HALEY & ALDRICH

PFAS TECHNICAL UPDATE

The chrome plating industry

Studies are showing that per- and polyfluoroalkyl substances (PFAS) may have potential adverse human health and environmental impacts. This has led to the setting of health-based standards, including mandatory state orders for various entities requiring investigation of potential PFAS contamination. The regulatory landscape is evolving as the scientific and regulatory communities continue to learn about PFAS and their impacts.

To make informed decisions about if, when, and how to investigate, manufacturers will need to understand the use of PFAS in their operations, including technical and historical details. Haley & Aldrich's PFAS Technical Updates will help you stay informed.

California has issued PFAS assessment orders for airports, landfills, and most recently, to about 270 chrome plating operations. And California is not alone. A growing number of states are pursuing PFAS policies and may, in time, also assess the plating industry.

THE CHROME PLATING PROCESS

Manufacturers use plating, in which a metal cover is deposited on a conductive surface, for many purposes. It is used for corrosion inhibition and radiation shielding; to harden, reduce friction, alter conductivity, and decorate objects; and to improve wearability, paint adhesion, infrared (IR) reflectivity, and solderability. Chrome plating is one of the most common forms of metallic plating.

Chrome plating is one of the most widely used industrial processes and is a finishing treatment using electrolytic deposition of a coating of chromium onto a surface for decoration, corrosion protection, or durability. An electrical charge is applied to a tank (bath) containing an electrolytic salt solution. The electrical charge causes the chromium metal in the bath to fall out of the solution and deposit onto objects placed into the plating bath. In an anodizing process, an oxide film is formed on the surface of the part (U.S. EPA, 2009). In chrome plating processes, only about 20 percent of the electrical current applied deposits chromium onto the part. The remaining current forms mist and bubbles of hydrogen gas at the cathode and oxygen at the anode that rise to the surface of the bath. As these bubbles burst, unless abatement measures are taken to prevent it, hexavalent chromium [Cr(VI)] will be emitted into the air.

HEXAVALENT CHROMIUM EMISSIONS

The U.S. EPA has classified Cr(VI) as a known human carcinogen by the inhalation route of exposure. EPA applies the Clean Air Act Maximum Achievable Control Technology (MACT) standards to regulate Cr(VI) electroplating or Cr(VI) anodizing tank operations. On January 25, 1995, EPA published the final MACT standard for chromium electroplaters. This rule applies to all facilities performing hard chromium electroplating, decorative chromium electroplating, and chromium anodizing (U.S. EPA, 1993). In California, the Air Resources Board (ARB) adopted the Hexavalent Chromium Airborne Toxic Control Measure for Chrome Plating and Chromic Acid Anodizing Operation (ATCM) in 1988. The ATCM set forth the requirements for reducing Cr(VI) emissions by at least 95 or 99 percent based on the type of operation (Air Resources Board, 2006). The ARB amended the ATCM in 1998 to establish equivalency with the EPA MACT standard. In 2003, the South Coast Air Quality Management District (SCAQMD) adopted amendments to Rule 1469, entitled Hexavalent Chromium Emissions from Chromium Plating and Chromic Acid Anodizing Operations. The amended rule requires hexavalent chromium facilities to reduce Cr(VI)

CALIFORNIA'S NEW REGULATORY ORDER FOR PLATING FACILITIES

In October 2019, the California State Water Resources Control Board (State Water Board) issued regulatory requirements to about 270 plating operations and other states are expected to follow (State Water Resources Control Board, 2019). The State Water Board is seeking to understand PFAS levels in the soil, groundwater, stormwater, and effluent waste-water in and around these plating facilities. To comply with this order, the State Water Board will require plating facilities to follow a three-step process:

1. Submit a site investigation work plan detailing the various potential pathways for discharge of PFAS and the nature of potential PFAS contamination;
2. Perform the site investigation; and
3. Submit the results of the site investigation in a final report.

emissions (Air Resources Board, 2006). Although these rules concern California plating operations, an increasing number of states are implementing PFAS policies, including Alaska, Michigan, New Jersey, New Hampshire, New York, and Vermont, among others.

PFAS IN CHROME PLATING

The use of chemical fume suppressants containing PFAS is a very common source reduction technique that inhibits chromium emissions at the source (Wang et al., 2017; 2015). Chemical fume suppressants reduce surface tension and thereby control Cr(VI) emissions. By reducing surface tension in the plating/anodizing bath, gas bubbles become smaller and rise more slowly than larger bubbles. Slowly rising bubbles reduce the kinetic energy so that when the bubbles do burst at the surface, the Cr(VI) is less likely to be emitted into the air, and the droplets fall back onto the surface of the bath (U.S. EPA, 2009).

PFAS use 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 MACT rule. Therefore, chrome plating facilities operating after promulgation of the MACT rule in 1995 likely used PFOS in their operations. In California, chrome plating facilities operating after 1988 likely used PFOS in their operations.

A 2003 survey conducted by the ARB found that 190 of the 222 Cr(VI) electroplating operations in California used a fume suppressant, either in part or solely, to control Cr(VI) emissions. Almost all of the 190 operations used a chemical fume suppressant with PFOS as the active ingredient, and 124 of these reported using the same suppressant (Fumetrol 140®) (U.S. EPA, 1998). 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, California banned the use of PFOS-based suppressants 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).

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TIMELINE

PFAS IN THE **PLATING INDUSTRY**

1947

3M starts mass-manufacturing PFOA, one of the best-known members in a family of thousands of fluorochemicals called PFAS (per- and polyfluoroalkyl substances).

1954

First reported use of PFAS for fume suppression in chrome plating industry

1995

EPA published the final Maximum Achievable Control Technology (MACT) standard for chromium electroplaters.

2015

U.S. EPA bans the use of PFOS in chrome plating fume suppressants effective September 21, 2015.

2016

California bans the use of PFOS in chrome plating fume suppressants following a one-year extension to federal ban to approve and certify alternatives.

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