

PFAS IN THE METAL PLATING INDUSTRY

FACT SHEET


INTRO

PFAS have been used in the metal finishing industry since the 1950s for a variety of purposes. PFAS, particularly PFOS, have been used as mist suppressants that are added to metal plating and finishing baths to prevent air emissions of toxic metal fumes. In addition, PFAS can be used in plating activities, including hard and decorative chrome plating; chromic acid anodizing; nickel, cadmium, or lead plating; metal plating on plastics; and alkaline zinc plating to reduce the surface tension of the electrolyte solution.

Studies show use of PFAS in these settings can result in high concentration wastewater discharges (USEPA 2009b) and air emissions. Once these wastewaters are treated PFOS and other PFAS may be present in effluent and treatment sludge. In addition, in 2007 EPA Region 5 conducted a study that determined PFOS from the fume suppressants were present in the water throughout Chicago and Cleveland. In response to the finding the EPA banned the use of PFOS as a fume suppressant for Chromium electroplating in 2015 and the industry phased it out completely by September 2016. (NASF 2019)

WHAT ARE CHEMICAL FUME SUPPRESSANTS?

Chemical Fume Suppressants reduce the surface tension which in turn controls the release of Chromium. By reducing the surface tension in the plating bath the gas bubbles become smaller and rise more slowly than larger bubbles. This means that if the bubbles make it to the surface, they do not have a lot of energy, which returns the material in the bubble to the bath. PFAS used for fume suppression in the chrome plating industry was reported as early as 1954 (U.S. EPA, 1998). A newer generation of perfluorinated suppressants emerged in the late 1980s/early 1990s and perfluorooctane sulfonate (PFOS) quickly became the industry standard as the most economic method of complying with the EPA's chromium emission requirements. Typical PFAS containing foam suppressants included;



COMPANY	PRODUCT NAME	CHROME PLATING APPLICATIONS	CONTAINS PFOS
Benchmark Products	Benchbrite CR	All	Yes
Clepo Chrome	MacDermid	All	Yes
Fumetrol 140	Atotech, U.S.A.	All	Yes
HCA - 6.2	Hunter Chemical LLC	All	Yes
HCA - 4	Hunter Chemical LLC	All	Yes

PFAS IN THE METAL PLATING INDUSTRY

EPA banned the use of PFOS-based fume suppressants in 2015 (U.S. Federal Register, 2012). Following a one-year extension for certification of alternative products, the use of PFOS-based suppressants was banned effective September 21, 2016. At that time, EPA approved five non-PFOS alternatives for use in chrome plating applications: Fumetrol 21 LF2, Dicolloy CRPF, HCA - 8.4 (for both decorative and hard plating), and Macuplex STR NPFX (Air Resources Board, 2016). It should be noted that federal regulations define “PFOS-free” as containing less than 1% PFOS by weight. In June 2020 Michigan Department of Environment, Great Lakes and Energy (EGLE),

Water Resources Division, published sampling results of “PFOS-free” fume suppressants and effluent from 11 different plating shops. Results of the fume suppressant sampling indicated that none of the fume suppressants contained detectible amounts of PFOS. The only PFAS compound detected in the samples was 6:2 fluorotelomer sulfonates, which is not a precursor to PFOS. Effluent sample results showed a much more complex picture. PFOS was found in the effluent samples at concentrations ranging from 15 ppt to 51,700 ppt. Additionally, several other types of PFAS were detected in the effluent samples. The authors of the study attributed the presence of these compounds to historical use of PFOS-based fume suppressants, which were used prior to 2015. (Michigan EGLE, 2020)

ADDITIONAL USES OF PFAS

In addition to use of PFAS within mist suppressants a literature review noted that PFAS use in the Plating industry may also include:

- Use to treat metal surfaces to prevent corrosion, reduce mechanical wear, or enhance aesthetic appearance. They promote the flow of metal coatings and prevent cracks during drying. (Kissa 2001)
- Similar to chromium plating operations, chromium anodizing operations use PFAS as WA/FS. Chromium anodizing facilities use chromic acid to form an oxide layer on aluminum to provide resistance to corrosion. The chromium anodizing process is used to coat aircraft parts (such as wings and landing gears), as well as architectural structures that are subject to high stress and corrosive conditions. (EPA 2012)
- A US EPA Significant New Use Rule in 2007 for PFAS lists exceptions for the rule as a “fume/mist suppressant in metal finishing and plating baths. Examples of such metal finishing and plating baths include: Hard chrome plating; decorative chromium plating; chromic acid anodizing; nickel, cadmium, or lead plating; metal plating on plastics; and alkaline zinc plating.” (EPA 2007)
- PFAS dispersion products, which are used to coat metals, have been manufactured since 1951. (Prevedouros, Cousins et al. 2006)
- Some PFASs are effective blocking agents for aluminum foil. Monfluor 91 is a noted brand name for this. (Kissa 2001)
- PFBS, PFHxS, PFOS, PFOA, PFNA, and PFDA are associated with metal plating. (Knepper 2012)

POTENTIAL RELEASE MECHANISMS

Based on a preliminary understanding of PFAS use in the metal finishing Industry areas of concern for PFAS include:

- Historical entrainment of PFAS within air emissions due to its use within mist suppressants and potential release to the surrounding environment
- Release to wastewater from PFAS use within plating baths as WA/FS
- Inclusion within the wastewater treatment systems sludge due to the treatment of metal finishing wastewaters

REFERENCES

(USEPA 2009b. USEPA. 2009b. “PFOS Chromium Electroplater Study.” US EPA – Region 5, Chicago, IL September 2009.

US EPA. 1993. “Proposed Standards for Chromium Emissions from Har and Decorative Chromium Electroplating and Chromium Anodizing Tanks; Proposed Rule.”

NASF. 2019 PFAS issue summary, Spring 2019

USEPA 2012, US Federal Register. 2012. Vol. 77 No. 102. 40 CFR Part 63

US EPA. 1998. “Capsule Report Hard Chrome Suppressants and Control Technologies.” December 1998

Air Resources Board. 2016. “Chemical Fume Suppressants for use in Chrome Plating Facility Operations”

Kissa, Erik. 2001. “Fluorinated Surfactants and Repellents” (Marcel Dekker, Inc.).

An EPA NESHAP Rule lists the NAICS code associated with these industries as 332813 with MACT codes 1607, 1610, and 1615. (EPA 2012)

Michigan Department of Environment, Great Lakes, and Energy (EGLE), Water Resources Division June 2020; Targeted and Nontargeted Analysis of PFAS in Fume Suppressant Products at Chrome Plating Facilities (Michigan EGLE, 2020)