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Category: 27 – Solids Applied/Transfer Efficiency

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

DATE: July 3, 1979

SUBJECT: Appropriate Transfer Efficiency for "Waterborne Equivalence"

FROM: Richard G. Rhoads, Director
Control Programs Development Division (MD-15)

TO: Director, Air and Hazardous Materials Division, Regions I-X

Many State regulations for automotive assembly plants allow for equivalence through improved transfer efficiency, add-on controls, or other means. In order to clarify the appropriate baseline for "waterborne equivalency," the Emission Standards and Engineering Division has reviewed the available data and concluded that present waterborne coating (2.8 lbs/gal less water) is being applied at a transfer efficiency of 30 percent. (See attached memo.) To assist you in evaluating State submittals, the following values are approximately equivalent.

Coating		Transfer Efficiency
lbs/gal (less water)	solids (by volume)	percent
2.6	62	30
3.2	55	40
3.6	50	50

Please note that these estimates are appropriate for calculations of equivalence for topcoating and guidecoat (prime surfacing) operations only. For prime, where equivalence is estimated, it should be based on electrophoretic dip (EDP, E-coat, ELPO). For repair, empirical plant case should be used. No single value for the transfer efficiency can be applied to repair because, depending on the nature of the repairs, transfer efficiency can be quite variable.

Attachment

Attachment

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

DATE: June 15, 1979

SUBJECT: Baseline Transfer Efficiency for Spray Application of Water-Borne Automotive Coatings

FROM: Robert T. Walsh, Chief
Chemical and Petroleum Branch (MD-13)

TO: Richard Rhoads, Director
Control Programs Development Division (MD-15)

THRU: Don R. Goodwin, Director
Emission Standards and Engineering Division (MD-13)

SUMMARY

Calculation of "water-borne equivalency" for purposes of compliance with the automobile control techniques guideline should assume water-bornes are applied with a transfer efficiency of 30 percent. This conclusion is based on recent tests conducted by General Motors. Using four different estimating techniques (including weighing the body before and after painting) estimates of transfer efficiency ranged from 17 to 42 percent (55 to 83 percent of paint is waster) with about 30 percent the most commonly reported value.

DETAILS

Review of a recent analysis of transfer efficiency by General Motors indicates that at this time the most reasonable baseline figure for transfer efficiency of spray applied water-borne automotive topcoats is 30 percent.

GM has been using water-borne coatings at its South Gate and Van Nuys plants for five years. GM's Oklahoma City Plant has recently begun production and is using water-borne coatings as well.

Originally, GM believed that there was no inherent difference between spray application of water-borne and solvent-borne coatings, and reported to us that the transfer efficiency at South Gate and Vam Nuys was 50 percent. Based on this, the baseline transfer efficiency for water-bornes was set at 50 percent.

In 1976 the California Air Resources Board alerted us to an inconsistency in GM's data. During December 1977 and April 1978, GM had submitted to CARE data on paint usage and production at the South Gate and Van Nuys plants. From this data, CARE estimated transfer efficiency for water-borne coatings to be only 40 percent.

GM recently formed a Transfer Efficiency Task Force to review methods for measuring transfer efficiency, and attempt to improve transfer efficiency nationwide. The work done by this group was discussed with EPA in a meeting on April 18, 1979. A short follow-up letter and preliminary report was received from GM in early May. A more detailed supplemental report was received on May 23, 1979. GM requested that this report be held as confidential. GM's final report on their transfer efficiency studies is not expected to be ready until the end of June.

GM explained that the intent of the data given CARE was not to estimate transfer efficiency. The data on average film thickness, for example, were quality control estimates with measurements made at hard to spray or highly corrosion susceptible points. This resulted in a vehicle average being based heavily on data representative of only a small fraction of the total surface area, thereby introducing possible errors in transfer efficiency calculations. GM believes they are now more accurately determining average film thickness.

GM now also maintains that transfer efficiency for water-bornes is inherently lower than for solvent-bornes because the lower viscosity and higher surface tension of water-bornes results in finer atomization. These mere finely atomized particles are susceptible to entrainment in the induced downdrafts in the spray booth.

GM measured transfer efficiency at South Gate and Van Nuys by four different methods. One method looked at paint usage and production over a one year period. Engineering tests were performed in which the volume or weight of solids applied to specific vehicles was measured and compared to the total amount of solids sprayed. Finally, laboratory tests which simulated plant conditions were conducted. The engineering tests were performed on two separate occasions at each plant. The results of the second test at Van Nuys are not yet available.

The range of transfer efficiencies derived from these tests was from 17 to 42 percent. The lowest figures are from the Van Nuys plant. At Van Nuys, hoods and fenders are coated separately from the rest of the vehicle. The highest figures are from the first series of tests at South Gate. Results from the second series of tests at South Gate were less scattered, falling consistently near 30 percent.

Based on the data presented by GM it appears that 40 percent is an over estimate of water-borne transfer efficiency. Although GM's investigative work has not spanned the full range of colors used, the average of all tests reported to date is approximately 30 percent. This is the most recurring estimate of water-borne transfer efficiency at this time and should be used in calculations involving water-borne equivalency for automotive coatings.

REFERENCES

1. Report on Transfer Efficiency of Water-Borne Enamel - Preliminary Results, C.M. Alcorfer and E.A. Pfraschan, General Motors, April 24, 1979.

2. Meeting Report - General Motors Transfer Efficiency for Water-Borne Coatings, David Salman to James C. Berry, May 7, 1079.