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Subject: Summary of June 22, 2007 Meeting between EPA and Representatives of the Plating and Polishing Industry on the Plating and Polishing Area Source NESHAP

From: Richard Marinshaw, Sarah LaRocca, RTI International

To: Donna Lee Jones, EPA/SPPD/MMG (D243-02)
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

I. Meeting Purpose

To discuss the draft control options for the Plating and Polishing Area Source Category.

II. Location and Date

U. S. Environmental Protection Agency
Research Triangle Park, North Carolina

June 22, 2007; 10:00 am

III. Participants

Environmental Protection Agency
Donna Lee Jones, OAQPS/SPPD/MMG/Project Leader
Steve Fruh, OAQPS/SPPD/MMG/Group Leader

Plating and Polishing Industry
Christian Richter, The Policy Group
Jeff Hannapel, The Policy Group
John Lindstedt, Artistic Plating Company
B.J. Mason, Mid-Atlantic Finishing Corp.
Al Rafini, Sirius Technology, Inc. (briefly, by telephone)

RTI International
Sandra Burns (by telephone)
Sarah LaRocca
Richard Marinshaw

IV. Discussion

A. Overview

The meeting began with introductions by the participants. Discussion of the EPA's assessment of the industry profile, operations, and control practices for the Plating and Polishing Area Source Category followed. This discussion is detailed below. Section V lists the action items identified during the discussions.

B. ORD Study of Nickel Plating Process Emissions

The nickel plating emission testing program sponsored by EPA's Office of Research and Development (ORD) was discussed. Two phases of emission tests were conducted during June 2004 (Phase I) and January 2006 (Phase II), and it was noted that the Sector Policies and Program Divisions (SPPD) has not yet received a copy of the final report for Phase II of the testing. Tests were performed on several types of nickel plating processes, including electroless nickel plating, and rack Watts, rack sulfamate, barrel Watts, and rack Woods strike electroplating. Mr. Lindstedt described the tests on barrel electroplating that were performed at Artistic Plating Company. Tests were performed with and without wetting agents in the electroplating tank, with and without the rectifier operating, and while the barrels were being removed from the tank. He stated that the highest emissions occurred when the barrels were being removed from the tank; emissions were an order of magnitude lower during plating as compared to emissions when barrels were being removed. He also believes that, at times, the tank exhaust system can pick up plating bath droplets that otherwise would have fallen back into the tank.

C. Use of Wetting Agents/Fume Suppressants in Nickel Plating Baths

Dr. Jones asked about the prevalence of WAFS or wetting agents/fume suppressants (WAFS) in nickel plating baths. Responses to the Information Collection Request (ICR) for the Plating and Polishing Industry indicated that WAFS are used in about 50 percent of nickel plating tanks. Mr. Mason and Mr. Lindstedt both stated that WAFS are used in at least 99 percent of nickel electroplating baths. Mr. Lindstedt explained that WAFS are needed to prevent pitting from hydrogen gas bubbles that form on the surface of the parts being plated. WAFS prevent the bubbles from adhering to the surface of the parts. He noted that electroplating chemical suppliers do not always refer to these chemicals as wetting agents or WAFS, as they are one of the many components of their proprietary bath chemistry. Technical data sheets also do not always refer to wetting agents as such. Therefore, many platers that use WAFS do not realize they are using them.

There was a discussion about how to demonstrate compliance if the Plating and Polishing Rule were to require the use of wetting agents. Mr. Mason stated that his facility uses a stalagomometer to monitor the surface tension as an indicator of adequate wetting agent in the bath. Dr. Jones asked about the feasibility of requiring plants to maintain records of wetting agent use. Mr. Mason stated that most plants currently keep records of plating chemical use. Mr. Richter stated that requiring recordkeeping would not be an additional burden for plants since they routinely maintain records anyway. Mr. Mason stated that the only potential problem with a recordkeeping requirement for wetting agents is that some plants may have trouble identifying the wetting agent and determining the quantity added if it is a component of a proprietary bath chemistry.

D. Electroless Nickel Plating

Following up on a previous discussion about establishing a bath temperature limit as a method to control HAP emissions from electroless nickel plating, Mr. Mason stated that electroless nickel plating baths operate at optimum temperatures of around 190°F. The key operating parameters in electroless nickel plating are plating time, bath temperature, and catalyst concentration. Mr. Lindstedt added that electroless nickel plating is basically the same as electrolytic nickel plating except that, instead of electrolysis providing the source of the metal to be plated, a chemical provides the source. He pointed out that electroless nickel plating cannot be used on all substrates. He mentioned copper as an example; when plating on copper, a nickel strike electroplate must first be applied.

Mr. Fruh asked about the advantages of electroless nickel over electrolytic nickel plating. Mr. Mason responded that electroless nickel is an autocatalytic process that provides a uniform deposition over the entire surface of the substrate. Mr. Lindstedt added that electroless nickel plates are more corrosion-resistant than electrolytic nickel plates. Mr. Mason stated that electroless nickel plating uses less nickel than does electrolytic nickel plating, but is much more expensive.

Mr. Lindstedt explained that all electroless nickel chemistries are proprietary and are a large source of revenue for electroplating chemical suppliers. He stated that some electroless nickel plating chemistries previously included cadmium or lead but those metals have been eliminated as the result of European directives that restrict the use of hazardous substances (RoHS) and waste electrical and electronic components (WEEE). These directives prevent U.S. companies from selling their products in Europe if they contain mercury, cadmium, lead, or hexavalent chromium.

Regarding controls for electroless nickel, Mr. Hannapel stated that there is a difference in opinion on whether additional wetting agent can be added to electroless nickel plating baths. He stated that some chemical suppliers resist adding WAFS to electroless baths because they have a lot invested in their particular electroless nickel chemistry with proprietary additives. One of the industry representatives suggested that control of electroless nickel plating could be in the format of a limit on the concentration of nickel in the plating bath, and WAFS then could be required in any baths with nickel concentrations that exceeded the limit.

Mr. Al Rafini of Sirius Technologies was contacted by telephone for clarification of some of the issues regarding electroless nickel plating chemistry. Mr. Rafini is an expert on electroless nickel plating. Mr. Rafini stated that wetting agents are feasible and in use in some electroless nickel plating baths. He said that the surface tension in most electroless nickel baths is approximately 70 dynes per centimeter (dynes/cm). However, wetting agents can reduce the surface tension to approximately 45 dynes/cm, and the lower the surface tension, the lower the emissions. He said that there are plants that currently operate their electroless nickel plating baths at surface tensions below 50 dynes/cm.

Regarding the nickel concentrations, Mr. Rafini stated that most electroless nickel plating baths operate with nickel concentrations of no more than 6 grams per liter or about 0.8 ounces per gallon. Because of the relatively small amounts of nickel in electroless nickel plating solutions, a maximum concentration of 1 to 2 ounces of nickel per gallon was discussed as a possible control.

E. Wetting Agent Cost

The costs of wetting agents in nickel electroplating tanks were discussed. Mr. Hannapel stated that the cost of wetting agents is minimal. Mr. Lindstedt stated that the records for his plant indicate an average cost of $15.50 per month for a 1,600 gallon tank ($0.01/gallon). An industry representative stated that the cost of wetting agents at his facility averages about $15.50 a month for a 1,600 gallon tank, or $0.01 per gallon. EPA received information on fume suppressant costs from several plants that submitted responses to the ICR for the plating and polishing industry. The costs in the ICR responses are significantly greater than $0.01 per gallon, and correspond to the cost of additional fume suppressant (beyond what is included in normal bath chemistry) added to lower surface tension, but may also have included the cost for other ingredients added to the tank. The costs to use fume suppressants will also depend on the amperage applied to the tank (in the case of electroplating) and the hours per month the tank is operated, since higher amperage and longer hours deplete the wetting agent in the tank and require that more be added. Dr. Jones remarked it would be useful if industry could provide average wetting agent costs in units of dollars per gallon per year. The industry representative indicated that they would provide that information to EPA.

F. Barrel Electroplating

Referencing the apparent increase in emissions when barrels are removed from the plating solution, as observed during the ORD-sponsored emission tests on barrel electroplating, one of the industry representatives suggested that an option for air emission control with barrel plating is to turn off the exhaust system when barrels are being removed from the tank, since that is when emissions from barrel electroplating are the highest. Mr. Fruh replied that turning off the exhaust would only delay emissions and not actually reduce them. Mr. Hannapel stated that he believed exhaust systems pull in plating solution as the barrels are draining. When asked how often barrels are removed from plating baths, Mr. Lindstedt responded that the removal time can vary from every 20 minutes to every 3 days, depending on the type of parts and plating parameters.

Mr. Lindstedt said that the barrel withdrawal time is key for minimizing the loss of plating solution from dragout; emissions are lower when barrels are withdrawn more slowly. He also stated that there is less dragout with slotted barrels, as opposed to barrels with holes. He explained that most barrels used in barrel electroplating have holes for drainage, and the holes typically amount to about 40 percent of the surface area of the barrel. He pointed out that a study of pollution prevention (P2) measures for electroplating conducted by the Illinois EPA addressed the issue of dragout from barrels with slots vs. barrels with holes and found there to be about 37 percent less dragout when slotted barrels are used. Mr. Mason remarked that regardless of whether the electroplating method is rack plating or barrel plating, plants try to minimize dragout to reduce loss of bath solutions. Mr. Richter added that, consequently, there is an economic incentive for plants to use slotted barrels. Mr. Mason added that there is a capital cost associated with using slotted barrels, so some plants may be unwilling or unable to switch to slotted barrels immediately. Mr. Hannapel stated that minimizing dragout is a good work practice, but primarily is a P2 measure for water.

G. Cadmium Electroplating

Dr. Jones asked if wetting agents typically are used in cadmium electroplating baths. Mr. Lindstedt estimated that WAFS are used in 20 to 50 percent of cadmium electroplating tanks. Mr. Mason remarked that the percentage of cadmium electroplating tanks using WAFS is definitely less than 50 percent. Mr. Hannapel added that if a brightener is used in the bath, WAFS are included in the chemistry. He also explained that cadmium-cyanide plating baths, which operate at high pH, do not need a WAFS because of the self-regulating nature of the cyanide bath chemistry. Mr. Lindstedt remarked that all cyanide plating baths have cyanide-metal complexes in solution. Cyanide is added to dissolve the metal cyanide (e.g., silver cyanide) and to create free cyanide in solution, which helps to corrode the anode. Caustic soda and carbonate also are added to the bath. These three constituents (cyanide, caustic soda, and carbonate) all work to increase the pH of the solution to at least 12. Since cyanide emissions in the form of hydrogen cyanide occur only at low pH, cyanide emissions from cadmium-cyanide plating baths are negligible. Mr. Hannapel added that the cyanide in the bath acts as if WAFS are being used. Mr. Mason remarked that cadmium electroplating is mostly performed overseas. Substitutes for cadmium cyanide plating are commonly used in the U.S. However, there are no substitutes for gold or silver cyanide electroplating, so those processes are still performed domestically.

In response to a question from Mr. Fruh, Mr. Mason said that cadmium-cyanide electroplating tanks typically are not ventilated. He added that cadmium cyanide electroplating tanks might be controlled for cadmium emissions, but not for cyanide emissions.

Mr. Fruh asked if there are health risks associated with cadmium electroplating. Mr. Mason replied that the only risks are from either falling into a plating tank or cleaning a tank in a confined, poorly ventilated, space. Mr. Lindstedt stated that because electroplating operations are water-based, emissions are minimal. Several of the industry representatives noted that there is a perception problem associated with electroplating operations. This is partly due to a concern over odors. Mr. Mason added that chromium electroplating is a primary reason that the plating and polishing industry is generally perceived to have a problem with emissions and health risks. Mr. Richter added that wastewater discharges and waste storage are much more significant issues for the plating and polishing industry. Mr. Hannapel called attention to the lack of data on emissions from plating and polishing operations and the fact that State-issued operating permits generally do not address electroplating other than chromium. Mr. Fruh indicated that EPA's intent is to keep the rule simple and avoid requirements that would cause a burden on the industry without reducing emissions significantly. Mr. Richter finished the discussion by stating that the plating and polishing industry is on the decline; therefore it would be preferable to minimize process-oriented regulations with the resulting burden on the industry.

H. Wood's Nickel Strike Electroplating

Dr. Jones discussed the possibility of control of emissions from Wood's nickel strike electroplating as a limit of the length of time the process is performed on any given day. Mr. Lindstedt stated that the amount of Wood's nickel strike plating performed depends on the other types of electroplating performed at the same plant. He said that a plant that performs chromium or zinc electroplating would have no need to perform Wood's nickel strike plating. He said that Wood's nickel strike is always used when plating stainless steel, Inconel or other tool steels and that typically a plant would only perform Wood's nickel strike for 2 to 3 minutes per hour. He also said that a WAFS can be used with that process. Dr. Jones suggested that it might be possible to allow nickel strike plating tanks that are operated no more than 3 minutes per hour (on the average) to comply without having to use a WAFS or install controls. She said that limiting the operation to 3 minutes per hour (or 72 minutes in 24 hours) is actually equivalent to a 95 percent reduction.

I. Electroforming

Dr. Jones asked if WAFS are commonly used with electroforming. Mr. Mason stated that some electroforming baths include WAFS, but other baths do not. He explained that electroforming is sometimes used in shipbuilding to build up metal on the hull, which is then subsequently ground down. In those applications, WAFS are not used. He noted that electroforming is essentially the same process as electroplating, with the only difference being that electroforming is used to make parts rather than just plate parts. Mr. Mason also stated that he is not sure that electroforming is still widely used. He explained that electroless nickel plating can be a substitute for electroforming, and some plants that reported doing electroforming may actually be doing electroless nickel plating. The industry representatives concluded that control of emissions from nickel electroforming should be the same as for electroless nickel plating.

J. Polishing

Electropolishing--Dr. Jones asked about the prevalence of electropolishing using chromic acid. Mr. Hannapel stated that less than 1 percent of plants that perform electropolishing use chromic acid. He noted that the only plants that use chromic acid for electropolishing are plants that also perform chromium electroplating. Therefore, those facilities would already have controls in place to meet the requirements of the Chromium Electroplating NESHAP. Dr. Jones pointed out that the Chromium Electroplating only covers chromium electroplating and chromium anodizing and facilities can comply by meeting surface tension requirements.

John Lindstedt added that, if chromic acid is used, the chromic acid content of electropolishing baths is typically 5 to 7 percent by volume. Dr. Jones asked about the level of emissions from chromic acid electropolishing baths. Mr. Hannapel said that he does not believe that emissions from chromic acid electropolishing baths are a serious concern, but he will try to find out more about emissions and the use of WAFS. Dr. Jones requested that Mr. Hannapel also try to find out what plants do to control emissions from chromic acid electropolishing.

Chemical polishing-- Dr. Jones asked if it would be reasonable to operate this process with a temperature limit of 120°F. Mr. Mason stated that chemical polishing tanks typically operate at much higher temperatures, but he also pointed out that none of the urban HAPs are used in chemical polishing baths.

Dry mechanical polishing--Mr. Mason stated that most plants are well-controlled for emissions from dry polishing operations. Mr. Lindstedt stated that at typical plants, dry polishing operations are hooded and exhausted to a high efficiency particulate air (HEPA) filter or fabric filter. Mr. Fruh stated that EPA could establish an equipment standard for dry polishing. Dr. Jones noted that some reports indicated that the capture efficiency for buffing (which is similar to dry polishing) can be as low as 80 percent; therefore it must be difficult at times to totally capture the emissions from these machines. Mr. Lindstedt stated that dry polishing is an inherently dusty process and is often performed in a separate room that is maintained under negative pressure and exhausted to the outside. He stated that he and the other industry representatives would try to collect additional information on dry polishing emissions and controls.

K. Thermal Spraying

There was a brief discussion of thermal spraying. Mr. Hannapel stated that all thermal spraying operations are controlled with fabric filters. Dr. Jones remarked that she read a report from the California Air Resources Board that indicated at least one plant uses water curtains to control emissions from thermal spraying, therefore the California rule for existing thermal spraying sources reflect the control level of water curtains, which is 90 percent. Mr. Richter stated that he has compiled a summary on thermal spraying operations and will send it to Dr. Jones.

L. Other Processes

Regarding the issues of maintaining bath temperature as a method to limit emissions from for other plating and polishing processes, Mr. Mason stated that the limit of 120°F discussed previously would be reasonable for chromate conversion baths, but not for some other types of baths. For example, manganese phosphate baths operate at about 180°F. Mr. Hannapel added that he has a technical data sheet for manganese phosphate that indicates a bath temperature of 200°F. Mr. Mason further stated that some black oxide baths are boiling. Mr. Lindstedt said that there are two types of black oxide baths, one which is heated, and the other which is not heated. He stated that black oxide baths that are not heated can include selenious acid, but none of the black oxide chemistries contain any of the urban metal HAPs. Dr. Jones remarked that emissions from black oxide tanks are not an issue if the baths do not contain any of the urban metal HAPs.

Dr. Jones asked about chromium passivation. Mr. Hannapel responded that passivation is the same as chromate conversion, which had been discussed previously.

Dr. Jones asked about anodizing followed by nickel acetate sealing. Mr. Mason responded that the operating temperature for nickel acetate tanks was typically about 160°F. He added that the concentration of nickel in nickel acetate sealant tanks is very low. Dr. Jones suggested that a control approach for nickel acetate and manganese phosphate tanks could be to maintain a maximum concentration of the metal HAP. Mr. Mason estimated that such a limit for manganese phosphate would be approximately 1 percent manganese by volume. The industry representatives indicated that they would find out more information about concentrations for both types of baths (manganese phosphate and nickel acetate). Mr. Hannapel added that he would find out about the use of lead in sealants, which was indicated in one of the responses to the plating and polishing information collection request (ICR).

M. Industry Size

At the request of EPA during a previous conference call, Mr. Richter provided an estimate of the current size of the plating and polishing industry. He stated that the trade association had previously estimated about 2,900 job shops, but he believes that number should be reduced by about 25 percent due to plant closures. He now estimates that there are approximately 2,036 job shops and about 1,000 captive plating shops, resulting in a total of about 3,036 plants.

Dr. Jones asked about the impact of the Chromium Electroplating NESHAP on the whole plating industry. Mr. Richter responded that the NESHAP most likely eliminated many of the marginal electroplaters. Mr. Mason added that the amount of recordkeeping now required under various regulations is overwhelming. He mentioned specifically the current EPA wastewater regulations, and the regulations on employee exposure to hexavalent chromium issued by the Occupational Safety and Health Administration (OSHA) in 2006.

V. Action Items

The following action items were identified:

Industry: Provide to EPA information on:
(1) Chromic acid electropolishing emissions and controls
(2) Dry polishing emission controls
(3) Thermal spraying emission controls
(4) Concentration of manganese in manganese phosphate baths
(5) Concentration of nickel in nickel acetate dip baths
(6) Use of lead as sealants after anodizing
(7) Average WAFS costs in units of $/gallon/year
(8) Request that ORD submit full nickel emissions study to SSPD

EPA: Provide draft meeting minutes to the industry representatives to review.