DEVELOPMENT OF A COATING ALTERNATIVES GUIDE FOR AIDING THE SELECTION OF LOWER-EMITTING COATINGS

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1.0 INTRODUCTION

Many manufactured items are painted or coated in order to protect the substrate, enhance the appearance of the product, or both. Conventional liquid paints and coatings contain a substantial quantity of organic solvent that evaporates during the curing or drying of the coating. Consequently, surface coating operations are a major source of Hazardous Air Pollutant (HAP) and Volatile Organic Compound (VOC) emissions. According to recent estimates, air emissions from industrial surface coating operations in 1992 accounted for nearly 24 percent of all VOC emissions to air from industrial processes (U.S. EPA 1993). This equaled more than 2.6 million tons (2.4 million metric tons) of VOCs.

As coatings users come under increasing pressure from environmental regulatory agencies to reduce their emissions of HAPs and VOCs, coatings suppliers are rapidly developing new lines of low- and no-VOC/HAP coatings. Due to the pace of new product development, coatings users, particularly small businesses, frequently are not aware of new products and of the degree to which these products can reduce their process emissions. Even when businesses are aware of new coatings, they may question whether these products can

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meet their operational, aesthetic, and performance requirements.

To assist the end user with sorting through information about lower-emitting coatings, Research Triangle Institute (RTI) is working in cooperation with the U.S. Environmental Protection Agency's Air and Energy Engineering Research Laboratory (AEERL) to develop the *C*oating *A*lternatives *G*uide (CAGE). The goal of this work is to develop a computer-based tool that coating users, and those providing technical assistance to them, will be able to use to select technically appropriate, cost-effective, and low-emitting coatings. CAGE is designed to provide information on coating equipment and chemistries in a user-friendly decision-tree format.

The technical effort is focused initially on developing CAGE to provide information about alternative coatings for metal parts and products painting. CAGE is being developed in three phases:

1) development of a prototype system using a limited set of coating options,
2) testing the prototype logic system with the help of coating users and state and local pollution prevention assistance offices, and
3) expansion of CAGE to include additional coatings and detailed information about coating options.

This paper summarizes progress in development of the logic framework for the prototype CAGE system.

2.0 THE CAGE CONCEPT

The traditional approach to providing information to smaller businesses generally focuses on gathering information on a topic and creating a written document which is then made available through business assistance hotlines, resource centers, and other distribution systems. Unfortunately, written documents generally have limited utility for meeting the information needs of a small business. Reasons for this include the difficulty of getting the information to the intended audience, incomplete information, information in excess of that needed by the user, and difficulty in keeping the information current.

The difficulties in gathering and distributing coatings information suggest an information diffusion approach based on electronic information media. The development of CAGE is based on the premise that an electronic information base available for personal computers can serve as an effective tool to assist coatings users (and the organizations that provide technical assistance to them). These users need not only information about the coating chemistries that can reduce emissions from coating operations, but also expertise to help focus their search on those coating chemistries that can best meet their specific performance and other requirements. Consequently, CAGE is being developed to meet both needs (i.e., to provide information about a variety of low-emitting coatings and to provide relative rankings, based on user input, of coatings that are most likely to meet the user's performance requirements). This allows the user to narrow the search for coatings and focus on those coating types most likely to apply to that business's manufacturing operations.

3.0 TECHNICAL DEVELOPMENT OF CAGE

The development of the logic system for ranking options in CAGE consists of three main parts:

1) developing the set of coatings to include in CAGE,
2) developing the set of questions that will be used to elicit key applications information from the user, and
3) developing the logical reasoning and scoring systems that determine how the user's answers to the questions affect the ranking of coatings.

Each of these items is discussed below.

3.1 Coatings Included in CAGE

While CAGE is designed to assist a user with the selection of lower-emitting coatings, CAGE is not intended to replace the expertise of the coatings vendor, nor is CAGE intended to identify a specific trade product for a particular application. Instead, CAGE is designed to identify the types of products that might offer a lower-emitting alternative to the user's current coating or coating system. CAGE provides the user with information about which alternative systems appear to be the most promising in light of the user's current operation and needs, and helps to identify the factors that may limit the applicability of these systems. Consequently, the alternative coatings included in CAGE represent "generic" formulations rather than specific vendor products.

Several generic coating systems are included in the current prototype for CAGE. Each of the coating chemistries in the system is currently available with VOC and HAP contents less than 3.5 lb/gal (420 g/l). Current systems are divided into primers and topcoats. The initial set of coatings included in CAGE has been limited intentionally to simplify the development of the prototype system. This set of coatings was selected based on the most common alternative system chemistries currently available, and will be expanded as the logic for the system is refined and verified.

3.2 Information Gathered by CAGE to Rank Alternative Coatings

Developing a ranking of potential coating alternatives requires a variety of information from the coating user regarding the operational, performance, appearance, and other requirements of the coating system. The system gathers information by asking a series of questions similar to those a coatings "expert" might ask of a user in order to narrow the list of likely coating selections.

3.3 Solution Ranking by CAGE

Information regarding the logic of selecting coatings was gathered primarily through a series of interviews with coating experts. This information was supplemented with additional

information from the literature regarding coatings properties. In general, alternatives in CAGE are ranked based on the user's response to questions. "Scores" for each option are tallied by the system based on the user's response to each question where scoring occurs. Alternatives receive a higher score if the coating will do a good job of meeting the user's need, a lower score if the coating does not meet the user's need effectively, and no change in score otherwise. If a coating cannot be used for the user's current operation (e.g., if the finish is baked and the user does not have, and will not purchase, the necessary curing equipment), the coating is eliminated from further consideration.

4.0 NEXT STEPS

In the near term, planned development of CAGE is focused on gathering information on coatings for user reports, expanding the field of expert knowledge on which the logic system is based, providing opportunities for user testing and feedback, and expanding the base of coatings to include other chemistries.

Long term development of the CAGE system will seek to expand system capabilities in a number of areas including coating equipment selection and non-metal substrates. The system may also be developed in a Windows-compatible version to add capabilities to CAGE such as graphics and a mouse-driven user interface.

REFERENCE

1. U.S. Environmental Protection Agency (U.S. EPA). 1993. National Air Pollutant Emission Trends, 1900-1992. EPA-454/R-93-032 (NTIS PB94-152097). October.

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16. ABSTRACT

The paper summarizes progress in development of the logic framework for a prototype Coating Alternatives GuidE (CAGE) system to assist the end user with sorting through information about lower-emitting coatings. The goal of this work is to develop a computer-based tool that coating users, and those providing technical assistance to them, will be able to use to select technically appropriate, cost-effective, and low-emitting coatings. CAGE is designed to provide information on coating equipment and chemistries in a user-friendly decision-tree format. The initial focus is on developing CAGE to provide information about alternative coatings for metal parts and products painting. CAGE is being developed in three phases: (1) development of a prototype system using a limited set of coating options, (2) testing the prototype logic system with the help of coating users and state and local pollution prevention assistance offices, and (3) expansion of CAGE to include additional coatings and detailed information about coating options.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Pollution Prevention	13B
Coatings	Stationary Sources	11C
Emission	Volatile Organic Compounds (VOCs)	14G
Painting		131l
Organic Compounds		07C
Volatility		20M

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