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How Did MP&M Come About?

Metal finishing companies may be in for a rude awakening when they tackle the job of redesigning their treatment facilities to meet the proposed Metal Products and Machinery (MP&M) category limits. The published limits themselves are significantly lower than existing electroplating and metal finishing standards. However, as suggested in this article, those low MP&M limits are only the tip of the iceberg. If you are designing new or upgraded treatment processes, you must use even lower design values as a result of expected variability of treatment processes and other considerations. This article examines how EPA derived the proposed limits and how you can use this information to help establish your design criteria. For additional information about the MP&M proposed regulations, visit www.nmfrc.org.

How Were the Limits Derived?

EPA's methodology for deriving MP&M limits is published in the MP&M Development Document.[1] The Jobshops Standards cover 10 metals (Cd, Cu, Cr, Pb, Mn, Mo, Ni, Ag, Sn, Zn), plus other parameters, and are based on the performance of actual treatment systems that employ a hydroxide precipitation, sedimentation treatment process, and some pollution prevention (referred to as option 2). To develop these limits, EPA performed measurements and computations. Wastewater samples were collected from the raw and treated wastewaters of 10 facilities employing precipitation and sedimentation processes. For each facility, EPA calculated the average daily effluent concentration of each metal during a sampling period (2-5 days). However, data from some of the 10 facilities were not used in the calculation of limits. Metals data were excluded for many reasons (*e.g.*, if a particular metal was never detected in the raw wastewater for a given facility. A complete description of how data were excluded is presented in the Development Document. Once the daily average effluent concentration of each metal was determined for each facility, the median value of those averages was calculated. This median value is referred to as a long-term average (LTA). The LTAs were then multiplied by variability factors to arrive at the actual daily and monthly effluent limits. The variability factors were derived through a statistical analysis. These factors are intended to account for normal fluctuations in a facility's treatment process. LTAs, variability factors, and effluent limits for the Jobshops Subcategory are summarized in Table 1.

Companies that endeavor to be in 100-percent compliance cannot use the MP&M effluent limits as design or target effluent concentrations, because of the documented variability of precipitation-sedimentation systems. If performed in reverse order, however, EPA's derivation of limits provides a glimpse of what it takes to avoid any violations. By dividing the limits by the variability factor, you arrive back at the LTA, a value that is 1.2 to 5.0 times lower than the limit (varies from metal to metal). However, even the LTA may be too high of a target for most jobshops. It is important to note that EPA calculated limits independently for each metal parameter, such as cadmium, chromium, and nickel. EPA's calculations do not take into account any influence that may exist from the presence of multiple metals in the same effluent. Because most jobshops apply more than one type of metal coating, and process various base metals, this will likely be problematic and, as shown below, most companies will need to target effluent concentrations lower than the LTAs. Also, most facilities will likely have to utilize more technology than identified by Option 2 to achieve these limits.

The Problem of Multiple Metals

As shown in Table 2, of the 10 companies used in deriving the jobshops limits, only one facility (4904) meets the LTA for all regulated metals. Actually, it is not a jobshop, but a General Metals Subcategory facility. The only MP&M wastewater being treated was from a chemical milling rinse, which is not representative of a jobshop facility. The wastewater treatment plant was only operating at three-percent of the design capacity. Therefore, with perhaps this one exception, the facilities selected by EPA for establishing the MP&M limits

Table 1
Long-term Averages, Variability Factors & Limitations For the Metal Finishing Jobshops Subcategory

Regulated Metal	Median LTA, mg/L	1-Day Variability Factor	4-Day Variability Factor	Maximum Daily Limit, mg/L	Maximum Monthly Avg. Limit, mg/L
Cadmium	0.05	4.5	1.9	0.21	0.09
Chromium	0.31	4.3	1.8	1.3	0.55
Copper	0.34	4.0	1.8	1.3	0.58
Lead	0.07	1.8	1.3	0.12	0.09
Manganese	0.05	5.0	2.0	0.25	0.10
Molybdenum	0.38	2.1	1.3	0.79	0.49
Nickel	0.39	3.7	1.7	1.5	0.64
Silver	0.04	4.5	1.9	0.15	0.06
Tin	1.3	1.5	1.2	1.8	1.4
Zinc	0.11	3.3	1.6	0.35	0.17

Table 2
Analysis of LTA Data for Facilities Used in Deriving Jobshop Limits

Facility Code	Meets LTA for:	Exceeds LTA for:	Metals not used to derive limits
4278	Cr, Cu, Ni, Zn	Mn	Cd, Pb, Mo, Ag, Sn
4279	Cu, Ni	Cd, Cr, Zn, Mn	Pb, Mo, Mn, Ag, Sn
4788	Cd, Cr, Ag, Sn, Zn	Pb, Ni	Cu, Mn, Mo
4806	None	Mo	Cd, Cu, Cr, Pb, Mn, Ni, Ag, Sn, Zn
4883	Ni	Cu, Zn	Cd, Cr, Pb, Mn, Mo, Ag, Sn
4893	Cr	Zn	Cd, Cu, Pb, Mn, Mo, Ag, Sn
4894	Ni	Cu, Zn	Cd, Cr, Pb, Mn, Mo, Ag, Sn
4904	Mo	none	Cd, Cu, Cr, Pb, Mn, Ni, Ag, Sn, Zn
6178	Cd, Pb, Zn, Mn	Cr, Cu, Ag	Ni, Mo, Sn
6187	Cu, Pb, Ag, Zn, Mn	Cd, Cr	Ni, Mo, Sn

would themselves be expected to violate the MP&M limits for at least one parameter, and some facilities would be expected to violate the limits up to four parameters.

It appears that certain combinations of metals may cause more difficulty than others. For example, all facilities have both nickel and zinc in their effluent. Of these facilities, only one was able to meet the LTA for both nickel and zinc during the brief sampling period. That particular facility (4278), however, is actually at the ceiling of the LTA for nickel, and there is no room for additional variability.[2] The nickel-zinc dilemma may be due to the fact that the pH for minimum solubility of nickel hydroxide and zinc hydroxide (formed during precipitation) is significantly different, making it technically difficult to simultaneously reduce the concentration of both metals. Other combinations of metals that appear to present problems are copper-chromium and lead-nickel. However, because of the limited number of metals present in the raw wastewaters of some facilities used in deriving the limits, it is not possible to evaluate many combinations of metals.

What Are the Options?

In conclusion, to avoid violations of the proposed MP&M limits, most jobshops will need to select target concentrations below the published LTAs. Because of the complexity caused by combinations of metals and a lack of available data, it is recommended that suitable design or target concentrations be identified through pilot testing. Further, it appears that some common combinations of metals (*e.g.*, Ni-Zn) may present a technical hurdle that cannot be solved by using the prescribed precipitation-sedimentation process. In such cases, it may be necessary to use more advanced technology, such as ion exchange.

Next month, "NMFRC News" further examines the problem of complying with MP&M limits by analyzing data from companies participating in the Strategic Goals Program (SGP). ***P&SF***

References

1. Development Document for the Proposed Effluent Limitations Guidelines & Standards for the Metal Products & Machinery Point Source Category (EPA #: 821-B-00-005). This document can be downloaded from www.nmfrc.org.
2. The published LTA for facility 4278 (0.070 mg/l) in Table 10-8D of the Development Document appears to be incorrect. The value should be 0.347 mg/l. Also, the median LTA for nickel appears to be miscalculated as shown in Table 10-9C. The LTA should be 0.35.