The Clean Air Act and Chromium Emissions

In January, AESF Week provided a forum where the U.S. EPA gave us a forecast of what to expect, in regard to the much-anticipated chromium emission standards under the Clean Air Act.

EPA officials made the following "guess" as to what the proposed maximum achievable control technology (MACT) standards for chromium plating might look like:

- Existing Decorative Chromium Finishers: 0.01 mg/cubic meter of air Technology: Use of wetting agents to reduce surface tension to 40 dynes/cm
- Existing hard chromium finishers: 0.03 mg/cubic meter of air Technology: Packed bed scrubber
- New decorative chromium finishers: Trivalent chromium process must be used
- New hard chromium finishers: 0.01 mg/cubic meter of air Technology: Packed bed scrubber

Variations on the above maybe imposed on finishers, based on shop size (large, medium, or small), which will be calculated according to net rectifier capacity, in amp-hr/yr.

It is anticipated that chromic acid anodizers will be required to meet the same standards as decorative chromium finishers.

The EPA intends to reduce the emission level (that would make a chromium finisher/anodizer a "major" source) from 10 tons per year, by an order of magnitude from 1-3 (as little as 2 lb), possibly less. Major sources are required to meet MACT standards.

The above emission standards will be proposed in the near future. The public will be asked for comment. The regulation will be re-evaluated and finalized by April 1993. Regulated companies will then have three years to get into compliance with the standards.

The standards were based on recommendations from the National Air Pollution Control Techniques Advisory Committee, coordinated by Lalit Banker. Status briefings from this committee provide a glimpse of the information it acted upon (these are the committee's data, which we have not confirmed): Hexavalent chromium accounts for 17 percent of the five city average aggregate cancer incidence. Chromium platers make up 9 percent of the total sources of Urban Cancer Incidence.[1] Hexavalent chromium emissions originate from three major processes; hard chromium finishing, decorative chromium finishing, and anodizing (chromic acid process).

The average electroplating shop that performs chromium finishing is a small business, with annual sales of between 1 and 2 million dollars. 92 percent of hard chromium finishers have sales exceeding $500,000, while the highest plant emission control costs are $19,000 annually. There are an estimated 2790 decorative job shops, 1540 hard chromium plating shops, and 680 anodizers using chromic acid. Estimated annual emissions are: All decorative finishers together, 11 tons per year (6 percent); all anodizers (3 percent), 4 tons per year; all hard chromium finishers, 160 tons per year (91 percent).

Of the hard chromium finishers, 30 percent have no emission controls, 30 percent utilize chevron blade mist eliminators (considered 95 percent efficient), 40 percent use packed bed scrubbers (considered 99 percent efficient) and less than 1 percent use advanced mesh-pad mist eliminators (considered 99.9 percent efficient).

No data on the number of hard chromium finishers using mist suppressants (considered 99 percent efficient) were provided.

Of the decorative chromium finishers, 15 percent have uncontrolled emissions, 5 percent use packed bed scrubbers, and 80 percent use fume suppressants.

Of the chromic acid anodizers, 40 percent had uncontrolled emissions, 10 percent used chevron blade demisters, 20 percent used packed bed scrubbers, and 30 percent used fume suppressants.

Section 112 of the Clean Air Act requires setting of standards achieving maximum degree of reduction in emissions (including prohibition) considering costs, non-air quality health impacts, environmental impact, and energy impact. Standards may be less stringent for existing sources. "Floor" emission controls must be established by adopting the average of the best performing 12 percent of existing sources. New sources must meet emission standards based on the best existing sources that are similar.

Fume suppressants would reduce emissions 3.6 tons per year at a maximum annual cost of $2,300 per year.

For hard chromium platers, five regulatory alternatives were developed ranging from chevron blade mist eliminators to advanced mesh pad demisters. Curiously, use of mist suppressants was not considered.

1. Chevron Blade Mist Eliminators would reduce emissions by 127.2 tons per year.

2. If packed bed scrubbers were required by large and medium sized installations and the small facilities used the mist eliminators, emissions would be reduced by 139 tons per year.

3. If packed bed scrubbers were required by large, medium and small installations, the emissions would be reduced by 140.8 tons per year.

4. If large and medium plants were required to install advanced mesh pad eliminators, emissions would be reduced by 143.7 tons per year.

5. if all hard chromium finishers had to install advanced mesh pad eliminators, emissions would be reduced by 144.2 **tons per year.**

In all cases, it was predicted that less than 2 percent of the affected companies would go out of business, based solely on the regulation. Small hard chromium finishers would experience a rise in plating costs of 5-32 percent, medium plating shops would see a rise in costs of 1-10 percent while large shops would see a rise of 1-6 percent.

Three representative markets were used to estimate the increases in electroplating costs: automobile parts, industrial roll, and hydraulic cylinders. Hydraulic cylinders had the highest increased cost, followed by industrial rolls and automotive parts. The committee expected these costs to be passed on to the customers.

Advanced mesh pad eliminator costs range from $34,000 to $73,000 and cost $13,000 to $19,000 annually to operate. Packed bed scrubbers cost about $45,000 and $11,000 annually to operate.

Of major concern to the decorative chromium plating industry is the concept of the EPA mandating that all new decorative chromium plating installation utilize the trivalent chromium plating process with no alternative standard that **would reduce emissions an equal amount.** While trivalent processes have come a long way in recent years in terms of appearance and ease of operation, some platers experience color matching problems when parts from various platers must be matched or when parts plated over various periods of time are assembled together. Decorative chromium finishers who deposit chromium over stainless steel for color match purposes also had difficulties with these processes.

Defining "Decorative"

Just what separates decorative chromium plating from hard? Many decorative applications take advantage of the hardness of chromium to remain decorative. It is well known that chromium deposits are all "hard." Decorative deposits generally are very thin but many applications of chromium plating utilize a thin coating that is all but decorative (consider the chromium deposits on gravure printing rolls, for example). Just where is EPA going make the distinction? When asked for a definition of decorative and hard chromium, EPA representatives asked for help from industry. If you can arrive at a definitive distinction, please let me know.

Early Emission Reductions

Early reductions of chromium emissions appears to be a perfect way to obtain additional time to comply with the regulation. If you can demonstrate substantial reductions of emissions of chromium before the regulations are proposed, you can get up to a six year extension of the application of the new law. The early emissions reduction (EER) must be proven against a year 1987 or later, and you must be able to prove a 95 percent reduction in chromic acid mist emissions since that time.

To apply for an early emissions reduction credit, you must make an enforceable commitment prior to the proposal of a MACT standard. The enforceable commitment cannot be made after January 1, **1994.**

Before jumping into an EER, be sure to check with your state EPA to see if they will go along with it. You could be wasting your time. If the state goes along with the idea, contact your regional U.S. EPA office, to ask for more information.

Estimating Chromium Emission

Until recently, there was no "valid" method of estimating chromium emissions. Stack testing is very expensive ($3,000+ per stack), so what can you do? AESF to the rescue! AESF research Project No. 81, jointly funded by the U.S. EPA and conducted by the University of Central Florida, has developed two equations from analysis of emission data from numerous chromium plating facilities that can be used to estimate stack emissions based upon ampere hours and the tank volume:

$$Cr=49{,}600 + 0.0016\ (\text{Amphr})(\text{Vol}) \quad (1)$$

where volume is in liters and Cr is in milligrams of chromium emitted (uncontrolled)

$$Cr=2{,}900 + 0.00065\ (\text{Amphr})(\text{Vol}) \quad (2)$$

Equation 1 will yield an answer that is roughly twice that of Equation 1 for an average size tank. The university could find no explanation for the difference between the equations. Use the conservative equation (1) to obtain the highest estimate. Use Equation 2 if you operate a tank with high freeboard, partial or total lid, if you use a high efficiency plating bath, or if you use floating plastic balls (efficiently) or some other reasonable method of significantly reducing emissions at the source (tank). Apply efficiency factors obtained from scrubber/ demister manufacturers to the emissions calculated from the equation above to obtain the true emissions from the stack.

The above method of estimating emissions can also be used to obtain better emissions estimates for toxic chemical release reporting. This AESF research project will be developing other stack and fugitive emissions equations in the near future.

Reference:

1. "Analysis of Air Toxics Emissions, Exposures, Cancer Risks and Controllability in Five Urban Areas," EPA 450/ 2-89-012a.