

XI.

Economic Impacts

A. Introduction

In this Chapter, we describe the economic impacts that would be expected from implementation of the proposed amendments to the Aerosol Coatings Regulation, proposed amendments to Method 310, and the proposed Table of Maximum Incremental Reactivity (MIR) Values. Our analysis found no economic impacts from the proposed amendments to Method 310 and the proposed Table of Maximum Incremental Reactivity (MIR) Values; thus, we are focusing on the Aerosol Coatings Regulation in this Chapter. However, because we believe that the proposed reactivity limits offer manufacturers more flexibility in reformulating products, the proposed amendments represent a cost-savings relative to the costs estimated to comply with the January 1, 2002, mass-based volatile organic compound (VOC) limits in the existing regulation. However, we realize that manufacturers will incur costs to comply with the proposed limits. Therefore, this analysis focuses on the costs incurred by manufacturers to meet the proposed reactivity limits, including the impacts on aerosol paint manufacturers, other industries associated with aerosol paints, and consumers. Our analysis also estimates the cost-effectiveness of the proposed regulation. The proposed amendments require a reduction in the ozone formed from aerosol coating emissions rather than requiring VOC reductions. However, because cost-effectiveness is traditionally based on cost per pound of VOC reduced, we are presenting our analysis in the same metric.

In our economic impact analysis we quantified the economic impacts to the extent feasible, although some projections are necessarily qualitative and based on general observations and facts about the aerosol coatings industry. The impacts analysis, therefore, serves to provide a general picture of the economic impacts typical businesses might encounter. We recognize individual companies may experience different impacts than projected.

The overall impacts are first summarized in Section B, followed by a more detailed discussion of specific aspects of the economic impacts in the sections listed below:

- (C) Economic Impacts Analysis on California Businesses as Required by the California Administrative Procedure Act (APA);
- (D) Analysis of Potential Impacts to California State or Local Agencies
- (E) Analysis of the Cost-Effectiveness and the Impacts on Per-Unit Cost of the Proposed Limits
- (F) Analysis of the Impacts to Raw Materials Cost

(G) Analysis of the Combined Impacts on Per-Unit Cost from Recurring and Nonrecurring Costs

It is important to note that we conducted the economic impacts analysis shown in this report to meet legal requirements under the APA. The economic impacts analysis was prepared in consultation with the Air Resources Board's (ARB's) Economic Studies Section (section) of the Research Division. The section is staffed with professionals who carry out a broad range of assignments for the ARB and other organizations, including the Governor's Office; California Environmental Protection Agency (Cal/EPA) boards, offices and departments; and local air pollution control agencies. The section manages extramural research contracts; develops methodologies; collects, analyzes and distributes economic and financial data; conducts economic and financial analyses, including the economic impact analyses of the Board's regulations; oversees the economic impact analyses of the regulations promulgated by all Cal/EPA boards, offices and departments; and carries out other related tasks as needed by the ARB. The staff hold Ph.D., J.D., M.B.A., M.A., and B.S. degrees in economics, business, chemical engineering, microbiology, and environmental resource science. Members of the section have taught economics, accounting, finance, and computer science at the university level; have given invited talks and presented technical papers to major universities, academic associations, and government agencies; and have worked in the private sector in credit analysis, accounting, auditing, production control, environmental consulting, and business law.

B. Summary of Findings

Because the proposed amendments are designed to provide manufacturers more reformulation flexibility, we believe this will likely result in potential cost savings to manufacturers. For perspective, we compare the estimated cost-effectiveness of the proposed reactivity limits to the cost-effectiveness of other ARB regulations and control measures, with particular emphasis on comparison to the 1998 Amendments to the Aerosol Coatings Regulation (mass-based VOC limits).

Overall, most affected businesses will be able to absorb the costs of the proposed regulation with no significant adverse impacts on their profitability. This finding is indicated by the staff's estimated change in "return on owner's equity" (ROE) analysis. The analysis found that the overall change in ROE ranges from negligible to a decline of about eight percent. However, the proposed measures may impose economic hardship on some businesses with small or no margin of profitability. These businesses, if hard pressed, can seek relief under the variance provision of the Aerosol Coatings Regulation for extensions to their compliance dates. Such extensions may provide sufficient time to minimize the cost impacts to these businesses. Because the proposed measures would not alter significantly the profitability of most businesses, we do not expect a noticeable change in employment; business creation, elimination or expansion; and business competitiveness in California. We also found no significant adverse economic impacts on any local or State agencies.

The cost-effectiveness of the reactivity limits appears to be comparable, or in some cases an improvement over, the cost-effectiveness of previous ARB consumer product regulations. In our consumer products regulations, as well as the Aerosol Coatings Regulation, the limits are all

mass-based VOC reductions. The higher cost estimate in our past rulemaking for aerosol coatings (ARB, 1998a) was mostly attributable to substitution of 1,1-difluoroethane (HFC-152a) for hydrocarbon propellants in the recurring costs. In the analysis conducted for the mass-based regulations in 1998, the cost-effectiveness ranges from less than \$1.00 to slightly over \$3.00 per pound of VOC reduced, with a sales-weighted average for all proposed limits of \$1.57 per pound of VOC reduced. For the proposed reactivity limits, our analysis shows that the cost-effectiveness of the proposed regulation ranges from about \$0.00 to \$1.67 per pound of VOC reduced. The overall cost-effectiveness across all categories of aerosol coatings is \$0.74 per pound of VOC reduced. However, we acknowledge that some formulators may have already initiated reformulation efforts to meet the 2002 mass-based VOC limits, thereby incurring higher costs than estimated in this analysis. At this present time, information is not available as to the number of such companies, and as to how many resources each of these companies might have incurred to comply with the 2002 mass-based VOC limits in the existing regulation.

C. Economic Impacts Analysis on California Businesses as Required by the California Administrative Procedure Act (APA)

The following analysis was completed for the Amendments to the Aerosol Coatings Regulation in 1998, which became legally effective in June, 1999. Because our current proposed reactivity-based amendments are designed to provide an equivalent air quality benefit to the mass-based VOC limits and our estimated costs are lower, we believe that the following section C is still applicable.

1. Legal Requirements

Section 11346.3 of the Government Code requires State agencies to assess the potential for adverse economic impacts on California business enterprises and individuals when proposing to adopt or amend any administrative regulation. The assessment shall include a consideration of the impact of the proposed regulation on California jobs, business expansion, elimination or creation, and the ability of California business to compete with businesses in other states.

Also, State agencies are required to estimate the cost or savings to any state or local agency and school district in accordance with instructions adopted by the Department of Finance. The estimate shall include any nondiscretionary cost or savings to local agencies and the cost or savings in federal funding to the state.

2. Findings

a. Potential Impact on California Businesses

Our findings show that most California businesses will be able to absorb the costs of the proposed amendments with no significant adverse impacts on their profitability. However, the proposed measures may impose economic hardship on some businesses with small or no margin of profitability. These businesses, if hard pressed, can seek relief under the variance provision of the aerosol coatings regulation for extensions to their compliance dates. Such extensions may

provide sufficient time to minimize the cost impacts to these businesses. Because the proposed measures would not alter significantly the profitability of most businesses, we do not expect a noticeable change in employment; business creation, elimination or expansion; and business competitiveness in California.

Discussion

This portion of the economic impacts analysis is based on a comparison of the return on owner's equity (ROE) for affected businesses before and after inclusion of the cost to comply with the proposed amendments. The data used in this analysis were obtained from publicly available sources, the ARB's 1997 Aerosol Coatings Survey, and the staff's 1998 cost-effectiveness analysis discussed later in this chapter.

Affected Businesses

Any business which manufactures or markets aerosol coating products can be directly affected. Also potentially affected are businesses which supply raw materials or equipment to these manufacturers or marketers and distribute or retail aerosol coating products. The focus of this analysis, however, will be on manufacturers or marketers of aerosol coating products.

Of the 115 responsible parties who reported product information in the Aerosol Coatings survey, a total of 66 made or sold products in 1997 which would not comply with our proposed limits (ARB, 1998b). Four of the companies that made or sold non-complying products are California-based. The total number of noncomplying products reported was 1143 out of 2238 speciated products.

Study Approach

The approach used in evaluating the potential economic impact of the proposed measures on these businesses is outlined as follows:

- (1) Affected businesses which responded to the survey were classified by the size of their sales in order to select a typical business.
- (2) Compliance cost was estimated for a typical business.
- (3) Estimated cost was adjusted for federal and state taxes.
- (4) The three-year average ROE was calculated for the typical business by averaging the ROEs for 1994 through 1996. ROE is calculated by dividing the net profit by the net worth. The adjusted cost was then subtracted from net profit data. The adjusted ROE was then compared with the ROE prior to inclusion of the compliance cost to determine the potential impact on the profitability of the business. The adjusted cost to determine the potential impact on the profitability of the business. A reduction of more than ten percent in profitability is considered to indicate a potential for significant adverse economic impacts.

The threshold value of ten percent has been used consistently by the ARB staff to determine impact severity (ARB, 1991; ARB, 1995). This threshold is consistent with the thresholds used by the United States Environmental Protection Agency and others.

Assumptions

The ROEs before and after the subtraction of the adjusted compliance costs were calculated based on the following assumptions:

- (1) A typical business on a nationwide basis in the aerosol coatings industry is representative of a typical California business in the aerosol coatings industry;
- (2) All affected businesses were subject to federal and state tax rates of 35 percent and 9.3 percent, respectively; and
- (3) Affected businesses are neither able to increase the prices of their products, nor able to lower their costs of doing business through short-term cost-cutting measures.

Given the limitation of the available data, staff believes these assumptions are reasonable for most businesses at least in the short run; however, they may not be applicable to all businesses.

Results

Typical California businesses are affected by the proposed limits to the extent that the implementation of these requirements would change their profitability. Using ROE to measure profitability, we found that of the three California manufacturers making noncomplying aerosol coatings, the change in ROE varied from a negligible effect to a drop of about eight percent (with an average of two percent) in the 1998 analysis. This represents a minor change in the average profitability of a California business. However, because we believe that the proposed reactivity limits offer manufacturers more flexibility in reformulating products, the proposed amendments represent a cost-savings relative to the costs estimated to comply with the VOC limits in the 1998 analysis.

The estimated potential impacts to businesses' ROEs may be high because affected businesses probably would not absorb all of the increase in their costs of doing business. They might be able to pass some of the cost on to consumer in the form of higher prices, reduce their costs, or do both.

b. Potential Impact on the Consumer

The potential impact of the proposed measures on consumer depends upon the ability of affected businesses to pass on the cost increases to consumers. In the short run, competitive market forces may prevent businesses from passing their cost increases on to consumers. Thus, we do not expect a significant change in retail prices in the short run. In the long run, however, if businesses are unable to bring down their costs of doing business, they could pass their cost

increases on to consumers. In such a case, we estimate that price increases would be less than seven percent, as calculated later in this chapter, which represents a minor impact on consumers.

The proposed measures may also affect consumers adversely if they result in reduced performance attributes of the products. However, this scenario is unlikely to occur for the following reasons. First, for most categories, there are complying products already available on the market; in fact, many categories have 100 percent complying marketshares. Thus, industry already has technology to manufacture the compliant products that meet consumer expectation. Second, marketers are unlikely to introduce a product which does not meet their consumer expectations. This is because such an introduction would be damaging not only to the product sale, but also to the sale of other products sold under the same brand name (impairing so-called “brand equity”). Finally, the Board has provided, under its existing consumer products program, flexibility to businesses whose situations warrant an extension to their compliance dates. For companies which can justify such variances, the additional time may afford more opportunity to explore different formulation, cost-cutting, performance-enhancing, or other marketing strategies which can help make the transition to new complying products nearly transparent to consumers.

c. Potential Impact on Employment

The proposed measures are not expected to cause a noticeable change in California employment and payroll. According to *Ward’s Business Directory of U.S. manufacturing industries*, California employment in businesses classified under Standard Industrial Code (SIC) 2851, which includes the aerosol paint industry, totaled less than 600 employees in 1994, well under one percent of the total manufacturing jobs in California. These employees generated about \$18 million in payroll, accounting for less than 0.1 percent of the total California manufacturing payroll in 1994.

d. Potential Impact on Business Creation, Elimination or Expansion

The proposed measures would have no noticeable impact on the status of California businesses. This is because the reformulation costs are not expected to impose a significant impact on the profitability of businesses in California. However, some small businesses with little or no margin of profitability may lack the financial resources to reformulate their products in a timely manner. Should the proposed measures impose significant hardship on these businesses, temporary relief in the form of a compliance date extension under the variance provision may be warranted.

While some individual businesses may be impacted, the proposed measures may provide business opportunities for other California businesses or result in the creation of new businesses. California businesses which supply raw materials and equipment or provide consulting services to affected industries may benefit from increased industry spendings on reformulation.

e. Potential Impact on Business Competitiveness

The proposed measures would have no significant impact on the ability of California's businesses to compete with businesses in other states. Because the proposed measures would apply to all businesses that manufacture or market aerosol coatings regardless of their location, the proposed measures should not present any economic disadvantages specific to California businesses.

D. Analysis of Potential Impacts to California State or Local Agencies

We have determined that the proposed amendments to the Aerosol Coatings Regulation, the proposed amendments to Method 310, and the proposed Tables of Maximum Incremental Reactivity (MIR) Values will not create costs or savings, as defined in Government Code section 11346.5 (a)(6), to any State agency or in federal funding to the State, costs or mandate to any local agency or school district whether or not reimbursable by the State pursuant to Part 7 (commencing with section 17500, Division 4, Title 2 of the Government Code), or other nondiscretionary savings to local agencies.

E. Analysis of the Cost-Effectiveness and the Impacts on Per-Unit Cost of the Proposed Limits

1. Introduction

For the following analysis, we evaluated the anticipated cost-effectiveness of the proposed reactivity limits to compare the efficiency of the proposed limits in reducing a pound of VOC relative to other existing regulatory programs. The proposed amendments require a reduction in the ozone formed from aerosol coating emissions rather than requiring VOC reductions. However, because cost-effectiveness is traditionally based on cost per pound of VOC reduced, we are presenting our analysis in the same metric. In this analysis, we applied a well-established methodology for converting compliance costs, both nonrecurring and recurring, to an annual basis. We then report the ratio of the annualized costs to the annual emission reductions in terms of "dollars (to be) spent per pound of VOC reduced." For perspective, we compared the estimated cost-effectiveness of the proposed limits to the cost-effectiveness of other ARB regulations and control measures, with particular emphasis on comparison to the 1998 Amendments to the Aerosol Coatings Regulation.

2. Methodology

The cost-effectiveness of a limit is generally defined as the ratio of total dollars to be spent to comply with the limit (as an annual cost) to the mass reduction of the pollutant(s) to be achieved by complying with that limit (in annual pounds). Annual costs include annualized nonrecurring fixed costs (e.g., total research and development (R&D), product and consumer testing, equipment purchases/modifications, etc.) and annual recurring costs (e.g., raw materials, labeling, packaging, etc.).

This approach was used to evaluate the cost-effectiveness for the proposed amendments to the Aerosol Coatings Regulation in October, 1998 (ARB, 1998a). In this analysis, staff considers that intracompany technology/research-and-development (T/R&D) transfers among product lines and other cost mitigating efforts are undertaken by companies to reduce costs. To provide consistency in this analysis, staff generally used the same assumptions for the cost analysis as performed for the rulemaking for the amendments to the Aerosol Coatings Regulation in 1998 (ARB, 1998a).

In determining the fixed and recurring costs for each category and subcategory with a proposed limit, we conducted a total of 25 individual cost-effectiveness analyses. Cost analyses were completed for each category and subcategory with the details from the best available technical information. While staff is required to protect the confidentiality of proprietary product information in some categories, particularly for the specialty categories (for groups of products of four or less), a surrogate example derived from non-flat paint category is used in its place.

We annualized nonrecurring fixed costs using the Capital Recovery Method, as recommended under guidelines issued by the Cal/EPA. Using this method, we multiplied the estimated total fixed costs to comply with each limit by the Capital Recovery Factor (CRF) to convert these costs into equal annual payments over a project horizon (i.e., the projected useful life of the investment) at a discount rate (Cal/EPA, 1996). We then summed the annualized fixed costs with the annual recurring costs and divided that sum by the annual emission reductions to calculate the cost-effectiveness of each limit, as shown by the following general equation (example shown is for calculating cost-effectiveness from pre-regulatory to the proposed limit):

$$(1) \quad \text{Cost-Effectiveness} = \frac{(\text{Annualized Fixed Costs})_{\text{Reactivity Limit}}^{\text{Pre-Reg}} + (\text{Annual Recurring Costs})_{\text{Reactivity Limit}}^{\text{Pre-Reg}}}{(\text{Annual Mass Reduction in VOC})_{\text{VOC Limit}}^{\text{Pre-Reg}}}$$

where:

$$(2) \quad \text{Annualized Fixed Costs} = (\text{Fixed Costs}) \times \frac{i(1+i)^n}{(1+i)^n - 1}$$

$i(1+i)^n / ((1+i)^n - 1)$ = Capital Recovery Factor (CRF)
 i = discount interest rate over project horizon, %
 n = number of years in project horizon
 Fixed Costs = total nonrecurring cost per product category

As shown by the 25 raw materials cost analyses in Appendix I, a convenient Method for estimating the annual recurring cost portion of overall cost-effectiveness (C.E.) is to separate Equation (1) into two fractions, one for the nonrecurring costs and one for the recurring costs. It can then be shown that the C.E. fraction for recurring costs can be simplified and calculated as follows:

$$(3) \quad \text{Annual Recurring Costs C.E.} = \frac{(\text{Compliant Materials Cost}) - (\text{Baseline Materials Cost})}{(\text{Baseline VOC Content}) - (\text{Compliant VOC Content})}$$

where:

Baseline Materials Cost	=	cost of raw materials for product before reformulation to the proposed reactivity limit, \$/lb product
Baseline VOC Content	=	product VOC weight fraction before reformulation to the 2002 mass-based limit, lb VOC/lb product
Compliant Materials Cost	=	cost of raw materials for reactivity-compliant product, \$/lb product
Compliant VOC Content	=	product VOC weight fraction at the 2002 mass-based limit, lb VOC/lb product.

To use Equation (3), we determined the product-weighted MIR of both compliant and noncompliant products in each of the 25 product categories/subcategories, based on sales data and the speciated formulations as reported by manufacturers in the ARB's 1997 Aerosol Coatings Survey (ARB, 1998b). To the extent feasible, we then determined the detailed formulations which most closely reflect the "typical" (i.e., sales-weighted average) compliant and noncompliant reactive organic compound (ROC) contents. These formulations, in turn, were designated as compliant and baseline formulations, respectively.

For most ingredients, we used the most recent, distributor-level bulk prices from *Chemical Market Reporter* (March 6, 2000), or from discussions with industry representatives, to calculate the baseline and compliant material costs based on these designated formulations. Unspecified ingredients or ingredients for which prices were unknown were grouped into an "all others" classification and assigned a default cost of \$3.50 per pound, respectively (ARB, 1997a). These analyses are shown in Appendix I and discussed in more detail in "Raw Materials Cost Impacts Analysis" later in this section.

3. Assumptions

We calculated the cost-effectiveness with an assumed project horizon of five years to be consistent with the mass-based regulation. However, a more commonly cited period for an investment's useful lifetime in the chemical processing industry is ten years. We also assumed a fixed interest rate of 10 percent (up from 7.5 percent in the 1998 analysis) throughout the project horizon. These assumptions are conservative considering that a ten-year horizon is standard practice in cost-effectiveness analyses of air pollution regulations, including previous consumer product rulemakings. Based on these assumptions, the CRF is 0.2638.

In this analysis, we report the California-apportioned (by population) annualized fixed cost divided by the California-apportioned emission reductions. To illustrate, a manufacturer may need to install \$10 million worth of equipment to produce its national sales volume of products compliant with the proposed limits. However, if the company were to produce a

California and 49-state product, the company may only need to install \$1 million worth of equipment to produce unit sales sufficient for the smaller California market. Using this approach, we discounted the total fixed costs for producing national sales volumes by the California-apportionment factor (i.e., the current ratio of California to U.S. population, or 13%), which we then divided by the California-only emission reductions.

Similar to the cost analysis performed in the Amendments to the Aerosol Coatings Regulation (ARB, 1998), the following methodology was used to calculate the fixed costs:

- Determine the manufacturers that make the non-complying products;
- Determine total complying and non-complying sales of these manufacturers;
- If total sales of these manufacturers are less than 33,000 lbs per year (100 cans per day), then research and development will be done by existing staff;
- If total sales are greater than 33,000 lbs per year, then two chemists would be hired for one year at a cost of \$100,000 per chemist for research and development;
- If a manufacturer's non-complying sales represent less than 10 percent of their total sales, then research and development will be handled by existing staff as part of on-going product development;
- Each manufacturer's fixed cost is apportioned over the categories in which it sells non-complying products by the percentage of its non-complying sales in that category relative to its total non-complying sales;
- Total fixed costs for each category are the sum of the apportioned fixed costs for each manufacturer of non-complying products in that category.

The assumptions used in this methodology differ from the one conducted in 1998 in two aspects. In this analysis, a new propellant tank is not required because propellant HFC-152a (1,1-difluoroethane) is not used in the analysis to calculate reformulation recurring costs. Given the greater flexibility that manufacturers have to reformulate to comply with the reactivity limits, it is not assumed that the manufacturer must reformulate with HFC-152a to meet the reactivity limits. Thus, the purchase of a new propellant tank, should the manufacturer choose to undertake this approach, is considered part of the company's ongoing product development and not considered in this analysis. Secondly, this analysis assumes that the manufacturer hires two chemists, instead of one. Given the shorter amount of time that manufacturers have to undertake reformulation efforts to comply with the reactivity limits, an additional chemist is hired as part of the reformulation efforts. As in the previous cost analysis, \$100,000 per year is the estimate for a chemist's salary.

For the annual recurring costs, we assumed compliant reformulations would result in cost changes as a result of changes in a product's raw materials and their associated prices. Changes in packaging, labeling, distribution and other recurring costs were assumed to be negligible relative to baseline levels of these costs. This assumption is based on our previous regulatory experiences. To illustrate, we conducted a comprehensive technical assessment of the 55 percent VOC hairspray limit, which required extensive reformulations and revolutionary changes to existing products (ARB, 1997a). The hairspray limit is generally considered to be among the most challenging of the consumer product limits; it likely resulted in more changes to the regulated product, relative to pre-regulatory products, than any other VOC limit. However, our

assessment found that changes to recurring costs other than hairspray raw material costs were expected to be negligible (ARB, 1997a). Based on this finding and because the proposed new limits are designed to preserve product forms, we believe our assumptions regarding the recurring costs are reasonable.

4. Results

Table XI-1 shows our estimates for per-product and total annualized nonrecurring costs for each of the 25 product categories/subcategories subject to the proposed limits. As shown, the estimated overall annualized fixed cost to industry to reformulate all non-compliant products is projected to be about \$1,316,985.

Table XI-2 shows the overall results of our cost-effectiveness analysis, with separate cost-effectiveness fractions representing the annualized nonrecurring and annual recurring costs. In general, Table XI-2 shows that the raw materials costs (i.e., annual recurring cost) have a generally larger impact on overall cost-effectiveness for the affected categories. The annualized nonrecurring fixed costs (i.e., R&D, product testing, etc.) have a relatively smaller impact on the overall cost-effectiveness. Table XI-2 shows that the estimated cost-effectiveness ranges from a low of \$0.00 (net savings or no cost for several categories) to a high of about \$1.67 per pound VOC for weld-through primers.

Another useful quantity to report is the emission reductions-weighted average (ERWA) cost-effectiveness. This value is the sum of the products of the emission reductions for each limit and its associated cost-effectiveness, divided by the sum of the total emission reductions for all the proposed limits. In contrast to a simple arithmetic mean of the reported cost-effectiveness values, the ERWA cost-effectiveness accounts for the relative magnitude of emission reductions and the relative efficiency of each limit in achieving those reductions. Thus, the ERWA cost-effectiveness is, in theory, a better indicator of the true average cost-effectiveness for achieving a pound of reduction under the proposed limits. As shown in Table XI-2, the ERWA cost-effectiveness is about \$0.74 per pound of VOC reduced. These costs compare favorably to the analysis conducted in 1998, in which the cost-effectiveness was estimated to range from less than \$1.00 to slightly over \$3.00 per pound of VOC reduced, with a sales-weighted average for all proposed limits of \$1.57 per pound of VOC reduced.

Based on the average cost of \$0.74 to comply with the reactivity limits, the total industry-wide annual compliance cost would be \$1.7 million. However, in the 1998 cost analysis for aerosol coatings no California apportionment was made. To compare more directly with this analysis, if we assume no California apportionment, our costs are estimated to be \$2.8 million each year for five years. \$4.1 million was estimated in the 1998 analysis; this proposal therefore represents a cost savings of \$1.3 million per year. We conclude that these proposed amendments are more cost-effective based on the foregoing analysis.

TABLE XI-1
ESTIMATED TOTAL ANNUALIZED NON-RECURRING FIXED COSTS
TO COMPLY WITH PROPOSED LIMITS

TABLE XI-2
ESTIMATED COST-EFFECTIVENESS FOR PROPOSED LIMITS

Table XI-3 shows a comparison of the cost-effectiveness for the proposed limits relative to other ARB consumer product regulations and control measures. As shown, the cost-effectiveness range of the staff's proposal is consistent with the cost-effectiveness of other ARB regulations and programs.

**TABLE XI-3
COMPARISON OF COST-EFFECTIVENESS FOR PROPOSED LIMITS AND
OTHER ARB CONSUMER PRODUCT REGULATIONS/MEASURES
(ADJUSTED TO 1998 DOLLARS)**

Regulation/Control Measure	Cost-Effectiveness (Dollars per Pound VOC Reduced)
Aerosol Coating Products Reactivity Regulation	\$0.00 to \$1.67 (\$0.74 avg.)
Mid-Term Measures II Consumer Products Regulation ¹	\$0.00 to \$6.30 (\$0.40 avg.)
Aerosol Coating Products Tier II Regulation ²	\$0.93 to \$3.19 (\$1.57 avg.)
Mid-Term Measures Consumer Products Regulation ³	\$0.00 to \$7.10 (\$0.25 avg.)
Hairspray Regulation ⁴	\$2.10 to \$2.50 (\$2.25 avg.)
Aerosol Coating Products Regulation ⁵	\$2.85 to \$3.20
Phase II Consumer Products Regulation ⁶	<\$0.01 to \$1.10
Phase I Consumer Products Regulation ⁷	net savings to \$1.80
Antiperspirants and Deodorants Regulation ⁸	\$0.54 to \$1.30

Cost-effectiveness values for previous years adjusted to 1997 dollars using the following *Chemical Engineering Plant Cost indices*: 383.4 (1997), 381.1 (1995), 361.3 (1991), and 357.6 (1989-1990); *Chem. Eng.*, April 1996/1997.

¹ ARB, 1999.

² ARB, 1998.

³ Range reported as min./max. for each individual Phase III limit; average C.E. of \$0.25/lb reduced reported as an emission reductions-weighted average cost-effectiveness⁷

⁴ Reported as sales-wtd average, incremental 2nd-tier cost-effectiveness (80% VOC to 55% VOC); ARB, 1997a.

⁵ ARB, 1995.

⁶ ARB, 1991.

⁷ ARB, 1990.

⁸ ARB, 1989.

F. Analysis of the Impacts to Raw Materials Cost

1. Introduction

In this analysis, we evaluated the anticipated cost impacts from the proposed limits on raw material costs. As stated previously, the raw material costs generally constitute a little or negligible portion of the compliance costs for most categories, since the manufacturer has greater flexibility in their selection of solvents, ingredients, and compounds. However, evaluating the

impacts to raw material costs provides only an indicator of possible impacts to the retail prices of the affected products (assuming the cost impacts are passed on partially or fully to consumers). Because of unpredictable factors such as the competitive nature of the market, it is not possible to accurately predict the final retail price of products that will comply with the proposed limits when they become effective. To the extent the cost impacts are passed on to consumers, the final retail prices may be lower or higher than suggested by this analysis.

2. Methodology

As discussed previously, we determined the detailed formulations which most closely reflect the “typical” (sales-weighted average) compliant and noncompliant products. These formulations, in turn, were designated as compliant and baseline formulations, respectively. Distributor-level ingredient prices from *Chemical Market Reporter* (March 6, 2000) or from discussions with industry representatives were used to calculate the baseline and compliant material costs for these formulations. Other sources of cost information were used for selected ingredients as discussed previously. Unspecified ingredients or ingredients for which prices were unknown were grouped into an “all others” classification and assigned a default cost of \$3.50 per pound (ARB, 1997a, *op cit.* at Volume II, p.56). These analyses and the detailed formulations evaluated (with individual weight fractions and unit prices per pound) are shown as cost spreadsheets in Appendix I. While these formulations may not reflect the exact composition of existing noncompliant products and compliant products that will be marketed, we believe they are reasonably representative for the purposes of this analysis.

3. Assumptions

As noted previously, we assumed changes in packaging, labeling, distribution and other recurring costs to be negligible relative to baseline levels of these costs (ARB, 1997a). Consistent with the goals of the proposed amendments, we believe that the formulators have more flexibility to select the types of solvents or compounds to comply with the proposed reactivity limits. With this flexibility, the substitution of lower-reactive ingredients for higher-reactive ingredients does not necessarily constitute higher costs; their costs can be almost the same. We also believe that the companies would undertake every effort to mitigate costs.

4. Results

As shown in Table XI-4, the anticipated raw materials cost changes range from no cost (net savings or no cost) to about \$0.09 increase per unit (automotive bumper and trim products).

TABLE XI-4
ESTIMATED IMPACTS TO RAW MATERIALS
COST PER UNIT (\$/UNIT OF PRODUCT)

Table XI-5 shows a comparison of the impacts to raw materials cost under the proposed limits relative to those of other ARB consumer product regulations. As shown, the raw materials cost impacts under the proposed limits are comparable to those of other ARB regulations.

**TABLE XI-5.
COMPARISON OF RAW MATERIALS COST IMPACTS FOR
THE PROPOSED LIMITS AND OTHER ARB CONSUMER
PRODUCT REGULATIONS (UNADJUSTED DOLLARS)**

Regulation	Cost Impacts (Dollars per Unit of Product)
Aerosol Coating Products Reactivity Regulation	\$0.00 to \$0.09
Mid-Term Measures II Consumer Products Regulation ¹	\$0.00 to \$0.25
Aerosol Coating Products Tier II Regulation ²	\$0.00 to \$0.10
Mid-Term Measures Consumer Products Regulation ³	\$0.00 to \$0.60
Hairspray Regulation ⁴	(\$0.10) to \$0.45
Aerosol Coating Products Regulation ⁵	\$0.30 to \$0.34
Phase II Consumer Products Regulation ⁶	<\$0.01 to \$0.60
Phase I Consumer Products Regulation ⁷	net savings to \$0.25
Antiperspirants and Deodorants Regulation ⁸	\$0.25

¹ ARB, 1999.

² ARB, 1998.

³ Phase III Staff Report; ARB, 1997b.

⁴ \$0.45/unit reported as a worst-case scenario using high-level of HFC-152a as propellant in “premium” products.

⁵ ARB, 1995.

⁶ ARB, 1991.

⁷ ARB, 1990.

⁸ Estimate based on assumption of using HFC-152a to replace HC propellants and meet the 0% HVOC limit.

G. Analysis of the Combined Impacts on Per-Unit Cost from Recurring and Nonrecurring Costs

1. Introduction

In this analysis, we evaluated the combined impacts of both recurring (i.e., raw materials costs) and nonrecurring costs from the proposed limits on per-unit costs. Although the non-recurring fixed costs constitute the major portion of the compliance costs, in some categories, on a per unit basis, the recurring cost was the major contributor. In performing this analysis, we used the fixed costs, raw material costs, assumptions, and other facts discussed previously.

2. Methodology

This Method differs from the raw-materials-cost-only analysis in the previous section in that the nonrecurring cost in this analysis is assumed to be “spread out” (i.e., recouped) through the entire California sales volume of each product category. Thus, the total annual recurring and annualized nonrecurring costs reported previously is divided by the number of units sold in California per year to estimate the per-unit cost increase. The California sales volume for a product category is estimated by dividing the total VOC emissions (pounds of VOC per year) for that category by the category’s sales-weighted average VOC content (pounds of VOC per pound of product).

3. Results

As shown in Table XI-6, the combined fixed and raw material cost changes to per-unit production costs ranged from no cost increase (net savings or no cost for various categories) to about \$0.11 per unit (photographic coatings). Averaged over the sales volume for each category, the unit sales-weighted average cost increase is about \$0.05 per unit. The cost per unit to comply with the mass-based VOC limits proposed in 1998 was estimated on average to be less than \$0.10 per unit.

TABLE XI-6
ESTIMATED PER-UNIT COST INCREASES FROM BOTH ANNUALIZED
NON-RECURRING AND ANNUAL RECURRING COSTS

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