Pollution Prevention Program for Metal Finishing

Prepared for Toronto Public Health
by
Rubidium Environmental

December, 2015

Contents

1.0 BACKGROUND INFORMATION

1.1 ChemTRAC Facilities

In the Metropolitan Toronto area, 249 facilities[1] have self-declared with NAICS code 332810, which corresponds to the Coating, Engraving, Cold and Heat Treating and Allied Activities sector. In the 2013 reporting year, twenty-six (26) unique facilities reported to ChemTRAC, representing approximately 10.4% of the facilities implicated in the sector.

1.2 Sector Releases

In the 2013 reporting year, the sector reported releases of eight (8) contaminants: non-hexavalent Chromium, Hexavalent Chromium, Dichloromethane, Nickel, Nitrogen Oxide, particulate matter less than 2.5 microns in diameter (PM2.5), Trichloroethylene and volatile organic compounds (VOCs). Seven (7) facilities reported meeting or exceeding the reporting thresholds for Chromium, non-hexavalent, twelve (12) for Hexavalent Chromium, one (1) for Dichloromethane, twelve (12) for Nickel, thirteen (13) for Nitrogen Oxide (NOx), eight (8) for PM2.5, one (1) for Trichloroethylene and ten (10) for VOCs, respectively. In total, twenty (20) facilities reported meeting or exceeding the thresholds for the contaminants mentioned above, while six (6) facilities voluntarily reported.

1.2.1 Hexavalent Chromium

Total hexavalent chromium releases to air were reported at 17 kg in the 2013 reporting year. Based on ChemTRAC data, Metal Koting Continuous Colour Coat Ltd. emitted 65% of the overall hexavalent chromium emissions in the sector, as shown in Table 1. Releases of hexavalent chromium are mainly from the coating operations. Because of its desired properties, hexavalent chromium is often incorporated into coatings to provide excellent corrosion protection to almost all metals in any environmental conditions[2]. As for the plating and metal finishing facilities, hexavalent chromium is most commonly used in the electroplating bath as it provides desired harness, coating durability, and excellent wear and corrosion resistance properties[3]. The five facilities that reported hexavalent chromium emissions to air is shown in Table 1.

---

[1] Source: Composite of Scott's Directory (2015), Industry Canada, and the 2013 ChemTRAC reporting year data set.
[2] SERDP. *Hexavalent Chromium*. https://www.serdp-estcp.org/Featured-Initiatives/Green-Manufacturing-and-Maintenance/Hexavalent-Chromium
[3] PF Products Finishing. *Functional Trivalent Chromium Electroplating of Internal Diameters.* http://www.pfonline.com/articles/functional-trivalent-chromium-electroplating-of-internal-diameters

1.2.2 Chromium, Non-hexavalent

Total chromium releases to air were reported at 8 kg in the 2013 reporting year. As shown in Table 1, only one facility reported release of chromium, non-hexavalent emissions. Usage of chromium in a coating company includes incorporating chromium compounds in the coating process for its corrosion resistance properties not consisting of hexavalent chromium. Releases of Chromium are expected from this process. Welding is not expected to be a significant operation in this sector, and associated chromium releases are not anticipated to be comparably significant. Chromium compounds are also used in the electroplating industry for its desired properties. The thickness of electroplated chromium falls under two categories: decorative chrome plating and hard chrome plating. Decorative chrome plating offers a reflective appearance, corrosion resistance, lubricity and durability. On the other hand, hard chrome plating are commonly used for industrial applications, where it provides resistance to heat, hardness, wear, corrosion and erosion[4]. Emissions of chromium are primarily released from the electroplating process where mists of the plating solution would be created due to surfaced gas bubbles[5]. Chromium is commonly released as tri-valent chromium. The most effective and easiest method to control the mist is to use a suitable mist/fume suppressant[6].

1.2.3 Dichloromethane

Total dichloromethane releases to air were reported at 2,884 kg in the 2013 reporting year. Dichloromethane is predominantly a solvent that is commonly used in metal cleaning and as a finishing solvent. As shown in Table 1, only one facility showed releases of dichloromethane.

1.2.4 Nickel

Total nickel releases to air were reported at 29 kg in the 2013 reporting year. Nickel electroplating is similar to that of chromium electroplating. The difference lies in its properties and may also contain organic agents in the nickel solution. Nickel plating is corrosion resistant but tarnishes, while chromium plating is durable, corrosion resistant and will not tarnish[7]. A total of 4 facilities reported nickel releases to ChemTRAC, as shown in Table 1. M M Plating Inc. comprised 90% of the overall nickel emission, while the remaining 10% are equally distributed amongst the rest of the facilities.

---

[4] Mandich, V. and Snyder, L (2010). *Modern Electroplating – Electrodeposition of Chromium*. http://www2.bren.ucsb.edu/~dturney/port/papers/Modern%20Electroplating/07.pdf
[5] National Center for Biotechnology Information. *Shiny Science: A New Substitute for Hexavalent Chromium*. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1552031/
[6] Atotech. *Second Generation Non PFOS, Low Foaming Mist Suppressant*. http://www.atotech.com/products/general-metal-finishing/functional-chrome-plating/fumetrolr-21-lf-2.html
[7] Philadelphia Luthier Tools and Supplies. *Differences between Nickel and Chrome Plating for Guitar Hardware.* http://blog.philadelphialuthiertools.com/2013/06/17/differences-between-nickel-and-chrome-plating-for-guitar-hardware/

1.2.5 Nitrogen Oxide (NOx)

Total nitrogen oxide releases to air were reported at 23,181 kg in the 2013 reporting year. Nitrogen oxide releases are expected to be from process heating, primarily the combustion of natural gas. Releases of nitrogen oxide are primarily from the heat treating processes (including case hardening) as well as heating of electroplating operations which occur at elevated temperatures. Hard chrome electroplating involves long electroplating time and intense heat generation where the plating solution is generally maintained an optimum plating temperature, typically within 2ºF of the target temperature of 135ºF[8]. Failure to maintain a uniform temperature throughout the bath would hinder with product quality.

1.2.6 Particulate Matter 2.5 (PM2.5)

Total PM2.5 releases to air were reported at 1,866 kg in the 2013 reporting year. Releases to air of PM2.5 are expected to be primarily from the polishing, grinding, sand blasting, alkaline cleaning, acid dipping, anodic treatment, and electroplating operations. Discharges to air from the facility are both controlled (via filter, dust collector, mist eliminator or scrubber), and direct (uncontrolled). Fume suppressants or wet scrubbers or a combination of both are commonly used to prevent chemical releases into the air from the electroplating bath[9], while polishing, grinding, cleaning, acid dipping, and anodic treatment are generally uncontrolled. Other ancillary operations such as fluids handling is not expected to emit comparably significant emissions. One of the facilities, Metal Koting Continuous Conlour Coat Ltd., released 1,370 kg of PM2.5, which entails 73% of the total contribution for that particular contaminant. The top three reporters from this sector comprise more than 80% of the releases. From the ChemTRAC data, the eight facilities with air releases of PM2.5 are provided in Table 1.

1.2.7 Trichloroethylene

Total trichloroethylene releases to air were reported at 285 kg in the 2013 reporting year. Similar to dichloromethane, trichloroethylene is predominantly used as a solvent and it is primarily released from the pre-treatment stage in the plating process where the parts are being cleaned and degreased prior to being treated. Only one facility reported releases of trichloroethylene, as shown in Table 1

1.2.8 Volatile Organic Compounds (VOCs)

Total VOC releases to air were reported at 57,290 kg in the 2013 reporting year. Releases to air from the sector are primarily from solvent-based degreasing activities. Ancillary operations such as handling of fluids are not expected to be emitting VOCs in significant amounts. From the ChemTRAC data, the top

[8] U.S EPA. *Innovative Cooling Systems for Hard Chrome Electroplating* http://www3.epa.gov/region9/waste/p2/projects/metal-innovcr.pdf
[9] U.S EPA. *AP-42 Electroplating*. http://www3.epa.gov/ttnchie1/ap42/ch12/final/c12s20.pdf

four facilities with VOC emission represent more than 80% of the releases. All facilities with VOC emissions are shown in Table 1 below.

Table 1. Top 10 Facilities with the Highest Air Releases and Contribution by Pollutant within the Coating, Engraving, Cold and Heat Treating and Allied Activities Sector[10]

Pollutant	Air Release (kg)	Sector Contribution (%)
Chromium, Hexavalent and its compounds (7440-47-3)	**17**	
Metal Koting Continuous Colour Coat Ltd	11	65%
Four Star Metal Finishing Ltd	3	18%
Sun Polishing And Plating Co Ltd	1	6%
Ardaven Platers Limited	1	6%
Leader Plating On Plastics	1	6%
Chromium, Non-Hexavalent and its compounds	**8**	
Metal Koting Continuous Colour Coat Ltd	8	100%
Dichloromethane (Methylene chloride) (75-09-2)	**2884**	
EMI RFI Shield Plating Inc.	2884	100%
Nickel and its compounds (7440-02-0)	**29**	
M M Plating Inc	26	90%
Superfinish CoLtd	1	3%
Electroless Nickel Technologies Inc	1	3%
Four Star Metal Finishing Ltd	1	3%
Nitrogen Oxides (NOx) (11104-93-1)	**23181**	
Metal Koting Continuous Colour Coat Ltd	11983	52%
Acadian Platers CoLtd	1659	7%
Eastend Plating	1600	7%
Four Star Metal Finishing Ltd	1477	6%
Pure Metal Galvanizing ULC	1125	5%
Vision Coaters Canada Ltd	1096	5%
Production Paint Stripping Limited	933	4%
Automatic Coating Ltd	925	4%
EMI RFI Shield Plating Inc.	832	4%
Active Metal Finishing Co Ltd	624	3%
Particulate Matter 2.5 (PM2.5)	**1866**	
Metal Koting Continuous Colour Coat Ltd	1370	73%
Automatic Coating Ltd	177	9%
Sun Polishing And Plating Co Ltd	91	5%
Vision Coaters Canada Ltd	83	4%
Brimac Anodizing 1985 Limited	47	3%
Pure Metal Galvanizing ULC	36	2%

[10] Source: 2014 Reporting Year ChemTRAC Data.

Pollutant	**Air Release** (kg)	**Sector Contribution** (%)
Superfinish CoLtd	32	2%
Eastend Plating	30	2%
Trichloroethylene (079-01-6)	**285**	
Sun Polishing And Plating Co Ltd	285	100%
Volatile Organic Compounds (VOCs) Total	**57290**	
Vacuum Metallizing Limited	24553	43%
Vision Coaters Canada Ltd	9532	17%
Metal Koting Continuous Colour Coat Ltd	7670	13%
EMI RFI Shield Plating Inc.	5691	10%
Production Paint Stripping Limited	4880	9%
Sun Polishing And Plating Co Ltd	1897	3%
LongLok Canada	1720	3%
Automatic Coating Ltd	1036	2%
Active Metal Finishing Co Ltd	174	0%
Ardaven Platers Limited	137	0%
Grand Total	**85560**	

1.3 Description of Sector Processes and Operations

Within Metal Finishing sector facilities receive metal or plastic parts which require surface finishing operations. Operations generally performed in this sector include surface preparation and surface treatment. The parts would undergo grinding and polishing as well as degreasing through the use of solvent to remove surface grease. For parts undergoing heat treating operations, they would be heated in a furnace and then cooled to impart specific properties in the metal. For coating operations, the parts will then go through the alkaline cleaning, which removes soils, while acid dipping is used to remove tarnish and the oxide film created by alkaline cleaning. Once surface preparation has been completed, the parts could go through an optional anodic treatment, which cleans the part's surface and improves the adhesion of the metallic coating on the parts, which in this sector is predominantly electroplating. This is then followed by the last step of the process, which is the electroplating operation prior to being stored and shipped to clients. For each process, various pollutants are emitted into the air, as shown in Figure 1.

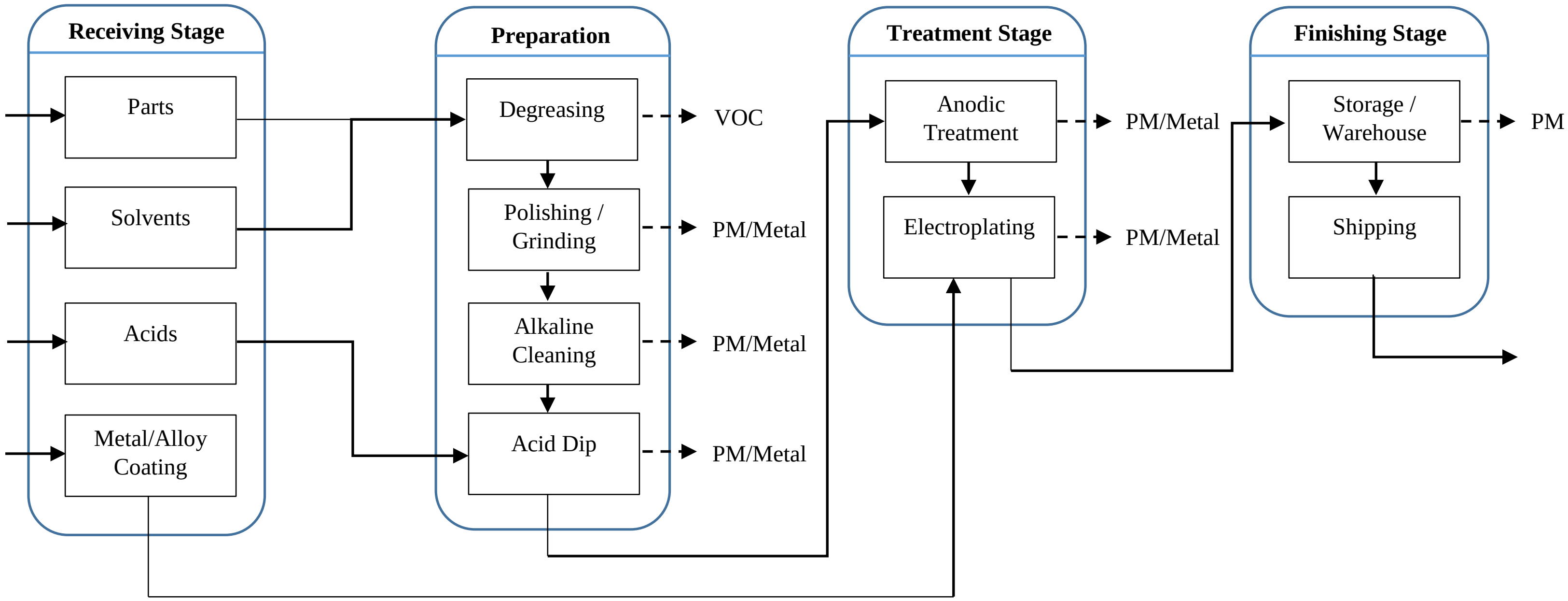

Figure 1. Process Flow Diagram of Coating, Engraving, Cold and Heat Treating and Allied Activities Sector with Corresponding Process Emissions

2.0 BARRIERS IDENTIFIED

2.1 Sector Breakdown

Within the sector, 45.3% of the facilities have less than 10 employees, and 24.3% have less than 5 employees. The demographics in this sector are varied, with more than 50% having 10 or more employees. The ownership mix contains owner/operator, family run corporations, and partnerships. With 5.2% of the sector with greater than 100 employees, such facilities in the sector are publicly traded entities, or owned by investment groups. Facilities are classified into 'job shops' facilities, implying that they offer services to manufacturers of fabricated metals objects and that their primary concern is metal finishing, and 'captive shop' companies that performs metal finishing on-site as part of their manufacturing process and metal finishing process is not there primary operation[11].

2.2 Motivation

The activities performed by the larger facilities are similar to those of smaller shops, which primarily include electroplating, plating, polishing, anodizing, and coloring. However, facilities that performs larger scale projects for industry, including the automotive and aerospace sector are more stringently governed and products produced must rigorously meet specifications.

Motivational barriers identified within this sector include:

- Businesses rely heavily on chemical suppliers to optimize existing processes and to seek alternative P2 solutions.[12]
- Businesses have been skeptical about pollution prevention programs' benefits.[13]
- Hesitancy to change existing practices.[14]
- Lack of financial incentives.
- Lack the means to recognize, appreciate and evaluate the environmental consequences of their actions[15]

[11] Thambiran, N., Barclay, S., Buckley, C. (2000). *Pollution Prevention Really Does Pay: Case Studies from the Metal Finishing Waste Minimisation Club*. Pollution Research Group, School of Chemical Engineering. http://www.ewisa.co.za/literature/files/173thambiran.pdf

[12] U.S EPA (1997). *Pollution Prevention for the Metal Finishing Industry*. EPA/742/B-97/005 http://nepis.epa.gov/Exe/ZyPDF.cgi/20000VPB.PDF?Dockey=20000VPB.PDF

[13] California Department of Toxic Substances Control. *Pollution Prevention Project.* http://www.dtsc.ca.gov/PollutionPrevention/SB14/upload/Metal_Finishing.pdf

[14] California Stage Water Resources Control Board Division of Water Quality. *Pollution Prevention Training for Pretreatment Inspectors.* p.12-2. https://www.owp.csus.edu/research/wastewater/papers/P2-Training-Manual.pdf

[15] Subhas K., Diwekar, U. *Tools and Methods for Pollution Prevention*. NATO Science Series. Vol 62. https://books.google.ca/books?isbn=9401144451

- Lack of pressure from customers.[16]

2.3 Knowledge

A considerable lack of history and failing to be up-to-date with green technologies creates a hesitant attitude about investing in alternative P2 processes[17]. With a limited number of staff, smaller facilities are not positioned to employ specialists with an enhanced knowledge of P2 measures. Small facilities of any size are more likely to learn from business-to-business discussions, suppliers, tradeshows or magazines, and from industry associations. Medium size enterprises, and facilities with more than 50 employees are likely to have technical sub-specialization within the organization. However, that knowledge is specific to performance optimization of the coatings and not typically related to environmental performance.

Within the sector, the following knowledge barriers have been identified:

- Limited or no technical resources in-house
- Business may not understand the necessary actions involved in implementation of a P2 technology or practice.[18]
- Lack of information of P2 benefits.[19]
- Unsure how new technologies will impact business (skeptical of how environmentally beneficial opportunities will impact product quality).
- Desire external expertise to validate potential opportunities[20]
- The belief that external regulations will force change, so hesitant to implement changes that could be subject to further regulations[21].

A major obstacle for the facilities is little or no knowledge about pollution prevention technologies. The effectiveness, capital cost, annual savings, and payback period of technologies are all the key factors to deciding whether or not alternative technologies should be implemented.

[16] Hassanali, et al. *The Toronto Region Sustainability Program: insights on the adoption of pollution prevention practices by small to medium-sized manufacturers in the Greater Toronto Region*. 2005.
[17] Altmayer, F. Scientific Control Labs Inc. *Barriers to Pollution Prevention in Metal Finishing*. http://infohouse.p2ric.org/ref/30/29948.pdf
[18] Heath & Heath, 2010. *How to change things when change is hard*. Crown Business.
[19] California Stage Water Resources Control Board Division of Water Quality. *Pollution Prevention Training for Pretreatment Inspectors.* p.12-2. https://www.owp.csus.edu/research/wastewater/papers/P2-Training-Manual.pdf
[20] ChemTRAC Business Panel, 2012.
[21] Discussions with S. McCallum. Kuntz Electroplating. 2015

2.4 Financial Resources

Based on historical data, the metal finishing industry's profitability has been decreasing overall[22]. The profit margin for this sector are generally small, and when combined with the small average business size, the metal finishing industries have limited financial resources to spend towards P2 programs[23]. The lack of capital due to limited financial resources and funding for shop restoration and modernization often becomes a major challenge to implement P2 measures, even if the initiative end up profitable[24]. In our experience, facility managers are often faced with managing critical assets, and their repair well beyond the intended service, which amplifies the requirement for building a strong business case for P2 initiatives. Within the sector, the smaller facilities are typically focussed on their day-to-day survival rather than research, and investing capital for retrofits, new equipment, or other supplies in order to prevent or reduce pollution.

The following financial barriers that have been identified within the sector include:

- Lack of financial capital to invest.[25]
- Capital tied up in other investments (repair, capital improvement to increase capacity)

2.5 Time/Human Resources

As a result of the financial competitiveness of the industry, operations are typically quite lean. Resources are deployed to maintain production levels. For larger companies, management personnel are heavily involved mostly in the technical aspects of the company, as well as sales, while smaller businesses are more focused on their the day-to-day operation. With minimal to no spare time at hand, identification of available P2 opportunities are often overlooked. Medium sized enterprises are likely to have staff allocated to continuous process improvement initiatives, but may lack specific technical knowledge to investigate P2 initiatives.

Time/Human Resource Barriers Include:

- Facilities with limited time and human resources cannot afford to release employees for training without affecting operations.
- Lack of available time to explore and research effectiveness of P2 opportunities

---

[22] Chalmer, P. (2008). *The Future of Finishing*. http://www.nmfrc.org/futfinrev2.doc
[23] U.S EPA. (2007). *Energy Trends in Selected Manufacturing Sectors: Opportunities and Challenges for Environmentally Preferable Energy Outcomes. http://archive.epa.gov/osem/sectors/web/pdf/ch3-8.pdf*
[24] Hassanali, et al. *The Toronto Region Sustainability Program: insights on the adoption of pollution prevention practices by small to medium-sized manufacturers in the Greater Toronto Region*. 2005.
[25] California Stage Water Resources Control Board Division of Water Quality. *Pollution Prevention Training for Pretreatment Inspectors.* p.12-2. https://www.owp.csus.edu/research/wastewater/papers/P2-Training-Manual.pdf

2.6 Organizational

In a mature industry, such as the metal finishing sector, a negative attitude and reluctance towards changing old processes and practices often leads to preventing new methods of reducing or eliminating pollution. Due to the size of most metal finishing facilities, managers are often reluctant to take risks with new technologies or may even simply become uninterested in changing their customary ways of doing business[26].

The following organizational barriers have been identified:

- Environmental managers may not fully understand production processes and may doubt that P2 opportunities or technologist exist[27].
- Limited worker involvement / no reward for pollution prevention.

2.7 Market

Facilities in the metal finishing sector that produces products for the military, aerospace, and automotive industries are stringently regulated, and products must rigorously meet customer's technical specifications[28]. In the military and aerospace industries, this specification often contain toxic substances such as hexavalent chromium[29]. The automotive industry is a major market segment for facilities in this sector. Programs are launched on a 5-year vehicle model life cycle, and production of parts are required throughout the life cycle. Deviations within that 5 year window are not allowed, unless subjected to rigorous quality control testing[30]. Often the costs associated with performing the quality control testing make changes not economically feasible. Facilities governed by the military are required to use environmentally harmful chemicals to produce the final products even though safer or less hazardous alternatives are available. Due to this constraint, metal finishers have minimal to no ability to modify the formulation of process chemicals.

The following are identified market barriers:

- Contract requirements.[31]

[26] Hassanali, et al. *The Toronto Region Sustainability Program: insights on the adoption of pollution prevention practices by small to medium-sized manufacturers in the Greater Toronto Region*. 2005.
[27] U.S Congress Office of Technology Assessment. (1994). *Industry, Technology, and the Environment – Competitive Challenges and Business Opportunities.*
[28] Discussions with Tom Kite. Messier-Dowty-Bugatti. 2015.
[29] U.S EPA (1997). *Pollution Prevention for the Metal Finishing Industry*. EPA/742/B-97/005 http://nepis.epa.gov/Exe/ZyPDF.cgi/20000VPB.PDF?Dockey=20000VPB.PDF
[30] Discussions with Janet Haynes. Magna. 2015
[31] California Stage Water Resources Control Board Division of Water Quality. *Pollution Prevention Training for Pretreatment Inspectors.* p.12-2. https://www.owp.csus.edu/research/wastewater/papers/P2-Training-Manual.pdf

- Lack of markets for recovered materials.[32]
- Lack of pressure of customers requiring greener solutions

2.8 Technological

The absence of readily available technologies may pose a challenge for metal finishing industries to implement pollution prevention measures. Even if the technology is available to the sector, proposed pollution prevention may require process shutdown due to modification of the work flow, product, or installing a new equipment, which would lead to loss of production time[33]. In addition to production losses, not only may new technologies require additional training for employees to operate the equipment safely, but may also change product quality or specifications that could lead to customer rejection. Processes and equipment in the metal finishing sector often require floor space, and when most metal finishers lack room to install new equipment for pollution prevention, purchasing additional equipment may not always be feasible[34]. Even where technically viable solutions exist that have proven market installations, it has been our experience that facilities in this sector may still reject change as they operate under the maxim “if it ain’t broke, don’t fix it.”

Technological barriers identified include:

- Lack of specialized staff training to implement new technology
- Lack of floor space for process modification or installation of new technology[35].
- Appropriate technologies may not be available, or reliability not proven.
- Existing solutions may negatively affect process or product[36].

2.9 Regulatory

Facilities in this sector are required to meet requirements from Environment Canada as well as the Ministry of Environmental and Climate Change (MOECC) as a result of discharging contaminants to the natural environment. These regulations are generally built around the release of hexavalent chromium

[32] Industry Canada. *Metal Finishing in Canada.* http://publications.gc.ca/collections/Collection/C45-2-3-2000-6E.pdf
[33] Hassanali, et al. *The Toronto Region Sustainability Program: insights on the adoption of pollution prevention practices by small to medium-sized manufacturers in the Greater Toronto Region*. 2005.
[34] U.S Environmental Protection Agency (1992). *Guides to Pollution Prevention – The Metal Finishing Industry.* http://nepis.epa.gov/Exe/ZyPDF.cgi/30004KLA.PDF?Dockey=30004KLA.PDF
[35] Illinois Sustainable Technology Center. *Metal Finishing Industry.* http://www.istc.illinois.edu/info/library_docs/manuals/finishing/rinsing.htm
[36] U.S Congress Office of Technology Assessment. (1994). *Industry, Technology, and the Environment – Competitive Challenges and Business Opportunities.* http://govinfo.library.unt.edu/ota/Ota_1/DATA/1994/9415.PDF

from electroplating, anodizing, and reverse etching activities. Environment Canada regulation SOR/2009-162 requires facilities to comply with point source emission standards based on:

- Validated source testing to show in stack concentration is below 0.03 mg/dscm of hexavalent chromium
- Limiting the surface tension of the plating solution in the tank using a tensiometer, or stalagmometer
- Using a tank cover attached to an evaluation device with a HEPA filter

The MOECC has a technical standard for the metal finishing sector that can be used to manage air emissions. The key contaminants of interests for this sector are hexavalent chromium and nickel compounds[37]. The regulations govern the point of impingement (POI) limits of hexavalent chromium and nickel. The downward pressure of the air quality limits for O. Reg 419/05 has been a challenge for the surface finishing sector to comply with MOECC, which necessitated the technical standard. The technical standard requires facilities to use an approved control measure (typically minimizing surface tension), keep updated logs of all ventilation equipment, perform preventative maintenance, and annual testing for the ventilation system to ensure the airflow is adequate. A table of the general emission limits at a provincial level, which will be phased-in in July 2016, is shown in Table 2 below.

Table 2. General Contaminant Concentration Limit - 2016 Phase-in[38]

Contaminant	**Concentration Limit (Annual Averaging Period, μg/m^3)**
Hexavalent Chromium	0.00014
Nickel Compounds	0.04

The following are some of the barriers identified:

- Concern that enrolling into the P2 program would open shops to enforcement actions.[39]
- Uncertainty about future regulatory activity.[40]

---

[37] Environmental Registry. *Metal Finishers – Industry Standard under the Local Air Quality Regulation (O. Reg. 419/05)I. https://www.ebr.gov.on.ca/ERS-WEB-External/displaynoticecontent.do?noticeId=MTI0NTEw&statusId=MTg3NDk2*
[38] Ontario Ministry of the Environment – Standards Development Branch. *Summary of Standards and Guidelines to support Ontario Regulation 419/05 – Air Pollution – Local Air Quality*. https://dr6j45jk9xcmk.cloudfront.net/documents/1428/3-7-6-contaminent-name-en.pdf
[39] California Department of Toxic Substances Control. *Pollution Prevention Project.* http://www.dtsc.ca.gov/PollutionPrevention/SB14/upload/Metal_Finishing.pdf
[40] U.S EPA (1997). *Pollution Prevention for the Metal Finishing Industry*. EPA/742/B-97/005 http://nepis.epa.gov/Exe/ZyPDF.cgi/20000VPB.PDF?Dockey=20000VPB.PDF

3.0 POLLUTION PREVENTION OPPORTUNITIES

The followings have been identified as potential P2 options for facilities:

- Chromic Acid Recovery and Reuse
    - Leader Plating on Plastics Limited, a facility located in North York, ON, that employs roughly 20 workers produces products primarily for the automotive industry. The facility installed an ion transfer technology (porous pots) on the etch bath to recover and reuse the chromic acid from the hexavalent chromium etch bath on the ABS plastic pre-plate line. The capital cost for the equipment was $13,000 and the annual cost saving was $13,000, which resulted in a 1 year payback period. The recovery and reuse of chromic acid reduced chromic acid purchases as well as the amount of chromium directed to the waste treatment system[41].
- Alternative Parts Cleaning
    - A small family-owned metal plating facility with 15 employees located in Toronto produces fireplace accessories and airport weight scales. The job shop switched from using vapor degreaser to caustic bath for cleaning the parts. This resulted in 50% reduction of trichloroethylene (TCE) usage, which saved the shop $2,100 annually with no capital cost involved[42].
- Alkaline Cleaner Bath Life Extension
    - Holody Electro-Plating Limited, an electroplating company located in Guelph with 5 employees has been awarded the prestigious P2 award from the MOECC for being environmentally conscious in their business practices. The company installed a coalescing unit for $2,700, which extended the cleaner life by 5 times, resulting in lower raw material cleaner consumption (40.8%) and waste treatment costs. The P2 initiative saved the company $2,700 annually with a 1 year payback period[43].
- Trivalent Chromium Plating
    - Foss Plating, a family-run chrome plating shop with approximately 30 employees converted their hexavalent chromium line to a fully automated single chrome-cell (III) system. The capital cost for the conversion was $30,000. The annual savings was approximately the same amount as the conversion cost; as a result, the payback period

---

[41] Task Force. (1998). *Fifth Progress Report – Metal Finishing Industry Pollution Prevention Project*. http://infohouse.p2ric.org/ref/11/10657.pdf

[42] Hassanali, et al. *The Toronto Region Sustainability Program: insights on the adoption of pollution prevention practices by small to medium-sized manufacturers in the Greater Toronto Region*. 2005.

[43] Holody Electro-Plating Limited. *Pollution Prevention Project – Electro Cleaner (Alkaline) Bath Life Extension and Reuse by Oil Removal.* http://holodyplating.com/quality/pollution-prevention.html

was less than a year. This conversion also increased system productivity and efficiency, along with a decreased number of rejected parts[44].

- Water Usage Reduction
  - Specialty Technical Services (STS), a chrome plating company located in Hamilton which consist of roughly 3 employees performs surface treatment of aircraft repair and overhaul parts. The company was able to reduce water consumption by reusing water from various processes to replace plating tank evaporative losses. Modifications were made, including switching their air scrubber wash down unit from manual operation to one that is controlled by the plating tank; a level controller monitors the evaporation and scrubber wash down water is automatically added into the plating solution to make-up for the evaporative losses. In addition, the water from the rinse tank is also pumped directly into the chrome plating solution instead of using fresh water to make-up for the evaporative losses. Discharge to sewer was eliminated; thus wastewater treatment system and attendant for off-shift was no longer required. The annual saving for the company was $1,200 for labor costs in addition to cost savings from water and chemical consumption. The total capital cost was $1,500 for the equipment and $1,000 for installation, which resulted in a payback period of less than a year[45].
- Drag-out Reduction
  - One of the most important low-tech methods to reduce contaminants into the waste water is through drag-out reduction[46]. One of All American Manufacturing facilities consisting of roughly 10-20 employees have installed three spray rinses to reduce dragon-out loss from its electroplating operations. The total capital cost was $4,890; $800 for 2 nickel plating tank nozzles, $480 for 2 nickel drag-out nozzles, $60 for a chrome plating tank nozzle, while the remaining costs are for piping, installations etc. Upon installation of the spray nozzles, the facility was able to save $3,756, $2,400, and $2,220 on nickel solution drag-out, chrome solution drag-out, and rinse water reduction, respectively. Thus, the total annual saving was $8,376 with a roughly 7 month payback period[47].

---

[44] Illinois Sustainable Technology Center. *Metal Finishing Industry.* http://www.istc.illinois.edu/info/library_docs/manuals/finishing/toc1.htm

[45] Task Force. (1998). *Fifth Progress Report – Metal Finishing Industry Pollution Prevention Project*. http://infohouse.p2ric.org/ref/11/10657.pdf

[46] Michigan Department of Environmental Quality. *MI DEQ & RETAP Pollution Prevention (P2) Training – Metal Finishing: Electroplating P2*. https://www.michigan.gov/documents/deq/deq-ess-retap-ppt_P2-Electroplating_448069_7.pdf

[47] U.S Environmental Protection Agency. *Reducing Dragout with Spray Rinses.* http://www3.epa.gov/region9/waste/p2/projects/metal-spray.pdf

- Resource Recovery / Closed-loop Recycling
    - A small family-owned job shop located in Toronto consisting of roughly 35 employees performs plating of lighting furniture and store fixtures. In order to recover metals from the plating bath rinse waters to be reused in the plating operations, the facility installed three separate electrolytic metal recovery units for copper, nickel and zinc. This reduced the load on the wastewater treatment system and the purchase of raw materials, which resulted in annual savings of $2,500 from waste disposal, $12,800 from waste treatment, and $2,880 from water consumption. The total capital cost was approximately $45,500 with a 2.5 years payback period[48].
- HVLP paint guns
    - High volume low pressure spray gun offer a 30% transfer efficiency improvement over siphon feed guns.[49] Painter technique, and training are integral to achieving such improvements. Recommended hand speeds are approximately half for HVLP guns, typically require changing reducers, and maintaining specific atomizing air.
    - The same small family-owned job shop located in Toronto that purchased metal recovery units as stated above, also switched their standard air atomized paint guns to HVLP spray guns. The HVLP guns reduced over spraying and improved fluid transfer efficiency, which resulted in a 20% reduction in air dry acrylic lacquer in their first year. This change led to an annual saving of $2,500 with a payback period of less than a year[50].

[48] Hassanali, et al. *The Toronto Region Sustainability Program: insights on the adoption of pollution prevention practices by small to medium-sized manufacturers in the Greater Toronto Region*. 2005.
[49] Autobody Profitability Handbook – Appendix 2. HVLP Background Information. Hamilton District Autobody Repair Association.
[50] Hassanali, et al. *The Toronto Region Sustainability Program: insights on the adoption of pollution prevention practices by small to medium-sized manufacturers in the Greater Toronto Region*. 2005.