements successfully implemented:** “EC3,” a citric acid-based, pre-plating cleaner.

c. **Identification of P2 problems experienced that could be of interest to other companies:** Problems with low-flow (spray) rinses and mists sprayers (“misters”). These did not rinse effectively, requiring more water and rinsing time.

d. **Identification of P2 measures facility is currently investigating:** None identified.

e. **Information provided to facility by Metal Finishing Team staff:** (1) Metal Finishing Toolkit. (2) Contact information for rubber recyclers that could use Electro-Coating’s waste rubber. (3) Information and contacts for ion exchange systems.

f. **Recommendations provided to facility:** (1) Team staff recommended that ECC resume wastewater treatment and POTW discharge, and offered technical assistance to meet POTW discharge limits. (2) Provided a recommendation that ECC send its waste rubber, now being disposed as solid waste, to a rubber recycler. The Team provided ECC with information on regional rubber recyclers. (3) ECC uses straight city water, with a very rudimentary filtration system, for process make-up water. Team staff recommended that ECC investigate purchasing an ion exchange system, and provided information on different ion exchange systems.

g. **DTSC recommendations acted on by facility, based on follow-up contact:** None as yet identified.

h. **Identification of questions/issues for possible follow-up research by Team:** None identified.

11. Valex Corporation

6080 Leland Street, Ventura, CA
Visited 9/20/2007 by Gipson, Carder
Hosts: Terry Kellenberger, Director of Operations and Engineering

Synopsis of industrial processes: Valex performs electropolishing, which is technically the reverse of electroplating (metal is removed from, rather than added to, a part by applying electric current in acid solution). Valex specializes in electropolishing stainless steel tubing used by the semiconductor industry (e.g., Intel, Samsung) to convey high-purity gases in the etching of computer chips. In Valex's electropolishing process, the rough inner surfaces of the steel tubes are smoothed to glass-mirror smoothness by applying electric current in sulfuric /phosphoric acid solution. Tubes are then rinsed, then further cleaned with ultrapure deionized water, then purged with nitrogen gas to prevent oxidation, and finally packaged in a cleanroom. Valex's primary waste streams are rinsewater, nitric acid, waste electropolish solution, sludge from the electropolish tanks, waste oil, coolants, and waste solvents.

a. **Identification of successful P2 measures of possible use to other facilities:** (1) Valex optimized the frequency of decanting its electropolish solution during the electropolishing process, by closely monitoring both tube quality and metal concentrations. (2) Valex changed its tube rinsing procedures and steps to enable greater reuse of rinse water within the plant. The same deionized water is used four different times, achieving approximately 75 percent reduction in filter cake. (3) As a product Q/C measure, Valex traces its steel tube suppliers, the weld schedules, and the dates of processing and purging of all electropolished parts. In that way, if anything goes wrong with a part, Valex has a record of the process and can back-trace the cause of the problem.

b. **Identification of chemical replacements successfully implemented:** None identified.

c. **Identification of P2 problems experienced that could be of interest to other companies:** Valex attempted several measures to extend the life of the electropolish solution, but it proved difficult without compromising production quality. Bath-life-extension measures that apply to electroplating do not apply to electropolishing. Measures Valex tried without success include (1) filtering metals out, (2) plating metals out of solution onto a sacrificial anode, (3) ion exchange treatment of electropolish solution, (4) boiling and re-condensing the solution, and (e) commercial additives to extend solution life.

d. **Identification of P2 measures facility is currently investigating:** None identified.

e. **Information provided to facility by Metal Finishing Team staff:** Information on DTSC's Model Shop Program.

f. **Recommendations provided to facility:** Metal Finishing Team staff suggested, as a possible method to remove suspended solids from electropolish solution, using a centrifugal flow separator, as opposed to a batch centrifuge or filtration, both of which had proved ineffective.

g. **DTSC recommendations acted on by facility, based on follow-up contact:** None yet identified.

h. **Identification of questions/issues for possible follow-up research by Team:** (1) Subsequent feedback from Valex revealed additional details about treatment needs for the electropolish solution. Evidently, the problem was not simply suspended solids (oxides) that needed removal, but also dissolved oxides. Dissolved oxides cannot be removed by a centrifuge. Based on subsequent Team staff review, this situation needs either chemical precipitation of the dissolved oxides prior to centrifuging, or a system

that integrates electrochemical (anodic) removal with filtration, and which resists fouling/clogging. Such systems are possible depending on the amount of money Valex wants to spend, but may be feasible given that their current management practice is expensive. Metal Finishing Team staff has yet to make a formal recommendation regarding this to Valex. (2) Valex may be able to replace organic solvents with aqueous solvents , unless its particular process needs preclude this. It may be worthwhile to pose this question to Valex.

12. **Industrial Plating Co, Inc** CAD981449416

803 American Street, San Carlos, CA
Visited 2/23/2009 by Gipson, Benelli
Hosts: Manuel Aguilar; Henry Aguilar; and consultant, Tim Lundel

Synopsis of industrial processes: Industrial Plating Company, Inc. (IPCI) is an old, established job shop performing a wide variety of plating, anodizing and coating services for a variety of industries including aerospace, military, communications, research, and medical.

a. **Identification of successful P2 measures of possible use to other facilities:** (1) IPCE decreased the size of their gold cyanide strip tank from 2200 gallons to 700 gallons, significantly reducing waste quantity from this process. (2) IPCI eliminated chrome from one process line (Copper Bright) to comply with ROHS. (3) IPCI replaced cyanide-zinc plating with alkali-zinc.

b. **Identification of chemical replacements successfully implemented:** None identified.

c. **Identification of P2 problems experienced that could be of interest to other companies:** None identified.

d. **Identification of P2 measures facility is currently investigating:** None identified.

e. **Information provided to facility by Metal Finishing Team staff:** (1) Metal finishing "Toolkit" including USEPA DVD on drag-out reduction, most common violations at electroplating facilities, Model Shop information, and the Hazardous Waste Minimization Checklist for Metal Finishers. (2) HWTS Printouts from DTSC's Hazardous Waste Tracking System (HWTS) of the facility's recent waste shipment history.

f. **Recommendations provided to facility:** None.

g. **DTSC recommendations acted on by facility, based on follow-up contact:** Not applicable.

h. **Identification of questions/issues for possible follow-up research by Team:** None identified.

13. **Cirexx International Corporation** CAD982322802

3391 Keller Street, Santa Clara, CA
Visited 12/19/2008 by Benelli, Gipson, Lam
Hosts: Don Angulo, Cirexx's Environmental Health & Safety Manager, and William Dunton.

Synopsis of industrial processes: Cirexx is an ISO 9001:2000 certified manufacturer of prototype single sided, double sided, flex and multi-layer printed circuit boards. Its main waste streams are rinse water, ammonia etch solution, and aluminum oxide slurry solutions.

a. **Identification of successful P2 measures of possible use to other facilities:** (1) Cirexx officials cited SB14 requirements as a major influence on significant source reduction achievements over the last four years. (2) An advanced "Develop-Etch-Strip" (DES) system minimizes the amount of cupric chloride etchant used in the manufacturing process. Spent cupric chloride etchant is sent for off-site reclamation. (3) Rinse water conservation measures have cut water use 37 percent, saving 10,000 GPD. These measures include (a) replacing manual shut-off valves (for rinse tanks) with rinse timers that have automatic shut-off after a pre-set time period, and (b) monitoring controls added to rinse tanks in the electroless copper line. (3) The waste treatment system clarifier utilizes pH-monitored addition of precipitant to remove chelated/complexed metals.

b. **Identification of chemical replacements successfully implemented:** (1) In tin plating, replacement of a nitric acid stripper with an ammonium bifluoride/hydrogen peroxide stripper. (2) Cirexx replaced the toxic dimethyldithiocarbamate (DTC) wastewater treatment chemical (precipitant) with aluminum sulfide. This less toxic alternative saved Cirexx money because it is more concentrated and efficient than DTC.

c. **Identification of P2 problems experienced that could be of interest to other companies:** Cirex encountered problems with a Kinetico ion exchange system, which led to operational downtime and abandonment of the system.

d. **Identification of P2 measures facility is currently investigating:** None identified.

e. **Information provided to facility by Metal Finishing Team staff:** Metal finishing "Toolkit."

f. **Recommendations provided to facility:** (1) Metal Finishing Team staff noted that Cirexx's analytical laboratory appeared understaffed, with a sampling/testing frequency of only once per day, a comparatively low frequency for plating printed circuit boards. Team staff suggested that plating shop workers be trained to conduct routine Q/C laboratory tests such as potentiometric titrations. In follow-up communications, Cirexx's health and safety manager stated that the company might consider this measure . (2) Team staff noted that several plating baths had no drip bars to hang boards, and recommended that drip bars could both reduce floor drippage and extend bath life. In follow-up communications, Cirexx's manager stated that instead of using drip bars, they have a place to lean the boards at the edge of the tanks, to let it drip back in that way. (3) Team staff recommended that Cirexx might be able to reduce the plate-out rate in the electroless nickel baths during inactive periods by cooling the baths with a cooling coil. In follow-up communications, the manager stated that they prevent plate-out in inactive baths by constantly circulating and aerating the baths with an aquarium pump, and switch tanks for that process daily, cleaning the tanks each time. (4) In follow-up communications, Metal Finishing Team staff recommended that Cirexx revisit ion exchange systems since some have worked well for other companies.

g. **DTSC recommendations acted on by facility, based on follow-up contact:** None identified.

h. **Identification of questions/issues for possible follow-up research by Team:** None identified.

14. **Dynamic Details Inc.** (DDI) CAD099156523

1992 Tarob Court, Milpitas, CA
Visited 1/16/2009 by Benelli, Gipson, Lam
Hosts: Jesus Rojas and Mike Trammel

Synopsis of industrial processes: Dynamic Details Inc. (DDI) is an ISO 9002 certified manufacturer of

high-tech printed circuit boards for computer, communications and space applications. It has facilities in five U.S. states besides California, and in Canada. A large component of the Milpitas' facility's work is research and development (R&D), and manufacture of prototypes. The major waste streams are plating rinse water, spent etchant solution (cupric and ammonia-based), and filter cake.

a. **Identification of successful P2 measures of possible use to other facilities:** (1) Corporate internal P2 competition: DDI officials gave Metal Finishing Team staff an impressive PowerPoint presentation on its highly progressive corporate source reduction program for its five U.S. facilities. These facilities compete with each other in efficiency of raw materials usage and waste reduction, using several operational benchmarks (e.g., square feet of copper used per number of employee hours and/or gross sales). The presentation included excellent graphs of the data for the five facilities for the last few years. Metal Finishing Team staff recognized this institutional P2 competition, which was not described in DDI's SB14 reports, as exemplary for the industry, and educational even to DTSC. (2) At the time of the visit, DDI had just completed a company-wide audit on utility (electricity, water, etc.) savings, and found that it had reduced total utility usage by $2.5 million. Water savings was accomplished by implementing four measures: (a) automatic sensors and activated timers to turn off rinse when not in use; (b) a Memtek ion exchange system for rinsewater recycling, which has worked well; and (c) a membrane filtration system. (3) DDI installed a specific-gravity-triggered automated pump system for fresh chemistry additions to plating baths, thereby improving bath quality and extending bath life. (4) DDI appears to have a well-staffed laboratory for plating bath Q/C. Lab staff use "TrueChem" software to track sample data. (5) DDI uses an automated hoist in the "desmear" line to reduce chemical use and reduce drag-in to downstream baths. (6) DDI optimized the efficiency of its wastewater treatment clarifier by having multiple wastewater inlet flows, which facilitate chemical mixing, flocculation, and precipitation of dissolved solids. (7) Wastewater treatment was further optimized through use of an oxidation-reduction potential (ORP) meter to control chemical additions.

b. **Identification of chemical replacements successfully implemented:** None identified.

c. **Identification of P2 problems experienced that could be of interest to other companies:** None identified.

d. **Identification of P2 measures facility is currently investigating:** To meet discharge limits, DDI has been investigating effective waste treatment precipitants and coagulants available in the commercial market.

e. **Information provided to facility by Metal Finishing Team staff:** (1) A metal finishing P2 toolkit. (2) A USEPA "Design for the Environment" report on spent etchant regeneration systems relevant to DDI's specific processes. (3) Documentation on WT676, an alternative to DDI's toxic waste water treatment chemical, DTC. (4) DTSC's most recent source reduction assessment report on the printed circuit board industry.

f. **Recommendations provided to facility:** (1) Metal Finishing Team staff proposed a joint-venture empirical study with DDI about further novel source reduction concepts, specifically, recycling/reuse of acid regenerant. DDI expressed much interest in that proposal. (2) Metal Finishing Team staff provided DDI with documentation on WT676, a wastewater treatment chemical alternative to the toxic DTC, which DDI currently used.

g. **DTSC recommendations acted on by facility, based on follow-up contact:** Follow-up contact confirmed that DDI is still interested in a joint venture study. DTSC, however, has been unable to follow-through with this initiative due to staff and budget constraints.

h. **Identification of questions/issues for possible follow-up research by Team:** (1) Development of the above-referenced joint-venture empirical study with DDI (about further novel source reduction concepts) would be mutually beneficial to DDI and DTSC. (2) DDI expressed reluctance to replace the toxic DTC (for wastewater treatment) with sulfide products based on concerns that sulfides would potentially create odor problems in the neighborhood, and DDI's desire to be a "good neighbor." It would be relevant to any future discussion with DDI that there are DTC alternatives other than sulfide-based products.

15. **Merix, dba Data Circuit Systems (**now **Viasystems Group)** CAT080013584

335 Turtle Creek Court, San Jose, CA
Visited 3/12/2009 by Benelli, Gipson, Lam
Hosts: Brett Bruhn and Casey Duke

Synopsis of industrial processes: Merix manufactures high-tech multi-layer circuit boards, with three main process lines: (1) a "Develop-Etch-Strip" (DES) line, which uses cupric chloride as etchant; (2) a "Strip-Etch-Strip" (SES) line, which uses cupric ammonium chloride as etchant; and (3) an oxide line (puts an oxide coating on copper). The company also does silver final finishes, and a limited amount of tin-lead solder for milspec work.

a. **Identification of successful P2 measures of possible use to other facilities:** (1) Merix has a unique system of nearly 100 flow meters on its process lines and "scrubber" water from which weekly flow readings which are entered into an Excel spreadsheet and analyzed for anomalies. This system has in the past given early warnings of flow problems such as stuck valves, thereby uniquely combining water conservation with preventative maintenance. (2) Merix uses deionized water for 50 percent of its rinses. (3) It has an onsite lab, and uses "TrueChem" sample analysis tracking software. (4) Merix constructed a new wastewater treatment system, having flow controls and flow-proportional chemical feeds.

b. **Identification of chemical replacements successfully implemented:** (1) In 2007, Merix switched from using cupric ammonium chloride as etchant to cupric chloride in one of its main (DES) plating lines, thereby achieving a large drop (approximately two-thirds) in ammonia etch waste. (2) Merix replaced sodium hydroxide (NaOH) with magnesium oxide (MgO) as wastewater treatment precipitant due to NaOH's greater expense and the resultant greater hygroscopicity of sludge, which increases sludge weight, therefore shipping costs.

c. **Identification of P2 problems experienced that could be of interest to other companies:** (1) In one of its process lines, Merix tried a formaldehyde-free alternative cleaner (citrate), and found it problem-ridden and therefore unfeasible. (2) It conducted a feasibility study on using a sludge drier, and determined that potential benefits were outweighed by the following problems: (a) excessive energy consumption; (b) it is "just one more thing to break down;" and (c) space limitations.

d. **Identification of P2 measures facility is currently investigating:** Merix is exploring buying a reverse osmosis (R/O) system, because treating incoming city water up-front with R/O would: (a) remove 90 percent of contaminants (salts), making the water clean enough for 90-95 percent of Merix's processes; and (b) greatly extend the life of ion exchange cartridges. One potential downside of R/O cited by Merix is that it increases water consumption and discharge flow due to R/O's constant reject stream percent. For some water/sewer districts, this increased consumption could place Merix in a higher surcharge

bracket, and possibly incur special permits with associated fees. He noted that, depending upon the water/sewer district, such added fees could be an effective disincentive to pursuing the R/O option. Mr. Bruhn further cited that this was unfortunate, since from a broader perspective, interestingly, the increased flow for R/O would be saving the additional water needed by an outside vendor to regenerate the ion exchange resins.

e. **Information provided to facility by Metal Finishing Team staff:** (1) Metal Finishing "Toolkit." (2) Team staff Ed Benelli gave a presentation at the November, 2009 IPC Conference in Irvine, California, on the topics of SB14 and "normalization" – a technique for measuring a company's production efficiency by normalizing raw material consumption and waste generation data to production benchmarks. Merix's Steve Edwards, who attended the presentation, afterwards met with Mr. Benellion these topics.

f. **Recommendations provided to facility:** Merix officials stated that it is required to perform a weekly "Dump & Re-make" (D&R) of its plating baths due to short turnaround times (two days) for products. Merix cannot afford a break in production through-put hours, and product volume and quality take precedence over optimal chemical use. This circumstance represents a significant waste of chemicals. Team staff asked whether there were any alternatives to dumping 2-day old baths. For example, some plating shops re-use plating baths for lower-spec work, or sell them to other shops for lower-spec work. Merix explained that, unfortunately, that was not an option for a circuit board shop.

g. **DTSC recommendations acted on by facility, based on follow-up contact:** None yet identified.

h. **Identification of questions/issues for possible follow-up research by Team:** An issue raised by Merix was that the last smelter within the US accepting F006 listed hazardous waste, Freeport McMoRan Copper and Gold, Inc., in Arizona, recently stopped accepting these materials due to actions by Arizona's Department of Environmental Quality. This unfortunately leaves F006 generators one choice for direct recycling/reclamation in continental North America: Xstrata in Rouyn-Noranda, Canada. Current metal pricing makes shipment for recycling a viable option only if shipping costs are low. The need to now ship sludge to Canada, unfortunately, makes landfilling of sludge a lower cost option for many F006 generators in California. A USEPA (Division of Solid Waste) final rule issued October 2008, would have avoided this outcome, and promoted a robust viable recycling infrastructure, and reduced the amount of recoverable metals land-filled. Unfortunately, however, almost every state has so far declined to adopt the rule while it undergoes a 3-4 year review.

E. ANALYSIS OF SB14 DATA FOR REPORTING YEAR 2006: NOTABLE P2 IMPLEMENTATIONS REPORTED BY METAL FINISHERS.

The objectives for this data analysis were similar to those of the FIP2 site visits:

- Characterize the scope of P2 measures in actual use by metal finishers;
- Identify novel and/or particularly successful P2 measures;
- Identify P2 challenges, including technical problems, experienced by the industry;
- Identify prevailing P2 needs of the industry, including information and training needs; and
- Lay the groundwork for a P2 technical information exchange for businesses.

This task was the retrieval and review of information residing in narrative "comment" fields within DTSC's SB14 database. This comment data was not readily extractable from DTSC's mainframe, as no programs existed to extract it. Metal Finishing Team staff worked with DTSC's Office of Environmental Information Management (OEIM), who wrote a Structured Query Language (SQL) program to export SB14 Summary Progress Report (SPR) comment field data from the DTSC mainframe into Microsoft Excel files. Team staff then used MS Excel to query and sort approximately 20,000 records to access text record fields on P2 measures implemented by companies, as reported in SPRs. Team staff also worked with the Office of Data Evaluation & Environmental Indicators (ODEEI) to export and condense data on metal finishers from DTSC's EnviroStor database.

Next, to organize the data, broad categories (parameters) of P2 achievements of various companies were developed. They parameters were originally drawn from several "metal finishing P2" checklists from different sources. A large number of these checklist parameters were evaluated, reorganized, and condensed into broader functional parameters, to illustrate various facilities' achievements in more easily comparable terms. The broad parameters developed and used below, are:

a. Materials Management/Spill Prevention.
b. Process Bath and Rinsing improvements.
c. Reuse and Recovery.
d. Green Chemistry Replacements.
e. Other Notable P2 Measures.

Using those parameters, the brief summary below highlights notable P2 implementations of several metal finishing companies. This includes information provided in those companies' 2006 SB14 reports and in follow-up communications with them conducted by Metal Finishing Team staff. This recognition of P2 implementations by these companies does not reflect regulatory compliance history or status.

1. USS-POSCO Industries (UPI), EPA ID No. CAD009150194
900 Loveridge Road, Pittsburg, CA

Notable P2/Source Reduction measures implemented:

a. Materials Management/Spill Prevention.

1. UPI implemented a "first in, first out" (FIFO) inventory control, and took advantage of a vendor

incentive to reduce chemical usage, for both acids and alkaline cleaners.

2. Measures were implemented to ensure raw material purity.
3. Housekeeping: Company standard operational procedures (SOPs) require immediate spill cleanup, regular process inspections, including logs; and regular preventive maintenance, with logs.

b. Process Bath and Rinsing Improvements.

1. For one annealing line cleaning bath, a filtration unit was replaced with a magnetic separator, which reduces soil loads and extends cleaner life.
2. Optimum bath temperatures are maintained.
3. On-site lab, frequent titration to optimize acid strength, and regular testing for dissolved metals.
4. DI water is used for both make-up and rinsing, and multiple counterflow rinse tanks, with drip guards and drip pans between rinse tanks, are used.

c. Reuse and Recovery.

1. In addition to recycling all of its scrap steel, UPI recycles most plating and other metal finishing metal waste. UPI installed a drag-out tank to re-use solution, and metals are recovered from drag-out by ion exchange. Tin anodes for UPI's electro-tinning process are cast on site by melting tin ingots, and partially consumed anodes are then re-melted and re-cast for reuse. Zinc dross, spent tin anodes, zinc and tin dust/skimmings (from melting and casting), tin filter cake, and tin plating sludge are sent to off site recyclers for metals recovery. Mercury switches and elemental mercury waste is sent to an off-site recycler for mercury recovery.
2. UPI performs extensive recycling of water (on the order of 800,000 gallons per day), from an array of processes including conductor roll cooling water, cooling tower water, electro-tinning and pickling rinse water, Tin Free Steel (TFS) rinse water, first stage reverse osmosis (RO) water, filter bed backwash water, steam condensate, and Chromium Recovery Unit (CRU) water. The CRU recycles chromium-contaminated rinse water and returns more than 200,000 gallons per year of chromium solution to the electrotinning lines, and recycles approximately 100 gallons per minute (gpm) of deionized and cooling water to the electrotinning lines. Rinse water is treated by ion exchange. UPI's end-of-pipe wastewater treatment plant treats eight million gallons per day of process, cooling and storm water, and the resultant effluent is cleaner than the source water, with most pollutants at or below detection limits. A portion of the effluent is recycled.
3. UPI's Acid Processor recycles over 16 million gallons per year of spent pickle liquor (hydrochloric acid) and rinse water, allowing the hydrochloric acid to be reused repeatedly, and 6,500 tons of iron oxide per year to be recovered as a by-product. UPI also uses spent acid/alkaline solutions to adjust pH in wastewater treatment systems and in scrubbers.
4. Waste heat is reused for pre-heating process solutions and combustion air. UPI is currently evaluating technology and the economics of additional use of combustion gases and heated waste rinse water for energy savings and to reduce the heat load on treated wastewater discharge.

2. Company B, San Jose, CA

Note: This company's P2 implementations were exemplary. Since compilation of this Report, however, the company was purchased, and its new owners requested that their company not be identified by name in this public report. Hence, it is identified herein as "Company B."

Notable P2/Source Reduction measures implemented:

a. Materials Management/Spill Prevention.

   1. Improved first in/first out (FIFO) procedures by barcoding virgin chemicals with lot numbers. This promotes employee awareness of chemical inventory, avoidance of the use of expired chemicals in the manufacturing line, and reduces disposal of expired chemicals.
   2. Drip trays were installed between stripping tanks.

b. Process Bath and Rinsing Improvements.

   1. Frequent titration and make-up of baths optimize bath lifespans and reduce chemical use and waste.
   2. Installed a new etchant purification unit that constantly re-circulates and filters the etchant to prevent etchant-degrading bacteria growth, increasing etchant life and reducing etchant waste by roughly 50 percent. High cost of etchant was a primary driver for this change.
   3. Operational controls to increase bath life including use of nitrogen bubblers and nitrogen blankets.
   4. In manufacturing, the "resist-dissolve" step uses solvent to reduce solution drag-out and rinse water use. Company engineers designed a new cassette that holds units at an optimum angle for complete draining of solution, and can be handled by a robot. Drag-out is further reduced by a combined air knife and fogging system, and unit drip time was extended.

c. Reuse and Recovery

   1. Optimized the ion exchange system for treating acidic and alkaline wastewaters. A mass balance study identified a design flaw: excessive flow rate through the IX system forced some effluent to circuit back to the reverse osmosis holding tank, resulting in unnecessary re-processing of water. This was solved by lowering the flow rate from 300 gpm to 10 gpm, saving water and reducing IX resin regeneration frequency.
   2. Wastewater from the etch process is reused to remake new etchant.
   3. Spent silicon monitors (electrodes that measure solution impurities) are recycled rather than being landfilled; they are returned to the manufacturer, who resurfaces and returns them. After 3-4 resurfacings, they become too thin for use, and are sold to a company that melts them down for remanufacturing.

d. Green Chemistry Replacements

   All gold-cyanide lines were replaced with gold-sulfite. Company B has steadily phased out cyanide plating, replacing it with alternatives where customer product specifications allow. Commendably, the company took a further step of notifying customers whose specifications require cyanide plating that the process would be eliminated for cost and environmental reasons.

e. Other Notable P2 Measures

1. Implemented an annual, in-house "Environmental Key Performance Indicators" (KPI) report on annual cost of waste and multi-media items including DI water consumption and energy use. Implementation of this communication tool significantly increased interest in cost savings, and increased information feedback between management and production staff.
2. Implemented a Survey and Reward program for production lines that took extra efforts to segregate hazardous and non-hazardous waste.
3. Source reduction achievements by individual staff are now awarded by recognition on the company web site and bulletin board, and with appreciation gifts as appropriate.
4. Minimized solvent use through teamwork. Formed cross-functional R&D team to find ways to reduce the amount of solvent used as resist-dissolve in manufacturing. Several measures were found and implemented:
   - Three hundred process steps were reviewed, and six using the solvent were found redundant and eliminated.
   - Installed flow meters to track solvent flow from bulk tanks to manufacturing.
   - Eliminated periodic bath dumps after testing found that not doing so did not introduce contamination.
   - Replaced spraying of solvent on units with use of a dip tank, which uses solvent more efficiently. This entailed new tool design.
   - Increased production batch size.
   - Reduced solvent contact time from 15 seconds to 8 seconds.
   - Reduced solvent "bleed and feed" amount, i.e., amount of fresh solvent added to process; testing is ongoing to maximize use of each solvent measure.
5. Similarly, a company team found ways to reduce use of chemicals, by process review and elimination of unnecessary steps, and reducing the amount of chemical used per unit, reducing both chemical use and chemical waste.
6. Reduction of wastewater containing nickel and copper. Several measures were implemented, also results of a team study, including:
   - Cut wet etch cycle time in half.

7. Switched from buying cleaning solvent in one-gallon containers to buying 55-gallon drums, reducing contaminated container waste and cardboard packaging waste and enabling a drum return arrangement with the supplier. Modified chemical feed systems for the 55-gallon drums, incorporating quick-disconnect chemical feed lines to replace manual additions of chemicals, which had in past resulted in accidental additions of wrong chemicals to tanks, necessitating parts scrapping or re-working and equipment sanitization, producing additional wastewater.
8. Shortened the cycle time of bottle washers that rinse empty chemical (acids, bases) containers before they are recycled off site, resulting in less waste water to the treatment plant.

9. Installed pulse plating stations for all Nickel-Iron (NiFe) plating, and installed two pulse-reverse plating stations. Pulse plating and pulse-reverse plating are advanced plating techniques that save electricity; and, in some applications, enhance final product qualities such as hardness and corrosion resistance.

3. **Quaker City Plating & Silversmith (QCPS)**, EPA ID No. CAD008506065
7937 Chatfield Ave., Whittier, CA

Notable P2/Source Reduction measures implemented:

a. Materials Management/Spill Prevention

1. Implemented a "wet floor" Facility Management Plan (FMP), which included operator training on procedures to minimize drippage in containment areas.
2. Improved and upgraded spill containment.
3. Improved material handling and chemical storage process.
4. Implemented computer-controlled chemical inventory.

b. Process Bath and Rinsing Improvements

1. Plating bath filtration: QCPS made a substantial investment in two filtration systems to increase plating efficiency, reduce part reworking, and extend bath life – all of which minimized chemical usage.
   - A continuous, polishing system of large-surface-area disc filters that remove part contaminants (such as oil and grease), and organic breakdown products of proprietary bath additives.
   - Use of in-line activated carbon canisters to remove organics. These are run in batch, either during production or down time, with each run lasting from16 to -24 hours.
2. Improved solution preventive maintenance (PM) on all process baths. QCPS now ensures that all cleaners, rinses, and process baths are within operating parameters and do not contributing to rejects. New PM measures include:
   - Perform PM per a regular schedule, not when problems arise.
   - Change disc filters weekly or twice a week.
   - Change anode bags and clean sludge buildup from anode baskets, enhancing throwing power.
   - Use low-amperage "dummy" anodes to remove metal impurities (copper, iron, zinc) from nickel baths.
3. Reduced in-tank surface area that controls nickel concentration in largest plating tanks. In the past, QCPS tried controlling nickel concentration by periodically diluting the bath and recycling its solution. The new process eliminated several anode baskets from one tank section. This decreased metal build up by 90 percent for an estimated cost saving of $10,000-$15,000 per year.
4. Improvements to rinsing, include:
   - Use of multiple rinse tanks where appropriate.
   - Use of conductivity sensors.

- Installation of flow restrictors for running rinses.
- Initiated use of high quality (1 mega ohm) D.I. water for make-up water in all process tanks and for final rinses, thereby extending bath life by preventing buildup of minerals and other contaminants, and minimizing stains on parts and the need for re-work.
- Operator training on improved rinsing techniques that minimize cross contamination.
- Improved operator training in gold stripping and provided operators with detailed process sheets. This has reduced contamination and rejects and minimized use of gold stripping solution.
- In the stoichiometry of their chromic acid etching process, some Cr+6 is slowly converted to Cr+3, attenuating the solution's etching potency, causing under-etching or skip plate/adhesion problems. QCPS is investigating three possible solutions to this problem: Increasing the starting Cr+6 concentration, replacing spent solution with new material, and re-oxidizing Cr+3 back to Cr+6.
- In its cyanide copper bath, QCPS is experimenting with two techniques to maintain optimum dissolved copper concentration: (i) Replacing a portion of its copper anodes with steel anodes. So far, this measure has impacted part quality; and (ii) Using a steel "dummy" bar to plate out copper, both for copper recovery and to minimize cyanide wastewater caused by excessive buildup of dissolved copper.

c. Reuse and Recovery

1. Implemented use of reverse osmosis (R/O) for rinse water in cyanide plating line.
2. Use of spent acid and alkaline solutions for pH adjustment in wastewater treatment system.
3. Reuse of chromic acid etch to etch plastic parts. Improved material handling and chemical storage process.

d. Problems Encountered With P2 Measures.

1. QCPS has encountered several problems with its ion exchange system, causing facility downtime, including mechanical and electrical problems, but primarily a constant need for very frequent resin regenerations. Based on details on QCPS' ion exchange problems, Metal Finishing Team staff view their problems as potentially solvable. QCPS, however, has expressed that they are not interested in DTSC P2 assistance at this time.
2. QCPS encountered problems with a cyanide alternative (non-cyanide silver plate), including instability in critical bath parameters such as pH, causing a high number of rejects, forcing QCPS' to resume cyanide silver use. QCPS is still interested in non-cyanide silver, and if they find a process that is stable and meets customer requirements, they will trial it.
3. QCPS trialed an acid extender product, "PRO-pHx," to extend life of nitric acid in a plating process. It did not work. This is consistent with findings of several other metal finishers.

4. All Metals Processing Company of Orange County
8401 Standustrial St., Stanton, CA

- Replaced 1675-gallon process tank with new 950-gallon tank and other equipment upgrades reducing contamination and waste volume.
- Altered cleaning bath formulae and increased bath temperature in largest process line, reducing drag-out.
- Promoted and used powder coating (alternative to plating) where customer specifications allow.
- Began using more efficient paint filters.
- Upgraded spray booths with best available control technology (BACT) technology including a high-efficiency particulate air (HEPA) filtration system.
- Implemented an EMS as part of continuous improvement.
- Added equipment that increased agitation in Cyanide Destruct retention tank, improving efficiency.
- Tried some alternatives (replacements) for nitric acid/ammonium bifluoride, but no feasible replacement was found.

5. GKN Aerospace Chem-Tronics Inc,
1150 West Bradley Avenue, El Cajon, CA

- Upgraded preventive maintenance program.
- Training in improved rinsing techniques significantly reduced acidic and alkaline rinse water.
- Changed from constant to trigger-activated and static rinses.
- Installed additional rinse tank on etching line.
- Increased reuse of rinses and baths
- Replaced old coolant recycling equipment with a new system, increasing recycling of waste coolant and cutting fluids.
- Initiated the collection and off site recycling of storm water containing residues of machine coolant and oily water.

F. FINDINGS

Described below are five major findings from Phase 1 of the Project.

1. Based on FIP2 site visits, there is still a prevalent need for simple, in-house changes. A surprising number of shops do not take advantage of simple BMPs, i.e., "low-hanging fruit," such as simple housekeeping measures, simple drag-out reduction methods (e.g., drip shields and drip bars), improved rinsing techniques (which simply requires advanced worker training on rinsing), and closer maintenance of process baths including more frequent chemical analysis. These types of changes are emphasized by the Model Shop Program, underscoring a continuing need for that Program.

2. Beyond simple BMPs: Need for slightly more complex P2 measures. In shops visited under the FIP2 project, a significant potential was also seen for slightly more complex changes that would require some capital outlay by shops, but which would realize a return on their investment within a reasonable time period. These observed needs included:

    - Optimizing process tank layout.
    - Adding a drag-out tank to recover process solution.
    - Adding additional rinse tanks per process line, using counter-current rinsing, other re-plumbing to maximize water recycling.
    - Installing pulse-spray rinsing.
    - Using flow restrictors and conductivity sensors.
    - Using in-line bath purification systems, which extend bath life, reduce waste and enhance product quality.
    - Installing ion exchange systems (discussed in more detail below).
    - Recycling of acid to reduce acid use.

3. Replacement of cyanide and hex chrome. A relevant finding is that replacement of hex chrome and cyanide is largely being driven by customer demand for RoHS-compliant products. Also, some platers visited reported their individual finding that trivalent chrome outperforms hexavalent chrome in corrosion resistance tests, and has better throwing power. For these reasons, increasingly, platers are voluntarily replacing hexavalent with trivalent for decorative chrome applications. This is not the case for hard chrome applications (e.g., aircraft landing gear parts), however, as hexavalent still outperforms trivalent in the parameters of hardness and durability, and so is still required by milspecs. Hexavalent also still slightly performs trivalent in the attribute of reflectivity (lustre), and therefore is still slightly preferred in some "niche" decorative chrome applications that prefer a high degree of lustre.

4. Need for wider use of ion exchange (IX) systems. The Project found a notable divergence of opinion among metal finishers as to the value of IX systems. Some companies have realized the significant benefits of a properly operating IX system, which include not only great savings in water, but also large reductions in both wastewater and solid hazardous waste, and improved product quality resulting in fewer rejects. Some other companies , however, still maintain that IX systems are a waste of money and time. Companies in the latter category usually have tried ion exchange and experienced considerable trouble getting it to work properly, for a number of reasons including poor system design, insufficient knowledge

of proper operation, lack of technical support by the vendor or manufacturer, and poor advice from hired consultants. Meanwhile, there are some companies that never tried IX and do not care to, stating that "straight city water is good enough for them." In one case, the Project ran across a plater who claimed to have never heard of ion exchange. There is another example of a large plater who has used IX for years and is still using it, yet based on data they have provided to DTSC, they are clearly not operating it properly, and consequently not getting full benefit from it.

Given the significant P2 benefits of ion exchange, this negative opinion of some companies represents both an opportunity and a challenge for the Metal Finishing Team. Specifically, an opportunity and challenge to convince those companies with negative opinions to invest in ion exchange for the first time, or to invest in IX again after they have tried it and had nothing but problems. This might be done by either directly giving them assistance in diagnosing the problems they have encountered in the past; or connecting them with consultants that DTSC knows are reputable. Another possible action would be for DTSC to write a short article for our website that lists the "most common problems" with IX systems, and the solutions. Such a document might also include convincing case studies of companies who had "given up" on ion exchange, but then found that their problems had fairly simple solutions.

5. Prohibitive costs of reverse osmosis systems. Metal finishers use very large quantities of water. Both reverse osmosis (R/O) and ion exchange (IX) systems are excellent tools for recycling water, and either can be stand-alone systems. However, having R/O to pretreat water going into an IX system, while costly up front, has long-term advantages. The biggest ongoing (monthly and yearly) expense involved with IX systems is the required periodic regeneration of IX resins, which entails chemical treatment and backwashing, or replacement of the resins. Resin regeneration (or replacement) frequency depends on several factors, with one of the biggest being relative cleanliness of the water entering the IX system (the influent). Influent pretreatment with R/O significantly decreases the frequency that resins must be regenerated. Very few platers, however, have R/O units due to their high cost. Several platers we visited were searching for a cheap R/O unit for this purpose. Therefore, a recommendation is that the Team explore possible ways of making these systems more economically reachable by platers, either though stimulus funding or by working through California's metal finishing associations with R/O manufacturers.

   Another potential disincentive for R/O use is that, as cited earlier in this report, R/O units increase a company's water consumption up front due to a "constant reject" stream of 25-30% that R/O requires. This increased consumption could in some cases entail higher water district fees. As Brett Bruhn of Merix noted, this is ironic given that, when R/O is not used, an amount of water equivalent to the reject steam would be used by the company, or by an outside vendor, to more frequently regenerate the resins. Therefore, the broader picture is that R/O ultimately would not use more water from the water district, unless the vendor performed the regeneration in a different water district.

   Based on that information, the Project recommends that, if DTSC and the metal finishing associations are to in the future promote use of R/O systems by platers, they might consider entering into a dialogue with the appropriate State and local water agencies to explore the possibility of special water use rebates for R/O systems.

G. CONCLUSION AND RECOMMENDATIONS

Based on Project findings, six recommendations are below presented.

1. Continue the Project (as Phase 2). There has been Team discussion about two possible new strategies for the Project, if it is to be continued:

   a. A continuation of the FIP2 project, but not SB14-based.

   b. The creation of a "Tiered" Model Shop program, which has less stringent requirements than the Model Shop requirements, yet will still "engage" shops individually, and give them some form of recognition for P2 achievements. The impetus for this discussion had been the relatively low number of Model Shop applicants. That low number may be due to several reasons:

      - The program is voluntary.
      - The requirements are somewhat exclusive.
      - Some shops have been skeptical of the Program's benefits.
      - Concern that enrolling in the program would open shops to enforcement action by DTSC (a trust issue).
      - Concern that enrolling would open the shops' processes to scrutiny by competitors.

   The first reason listed above was the original impetus behind the Project's approach of using SB14 authority for P2 site visits. Many of the shops visited by the Team under the FIP2 project were not shops that would have volunteered for P2 assistance from DTSC. Some, in fact, openly admitted that they had been afraid of the Team coming to visit them, even though our expressed intent had been P2 and not Enforcement-type inspection. They acquiesced to our visit only because we sent them an introductory letter in July, 2007 informing them that DTSC was authorized to visit them pursuant to SB14 requirement. This strategy had some success. The SB14 approach, a "foot in the door" to reluctant facilities, enabled us to arrange visits to more shops than we were physically able to visit. Also, while companies we visited were initially frightened of us, some were inspired to make changes. Four out of 15 shops visited adopted Team recommendations (described above) as a result of a single FIP2 site visit. This also reflects the skill of Metal Finishing Team staff, who, notably, included Model Shop staff. During the visits, Team staff did not presume or pretend to know more about a particular facility's operations than the facility did. Rather, staff came asking questions and making careful observations. As a result, in several cases the Team was able to make relevant observations that proved helpful to a facility. Based on that experience of reluctance of shops toward voluntary P2 visits, it is likely that there are many more shops that we could measurably help but that would not acquiesce to voluntary visits.

   That having been said, it may also be possible to attract more shops, i.e., as many shops as we could physically handle, to a "Tiered" Model Shop program that is entirely voluntary, but has less stringent requirements than the full Model Shop Program. As discussed previously by the Team, a "Tiered" program and a new, non-SB14-based FIP2 program could conceivably be one and the same. One incentive of such a Tiered program for companies could be that it would give them some level of public recognition for their P2 achievements, although not as high a level of recognition as Model Shop graduates get. It is important to not undercut the value of full Model Shop enrollment. Therefore, perhaps a lower "Tier" program should have a different name, perhaps something like "Progressive Shop," that signifies that it is not quite as good as a Model Shop.

In terms of incentives, it is important to note that the Model Shop Program, through its successes with companies and its P2 workshops, has done a great deal towards spreading the word about the economic advantages of P2. This spreading of the word could, by itself, be an incentive to more shops to either enroll in a DTSC program, or even to make changes on their own. Our bottom-line goal is to get as many shops as possible to make changes. The exact nature of a future "Tiered" program will be a decision of the Team and DTSC management.

2. Give recognition to shops that adopt DTSC recommendations under FIP2. As noted earlier in this report, four shops visited under FIP2 adopted DTSC recommendations made during site visits. DTSC should consider granting those shops some form or recognition, perhaps just a passing mention on our web site. This could be a strong selling point for the Model Shop, as it would demonstrate what can result from just one visit from DTSC's P2 staff.

3. Give recognition to shops for independent achievements. The Project discovered several companies with impressive P2 achievements attained on their own, without help. This includes some shops visited under FIP2, and others with notable achievements discovered from SB14 data. DTSC should reward these shops with some form of recognition, perhaps on our web site. In fact, to not do so could be counterproductive for DTSC's mission. Some of these achievements have been educational even to DTSC and would be beneficial to many other metal finishers.

4. Add information on emerging technologies to the FIP2 "toolkit." There are cutting-edge technologies not yet in wide use by California metal finishers, and therefore represent new potential for P2, energy savings, and toxicity reduction. Some are in-tank systems (can be added to existing process tanks) and therefore are not terribly expensive. Two examples of these new technologies are:

   - Advanced electroplating techniques that save electricity, plating time and plating chemicals; and improve product quality. These include pulse-reverse plating and use of "smart" anode shields.
   - Trivalent Chromate Pretreatment (TCP), a process that improves strength and hardness of trivalent chromate coatings, making them more competitive with Hex chrome in those parameters.

5. Legislative proposal. Discussed earlier in this report was the 2008 task/accomplishment of developing a legislative proposal for clarifying our existing recycling statutes. That need remains. Vagueness of the existing laws are problematic not only for the regulated community, but for CUPAs and DTSC as well. Moreover, if DTSC's mission is truly to encourage recycling, we should revisit the possibility of lowering tiered permitting requirements for some recycling activities.

6. Create an information exchange. Create a framework, possibly web-based, for P2 information-sharing between facilities. While many shops are competitors with each other, some are either captive shops or "niche" shops without real competitors, and so would not mind sharing information. The Project has already stimulated some degree of information sharing between shops, and this potential can be greatly expanded.

Acknowledgement. The Metal Finishing Team Leader for the period covered by this report sincerely thanks the Team members for their constant levels of professional excellence and enthusiasm.