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Research Triangle Park, NC 27711

Research and Development

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Project Summary

Development of Proposed Standard Test Method for Spray Painting Transfer Efficiency

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The two-volume report describes the development and verification, respectively, of a standardized spray-painting transfer-efficiency test method. The result of the research was determined to be viable for laboratory evaluation.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in two separate volumes of the same title (see Project Report ordering information at back).

Introduction

This research program was initiated with the objective of developing a standardized spray-painting transfer-efficiency test method. Both review of the literature and laboratory research were conducted. Transfer efficiency measurement methods presently used by industry were evaluated and compared. The best characteristics of these methods were incorporated into the final proposed standard method. The resulting method was determined to be viable for laboratory evaluations. It still awaits adaptation and verification for production line applications.

Phase I. Method Development

Phase I of the transfer efficiency development program involved the formulation of a practical procedure. Many methods used by industry were reviewed and evaluated. The best characteristics of these methods were assembled, resulting in a testing procedure suitable for extensive laboratory evaluation of the accuracy and precision of the results.

Based on ASTM 691-79, the first requirement for the "existence of a valid, well-written test method [is that the test method] has been developed in one or more competent laboratories and has been subjected to a screening procedure or to ruggedness testing." To fulfill this requirement, the test method was developed at three painting laboratories which specialize in paint and painting equipment testing and evaluation.

In the initial tests, the standardized laboratory method consisted of three major equipment types, two paint types, and specially designed spray targets. Paint was applied to the targets under rigidly specified conditions. The amount of solids deposited on the target was divided by the net solids sprayed at the target to arrive at transfer efficiency.

The results of the initial evaluations within each laboratory were tightly grouped and exhibited a high degree of precision. The standard deviations for the series of tests were defined as 2.5 or less transfer efficiency points for each site.

Phase II. Method Verification

The Phase II program involved extensive testing of the transfer efficiency procedure at eight laboratory sites in accordance with ASTM 691-79. These evaluations were to verify the method's accuracy, precision, and ruggedness; i.e., the repeatability of the method and how well it defines the actual site's transfer efficiency. six replicate transfer efficiency measurements were made for each equipment type at each laboratory.

Results

In classical interlaboratory programs, there are two measures of the quality of the method: accuracy and precision. Precision is the measure of variability. The precision goals based on Phase I results were established as a standard deviation of 2.5 transfer efficiency units. Accuracy is the measure of how far off the observed values of transfer efficiency are from the *true* transfer efficiency. In this research, there is no known *true* measure of transfer efficiency; therefore, accuracy cannot be addressed. Since accuracy is a measure of the bias encountered in estimating the value of a parameter (and because there is no reason to believe that the spray system, laboratories, and targets examined have a significant bias), the proposed transfer efficiency test method should be reasonably accurate. The absence of statistical evidence regarding bias may be interpreted as an absence of bias. Therefore, it can be assumed that the true value determined represents the actual transfer efficiency exhibited at the specified site.

The results of these experiments document the maturity of the proposed transfer efficiency test method and the expected ruggedness of the results to differences within and between laboratories. As anticipated from earlier research efforts, the transfer efficiency results for each spray system were different. However, the results for eac spray system demonstrated exception consistency when expressed as withi laboratory standard deviation. Standa deviation is expressed in units of transf efficiency. It can be used for estimatir precision at various confidence interval The within-laboratory standard deviatic across eight laboratories was:

Conventional air spray	1.52
Electrostatic air spray	1.91
Airless spray	1.10

These within-laboratory standa deviations clearly demonstrate th capability of the test method to produc consistent results within a particul laboratory. The within-laborato standard deviations were well below th 2.5 predicted at the onset of this project

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The complete report consists of two volumes, entitled "Development of Proposed Standard Test Method for Spray Painting Transfer Efficiency:"
"Volume I. Laboratory Development" (Order No. PB 88-204 243/AS; Cost: $19.95)
"Volume 2. Verification Program," (Order No. PB 88-204 250/AS; Cost: $19.95)
The above reports will be available only from: (cost subject to change)
National Technical Information Service
5285 Port Royal Road
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