United States
Environmental Protection
Agency

Region IV
Air Programs Branch
Atlanta, Georgia 30308

EPA 904/9-79-038
April 1979

Air

EPA

Economic Impact of Implementing RACT Guidelines in the State of Alabama

EPA-904/9-79-038

FINAL REPORT

ECONOMIC IMPACT OF IMPLEMENTING TWO RACT GUIDELINES IN THE STATE OF ALABAMA

TASK ORDER NUMBER 6 UNDER:

Basic Ordering Number 68-02-2544

RESEARCH AND DEVELOPMENT SERVICES FOR ASSISTANCE TO STATES AND EPA CARRYING OUT REQUIREMENTS OF CLEAN AIR ACT AND APPLICABLE FEDERAL AND STATE REGULATIONS

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY REGION IV
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from:

BOOZ, ALLEN & HAMILTON Inc.

May, 1979

BOOZ ALLEN

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This chapter summarizes the major elements and most significant findings of the study to determine the economic impact of implementing Reasonably Available Control Technology (RACT) guidelines for volatile organic compounds for two industrial categories in the state of Alabama. Further discussion and data are presented in detail in the subsequent chapters of the report. This Executive Summary is divided into two sections:

- Objectives, Scope and Approach
- Economic Implications of Each RACT Guideline and Statewide Aggregate

1.1 OBJECTIVES, SCOPE AND APPROACH

1.1 OBJECTIVES, SCOPE AND APPROACH

The Clean Air Act Amendments of 1977 required the states to revise their State Implementation Plans (SIPs) to provide for the attainment and maintenance of national ambient air quality standards in areas designated as nonattainment. The Amendments require that each state submit the SIP revisions to the U.S. Environmental Protection Agency (EPA) by January 1, 1979. These proposed regulations should contain an oxidant plan submission for major urban areas to reflect the application of Reasonably Available Control Technology (RACT) to stationary sources for which the EPA has published guidelines. The Amendments also require that the states identify and analyze the air quality, health, welfare, economic, energy and social effects of the plan provisions.

1.1.1 Objectives

The major objective of the contract effort was to assist the states in the determination of the direct economic impact of selected segments of their SIPs for six states (Alabama, Georgia, Kentucky, North Carolina, South Carolina and Tennessee) of Region IV of the U.S. Environmental Protection Agency. These studies will be used primarily to assist EPA decisions on achieving emission limitations.

1.1.2 Scope

The scope of this project for Alabama was to determine the costs and direct impacts of control to achieve RACT guideline limitations in two industrial categories. The impact was addressed for each industry and for each state so that the respective studies are applicable to individual state regulations. Direct economic costs and benefits from the implementation of the RACT guidelines were identified and quantified. While secondary (social, energy, employment, etc.) impacts were addressed, they were not a major emphasis in the study. In summary, direct economic impact analysis of each industrial category was aggregated on a statewide basis for the RACT categories studied.

In Alabama, the economic impact was assessed for the following RACT industrial categories:

- Surface coating of cans
- Surface coating of metal furniture.

In the determination of the economic impact of the RACT guidelines, the following are the major study guidelines:

- The emission limitations for each industrial category were studied at the control level established by the RACT guidelines. These are presented in Exhibit 1-1, on the following page.

- The timing requirements for implementation of controls to meet RACT emission limitations was December 31, 1982.

- All costs and emission data were presented for 1977.

- Emission sources included were existing stationary point sources in the applicable industrial categories with VOC emissions:

  - In urban nonattainment areas--greater than 3 pounds in any hour or 15 pounds in any day

  - In rural areas--greater than 100 ton potential annually.

- The following volatile organic compounds were exempted:

  - Methane

  - Ethane

  - Trichlorotrifluorethane (Freon 113)

  - 1,1,1-trichloroethane (methyl chloroform).

EXHIBIT 1-1
U.S. Environmental Protection Agency
LISTING OF EMISSION LIMITATIONS THAT REPRESENT
THE PRESUMPTIVE NORM TO BE ACHIEVED THROUGH
APPLICATION OF RACT FOR SPECIFIC INDUSTRY CATEGORIES

Category	RACT Guideline Emission Limitations Surface Coating Categories Based on Low Organic Solvents (lbs. solvent per gallon of coating, minus water)
Surface coating of cans	
. Sheet base coat (exterior and interior) Overvarnish Two-piece can exterior (basecoat and overvarnish)	2.8
. Two and three-piece can interior body spray Two-piece can exterior end (spray or rollcoat)	4.2
. Three-piece can side-seam spray	5.5
. End sealing compound	3.7
Surface coating of metal furniture	
Prime and topcoat or single coat	3.0

Source: Regulatory Guidance for Control of Volatile Organic Compound Emissions from 15 Categories of Stationary Sources, U.S. Environmental Protection Agency, EPA-905/2-78-001, April 1978.

1.1.3 Approach

The approach applied to the overall study was: a study team with technology and economic backgrounds utilized available secondary sources to estimate the emissions, statistics and costs for each RACT industrial category; then, the study team completed, calibrated and refined these estimates based on interviews with industry representatives in the state.

For the two surface coating RACT industrial categories studied (cans and metal furniture), the potentially affected facilities, emissions and emission characteristics were obtained primarily from the state emission inventory. Therefore, the following generalized methodology was applied:

- A list of potentially affected facilities was compiled from secondary reference sources.
- Data from the emission inventory were categorized and compiled for each RACT industrial category.
- Firms not listed in the emission inventory were identified. Some of these facilities were then interviewed by telephone when there was doubt concerning their inclusion.
- Emissions, emission characteristics, control options and control costs were studied for relevant firms.
- Interviews were conducted to determine applicable control options and potential control costs.
- The study team then evaluated the control cost to meet the RACT requirements and the potential emission reduction.

1.1.4 Quality of Estimates

The quality of the estimates that are presented in this report can be judged by evaluating the basis for estimates of the individual study components. In each of the chapters that deal with the development of estimated compliance cost, the sources of information are fully documented. In addition, the study team has categorically ranked by qualitative judgment the overall data quality of the major sources and, therefore, of the outcomes. These data quality estimates were ranked into three categories:

- High quality ("hard data")--study inputs with variation of not more than ± 25 percent
- Medium quality ("extrapolated data")--study inputs with variation of ± 25 to ± 75 percent
- Low quality ("rough data")--study inputs with variation of ± 50 to ± 150 percent.

Each of these data quality estimates is presented in the individual chapters. The overall quality ranking of the study inputs for each RACT industrial category was generally in the medium quality range.

1.2 ECONOMIC IMPLICATIONS OF EACH RACT GUIDELINE AND STATEWIDE AGGREGATE

1.2 ECONOMIC IMPLICATIONS OF EACH RACT GUIDELINE AND STATEWIDE AGGREGATE

This section presents a summary of the economic impact for the two RACT industrial categories studied in Alabama. The aggregated economic implications are then presented in terms of cost of control versus emission reductions.

1.2.1 Surface Coating of Cans

Currently there are six major can coaters in the state of Alabama. The Birmingham area is a major supplier of coated can stock to can assembly plants located in the southeast section of the nation. The coated stock industry has been declining in recent years because of the rapid growth of two-piece cans.

The industry preferred method of control to meet the RACT requirements is to convert to low solvent (waterborne) coatings. However, low solvent coatings for end sealing compounds are presently not available and may not be available by 1982. To meet the RACT requirements, can manufacturers may replace some three-piece can facilities with two-piece can facilities which inherently have lower emissions (where commercially feasible), convert three-piece can lines to waterborne coatings or install thermal incineration for controlling high solvent coatings.

As a result of the industry trend toward two-piece can lines, a number of the precoated stock facilities in Alabama may shut down in the near term, regardless of the RACT requirements. In some cases, the capital requirements of meeting the RACT standards may be a contributing factor towards a decision to shut down a marginally profitable precoated stock facility. The emission controls to meet the RACT requirements represent an estimated $1.1 million in capital and $0.5 million in annualized costs. However, much of this investment is already in place to meet the Jefferson County smoke regulations. The incremental cost of meeting the RACT requirements (above current control levels) is estimated to be $100,000 in capital and $20,000 in annualized cost. This cost represents approximately 1 percent of the value of shipments manufactured for those facilities currently not meeting the RACT requirements.

Exhibit 1-2, on the following page, presents highlights of the study findings, which are presented in detail in Chapter 3 of this report.

EXHIBIT 1-2
U.S. Environmental Protection Agency
SUMMARY OF DIRECT ECONOMIC IMPLICATIONS OF
IMPLEMENTING RACT FOR CAN MANUFACTURING
PLANTS IN THE STATE OF ALABAMA

Current Situation	Discussion
Number of potentially affected facilities	There are 6 can manufacturing facilities
Indication of relative importance of industrial section to state economy	The Birmingham area is a major source of precoated can stock but contains minimal can manufacturing facilities. The 1977 value of shipment was about $23 million.
Current industry technology trends	Beer and beverage containers rapidly changing to two-piece construction
VOC emissions	1,600 tons per year (Booz, Allen estimate); theoretical uncontrolled level is 2,800 tons per year
Industry preferred method of VOC control to meet RACT guidelines	Low solvent coatings (waterborne) with incineration as an interim approach for older facilities
Affected Areas in Meeting RACT	
Capital investment (statewide)	$1.1 million from the uncontrolled state. However, most facilities have control due to smoke regulations. Approximately $100,000 would be the incremental capital requirements above current levels of control.
Annualized cost (statewide)	$0.5 million from the uncontrolled state. However, incremental annualized costs are estimated to be $20,000 (above current control levels)
Price	Assuming a direct pass-through of costs, no significant change in price
Energy	8,600 equivalent barrels of oil annually to operate incinerators (virtually no increase from 1977 level, assuming incinerators are operating 90 percent efficiency)
Productivity	No major impact
Employment	No major impact
Market structure	Accelerated technology conversion to two-piece cans
	Further concentration of sheet coating operations into larger facilities
Problem area	Low solvent coating technology for end sealing compound
VOC emission after RACT	1,100 tons per year (70 percent of current emission level)
Cost effectiveness of RACT	$40 annualized cost/annual ton of VOC reduction from current level of control

Source: Booz, Allen & Hamilton Inc.

1.2.2 Surface Coating of Metal Furniture

There are five facilities in Alabama identified as manufacturers and coaters of metal furniture, which would be affected by the proposed limitations for the RACT industrial category. None of the facilities currently have controls which would meet the proposed limitations.

To meet the RACT requirements, these facilities will need to invest approximately $150,000 in capital, and the annualized cost of control would be approximately $26,000.

No significant productivity, employment or market structure dislocations should be associated with the implementation of the RACT guidelines.

To meet the RACT requirements, the low solvent coating materials may not totally be available in the quality, color variety or specifications of each of the manufacturers. The development of totally suitable coating materials (or changes in current manufacturing requirements) is the key to successful implementation of the RACT requirements within the given time limitations.

Exhibit 1-3, on the following page, presents highlights of the study findings, which are presented in detail in Chapter 4 of this report.

EXHIBIT 1-3
U.S. Environmental Protection Agency
SUMMARY OF DIRECT ECONOMIC IMPLICATIONS OF IMPLEMENTING RACT FOR SURFACE COATING OF METAL FURNITURE IN ALABAMA

Current Situation	Discussion
Number of potentially affected facilities	There are 5 metal furniture manufacturing facilities
Indication of relative importance of industrial section to state economy	1977 value of shipments was $78 million industrywide and approximately $48 million for five affected facilities
Current industry technology trends	Trend is towards the use of a variety of colors
1977 VOC emissions (actual)	460 tons per year
Industry preferred method of VOC control to meet RACT guidelines	Low solvent coatings
Assumed method of control to meet RACT guidelines	Low solvent coatings

Affected Areas in Meeting RACT	Discussion
Capital investment (statewide)	$148,000
Annualized cost (statewide)	$26,000, which represents less than 0.1 percent of the value of shipments from the five affected firms
Price	No major change
Energy	No major impact
Productivity	No major impact
Employment	No major impact
Market structure	No major impact
RACT timing requirements (1982)	Companies using a variety of colors may face a problem finding suitable low solvent coatings
Problem area	Low solvent coating in a variety of colors providing acceptable quality needs to be developed
VOC emissions after RACT	80 tons per year (approximately 15 percent of current emissions level)
Cost effectiveness of RACT	$68 annualized cost/annual ton of VOC reduction

Source: Booz, Allen & Hamilton Inc.

1.2.3 Statewide Aggregate Economic Impact for the Two RACT Guidelines Studied

The implementation of RACT emission limitations for the surface coating of cans and metal furniture in Alabama involves an estimated $250,000 in capital cost and approximately $50,000 annualized cost per year. The net VOC emission reduction is estimated to be 880 tons annually from a 1977 baseline of 2,060 tons. Exhibit 1-4, on the following page, presents a quantitative summary of the emissions, estimated cost of control, cost indicators and cost effectiveness of implementing the two RACT guidelines studied.

* * *

The remaining chapters present details on the findings that are presented in this executive summary.

EXHIBIT 1-4
U.S. Environmental Protection Agency
SUMMARY OF IMPACT OF IMPLEMENTING RACT
GUIDELINES IN TWO INDUSTRIAL CATEGORIES--ALABAMA

	Emissions				Cost of RACT Control		Cost Indicators		Effectiveness
Industry Category	Number of Facilities Potentially Affected	1977 VOC Emissions (tons/yr)	Estimated VOC Emissions After Implementing RACT (tons/yr)	Net VOC Emission Reductions (tons/yr)	Capital Cost ($ millions)	Annualized Cost (credit) ($ millions)	Annualized Cost as Percent of Value of Shipments[a] (percent)	Annualized Cost Per Unit Shipment (cost per unit)	Annualized Cost (credit) Per Ton of VOC Reduction ($ per tons/yr)
Surface coating of cans	6	1,600	1,100	500	0.10	0.02	1	neg.[b]	$40
Surface coating of metal furniture	5	460	80	380	0.15	0.03	<0.1	neg.[b]	$68
TOTAL	11	2,060	1,180	880	0.25	0.05			

Note: Figures presented in this exhibit are rounded and approximated for comparison purposes.

a. Value of shipments represent the estimated value of shipments for those firms in the specific industry category required to implement controls to meet the RACT requirements.

b. This represents a negligible industrywide annualized cost per unit shipment.

Source: Booz, Allen & Hamilton Inc.

2.0 INTRODUCTION AND OVERALL STUDY APPROACH

2.0 INTRODUCTION AND OVERALL STUDY APPROACH

This chapter presents an overview of the study's purpose, scope and methodology. It is divided into six sections:

- Background
- Summary of State Implementation Plan revisions and state's need for assistance
- Scope
- Approach
- Quality of estimates
- Definitions of terms used.

Each of these sections is discussed below.

The approach and quality of estimates is discussed in detail in each of the respective chapters dealing with the specific RACT industrial categories (chapters 3 and 4).

2.1 Background

The Clean Air Act Amendments of 1977 required the states to revise their State Implementation Plans (SIPs) to provide for the attainment and maintenance of national ambient air quality standards in areas designated as nonattainment. The Amendments require that each state submit the SIP revisions to the U.S. Environmental Protection Agency (EPA) by January 1, 1979. These proposed regulations should contain an oxidant plan submission for major urban areas to reflect the application of Reasonably Available Control Technology (RACT) to stationary sources for which the EPA has published guidelines. The Amendments also require that the states identify and analyze the air quality, health, welfare, economic, energy and social effects of the plan provisions.

Under the direction of Region IV, the EPA contracted with Booz, Allen & Hamilton Inc. (Booz, Allen) to assist the states of Alabama, Georgia, Kentucky, North Carolina, South Carolina and Tennessee in analyzing the economic, energy and social impacts of the SIP revisions proposed by these states. The assignment was initiated on September 28, 1978, and, as a first step, the proposed SIP revisions and the type of assistance desired by each state were reviewed.

After a review with each of the states and EPA Region IV representatives, a work scope was defined that would include in the study these industrial segments most likely to have significant impact at the statewide level. For the most part this included industrial categories that had more than a few facilities potentially affected. The next section discusses those specific industrial categories included in this work scope.

2.2 SUMMARY OF PROPOSED SIP REVISIONS IN ALABAMA AND THE STATE'S NEED FOR CONTRACTOR SUPPORT

Alabama has designated five areas, three urban and two nonurban, as nonattainment for ozone. In order to attain the ambient ozone standards in these areas, the state has proposed to reduce the volatile organic compound (VOC) emissions from existing stationary sources in these areas by implementing the Reasonably Available Control Technology Guidelines developed by the EPA. In addition, the state has proposed motor vehicle inspection/maintenance programs in two areas. The state has also designated five areas as nonattainment for total suspended particulates (TSP) and two areas as nonattainment for sulfur dioxide (SO_2) and has proposed regulations to control the TSP and SO_2 emissions from existing sources.

The state officials were interviewed to determine their need for support in analyzing the economic impact of the SIP revisions. The analysis of implementing the RACT guidelines for reducing VOC emissions was expressed as the fundamental concern. Specifically, the state needed assistance in the analysis of two of the 15 industrial categories for which the EPA has published RACT guidelines. These two RACT industrial categories were surface coating of metal cans and surface coating of metal furniture. The other 13 industrial categories were excluded from this study because either a very limited number of sources were affected by the proposed regulation in those categories or the state had the necessary resources to perform analysis itself.

2.3 SCOPE

The principal objective of this study is to determine the costs and impact of compliance with the proposed SIP revisions in six states in EPA Region IV. The study will emphasize the analysis of direct economic costs and benefits of the proposed SIP revisions. Secondary (social, energy and employment) impacts will also be addressed, but are not the major study emphasis.

In Alabama, the economic impact will be analyzed for implementing RACT guidelines to reduce VOC from the following two industrial categories:

- Surface coating of cans
- Surface coating of metal furniture.

In the determination of the economic impact of the RACT guidelines, the following are the major study guidelines:

- The emission limitations for each industrial category were studied at the control level established by the RACT guidelines. These are presented in Exhibit 2-1, on the following page.

- The timing requirement for implementation of controls to meet RACT emission limitations is December 1, 1982.

- All costs and emission data were presented for 1977.

- Emissions sources included were existing stationary point sources in the applicable industrial categories with VOC emissions greater than 3 pounds in any hour or 15 pounds in any day in urban nonattainment areas and greater than 100 tons per year in nonurban and attainment areas.

- The following volatile organic compounds were exempted:

  - Methane
  - Ethane
  - Trichlorotrifluorethane (Freon 113)
  - 1,1,1-trichloroethane (methyl chloroform).[1]

1 The exemption status of methyl chloroform under these guidelines may be subject to change.

Exhibit 2-1

U.S. Environmental Protection Agency

LISTING OF EMISSION LIMITATIONS THAT REPRESENT THE PRESUMPTIVE NORM TO BE ACHIEVED THROUGH APPLICATION OF RACT FOR SPECIFIC INDUSTRY CATEGORIES

Category	RACT Guideline Emission Limitations[a] Surface Coating Categories Based on Low Organic Solvents (lbs. solvent per gallon of coating, minus water)
Surface coating of cans	
. Sheet basecoat (exterior and interior) Overvarnish Two-piece can exterior (basecoat and overvarnish)	2.8
. Two and three-piece can interior body spray Two-piece can exterior end (spray or rollcoat)	4.2
. Three-piece can side-seam spray	5.5
. End sealing compound	3.7
Surface coating of metal furniture	
Prime and topcoat or single coat	3.0

Source: Regulatory Guidance for Control of Volatile Organic Compound Emissions from 15 Categories of Stationary Sources, U.S. Environmental Protection Agency, EPA-905/2-78-001, April 1978.

2.4 APPROACH

This section describes the overall approach and methodology applied in this assignment. In general, the approach varied for each state and also for each industrial category studied. This section specifically describes the overall approach that was applied for the state of Alabama. The methodology applied to determine the economic impact for each of the two RACT industrial categories in Alabama is described in detail in each chapter dealing with the specific RACT category.

There are five parts to this section to describe the approach for determining estimates of:

- Industry statistics
- VOC emissions
- Process descriptions
- Cost of controlling VOC emissions
- Comparison of direct cost with selected direct economic indicators.

2.4.1 Industry Statistics

The assembly of economic and statistical data for each industrial category was an important element in establishing the data base that was used for projection and evaluation of the emissions impact. Some of the major variables for each industrial category were:

- Number of manufacturers
- Number of employees
- Value of shipments
- Number of units manufactured
- Capital expenditures
- Energy consumption
- Productivity indices
- Current economics (financial) status
- Industry concentration
- Business patterns (small vs. large; downstream integration)

- Age distribution of facilities
- Future trends and developments.

For the two surface coating RACT industry categories studied (cans and metal furniture) in Alabama, the industry statistics were compiled as follows:

- The facilities potentially affected by the RACT guidelines were identified by the Alabama Air Pollution Control Commission staff.
- Industry category statistical data were compiled using secondary sources such as:
  - Department of Commerce
  - Census of Manufactures
  - Trade associations
  - Bureau of Labor Statistics
  - National Technical Information Services.
- The industry statistical data were refined by two mechanisms:
  - Assessing the statistical data for reasonableness in comparison to the list of potentially affected facilities
  - Using industry and association interviews for completion and validation.

2.4.2 VOC Emissions

An approach that made maximum use of the existing Alabama emission data was defined.

- State Air Pollution Control Commission representatives were interviewed to determine the completeness and validity of emission data available for each RACT industrial category. It was determined that:
  - VOC emission data for major industrial sources appeared to be reasonable.

- The emission data provided relevant data that could be utilized for economic evaluation, i.e., current emission levels (controlled and uncontrolled emissions) and number of sources (total and those controlled), type of control implemented (if any) and average efficiency of control.

- The data base was compiled in a baseline consistent with the RACT industrial categories.

- The Alabama Air Pollution Control Commission provided data for the two industrial categories: cans and metal furniture.

- The emission estimates for each of the two RACT industrial categories studied were refined during industry interviews.

2.4.3 Process Descriptions

For each of the industrial categories, the basic technology and emission data were reviewed and summarized concisely for subsequent evaluation of engineering alternatives. In this task, the RACT documents that had been prepared for each industrial category and other air pollution control engineering studies served as the basis for defining technological practice. Additional alternatives to control that met the requirements of the RACT guidelines were identified from literature search. The most likely control alternatives were assessed and evaluated by:

- Technical staff at Booz, Allen
- Interviews with industry representatives
- Interviews with EPA representatives
- Interviews with equipment manufacturers.

2.4.4 Cost of Controlling VOC Emissions

The cost of control to meet the requirements of the RACT guidelines had been presented in the RACT documents, other technical EPA studies and trade journal technical documents and by industry representatives. The approach applied in developing capital and annualized cost estimates was to:

- Utilize available secondary source information as the primary data source

- Validate the control alternatives industry is likely to apply

- Calibrate these cost estimates provided in technical documents.

It was not within the purpose or the scope of this project to provide detailed engineering analysis to estimate the cost of compliance.

Cost data presented within the body of the report were standardized in the following manner:

- All cost figures are presented for a base year, 1977.

- Capital cost figures represent installed equipment cost including:

  - Engineering
  - Design
  - Materials
  - Equipment
  - Construction

  The capital cost estimates do not account for costs such as:

  - Clean-up of equipment
  - Lost sales during equipment downtime
  - Equipment start-up and testing
  - Initial provisions (spare parts).

- Capital-related annual costs are estimated at 25 percent of the total capital cost per year (unless explicitly stated otherwise). The estimation procedure applied was built up from the following factors:

  - Depreciation--10 percent (assuming straight-line over a ten-year life)

  - Interest--8 percent

  - Taxes and insurance--3 percent

  - Maintenance--4 percent.

The capital-related annual costs do not account for investment costs in terms of return or investment parameters (i.e., the "opportunity cost" of money is not included).

- Annual operating costs of compliance with the RACT guidelines were estimated for each of the control alternatives studied. The annual operating costs included were:

  - Direct labor
  - Raw material costs (or savings)
  - Energy
  - Product recovery cost (or savings).

  Other types of costs, not included in this analysis, involve compliance costs, such as:

  - Demonstration of control equipment efficiency

  - Supervisory or management time

  - Cost of labor or downtime during installation and startup.

- The annualized cost is the total of direct operating costs (including product or raw material recovery) and the capital related annual costs.

2.4.5 Comparison of Direct Cost with Selected Direct Economic Indicators

In each of the industrial categories studied, after the costs (or savings) of compliance had been determined, these costs were compared with selected economic indicators. This comparison was performed to gain a perspective on the compliance costs rather than to estimate price changes or other secondary effects of the regulation. Presented below are typical comparisons of direct costs with indicators that are presented in this study.

- Annualized cost in relation to current price-- To gain a perspective on the compliance cost in relation to current prices of the manufactured items at the potentially affected facilities, the annualized cost is presented in terms of a price increase assuming a direct pass-through of costs to the marketplace.

- This analysis was based on the average cost change (including those facilities that may have little or no economic impact associated with meeting the proposed standards) divided by the average unit price of goods manufactured.

- For this reason as well as many others (that might be addressed in a rigorous input-output study to estimate eventual price increase), this analysis should not be interpreted as forecast of price changes due to the proposed standards.

. Annualized costs as a percent of current value of shipment--The annualized costs applied are for all those facilities potentially affected divided by the estimated value of shipments for the statewide industrial category (i.e., including those facilities which currently may meet the proposed standard). This approach tends to understate the effect to those specific firms requiring additional expenses to meet the proposed standard. Therefore, when available, the compliance cost is also presented as a percent of the value of shipments for only those firms not currently meeting the proposed regulation.

. Capital investment as a percent of current annual capital appropriations--Estimated statewide capital investment for the potentially affected facilities divided by the estimated capital appropriations for the industry affected as a whole in the state (including those facilities that may not require any capital investment to meet the proposed standard).

2.5 QUALITY OF ESTIMATES

The quality of the estimates that are presented in this report can be judged by evaluating the basis for estimates of the individual study components. In each of the chapters that deal with the development of estimated compliance cost, the sources of information are fully documented. In addition, the study team has categorically ranked the overall data quality of the major sources and, therefore, of the outcomes. These data quality estimates were ranked into three categories:

- High quality ("hard data")--study inputs with variation of not more than $\pm$ 25 percent

- Medium quality ("extrapolated data")--study inputs with variation of $\pm$ 25 to $\pm$ 75 percent

- Low quality ("rough data")--study inputs with variation of $\pm$ 50 to $\pm$ 150 percent

Each of these data quality estimates are presented in the individual chapters. The overall quality ranking of the study inputs for each RACT industrial category was generally in the medium quality range.

2.6 DEFINITIONS OF TERMS

Listed below are definitions of terms that are used in the body of the report:

- Capture system--the equipment (including hoods, ducts, fans, etc.) used to contain, capture or transport a pollutant to a control device.
- Coating applicator--an apparatus used to apply a surface coating.
- Coating line--one or more apparatuses or operations which include a coating applicator, flash-off area and oven, wherein a surface coating is applied, dried and/or cured.
- Control device--equipment (incinerator, adsorber or the like) used to destroy or remove air pollutant(s) prior to discharge to the ambient air.
- Continuous vapor control system--a vapor control system that treats vapors displaced from tanks during filling on a demand basis without intermediate accumulation.
- Direct cost pass-through--the relationship of the direct annualized compliance cost (increase or decrease) to meet the RACT limitations in terms of units produced (costs per unit value of manufactured goods).
- Emission--the release or discharge, whether directly or indirectly, of any air pollutant into the ambient air from any source.
- Facility--any building, structure, installation, activity or combination thereof which contains a stationary source of air contaminants.
- Flashoff area--the space between the application area and the oven.
- Hydrocarbon--any organic compound of carbon and hydrogen only.

- Incinerator--a combustion apparatus designed for high temperature operation in which solid, semisolid, liquid or gaseous combustible wastes are ignited and burned efficiently and from which the solid and gaseous residues contain little or no combustible material.

- Intermittent vapor control system--a vapor control system that employs an intermediate vapor holder to accumulate vapors displaced from tanks during filling. The control device treats the accumulated vapors only during automatically controlled cycles.

- Loading rack--an aggregation or combination of gasoline loading equipment arranged so that all loading outlets in the combination can be connected to a tank truck or trailer parked in a specified loading space.

- Organic material--a chemical compound of carbon excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates and ammonium carbonate.

- Oven--a chamber within which heat is used to bake, cure, polymerize and/or dry a surface coating.

- Prime coat--the first film of coating applied in a two-coat operation.

- Reasonably available control technology (RACT)--the lowest emission limit as defined by EPA that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility. It may require technology that has been applied to similar, but not necessarily identical, source categories.

- Reid vapor pressure--the absolute vapor pressure of volatile crude oil and volatile nonviscous petroleum liquids, except liquified petroleum gases, as determined by American Society for Testing and Materials, Part 17, 1973, D-323-72 (Reapproved 1977).

- Shutdown--the cessation of operation of a facility or emission control equipment.

- Solvent--organic material which is liquid at standard conditions and which is used as a dissolver, viscosity reducer or cleaning agent.

- Standard conditions--a temperature of 20°C (68°F) and pressure of 760 millimeters of mercury (29.92 inches of mercury).

- Startup--the setting in operation of a source or emission control equipment.

- Stationary source--any article, machine, process equipment or other contrivance from which air pollutants emanate or are emitted, either directly or indirectly, from a fixed location.

- Topcoat--the final film of coating applied in a multiple coat operation.

- True vapor pressure--the equilibrium partial pressure exerted by a petroleum liquid as determined in accordance with methods described in the American Petroleum Institute Bulletin 2517, "Evaporation Loss from Floating Roof Tanks," 1962.

- Equivalent barrel of oil--energy demand is converted into barrels of oil at the conversion rate of 6,000,000 BTU per barrel of oil.

- Vapor collection system--a vapor transport system which uses direct displacement by the liquid loaded to force vapors from the tank into a vapor control system.

- Vapor control system--a system that prevents release to the atmosphere of at least 90 percent by weight of organic compounds in the vapors displaced from a tank during the transfer of gasoline.

- Volatile organic compound (VOC)--any compound of carbon that has a vapor pressure greater than 0.1 millimeters of mercury at standard conditions excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates and ammonium carbonate.

3.0 THE ECONOMIC IMPACT OF IMPLEMENTING RACT FOR CAN MANUFACTURING PLANTS IN THE STATE OF ALABAMA

3.0 THE ECONOMIC IMPACT OF IMPLEMENTING RACT FOR CAN MANUFACTURING PLANTS IN THE STATE OF ALABAMA

This chapter presents a detailed economic analysis of implementing RACT controls for can manufacturing plants in the State of Alabama. The chapter is divided into six sections:

- Specific methodology and quality of estimates
- Industry statistics
- The technical situation in the industry
- Cost and VOC reduction benefit evaluations for the most likely RACT alternatives
- Direct economic implications.

Each section presents detailed data and findings based on analyses of the RACT guidelines, previous studies of can manufacturing plants, interviews and analysis.

3.1 SPECIFIC METHODOLOGY AND QUALITY OF ESTIMATES

This section describes the methodology for determining estimates of:

- Industry statistics
- VOC emissions
- Processes for controlling VOC emissions
- Cost of controlling VOC emissions
- Economic impact of emission control

for can manufacturing plants in Alabama.

The quality of the estimates is described in detail in the latter part of this section.

3.1.1 Industry Statistics

Industry statistics on can manufacturing plants were developed from several sources since the census data do not provide data for Alabama because of the concentration of the industry. The sources included:

- The 1972 Census of Manufactures
- Data provided by the Alabama Air Pollution Control Commission
- Interviews with can manufacturers
- Relevant experience developed in performing similar studies for the EPA in Illinois, Ohio Michigan and Wisconsin.

The value of shipments of the Alabama can manufacturing industry was based on scaling up 1972 published data to 1977 and estimating the percentage of the cans that were produced in Alabama.

- The 1972 Census of Manufactures reported a total U.S. volume of shipments of 78 billion units with a value of $4.5 billion.
- The value of shipments in the East South Central Division was reported as:

State	Value of Shipments, 1972 ($ Million)	Percent of U.S. Total
Alabama	Withheld	
Kentucky	Withheld	
Mississippi	Withheld	
Tennessee	31.7	0.70
TOTAL	71.7	1.59

- The value of shipments in 1976 in the U.S. was reported to be $6,357 million. Based upon the same ratio of state production to total U.S. production as in 1972, the 1976 production in the states was estimated to have been:

State	1976 Value of Shipments ($ Million)
Alabama	
Kentucky	
Mississippi	
Tennessee	44.7
TOTAL	101.2

For 1977, the Current Industrial Reports indicates that the increase in production is 3 percent, with a 10 percent increase in value of shipments. This factor was used to estimate 1977 can production and the value of shipments.

The can manufacturing industry in the states of Alabama, Kentucky and Mississippi is estimated to have a value of shipments of $56.5 million in 1976 and $62 million in 1977.

- In 1972, 17 establishments had a value of shipments of $71.7 million or $4.2 million per plant. Mississippi was reported to have four establishments, and it was assumed that their sales were $16.8 million in 1972 and $26 million in 1977. This leaves a balance of $23.3 million in Alabama and Kentucky.

- The four major plants in Alabama, along with fragmented minor facilities, are estimated to have sales of $23.3 million--Kentucky is assumed not to have a can manufacturing industry.

- The product mix of the type of cans currently produced in the state was estimated using the national average and refined using data obtained from the Alabama emission inventory and from interviews.

3.1.2 VOC Emissions

The data for determining the current level of emissions from six plants was provided by the Alabama emission inventory. These were compared with emissions estimated through the development of representative can assembly plants.

3.1.3 Processes for Controlling VOC Emissions

Processes for controlling VOC emissions for can manufacturing plants are described in Control of Volatile Organic Emissions from Existing Stationary Sources, EPA-450/2-77-008. These data provide the alternatives available for controlling VOC emissions from can manufacturing plants. Several studies of VOC emission control were also analyzed in detail, and the industry trade association and can manufacturers were interviewed, to ascertain the most likely types of control techniques to be used in can manufacturing plants in Alabama. The specific studies analyzed were Air Pollution Control Engineering and Cost Study of General Surface Coating Industry, Second Interim Report, Springborn Laboratories, and informational literature supplied by the Can Manufacturers Institute to the state EPA programs.

The alternative approaches to VOC control, as presented in the RACT document, were supplemented by several other approaches. The approaches were arrayed and the emissions to be reduced from using each type of control were determined. This scheme forms the basis of the cost analysis, for which the methodology is described in the following paragraphs.

3.1.4 Cost of Control Approaches and the Resulting Reduction in VOCs

The costs of VOC control approaches were developed by:

- Separating the manufacturing process into discrete coating operations:
  - By can manufacturing technology
  - By type of can manufactured; i.e., beer vs. food
- Determining the alternative approaches to control likely to be used for each type of coating operation
- Estimating installed capital costs for each approach
- Estimating the probable use of each approach to control considering:
  - Installed capital cost
  - Annualized operating cost
  - Incremental costs for materials and energy
  - Technical feasibility by 1981.
- Aggregating costs to the total industry in Alabama.

Costs were determined from analysis of the previously mentioned studies:

- Control of Volatile Organic Emissions From Existing Stationary Sources, EPA-450/2-77-008
- Air Pollution Control Engineering and Cost Study of General Surface Coating Industry, Second Interim Report, Springborn Laboratories.

and from informational data supplied by the Can Manufacturers Institute and from interviews with major can manufacturing companies.

The cost of compliance and the expected emission reduction in Alabama were developed based on the plant operational data (included in the Alabama emission inventory) and discussions with individuals at PEDCO Environmental Specialists, and were refined using interviews with can manufacturers. Based upon the assessment of the degree and types of controls currently in place, the cost of VOC emission control and the net reduction in emissions were estimated.

3.1.5 Economic Impact

The economic impact was analyzed by considering the lead time requirements needed to implement RACT, assessing the feasibility of instituting RACT controls in terms of available technology, comparing the direct costs of RACT control to various state economic indicators and assessing the secondary impacts on market structure, employment and productivity from implementing RACT controls in Alabama.

3.1.6 Quality of Estimates

Several sources of information were utilized in assessing the emissions, cost and economic impact of implementing RACT controls on can manufacturing plants in Alabama. A rating scheme is presented in this section to indicate the quality of the data available for use in this study. A rating of "A" indicates hard data, "B" indicates data were extrapolated from hard data and "C" indicates data were estimated based on interviews, analyses of previous studies and best engineering judgment. Exhibit 3-1, on the following page, rates each study output and overall quality of the data. However, emission data are only as good as the assessment of the 1977 technical approach to emission controls, particularly the degree of usage of "exempt" solvents and the percentage of solvent that is actually incinerated.

EXHIBIT 3-1
U.S. Environmental Protection Agency
DATA QUALITY

Study Outputs	A "Hard Data"	B "Extrapolated Data"	C "Estimated Data"
Industry statistics		●	
Emissions	●	●	
Cost of emissions control			
Statewide costs of emissions			
Overall quality of data		●	

Source: Booz, Allen & Hamilton Inc.

3.2 INDUSTRY STATISTICS

Industry characteristics, statistics and business trends for can manufacturing plants in Alabama are presented in this section. Data in this section form the basis for assessing the impact of implementing RACT to VOC emissions from can manufacturing plants in the state.

3.2.1 Size of the Industry

There are approximately six can manufacturing facilities in Alabama. The Birmingham area is one of the can manufacturing centers in the Southeast. The can manufacturing industry in Alabama appears to be relatively unique when compared to other areas of the country. The industry assembles very few cans but coats a significant quantity of steel plate which is shipped out of the state. The state imports almost its entire requirements of assembled cans. This phenomona is caused by the Birmingham steel industry. Exhibit 3-2, on the following page, presents a summary of can manufacturing facilities in the state.

The estimated number of employees in 1977 was 1,000 to 1,200. Can industry capital investments in Alabama are estimated to have been less than $2 million, primarily for the rationalization of existing plants. These plants are generally antiquated and of declining importance.

3.2.2 Comparison of the Industry to the State Economy

The Alabama can manufacturing industry employs 0.1 percent of the state labor force, excluding government employees. The growth potential of the industry is not promising as the U.S. can industry moves toward products that do not require steel plate--the major rationale for establishing operations in the Birmingham area.

3.2.3 Characterization of the Industry

The can industry is composed of independent and captive manufacturers. Nationwide, about 70 percent of all cans are produced by independent manufacturers and about 30 percent by captive producers. The majority of captive can producers use the cans to package canned food/soup and beer. In Alabama, the independent producers are the only can manufacturers.

EXHIBIT 3-2
U.S. Environmental Protection Agency
LIST OF METAL CAN MANUFACTURING FACILITIES
POTENTIALLY AFFECTED BY RACT IN ALABAMA

Name of Firm	Location	Products	Notes
Continental Can Co. Plant 410	Jefferson County	3-piece can assembly and decorated can coated stock	
Continental Can Co. Plant 411	Jefferson County	Coated and decorated stock can ends	
National Can Co.	Jefferson County	Coated and decorated can stock can ends	A plant shutdown is reportedly being considered
SIRCO Systems	Jefferson County	Coated and decorated can stock Decorated can stock	Primarily produces steel pails
George Frank Co.	Jefferson County	Coated and decorated can stock	Reportedly a new plant built to replace capacity being phased out by major producers
Gerber Metal	Jefferson County	Coated and decorated can stock	

Source: Booz, Allen & Hamilton Inc., Alabama Emissions Inventory

The independent can producers generally operate on a "job shop" basis, producing cans for several customers on the same production facilities. In addition to differences in can size and shape, there are differences in coatings resulting from:

- The need to protect different products with varying characteristics from deterioration through contact with the metal can
- The decoration requirements of customers and requirements for protection of the decoration.

Nationally, the can industry produces more than 600 different shapes, types and sizes to package more than 2,500 products. A relatively few can sizes and coating combinations employed for packaging beverages and food represent about 80 percent of the market. The approximate percentage of total can production represented by the major groups follows.

Type of Can	Percent of Total Production
Beer and soft drink	54
Fruit and vegetable	18
Food cans in the category that includes soup cans	8
Other	20
TOTAL	100

In Alabama, the can industry is focused on meeting the needs of can assembly plants in the southeast by providing precoated stock.

Booz, Allen believes the can industry in Alabama produced 100 million cans in 1977 with a value of $7.0 million, as well as coated stock for an estimated 3.2 billion cans that were assembled out of state.

- 50 million food, general cans and aerosol cans were produced almost entirely of three-piece construction.
- 50 million three-piece beer and soft drink cans were produced.

- Stock for 1.2 billion beer and soft drink cans was coated for shipment to plants in other states.
- Stock for 1.2 billion food and general purpose cans was coated for shipment to plants in other states.
- Stock for 0.8 billion food and general purpose cans that were decorated only, for coating and assembly in other states.

This estimate was based on combining three sources of data: (1) the Alabama emissions inventory, (2) information on plant operations developed in the interviews and (3) a methodology developed by Booz, Allen (as a result of similar projects in other states) that correlates emissions with can production for several types of can manufacturing operations, specifically:

- The total emissions, as developed later in this report, was assumed to be about 2,800 tons.
- The can assembly operations contributed about 50 tons.
- 25 percent of the sheet stock was decorated only, resulting in no emissions.
- 37.5 percent of the sheet stock was decorated and coated on two sides for the production of beer and beverage cans. The resulting emissions were 0.465 tons per million cans.
- 37.5 percent of the sheet stock was coated on one side for the production of food and general purpose cans. The resulting emissions were 0.260 tons per million cans.
- End production was equivalent to twice the total number of can blanks produced, resulting in emissions of 0.435 tons per million cans.
- An equation was developed and solved that indicated that stock was coated for approximately 2.4 billion cans and an additional 0.8 billion can blanks were decorated but not coated.

The can industry in Alabama, as well as nationally, has experienced rapid technological changes since 1970 caused by the introduction of new can making technology--the two-piece can. These changes in can manufacturing technology have resulted in the closing of many can plants producing the traditional three-piece product and replacing the capacity with two-piece cans. There is evidence that this trend will continue, so that by 1981 about 80 percent of the beer and beverage cans and a relatively small but growing percentage of other cans will be of two-piece construction. There are currently no two-piece can manufacturing facilities in the state of Alabama.

3.3 THE TECHNICAL SITUATION IN THE INDUSTRY

This section presents information on can manufacturing operation, estimated VOC emissions, the extent of current emission control and the likely alternatives which may be used for controlling VOC emissions in Alabama.

3.3.1 Can Manufacturing Operations

The can industry produces cans using two fundamental technologies, the traditional three-piece method and the newer two-piece technology. These technologies are fully described in the RACT documents and therefore are not discussed in this study.

3.3.2 Emissions and Current Controls

This section presents the estimated VOC emissions from can manufacturing facilities in Alabama in 1977 and the current level of emission controls implemented in the state. Exhibit 3-3, on the following page, shows the total emissions from six can manufacturing facilities to be about 1,600 tons per year. The source of this emission data is the Alabama emission inventory with minor revisions by Booz, Allen based on data developed during interviews. The data indicate that, at the present time, in-place controls have reduced emissions by about 1,200 tons.

The industry in Alabama is currently partially controlling emissions on an estimated 60 percent of the coating throughput through the use of incineration designed to meet Jefferson County regulations on smoke. There are currently no regulations on hydrocarbon emissions.

The can industry is moving toward products with inherently lower VOC emissions during manufacture. Differences in the manufacturing process between two-piece and three-piece cans allow for a 50 percent to 60 percent reduction in emissions in converting from a three-piece beer can to a two-piece beer can decorated in a similar manner. This is caused by a greater number of interior coating operations for three-piece cans, as well as a tendency to eliminate certain exterior coatings on two-piece beer and soft drink cans. The exhibits, on the following pages, present the emissions from typical can coating operations based upon average coating properties, can production rates and annual hours of operation. They present data for conventional systems, as well as low solvent systems. It is important to note that, in most instances, can manufacturing does not require all the coatings.

EXHIBIT 3-3
U.S. Environmental Protection Agency
ALABAMA EMISSION INVENTORY AS REVISED BY
BOOZ, ALLEN & HAMILTON Inc.

Facility	Product	Number of Emitting Sources	Gal./Yr. (1000)	Lb./Gal.	Lb./Yr. (1000)	Emissions Factor	Tons VOC/ Year	Present Emissions from Afterburner
Continental Can Co. Plant 410	3-piece can assembly coated can stock	6	205[a]	9.5[a]	1,948[a]	0.60[a]	585	264
Continental Can Co. Plant 411	Coated can stock can ends	9	564[a]	9.5[a]	5,360[a]	0.60[a]	1,061	860
National Can Co.	Coated can stock can ends	11	299	9.7[a]	2,913[a]	0.60[a]	875[b]	385
SIRCO Systems	Coated can stock Litho can stock (not coated)	2	21	8.0	167	0.60	50	50
George Frank Co.	Coated can stock	2	27	9.2	248	0.74	92	9
Gerber Metal	Coated can stock	2	42	11.6	487	0.62	151	15
	TOTAL	32	1,158				2,814	1,583

a. Booz, Allen estimate
b. Booz, Allen estimate based on discussions with National Can Company and PEDCO. The PEDCO document reports 1,051 tons, including cleaning solvents which are largely recycled.

Source: Booz, Allen & Hamilton Inc., Alabama Emissions Inventory

- Exhibit 3-4 presents VOCs resulting from coating operations used in the manufacture of two-piece cans.

- Exhibit 3-5 presents VOCs resulting from sheet coating operations used in the manufacture of three-piece cans.

- Exhibit 3-6 presents VOCs resulting from typical three-piece can assembly operations.

3.3.3 RACT Guidelines

The RACT guidelines for VOC emission control are specified as the amount of allowable VOC, in pounds per gallon of coating, minus any water in the solvent system. To achieve this guideline, RACT suggests the following options:

- Low solvent coatings
  - Waterborne
  - High solids
  - Powder coating
  - Ultraviolet curing of high solids coatings
- Incineration
- Carbon adsorption.

The RACT guidelines have established different limitations for each of four groups of can coating operations. Exhibit 3-7, following Exhibit 3-6, presents the recommended VOC limitations, compared with typical, currently available, conventional coatings.

3.3.4 Selection of the Most Likely RACT Alternatives

Projecting the most likely industry response for control of VOC emissions in can manufacturing facilities is complicated by the thousands of different products offered by the can industry. Several general assumptions can be made.

- The industry preferred response will be to use low solvent coatings (primarily waterborne) wherever technically feasible.

EXHIBIT 3-4 (1)
U.S. Environmental Protection Agency
EMISSIONS FOR TYPICAL COATING
OPERATION USED IN THE MANUFACTURE
OF TWO-PIECE CANS

Operation	Coating Properties							
	Density (lb./gal.)	Solids (wt. %)	Organic Solvent (wt. %)	Organic Solvent (lb./gal.)	Water (gal./gal. coating)	VOC (lb. solvent/ gal. less water)	VOC (lb. solvent/ gal. incl. water)	Yield (1000 can/ gal.)
Organic Systems								
Print and varnish	8.0	45	100	4.40	0	4.40	4.40	12
Size and print	8.0	40	100	4.80	0	4.80	4.80	20
White base coat and print	11.0	62.5	100	4.13	0	4.13	4.13	9
Interior body spray	7.9	26	100	5.85	0	5.85	5.85	6[a]
End coating Al	8.0	45	100	4.40	0	4.40	4.40	200
End coating steel	8.0	45	100	4.40	0	4.40	4.40	40
Low Solvent Systems								
Waterborne								
Print and varnish	8.5	35	20	1.11	0.53	2.36	1.11	11
Size and print	8.5	30	20	1.19	0.57	2.76	1.19	17
White base coat and print	11.7	62	20	0.89	0.43	1.55	0.88	8
Interior body spray	8.55	20	20	1.37	0.66	3.99	1.36	5[a]
End coating Al	8.5	35	20	1.11	0.53	2.36	1.11	200
End coating steel	8.5	35	20	1.11	0.53	2.36	1.11	40
UV Cure High Solids								
Print and varnish[b]	8.0	95	100	0.40	0	0.40	0.40	25

a. Assuming 75 percent beer cans, all given a single coat, and 25 percent soft drink cans, given a double coating

b. Booz, Allen & Hamilton, Inc. estimate based on data supplied by CMI, individual can manufacturers and the EPA document 450/2-77-008

Operation	Production (cans/min.)	Production (Million cans/yr.)	Coating Consumed (gal./hr.)	Coating Consumed (1000 gal./yr.)	VOC (lb./hr.)	VOC (tons/yr.)	VOC (lb./million cans)
Organic Systems							
Print and varnish	650	253.5	3.25	21.1	14.3	46.5	364
Size and print	650	253.5	1.95	12.7	9.4	30.6	241
White base coat and print	650	253.5	4.33	28.1	17.8	57.9	457
Interior body spray	650	253.5	6.50	42.3	38.0	123.5	974
End coating Al	650	253.5	0.20	1.3	0.9	2.9	23
End coating steel	650	253.5	0.98	6.4	4.3	14.0	110
Low Solvent Systems							
Waterborne							
Print and varnish	650	253.5	3.55	23.1	3.9	12.7	100
Size and print	650	253.5	2.29	14.9	2.7	8.8	69
White base coat and print	650	253.5	4.88	31.7	4.3	14.0	110
Interior body spray	650	253.5	7.80	50.7	10.6	34.5	272
End coating Al	650	253.5	0.20	1.3	0.2	0.7	6
End coating steel	650	253.5	0.98	6.4	1.1	3.6	28
UV Cured High solids							
Print and varnish	650	253.5	1.56	10.1	0.6	2.0	15

Source: Booz, Allen & Hamilton Inc. estimates based on data supplied by Can Manufacturers Institute and interviews with can companies.

EXHIBIT 3-5 (1)
U.S. Environmental Protection Agency
COATING AND PRINTING OPERATIONS USED IN
THE MANUFACTURE OF THREE PIECE CANS
(Sheet Coating Operation)

Operation	Coating Properties							Dry Coating Thickness	
	Density (lb./gal.)	Solids (wt %)	Organic Solvent (wt %)	Organic Solvent (lb./gal.)	Water (gal/gal coating)	VOC (lb. solvent/ gal. less water)	VOC (lb. solvent/ gal. including water)	(Mg / In2)	(lb. / basebox)
Conventional Organics Systems									
Sizing and print	8.0	40	100	4.80	0	4.80	4.80	5	0.086
Inside basecoat	8.05	40	100	4.83	0	4.83	4.83	20	0.346
Outside white and print	11.0	62.5	100	4.13	0	4.13	4.13	40	0.692
Outside sheet printing and varnish	8.0	45	100	4.40	0	4.40	4.40	10	0.172
Low Solvent Systems									
Sizing (waterborne)	8.5	30	20	1.19	0.57	2.76	1.19	5	0.086
Inside basecoat									
High solids	8.0	80	100	1.60	0	1.60	1.60	20	0.346
Waterborne	8.8	40	20	1.06	0.51	2.15	1.05	20	0.346
Outside white									
High solids	12.0	80	100	2.40	0	2.40	2.40	40	0.692
Waterborne	11.7	62	20	0.89	0.43	1.55	0.88	40	0.692
Outside sheet print and varnish (waterborne)	8.5	35	20	1.11	0.53	2.36	1.11	10	0.172

Operation	Production (base box / hr.)	Production (1000 base boxes[a] / year)	Coating Consumption (gallon / basebox)	Coating Consumption (gallon / hour)	Coating Consumption (1000 gal. / year)	VOC (lb. / hour)	VOC (tons / year)	VOC (lbs. / 1000 base boxes)
Conventional Organics Systems								
Sizing and print	150	240	.027	4.1	6.6	19.7	15.8	130
Inside basecoat	150	240	.107	16.1	25.7	77.8	62.2	517
Outside white and print	150	240	.100	15.0	24.0	62.0	49.6	413
Outside sheet printing and varnish	150	240	.048	7.2	11.5	31.7	25.4	211
Low Solvent Systems								
Sizing (waterborne)	150	240	.034	5.1	8.1	6.1	4.9	41
Inside basecoat								
High solids	150	240	.054	8.1	13.0	13.0	10.4	87
Waterborne	150	240	.098	14.7	23.5	15.4	12.3	103
Outside white								
High solids	150	240	.072	10.8	17.3	25.9	20.7	172
Waterborne	150	240	.095	14.3	22.9	12.6	10.1	841
Outside sheet print and varnish (waterborne)	150	240	.057	8.6	13.8	9.5	7.6	63

a. Assuming 1,600 hours per year of operation.

Source: Booz, Allen & Hamilton Inc. estimates based on data supplied by Can Manufacturers Institute and interviews with can companies.

EXHIBIT 3-6 (1)
U.S. Environmental Protection Agency
EMISSIONS OF TYPICAL COATING
OPERATIONS USED IN THREE-PIECE
CAN ASSEMBLY

Operation	Coating Properties							
	Density (lb./gal.)	Solids (wt. %)	Organic Solvent (wt. %)	Organic Solvent (lb./gal.)	Water (gal./gal. coating)	VOC (lb. solvent/ gal. less water)	VOC (lb. solvent/ gal. incl. water)	Yeild (1000 cans/ gal.)
Organic Systems								
Interior body spray								
(beer)	7.9	26	100	5.85	0	5.85	5.85	4
Inside stripe								
(beer & bev.)	8.0	13.5	100	6.9	0	6.92	6.92	70
(food)	8.0	13.5	100	6.9	0	6.92	6.92	70
Outside stripe								
(beer)	8.0	13.5	100	6.9	0	6.92	6.92	50
End sealing compound								
(beer & bev.)	7.1	39	100	4.3	0	4.33	4.33	10
(food)	7.1	39	100	4.3	0	4.33	4.33	10
Low Solvent Systems (waterborne)								
Interior body spray								
(beer)	8.55	20	20	1.37	0.66	3.99	1.36	5
Inside stripe								
(beer & bev.)	8.55	36	20	1.09	0.53	2.30	1.08	70
(food)	8.55	36	20	1.09	0.53	2.30	1.08	70
Outside stripe								
(beer)	8.55	36	20	1.09	0.53	2.30	1.08	45
End sealing compound								
(beer & bev.)[a]	9.00	40	3	0.16	0.63	0.43	0.16	10
(food)[a]	9.00	40	3	0.16	0.63	0.43	0.16	10

Operation	Production Rate[b] (cans/min.)	Production Rate[b] (Million cans/yr.)	Coating Consumed (gal./hr.)	Coating Consumed (1000 gal./yr.)	VOC (lb./hr.)	VOC (tons/yr.)	VOC (lb./million cans)
Organic Systems							
Interior body spray (beer)	400	120	6.00	30.0	35.1	87.8	1,463
Inside stripe							
(beer & bev.)	400	120	0.30	1.5	2.1	5.3	88
(food)	400	72	0.30	0.9	2.1	3.2	88
Outside stripe (beer)	400	120	0.48	2.4	3.3	8.3	138
End sealing compound							
(beer & bev.)	400	120	2.40	12.0	10.4	26.0	433
(food)	400	72	2.40	7.2	10.4	15.6	433
Low Solvent Systems (Waterborne)							
Interior body spray (beer)	400	120	4.8	24.0	6.5	16.3	272
Inside stripe							
(beer & bev.)	400	120	0.30	1.5	0.3	0.8	13
(food)	400	72	0.30	0.9	0.3	0.5	13
Outside stripe (beer)	400	120	0.53	2.6	0.6	1.5	25
End sealing compound							
(beer & bev.)[a]	400	120	2.40	12.0	0.4	1.0	17
(food)[a]	400	72	2.40	7.2	0.4	0.6	17

a. Waterborne systems are currently only used on aerosol and oil cans.

b. Assumes 4,000 hours per year, as an average of 3,000 hours for food cans and 5,000 hours for beer and beverage cans.

Source: Booz, Allen & Hamilton Inc. estimates based on data supplied by CMI and individual can companies

EXHIBIT 3-7
U.S. Environmental Protection Agency
RACT GUIDELINES FOR CAN COATING OPERATIONS

Coating Operation	Recommended Limitation		Typical Currently Available Conventional Coatings
	kg. per liter of coating (minus water)	lbs. per gallon of coating (minus water)	lbs. per gallon of coating (minus water)
Sheet basecoat (exterior) and interior) and overvarnish; two-piece can exterior (basecoat and overvarnish)	0.34	2.8	4.1-5.5
Two- and three-piece can interior body spray, two-piece can exterior end (spray or roll coat)	0.51	4.2	6.0
Three-piece can side-seam spray	0.66	5.5	7.0
End sealing compound	0.44	3.7	4.3

Source: U.S. Environmental Protection Agency

- The choice between thermal incinerators and catalytic incinerators will be based on the availability of fuel and the preference of the individual companies.

- Incinerators with primary heat recovery will be used in preference to those with secondary recovery or no heat recovery.

. The industry will not install carbon adsorption systems because of the very poor performance record established to date.

. Eight likely control alternatives, as well as two base cases, are discussed in the paragraphs below. The percentage of cans likely to be manufactured by each of the control option alternatives, by 1982, is summarized in Exhibit 3-8, on the following page. The resulting emissions are summarized in Exhibit 3-9, at the end of this section. For cases involving incineration, the following assumptions were made.

  - Energy cost is $2.25 per million BTUs.

  - Capital cost is $20,000 per CFM.

  - Incinerators operate at 10 percent of the lower explosive limit.

  - 90 percent of the roller coating emissions are collected and incinerated.

  - 30 percent of the interior spray coating emissions are collected and incinerated.

3.3.4.1 Three-Piece Beer and Soft Drink Cans--Base Case

At the present time, the majority of three-piece beer and soft drink cans are produced by the following coating operations:

. Interior base coat
. Decoration and over varnish
. Interior and exterior stripe
. Interior spray coating
. End sealant.

EXHIBIT 3-8
U.S. Environmental Protection Agency
PERCENTAGE OF CANS MANUFACTURED
USING EACH ALTERNATIVE IN 1982

Can Type	Water-borne or Other Low Solvent Coatings	Thermal Incineration with Primary Heat Recovery	Print Only, All Low Solvent Coatings	Low Solvent Coatings Except End Sealant Which Is Incinerated	UV Cured Outside Varnish Waterborne Inside Spray
3-piece beer and soft drink	25	20	--	55	--
3-piece food and other cans	25	20	--	55	--
Sheet coating and end compounding in feeder plants of material to be shipped for assembly elsewhere	40	60	--	--	--

Source: Booz, Allen & Hamilton Inc.

The production of beer cans differs from the production of soft drink cans in some respects, the impact of which has not been considered in this study.

- Beer cans almost always have an exterior stripe, but soft drink cans frequently do not.
- Beer cans always have an inside spray coating but soft drink cans usually do not. However, soft drink cans frequently have a heavier inside base coat to offset the elimination of the spray coating.

Consideration of these differences has been elminated to reduce the complexity of the study. Because of the declining importance of three-piece beer and beverage cans, the impact will be smaller in 1982 than it would be currently.

The total emissions from this alternative are 1.79 tons per million cans (2.5 times the emissions from a similar two-piece can).

3.3.4.2 Three-Piece Beer and Soft Drink Cans--Waterborne Coatings as Proposed in RACT

In this alternative, all the coating operations currently employed in the base case have been converted to waterborne coatings. The cost of converting to waterborne systems was assumed to be minimal.

- The capital cost for converting each of five coating operations was assumed to be $10,000. This results in an annualized capital cost of $104 per million cans--assuming that the cost of capital and maintenance is 25 percent of the total installed capital cost and that 120 million cans are produced annually on the coating line.[1]
- The raw material cost of coatings is the same as for conventional coatings.
- The energy consumption is the same--this would appear reasonable since most of the energy is consumed to heat the wickets and belts and also the can metal.

[1]Annualized capital cost includes depreciation, interest taxes, insurance and maintenance.

- The yield (spoilage) is the same--it appears that the industry will continue to encounter significant spoilage in changing over to new coatings. However, as the technology is established, it is assumed that spoilage will decline to currently acceptable levels.

The total incremental cost to convert to waterborne coatings is estimated to be about $100 per million cans. This represents a cost increase of about 0.15 percent. The emissions would be reduced to 0.34 tons per million cans, an 80 percent reduction, at a cost of about $72 per ton.

It is estimated that 25 percent of all beer and soft drink facilities will employ this option. The acceptance of this technology will be retarded by the lack of a complete line of available coatings.

3.3.4.3 Three-Piece Beer and Soft Drink Cans--Base Case with Thermal Incinerators and Primary Heat Recovery

This alternative assumes that all coating operations currently employed in the base case are retrofitted with thermal incinerators. Several thermal incinerators are currently being employed on coating lines in Alabama.

The capital required for five incinerators would be about $320,000--assuming an installed cost of $20,000 per CFM.

- The annualized capital cost would be about $668 per million cans.
- The energy cost to operate the incinerators would be $166 per million cans.
- The material costs would be the same as the base case.

The total incremental cost of adopting thermal incineration is estimated to be about $834 per million cans. This represents a cost increase of about 0.2 percent. The emissions would be reduced by 59 percent to 0.74 tons per million cans, at a cost of $794 per ton of emissions removed. Because of the prohibitively high costs of this alternative, it is estimated that it will be employed only on 20 percent of all three-piece beer and soft drink cans manufactured in Alabama in 1982.

3.3.4.4 Three-Piece Beer and Soft Drink Cans--All Waterborne Except End Sealant, Which Is Thermally Incinerated

It is likely that the can industry will adopt a hybrid system, which will focus on waterborne or possibly other low solvent coatings and thermal incineration of the end sealant and which probably will not be universally available by 1982. Because end sealing compounds represent approximately 12 percent of the VOC from three-piece beer and soft drink can manufacture, this case was developed under the assumption that technology-based exceptions will not be granted.

- The capital cost of converting four coating operations and adding one incinerator would be about $340 per million cans.

- The additional energy costs of one incinerator would be about $93 per million cans.

- Material cost would be the same.

The total incremental cost of this scenario would be about $171 per million cans. This represents a cost increase of about 0.2 percent, to reduce emissions by 80 percent. It is estimated that about 55 percent of the beer and soft drink cans will be produced using this technology.

3.3.4.5 Three-Piece Food Cans--Base Case

Three-piece food cans are currently produced utilizing the following coating operations:

- Interior base coat
- Exterior base coat
- Interior stripe
- End sealant.

The emissions from this case are estimated to be 0.99 tons per million cans.

3.3.4.6 Three-Piece Food Cans--Waterborne as Proposed in RACT

In this alternative, all the coating operations currently employed in the base case have been converted to waterborne coatings.

The total incremental cost to convert to waterborne coatings is estimated to be $113 per million cans. A 76 percent reduction in emissions is achieved, to 0.24 tons per million cans. It is unlikely that a complete spectrum of waterborne coatings will be available to meet industry requirements by 1982 because:

- The focus of research is on two-piece beer and soft drink cans, which is the most rapidly growing market segment.
- The need to achieve FDA approval for the broad spectrum of products required has caused coating manufacturers to focus on the large-volume coatings required for beer and soft drinks.

As a result, it is estimated that only 25 percent of the cans will be produced using this control approach.

3.3.4.7 Three-Piece Food Cans--Base Case with Thermal Incinerators and Primary Heat Recovery

This alternative assumes that all coating operations currently employed in the base case are retrofitted with thermal incinerators.

The total incremental cost of adopting this approach is estimated to be about $690 per million cans; about $595 in capital cost and $95 in energy costs. Emissions would be reduced by 81 percent, to 0.19 tons per million cans. An estimated 20 percent of the cans would be produced using this approach.

3.3.4.8 Three-Piece Food Cans--All Waterborne Except End Sealant, Which Is Thermally Incinerated

Because waterborne and other low solvent coatings are not available, it is likely that the industry will develop a hybrid approach utilizing waterborne coatings where available and incinerating the balance of the emissions. The end sealing compound appears to be the coating most likely to be unavailable in low solvent form by 1982--end sealing compounds release about 18 percent of the VOC emissions from food can manufacturing operations.

The total incremental cost of this scenario is about $200 per million cans; $500 in capital cost and $100 in energy costs. The emissions are reduced by about 79 percent to 0.25 tons per million cans. It is estimated that 55 percent of the cans would be produced using this approach.

3.3.4.9 Sheet Coating Feeder Plant--Low Solvent As Proposed in RACT

In this alternative, all the sheet coating and end compounding operations will be converted to waterborne. The total incremental cost to convert to waterborne is estimated to be about $15 per million cans. It is unlikely that a complete spectrum of waterborne coatings will be available to meet industry requirements by 1982; as a result, 40 percent of the stock will be coated with waterborne coatings.

3.3.4.10 Sheet Coating Feeder Plant--Thermal Incinerators And Primary Heat Recovery

This alternative assumes that all sheet coating and end compounding lines are retrofitted with incinerators. At the present time, a significant number of sheet coating lines in Alabama already are operating incinerators. Because of the already installed incinerators and the lack of a complete spectrum of coatings, it is estimated that 60 percent of the stock will be coated using thermal incinerators for VOC control.

EXHIBIT 3-9
U.S. Environmental Protection Agency
EMISSIONS FROM COATING THREE-PIECE
CANS PER MILLION CANS

Case	Annualized Incremental Costs					Coating And Emissions				
	Capital ($)	Annualized Capital Cost/Millions ($)	Materials ($)	Energy ($)	Total ($)	Coating Input (gal.)	VOC Emissions (tons)	VOC Decrease (tons)	VOC Decrease %	Incremental Cost ($ per ton)
				BEVERAGE CANS						
1978 BASE CASE Interior base coat Decoration and/or varnish Interioring and exterioring stripe Interior spray End sealant	0	0	0	0	0	894	1.79	a	a	a
WATERBORNE AS PROPOSED IN RACT	416	104	0	0	104	720	0.34	1.45	81	72
BASE CASE WITH THERMAL INCINERATORS AND HEAT RECOVERY PRIMARY	2670	668	0	166	834	694	0.74	1.05	59	794
SUPPLEMENTAL SCENARIO 3 Waterborne except end sealant which is incinerated	686	171	0	20	191	715	0.35	1.44	80	133
				FOOD CANS						
1978 BASE CASE Interior base coat Exterior base coat Interior stripe End sealant	0	0	0	0	0	424	0.99	a	a	a
WATERBORNE AS PROPOSED IN RACT	453	113	0	95	687	439	0.24	0.75	76	151
BASE CASE WITH THERMAL INCINERATORS AND PRIMARY HEAT RECOVERY	2380	595	0	95	687	424	0.19	0.80	81	859
SUPPLEMENTAL SCENARIO 4 All waterborne except end sealant which is incinerated	768	192	0	17	209	435	0.23	0.76	77	275

a. Not Applicable

Source: Booz, Allen & Hamilton Inc. estimates

3.4 COST AND VOC BENEFIT EVALUATIONS FOR THE MOST LIKELY RACT ALTERNATIVES

Costs for alternative VOC emission controls are presented in this section based upon the costs per million cans developed for each alternative in the previous section. The extrapolation is based upon can production and emission for actual can manufacturing processes and not upon the representative plants.

3.4.1 Costs for Alternative Control Systems

Although there is no typical can manufacturing facility, the following two representative plants describe the situation in most three-piece can manufacturing facilities in Alabama.

- Representative Plant A produces 50 percent three-piece beer and soft drink cans and 50 percent three-piece food cans using two assembly lines. The sheet coating lines operate at 2.5 base boxes per minute for about 1,500 hours per year, to support the assembly line. Each can assembly line operates at 400 cans per minute, for 2,000 hours annually.

- Representative Plant B coats and decorates flat stock for use in satellite assembly plants. The plant coats at 2.5 base boxes per minute. Its operating rate is approximately 1,000 hours per satellite plant production line. Assuming the plant supports four lines, its operating rate would be 4,000 hours annually.

The capital cost to adopt the alternative controls to the representative plants ranges from $30,000 (to convert the sheet coating plant to waterborne coatings) to more than $300,000 (to retrofit the three-piece coating and assembly plant with incinerators). The incremental operating costs (energy plus 25 percent of capital) range from $8,000 (coating plant converted to waterborne coating) to a cost of $177,000 (for operating incinerators at the three-piece coating and assembly plant). Capital and annual operating costs for each of the representative plants is presented for each applicable alternative on Exhibit 3-10, on the following page.

3.4.2 Extrapolation of the Costs to the Statewide Industry

Exhibit 3-11, following Exhibit 3-10, shows an extrapolation of the costs of VOC emission control to the state of Alabama. The costs are based upon:

- The estimates of the cost of compliance for each of the coating operations that were developed in section 3.3
- An estimate of the share of the market for each type of can manufactured
- The assumption that coated stock sufficient to produce an additional 2.4 billion cans is shipped from Alabama to other states.

Based on the above assumptions and assuming that the industry currently is not controlling emissions, the total capital required to reduce emissions to meet the RACT guidelines from the uncontrolled level would be about $1.1 million. The annual compliance cost would be about $0.5 million.

Emissions from the Alabama can manufacturing industry were reduced by an estimated 1,200 tons per year by the end of 1977, through control approaches acceptable under RACT--incineration.

The industry currently is spending more on controls than they are likely to in 1982, assuming the industry substantially increases its usage of waterborne coatings. However, it is entirely possible that, in the face of falling demand for three-piece cans, manufacturers will shut down some capacity and use existing incinerators on remaining capacity.

EXHIBIT 3-10
U.S. ENVIRONMENTAL PROTECTION AGENCY
COST OF IMPLEMENTING RACT ALTERNATIVES FOR
REPRESENTATIVE CAN MANUFACTURING PLANTS ($1,000)

Representative Plant	Waterborne		Thermal Incinerators		Print Only/Waterborne		UV Cured/Waterborne		Waterborne Incinerate End Sealant	
	Capital	Annual Expense	Capital	Annual Expense	Capital	Annual Expense	Capital	Annual Expense	Capital	Annual Expense
3-piece beer & soft drink and food can coating and assembly plant 1 coating line 1 sheet varnish line 2 assembly lines 100 million cans	80	20	330	177	a	a	b	b	128	67
Sheet coating facility for 50% beer cans & 50% food cans 1 sheet coating line 1 sheet varnishing line 1 end compounding line Supplies stock for 290 million cans	30	8	255	143	a	a	b	b	82	34

a. Not applicable
b. Not considered to be a likely response by 1982

Source: Booz, Allen & Hamilton Inc. estimates

EXHIBIT 3-11(1)
U.S. Environmental Protection Agency
COST OF COMPLIANCE TO RACT FOR THE
CAN MANUFACTURING INDUSTRY IN ALABAMA

CAN TYPE	Can Production (millions of units)					Capital Investment (thousands of $)				
	Water-borne or Other Low Solvent Coatings	Thermal Incineration with Primary Heat Recovery	Print Only, All Low Solvent Coatings	Low Solvent Coatings Except End Sealant Which Is Incinerated	Total	Water-borne or Other Low Solvent Coatings	Thermal Incineration with Primary Heat Recovery	Print Only, All Low Solvent Coatings	Low Solvent Coatings Except End Sealant Which Is Incinerated	Total
3-Piece Beer and Soft Drink	12	10	a	28	50	5	27	0	15	47
3-Piece Food and Other Cans	12	10	a	28	50	3	24	a	21	48
Sheetcoating operations for shipment out of Alabama	960	1,440	a	a	2,400	100	1,266	a	a	1,366
					2,500					1,461

CAN TYPE	Annual Compliance Cost (thousands of $)					Emission Reduction (tons)					
	Water-borne or Other Low Solvent Coatings	Thermal Incineration with Primary Heat Recovery	Print Only, All Low Solvent Coatings	Low Solvent Coatings Except End Sealant Which Is Incinerated	Total	Water-borne or Other Low Solvent Coatings	Thermal Incineration with Primary Heat Recovery	Print Only, All Low Solvent Coatings	Low Solvent Coatings Except End Sealant Which Is Incinerated	Total	Unit Cost of Emission Reduction ($ per ton)
3-Piece Beer and Soft Drink	1	8	a	5	14	18	10	a	40	68	209
3-Piece Food and Other Cans	1	7	a	6	14	9	8	a	21	38	360
Sheetcoating operations for shipment out of Alabama	16	710	a	a	726	633	948	a	a	1,581	459
					754	660	966		61	1,687	447

a. Not Applicable

Source: Booz, Allen & Hamilton Inc.

3.5 DIRECT ECONOMIC IMPLICATIONS

This section presents the direct economic implications of implementing RACT controls to the statewide industry, including: availability of equipment and capital; feasibility of the control technology; and impact on economic indicators, such as value of shipments, unit price, state economic variables and capital investment.

3.5.1 RACT Timing

RACT must be implemented statewide by January 1, 1982. This implies that can manufacturers must have either low solvent coatings or VOC control equipment installed and operating within the next four years. The timing of RACT imposes several requirements on can manufacturers including:

- Obtaining development quantities of low solvent coatings from their suppliers and having them approved by their customers
- Having coating makers obtain FDA approval where necessary
- Obtaining low solvent coatings in sufficient quantity to meet their volume requirements
- Acquiring the necessary VOC control equipment
- Installing and testing incinerators or other VOC control equipment to insure that the system complies with RACT.

The sections which follow discuss the feasibility and the economic implications of implementing RACT within the required timeframe.

3.5.2 Feasibility Issues

Technical and economic feasibility issues implementing RACT controls are discussed in this section.

The can manufacturing industry, in conjunction with coating suppliers and incinerator vendors, has extensively evaluated most of the approaches to meeting RACT. The feeling in the industry is that, except for one notable exception, RACT can be achieved by January 1, 1982, using low solvent coatings--primarily waterborne. The coating most likely to be unavailable in 1982 is the end sealing compound. The physical characteristics of this material, as well as its method of application, do not lend themselves to incineration. Currently, the coating is air dried over a period of 24 hours.

The can manufacturers have shut down a significant number of three-piece can manufacturing facilities. It appears likely that the implementation of RACT will accelerate this trend, because of the lower cost of compliance with two-piece cans and the probable reluctance on the part of can manufacturers to invest capital in facilities producing products with declining demand.

3.5.3 Comparison of Direct Cost with Selected Direct Economic Indicators

This section presents a comparison of the net increase in the annual operating cost of implementing RACT with the total value of cans sold in the state, the value of wholesale trade in the state and the unit price of cans.

The net incremental operating cost from the uncontrolled level to can manufacturers is estimated to be $0.5 million (0.4 percent) of current manufacturing costs. The future economic impact on the industry is likely to be considerably less than $0.5 million because of considerable controls already in place -- and in fact, will probably not exceed $20,000 from the current level.

3.5.4 Ancillary Issues Relating to the Impact of RACT

This section presents two related issues that were developed during the study.

The can manufacturers have succeeded in having the guidelines altered to encompass a plant-wide emissions basis. This allows a credit from one operation, where emissions were reduced to below the RACT recommended level, to be applied to another operation that is not in compliance. The plant would be in compliance if the total emissions were reduced to the level proposed in RACT. It appears that the impact of this regulation would be to further concentrate the difficult-to-control emissions, such as end sealing compounds, into the largest facilities and to reduce further the number of can assembly plants.

High solvent coatings represent a considerable fire hazard. The conversion to low solvent coatings has reduced fire insurance costs for at least one can manufacturing facility.

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Exhibit 3-12, on the following page, presents a summary of the current economic implications of implementing RACT for can manufacturing plants in the State of Alabama.

EXHIBIT 3-12
U.S. Environmental Protection Agency
SUMMARY OF DIRECT ECONOMIC IMPLICATIONS OF
IMPLEMENTING RACT FOR CAN MANUFACTURING
PLANTS IN THE STATE OF ALABAMA

Current Situation	Discussion
Number of potentially affected facilities	There are 6 can manufacturing facilities
Indication of relative importance of industrial section to state economy	The Birmingham area is a major source of precoated can stock but contains minimal can manufacturing facilities. The 1977 value of shipment was about $23 million.
Current industry technology trends	Beer and beverage containers rapidly changing to two-piece construction
1977 VOC emissions	1,600 tons per year (Booz, Allen estimate); theoretical uncontrolled level is 2,800 tons per year
Industry preferred method of VOC control to meet RACT guidelines	Low solvent coatings (waterborne) with incineration as an interim approach for older facilities
Affected Areas in Meeting RACT	
Capital investment (statewide)	$1.1 million from the uncontrolled state. However, most facilities have control due to smoke regulations. Approximately $100 000 would be the incremental capital requirements above current levels of control.
Annualized cost (statewide)	$0.5 million from the uncontrolled state. However, incremental annualized costs are estimated to be $20,000 (above current control levels)
Price	Assuming a direct pass-through of costs, no significant change in price
Energy	8,600 equivalent barrels of oil annually to operate incinerators (virtually no increase from 1977 level, assuming incinerators are operating 90 percent efficiency)
Productivity	No major impact
Employment	No major impact
Market structure	Accelerated technology conversion to two-piece cans
	Further concentration of sheet coating operations into larger facilities
Problem area	Low solvent coating technology for end sealing compound
VOC emissions after RACT	1,100 tons per year (70 percent of current emission level)
Cost effectiveness of RACT	$40 annualized cost/annual ton of VOC reduction from current level of control

Source: Booz, Allen & Hamilton Inc.

BIBLIOGRAPHY

Control of Vclatile Organic Emissions from Existing Stationary Sources, EPA-450/2-77-008, May 1977.

Air Pollution Control Engineering and Cost Study of General Surface Coating Industry, Second Interim Report, Springborn Laboratories, Enfield, CT, August 23, 1977

Private conversations with the following:

George Frank Company, Birmingham, Alabama
Southeastern Steel, Birmingham, Alabama
SIRCO System, Birmingham, Alabama
Guber Metal, Birmingham, Alabama
Alabama Air Pollution Control Commission, Montgomery, Alabama
American Can Company, Greenwich, Connecticut
Continental Can Company, Chicago, Illinois & Birmingham, Alabama
National Can Company, Chicago, Illinois & Birmingham, Alabama
Can Manufacturers Institute, Washington, D.C.

4.0 THE ECONOMIC IMPACT OF IMPLEMENTING RACT FOR SURFACE COATING OF METAL FURNITURE IN THE STATE OF ALABAMA

4.0 THE ECONOMIC IMPACT OF IMPLEMENTING RACT FOR SURFACE COATING OF METAL FURNITURE IN THE STATE OF ALABAMA

This chapter presents a detailed economic analysis of implementing RACT controls for surface coating of metal furniture in the State of Alabama. The chapter is divided into six sections:

- Specific methodology
- Industry statistics
- The technical situation in the industry
- Cost and VOC reduction benefit for the most likely RACT alternatives
- Direct economic implications
- Selected secondary economic impacts.

Each section presents detailed data and findings based on analyses of the RACT guidelines, previous studies of metal furniture plants, interviews and analysis.

4.1 SPECIFIC METHODOLOGY

This section describes the methodology for estimating:

- Industry statistics
- VOC emissions
- Processes for controlling VOC emissions
- Cost of controlling VOC emissions
- Economic impact of emission control

for surface coating of metal furniture in Alabama.

The quality of the estimates is described in detail in the last part of this section.

4.1.1 Industry Statistics

Industry statistics on metal furniture manufacturing plants were obtained from several sources. All data were converted to a base year 1977, based on specific scaling factors. The number of establishments for 1977 was based on the Solvent Emissions from Stationary Sources in Alabama; and supplemented by a review of the 1976 County Business Patterns and interviews with selected metal furniture manufacturing corporations. The number of employees was obtained from the 1976 County Business Patterns and refined based on information obtained during interviews with selected metal furniture manufacturers.

The industry value of shipments was estimated by scaling up 1972 and 1976 published data to 1977. Because of the lack of uniform data, different approaches were used for the household and business/institutional furniture subcategories of this industry, as discussed below.

4.1.1.1 Value of Shipments for Household Metal Furniture

Predicasts Inc. (Issue #64, July 27, 1976) presented the 1976 U.S. value of shipments of household metal furniture (SIC 2514) as $1,161 million and indicated an 8.7 percent increase in the value of shipments for 1977. The 1972 Census of Manufactures reported that the value of shipments in the East South Central region was $152 million, or 21 percent of the U.S. value of shipments. The value of shipments for household metal furniture in Alabama was reported as $22.0 million, or 14.5 percent of the regional value of shipments.

The 1977 value of shipments of metal household furniture in Alabama was estimated by scaling up the 1976 U.S. value of shipments to 1977 and applying the above regional and state percentages.

4.1.1.2 Value of Shipments for Business/Institutional Metal Furniture

Business/institutional metal furniture includes office furniture (SIC 2522), metal partitions (SIC 2542) and public building furniture (SIC 2531). The value of shipments was estimated using the following technique:

- For office furniture, the 1976 Current Industrial Reports presented the U.S. value of shipments as $1,002 million and Predicasts Inc., Issue #64, July 27, 1976 indicated an 8 percent increase in the value of shipments for 1977. The value of shipments for Alabama was reported as $15.7 million in the 1976 Census of Manufactures, which was 1.85 percent of the U.S. value of shipments. The 1977 value of shipments for Alabama was estimated by applying this percentage to the 1977 U.S. value of shipments.

- For metal partitions, which also include shelving, lockers, storage racks and accessories and miscellaneous fixtures, the 1972 Census of Manufactures reported the value of shipments for Alabama as $14 million. The 1977 value of shipments was estimated by assuming a 6 percent linear rate of growth between 1972 and 1977.

- For public building furniture, which includes metal, wood and plastic furniture for stadiums, schools and other public buildings, the 1972 Census of Manufactures reported the U.S. value of shipments as $546.9 million and the value of shipments for the East South Central region as $35.7 million. The value of shipments for Alabama was reported as $3.2 million. The breakdown among metal, wood and plastic furniture was not reported. Because of the lack of data on the breakdown among metal and other types, half of the total value of shipments was assumed to be for metal furniture. The 1977 value of shipments was estimated by assuming a 6 percent linear rate of growth between 1972 and 1977.

4.1.2 VOC Emissions

The VOC emissions were obtained from the Alabama Air Pollution Control Commission's emissions inventory, except for one facility where the annual throughput of coatings was used to estimate the emissions. Current VOC emissions controls were determined through interviews with plant operations.

4.1.3 Processes for Controlling VOC Emissions

Processes for controlling VOC emissions for metal furniture plants are described in Control of Volatile Organic Emissions from Existing Stationary Sources, EPA-450/2-77-032. The data provide the alternatives available for controlling VOC emissions from metal furniture manufacturing plants. Several studies of VOC emission control were also analyzed in detail, and metal furniture manufacturers were interviewed to ascertain the most likely types of control techniques to be used in metal furniture manufacturing plants in Alabama. The specific studies analyzed were Air Pollution Control Engineering and Cost Study of General Surface Coating Industry, Second Interim Report, Springborn Laboratories, and informational literature supplied by the metal furniture manufacturers.

4.1.4 Cost of Controlling VOC Emissions for Surface Coating of Metal Furniture

The costs of control of volatile organic emissions for surface coating of metal furniture were developed by:

- Determining the alternative types of control systems likely to be used
- Estimating the probable use of each type of control system
- Defining equipment components
- Developing installed capital costs for each alternative control system
- Aggregating installed capital costs for each alternative control system
- Defining two model plants

- Developing costs of a control system for the model plants:
  - Installed capital cost
  - Direct operating cost
  - Annual capital charges
  - Energy requirements
- Extrapolating model costs to individual industry sectors
- Aggregating costs to the total industry for the state.

The model plants used as the basis for estimating the costs of meeting RACT were solvent-based dipping and electrostatic spraying operations. The cost of modifications to handle waterborne or high solids was not considered to be a function of the type of metal furniture to be coated, since no modifications to the production lines should be necessary. Modifications are required only to the coatings handling and pumping and spraying equipment, and these would probably not differ for different types of furniture pieces.

4.1.5 Economic Impacts

The economic impacts were assessed in terms of analyzing the lead time requirements to implement RACT, assessing the feasibility of instituting RACT controls in terms of capital availability and equipment availability, comparing the direct costs of RACT control to various state economic indicators and assessing the secondary effects on market structure, employment and productivity as a result of implementing RACT controls in Alabama.

4.1.6 Quality of Estimates

Several sources of information were utilized in assessing the emissions, cost and economic impact of implementing RACT controls on the surface coating of metal furniture in Alabama. A rating scheme is presented in this section to indicate the quality of the data available for use in this study. A rating of "A" indicates hard data (data that are published for the base year), "B" indicates data that were extrapolated from hard data and "C" indicates data that were not available in secondary literature and were estimated based on interviews, analysis or previous studies and best engineering judgment. Exhibit 4-1, on the following page, rates each study output listed and the overall quality of the data.

EXHIBIT 4-1
U.S. Environmental Protection Agency
SURFACE COATING OF METAL FURNITURE DATA QUALITY

Study Outputs	A Hard Data	B Extrapolated Data	C Estimated Data
Industry statistics		X	
Emissions	X	X	
Cost of emissions control			X
Economic impact			X
Overall quality of data			X

Source: Booz, Allen & Hamilton Inc.

4.2 INDUSTRY STATISTICS

Industry characteristics, statistics and business trends for metal furniture manufacturing plants in Alabama are presented in this section. Data in this section form the basis for assessing the impact of implementing RACT for control of VOC emissions from metal furniture manufacturing plants in the state.

4.2.1 Industry Characteristics

Metal furniture is manufactured for both indoor and outdoor use and may be divided into two general categories: office or business and institutional, and household. Business and institutional furniture is manufactured for use in hospitals, schools, athletic stadiums, restaurants, laboratories and other types of institutions, and government and private offices. Household metal furniture is manufactured primarily for home and general office use.

4.2.2 Size of Industry

The Alabama Air Pollution Control Commission reports and Booz, Allen interviews have identified four companies with five plants in Alabama, participating in the manufacture and coating of metal furniture, as shown in Exhibit 4-2, on the following page. Statewide, the metal furniture industry in Alabama accounted for an estimated $38 million in household metal furniture shipments and $40 million in business/institutional metal furniture shipments in 1977. This is equivalent to about 3 percent and 1.7 percent of the U.S. value of shipments of household and business/institutional metal furniture, respectively. The metal furniture industry in Alabama employs approximately 2,600 persons. Since the five plants affected by RACT account for approximately 1,600 employees (or 62 percent) of the industry, it is assumed that these five firms also account for approximately 62 percent of the value of shipments.

4.2.3 Comparison of the Industry to the State Economy

A comparison of the value of shipments of metal furniture with the state economy indicates that the metal furniture industry represents about 0.4 percent of the total Alabama value of shipments of all manufactured goods. The industry employs approximately 0.8 percent of all people employed in manufacturing in Alabama.

Exhibit 4-2

U.S. Environmental Protection Agency
LIST OF MANUFACTURERS POTENTIALLY AFFECTED BY RACT GUIDELINES FOR SURFACE COATING OF METAL FURNITURE IN ALABAMA

Facility Name	Location
Birmingham Ornamental Iron	Birmingham
Plantation Patterns	Birmingham
Southeastern Metal Company (SIMCO) Division of United Chair Corp.	Birmingham
United Chair Corporation (Subsidiary of U.S. Industries)	Leeds
Dixie Craft Manufacturing Company	Goodwater

Source: Alabama Air Pollution Control Commission and Booz, Allen and Hamilton Inc. interviews.

4.3 THE TECHNICAL SITUATION IN THE INDUSTRY

This section presents information on metal furniture manufacturing operations, estimated VOC emissions, the extent of current control and the likely alternatives which may be used for controlling VOC emissions in Alabama.

4.3.1 Emissions and Current Controls

This section presents the estimated VOC emissions from metal furniture manufacturing facilities in Alabama in 1977 and the current level of emission controls implemented in the state. Exhibit 4-3, on the following page, shows the total emissions from the 5 metal furniture manufacturing facilities to be about 460 tons per year. These data were obtained from the Alabama Air Pollution Commission and interviews with industry representatives. None of the manufacturers listed has implemented hydrocarbon emissions control systems.

4.3.2 RACT Guidelines and Control Options

The emission limitations that can be achieved through the application of Reasonably Available Control Technology (RACT) for the metal furniture coating industry are presented in Exhibit 4-4, on the following pages. This emission limit is based on the use of low organic solvent coatings. It can also be achieved with waterborne coatings and is approximately equivalent (on the basis of solids applied) to the use of an add-on control device that collects or destroys about 80 percent of the solvent from a conventional high organic solvent coating. In some cases, greater reductions (up to 90 percent) can be achieved by installing new equipment which uses powder or electrodeposited waterborne coatings. A comparison of the various control options is presented in Exhibit 4-5, following Exhibit 4-4.

4.3.3 Selection of the Most Likely RACT Alternatives

The choice of application of control alternatives, for the reduction of hydrocarbon emissions in existing facilities for the surface coating of metal furniture, requires a line-by-line evaluation. A number of factors must be considered based on the individual characteristics of the coating line to be controlled. The degree of economic dislocation is a function of these factors.

Exhibit 4-3
U.S. Environmental Protection Agency
SUMMARY OF HYDROCARBON EMISSIONS FROM METAL FURNITURE
MANUFACTURING FACILITIES IN ALABAMA

Facility Name	Number of Coating Lines	Current Average Hydrocarbon Emissions (tons/year)
Birmingham Ornamental Iron	1	43
Plantation Patterns	2	175
Southeastern Metals Company (SIMCO)	1	74
United Chair Corporation	1	28
Dixie Craft Manufacturing Company	1	140
Total, Statewide	6	460

Source: Alabama Air Pollution Control Commission and Booz, Allen and Hamilton Inc. interviews.

EXHIBIT 4-4
U.S. Environmental Protection Agency
EMISSION LIMITATIONS FOR RACT IN SURFACE COATING OF METAL FURNITURE

Affected Facility	Recommended Limitation: kg of organic solvent emitted per liter of coating (minus water)	Recommended Limitation: lbs. of organic solvent emitted per gallon of coating (minus water)
Metal furniture coating line	0.36	3.0

Source: Environmental Protection Agency.

EXHIBIT 4-5(1)
U.S. Environmental Protection Agency
RACT CONTROL OPTIONS FOR THE METAL FURNITURE INDUSTRY

Control Options	Affected Facility and Application	Typical Percent Reduction	Comparison of Control Options
Waterborne (electrodeposition, EDP)	Primecoat or single coat	90-95[a]	Provides excellent coverage, corrosion protection and resistance Fire hazards and potential toxicity are reduced Dry off oven may be omitted after cleansing if an iron-phosphate pretreatment is used Good quality control due to fully automated process may be offset by increased electrical requirements for the coating, refrigeration and circulation systems if EDP replaces waterborne flow or dip coating operations. This would not be true if EDP replaces a spraying operation EDP can be expensive on small-scale production lines
Waterborne (spray dip or flow coat)	All applications	60-90[a]	This will likely be the first option considered because of the possibility that these coatings can be applied essentially with existing equipment

EXHIBIT 4-5(2)
U.S. Environmental Protection Agency
RACT CONTROL OPTIONS FOR THE METAL FURNITURE INDUSTRY

Control Options	Affected Facility and Application	Typical Percent Reduction	Comparison of Control Options
Waterborne (spray dip or flow coat) (continued)			Requires a longer flash-off area than organic solvent-borne coatings Curing waterborne coatings may allow a decrease in oven temperature and some reduction in airflow, but limited reduction if high humidity conditions occur Spraying electrostatically requires electrical isolation of the entire system. Large lines may be difficult to convert because coating storage areas may be hundreds or thousands of feet away from the application area Dip or flow coating application requires closer monitoring due to its sensitive chemistry Weather conditions affect the application, so flash-off time, temperature, air circulation and humidity must be frequently monitored

EXHIBIT 4-5(3)
U.S. Environmental Protection Agency
RACT CONTROL OPTIONS FOR THE METAL FURNITURE INDUSTRY

Control Options	Affected Facility and Application	Typical Percent Reduction	Comparison of Control Options
Waterborne (spray dip or flow coat) (continued)			Changes in the number of nozzles may be required
			Sludge handling may be more difficult
Powder (spray or dip)	Top or single coat	95-99[a]	No solid or liquid wastes to dispose of
			Powder may reduce energy requirements in a spray booth and the ovens because less air is required than for solvent-borne coatings and flash-off tunnel is eliminated
			Powder can be reclaimed, resulting in up to 98% coating efficiency
			All equipment (spray booths, associated equipment and often ovens) used for liquid systems must be replaced
			Powder films cannot be applied in thicknesses of less than 2 mils and have appearance limitations
			Powder coatings may be subject to explosions

EXHIBIT 4-5(4)

U.S. Environmental Protection Agency

RACT CONTROL OPTIONS FOR THE METAL FURNITURE INDUSTRY

Control Options	Affected Facility and Application	Typical Percent Reduction	Comparison of Control Options
Powder (spray or dip) (continued)			Excessive downtime (half-hour) is required during color changes. If powders are not reclaimed in their respective colors, coating usage efficiency drops to 50% to 60%
High solids (spray)	Top or single coat	50-80[a]	May be applied with existing equipment
			Reduces energy consumption because it requires less airflow in the spray booth, oven and flash-off tunnel
			Potential health hazard associated with isocyanates used in some high-solid two-component systems
Carbon adsorption	Prime, single or top coat (application and flash-off areas)	90[b]	Although it is technically feasible, no metal furniture facilities are known to use carbon adsorption
			Additional energy requirements is a possible disadvantage
			Additional filtration and scrubbing of emissions from spray booths may be required

EXHIBIT 4-5(5)

U.S. Environmental Protection Agency

RACT CONTROL OPTIONS FOR THE METAL FURNITURE INDUSTRY

Control Options	Affected Facility and Application	Typical Percent Reduction	Comparison of Control Options
Carbon adsorption (continued)			There is little possibility of reusing recovered solvents because of the variety of solvent mixtures
			Many facilities may require dual-bed units which require valuable plant space
			Particulate and condensible matter from volatilization and/or degradation of resin, occurring in baking ovens with high temperature, could coat a carbon bed
Incineration	Prime, single or topcoat (ovens)	90[b]	These are less costly and more efficient than carbon adsorbers for the baking ovens because the oven exhaust temperatures are too high for adsorption and the high concentration of organics in the vapor could provide additional fuel for the incinerator

EXHIBIT 4-5(6)

U.S. Environmental Protection Agency

RACT CONTROL OPTIONS FOR THE METAL FURNITURE INDUSTRY

Control Options	Affected Facility and Application	Typical Percent Reduction	Comparison of Control Options
Incineration (continued)			Heat recovery system to reduce fuel consumption would be desirable and would make application and flash-off area usage a viable option

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a. The base case against which these percent reductions were calculated is a high organic solvent coating which contains 25 volume percent solids and 75 percent organic solvent. The transfer efficiencies for liquid coatings were assumed to be 80 percent for spray, 90 percent for dip or flow coat, 93 percent for powders and 99 percent for electrodeposition.

b. This percent reduction in VOC emissions is only across the control device and does not take into account the capture efficiency.

Source: Control of Volatile Organic Emissions from Existing Stationary Sources--Volume III: Surface Coating of Metal Furniture, EPA-450/2-77-032, December 1977.

The first factor to be considered is whether the existing equipment can be used by the substitution of a coating material which will meet the RACT guideline. This alternative would require the least capital expenditure and may minimize production downtime.

If the existing equipment has to be modified, replaced or expanded, factors to consider are the kind of changes that have to made, the capital costs, the change in operating costs, the length of time needed to make the changes, the effect on the production rate, the operational problems that will have to be handled and the effect on the quality of the product.

Interviews with industry representatives in Alabama indicated that plans for VOC controls have not yet been formulated. Based on the experience in several states in Region V, it is assumed that most manufacturers will use their existing spraying equipment and modify it to handle high solids or waterborne coatings. It was assumed that existing dipping or flow coating equipment will be modified to handle waterborne coating.

4.4 COST AND VOC REDUCTION BENEFIT EVALUATIONS FOR THE MOST LIKELY RACT ALTERNATIVES

This section presents the cost for the most likely control systems and associated VOC reduction benefit. First the costs for the two types of model plants are presented, which are then extrapolated to the statewide industry.

4.4.1 Model Plant Costs and VOC Reduction Benefits

Two types of model plants, distinguished by production output, were selected for the surface coating of metal furniture. The first type included an electrostatic spraying line with outputs of 3 million square feet and 48 million square feet of surface area coated per year. The second type included a dip coating line with outputs of 7 million square feet and 22.5 million square feet of surface area coated per year. Assuming a one-color single-coating line, the capital, operation and maintenance costs for the model plant were estimated. The cost of pretreatment facilities, ovens and plant building was excluded from total capital costs. The annualized cost includes coating materials, utilities, operation and maintenance labor[1], maintenance material[1] and capital charges (depreciation, interest, taxes, insurance and administrative charges)[2]. General plant overhead cost was excluded from the annualized cost. The estimated costs for the model base plant and the incremental costs for the most likely control options are presented in Exhibit 4-6 for the electrostatic spraying and in Exhibit 4-7 for dip coating lines, on the following pages.

The assumptions for the cost estimates are discussed in the RACT guidelines document (EPA-450/2-77-032). It should be noted that the incremental costs, or savings, can change significantly if the underlying assumptions are changed. For example, if the base plant assumption of 25 percent solids coating was 30 percent solids coating, no savings for conversion to higher solids (70 percent) would result. Similarly, capital costs for conversion to water-borne coating would increase dramatically, if significant changes to the facility were needed, compared to the assumption of cleaning and corrosion protection only of existing dip tanks.

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1. Maintenance material and labor charges were assumed to be approximately equal to 4 percent of the capital cost
2. Capital charges were assumed to be equal to 18.68 percent.

EXHIBIT 4-6
U.S. Environmental Protection Agency
ESTIMATED COST OF CONTROL FOR MODEL
EXISTING ELECTROSTATIC SPRAY COATING LINES

	Model Plant A-1 (3 Million Square Feet/Yr)				Model Plant A-2 (48 Million Square Feet/Yr)			
	Base Plant Cost 25% Solids	Incremental Costs for Conversion			Base Plant Cost 25% Solids	Incremental Costs for Conversion		
		Higher Solids	Waterborne	Powder		Higher Solids	Waterborne	Powder
Installed capital cost ($000)	255	15	15	60	1,200	62	62	317
Direct operating costs (savings) ($000)	175	(6)	5	17	1,113	(81)	50	343
Capital charges ($000/yr)	48	3	3	11	224	12	12	59
Net annualized cost (credit) ($000/yr)	223	(3)	8	28	1,337	(69)	62	402
Solvent emissions controlled (tons/yr)	N/A	21	20	24	N/A	336	314	380
Percent emissions reduction	N/A	86	80	97	N/A	86	80	97
Annualized cost (credit) per ton of VOC controlled ($/ton)	N/A	(143)	400	1,167	N/A	(205)	197	1,076

Note: 1977 dollars and short tons

Source: Control of Volatile Organic Emissions from Existing Stationary Sources, Volume III: Surface Coating of Metal Furniture, EPA-450/2-77-032, December 1977

EXHIBIT 4-7

U.S. Environmental Protection Agency
ESTIMATED COST OF CONTROL OPTIONS FOR
MODEL EXISTING DIP COATING LINES

	Model Plant B-1 (7 Million Square Feet/Yr)		Model Plant B-2 (22.5 Million Square Feet/Yr)	
	Base Plant Cost 25% Solids	Incremental Costs for Conversion to Waterborne	Base Plant Cost 25% Solids	Incremental Costs for Conversion to Waterborne
Installed capital cost ($000)	105	3	215	5
Direct operating costs ($000)	135	10	450	17
Capital charges ($000/yr)	20	1	40	1
Net annualized cost ($000/yr)	155	11	490	18
Solvent emissions controlled (tons/yr)	N/A	27	N/A	122
Percent emissions reduction	N/A	80	N/A	80
Annualized cost per ton of VOC controlled ($/ton)	N/A	407	N/A	148

Note: 1977 dollars and short tons

Source: Control of Volatile Organic Emissions from Existing Stationary Sources, Volume III: Surface Coating of Metal Furniture, EPA-50/2-77-032, December 1977

4.4.2 Extrapolation of Control Costs to the Statewide Industry

In Exhibit 4-8, on the following page, the costs for meeting RACT guidelines for VOC emission control for surface coating of metal furniture are extrapolated to the statewide industry in Alabama. The estimates are based on the following assumptions and methods:

- The 5 plants listed in Exhibit 4-3 were assumed to require controls to comply with the RACT guidelines.
- The distribution of control options was based on industry interviews, as well as Booz, Allen estimates. Existing spray coating lines were assumed to convert to high solids or waterborne coatings and existing dip coating lines to waterborne dip.
- The capital cost of control for high solids and waterborne spray and for waterborne dipcoating was estimated by scaling up the model plants A-1 and B-1 costs by a capacity factor calculated as follows. The capacity factor was assumed to be one for the coating lines with the model plants. For the coating lines with greater emissions per line than those of the model plant, the capacity factor per line was determined to be equal to:

  $(\text{actual emissions/model plant emissions})^{0.6}$

- The annual operating cost for high solids and waterborne spray and waterborne dipcoating was assumed to be proportional to the amount of emissions reduction and was scaled up from the model plant costs.

The data in Exhibit 4-8 show that the control of VOC for surface coating of metal furniture to meet the RACT guidelines in Alabama would require a statewide capital investment of about $150,000 and a statewide net annualized cost of about $26,000.

Exhibit 4-8
U.S. Environmental Protection Agency
STATEWIDE COSTS FOR PROCESS MODIFICATIONS OF
EXISTING METAL FURNITURE COATING LINES
TO MEET RACT GUIDELINES FOR VOC EMISSION CONTROL

	High Solids Spray	Water-borne Spray	Waterborne Dip	Total
Number of plants[a]	4	1	1	5
Number of process lines	4	1	1	6
Uncontrolled emissions (ton/yr)	232	140	87	459
Potential emission reduction (ton/yr)[b]	200	110	70	380
Installed capital cost ($000)[c]	97	42	8	147
Direct annual operating cost (credit) ($000) (1-3 shifts/day)[c]	(56)	29	26	(1)
Annual capital charges (credit) ($000)	18	8	1	27
Net annualized cost (credit) ($000)[d]	(38)	37	27	26
Annualized cost (credit) per ton of emissions reduced ($)	(190)	324	390	68

a. Total number of plants is less than the sum of individual columns because some plants have both spraying and dipping lines.
b. Based on control efficiency of 86 percent for high solids, and 80 percent for waterborne coating.
c. Based on cost for model plant A-1 and B-1 from Exhibits 4-6 and 4-7.
d. 18.7 percent of capital cost.

Source: Booz, Allen & Hamilton Inc.

4.5 DIRECT ECONOMIC IMPACTS

This section presents the direct economic impacts of implementing the RACT guidelines for surface coating of metal furniture, on a statewide basis. The analysis includes the availability of equipment and capital; feasibility of the control technology; and impact on economic indicators, such as value of shipments, unit price (assuming full cost pass-through), state economic variables and capital investment.

4.5.1 RACT Timing

RACT guidelines must be implemented statewide by December 31, 1982. This implies that surface coaters of metal furniture must have made their process modifications and be operating within the next four years. The timing requirements of the RACT guidelines impose several requirements on metal furniture coaters:

- Determine the appropriate emission control system.
- Raise or allocate capital to purchase new equipment or modify existing facilities.
- Acquire the necessary equipment or coating material for emission control.
- Install new equipment or modify existing facilities and test equipment and/or new materials to ensure that the system complies with RACT and provides acceptable coating quality.

The sections which follow discuss the feasibility and the economic implications of implementing RACT guidelines within the requirement timeframe.

4.5.2. Feasibility Issues

Technical and economic feasibility issues of implementing the RACT guidelines are discussed in this section.

None of the metal furniture manufacturers in Alabama interviewed during this study has implemented high solids or water-based coatings to date. However, based on experience in other states, it is predicted that these manufacturers will convert to low solvent spray or waterborne dip coatings in order to comply with RACT guidelines. These coating materials may not be available in the desired quality and the variety of colors required by the manufacturers. The development of suitable coating materials in a variety of colors is the key to successful implementation of RACT in the required time.

Unless major modifications to equipment are required, the cost of conversion to high solids or waterborne coatings is not likely to have a significant effect on the implementation of the RACT guidelines for surface coating of metal furniture.

4.5.3 Comparison of Direct Cost With Selected Direct Economic Indicators

The slight change in the annualized cost to the coaters of metal furniture as a result of implementing RACT guidelines is not expected to have a significant effect on the economic situation in the metal furniture industry in Alabama.

The major economic impact, in terms of cost outlay, will be capital-related, rather than from increased annual operating costs. The predicted capital costs are not significant; however, they are based on the assumption that no extensive modifications will be required. If extensive modifications to existing plants are required, these costs may become significant.

4.6 SELECTED SECONDARY ECONOMIC IMPACTS

This section discusses the secondary impacts of implementing RACT on employment, market structure, productivity, and energy consumption.

Employment is expected to remain unchanged. Employment would be reduced if marginally profitable facilities closed, but the present indication from the industry is that no such closures are anticipated.

Productivity for those coaters who would be coating only with high solids could be increased, because they will be able to get more paint on per unit volume basis and reduce paint application time.

Plants that convert to low solvent coatings will save a small quantity of energy (less than 1,000 barrels per year) due to the reduced drying time required. Those converting to water-based coating will experience a small increase in energy usage due to increased drying time.

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Exhibit 4-9, on the following page, presents a summary of the current economic implications of implementing the RACT guidelines for surface coating of metal furniture in the State of Alabama.

EXHIBIT 4-9
U.S. Environmental Protection Agency
SUMMARY OF DIRECT ECONOMIC IMPLICATIONS OF
IMPLEMENTING RACT FOR SURFACE COATING OF METAL
FURNITURE IN ALABAMA

Current Situation	Discussion
Number of potentially affected facilities	There are 5 metal furniture manufacturing facilities
Indication of relative importance of industrial section to state economy	1977 value of shipments was $78 million industrywide and approximately $48 million for five affected facilities
Current industry technology trends	Trend is towards the use of a variety of colors
1977 VOC emissions (actual)	460 tons per year
Industry preferred method of VOC control to meet RACT guidelines	Low solvent coatings
Assumed method of control to meet RACT guidelines	Low solvent coatings
Affected Areas in Meeting RACT	**Discussion**
Capital investment (statewide)	$148,000
Annualized cost (statewide)	$26,000, which represents less than 0.1 percent of the value of shipments from the five affected firms
Price	No major change
Energy	No major impact
Productivity	No major impact
Employment	No major impact
Market structure	No major impact
RACT timing requirements (1982)	Companies using a variety of colors may face a problem finding suitable low solvent coatings
Problem area	Low solvent coating in a variety of colors providing acceptable quality needs to be developed
VOC emissions after RACT	80 tons per year (approximately 15 percent of current emissions level)
Cost effectiveness of RACT	$68 annualized cost/annual ton of VOC reduction

Source: Booz, Allen & Hamilton Inc.

BIBLIOGRAPHY

U.S. Environmental Protection Agency, Control of Volatile Organic Emissions from Existing Stationary Sources, Volume III: Surface Coating of Metal Furniture. EPA-450/2-77-032, December 1977.

U.S. Department of Commerce, County Business Patterns, 1976.

U.S. Department of Commerce, Census of Manufactures, 1977.

Springborn Laboratories, Air Pollution Control Engineering and Cost Study of General Surface Coating Industry, Second Interim Report, Enfield, CT, August 23, 1977.

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-904/9-79-038	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Economic Impact of Implementing RACT Guidelines in Alabama		5. REPORT DATE May 1979 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Booz, Allen & Hamilton, Inc. Foster D. Snell Division (Florham Park, NJ) & Public Management Technology Center (Bethesda, MD)		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO. 68-02-2544, Task 6
12. SPONSORING AGENCY NAME AND ADDRESS U.S. Environmental Protection Agency Region IV Air & Hazardous Materials Division Atlanta, GA		13. TYPE OF REPORT AND PERIOD COVERED 14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

EPA Project Officer: Winston Smith

16. ABSTRACT

The major objective of the contract effort was to determine the direct economic impact of implementing RACT standards for selected industrial categories in Alabama. The study is to be used primarily to assist EPA and state decisions on achieving the emission limitations of the RACT standards.

The economic impact was assessed for the following 2 RACT industrial categories: surface coating of cans and metal furniture.

The scope of this project was to determine the costs and direct impact of control to achieve RACT guideline limitations. Direct economic costs and benefits from the implementation of RACT limitations were identified and quantified while secondary impacts (social, energy, employment, etc.) are addressed, they were not a major emphasis in the study.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Surface coatings Air pollution Can coatings Solvent substitution Emission limits Metal furniture coatings	Air pollution control Stationary sources Alabama Economic impact Hydrocarbon emissions Coatings	

18. DISTRIBUTION STATEMENT Unlimited	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

EPA Form 2220-1 (9-73)