ELECTRO-CHEMICAL TANK OPERATIONS

Date Initiated:

November 13, 1998

Dates Modified / Updated:

February 2, 2005

March 16, 1999

PROCESS DESCRIPTION:

Electro-chemical tank operations apply electric current through a conductive part submerged in a tank containing an electrolytic solution. Most of these operations are electroplating (metal ions in solutions are deposited on to the conductive part). However, there are some operations where the metal from the conductive part is transferred into the solution. Typically, when current passes through the metal part, gas bubbles (usually hydrogen gas) form in the tank solution. These bubbles burst and produce a mist of the tank solution. Foam additives or surface tension adjusters may be added in the tank solution to reduce the emissions. Wet scrubbers, mist eliminators, and HEPA filters may also be used to control emissions. Typical electro-chemical tank operations include decorative chrome plating, hard chrome plating, chromic acid anodizing, nickel plating, copper plating and cadmium plating.

The standard District technique for estimating emissions from electro-chemical tank operations are based upon current usage as described in the following equations:

$$\mathbf{Ea = Ua \times EF \times e_{capture} \times (1 - e)}$$

$$\mathbf{Eh = Uh \times EF \times e_{capture} \times (1 - e)}$$

Where:

Ea = Annual emissions of each listed substance, (lbs/year)

Eh = Maximum hourly emissions of each listed substance, (lbs/hour)

Ua = Annual amount of current applied, (amp-hr/year)

Uh = Maximum hourly amount of current applied, (amp-hr/hr)

EF = Emission factor for each contaminant, (lbs/amp-hr)

$e_{capture}$ = Capture efficiency, (%)

e = Control efficiency, (%)

For other compounds in solution that do not have a process specific emission factor, emissions may be quantified based on the tank solution material composition.

$$Ea = Ua \times EF \times (Ci / C) \times e_{capture} \times (1 - e)$$

$$Eh = Uh \times EF \times (Ci / C) \times e_{capture} \times (1 - e)$$

Where:

Ci = Weight percent of individual compound, (%)

C = Weight percent of compound with emission factor, (%)

Note: All other parameters are defined similarly above.

EMISSIONS INFORMATION:

For hard chrome plating, decorative chrome plating and chromic acid anodizing, the emission estimation technique uses an average emission factor from AP-42 (July 1996), Table 12.20-1 and ARB's Technical Support Document to "Proposed Airborne Toxic Control Measure for Emissions of Hexavalent Chromium from Chrome Plating and Chromic Acid Anodizing Operations" (Aug. 1989).

For cadmium electroplating, the above emission estimation technique is based on emission factors obtained from EPA's "Toxic Air Pollutant Emission Factors - A Compilation For Selected Air Toxic Compounds and Sources", EPA-450/2-88-006 (Oct. 1988). For cadmium cyanide electroplating, the emission factor from AP-42 (July 1996), Table 12.20-4 was used.

For nickel electroplating, the above emission estimation technique uses an average of emission factors from AP-42 (July 1996) Table 12.20-4, EPA's "Toxic Air Pollutant Emission Factors - A Compilation For Selected Air Toxic Compounds and Sources" EPA-450/2-88-006 (Oct. 1988), and South Coast AQMD's "2003 - 2004 New Reporting Procedures for AB2588 Facilities for Reporting their Quadrennial Air Toxics Emissions Inventory" (June 2004). Typical nickel electroplating solutions have a surface tension below 45 dynes/centimeter. Since the default emission factor already accounts for controls due to a low surface tension, no additional control efficiency should be credited for a low surface tension

For copper electroplating, the emission factor was assumed to be equal to the nickel emission factor. For copper cyanide and copper sulfate electroplating, the emission factors in AP-42 (July 1996), Table 12.20-4 are in lbs/dscf. The conversion factor in AP-42 was used to change these emissions factors in lbs/amp-hr.

ASSUMPTIONS / LIMITATIONS:

- Other types of emission mechanisms (air agitation, evaporation, operating emissions, etc.) must be

quantified separately from electroplating operations since these emissions are typically based upon different types of process information

- A 100% capture efficiency is typically assumed for devices with collection systems. Assume 75% control efficiency for wet scrubbers, 95% control efficiency for chemical fume suppressants (foam and wetting agents) and 99% control efficiency for HEPA filters.

- If a device employs more than one type of control device (i.e. chemical fume suppressant and HEPA filters), the most efficient control efficiency should be used for emission calculations.

- The emission factor for hard chrome plating is assumed to be applicable to chromic acid anodizing.

- TSP are assumed to be equivalent to PM10 emissions. If no weight percent is provided for TSP and PM10, the TSP and PM10 emission factors are assumed to be equal to the sum of all compounds with available emission factors.

- There are several chromium emissions factors in EPA's "Toxic Air Pollutant Emission Factors - A Compilation For Selected Air Toxic Compounds and Sources", EPA-450/2-88-006. These emission factors are considered outdated and were not used in the current default estimation procedures.

- It is suspected that tanks with collection & control systems accumulate a residue of plating solution and other contaminants in the ducting and removal equipment. This residue may periodically be dislodged and emitted due to the air flow through the system. Therefore, it is possible for emissions to occur during non-operation of the plating tank. Currently, there are no available procedures or test data to estimate these emissions.

- Site specific test data approved by the District may be used in place of the above emission estimation equation where appropriate. In practice, test results are usually limited to the control device removal efficiency and may not evaluate the capture efficiency.

FORMS:

An entry for EACH material used in each device must be completed. Emissions are assumed to occur from only one type of tank solution at a time per device (i.e.; it is assumed that simultaneous emissions from several materials used concurrently in the same device does not occur). Emissions from evaporation and/or air agitation must be quantified separately.