South Coast
Air Quality Management District
21865 Copley Drive, Diamond Bar, CA 91765-4178
(909) 396-2000 • www.aqmd.gov

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VOC Emission Calculation Methodology for Lithographic Printing Operations

Beginning with the 1999-2000 Annual Emissions Reporting (AER) cycle, the following methodology should be used to calculate VOC emissions from lithographic printing operations. This methodology has been developed by the District in cooperation with the Printing Industries Association.

Lithographic Inks

$$E_{LITHO} = Q \times [\ OC \times (1 - RF)\ ] \times (1 - C_{OVERALL}) \qquad \text{Eq. (1)}$$

where:

E_{LITHO}	=	Volatile organic compound emission of lithographic inks (lbs)
Q	=	Quantity of ink applied (lbs)
OC (1)	=	Organic content (weight fraction or lb/lb) of ink
RF (2)	=	Retention factor for OC in lithographic inks (decimal)
$C_{OVERALL}$ (3)	=	Control System Overall Efficiency (decimal)

(1) User may refer to the product Material Safety Data Sheet (MSDS) to determine the content of organic compounds (OC). This may include, but not limited to, one or more of the following:

Volatile organic compounds (VOC) content
Lithographic oil content (LOC) such as:
- Petroleum-based oils
- Vegetable-based oils
- Oxidizing oils
- Middle distillates
- Linseed oil
- White mineral oil
- Other oils

If MSDS provides both VOC and LOC percentages or decimals, use the higher number for calculation purposes. **NOTE:** Unit of OC must be consistent with that of ink applied (Q), i.e., OC in weight fraction or lb/lb.

(2) Depending on the type of inks, the following retention factors are applicable for equation (1):

HEATSET INKS: RF = 0.20

NON-HEATSET INKS: RF = 0.95

(3) Overall efficiency ($C_{OVERALL}$) of a control system is defined as:

$$C_{OVERALL} = C_{CAP} \times C_{DES} \qquad \text{Eq. (2)}$$

where:

C_{CAP} = Control System Capture Efficiency (decimal)

C_{DES} = Control Equipment Destruction Efficiency (decimal)

In general, control systems are tested to determine these efficiencies. In the absence of specific source test results, a default capture efficiency of 99.5% (C_{CAP} = 0.995) is allowed for **heatset inks only**. Any deviation from this default value must be substantiated with supporting documentation.

HEATSET INK is a printing ink used on continuous web-feed printing presses that are equipped with dryers or ovens. The ink dries or sets by heat induced evaporation of the ink oils and subsequent chilling of the ink by chill rolls.

NON-HEATSET INK is a printing ink that sets and dries by absorption into the substrate, and hardens by ambient air oxidation that may be accelerated by the use of infrared light sources. Ultraviolet and electron-beam curable inks are examples of non-heatset inks.

Instructions for Reporting Inks on Forms B3 and B3U

a) Enter the total quantity of the lithographic inks (Q in pounds) used during the reporting period in column "f" (annual usage). If needed, convert Q from gallon to pound by multiplying Q (in gallons) by the ink density (lb/gal).

b) From ink MSDS, find OC content based on VOC or lithographic oil content (LOC) in weight fraction or lb/lb. **If MSDS provides both VOC and LOC percentages or fractions, use the higher number**. If VOC is given in lb/gal then convert VOC from lb/gal to lb/lb by dividing VOC (lb/gal) by the ink density (lb/gal).

c) Determine the applicable retention factor (RF = 0.95 or 0.20). Multiply OC by (1 minus retention factor) and enter in column "h" (emission factor).

d) Based on source test results, determine control system overall efficiency using Equation (2). Enter this number in decimal fraction in column "i".

e) Calculate the VOC emissions using Equation (1) and enter in column "j" in pounds.

Assumptions for Other Lithographic Printing Ink Operations

Fountain solutions and blanket/roller washes do not possess the same characteristics as lithographic inks; therefore, retention factors are not applicable to emissions from the use of these materials. However, in the absence of a specific source test, a carry-over factor is allowed as follows:

- 70% of emissions from fountain solution is allowed to carry-over into the **heat set dryer**, provided that the dryer is vented into the afterburner. The VOC emissions from the use of fountain solutions is calculated using the following equation:

$$E_{FOUNTAIN} = Q \times OC \times (1 - 0.70C_{OVERALL}) \quad \text{Eq. (3)}$$

- 40% of emissions from **blanket/roller washes** is allowed to carry-over into the **heat set dryers only** for **automatic wash operations** provided that:
  - The vapor pressure for the VOC-containing components is less than 10 mm Hg at 20 degrees C, and
  - The dryer is vented into the afterburner.

  The VOC emissions from the use of blanket/roller washes is calculated using the following equation:

$$E_{WASH} = Q \times OC \times (1 - 0.40C_{OVERALL}) \quad \text{Eq. (4)}$$

where:

$E_{FOUNTAIN}$ = Volatile organic compound emission of fountain solution (lbs)

E_{WASH} = Volatile organic compound emission of blanket/roller washes (lbs)

Q = Quantity of material applied (lbs or gallons)

OC [(1)] = Organic compound content (lb/lb or lb/gal)

$C_{OVERALL}$ = Control System Overall Efficiency (decimal)

User can refer to the product Material Safety Data Sheet (MSDS) to determine the content of OC. **NOTE:** Unit of OC content must be consistent with that of material applied (Q), i.e., OC in weight fraction or lb/lb for Q in pounds and OC in lb/gal for Q in gallons.

Instructions for Reporting Fountain Solutions and Blanket/Roller Washes on Forms B3 and B3U

a) For each type of material, enter the total quantity (Q) in gallons used during the reporting period in column "f" (annual usage).

b) From MSDS, find OC content based on VOC content in lb/gal and enter in column "h" (emission factor).

c) Based on source test results, determine control system overall efficiency using Equation (2). Multiply $C_{OVERALL}$ by appropriate carry-over factor and enter this number in decimal fraction in column "i".

d) Calculate the VOC emissions using Equation (3) or (4) and enter in column "j" in pounds.