

## MFFRST ERRATA/MODIFICATIONS ADDENDUM

Since MFFRST was posted on EPA's web site on October of 2001, concerns have been raised regarding some of the algorithms and default parameters used. This Addendum addresses these concerns. It should be understood that default parameter values were developed with the intention of being reasonably representative of industry practice. Users of MFFRST have alerted EPA that a few key parameters are clearly not representative, and have also expressed concern about other parameters and model default assumptions. It is not anticipated that all of the default values will be correct at every modeled facility. Indeed, a wide range of values for the various parameters are possible. Site specific values for the parameters used in modeling an actual facility should be substituted for the default values to the maximum extent possible. MFFRST users are urged to research the process lines for which they seek emissions/exposure/risk estimations, so that they can choose the most accurate input parameters, rather than relying upon the MFFRST default parameters.

Users should also recognize that the emissions and fate algorithms present in MFFRST are basically simplified representations of very complex processes. The word "screening" in the acronym MFFRST is meant to inform users to exercise caution in using MFFRST and interpreting the model outputs. As pointed out in one of the opening screens of MFFRST:

*...If an exposure is found to result in an unacceptably high health risk with a screening tool, then the appropriate first response is to refine the parameter input and/or evaluate the problem with different and perhaps more complex models. Another response might be to consider monitoring to confirm results of the tool. Screening tools are rarely, if at all, used as the sole justification in regulatory decision making by the U.S. Environmental Protection Agency.*

Still, the modeling approaches used in MFFRST, such as the AP-42 equations, have proven useful to government, industry, and the private sector when used properly. The MFFRST documentation has included several example applications and model testing exercises showing that concentration predictions both within a facility and outside in the ambient air fall within the range of measured concentrations.

In any case, users are reminded to exercise caution and care in using MFFRST, as they would any computer modeling tool. Emissions estimates are only as good as the input parameters chosen for those algorithms. For instance, for a decorative chromium electroplating tank MFFRST uses a default chromium concentration of 160 grams per liter. If an MFFRST user elects to use the 160 g/l default for a process in which the actual tank concentration is only 120 g/l, then the resulting MFFRST emissions estimate will, at least, overestimate reality by about 33% ( $\{[160-120] \times 100\} / 120$ ), contingent of course on the realism of the other model parameters, and process line definitions.

Specific issues and concerns are discussed below. Item 1 below discusses modifications that have been made to the first version of MFFRST based on commenter issues/concerns. Items 2 - 7 address other issues/concerns raised by commenters. However, no modifications were made in MFFRST relative to items 2 - 7. Item 8 refers to an issue unrelated to the selection of default information.

## ***Modifications Reflected in This Current Version of MFFRST***

1. As noted above, the default input operating parameters used in MFFRST are those expected to be *typical* of the processes being evaluated. However, based on comments received since the first version of MFFRST was placed on the EPA Web Site, three *significant* differences were noted between MFFRST default parameters and those thought to be realistic. They are as follows:
  - i. For the trivalent chromium electroplating process, the default cathode efficiency is given as 95 percent in the first MFFRST version. A more accurate value for cathode efficiency in trivalent chromium electroplating is thought to be 40 percent. Therefore, 40 percent appears in this current MFFRST version.
  - ii. For the chromate conversion process, the default hexavalent chromium process tank concentration is given as 45 g/l in the first MFFRST version. A more accurate range of concentrations is thought to be 0.2 - 2.0 g/l of hexavalent chromium. Therefore, a value of 2.0 g/l is being used in this current MFFRST version.
  - iii. For the chromic acid anodizing process, the default for current density is 3 amperes per square inch (ASI) in the first MFFRST version. A more accurate range of current densities is thought to be 0.015 - 0.05 ASI. Therefore, a value of 0.05 ASI is being used in this current MFFRST version.

*The above three changes are the only quantitative modifications being made in this current MFFRST version (i.e., the second version) as compared to the first version.*

## ***Other Specific Issues and Concerns***

2. **Use of Solvent Degreasing:** The vapor degreasing process is *available* on each of the 17 metal finishing lines presented in MFFRST, and shown by an icon on the “Generic Process Tank Schematic” screen for most metal finishing lines. However, even though a vapor degreasing tank icon is *shown* on the “Generic Process Tank Schematic” screen, the tank is not checked in the “Include Tank” box adjacent to the icon. This means that vapor degreasing will *not* be included in emissions estimates unless the user checks (i.e., clicks on) the “Include Tank” box adjacent to the vapor degreasing icon. The default degreasing steps that *are* checked for each line are alkaline cleaning and electrocleaning. The user may choose to *uncheck* either or both of these steps if they are not in the metal finishing line being evaluated.
3. **Ventilation Rates:** The default “Ventilation Rates” shown in the center column of the MFFRST “Tank Emission Inputs” screen are based on the assumption that (1) a tank is ventilated by lateral exhaust intakes (i.e., intakes mounted along the full length of one or both long sides of the tank), (2) that the aspect ratio of the process tank (the surface width divided by the surface length) is in the 0.5 - 0.99 range, and (3) that the liquid in the tanks have specific American National Standards Institute (ANSI) hazard “class” designations. (ANSI designations consist of a letter and a number [e.g., B-3]. The letter defines the inhalation toxicity of the chemical involved; “A” being most toxic, and “D” being least toxic. The number defines the volatility of the chemical; “1” being most volatile, and “4” being least

volatile. Volatility is determined both by the physical properties of the chemical, and by the temperature of the tank contents.)

If a process tank has a “push-pull” exhaust system (as many metal finishing tanks do) the actual ventilation rate requirement will be as little as 50% of the MFFRST default ventilation rates (e.g., if the MFFRST default ventilation rate is 5,000 cubic feet per minute [CFM], the actual requirement might be as little as 2,500 CFM). Note, however, that a “push-pull” system may release more of the vaporized tank contents to the air inside the metal finishing facility than a lateral ventilation system. If the tank has a smaller aspect ratio than 0.5, actual ventilation rate requirements will be about 10% less than the default rates (e.g., if the default is 5,000 CFM, the actual rate might be 4,500 CFM). If the tank has a less hazardous ANSI class, the ventilation rate requirement might be less than the default rate (or in some cases, require no ventilation at all). In any case, the MFFRST user can insert any ventilation rate he/she chooses in the “Ventilation Rate” location rather than accepting the default rate.

- 4. Rack versus Barrel versus Coil Metal Finishing:** In determining MFFRST default values it was assumed that metal finishing operations were performed in a “rack” mode (i.e., parts are hung on hooks and dipped in the various process tanks). Default values are likely to be much different with “barrel” and “coil” modes (i.e., small parts placed in a perforated drum which is dipped in the process tank, typically while rotating; and coiled strips of metal unwound and drawn through process tanks; respectively). Specifically, current densities, rates of misting, level of mechanical agitation, and tank chemistries will be different. If the MFFRST user knows what these values are for his/her barrel or coil processing operation, the user can insert any value he/she chooses rather than accepting the default value.
- 5. Anodic Processes:** Cathode Efficiency is one of the variables used to determine emissions in each electrically activated process tank (i.e., electroplating tanks as well as anodizing and electrocleaning tanks). The lower the cathode efficiency, the higher the rate of misting/emissions. For tanks where the primary activity takes place at the anode (rather than the cathode), such as the anodizing and electrocleaning processes, the default value used in MFFRST is 95 or 100 percent efficiency, and probably should be referred to as Anode Efficiency. The 95/100 percent default values were chosen because they are similar to the typical efficiencies achieved during cathodic operations (i.e., electroplating of metals). However, in these anodic operations hydrogen is produced at the cathode, rather than electro-deposition of metals. Hydrogen production contributes greatly to misting. Therefore, cathodic releases of hydrogen in operations where anodic activity is the primary concern probably cause much more misting than would be accounted for by the 95/100 percent default levels. No specific data were found relating to cathode efficiency in processes where anodic activity is the primary concern. Nevertheless, MFFRST probably underestimates the rate of emissions from anodic operations due to the high cathodic efficiency defaults used. Therefore, users may wish to decrease the percent efficiency from 95/100 to a lower percent, such as 80 percent.
- 6. Surface Tension Considerations:** In MFFRST, one of the operating variables listed for non-electrolytic processes (e.g., electroless nickel, alkaline cleaning, chrome conversion, acid cleaning, phosphate coating) is surface tension. The default for alkaline cleaning is 35 dynes/centimeter, and 70

dynes/cm for all other non-electrolytic process tanks. The lower the surface tension, the less misting can be expected to occur, hence less emissions. Metal finishing process fluids, for both electrolytic and non-electrolytic processes, have a variety of surface tension properties; surface tension also varies greatly with tank temperature. It is probable that non-electrolytic processes, such as electroless nickel plating, phosphate coating, and chromate conversion coating, contain surfactants that lower surface tension to well below the default 70 dynes/cm. For electrolytic tanks MFFRST does not use surface tension as an operating variable (because there have been no algorithms to define the relationship for electrolytic processes); nevertheless, surface tension also affects the misting rate of electrolytic tanks. As with other operating parameters for non-electrolytic process tanks, MFFRST allows the user to insert any surface tension value he/she chooses rather than accepting the default value of 35 or 70 dynes/cm. For electrolytic tanks there is no option available for adjusting or evaluating the effect of surface tension, since surface tension is not part of the emissions algorithms for these types of process tanks.

- 7. Other Considerations:** For non-electrolytic tanks one of MFFRST's operating variables is tank aeration rate. (MFFRST assumes that aeration is the method used to mix the non-electrolytic tank contents. If mechanical mixers or circulating pumps are used to achieve mixing, then there should be little or no mixing-related air emissions). The MFFRST default aeration rate is 10 CFM per square foot of tank surface area. The MFFRST user may wish to adjust this rate up or down to reflect his/her own situation.

Like surface tension, the viscosity of process tank contents will affect the rate of air emissions from the tank. Viscosity varies inversely with the temperature of the tank contents. However, no algorithms exist to define the relationship between tank viscosity and air emissions. Therefore, viscosity is not a parameter in any of the emissions algorithms.

The type of substrate metal being finished is said to affect the rate of emission. One commenter indicated that 2000-series aluminum alloys will produce higher emissions than 6000-series aluminum alloys during the anodizing process. If the MFFRST user understands the impact on emissions from the type of substrate alloy being used, he/she should correct the MFFRST defaults as necessary. It might be most appropriate for the user to change the "Emission Concentration" value in the center column of the MFFRST Tank Emission Input screen, assuming the user has knowledge of those concentrations.

**8. Use of the “*Perform an Assessment Based on Facility-Specific Emissions (TRI data)*” Option:**

Users of the “*MFFRST Simulation Selection*” screen option to “*Perform an Assessment Based on Facility-Specific Emissions (TRI data)*” are allowing MFFRST to supply EPA Toxic Release Inventory (TRI) atmospheric emissions data from specific electroplating facilities. (TRI data include mass annual atmospheric emissions data, for metals and other constituents, from specific electroplating facilities. The emissions data are supplied annually by the facilities themselves to EPA for use in the TRI data base.) The TRI data option can be used instead of using the “*Perform an Assessment Based on Generic Facility Processes and Emission Factors*” option. It should be noted that it is the 1997 TRI data base that is incorporated into the current version of MFFRST. It is entirely possible that a more current annual TRI data base would have different atmospheric emissions estimates than those submitted for 1997.