5. IMPLEMENTATION OF ECONOMIC INCENTIVE SYSTEMS

This section presents a detailed discussion of how fees and quotas could be implemented to provide economic incentives for reducing PROC emissions from hair spray and spray paint consumer products in California. General conclusions and recommendations concerning the feasibility and implementation of the incentive systems, along with specific implementation issues and areas requiring resolution, are highlighted.

Because the structure of the markets for hair spray and spray paint consumer products in California are very similar, the requirements for implementing incentives for each product are also quite similar, and are therefore presented jointly. First fee systems are discussed, followed by quota systems.

5.1 FEE-BASED INCENTIVE SYSTEM

As described above in Chapter 2, a fee-based system provides an incentive for reducing PROC emissions from consumer products by increasing the cost of continuing to use PROCs in product formulations. The feasibility of implementing a fee-based system is contingent upon the specific needs and structure of the product market to which it is applied.

This section discusses the implementation of a fee-based economic incentive system for reducing PROC emissions from hair spray and spray paint products in the California market with regard to five key components:

(1) what the fee is levied on;

(2) the point at which the fee is collected;

(3) setting the fee;

(4) use of revenues from the fee; and

(5) the steps necessary to ensure compliance.

A summary of the key components of the fee-based system is presented in Exhibit 5-1.

EXHIBIT 5-1

IMPLEMENTATION OF A FEE-BASED INCENTIVE SYSTEM

What the Fee is Levied on

Fee is levied upon the manufacture or import for sale in California of any hair spray or spray paint product that contains PROCs. The fee is expressed in dollars per pound of PROC that is integrated into the product and which is anticipated to be released during use and/or disposal.

Point at Which The Fee is Collected

Fee is collected from manufacturers or importers of hair spray and spray paint products sold in California. Each manufacturer is required to forecast sales periodically (e.g., quarterly) and submit fees to the California Board of Equalization on a regular basis. Overpayment or underpayment, based on actual sales and shipments, will be deducted or added to payment for new period.

Setting the Fee

ARB will determine the initial level of the fee to achieve an emissions reduction goal. Fee will be phased in over a predetermined time (e.g., five years) to achieve the emissions reduction goal. An assessment of the market activity and potential adjustments necessary to meet the goal will be completed following full implementation of the fee.

Use of Revenues From the Fee

Revenues from the fee will be deposited in a fund to be used for operation of the program, with the balance of revenues transferred to the State General Fund.

Steps Necessary to Ensure Compliance

Hair spray and spray paint containers are required to bear, in a visible location, a label, stamp, metered impression, or other printed notification indicating the PROC content, by percentage of net weight, and signifying that the fee for the product has been paid. Sale or distribution for sale within California of products that have not complied with these requirements shall be subject to penalties and fines. Each manufacturer will submit appropriate records, receipts, invoices, and other documentation to support the fee paid, including any additional fee that is required to balance an account. Reports and documentation submitted by manufacturers will be subject to audit and inspection for accuracy.

5.1.1 What the Fee is Levied on

Fee is levied upon the manufacture or import for sale in California of any hair spray or spray paint product that contains PROCs. The fee is expressed in dollars per pound of PROC that is integrated into the product and which is anticipated to be released during use and/or disposal.

Under this approach a fee will be paid based upon amount of PROCs used in the formulation of hair spray and spray paint products. The fee is levied upon all such products manufactured or imported for sale in California. The fee applies equally to all PROCs used in the products that are anticipated to be released during use and/or disposal of the product.

Implementation Issues

Several steps are required to implement this type of fee, including the following.

- Definition of products. The products covered by the fee must be defined precisely. As discussed above, it may be preferred to implement an economic incentive system that covers a range of products. A list will be required of the products that are covered, and specific definitions will be required for each product. For example, hair sprays have a specific technical definition that does not include styling mousses and spritzers. Care must be taken to adequately define the full range of products to be covered.

- Definition of PROC. For the products of interest, a precise PROC definition must be prepared. All substances that meet the definition criteria will be subject to the fee. If PROCs are to be treated differently based on physical criteria (such as reactivity), the trade offs among the PROCs must be defined precisely.

- Definition of "anticipated to be emitted". It is appropriate to place the fee only on the PROCs that will be emitted. Initially, it may be presumed that all the PROCs contained in the product will be emitted. However, manufacturers should have the opportunity to demonstrate that some portion of the PROCs in their products are not emitted during use and/or disposal.

- Definition of manufacture and import. The activity that triggers a liability for a fee must be clearly defined. For example, does the mixing of hair spray or spray paint ingredients constitute manufacture, or must the ingredients be put into a package? Given that some manufacturers prepare pre-mixed ingredients prior to filling, the definition of manufacture can be important. Based on the current understanding of the practices used to manufacture hair sprays and spray paints, it is recommended that manufacturing be defined as the placing of ingredients into packages that are intended for sale in California. Given that the final sales location cannot be determined precisely for all products at the time of filling, a mechanism will be required that allows for prospective estimating of expected sales, and retrospective adjustments to account for deviations from anticipated levels. For example, shipments into the state may be assumed to be intended for sale. Subsequent shipments out of the state would be evidence that the products are no longer intended for sale.

- Certification of PROC usage. Techniques will be required for evaluating the quantity of PROC usage. A manufacturer may be required to keep records on the total quantity of PROCs used in the manufacture of products that are covered by the fee. A preferred approach may instead be the certification of the PROC usage per container manufactured, and a procedure for estimating the number of containers sold in the state. This approach may be preferred because sales and inventory data are likely to be collected on the basis of the number of units involved. These data could then be used to estimate fees. In order to use this approach, the PROC contents of the individual products would have to assessed.[43]

Variations in Approach

If it is found to be legally or administratively not possible to place the fee upon products manufactured out of state, or if for some other reason this is found to be undesirable, then it may be required to impose the fee upon the distribution of products within California. Such an approach, similar to the State cigarette tax, would impose the fee upon the first primary source of distribution of the products within California.

While such an approach may be feasible, tracking and implementing the program would be very complex. Distributors would be required to keep records of products distributed in the state. Each distributor would have to be registered with the state, and procedures for record-keeping would be required. The PROC contents of the products would still have to be certified, and the certification information would still likely have to come from the manufacturers.

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[43] Note that it is not contemplated that each can be examined. Instead, the PROCs in a given formulation that is put into a can of a given size need only be certified once. Once it is certified, any number of cans could be filled with that formulation without subsequent certification being required. This certification procedure will require a mechanism that will allow manufacturers to maintain the confidentiality of their formulations.

5.1.2 Point at Which the Fee is Collected

Fee is collected from manufacturers or importers of hair spray and spray paint products sold in California. Each manufacturer is required to forecast sales periodically (e.g., quarterly) and submit fees to the California Board of Equalization on a regular basis. Overpayment or underpayment, based on actual sales and shipments, will be deducted or added to payment for new period.

Under this approach the liability for the fee would rest with the manufacturer. Contract fillers, distributors, wholesalers, and retailers would not be involved in the payment of any fees. Fees would be paid on an ongoing basis based on reports prepared by the manufacturers. Subsequent adjustments to reflect larger or smaller than anticipated sales would be required. Such adjustments are currently made as part of the existing cigarette tax program in California.

Implementation issues

Several steps are required to implement this approach, including the following.

- Procedures for fee computations. Procedures and rules that describe the method for computing fees owed to the state must be developed. These procedures would include requirements for keeping records on number of units manufactured with various formulations, and numbers of units shipped to California for sale. Procedures for estimating the number of units subsequently not sold in the state would also be required. The preferred approach would likely be that all shipments into the state would be presumed to be sold in the state. Adjustments for units not sold in the state would also be made. Forms for reporting to the Board of Equalization would need to be developed, and staff at the board would be required in order to handle and record the reports.

- Notification of affected parties. Information about the fee program and its requirements must be provided to affected parties.

- Procedures for fee remittance. The procedures for sending in the fee payments must be developed. The frequency of the payments (e.g., quarterly) and opportunities for averaging must be defined. Averaging may be important because some production is done on a "campaign basis." Over a six-week period a contract filler may fill a large number of units for a given manufacturer. These units could be shipped to a warehouse (e.g., in California) and sold throughout the year. Given that this single shipment may represent the intended sales for a long period of time (e.g., six months or even a year), it may not be appropriate to require payment for the entire shipment in one quarter.

Variations in Approach

The most difficult aspect of implementing fees in this manner is that manufacturers may not be aware of the intended final point of sale of their products. For example, a manufacturer may sell products to a wholesaler or a national chain that sells products in many states. Under the approach outlined above, the manufacturer would rely on his client to estimate: (1) expected sales in California; and (2) subsequent deviations from the expected level of sales in California. This arrangement may be troublesome for manufacturers, in particular if they are subject to penalties if their client who purchased the products fails to report accurately.

One method of addressing this issue is to require those units that are manufactured for sale in California to be labelled in some manner that can be easily identified. In this manner, national chains or others who purchase products from manufacturers would be required to estimate the number of "California" units desired. Fees would be due on all these units that were produced unless subsequent documentation was provided that indicated that sales in California did not take place. This approach is similar to the approach used to enforce cigarette taxes.

Another way to address this issue is to make the party that introduces the goods into the state for sale responsible for the fee. If a manufacturer sold products to a national chain, the national chain would subsequently be responsible for the fee if they sold the products in California. While this approach makes it easier for manufacturers, its drawbacks include:

- more parties are subject to the fee, increasing the complexity of the program;
- parties are subject to the fee that may not have data on the PROC contents of the products; and
- parties are subject to the fee that are not involved in decisions regarding the formulations of the products.

5.1.3 Setting the Fee

ARB will determine the initial level of the fee to achieve an emissions reduction goal. Fee will be phased in over a predetermined time (e.g., five years) to achieve the emissions reduction goal. An assessment of the market activity and potential adjustments necessary to meet the goal will be completed following full implementation of the fee.

Under this approach, ARB would be required to estimate emissions reductions anticipated in response to various fees. Then an emissions reduction goal would be set, and a fee level chosen. The fee would then be phased in so as to minimize market disruptions and allow manufacturers a reasonable time for adjustment and reformulation. Following full implementation of the system, ARB would evaluate the economic, social, and emission reduction impacts of the system and suggest further modifications.

Implementation Issues

The most important implementation issues under this approach concern the assumptions on which the initial fee is based and evaluated. Setting the fee too high could result in significant market impacts, including elimination of the controlled products from the California markets entirely or very large price increases. Setting the fee too low could result in little or no change in current emissions from the controlled products. One of the most important steps in this process, therefore, will be the collection of accurate and detailed information concerning these markets, the technical alternatives available, the cost of these alternatives, and the reactions of consumers and producers to changes in the prices of the products.

Specific information that will be required includes:

- technical alternatives, both present and future, for reducing PROC emissions from the controlled products;
- fixed and variable costs of using each technical alternative;
- detailed descriptions of and data for the markets in which the products are produced and sold;
- price and income elasticities for the products.

ARB will also need to determine an appropriate period of time over which to phase in implementation of the incentive system. The time period over which phase-in occurs should provide manufacturers a reasonable amount of time to take whatever compliance measures they require. The phase in period should be at least a period of years, during which time manufacturers could reformulate and test their products. A period of two to five years seems appropriate. During this time the ARB could also promote the dissemination of information on technical options for reducing emissions. The dissemination of such information may speed the pace at which modifications are made, as well as reduce the costs faced by manufacturers.

Variations in Approach

As discussed above, the approach involves selecting a fee to achieve a given level of emissions reduction. The fee could also be set at a level that represents the costs of achieving emissions reductions from other sources. Alternatively, the fee could also be set at a level that represents the costs of the damage caused by the emissions in terms of reduced air quality.

The fee could also be set to change in response to estimated emissions levels over time. For example, the fee would increase if emissions reductions targets were not achieved.

5.1.4 Use of Revenues From the Fee

Revenues from the fee will be deposited in a fund to be used for operation of the program, with the balance of revenues transferred to the State General Fund.

Under this approach revenue from the fee will be deposited into a fund that will be used to operate the program, including study, administration, compliance, and enforcement activities. Depending on the level of the fee, surpluses may build up. Such surpluses could be transferred to the State General Fund periodically.

Implementation Issues

The use to which the revenues will be put will likely be a controversial issue, regardless how the fee program is designed. If large revenues are anticipated (e.g., tens of millions of dollars per year), then revenues in excess of the costs of operating the program will exist.

From an incentive perspective, the funds should be used in a manner that does not counter-act the economic incentives for reducing emissions. From a fee-program design perspective, it is preferred not to promote the development of a program that grows to depend on the fee for its funding. The fee is designed as an incentive, not as a revenue-generating tax. Consequently, it is preferred not to create a program that depends on the revenues.

Variations

The funds could be used to further the development of technical alternatives for reducing emissions, or for other environmental quality programs. Care should be taken so that future fee-level decisions are not driven by a desire to fund such programs. Alternatively, excess funds could be returned to the population at large, e.g., through the tax law.

5.1.5 Steps Necessary to Ensure Compliance

Hair spray and spray paint containers are required to bear, in a visible location, a label, stamp, metered impression, or other printed notification indicating the PROC content, by percentage of net weight, and signifying that the fee for the product has been paid. Sale or distribution for sale within California of products that have not complied with these requirements shall be subject to penalties and fines. Each manufacturer will submit appropriate records, receipts, invoices, and other documentation to support the fee paid, including any additional fee that is

required to balance an account. Reports and documentation submitted by manufacturers will be subject to audit and inspection for accuracy.

Under this approach, products are required to bear some form of easily distinguishable marking to identify that a fee has been paid by the manufacturer, and to certify that they are approved for sale within California. In addition, as indicated in the prior sections, extensive reporting and documentation will be required on a periodic basis in order to substantiate manufacturers' payment of fees.

As discussed, it is important that the administrative requirements of the fee-based system not be overly burdensome to manufacturers or the implementing agency. However, documentation, tracking, reporting, and a system for real and enforceable penalties are essential to ensuring not only that manufacturers comply with the requirements of the regulation, but to ensure that markets are not unduly disrupted by "black market" or covert sales and that the system achieves its intended responses. Because manufacturing is both a focal point of the incentive system (i.e., reformulation of products) and the most centralized activity in both the hair spray and spray paint markets, the overall commitment required to ensure compliance can be minimized by focusing reporting and enforcement efforts upon manufacturers.

Implementation Issues

Three main points exist with regard to ensuring compliance with the requirements of the incentive system. These are: (1) ensuring that products sold in California have met the requirements of the regulation and that appropriate fees have been paid; (2) the level of reporting that will be required; and (3) enforcing regulations and penalizing violators.

Labelling products to be sold in California in a manner that signifies compliance will be a key step in ensuring that products sold in California have met the requirements and that manufacturers have paid the appropriate fees for these products. The labelling requirements and the system for distributing or licensing the label must be developed. The system could be patterned after the current system used to put stamps on cigarette packages. Cigarette packages bear a stamp that indicates that the cigarette tax has been paid. The stamp may be purchased (for the cost of the tax) or machines may be used to print the stamp, with the meters on the machines used to compute the tax owed. Because the PROC content of each product would be different, meaning that the fee owed would also be different for each product, more flexibility would be required than is currently available in the cigarette tax system.

To ensure that requirements have been met, a system of reporting, inspecting, and auditing will be required. This system must be able to substantiate all aspects of the fee program, including: fee payment; product formulations; number of containers of product sold; and final destination of products. Inspections, records reviews, and audit procedures must be developed, and a specially trained staff will be required to implement the program. In addition, some additional rules and procedures may need to be established to give inspectors and the administering agency the authorities necessary to fulfill these functions.

Other staff and administrative issues to be resolved concerning reporting, auditing, and inspecting include:

- how often reports should be required;
- whether certain exemptions will be granted, such as less frequent reporting for small manufacturers;
- whether compliance and enforcement authorities will be developed within ARB or another agency;
- what reports should be required and how detailed the documentation should be;
- whether and to what extent will requirements apply to distributors, retailers, and transporters of the products; and
- the level of commitment the administering agency wants to make to tracking and enforcement activities.

In addressing these issues, innovative and time-saving techniques should be explored. For example, in the implementation of its rule restricting the production and consumption of CFCs in the U.S., the U.S. EPA has established a system whereby CFC manufacturers can submit reports electronically. This system reduces the reporting burden on both industry and EPA.

Penalties for non-compliance may be one component of the enforcement system. Penalties should be clearly stated and sufficiently onerous to deter any willing evasion of the requirements of this system. However, no penalty will be effective if the agency does not enforce the regulations and impose those penalties. Within this scope, it is again important to explore what authorities may or may not be possible. For example, it may not be possible (or at least very difficult) to enforce the regulations upon out-of-state manufacturers.

<u>Variations in Approach</u>

If evasion of the requirements is considered particularly serious, one alternative, albeit resource intensive, is to establish a greater tracking system of "cradle to grave" manifesting of shipments of the consumer products. Such a system would be similar to that used for hazardous wastes in that each product or group of products that reaches a retail outlet in California would be required to be accompanied by a "manifest" or invoice record that would indicate clearly each party that handled the product all the way back to its original manufacture. Auditing of retail sales and distribution operations would provide this information as a ready check of the compliance status of firms manufacturing hair spray and spray paint consumer products for sale in California.

Given the number of parties involved in the sale of consumer products, such manifesting would be intrusive and costly. A modified approach would be to "register" the major parties that are involved, including manufacturers, wholesalers, and distributors, but excluding retailers. The registered parties would be required to keep records of shipments of the affected products. Enforcement would then be focused toward these registered parties. Sales to non-registered organizations in California would be presumed to be sold in California and be subject to the fee.

5.2 IMPLEMENTATION OF A QUOTA-BASED ECONOMIC INCENTIVE SYSTEM

The issues associated with implementing a quota-based incentive system have many parallels to the implementation of a fee-based system. Unlike a fee-based system, however, a quota-based system imposes a firm limit on the total quantity of PROC that is allowed to be used in the consumer products sold in the State. It is important, therefore, that the activity upon which the quota is placed be defined carefully, that the initial allocation of the quota be meaningful in terms of the amount of PROC allowed for use, and that some trading be allowed for the redistribution of the limited rights to use PROC in order to promote efficient attainment of the quota.

This section discusses the implementation of the quota-based economic incentive system for reducing PROC emissions from hair spray and spray paint consumer products in the California market with regard to the following five key components:

- what the quota is placed upon;
- the initial allocation of the quota;
- the trading of quota allowances;
- evaluation of emissions reductions and revisions of the quota; and
- steps necessary to ensure compliance.

A summary of the key components of the quota-based system is presented in Exhibit 5-2.

EXHIBIT 5-2

IMPLEMENTATION OF QUOTA-BASED SYSTEM

What the Quota is Placed Upon

The quota is placed upon the use of PROCs during the manufacture of any hair spray or spray paint consumer product for sale in California. The quota limits the overall quantity of PROCs that manufacturers may use in the production of products for sale in California.

Initial Allocation of Quota

The quota allowances will be allocated to product manufacturers based on historical usage of PROCs in consumer products in California. A quantity of allowances will be set aside for new manufactures that can demonstrate that they have a promising low-PROC product.

Trading of Quota Allowances

An "aftermarket" for trading the allowances will be structured to allow unrestricted trading of the allowances at any time without penalty.

Evaluation of Emissions Reductions and Revisions of the Quota

An evaluation of the effects of the quota allocation and potential adjustments necessary to meet the emissions reductions goal will be completed after some predetermined time following implementation of the quota system.

Steps Necessary to Ensure Compliance

Hair spray and spray paint containers are required to bear, in a visible location, a label, stamp, metered impression, or other printed notification indicating PROC content, by percentage of net weight, and that manufacture of the product is authorized under allowances held by the manufacturer. Sale or distribution for sale within California of products that have not complied with these requirements shall be subject to penalties and fines. Each manufacturer will submit appropriate records, receipts, invoices, and other documentation to support the quantities of product sold in California under their permit. Reports and documentation submitted by manufacturers will be subject to audit and inspection for accuracy.

5.2.1 What the Quota is Placed Upon

The quota is placed upon the use of PROCs during the manufacture of any hair spray or spray paint consumer product for sale in California. The quota limits the overall quantity of PROCs that manufacturers may use in the production of products for sale in California.

Under this approach, an overall limit or quota will be set upon the total amount of PROC allowed in the applicable products (e.g., hair sprays and spray paints) that are intended for sale in California. It is presumed that the PROCs in the products will be emitted at some point, although manufacturers should have an opportunity to demonstrate that some PROCs that are used to formulate their products are not subsequently emitted, and would therefore not be subject to the quota. The total PROC quota will be allocated to current manufacturers/marketers of these products in California. These quota allowances will serve as the main control over the use of PROCs in consumer products solid in California.

Implementation Issues

The steps necessary to implement this type of quota include several of the same steps required for implementing a fee-based system, including the following.

- Definition of products. The products covered by the quota must be defined precisely.

- Definition of PROC. For the products of interest, a precise PROC definition must be prepared. All substances that meet the definition criteria will be subject to the quota. If PROCs are to be treated differently based on physical criteria (such as reactivity), the trade offs among the PROCs must be defined precisely.

- Definition of "anticipated to be emitted". It is appropriate that the quota only be applied to the PROCs that will be emitted.

- Definition of manufacture and import. The activity that requires a quota allocation must be clearly defined. As in the case with the fee-based system described above, it is recommended that manufacturing be defined as the placing of ingredients into packages that are intended for sale in California. Given that the final sales location cannot be determined precisely for all products at the time of filling, a mechanism will be required that allows for prospective estimating of expected sales, and retrospective adjustments deviations from anticipated levels.

- Certification of PROC usage. Techniques will be required for evaluating the quantity of PROC usage. As in the case with the fee-based system described above, it may be preferred to certify the PROC usage per container manufactured, and to estimate the number of containers sold in the state.

In addition to these steps, it will be required to develop a comprehensive list of all parties who hold quota allocations. This is discussed further below.

Variations in Approach

As with the fee system, the quota system could, if necessary, be imposed upon the distribution of products within California. While such an approach may be feasible, tracking and implementing the program would be very complex. Distributors would be required to keep records of products distributed in the state. Each distributor would have to be registered with the sate, and procedures for record-keeping would be required.

5.2.2 Initial Allocation of The Quota

The quota allowances will be allocated to product manufacturers based on historical usage of PROCs in consumer products in California. A quantity of allowances will be set aside for new manufactures that can demonstrate that they have a promising low-PROC product.

The initial allocation of the quota is one of the most important, and difficult, aspects of this type of incentive system. Under the approach proposed here, the majority of the allowable level of PROC usage would be allocated to current manufacturers by the ARB based on historical usage. A small portion of the allowances would be set aside for new manufacturers that have promising low-PROC products. As discussed in Chapter 2, the purpose of this set aside is to reduce the barriers to entry caused by the quota system.

Implementation Issues

The following steps are required to allocate the quota based on historical usage.

- Authoritative Historical Use Estimates. Authoritative data must be collected that describe the historical use of PROCs in the affected products sold in California. To collect these data, the following will be required:[44]

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[44] This procedure is based on the approach used by the U.S. EPA to establish historical production and consumption data for chlorofluorocarbons (CFCs) and halon compounds. The CFCs are currently being limited in the U.S. using a quota system. The quota was allocated initially based on historical patterns. See Appendix G for a copy of the EPA regulation.

-- A base period for the analysis must be chosen. The base period should be in the past so that future activities cannot be undertaken to influence the share of the quota that will be received. A given year (such as 1988) should be specified. Manufacturers could also be given an option to use an average over a longer period (e.g., 1985 to 1988).

-- A reporting requirement must be promulgated by ARB. Parties that consider themselves to be eligible to receive quota allowances would be required to report their claim of historical usage. Claims would be accompanied by documentation of the basis for the claims, and a certification that the information provided was accurate.

-- A reporting form must be prepared that describes the basis for a party's estimate of its historical PROC usage. The need to report must be publicized and assistance in completing the form must be made available.[45]

-- Claims of historical usage would have to be validated by ARB staff to ensure accuracy. Procedures for settling conflicting claims would be required.[46] A mechanism for dealing with confidential information will also be required.

-- The final data developed by ARB based on the reported historical activity would be published. These published data would subsequently be the basis for allocating quota allowances.

o The ARB would select a quantity of annual PROC usage as the quota. This quantity could change over time (e.g., be phased down) and would be selected based on evaluations of the technologies available and the costs of meeting various quota limits. For example, as described above, if aerosol hair sprays were reformulated with HCFCs, PROC emissions could be reduced by about

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[45] For example, a "hot line" could be set up to answer questions about how to fill out the form. Similarly, workshops could be held (e.g., jointly sponsored by industry groups) to provide information about how to report.

[46] Conflicting claims arose when the U.S EPA collected data on historical production and consumption of CFCs and halons. In particular, several parties claimed historical consumption based on imports. To resolve these conflicting claims, a clear definition of the "importer of record" was adopted that corresponded to the definition of the U.S. Customs Service. Similar definitions will likely be required to resolve conflicting claims for products that were shipped for sale in California via various arrangements (e.g., under contract).

30 to 80 percent. The ARB would have to determine whether the costs of such a switch were acceptable.

- The ARB would allocate the selected quantity of annual PROC usage to the parties with valid claims of historical usage. The allocations would be made in proportion to historical usage. A mechanism for demonstrating ownership of the allowances would be required, and official state recording (e.g., by ARB) may be preferred.

- A procedure will be required to allocate the allowances set aside for new manufacturers. Given that the objective of the set aside is to allow new manufacturers with low-PROC products to enter the market, definitions will be required for those parties that will be considered new manufacturers and those product formulations that will be considered low in PROCs. A procedure for applying for these set aside allowances will be required, as well as procedures for allocating allowances when the demand for them is over subscribed. One approach would be to allocate the set aside quota allowances to those qualified entities with the lowest effective PROC formulations. Retaining the set aside allowances in future years would be contingent on actually marketing the products in the state.

Variations in Approach

Numerous variations are possible in the manner in which the quota is allocated and set. Rather than allocate the quota, it can be auctioned by the state. A wide range of auction types are possible, and set-asides or other special rules for small businesses may be established. The following types of activities would be required to hold an auction:

- establish the auction procedures, for example, sealed bid auction with or without minimum bids, dutch auction, auction with entrance fees;

- define the quantities of quota allowances to be auctioned, i.e., the lot sizes, in pounds;[47]

- define the parties that are eligible to participate in the auction, for example, participation may be limited to certain parties, or may be open;

- identify how the revenues from the auction will be used; and

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[47] The choice of the lot sizes may be important. Lots must be small enough to allow companies of all sizes to participate effectively. The order in which the lots are auctioned could also be important for the same reason. To protect small businesses, set-asides may be desireable.

- o publicize and hold the auction.

The advantage of an auction is that it allocates the quotas initially based on a market. If the market (i.e., the auction) works well, the allocation will be efficient.

Unfortunately, because such an auction will be the first time that the allowances are distributed, there is no experience upon which to judge whether the auction will work well. There will be a lot of uncertainty regarding the value of the allowances, and consequently it will be difficult for firms to develop bidding strategies. Although the markets for the consumer products analyzed here are quite competitive, it is not necessarily the case that an auction will not be heavily influenced by a small number of players. Because of the uncertainty that an auction will create, and because the auction will produce revenues, it is not recommended at this time. The potential inefficient allocation of allowances based on historical usage can be addressed by allowing the trading of the allowances, which is discussed below.

The manner in which the allowances are used can also vary. Implicitly, the approach recommended above requires that all allowances be for individual years, i.e., an allowance for 100 pounds of PROC usage would be for a given year, such as 1992. The allowance does not permit trading across years.

Alternatively, firms could be given flexibility regarding the timing of the use of their allowances, e.g., within a several year period. This flexibility could reduce the costs of meeting the quota limits, in particular if new non-PROC technologies are anticipated to be introduced in the future. Trading across years increases the complexity of the program and reduces control over annual emissions.

5.2.3 Trading of Quota Allowances

An "aftermarket" for trading the allowances will be structured to allow unrestricted trading of the allowances at any time without penalty.

Under this approach, restrictions would not be placed upon the transfer of the PROC-use quota allowances in order to allow free movement of the allowances to the most highly valued uses. Manufacturers will be allowed to sell the allowances at any time. Transfer or intention of transfer will, however, require a pre-transfer notification of intent to buy of sell PROC allowances. Such notifications, made to the ARB, will allow ARB to notify the parties if the proposed seller of the allowances does not have the number of allowances that he proposes to sell. By maintaining a "clearing house" in this manner, information about the parties who hold allowances will be readily available.

One exception to the unregulated transfer of quota allowances are those allowances that were obtained as part of the set aside. These allowances should not be transferable. If these allowances could be transferred, the intended objective of the set aside would not be met, namely to facilitate the introduction of low-PROC products by new entrants to the market. Additionally, if these allowances could be sold, entities might apply for the set aside allowances with the primary objective of selling them once they were obtained. Again, this set of activities would not be in accordance with the objectives of the set aside program.

Implementation Issues

This approach allows industry to trade allowances as freely as possible. Tracking by ARB is proposed as a means of providing information about the parties that hold allowances. Under this scheme ARB approval is not a pre-condition to the transfer of allowances among parties. However, ARB could be given a period (e.g., 5 working days) during which it could disapprove a transfer based on a finding that the party proposing to sell the allowances does not, in fact, own them.

Reporting to ARB would also assist in enforcement of the quota limitations. As described below, the ARB needs to track which parties have quota allowances.

To perform this tracking role, the ARB would require staff and procedures for collecting information and making determinations regarding the ownership of allowances. A secure centralized data-handling facility would be required. Forms and procedures for reporting to ARB would have to be developed. Such procedures could be patterned after the U.S. EPA program that has recently been established for tracking the trading of allowances for CFC production and consumption.

Variations in Approach

The type of trading allowed and the control over the aftermarket exercised by the ARB are likely to be controversial issues. A well-working aftermarket that allows trading is important for ensuring that PROCs are used in their most highly-values uses. The aftermarket, if it works well, helps to reduce the overall industry costs of meeting the quota limits.

As a means of controlling the aftermarket and reducing emissions, it may be recommended that the quota allowances be devalued when they are transferred. Such a devaluation procedure would tend to limit the number of transfers made, and would tend to "lock in" PROC usage with the parties that received the initial allowance allocations. The potential benefits of reducing emissions through trading would need to be balanced against the costs of making it less likely that PROCs would be used in their most highly-valued uses.

As described above, trades would also be allowed among products that are covered by the quota. By allowing trades among products (e.g., hair sprays and spray paints), advances in non-PROC technologies in one product would potentially "free up" PROCs for use in other products. Such trading would help to reduce the overall costs to industry of meeting the quota limits. Separate quotas could, however, be set for each product (or group of products), and trade between products (or product groups) could be restricted.

5.2.4 Evaluation of Emissions Reductions and Revisions of the Quota

An evaluation of the effects of the quota allocation and potential adjustments necessary to meet the emissions reductions goal will be completed after some predetermined time following implementation of the quota system.

Under this approach, ARB will undertake a study to determine whether the intended emissions reduction goals have been achieved and whether further reductions are possible. This study would be undertaken after some predetermined moderate time period deemed sufficient for allowing efficient use and redistribution of the PROC-use allowances (e.g., five years). Revisions to the quota system would then be implemented.

Implementation Issues

As with the fee-based system, one of the most important implementation issues to be addressed in facilitating evaluation of the quota system will be the collection and analysis of accurate and detailed information concerning the use and impact of the quotas. For purposes of the study, therefore, one key issue to be resolved will be what information is required for this study and how to structure reporting to provide this information. Specific information that would be required for such a study includes:

- technical alternatives used, and their costs;
- impacts on prices and consumers;
- trading of the PROC-use allowances; and
- emissions reductions achieved.

Following this study, ARB will determine whether changes in the quota system are required to enhance/ensure its effectiveness. Issues that may need to be addressed at this point include:

- whether the quota for PROC-use should be increased or decreased;
- whether some intervention in the market for PROC-use allowances is necessary to ensure effectiveness of the system; and
- whether the program can achieve its intended goals.

Variations in Approach

To minimize potential impacts of the quota is may be preferred to put a ceiling on potential increases in the prices of consumer products. For example, an index of prices for selected products could be developed. If the index exceeded a given level, additional quota allowances could be allocated. Other "automatic adjustments" could also be added to the program, such as relating adjustments to the quota to observed prices for trading in the aftermarket.

5.2.5 Steps Necessary to Ensure Compliance

Hair spray and spray paint containers are required to bear, in a visible location, a label, stamp, metered impression, or other printed notification indicating PROC content, by percentage of net weight, and that manufacture of the product is authorized under allowances held by the manufacturer. Sale or distribution for sale within California of products that have not complied with these requirements shall be subject to penalties and fines. Each manufacturer will submit appropriate records, receipts, invoices, and other documentation to support the quantities of product sold in California under their permit. Reports and documentation submitted by manufacturers will be subject to audit and inspection for accuracy.

Under this approach, products are required to bear some form of easily distinguishable marking to identify that the product has been manufactured in accordance with the quota limitations. In addition, as indicated in the prior sections, extensive reporting and documentation will be required on a periodic basis in order to substantiate manufacturers' compliance with the quota system.

As with the fee-based system, it is important that the administrative requirements not be overly burdensome to manufacturers or the implementing agency. Documentation, tracking, reporting, and a system for real and enforceable penalties are essential to ensuring not only that manufacturers comply with the requirements of the regulation, but to ensure that markets are not unduly disrupted by "black market" or covert sales and that the system achieves its intended responses.

Unlike the fee-based system, no funds will be submitted to ARB or the administering agency, so audit and monitoring of fee payments will not be necessary. However, reporting requirements and milestones will need to be established in order to ensure reporting of the information concerning units sold and PROC content of formulations necessary for ensuring compliance.

Implementation Issues

Many of the issues key to the successful implementation of this approach are similar to those identified and discussed for the fee-based system. As with a fee-based system, to ensure that requirements have been met, a system of reporting, inspecting, and auditing will be required. This system must be able to substantiate all aspects of the quota program, including:

- product formulations;
- number of containers of product sold and total PROC used; and
- final destination of products.

Inspections, records reviews, and audit procedures must be developed, and a specially trained staff will be required to implement the program. In addition, some additional rules and procedures may need to be established to give inspectors and the administering agency the authorities necessary to fulfill these functions.

Unlike the fee system, the quota system requires that the ownership of the PROC-use allocations be tracked. Adequate tracking will require periodic or annual reporting by the holders of the allowances, along with notification any time a PROC-use allocation is bought or sold. Issues to be resolved with regard to this effort include:

- who will maintain records;
- how often reporting will be required;
- the extent of the information to be reported; and

  what fees or penalties will be levied for non-compliance.

Variations in Approach

The extent of compliance activities may vary depending on the level of attention given to the program. As with a fee-based system, detailed "cradle-to-grave" manifesting could be implemented, but only at great cost.

6. EVALUATION OF ECONOMIC INCENTIVE SYSTEMS

This section presents the estimates of the costs of reducing PROC emissions from hair sprays and spray paints in California via fee and quota economic incentive systems.

This section is divided into the following two parts:

6.1 Summary of Approach presents the methods and assumptions used to estimate costs; and

6.2 Cost Estimates presents the estimates of the costs of reducing PROC emissions.

6.1 SUMMARY OF APPROACH

The costs of reducing PROC emissions from hair sprays and spray paints are estimated by:

- dividing the market for the products into product categories;
- identifying the technical options for reducing PROC emissions for each of the product categories and their emissions reduction potential;
- estimating the costs of implementing these individual technical options using a discounted cash flow analysis;
- simulating the extent to which each of the technical options would likely be adopted for ranges of fee levels and quota levels; and
- estimating the overall emissions reductions and costs across the set of technical options simulated to be adopted.

6.1.1 Product Categories

Exhibit 6-1 shows the product categories used in this analysis which are described in section 4 above. As shown in the exhibit, six product categories were used for hair sprays to represent the four main formulations of aerosol hair sprays and the two formulations of pump hair sprays. The estimated number of aerosol cans and pump containers sold in 1987 for each product category is also shown. In terms of number of units sold, Formulation I is clearly the major market formulation.

As shown in Exhibit 6-1 there are five major spray paint formulations discussed in section 4. Additionally, car touch up paint is also separated as a product category because it is anticipated that the these paints are a

EXHIBIT 6-1

PRODUCT CATEGORY DEFINITIONS

DESCRIPTION	PROC CONTENT (% wt)	NUMBER OF UNITS (000)
HAIR SPRAYS		
Aerosols:		
Formula I: Ethanol solvent, hydrocarbon propellant	97.8%	46,182
Formula II: Ethanol solvent, hydrocarbon propellant, 6.5 percent water	91.1%	6,447
Formula III: Ethanol and methylene chloride solvents, hydrocarbon propellant	85.8%	537
Formula IV: Formula I with a colorant/tint added	97.3%	537
Pumps:		
Pump Formula I: Ethanol solvent	91.0%	4,400
Pump Formula II: Ethanol and methyl chloroform (1,1,1-trichloroethane) solvents	56.0%	600
SPRAY PAINTS		
Formula I: Alkyd resin solids, various PROC solvents, hydrocarbon propellants	87.8%	15,904
Formula II: Nitrocellulose solids, various PROC solvents, hydrocarbon propellants	85.8%	3,408
Formula III: Alkyd resin solids, methylene chloride and various PROC solvents, hydrocarbon propellants	59.8%	852
Formula IV: Metallic version of Formula I	81.7%	852
Formula V: Alkyd resin solids, water and various PROC solvents, DME propellant	59.2%	284
Car Touch Up: Formula I (in smaller cans)	87.8%	7,100

distinct market from general spray paints, in part because performance and marketing requirements may be quite different. Like the hair spray categories, these data are for 1987.

6.1.2 Technical Options

Exhibit 6-2 lists the major technical options for reducing PROC use and emissions in hair sprays and spray paints. The primary means for reducing emissions from hair sprays include the following:

- Reformulate the hair sprays to include non-PROC propellants, such as partially-halogenated chlorofluorocarbons (HCFC-22 and HCFC-142b). The HCFC substitute ingredients are more costly than current ingredients, and their performance remains to be evaluated fully. Concerns over the impacts of the HCFCs on stratospheric ozone may limit the future availability of these compounds. Methylene chloride could also be used, but this compound has been almost completely phased out of hair spray use due to concerns over toxicity. Consequently, methylene chloride based formulations are not considered further. The advantage of reformulating with HCFCs is that it enables aerosol packaging to remain in use.

- Reformulate the hair sprays to include water and dimethyl ether (DME) as a solvent. The use of water as a solvent reduces the PROC content of the formulation. The use of DME (which is a PROC) increases the evaporation rate of the water, thereby improving its performance as a hair spray. For good performance, it is important that the solvent in the hair spray evaporates quickly. As shown in the exhibit, the PROC emissions reductions from this option are modest.

- Reformulate the hair sprays to include high levels of water, DME, and no alcohol. This formulation has recently been introduced and there is uncertainty regarding potential consumer acceptance. As discussed in Chapter 4, reports are that initial focus group and market research have indicated positive results.

- Replace the aerosol package with a non-propellant-based package. Two options include:

    - Growpak and Exxel packaging: These packages reportedly provide aerosol-type sprays, so that from the consumer's point of view, performance of the product is similar to the current aerosol package. These technologies are currently being developed, and various questions remain (such as the development of package components that are compatible with the product formulations). The formulations of the products would be anticipated to be similar to current pump packaging

EXHIBIT 6-2

TECHNICAL OPTIONS FOR REDUCING PROC EMISSIONS[a]

DESCRIPTION	COST/LB	REDUCTION	COMMENTS
HAIR SPRAYS			
Aerosols:			
HCFC I: use HCFC-142b as a solvent/propellant	2.60	81%	This is a new formulation that remains to be fully tested.
HCFC II: use HCFC-22 with ethanol	1.20	31%	HCFC-22 has been tested in aerosol hair sprays.
HCFC III: use HCFC-22 with DME	0.90	31%	This propellant/solvent system is currently being marketed to hair spray manufacturers.
DME/Water: use increased amounts of water in conjunction with DME	0.90	13%	This propellant/solvent system is currently being marketed to hair spray manufacturers.
High H_2O No Alcohol: use 60% water in conjunction with DME and eliminate the alcohol entirely	0.20	65%	This formulation has recently been introduced. Uncertainty remains regarding consumer acceptance.
Switch to pumps	<.25	45%-66%[b]	Switching will probably be limited due to consumer preferences. The PROC reduction is achieved by eliminating the propellant, and thereby reducing the amount of PROC required per effective application.

[a] Costs and emissions reductions shown are relative to Formula I for both aerosol hair sprays and spray paints.

[b] Emissions reduction is estimated based on the composition of the formulations. As described in Chapter 4, a recent study by ARTI (1988) found that emissions reductions may be smaller if consumers do not adjust their application rates as anticipated based on product composition.

EXHIBIT 6-2 (continued)

TECHNICAL OPTIONS FOR REDUCING PROC EMISSIONS[a]

DESCRIPTION	COST/LB	REDUCTION	COMMENTS
HAIR SPRAYS (continued)			
Alternative packaging: switch to GrowPak and Exxel packaging	<.25	45%	The packages are currently being marketed. They may be able to achieve aerosol-like performance. Costs are uncertain, and may be negligible.
Pumps:			
Switch from pump formula I to pump formula II	<.25	38%	This switch may not be possible if the use of methyl chloroform (a non-PROC used in pump Formula II) is limited due to concern about its impacts on stratospheric ozone.
SPRAY PAINTS			
Water/DME: use water and DME	1.80	32%	This is currently marketed as Formulation V. Its use is limited to applications that do not require high gloss finishes.
HCFC/DME: use HCFC-22/DME as the propellant	1.50	33%	This requires that HCFCs not be limited in these applications.

[a] Costs and emissions reductions shown are relative to Formula I for both aerosol hair sprays and spray paints.

EXHIBIT 6-2 (continued)

TECHNICAL OPTIONS FOR REDUCING PROC EMISSIONS[a]

DESCRIPTION	COST/LB	REDUCTION	COMMENTS
SPRAY PAINTS (continued)			
High solids: increase the paint solids to about 25 percent of the formulation, by weight	[c]	59%	The use of this formulation depends on a consumer education program that would include a performance rating system or another mechanism for educating consumers. The emissions reduction is primarily associated with reduced PROC emissions per effective application. This option costs less than current formulations per amount of paint delivered.

[a] Costs and emissions reductions shown are relative to Formula I for both aerosol hair sprays and spray paints.

[c] At current ingredient and packaging costs, high-solids paint formulations cost less per amount of paint delivered. However, the ingredient costs per can are higher for high-solids paint.

formulations. The reduction in PROC emissions is achieved by eliminating the PROC propellant.

-- Pump packaging: Pump packaging has been and continues to be used for various hair care products, including hair sprays. Following the U.S. ban on chlorofluorocarbon (CFC) aerosol propellants in non-essential applications (including hair sprays) in 1978, pump sprays gained as large as 30 to 40 percent of the hair spray market. Current estimates are that pumps account for a smaller fraction of hair sprays today (see Chapter 4). The reduction in PROC emissions is achieved by eliminating the PROC propellant.

  Of note is that the past experience with pump packaging after the CFC aerosol propellant ban may be interpreted to indicate that pump sprays do not have adequate performance characteristics to replace aerosol packaging for most hair spray users. Consequently, switching to pumps is not an option that is applicable to all hair spray use. Therefore, in this analysis it is assumed that at a maximum pump sprays can only penetrate the market an additional 20 percent, for a total of a 30 percent market share.

o Reformulate pump spray formulation I to pump spray formulation II. As shown in Exhibit 6-1, pump spray formulation II has a lower PROC content than pump spray formulation I.

As shown in Exhibit 6-2, reformulation to use non-PROC ingredients (such as HCFCs or water/DME) is also the primary means via which PROC emissions may be reduced from spray paints. Unlike hair sprays, however, non-aerosol packaging (e.g., pumps) are not considered as options.

In addition to reformulation to non-PROC ingredients, there is the potential to produce paints with "high-solids" formulations. The process of using a spray paint consists of transferring the paint (e.g., a resin) to a surface. The PROC solvents and propellants are used to accomplish this transferring process. A "high-solids" formulation is one that increases the amount of paint in the can to be transferred (i.e., the "solids") in relation to the other ingredients.

For example, spray paint Formulation I has about 12 percent solids, meaning that 12 percent of the formulation (by weight) is the actual paint that is being transferred to the surface being painted. The upper limit on the solids content of spray paint is believed to be about 25 percent. By increasing the solids content of Formulation I to 25 percent, the amount of PROCs emitted per amount of paint transferred to a surface would be reduced by about a factor of two (25 ÷ 12). The cost of high solids paints, per amount of paint transferred, is actually lower than the cost of the current popular formulations.

The primary obstacle to the introduction and acceptance of high-solids paints is consumer awareness and education. It is believed that most spray paint consumers purchase sprays paints infrequently. Consequently, paints are often purchased based on the price of the can, without consideration of potential differences in quality. Because the ingredients of a high-solids paint formulation would be more costly than current formulations for a given volume (a 12 ounce container for example), consumers would only purchase it if they realized that the high-solids formulation would actually paint more of an area. Because there is no standard performance rating for spray paints, and because most consumers are believed to purchase spray paints infrequently, it is likely that high-solids formulations would not gain a large market share unless consumer attitudes are changed. By educating consumers, for example, through the development of a paint rating system and a public information program, the potential acceptance of high-solids formulations could likely be increased.

Like with hair sprays, methylene chloride based formulations are not considered as options for reducing PROC emissions from these products. Similarly, the airless sprayer (discussed in Chapter 4) is not considered here due to its high costs.

6.1.3 Costs of Individual Options

Exhibit 6-2 also shows the estimated costs of the various technical options for reducing PROC emissions per pound of PROC emissions avoided. These costs are estimated using discounted cash flow analysis, taking into account depreciation and tax effects,[48] and include:

- costs of different ingredients based on price quotes received in July 1989 from vendors;
- costs of developing and market testing the new formulations;
- capital costs of upgrading filling facilities to store and handle DME;[49] and

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[48] This discounted cash flow analysis is described in Appendix F.

[49] It is assumed in this analysis that over time most brands are filled at more than one location. For example, the larger brands may be filled at four different locations (some in-house, other contract fillers). Consequently, under this assumption four filling lines may be required to be upgraded to handle DME, even though a single line could theoretically handle the filling requirements. It is further assumed in the analysis that the costs of these capital investments must be recovered from increased revenues received from the cans marketed in California. If DME-based formulations are marketed elsewhere as well (e.g., due to PROC emissions concerns elsewhere), the cost estimates presented here may be biased upward because the costs of the capital investments could be spread across a larger market.

- costs of different packaging (e.g., pump packaging).

The estimates shown in Exhibit 6-2 are sensitive to some extent on the market share that the option receives. Larger market shares allow up-front expenditures (such as market testing of new formulations) to be spread over more units, thereby reducing the per pound costs of reducing PROC emissions. The differing market shares are reflected in the analysis.

These cost estimates per pound of PROC emissions avoided reflect expenditures that would be required by industry. Depending on the characteristics of the market and demand by consumers, these costs will be passes along to consumers to various extents as discussed below.

6.1.4 Simulating the Technical Options Undertaken

To simulate the extent to which the various technical options are adopted in response to fees imposed on the use of PROCs it is assumed that:

- Technical options become candidates for adoption when they are less costly than continuing with current practices and paying the fee. A technical option is less costly when its cost per pound of PROC emissions avoided is less than the fee level imposed. For example, if a $2.00 per pound fee were imposed, options that cost less than $2.00 per pound of PROC emissions avoided would be cost effective. Those options costing more than $2.00 per pound would not be cost effective.

- Of those options that are candidates, any that are not likely to be acceptable from a performance or other perspective will not be undertaken. For example, methylene chloride-based formulations were eliminated from consideration in this analysis due to toxicity concerns even though they are inexpensive PROC reduction options. Similarly, a hair spray case was constructed that assumes that HCFCs are not viable options due to concerns about their ozone depleting potential. Also, a separate scenarios were analyzed with and without the High H_2O No Alcohol formulation.

- The relative cost of the options is the primary driver of the extent to which the acceptable candidates are undertaken. The other factor driving the extent to which the options are implemented is consumer acceptance. The total expenditure required by industry is used to evaluate the relative costs of the options, including both the costs of the technical options and the fees that must be paid on the PROC emissions that remain. The following is an example of how this is done.

For this example, assume that there are four options under consideration for aerosol hair sprays: (1) do nothing (i.e., do not change from the current formulation); (2) reformulate with HCFC-22/DME; (3) reformulate with HCFC-22/ethanol; and (4) reformulate with HCFC-142b. At a fee level of $0.50 per pound the HCFC reformulations are not cost effective (see Exhibit 6-2). Consequently, it is assumed that the "do nothing" alternative is adopted.

At a fee level of $1.50 per pound, the two HCFC-22 reformulations are cost effective. The increased cost of producing hair sprays using these reformulations is estimated at about 25 percent. This estimate includes the cost of paying the $1.50 per pound fee on the remaining PROCs. By comparison, the cost increase associated with the "do nothing" alternative is about 27 percent. Although the HCFC-22 reformulation is preferred on a cost basis, it is only by a small amount. Because the cost differential is small, the switch to the HCFC-22 reformulations is expected in this example to be fairly modest.

At higher fee levels, the cost differential between the HCFC-22 reformulations and the "do nothing" alternative increases. Consequently, the penetration of these alternatives would also increase. At a fee level of $3.00 per pound, the HCFC-142b alternative is cost effective (see Exhibit 6-2). Because the HCFC-142b reformulation reduces PROC emissions more than the HCFC-22 alternative, it becomes preferred to the HCFC-22 alternatives at high fee rates (e.g., $4.00 per pound).

This choice of penetration of the various options is clearly judgmental and alternative plausible assumptions may be used. However, the overall estimates of emissions reductions and costs are not overly sensitive to the details of the specific assumptions made. In general, the results are more sensitive to assumptions about which controls are available to be undertaken at all, as opposed to the relative mix of available controls that are undertaken.

To simulate the options undertaken in response to quotas, a similar assessment is made. In the case of quotas, however, it is assumed that the quota allowances are allocated to industry (as opposed to auctioned) so that transfer payments are not paid. In this case, the increases in the costs of producing the product are driven solely by the costs of the technical controls. Consequently, the lowest cost technical controls that will meet the quota limitation are assumed to be undertaken.

6.1.5 Total Emissions Reductions and Costs

To evaluate the total emissions reductions the following is done:

- For each technical control option simulated, an increase in product price is estimated. This increase in price includes the impacts of fees paid under the fee-based incentive system. The anticipated change in consumer demand associated with the change in price is estimated using a range of demand elasticities. This procedure produces an estimate of the change in product quantity.

- The remaining PROC contents of the products, reflecting the reductions associated with, for example, reformulation, are multiplied by the estimate of the product quantity that reflects the demand response due to higher prices to estimate total PROC emissions.

- The reduction in emissions is estimated as the difference between the current emissions and the emissions simulated as the result of the influence of both the demand response and the technical control options.

This procedure does not take into account potential growth in the size of the market. The hair spray market, for example, has grown significantly in the past 10 years. Future growth would likely, in part, offset the emissions reductions estimated here for the fee-based system.

The overall costs of the reductions are estimated by summing across the technical control options simulated to be implemented. Several types of costs are estimated:

- Private annualized costs of the technical controls represent the annual expenditures by industry to implement the controls. These costs are used to evaluate how technical controls will be implemented in response to the incentives.

- Capital costs and one-time expenditures are the amount of outlays required initially to upgrade filling lines and reformulate products. These costs are not borne annually, but indicate the amount of investment that the industry will need to make when the incentives go into effect.

- Transfer payments are the amounts that industry would pay to the state in the form of a fee on the remaining PROC usage. Depending on the characteristics of the market, a portion or all of this fee payment will be passed on to consumers in the form of higher prices.

- Lost consumer surplus represents the amount that consumers are "less well off" due to increased prices and reduced quantities of consumption. This measure is defined precisely in the field of economics and is an estimate of the costs that are incurred by consumers. In general, the lost consumer surplus is the amount that consumers are willing to pay to avoid foregoing some amount of consumption and to avoid some price increase.

- Social costs are the net real resource costs that society has incurred. This cost is estimated as the lost consumer surplus minus the transfer payments made by industry.

These cost quantities are described in Appendix F.

To evaluate industry and macroeconomic impacts these cost estimates are compared to average annual industry profits and overall economic activity. Additionally, total social costs per pound of PROC emissions avoided may be estimated for purposes of comparing the costs of emissions reductions from these products to the costs of alternative means of reducing emissions.

6.2 COST ESTIMATES

This section presents results for fee and quota economic incentive systems as applied to hair sprays and spray paints.

6.2.1 Hair Sprays

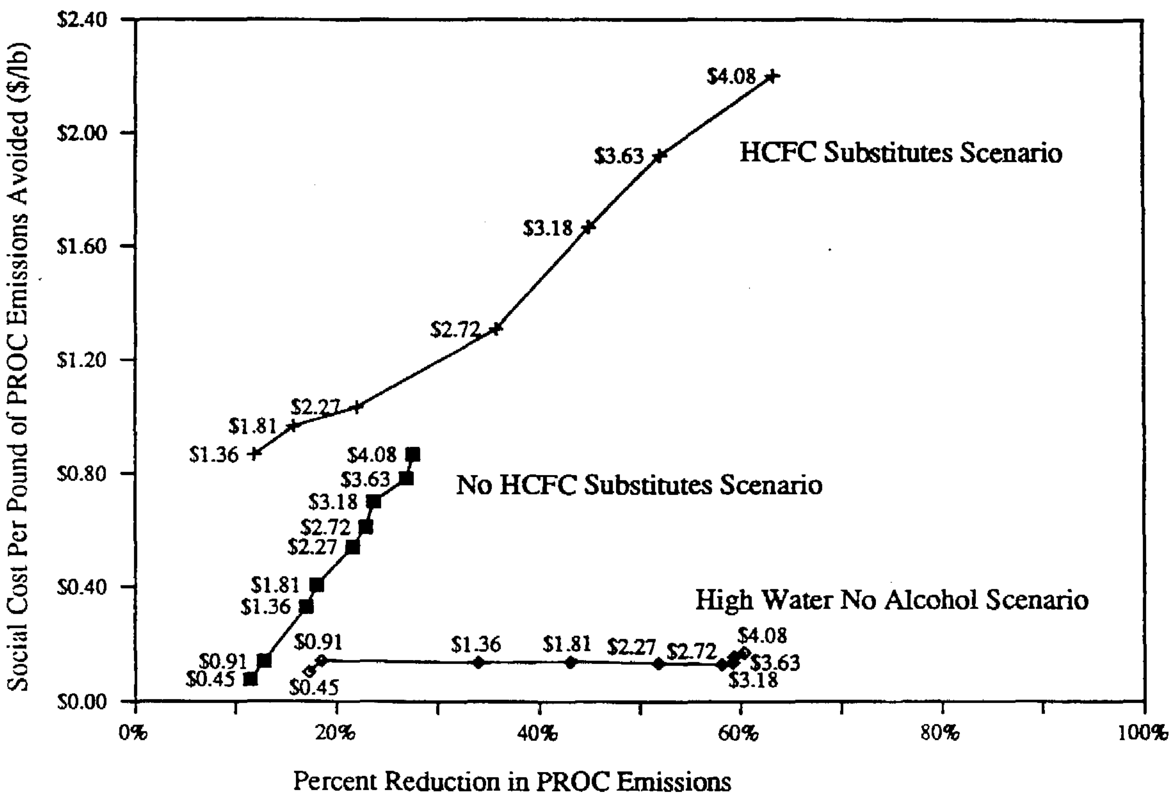
Exhibit 6-3 presents estimates of the social costs per pound of reducing PROC emissions from hair spray formulations in California using a fee system in which a fee is imposed on the PROCs used in hair sprays. The horizontal axis is the percent reduction in emissions, and the vertical axis is the social cost per pound of emissions avoided. The points on each line are labeled with the fee levels, in dollars per pound, that produce the social cost and percent reduction estimates shown in the graph. As mentioned above, the percent reductions are estimated using the 1987 level of emissions as a base. If the market for hair sprays grows, realized reductions from the 1987 level will be smaller.

The social cost is a measure of how much it costs society to eliminate a pound of PROC emissions from these products. High social costs imply that it is very costly to eliminate these emissions. Conceptually, social costs represent the real resources that society must expend to avoid these emissions. The fee that is paid is not included in the social costs because the fee is merely a transfer from one party to another. Social cost is one of the several different types of costs that are important to examine when evaluating emissions reduction policies.

Three cases are shown in the exhibit. The HCFC Substitutes Scenario assumes that HCFC compounds will be available for use in hair spray products at current prices, and that they are the principal means via which emissions are reduced in response to the incentives. Under this case, fee levels of \$1.36 to \$4.08 per pound (\$3.00 to \$9.00 per kilogram) could produce emissions reductions of about 10 to 60 percent, at average social costs on the order of \$0.90 to \$2.25 per pound (\$2.00 to \$5.00 per

EXHIBIT 6-3

SOCIAL COSTS PER POUND OF REDUCING PROC EMISSIONS FROM HAIR SPRAYS USING A FEE SYSTEM



The points on each line are labeled with the fee levels, in dollars per pound, that produce the social cost and percent reduction estimates shown in the graph.

kilogram) of emissions avoided. The fee levels per pound of PROC emissions simulated to produce these emissions reductions are shown on the exhibit next to the lines.

As discussed above, at increasing fee levels it is estimated that the HCFC formulations will achieve increasing penetration into the market. These estimates also assume that some pump formulations change to lower PROC formulations. Exhibit 6-4 summarizes the technology implementation assumptions made in the HCFC Substitutes Scenario. The first 6 columns to the right of the fee level refer to the penetration of options for reducing emissions from aerosol packages. The last column refers to the reformulation of pump packages.

A second case is also shown on the exhibit in which it is assumed that HCFC compounds are restricted so that they may not be used in hair spray products in the future. This No HCFC Substitutes Scenario also assumes that the High H_2O No Alcohol formulation is not used widely. In this scenario, the main sources of emissions reductions are reformulation with water/DME in aerosol products and limited switching to pump sprays. This No HCFC case cannot achieve reductions in emissions as large as the HCFC case. The social costs in this scenario are in the range of up to $0.80 per pound ($1.75 per kilogram) of emissions avoided and the fee level ranges from $0.45 to $4.08 per pound ($1.00 to $9.00 per kilogram).

The third scenario shown in the exhibit is the High H_2O No Alcohol Scenario. Under this scenario the High H_2O No Alcohol formulation achieves widespread use. This formulation produces emissions reductions at social costs that are well below the other formulations. Consequently, as shown in the exhibit, the ability to reduce emissions at low social costs is sensitive to the ability to use this formulation widely. The social costs in this scenario are on the order of $0.20 per pound ($0.45 per kilogram) of emissions avoided.

Exhibit 6-5 shows the total annualized expenditures by industry at the various reduction/fee levels for the three scenarios. These expenditures include the increased costs of formulations, the annualized costs of capital expenditures and reformulation costs, and fee payments required on the remaining PROC usage. For both the HCFC and non-HCFC scenarios the expenditures by industry are similar for given fee levels, even though the emissions reductions are quite different. Under the High H_2O No Alcohol Scenario industry expenditures are somewhat lower.

For all three scenarios, the total expenditures by industry are large compared to the revenue it receives from these products. The total annual revenue received by hair spray manufacturers from sales in California is about $0.85 per unit times 60 million units sold, or $51 million. Under the various scenarios shown in the exhibit, annualized expenditures by industry, which are almost entirely paid by manufacturers under this incentive system, are in the range of $10 to $90 million, which is the same magnitude as the revenues generated by the products.

EXHIBIT 6-4

PENETRATION OF TECHNICAL OPTIONS FOR
REDUCING EMISSIONS FROM HAIR SPRAYS

Fee Level	HCFC-I	HCFC-II	HCFC-III	DME/Water	Switch to Pumps	Alt. Package	Reform. Pump I
HCFC Substitutes Scenario: HCFCs are available for use							
$1.36	--	10%	15%	--	--	--	50%
$1.81	--	15%	20%	--	--	--	50%
$2.27	--	25%	30%	--	--	--	50%
$2.72	10%	35%	45%	--	--	--	75%
$3.18	25%	30%	40%	--	--	--	75%
$3.63	40%	25%	30%	--	--	--	75%
$4.08	65%	15%	15%	--	--	--	75%
Non-HCFC Substitutes Scenario: HCFCs are not available for use							
$0.45	--	--	--	--	10%	10%	25%
$0.91	--	--	--	--	10%	10%	25%
$1.36	--	--	--	25%	10%	10%	50%
$1.81	--	--	--	25%	10%	10%	50%
$2.27	--	--	--	50%	10%	10%	50%
$2.72	--	--	--	50%	10%	10%	75%
$3.18	--	--	--	50%	10%	10%	75%
$3.63	--	--	--	75%	10%	10%	75%
$4.08	--	--	--	75%	10%	10%	75%

This table shows the extent to which each of the technical alternatives is assumed to be undertaken at fee levels that range from $0.45 to $4.08 per pound ($1.00 to $9.00 per kilogram). The percentages apply to Formulation I, which accounts for the majority of the market. Small variations exist for the other formulations due to differing levels of PROC contents.

EXHIBIT 6-4 (Continued)

PENETRATION OF TECHNICAL OPTIONS FOR
REDUCING EMISSIONS FROM HAIR SPRAYS

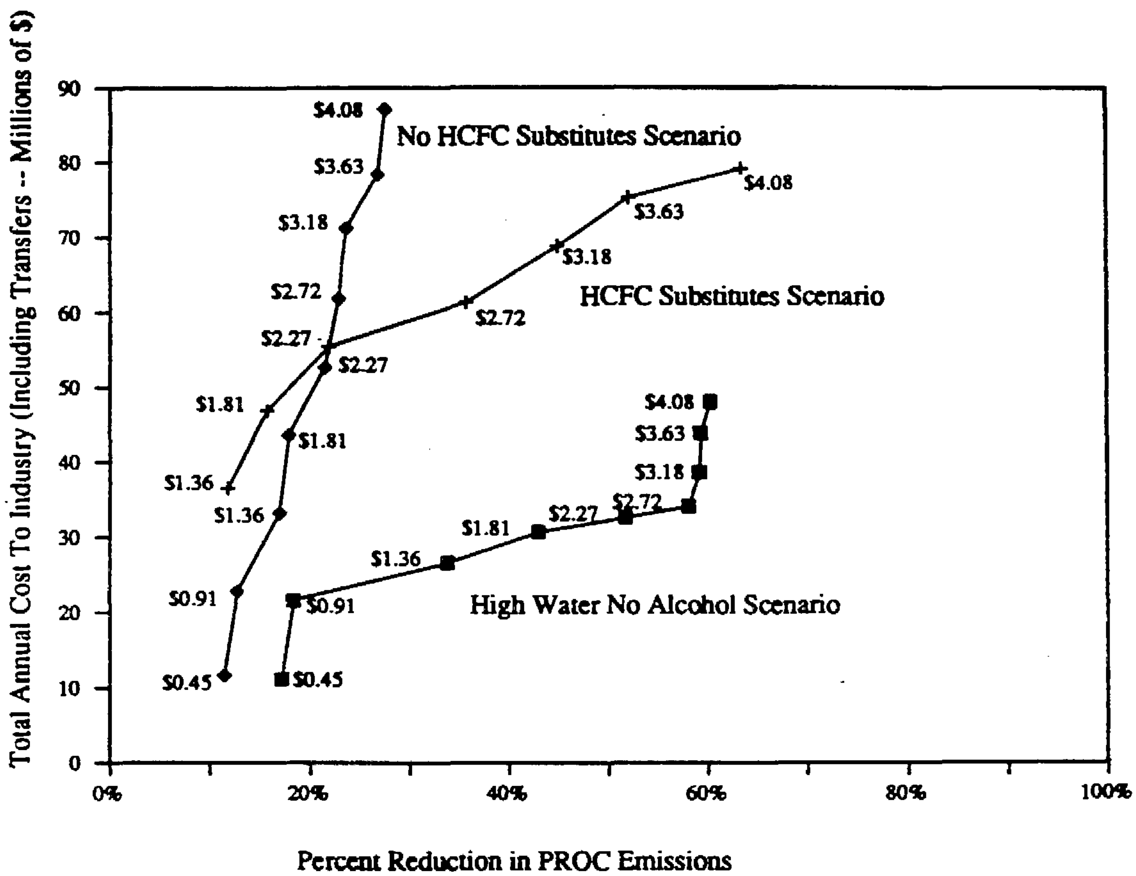
Fee Level	HCFC-I	HCFC-II	HCFC-III	High H_2O No Alcohol	Switch to Pumps	Alt. Package	Reform. Pump I
High H_2O No Alcohol Scenario: HCFCs are not available for use and the High H_2O No Alcohol Formulation is used widely							
\$0.45	--	--	--	5%	10%	10%	25%
\$0.91	--	--	--	10%	10%	10%	25%
\$1.36	--	--	--	35%	10%	10%	50%
\$1.81	--	--	--	50%	10%	10%	50%
\$2.27	--	--	--	65%	10%	10%	50%
\$2.72	--	--	--	75%	10%	10%	75%
\$3.18	--	--	--	80%	10%	5%	75%
\$3.63	--	--	--	85%	5%	5%	75%
\$4.08	--	--	--	90%	--	5%	75%

This table shows the extent to which each of the technical alternatives is assumed to be undertaken at fee levels that range from \$0.45 to \$4.08 per pound (\$1.00 to \$9.00 per kilogram). The percentages apply to Formulation I, which accounts for the majority of the market. Small variations exist for the other formulations due to differing levels of PROC contents.

The first 6 columns to the right of the fee level refer to the penetration of options for reducing emissions from aerosol packages. These first 6 columns must sum to less than or equal to 100%. The last column on the right refers to the reformulation of pump formulation I. This column is independent of the penetration estimates in the other 6 columns. This seventh column must, by itself, be less than or equal to 100%.

EXHIBIT 6-5

TOTAL EXPENDITURES BY INDUSTRY FOR REDUCING PROC EMISSIONS FROM HAIR SPRAYS USING A FEE SYSTEM



The points on each line are labeled with the fee levels, in dollars per pound, that produce the total cost and percent reduction estimates shown in the graph.

Of note is that the majority of the expenditures by industry are associated with paying the fee. These "transfer payments" are shown in Exhibit 6-6 for the three scenarios. These payments account for nearly all the expenditures by industry in the No HCFC Substitutes Scenario. In the HCFC Substitutes Scenario, transfer payments decline at high fee levels as larger reductions are made in the use and emissions of PROCs. In this situation, the increased costs of the formulations account for an increasing share of total expenditures, although fee payments remain responsible for most of the expenditures even in this case.

Like the No HCFC Scenario, nearly all the expenditures under the High H_2O No Alcohol Scenario are associated with the fee payments. The expenditures associated with reformulation and product ingredients are less than 10 percent of the total expenditures.

This result, that industry expenditures are principally associated with the fee payment, is the result of two factors:

- the assumptions made regarding the penetration of the technologies at the various fee levels; and

- the emissions reductions achieved by the technologies.

Because none of the technologies eliminate emissions entirely, fee payments will always exist under the fee-based incentive system analyzed here. Because it is assumed that the technologies are implemented to various degrees as the fee level is increased, significant amounts of fees are paid on the remaining PROC emissions.

These estimates of the fee payments are too low if the anticipated levels of emissions reduction in fact cannot be achieved. In this case, more PROC emissions remain and consequently more fees are paid. These estimates are too high if larger reductions are in fact achieved. Nevertheless, the transfer payments will likely exceed at least $10 million even under extremely optimistic assumptions. For example, if a $1.36 per pound ($3.00 per kilogram) fee were introduced that triggered switching to cost effective technologies by 100 percent of the industry, fee payments would still be in the following range:

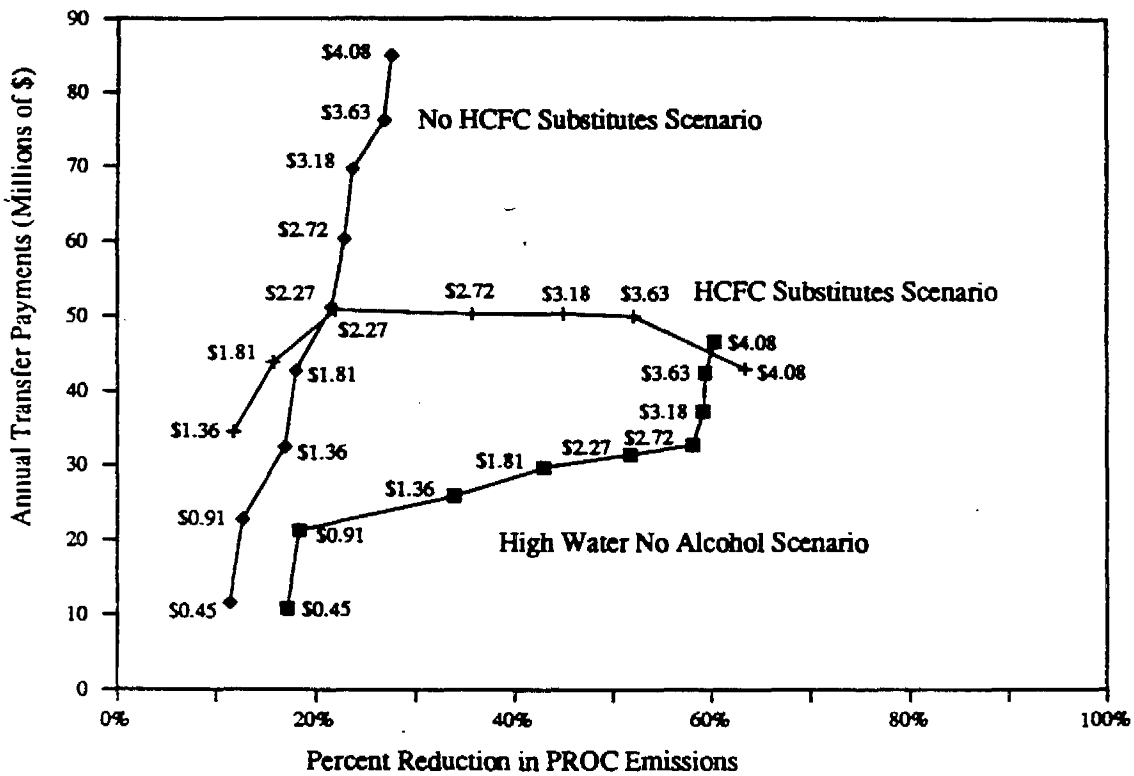
- assuming that only the No HCFC Substitute Scenario technologies were introduced, fee payments would be about $30 million;

- assuming that the HCFC Substitutes Scenario technologies are used, fee payments would be about $15 million;

- assuming that the High H_2O No Alcohol formulation is used widely, the fee payments would be about $15 million.

EXHIBIT 6-6

TRANSFER PAYMENTS MADE BY INDUSTRY FOR REDUCING PROC EMISSIONS FROM HAIR SPRAYS USING A FEE SYSTEM



The points on each line are labeled with the fee levels, in dollars per pound, that produce the transfer payment and percent reduction estimates shown in the graph.

Consequently, even under fairly optimistic assumptions, fee payments will likely be the same general magnitude as current revenues earned by manufacturers.

Of note is that reduced demand plays a relatively small role in the reductions in emissions estimated above. As shown in Exhibit 6-7, the reduced demand accounts for about 1.5 percent to about 9 percent reductions in emissions. Even at high fee levels such as $3.00 to $4.00 per pound ($7.00 to $9.00 per kilogram) of PROC, the reduction in demand is less than 10 percent for both cases. The demand reduction is small because:

- The demand elasticity assumed for these estimates is -0.2. At an elasticity of -0.5 the reduction in demand would be much larger, ranging up to about a 20 percent reduction in demand in response to the high fee levels. If the demand elasticity were -1.0, which seems unlikely given the nature of the product, demand could decline by as much as 35 or 40 percent in response to the high fee levels.

- The increased cost of the product is primarily influenced by the increased costs of the formulation ingredients and the transfer payments (i.e., the fee on the remaining PROCs). The costs of the container, transportation, storage, and distribution are assumed to remain unchanged. Consequently, a 100 percent increase in the cost of the product ingredients translates into only about a 10 percent increase in the final product price.

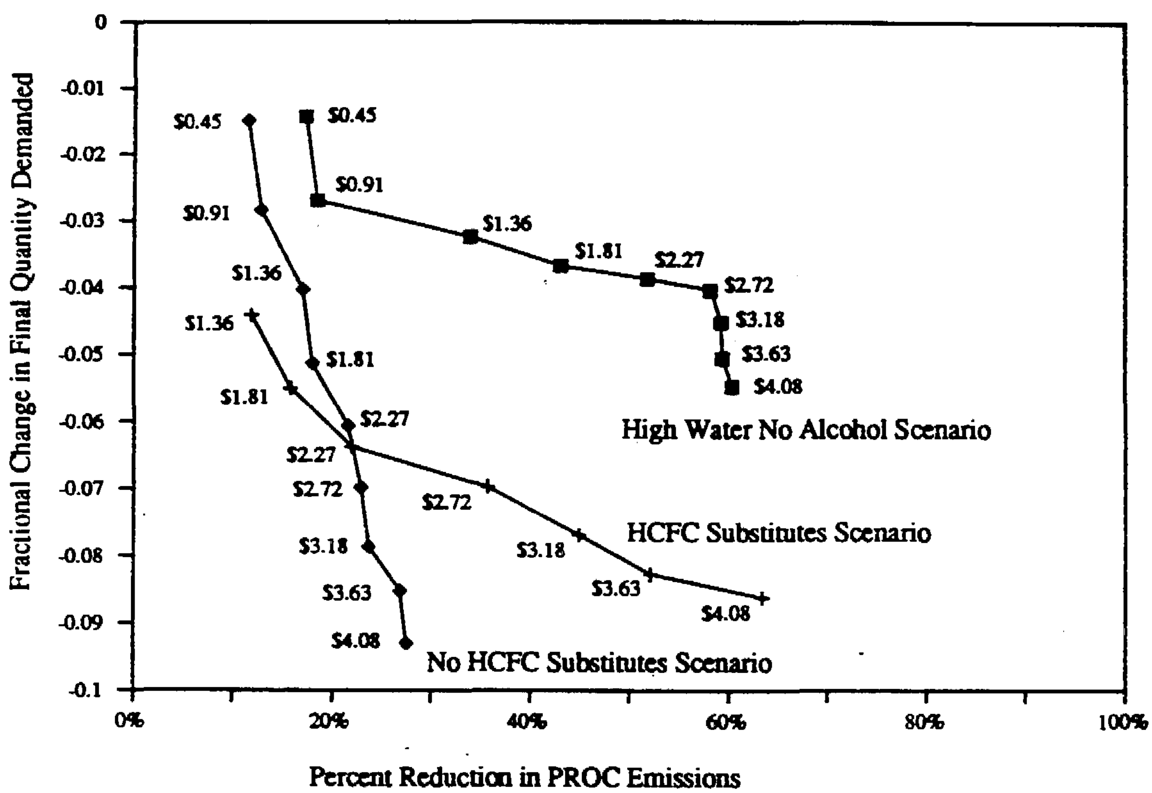
Although the reduction in quantity demanded is expected to be fairly modest, the change in manufacturing costs is quite substantial. Exhibit 6-8 shows how the cost of ingredients per can will change under the various scenarios. As shown in the exhibit, current ingredient costs are on the order of $0.20 per can. The ingredient costs, including the payment of the fee, will at least double, and may increase by a factor of five or more for the high fee levels.

These increased costs will substantially be passed on to consumers. For example, at a fee level of $1.36 per pound ($3.00 per kilogram), ingredient costs will increase by about $0.40 to $0.60 per can. If these costs are passed on to consumers, prices will increase by the same amount. Given that current prices per can are on the order of $2.50, these price increases would be on the order of 16 to 24 percent of current prices.

Exhibit 6-9 examines the results for a quota system using the combined results of the HCFC and No HCFC cases. The combined case uses the No HCFC results at fee levels less than or equal to $2.27 per pound ($5.00 per kilogram), and the HCFC results at fee levels above this amount. The quota is simulated assuming that the quota allowances are allocated to industry, so that no transfer payments result.

EXHIBIT 6-7

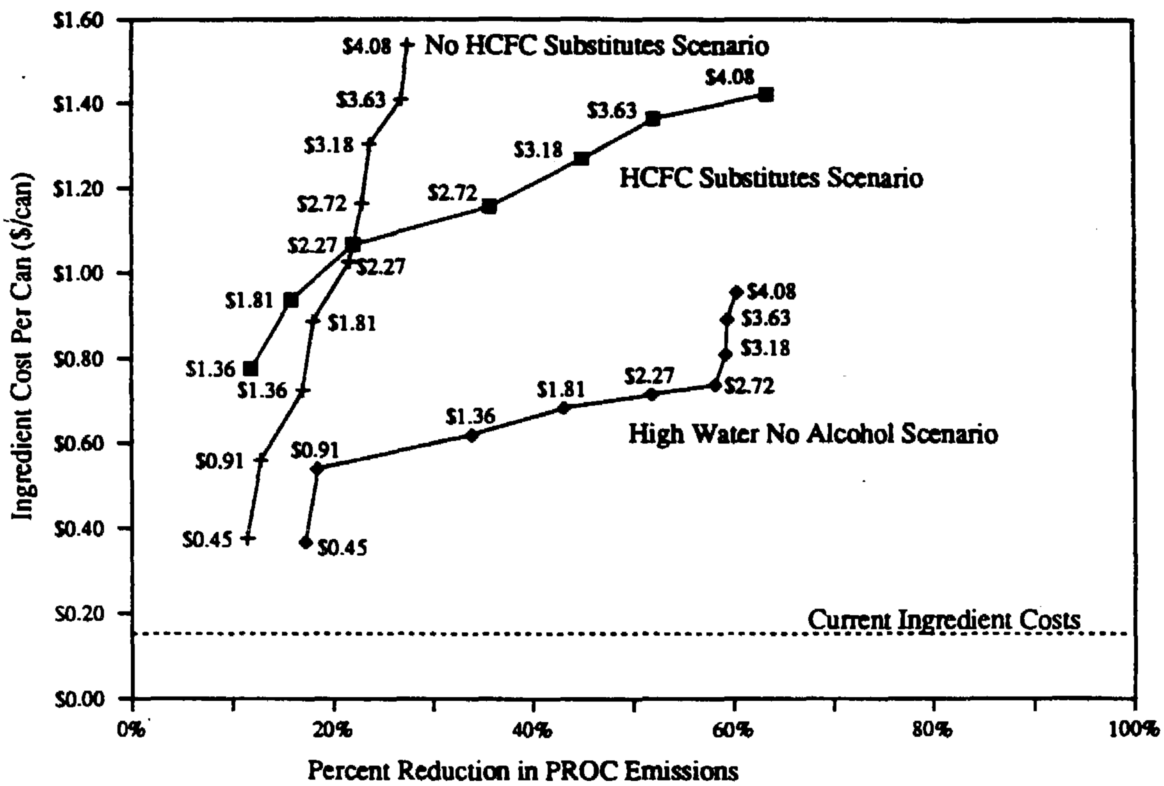
REDUCED DEMAND FOR HAIR SPRAYS DUE TO INCREASED COSTS ASSOCIATED WITH REDUCING EMISSIONS FROM HAIR SPRAYS USING A FEE SYSTEM



The points on each line are labeled with the fee levels, in dollars per pound, that produce the reduced demand and percent reduction estimates shown in the graph.

EXHIBIT 6-8

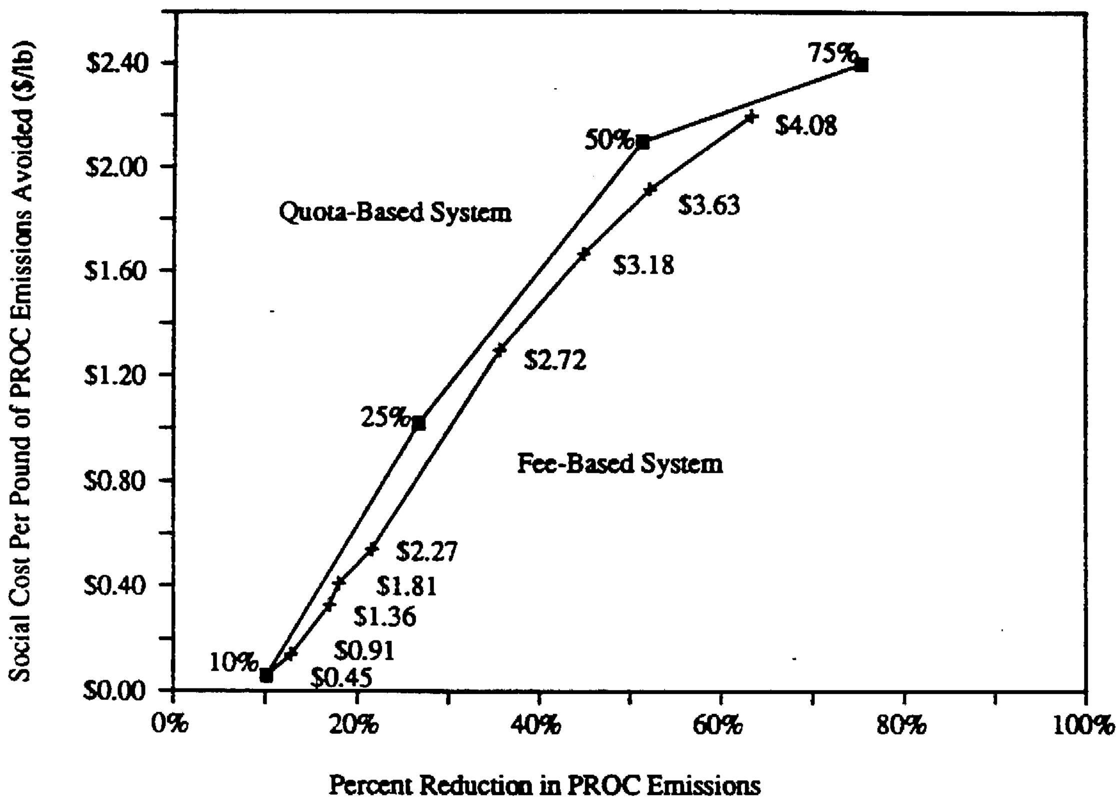
INGREDIENT COSTS PER AVERAGE SIZED CAN RESULTING FROM PROC EMISSIONS REDUCTIONS FROM HAIR SPRAYS USING A FEE SYSTEM



The points on each line are labeled with the fee levels, in dollars per pound, that produce the ingredient cost and percent reduction estimates shown in the graph.

EXHIBIT 6-9

SOCIAL COSTS PER POUND OF REDUCING PROC
EMISSIONS FROM HAIR SPRAYS USING FEE AND QUOTA SYSTEMS
(Based Solely on the HCFC and No HCFC Scenarios)



The points on the Fee-Based System line are labeled with the fee levels, in dollars per pound, that produce the social cost and percent reduction estimates shown in the graph. The points on the Quota-Based System line are labeled with the quota levels, as percent reductions from current use, that produce the social cost and percent reduction estimates shown in the graph.

The social costs per pound of PROC emissions avoided are essentially the same for the quota and fee systems, as would be expected because the social costs do not reflect fee payments. Of note is that in order to achieve reductions of 25 percent and larger in Exhibit 6-9, it is assumed that HCFCs are available for use in these products.

Exhibit 6-10 shows the social costs per pound of PROC emissions avoided for the High H_2O No Alcohol Scenario. Again, the costs under the fee and quota systems are very similar as is expected. The costs under this scenario are much smaller than under the combined No HCFC/HCFC scenario shown in the previous exhibit. Clearly, if the High H_2O No Alcohol formulation is accepted by consumers, the costs of reducing PROC emissions from hair sprays can be fairly low.

The total expenditures by industry are much smaller under the quota system than under the fee system because the quota system does not require fee payments, so that there are no transfer payments. Because transfer payments do not increase production costs in the quota system, the changes in product prices and the impacts on consumers are much smaller under the quota system. Because product prices are not expected to increase substantially, the reductions in demand are smaller under the quota system as compared to the fee system at comparable levels of emissions reductions.

6.2.2 Spray Paints

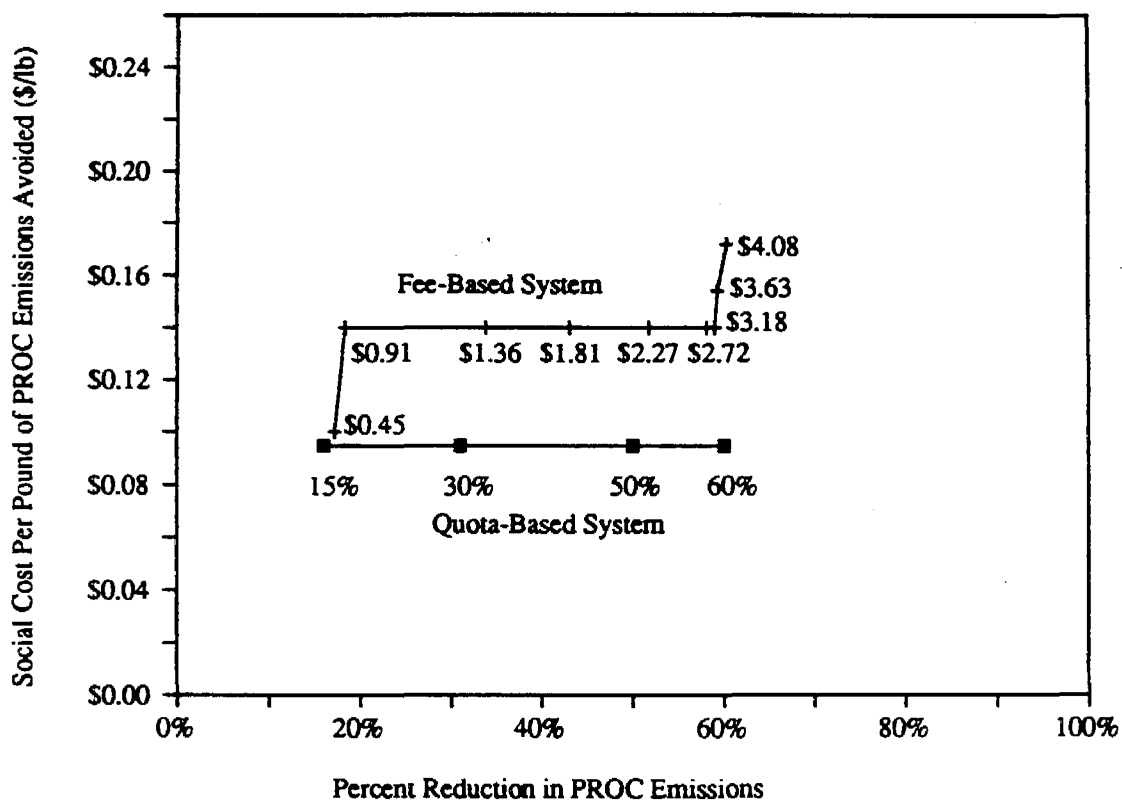
The analysis indicates that high-solids spray paint formulations are the least costly means of reducing PROC emissions from consumer spray paints. At current ingredient costs, high solids pains actually cost less per amount of paint delivered as compared to current formulations.

A 12 ounce can of a high-solids spray paint will paint twice the area of a 12 ounce can of a current formulation. The cost of making 12 ounces of the high-solids paint may be 5 or 10 percent higher than the costs of making 12 ounces of the current formulation. Clearly, the cost per effective painted area is lower for the high-solids paint.

Given that the high-solids paints are less costly than the current formulations per amount of paint delivered, it appears that cost per effective amount of paint is not the barrier that is preventing these paint formulations from being implemented widely. The primary barrier preventing the widespread use of the high-solids paints is that the consumer purchases paint solely on original purchase price, without recognizing that the high-solids paint is actually cheaper. Economic incentives that change the purchase price of paints so that high-solids paint formulations are cheaper per can than current formulations should therefore help promote the use of the low-PROC formulation.

EXHIBIT 6-10

SOCIAL COSTS PER POUND OF REDUCING PROC EMISSIONS FROM HAIR SPRAYS USING FEE AND QUOTA SYSTEMS (Based Solely on the High H_2O No Alcohol Scenario)



The points on the Fee-Based System line are labeled with the fee levels, in dollars per pound, that produce the social cost and percent reduction estimates shown in the graph. The points on the Quota-Based System line are labeled with the quota levels, as percent reductions from current use, that produce the social cost and percent reduction estimates shown in the graph.

Consumer education would also be required in order to allow the high solids paints to gain acceptance. A reliable system for evaluating and reporting the performance of spray paint products would be required in order to educate consumers regarding the value of high-solids spray paints.

Given the importance of the consumer education aspect of this opportunity for reducing PROC emissions from spray paints, it is difficult to evaluate quantitatively the effect that various fee levels would have on the PROC emissions from spray paints. For this analysis, a range of assumptions is used to represent the potential magnitudes of emissions reductions at various fee levels. Exhibit 6-11 shows the assumptions used.

As shown in the exhibit, the consumer awareness program could, by itself, lead to the introduction of high-solids spray paints. The extent to which these paints are adopted will depend on the effectiveness of the program. For this example, a fairly modest penetration is assumed (15 percent).

With increasing fee levels of up to $1.81 per pound ($4.00 per kilogram) of PROC, the relative ingredient costs for the high-solids paint formulation improves relative to the ingredient costs of the current most popular spray paint formulation. In the absence of an incentive fee, the ingredient costs of the high-solids paint formulation is about 31 percent higher. This higher ingredient cost leads to a higher original purchase price which, as discussed above, appears to be an important barrier preventing the widespread adoption of this formulation.

With an incentive fee of $0.91 per pound ($2.00 per kilogram), the high-solids paint formulation ingredient costs are about equal to the costs of the current formulation. The costs are about equal because a can of the current formulation has about 88 percent PROCs, whereas a can of the high-solids paint has 75 percent PROCs. Therefore, the incentive fee increases the ingredient costs for a can of the current formulation by a larger amount than it increases the ingredient costs of the high-solids formulation.

As shown in Exhibit 6-11, at an incentive fee of $0.91 per pound it is assumed that the high-solids paint formulation achieves a 50 percent share of the market. At high fee levels, the market share increases because it has a cost advantage in terms of ingredient costs per can.

The transfer payments associated with the fees are also shown in Exhibit 6-11. Of note is that such transfer payments could be used to fund a consumer awareness program. The transfer payments increase by only about a factor of two when the fee is increased from $0.45 to $1.81 per pound because it is assumed that the higher fee leads to increased use of high-solids paints. Of note is that at demand elasticities of -0.2 (used in the

EXHIBIT 6-11

ASSUMED PENETRATION OF HIGH-SOLIDS
PAINTS AT VARIOUS INCENTIVE FEE LEVELS

FEE ($/LB)	PENETRATION (%)	EMISSIONS REDUCTION (%)	TRANSFER PAYMENTS (10^6 $)	RELATIVE INGREDIENT COST	COMMENTS
No Fee	15%	8%	(none)	+31%	The consumer education awareness program would likely lead to some use of high-solids paints without a fee incentive.
0.45	25%	15%	4.7	+5%	The transfer payments are due to the fee on the remaining PROC usage.
0.91	50%	30%	7.8	-2%	
1.36	75%	44%	9.3	-5%	
1.81	95%	55%	10.0	-7%	

The relative ingredient costs are estimated for the difference in the product ingredient costs per can, including the cost of the incentive fee. The comparison is made between the most popular current formulation and the prototype high-solids formulation. A positive relative ingredient cost means that the high solids paint formulation is more costly per 12 ounce can than is the current formulation for the same size can. Of note is that the high-solids formulation is less costly than the current formulation per amount of paint delivered even without an incentive fee.

estimates shown in Exhibit 6-11) and -0.5, the reductions in emissions associated with reduced demand are small compared to the total reductions in emissions.

The results of this assessment are clearly based on judgment. A highly effective consumer awareness program could, by itself, lead to larger penetrations of high-solids paints. Alternatively, economic incentives aimed specifically at promoting the adoption of high-solids paints (as opposed to reducing PROC emissions) could be developed.

For example, a fee could be developed based on the solids content of spray paint formulations. No fee would be due if a high-solids paint were sold (e.g., 25 percent solids by weight). However, a fee would be due if low solids formulations were sold, with the fee designed to be a function of the solids content. Although this fee approach would promote the use of high-solids paint with likely lower transfer payments than would a fee system based on PROCs, it would not necessarily achieve the maximum possible reductions in PROC emissions over time.[50]

As a comparison to the high-solids formulations case, a separate case was also analyzed that assumes that consumer purchasing behavior cannot be changed substantially, so that high-solids paint formulations are not marketed widely. In this case, substitution with formulations based on water/DME and HCFC-22/DME are the primary means of reducing emissions. These options are more costly than the high-solids formulations (see Exhibit 6-2), requiring fees on the order of $1.75 per pound of PROC in order to make them cost effective.

Exhibit 6-12 displays the results of this analysis. As shown in the exhibit, fees ranging from $1.81 to $3.63 per pound ($4.00 to $8.00 per kilogram) could produce emissions reductions on the order of 10 to 30 percent. The reduced demand for the products associated with the increased costs of production account for about one-half to one-third of the total simulated reductions. The transfer payments, which account for over 90 percent of the total costs to industry, are shown in the exhibit. These transfers (on the order of $20 to $30 million annually) are very large relative to the total sales revenue for these products. At about $2.70 per can of paint, the total sales revenue for the 28 million can is about $75 million. Manufacturers' revenues would, of course, be only a fraction of this total.

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[50] For example, if a new spray paint formulation were developed that had both high solids and reduced levels of PROC solvents and propellant, the fee based solely on the solids content would provide no incentive to introduce the new low-PROC formulation. A fee based on total PROC content would provide such an incentive.

EXHIBIT 6-12

ANALYSIS OF EMISSIONS REDUCTIONS FROM SPRAY PAINTS AT VARIOUS INCENTIVE FEE LEVELS ASSUMING THAT HIGH-SOLIDS PAINTS ARE NOT USED WIDELY

FEE ($/LB)	PENETRATION (%)	EMISSIONS REDUCTION (%)	TRANSFER PAYMENTS (10^6 $)	COMMENTS
1.81	10% each[a]	11%	20.	No reductions in car touch up paints.
2.27	15% each	14%	24.	No reductions in car touch up paints.
2.72	25% each	18%	28.	Car touch up paints assumed to use some high solids formulations.
3.18	35% each	26%	29.	
3.63	45% each	32%	30.	

[a] The penetration is for water/DME and HCFC-22/DME formulations.

As shown in the exhibit, it was assumed that high-solids paint formulations would penetrate into the car touch up market under the assumption that consumers shop for touch up paints differently because there would normally be only one supplier for each type of paint. Consequently, price comparisons are not made as readily, and high-solids formulations could more likely be marketed successfully.

The average social cost of PROC emissions avoided is about $1.25 per pound across all the cases shown in Exhibit 6-12. If high-solids paints are used as described in Exhibit 6-11, social costs are very small, less than $0.05 per pound, because high-solids paints are less costly per amount of paint delivered.

The results of imposing a PROC quota on spray paints should be similar to the results for a fee. Whether a high-solids paints are used will likely depend on changing consumer awareness. As with hair sprays, a quota system will not produce transfer payments, meaning that industry expenditures are lower as compared to a fee system.

6.2.3 Industry and Macroeconomic Impacts

The expenditures estimated above are large for the industries that are being affected. For example, even a $0.45 per pound ($1.00 per kilogram) fee on PROCs in hair sprays produces fee expenditures in excess of $10 million per year for industry. Larger fees, of course, produce larger expenditures.

The majority of these expenditures would be made by the product manufacturers. Given the types of products being sold, most of these costs will likely be passed on to consumers in the form of higher prices. Consequently, the impacts on consumers could be important.

Although the expenditures required to reduce PROC emissions under the various incentive systems would likely be passed on to consumers in the form of higher prices, it is useful to get a sense of the magnitude of the expenditures by comparing them to current industry profits. When compared to profits derived from product sales in California in this industry, these expenditures are quite large.

Annual sales in California by the manufacturers of hair sprays are on the order of $50 million per year. This estimate is computed as $0.85 per unit (see Chapter 3 above) times 58.7 million units of aerosol and non-aerosol hair sprays sold in California in 1987. This estimate is consistent with the most recent data available from the Census of Manufactures, which reports national value of products shipped of $372.5 million in 1987 for the estimated 488 million units, or about $0.76 per unit for aerosol hair sprays.

Return on revenues for firms in SIC code 284 (Soap, Detergents, and Cleaning Preparations; perfumes, Cosmetics, and Other Toilet Preparations) is estimated at about 5 percent. The median return on sales was obtained from Dun & Bradstreet Dunsprint Service, July 1989, for firms of all sizes in SIC Code 284. Data for 1986, 1987, and 1988 show median returns on sales ranging from 3.2 percent to 8.1 percent. The estimate for the largest firms (over $5 million in assets) was 5.3 percent for 1988.

Profits derived by hair spray manufacturers from hair spray sales in California, therefore are on the order of 5 percent of $50 million, or $2.5 million per year. The expenditures by manufacturers under fee-based incentives, even under the most modest assumptions, are many times this level of industry profit.

Relative to the total retail sales revenues of hair sprays in California (only a small fraction of which is obtained by the manufacturers), the expenditures by industry are still relatively large. Given that total retail sales are about 58.7 million units, and assuming an average retail sales price on the order of $2.50 per unit, total retail sales are on the order of $147 million per year. As described above, total expenditures by industry under a fee-based incentive system are estimated to vary from about $10 million per year to about $80 million per year. These levels of expenditures would be passed on to consumers and represent a potentially large fraction of the overall retail expenditures by consumers for these products.

Of note is that the expenditures and price impacts under the quota-based system are smaller because the transfer payments are avoided. Under the quota-based system, a given level of reduction in emissions can be achieved with expenditures by industry being much smaller than the expenditures anticipated with a fee-based system.

Despite the relatively large levels of expenditures anticipated under the fee-based system, reductions in demand for hair spray products are estimated to be fairly modest, less than 10 percent, because a demand elasticity of -0.2 was used. If demand is more elastic, larger reductions in product demand would be expected.

Small reductions in demand indicate that employment effects would likely be small. Nationally, the Census of Manufactures reports total employment of about 58,400 in SIC code 2844 (Perfumes, Cosmetics, and Toilet Preparations). If a 10 percent decline in sales translated into a 10 percent decline in employment, about 5,800 people would be affected nationwide. The number of employees affected in California would be a small fraction of total affected nationally.

Employment in manufacturing would not be anticipated to decline linearly with sales, so employment impacts would likely be smaller. Given that hair sprays are a small fraction of total consumer products, no significant employment effects are expected in other industries related to these products, including transportation, wholesale, distribution, and retail.

Given these small employment effects, it is very unlikely that significant macroeconomic effects would be experienced. Regional and local impacts should also not be significant because no region or location depends on these individual products to any large extent. As described above, the demand elasticity for hair sprays is not well quantified. If demand elasticities are large (i.e., if sales decline by a large amount when prices increase), then employment impacts could be larger than described here. However, it is unlikely that macroeconomic impacts would be large even if larger reductions in sales of hair sprays were experienced than are estimated here.

The conclusions for spray paints similar. If high-solids spray paints are introduced successfully, there should be no impact on the spray paint industry. In fact consumer demand could increase because the costs per amount of paint delivered would decline for the high-solids formulations. As described above, a consumer awareness program will likely be an important component of adopting this formulation.

If high-solids paints are not introduced as the primary means of reducing PROC emissions, industry expenditures will be large relative to industry profits and overall product revenues. Like with hair sprays, these expenditures will be passed on to consumers in the form of higher product prices. Nevertheless, the macroeconomic impacts will be very small.

Although the industry, macroeconomic and regional/local impacts are expected to be small for emissions reductions associated with these individual products, reducing emissions from a wide range of products could produce larger impacts. For example, if demand for all consumer aerosol products declines due to initiatives to reduce PROC emissions from these products, the aerosol filling industry could experience a large reduction in demand for their services. This situation could be similar to the situation that occurred when CFCs were banned from nonessential aerosol propellant applications in the late 1970s.

Although such impacts could be important, emissions reduction initiatives across a wide range of products would likely be required nationally to have large national or even regional impacts. If California and several other large states with air quality problems undertook to reduce PROC emissions from consumer products, the combined effect of such initiatives could produce shifts in formulations and packaging in a way that could produce employment effects in selected industries, such as the aerosol filling industry. The potential magnitude of these impacts cannot be quantified at this time.

7. SYNTHESIS AND RECOMMENDATIONS

The analyses in the previous chapters evaluate the potential to reduce PROC emissions from hair sprays and spray paints using fee-based and quota-based economic incentive systems. The analyses indicate that reductions in PROC emissions may be induced in both the hair spray and spray paint markets. Achieving large reductions in hair spray PROC emissions requires that HCFCs be made available for these products or that a new High H_2O No Alcohol formulation be accepted by consumers. Due to concerns that the HCFCs may contribute to stratospheric ozone depletion, their availability in the future is not assured.

Of note is that large transfer payments (government revenues) are anticipated under the fee systems. An allocated quota system that did not generate transfers would likely produce similar emissions reductions with reduced expenditures by industry as a whole. An equitable mechanism for allocating the quota is needed.

In the case of spray paints, the introduction of high-solids paints could reduce PROC emissions. However, the success of such an approach would likely require an effective consumer education program. The effectiveness of such a program cannot be determined at this time. Although a fee system could be used to raise funds to conduct such a program, the fee levels needed to raise adequate funds for the program would likely be very small. For example, a fee of $0.25 per pound of PROC in spray paints sold in California[51] would raise on the order of $3 million per year, which would likely be adequate for a consumer education program. Such small fees, however, would provide little or no incentive for modifying the formulations of spray paints.

If high-solids paints cannot be introduced significantly into the spray paints markets, water/DME and HCFC-22/DME based reformulations may be used to reduce emissions. The fees needed to make these options cost effective would be fairly large (over $1.80 per pound) resulting in large transfer payments from industry, and reductions in demand.

An important characteristic of the products analyzed is that there are uncertainties regarding the techniques for reducing PROC emissions and the level of emissions reduction that can be achieved. In the case of hair sprays several HCFC formulations may be possible, which could reduce PROC emissions by large amounts (by 30 percent or more). A new High H_2O No Alcohol formulation could reduce emissions by about 60 percent. Emissions reductions will not likely be as large if the water/DME formulation and alternative packaging are the primary technologies employed.

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[51] Such a fee amounts to about $0.10 per can of spray paint.

Similar uncertainties exist in the spray paints products. While high-solids paint formulations hold good promise, other alternatives may have to be relied upon in order to achieve emissions reductions.

These uncertainties can only partially be resolved over time through additional study. The adequacy of various formulations and emissions reduction opportunities must ultimately be tested in the marketplace. It is these uncertainties that make economic incentives a potentially useful mechanism for reducing emissions.

The advantage of using an economic incentives approach is that industry and consumers are provided with the maximum amount of flexibility for resolving these various uncertainties. The best technologies can be developed over time that are the most cost effective. While some technologies may not be as effective as believed today, others may come along that are even better. In the case of hair sprays again, an economic incentives approach allows alternative formulations and alternative packaging (such as Exxel, Growpak, and pump sprays) to compete on an equal basis. The most cost effective technologies that provide the product characteristics that are most valued by consumers will succeed.

Given this view that an important advantage of economic incentives is that they provide flexibility, to maximize the flexibility of industry and consumers to reduce emissions it would be preferred to cover a wide range of products under a single economic incentives umbrella. For example, rather than set up separate fees or quotas for each product, a single fee or quota system could be established for a group of products. If, for example, all personal care aerosol products were covered by a single quota system, the diversity of products would be fairly great. The opportunities for reducing emissions would vary (possibly significantly) from one product to the next, and would likely be numerous. Over time some opportunities for reducing emissions would be realized, while other opportunities are not. By covering a wide range of products the system automatically allocates emissions reductions over time as technologies develop.

This approach is analogous to the approach recently taken by the U.S. EPA in its control of CFCs. A quota has been set on the production and consumption of CFCs, which are used in a very broad range of products in the U.S. and around the world. Individual controls for selected products have not been required. The result is that a wide range of opportunities for reducing CFC use has been developed. Some product areas have found inexpensive avenues for making large reductions, while others have made little or no progress in reducing CFC use. The overall umbrella approach enables CFCs to be used in the most cost effective manner possible over time as progress is made.

A similar result would be anticipated if an umbrella approach were taken for implementing a quota on PROC emissions from consumer products. By covering a wide range of products, the rule would limit the risks associated with individual emissions reduction technologies not working out. By limiting these risks, the likelihood of inadvertently imposing large costs on industry and consumers is minimized.

The analysis of spray paints presented above also indicates that economic incentives are not always sufficient for promoting emissions reduction. In this case it appears that consumer education would be an important companion to an economic incentives program. Coordinated testing of alternative compounds and/or setting standards are also potentially important companion programs for some products.

Given the analyses of the two products presented above, and these perspectives on the value of economic incentives for reducing PROC emissions, the following is recommended:

- Several groups of products should be defined as candidates for economic incentive programs. Possible groups could include: personal care products; household products; automotive/industrial products; pesticide products; and miscellaneous products.

- For each group of products defined above, the potential range of emissions reduction that could be achieved under various assumptions should be assessed. The barriers that must be overcome to realize these emissions reduction should be identified.

- For each group of products defined above, the number of manufacturers that would potentially be affected by an economic incentives program should be estimated.

- Based on these assessments, an economic incentives program to reduce PROC emissions from each of the individual groups of products should be defined. Because an allocated quota system appears to produce smaller impacts than would a fee system, a quota system should be designed as part of this process. Additionally, if innovative fee systems can be identified that do not produce unreasonable levels of revenues, they should also be considered.

- If non-cost market barriers exist that will prevent the timely introduction of PROC emission-reducing technologies, strategies for overcoming these barriers should be defined as companions to the economic incentive system.

APPENDIX A

MARKETERS/MANUFACTURERS OF HAIR SPRAY AND SPRAY PAINT PRODUCTS IN CALIFORNIA

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APPENDIX A

MARKETERS/MANUFACTURERS OF HAIR SPRAY AND SPRAY PAINT PRODUCTS IN CALIFORNIA[1]

Altawood Inc. 18924 S. Broadway Gardena, CA 90248 (213) 321-0582	spray paints
Behr Process Corp. 3400 W. Segerstrom Ave. Santa Ana, CA 92704 (714) 545-7101	spray paints
California Custom Accessories Manufacturing Co. 23011 S. Wilmington Ave. Carson, CA 90745 (213) 775-8621	spray paints
Colonial Dames Co., Inc. 6820 East Watcher St. Commerce, CA 90022 (213) 773-6441	hair products
Deft Inc. 17451 Von Karman Ave. Irvine, CA 92714 (714) 474-0400	spray paints
Flecto Co., Inc. P.O. Box 12955 Oakland, CA 94604 (415) 655-2470	spray paints
Image Laboratories 721 South San Pedro Los Angeles, CA 90014 (213) 623-9254	hair spray

[1] Includes national, regional, and local firms with operations in California. National marketers that distribute to California, but that do not have manufacturing facilities in California are not included.

Jhirmack Enterprises, Inc. 4350 Caterpillar Road Redding, CA 96003 (916) 246-2100	hair spray
Max Factor & Co. 1655 N. McCadden Place Hollywood, CA 90028 (213) 856-6000	hair spray
Merle Norman Cosmetics 9130 Bellanca Ave. Los Angeles, CA 90045 (213) 641-3000	hair spray
Met-L-Chek Co. 1639 Euclid St. Santa Monica, CA 90404 (213) 450-1111	spray paints
National Aerosol Products, Co. Division of Grow Group 2193 E. 14th St. Los Angeles, CA 90021 (213) 627-2668	spray paints
Pactra Industries, Inc. 420 S. 11th Ave. P.O. Box 280 Upland, CA 91786 (714) 946-3871	spray paints
Redken Laboratories 6625 Variel Ave. Canoga Park, CA 91303 (818) 992-2700	hair spray
San Leandro Color 555 East 14th St. San Leandro, CA 94577 (415) 569-8236	spray paints
Sebastion International 6109 De Soto Ave. Woodland Hills, CA 91367 (818) 999-5112	hair spray

Standard Brands Paint Co. 4300 W. 190th St. Torrance, CA 90509 (213) 542-5901	spray paints
Trail Chemical Corp. 9904 Gidley St. El Monte, CA 91731	spray paints
Zynolyte Products Co. Subsidiary of Standard Brands Paint Co. 2320 E. Dominguez St. Carson, CA 90749 (213) 513-0700	spray paints

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APPENDIX B

HAIR SPRAY AND SPRAY PAINT AEROSOL FILLERS IN CALIFORNIA

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APPENDIX B

HAIR SPRAY AND SPRAY PAINT AEROSOL FILLERS IN CALIFORNIA

Aerosol Paint Packaging, Inc. 4730 Astoria Circle Anaheim, CA 92807 (714) 998-4676	spray paints
Aerosol Services Company, Inc. 425 S. Ninth Ave. City of Industry, CA 91746 (818) 968-8531	hair spray
National Aerosol Products Co. (Division of Grow Group, Inc.) 2193 E. 14th St. Los Angeles, CA 90021 (213) 627-2668	spray paints
Shield Aerosol Co. of California 5165 G Street Chino, CA 91710 (714) 628-4707	spray paints and hair spray
Sprayon Products Division The Sherwin-Williams Co. 3818 E. Coronado St. Anaheim, CA 92807 (714) 630-1400	spray paints
Sun Labs 9151 Mason Ave. Chatsworth, CA 91311 (818) 709-7777	hair spray
Zynolyte Products Co. Subsidiary of Standard Brands Paint Co. 2320 E. Dominguez St. Carson, CA 90749 (213) 513-0700	spray paints

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APPENDIX C

HAIR SPRAY AND SPRAY PAINT DISTRIBUTORS IN CALIFORNIA

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APPENDIX C

HAIR SPRAY AND SPRAY PAINT DISTRIBUTORS IN CALIFORNIA

Aerosol Services, Inc.	City of Industry	hair spray
Altawood, Inc.	Gardenia	spray paints
Amway	Orange	utlity/personal products
Armor-all Division	Irvine	spray paints
Behr Process Corporation	Santa Ana	spray paints
California Custom Accessories	Carson	spray paints
California Hardware	City of Industry	spray paints
Carter-Wallace	Obispo Beach	personal care products
Champion's Choice, Inc.	Anaheim	spray paints
Colonial Dames Company	City of Commerce	hair spray
Deft, Inc.	Irvine	spray paints
Duart Manufacturing Company	San Francisco	hair spray
Flecto Company, Inc.	Oakland	spray paints
Image Laboratories, Inc.	Los Angeles	hair spray
Orb Industries, Inc.	Upland	spray paints
Pactra Industries, Inc.	Upland	spray paints
Redken Laboratories, Inc.	Canoga Park	hair spray
San Leandro Color	San Leandro	spray paints

Standard Brands Paint Company	Torrence	spray paints
E.A. Thompson Company Inc.	San Francisco	spray paints
Trail Chemical Corporation	El Monte	spray paints
Zynolyte Products Company	Carson	spray paints

APPENDIX D

DISCUSSION OF AVERAGE AND LARGEST CAN SIZES

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APPENDIX D

DISCUSSION OF AVERAGE AND LARGEST CAN SIZES

The computation of PROC emissions from hair sprays and spray paints sold in California is sensitive to the estimate of the sizes of the cans that are sold. For this analysis, both average and largest (or upper bound) can sizes are used. For aerosol hair sprays and spray paints, can sizes vary over a range of 3 to 13 weight ounces. Based on production volume data from Johnsen (1987a, 1987b), average can sizes were determined as a weighted average value. Because there are limited data on typical can sizes[1] and actual can size market shares, these estimated weighted averages provided by this industry source are considered the best available information.

One factor that must be taken into consideration with can size is the extra space required for overfill. Overfill ensures that the consumer gets the declared weight of product out of the can and permits the packager to meet the specifications given on the label. Thus, the true can size consists of the declared net weight plus the required overfill.[2] The overfill is size- and product-specific. For example, a 3 ounce spray paint can may require an overfill of 0.15 ounces, whereas an 8 ounce can may require an overfill of 0.20 ounces. These values also depend on the product -- more specifically, on the density of a given formulation.

Due to the difficulties in accurately defining predominant or average can sizes, upper bound can sizes are included to compute upper bound PROC emission estimates. The upper bound can size is defined in this study as the mid-point between the largest can size commercially available and the weighted average can size provided by Johnsen (1987b). Two basic considerations guide this approach in determining an upper bound can size. First, if the weighted average can size is underestimated, the true average is likely to be placed below the maximum can size. Second, certain product

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[1] There are usually no "typical" can sizes for a given product type or for individual marketers. There are many companies that package their aerosol products in numerous can sizes. Therefore, determining the typical size, without sales volume data from each marketer (by can size), is not possible.

[2] It should be noted that assuming the aerosol is fully used, the small amount of product that still remains in the can represents the overfill. Johnsen (1989) reports that these disposed cans are normally crushed, releasing the small amount of remaining product. The can size (i.e., including overfill) is used in calculating PROC emissions from spray paints, since all of the contents are eventually released to the atmosphere. Data on overfill rates for hair sprays are currently not available.

categories have a wider range of can sizes than others and, presumably, the standard deviation from the reported average size will be higher for these products (e.g., spray paints). Compared to an arbitrary percent increase from the average can size (e.g., plus or minus 25 percent), the approach used in this study accounts for the actual range of can sizes available in the market.

Aerosol Coatings

For aerosol coatings, the average can size was determined to be 8.1 ounces. Johnsen (1987a, 1987b) states that without accounting for overfill, 40 percent of aerosol coating cans are 3 ounces, 10 percent are 8 ounces, and 50 percent are 10 to 13.5 ounces (or an average of 11.75 ounces). These typical sizes, i.e., 3, 8, and 11.75 ounces, are adjusted to account for the overfill by adding in 0.15, 0.20, and 0.25 ounces, respectively. Thus, the weighted average is determined to be approximately 8.1 ounces as follows:

40% of 3.15 ounces	= 1.26
10% of 8.20 ounces	= 0.82
50% of 12.00 ounces	= 6.00
Average Fill	= 8.08

It is important to note that 3-ounce cans are widely used in this market (Johnsen 1987b):

- The 3-ounce can is the most common size used for automobile touch-up work. These enamels come in approximately one thousand different colors. Few people will buy a large 12-ounce can just to cover a scratch on a painted surface. Additionally, the large cans are only available in a limited array of colors.

- Most of the major automobile dealers, supply stores, and body shops sell 3-ounce cans for touch-up work. These firms are supplied by distributors. Supermarkets and other general stores, however, tend to carry the larger sizes only.

As previously mentioned, there are no "typical" can sizes for specific product categories, nor are there typical sizes for individual marketers. New York Bronze, for example, markets no less than eight can sizes (Johnsen 1987b).

For aerosol coatings the upper bound can size is estimated at 10.1, i.e., the mid-point between the average can size of 8.1 and the maximum size of 12 ounces.

Hair Sprays

For aerosol hair sprays the weighted average can size of 8.3 ounces is computed based on the can sizes and market shares of the 10 most popular brands (see Section 3 in the main body of the text). Data are currently not available on the amount of overfill used in aerosol hair sprays. The upper bound estimate of 9.7 ounces is computed as the mid-point between 8.3 and the largest prevalent can size of 11 ounces.

For pump hair sprays, an estimate of average container size of 6.3 ounces is used (Johnsen 1989). An upper bound estimate of 7 ounces is used to determine upper bound emission estimates.

REFERENCES

Johnsen, M. A. 1987a. Aerosol Chlorinated Solvent Market Survey, by Monfort A. Johnsen commissioned by ICF Inc., July 1987.

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APPENDIX E

CALCULATIONS FOR CORRECTED RATIO OF AEROSOL/PUMP PROC APPLICATION RATES

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APPENDIX E

CALCULATIONS FOR CORRECTED RATIO OF AEROSOL/PUMP PROC APPLICATION RATES

Female Adult Aerosol

Weight Used (grams)	PROC %	Total PROC Used (grams)
256	98.1	251.136
61.5	98.1	60.3315
180.2	98.1	176.7762
86.4	95.4	82.4256
7.8	97.5	7.605
73.8	97.5	71.955
30	98	29.4
62.8	98	61.544
103.7	98	101.626
145.9	98	142.982
153.7	98	150.626
16.7	97	16.199
18.2	97	17.654
23.2	97	22.504
30.1	97	29.197
47.1	97	45.687
106.1	98	103.978
124.4	97	120.668
171.3	97	166.161
85	94.6	80.41
76.7	98.4	75.4728
69.1	90.8	62.7428
80.6	90.8	73.1848
193	90.8	175.244
11.6	89.2	10.3472
39.4	89.2	35.1448
43.8	89.2	39.0696
49.7	89.2	44.3324
55.4	89.2	49.4168
12.1	98.1	11.8701
33.2	98.1	32.5692
48	98.1	47.088
51.1	98.1	50.1291
52.4	98.1	51.4044
52.8	98.1	51.7968
99.3	98.1	97.4133
37.8	98.1	37.0818
40.1	98.1	39.3381
104.6	98.1	102.6126
217.2	98.1	213.0732
27.5	95.1	26.1525
29.6	95.1	28.1496
81.2	96.7	78.5204

Female Adult Pump

Weight Used (grams)	PROC %	Total PROC Used (grams)
1.7	89.3	1.5181
7.9	89.3	7.0547
12.3	89.3	10.9839
32.8	89.3	29.2904
43	89.3	38.399
115.2	89.3	102.8736
8.8	89.2	7.8496
32.7	89.2	29.1684
41.7	89.2	37.1964
53.3	89.2	47.5436
70.7	89.2	63.0644
94	89.2	83.848
181.2	89.2	161.6304
34.8	95.5	33.234
38.8	86.5	33.562
146	86.5	126.29
10.9	90.5	9.8645
128.7	90.5	116.4735
200.1	90.5	181.0905
12.7	90.1	11.4427
58.5	90.1	52.7085
64	94.3	60.352
13.2	94.3	12.4476
20.5	94.3	19.3315
26.1	94.3	24.6123
31.5	94.3	29.7045
41.2	94.3	38.8516
46.3	94.3	43.6609
59.7	94.3	56.2971
60.6	94.3	57.1458
11.7	94.9	11.1033
28.2	94.9	26.7618
28.6	94.9	27.1414
57.5	94.9	54.5675
77.4	94.9	73.4526
87.2	94.9	82.7528
92.8	94.9	88.0672
135.3	94.9	128.3997
27.6	90.7	25.0332
32.9	90.7	29.8403
58	90.7	52.606
58.9	90.7	53.4223
69.3	90.7	62.8551

Female Adult Aerosol

Weight Used (grams)	PROC %	Total PROC Used (grams)
63.4	96.7	61.3078
74	96.7	71.558
81.3	96.7	78.6171
89.1	96.7	86.1597
108.4	96.7	104.8228
5.4	94.6	5.1084
10.5	94.6	9.933
14.7	94.6	13.9062
135.1	94.6	127.8046
71.7	93.5	67.0395
171.6	93.5	160.446
178.1	93.5	166.5235
9.1	97.5	8.8725
49.1	97.5	47.8725
142.9	97.5	139.3275
26.4	95.2	25.1328
31.5	95.2	29.988
59.5	95.2	56.644
62.4	95.2	59.4048
108.9	95.2	103.6728
14	94.7	13.258
16.8	97.4	16.3632
26.8	97.4	26.1032
26.9	97.4	26.2006
29.8	97.4	29.0252
48.3	97.4	47.0442
50	97.4	48.7
68	97.4	66.232
110.6	97.4	107.7244
176.3	97.4	171.7162
16.7	96.2	16.0654
24.5	96.2	23.569
78.3	96.2	75.3246
123.2	96.2	118.5184
154.3	96.2	148.4366
30.4	97.5	29.64
58.6	97.5	57.135
119.1	97.5	116.1225
35.7	92.9	33.1653
49.2	92.9	45.7068
83.3	92.9	77.3857
88.4	92.9	82.1236
96.8	92.9	89.9272

Female Adult Pump

Weight Used (grams)	PROC %	Total PROC Used (grams)
8.5	91.9	7.8115
259.3	91.9	238.2967
182.4	88.8	161.9712
23.7	88.8	21.0456
201.1	88.8	178.5768
9.6	92.3	8.8608
16.6	92.3	15.3218
88	92.3	81.224
105	92.3	96.915
14.9	89.9	13.3951
50.9	89.9	45.7591
63.4	89.9	56.9966
87.4	89.9	78.5726
97.9	89.9	88.0121
46.1	92.6	42.6886
69.7	88.3	61.5451
11.6	93.9	10.8924
24.6	93.9	23.0994
26.3	93.9	24.6957
27.8	93.9	26.1042
31.3	93.9	29.3907
47.3	93.9	44.4147
58.6	93.9	55.0254
115.4	93.9	108.3606
12.5	92.8	11.6
38.9	92.8	36.0992
50.2	92.8	46.5856
75.1	92.8	69.6928
12.2	92.8	11.3216
32.6	92.8	30.2528
52.2	92.8	48.4416
196.6	92.8	182.4448
202.4	92.8	187.8272
25.1	94	23.594
33.4	86.5	28.891
62.1	94.5	58.6845
31.4	96.9	30.4266
40.7	96.9	39.4383
50.4	96.9	48.8376
63.3	93.8	59.3754
299	93.8	280.462
171.2	87.8	150.3136
173.5	87.8	152.333

Female Adult Aerosol

Weight Used (grams)	PROC %	Total PROC Used (grams)
106.7	92.9	99.1243
151.2	92.9	140.4648
13.8	97.8	13.4964
171.6	95.9	164.5644
25.7	96.6	24.8262
43.4	96.6	41.9244
73.5	96.3	70.7805
205.2	96.3	197.6076
8.7	98.8	8.5956
32.6	98.8	32.2088
36.7	98.8	36.2596
39.7	98.8	39.2236
39.8	98.8	39.3224
45.1	98.8	44.5588
46.2	98.8	45.6456
19.3	96.8	18.6824
19.8	96.8	19.1664
41.6	96.8	40.2688
42.2	96.8	40.8496
42.8	96.8	41.4304
60.4	96.8	58.4672
78.6	96.8	76.0848
123.5	96.8	119.548
125.8	96.8	121.7744
10.8	95.7	10.3356
13	95.7	12.441
15.6	95.7	14.9292
22.3	95.7	21.3411
30.5	95.7	29.1885
37.9	95.7	36.2703
45.4	95.7	43.4478
51.1	95.7	48.9027
58.1	95.7	55.6017
58.7	95.7	56.1759
76.4	95.7	73.1148
78.8	95.7	75.4116
102.8	95.7	98.3796
106.2	95.7	101.6334
113.6	95.7	108.7152
114.3	95.7	109.3851
118.2	95.7	113.1174
155.7	95.7	149.0049
167.6	95.7	160.3932

Female Adult Pump

Weight Used (grams)	PROC %	Total PROC Used (grams)
40.1	87.5	35.0875
15.5	89.3	13.8415
40.5	89.3	36.1665
7.2	96.8	6.9696
7.7	96.8	7.4536
15.4	96.8	14.9072
16.5	96.8	15.972
20	96.8	19.36
32.4	96.8	31.3632
33	96.8	31.944
46.5	96.8	45.012
125.3	96.8	121.2904
4.1	96.9	3.9729
26	96.9	25.194
43.8	96.9	42.4422
52.1	96.9	50.4849
58	96.9	56.202
64.3	96.9	62.3067
96.4	96.9	93.4116
2.8	77.3	2.1644
11.4	77.3	8.8122
20.3	77.3	15.6919
27.1	77.3	20.9483
30.2	77.3	23.3446
39.7	77.3	30.6881
41	77.3	31.693
42.1	77.3	32.5433
43.8	77.3	33.8574
47.5	77.3	36.7175
71.4	77.3	55.1922
76.2	77.3	58.9026
99.8	77.3	77.1454
163.2	77.3	126.1536
23.1	0	0
41.7	0	0
52.1	0	0
52.6	0	0
60	0	0
62.5	0	0
66.9	0	0
108.7	0	0
141.8	0	0
211	0	0

	Female Adult Aerosol			Female Adult Pump		
	Weight Used (grams)	PROC %	Total PROC Used (grams)	Weight Used (grams)	PROC %	Total PROC Used (grams)
	200.4	95.7	191.7828	13.3	91.8	12.2094
	225.9	95.7	216.1863	29.4	91.8	26.9892
	239.7	95.7	229.3929	40	91.8	36.72
	7.8	97.6	7.6128	47	91.8	43.146
	28.2	97.6	27.5232	71.5	91.8	65.637
	47.4	97.6	46.2624	122.8	91.8	112.7304
	152.5	97.6	148.84	93.8	0.0	0.0
	47.7	96	45.792	48.0	0.0	0.0
	99.8	96	95.808	20.2	87.7	17.7154
	28.3	96.8	27.3944	50.7	87.7	44.4639
	29.4	96.8	28.4592	46.8	87.7	41.0436
	93.8	96.8	90.7984	45.7	94.7	43.2779
	25.5	97.5	24.8625	62.1	94.7	58.8087
	44.5	97.5	43.3875	155.4	94.7	147.1638
	140	97.5	136.5	9.4	94.7	8.9018
	68.4	94.4	64.5696	24.9	94.7	23.5803
	32.6	97.6	31.8176	21.8	94.7	20.6446
	136.7	97.6	133.4192	41.3	94.7	39.1111
	98	94.4	92.512	75.8	87	65.946
	29.9	94.4	28.2256	41	91.4	37.474
	64.4	94.4	60.7936	52	91.4	47.528
	131.3	94.4	123.9472	31.4	88.9	27.9146
	174.2	94.4	164.4448	82.9	88.9	73.6981
	10.6	97.5	10.335	88.1	88.9	78.3209
	40	97.5	39			
	56.3	96.5	54.3295			
	98.2	96.5	94.763			
Total	11631.6		11172.1	8379.3		7599.4
Average per User	74.6	96.1	71.6	59.4	90.9	53.9
Sample Size		156			141	

PROC RATIO AEROSOL/PUMP (ADJUSTED FOR SAMPLE SIZE)= 1.33

APPENDIX F

FRAMEWORK AND METHOD FOR ESTIMATING COSTS OF REDUCING THE USE OF PROC COMPOUNDS IN CALIFORNIA

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APPENDIX F

FRAMEWORK AND METHOD FOR ESTIMATING COSTS OF REDUCING THE USE OF PROC COMPOUNDS IN CALIFORNIA

This appendix describes the analytical framework and methods used to estimate the costs of reducing the use of photochemically reactive organic compounds (PROC) in consumer products sold in California. The emphasis of the approach is on estimating the net social costs of reducing the use of the compounds. An essential step in estimating these social costs is assessing potential industry responses to incentives which would be implemented to achieve the desired reductions. This assessment, in turn, calls for estimates of the private costs faced by the affected industries of complying with the regulations. Hence, the approach employed provides estimates of both private and social costs.

The framework for estimating social costs essentially consists of measuring the changes in consumer surplus in the markets for products that contain PROCs. This appendix is organized as follows:

- Section 1 discusses the conceptual approach for estimating social and private costs in response to economic incentives (fees and quotas).
- Section 2 describes the methods used to estimate the costs.
- Section 3 discusses some of the inherent limitations of the analytic methods used.

1. CONCEPTUAL APPROACH FOR ESTIMATING REGULATORY COSTS

This section discusses the economic theory that underlies the approach used to estimate the private and social costs of regulations that restrict the use of PROCs in consumer products. The basic method for estimating costs is to measure changes in producer and consumer surplus in the relevant markets that result from the implementation of incentives for reducing PROC emissions.

The section initially identifies the relevant markets and characterizes the supply and demand schedules that underlie them. The section then turns to the issue of measuring changes in producer and consumer surplus in these markets due to exogenously imposed incentives for reducing PROC emissions. The section ends with a discussion of the differences between private and social costs.

1.1 Affected Parties and Relevant Markets

To analyze the costs of the proposed incentives it is necessary, first, to identify the parties that are likely to be significantly affected by the incentives and the markets in which the changes in the welfare of these parties can be measured.

The parties likely to be affected by the incentives are:

- firms that produce PROCs;
- owners of factors employed in the production of PROCs;
- firms that use PROCs in the production of PROC-containing consumer products;
- owners of factors employed in the production of PROC-containing consumer products; and
- final consumers of goods manufactured using PROCs.

For this analysis it is assumed that incentives for reducing PROC emissions from consumer products in California do not have important impacts on the overall markets for the production of PROCs.[1] Therefore, the impacts to be estimated are focused in the firms that produce PROC-containing consumer products and the final consumers of those products.

1.2 Estimating Consumer and Producer Surplus Changes

Consumer surplus is a measure of the difference between what consumers are willing to pay for a good and what they have to pay for it. As such, it indicates the net gain to consumers of being able to buy all units of the good at the prevailing price. In graphical terms, consumer surplus is given by the area under a demand curve above the price line.

Producer surplus is a measure of the difference between the price firms received for their output and the price at which they are willing to supply the output. Thus, it is a measure of the net gains to firms of being able to sell all of their output at the prevailing price. In graphical terms, the aggregate producer surplus of a competitive industry is given by the area above the industry's supply curve under the price line.

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[1] Specifically, the assumption is that the reductions in PROC use in consumer products in California does not change the price of PROCs in the market for PROCs. Under this "unchanged PROC price" assumption, there are no welfare impacts in the PROC market, even though total quantities of PROCs produced and consumed may change.

Exhibit F-1 shows graphically the changes in producer and consumer surplus quantities that are being estimated for this analysis. The exhibit shows quantity consumed on the horizontal axis (e.g., the number of hair spray cans sold in California in a year) and the price per unit on the vertical axis (e.g., the price per can of hair spray). The initial situation is described by the point A in the exhibit, which shows Q_0 units consumed at a price of P^0. In response to the economic incentives, the cost of producing the product increases and the new situation is described by point B.

When going from A to B consumer surplus in this market falls by an amount equal to the rectangular area D+E. The change in producer surplus is equal to the difference between the lower triangular area F+G and the upper triangular area D+F; this difference is area G-D. If the higher PROC price simply results in a parallel shift in the output supply curve, and if total quantity consumed does not change, area D is equal to area G and there is no change in producer surplus.

The net change in the sum of producer and consumer surpluses is equal to area D+E plus area G-D, which is areas E+G. Thus, the cost is driven by the shift in the supply curve.

To evaluate these quantities shown in the exhibit, data were collected on the manner in which the supply curve for consumer products produced with PROCs would shift in response to economic incentives. Such a shift is a change in the costs of producing the products associated with changing the product formulations and/or making capital expenditures and one-time expenditures. As the supply curve shifts in response to the incentives, the quantity of PROC emissions also changes.

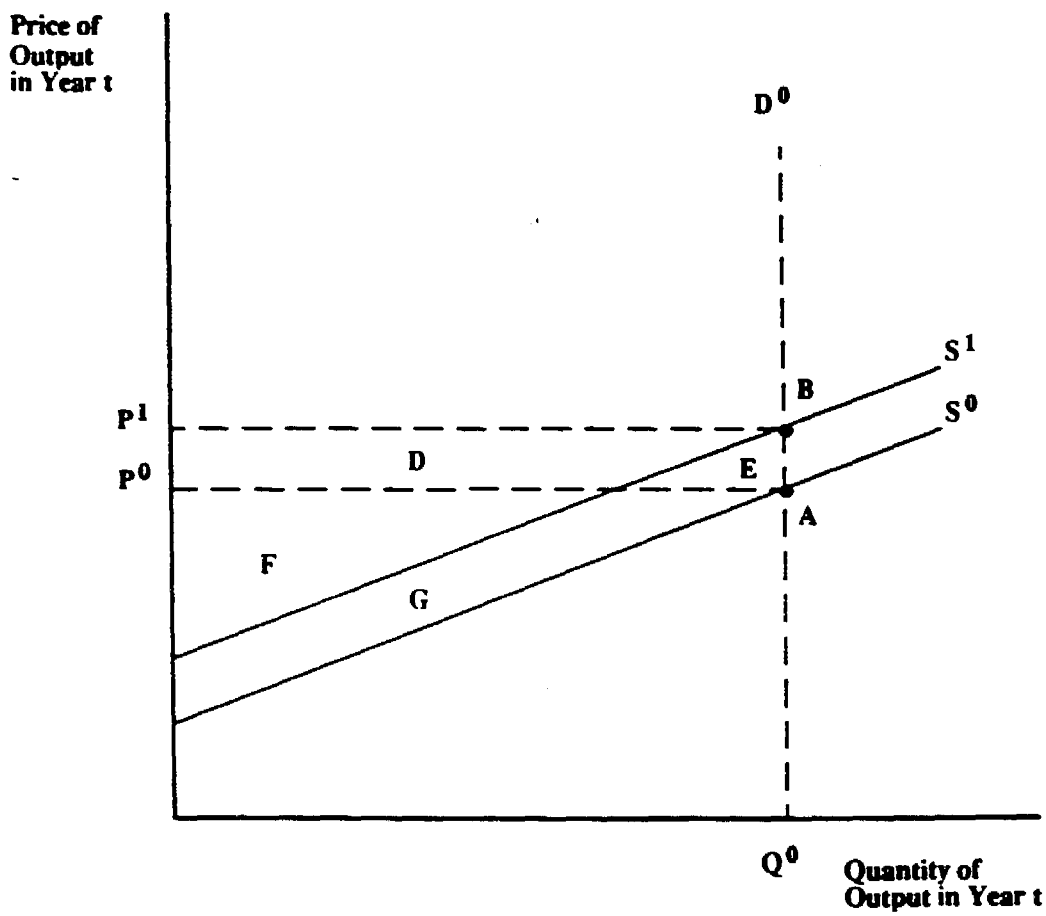
To evaluate these shifts, a series of discrete technical options for reducing PROC emissions were defined. These options primarily include product reformulations, although product substitutes are also possible. Under various incentives, manufacturers are assumed to switch to these various technical options to various extents, thereby shifting their supply curves. For purposes of this analysis, these shifts are evaluated as discrete jumps (i.e., from current formulations to new formulations).

The assumptions regarding the extent to which various switches take place are driven by estimates of the private costs of making the switches. The private costs represent the costs faced by manufacturers. In general, the least cost alternatives (given the incentives provided) are assumed to be implemented. Limits on the use of some technologies (principally alternative packaging) are assumed.

To evaluate an incentive fee, the switches that cost less than the fee are assumed to take place to various extents. To make this assessment, the cost of each technical option is evaluate in terms of its cost per kilogram

EXHIBIT F-1

CHANGES IN CONSUMER AND PRODUCER SURPLUS



of PROC emissions avoided. This cost can then be compared to the fee to assess whether it is cost effective to implement the technical option from the perspective of a manufacturer.

The extent to which the various options are undertaken in response to an incentive fee is also influenced by the fee that must be paid on the remaining PROC emissions. This fee payment results in a transfer of resources from the manufacturers to the fee collection agency. As such the transfer is not a real resource cost to society, although it is a cost incurred by manufacturers that will influence their response to the incentive fee.

Once the technical options that will be undertaken are identified, the costs are estimated in terms of the areas in the exhibit described above. The shift in the supply curve is evaluated in terms of an increase in the cost of manufacturing the product. The costs incurred by manufacturers includes the costs of the technical options and the fee payments. The change in consumer surplus is associated with the increase in the price of the products and changes in quantity consumed. The net cost to society is equal to the lost consumer surplus minus the transfer payments in the form of fees paid.

A similar method is used to evaluate a quota system. In this case no fee is paid (the quota is allocated to manufacturers). The least cost options for reducing PROC emissions are assumed to be undertaken to various extents, and although no fee is paid, the mix of options undertaken is very similar in both the fee and quota systems. The costs incurred by manufacturers and the lost consumer surplus are estimated in a similar manner as with the fee incentive system.

1.3 Social Versus Private Costs

In the discussion thus far, no distinction has been made between the private costs of undertaking an action to reduce PROC use and the social costs of such an action. The distinction is unnecessary if private and social costs are identical. However, there are two reasons why the two costs measures diverge:

- o industry is concerned with profits after taxes (absent exogenous forces) while society is concerned with total returns including taxes, and

- o the private discount rate exceeds the social discount rate.

The first factor implies that social costs exceed private costs if the costs of reducing PROC emissions incurred by a firm is partially offset by tax effects (e.g., tax deductions). The second factor implies relatively higher private costs because the amortized value of capital expenditures increases with a higher discount rate.

Because the primary purpose of the cost analysis described in this appendix is to determine the social costs of the proposed regulations, the relevant cost measure is the social one. Thus, the final cost estimates are based on the real before-tax costs of industry responses to the proposed incentives. However, to assess potential industry responses, private costs are the relevant measure because they determine the choice of control options by PROC-using firms. In evaluating alternative control options, these firms will compare the private (rather than the social) costs of the options.

For purposes of this analysis, a social discount rate of two percent is used. A private, pre-tax real discount rate of six percent is used, along with a total marginal tax rate of 44 percent.

2. METHODS USED TO ESTIMATE COSTS

This section describes the manner in which the framework presented above was implemented to estimate the social and private costs of incentive systems for reducing PROC emissions from consumer products in California. To compute the social and private costs the following seven steps were performed for each product analyzed (hair sprays and spray paints):

1. Divide the Product into Segments. Each product was divided into market segments that become the basis for the analysis. Each major product formulation is treated as a separate segment. Additionally, pump hair sprays were treated separately from aerosol hair sprays because their responses to the incentives would be different. Car touch-up spray paints were similarly separated out as a separate market.

2. Identify Control Options for Each Product Segment. A range of control options was identified for each product. The options were evaluated separately for each product segment as applicable. For each of the control options the potential cost of undertaking the control and the influence that the control may have on PROC emissions was defined. Costs were estimated in terms of capital costs, one-time reformulation expenditures, and ingredient costs.

3. Estimate PROC Emissions Reductions Achievable with Each Control Option. The reduction in PROC emissions that can be achieved if the control option were implemented was estimated for each control individually, using the 1987 pattern of emissions as a base.

4. Estimate Annualized Costs of the Control Options. Social and private annualized costs of the control options were estimated from the cost data developed. One-time costs (such as capital costs) were converted into equivalent annual costs using a

standard annualization factor. The annualized costs were expressed in terms of dollars per kilogram of PROC emissions avoided by dividing the annualized cost estimate by the number of kilograms of PROC emissions that are avoided by implementing the control. Again the 1987 pattern of emissions was used as a base.

5. Select the Candidate Control Options and their Extent of Use. Based on the annualized costs per kilogram estimated above, the control options anticipated to be implemented in response to the economic incentives were identified. The extent to which the controls would be implemented were estimated based on judgment, taking into consideration the relative costs of the alternatives.

6. Revise the Cost Estimates based on the Extent of Implementation. Based on the extent of implementation developed above, the cost estimates were adjusted. In particular, cost estimates per kilogram of PROC emissions avoided increase when the number of units of production over which capital costs and one-time costs are spread is reduced. Based on these revised costs, the extent of implementation of the various options may be revised.

7. Estimate Private and Social Costs. The social and private costs of various economic incentives were computed by summing the costs across all the control options implemented in each of the product segments.

These estimates were made for each of the economic incentives evaluated. Under fee systems, the evaluation is performed for each fee level. For a quota system, the evaluation is performed for each quota level.

The key steps in this evaluation are the estimates of the emissions reductions and the annualized costs of the controls. Each is discussed in turn.

2.1 Emissions Reduction Estimates

The emissions reduction achievable with each control option was estimated by comparing the emissions per unit anticipated with the control to emissions per unit estimated for each of the product segments. For example, DME/water hair spray formulations were assumed to replace existing hair spray formulations on a one-to-one basis. In this case the emissions reduction per unit is driven by the differences in the PROC contents of the formulations. The total emissions reduction is estimated as the reduction per unit times the number of units that use the new formulation. The number of units that use the new formulation is driven by the extent to which the new formulation is expected to be implemented.

The emissions reduction can also be influenced by differences in the manner in which the products are used. For example, high-solids spray paint formulations have lower PROC contents than current spray paint formulations. This lower PROC content of the formula contributes to reductions in emissions. However, the more important factor driving emissions reductions in this case is that high-solids spray paint formulations cover more area per unit of product than do current formulations. Consequently, fewer units of spray paint are required to meet the same consumer need. The per unit emissions reduction is therefore driven by both the characteristics of the formulation and the manner in which the substitute formulation compares to the existing formulation. The total emissions reduction is again driven by the extent to which high-solids spray-paint formulations are used.

2.2 Annualized Costs Estimates

For each control option, both social and private annualized costs were estimated. These annualized costs reflect the capital, operating, and other costs that are incurred when the control is undertaken. These costs are based on engineering estimates and are defined as the costs that are incremental relative to continuing to manufacture and use the PROC-containing products in their current forms. The social costs reflect the total resource costs to society, and the private costs reflect the costs faced by firms, including appropriate adjustments for tax liabilities and costs of capital.

To enable the controls options to be compared and analyzed in relation to a policy of restricting the emissions of PROCs, the annualized costs are expressed on a per kilogram of emissions avoided basis. This "per kilogram" estimate is made by dividing the annualized cost of undertaking the control by the amount of PROC emissions that may be reduced by the control. The resulting value (based on private costs) is taken as an indication of the increase in the price of PROCs that would be required in order for firms to be indifferent between undertaking the control or continuing to use the PROCs in their products. If the price of the PROCs exceeds this annualized value, the firm would be better off to reduce its use of PROC and undertake the control. Consequently, the cost estimates are designed to be used in the analysis framework described in the previous section, where economic incentives are used to promote reductions in PROC emissions.

The following types of costs were obtained (where applicable) for each control possibility:[2]

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[2] Not all of these cost categories apply to all of the controls. Some chemical substitutes, for example, can be used without additional capital investment.

- capital costs -- such as the acquisition cost of equipment required to convert filling lines to use substitute chemicals. Capital costs are one-time costs that are subject to depreciation.
- non-recurring costs -- transitional, one-time costs such as research and development, reformulation, or training required to implement a control. For purposes of computing private annualized costs, non-recurring costs were considered not to be depreciable.
- annual operating costs -- incremental materials, and labor required to implement the control. In this analysis these costs are the costs of alternative ingredients in the formulations.
- salvage of capital equipment -- residual value of equipment used to implement a control.[3]

All of these reported engineering-based cost estimates are on a before-tax, real basis in 1989 U.S. dollars.

2.2.1 Social Annualized Costs of Individual Control Options

The social costs of individual controls may be evaluated. For purposes of the overall cost estimates, however, changes in consumer surplus were used to estimate social costs.

To evaluate social costs for individual control options estimates of capital and non-recurring costs were annualized by multiplying these costs by:

$$\left[\frac{r}{1 - [1/(1+r)]}\right]^{t}$$

where r is the real social discount rate and t is the estimated economic life of capital. This factor is used to spread capital and non-recurring costs over the economic life of the capital to which a control is applied. The economic life of the capital equipment for each control was estimated to be 5 years.

Non-recurring costs (such as research, development and market study costs) represent one-time costs which, in practice, will not be replicated in future years. Using this interpretation, such non-recurring costs should not be included in annualized costs because they will not recur at a constant scale (i.e., the costs only occur once, regardless of how long the control is undertaken). Nonetheless, non-recurring costs were included

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[3] A salvage value for necessary capital equipment was included in only a few instances.

with capital costs so that the annualized cost estimates would reflect the full social costs of controls.

To compute total annualized costs, annualized capital and non-recurring costs were added to estimates of other annual pre-tax costs as follows:

- o <u>annual operating costs</u> -- annual costs of alternative ingredients were added directly.

- o <u>salvage of control equipment</u> -- few controls were expected to have salvageable capital. The present value of the salvage value of control equipment was estimated as:

  $$S * C/(1+r)^t$$

  where S is the percentage of capital costs estimated to be recoverable on salvage, C is the original capital cost, t is the useful life of capital, and r is the real social discount rate. This present value salvage amount was annualized in the same manner as described above for capital and non-recurring costs. The resulting annualized salvage value was then deducted from total annualized costs.

These estimates were initially done presuming that each control option was implemented to its fullest extent possible. The estimates were subsequently revised to reflect the costs of implementing them to various extents which depend on the incentives provided.

To estimate the costs per kilogram of PROC emissions avoided, this cost estimate is divided by the number of kilograms of PROC emissions avoided.

2.2.2 Private Annualized Costs of Individual Control Options

For purposes of assessing firms' potential reactions to incentives for reducing PROC emissions, the costs faced by the firms must be estimated. These costs are referred to as private costs. As discussed above, private costs will differ from social costs because of tax effects, differences in discount rates, and possible differences in the kinds of costs incurred.

To estimate private costs, a discounted cash flow analysis was used. This cash flow analysis: (1) computes annualized before-tax costs using a before-tax private discount rate, (2) estimates incremental cash flows incurred by private entities including the effects of depreciation and taxes on cash flows, and (3) computes an annual cost as the net of all annualized cash flows.

In general, the methods used to compute private annualized costs follow those described to compute social annualized costs. The methods used to estimate private annualized costs are comprised of the following steps:

1. The magnitude and timing of pre-tax costs (i.e., capital and operating costs) were specified. Assumptions regarding the timing of the costs and expenses (relative to the initiation of the control) are:

   o capital and non-recurring costs occur in year 0;

   o capital salvage occurs at end of the capital's operating life;

   o depreciation expense occurs over five years; operating costs are incurred each year.

2. Total pre-tax costs were calculated for each year over the control's operating life (assumed to be five years).

3. Taxes were applied to costs incurred by multiplying the costs by (1-marginal tax rate).

4. Depreciation was "added back" to net after-tax costs to account for the tax savings attributable to this non-cash expense.

5. The stream of after-tax cash flows was discounted using the private cost of capital to compute a net present value of the costs of the control over its entire life (assumed to be five years).

6. The present value of the after-tax costs was annualized using the private cost of capital as the discount rate. This present value is then divided by the total reduction in PROC use that can be achieved by the control to produce an annualized private cost per kilogram of use avoided.

Taxes were calculated using a marginal total tax rate of 44 percent. Investment Tax Credits (ITCs) were assumed not to be available. After-tax cash flows arising from capital salvage were calculated by multiplying pre-tax salvage by (1-tax rate). A tax loss would be included on undepreciated capital whenever the depreciable life exceeded the operating life of capital (however, this did not occur).

Annual depreciation expense was calculated using the straight line method over five years. This assumption is conservative because depreciation expenses occur uniformly over the depreciation period, whereas accelerated depreciation methods produce tax benefits in earlier years. Because depreciation is based on initial acquisition costs, annual depreciation expense was deflated by an inflation index to calculate real depreciation. An inflation rate of 4 percent was used.

To select the appropriate rate of private discount, the available literature was surveyed.[4] Little consensus existed among the experts who have studied this problem. The range of estimated values for the real rate of return on private investments was from 4 to 9 percent. Accordingly, 6 percent was selected as a median estimate.

This range of estimates agrees well with the cited range for the rate of social discount. One would expect the private rate to be from 2 to 5 percentage points higher than the social rate because of (a) the taxation of private income and (b) the need for society to subsidize capital formation to provide for future generations.

3. LIMITATIONS

The methods used to assess the social and private costs of proposed restrictions on PROC use are limited in terms of the data available and the manner in which the method is applied. The primary limitations of the data include:

- Identification of Control Options. By definition, only those control options that are currently known are included in the analysis. It is likely that as incentives are provided to reduce PROC emissions that additional control options will be identified. The inability to incorporate unknown control options biases the estimates of costs upward, although the extent of the bias is not known.

- Aggregation of Control Possibilities. The aggregation of the control possibilities to reflect the impacts of taking groups of controls is subjective. Alternative views of aggregation could lead to alternative estimates of control costs and achievable reductions.

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[4] Studies that address this issue include: Jacob Stockfish, "The Interest Rate Applicable to Government Investment Projects," in Program, Budgeting and Benefit Cost Analysis, Hinrichs and Taylor (eds.); Daniel Holland and Stewart Myers, "Profitability and Capital Costs for Manufacturing Corporations and All Nonfinancial Corporations," American Economic Review, May 1980; Barbara Fraumeni and Dale Jorgenson, "Rates of Return by Industrial Sector in the United States, 1948-1976," American Economic Review, May 1980; William Brainard, John Shoven and Laurence Weiss, "The Financial Valuation of the Return to Capital," Brookings Papers on Economic Activity, 1980; Robert Lind, "A Primer on the Major Issues Relating to the Discount Rate for Evaluating National Energy Options," in Discounting for Time and Risk in Energy Policy, Resources for the Future, 1982.

- <u>Uncertainty Surrounding New Chemical Substitutes</u>. The uncertainty surrounding the data describing the new chemical substitutes (particularly the HCFCs) has a large influence on the cost estimates produced. The areas of uncertainty primarily include the timing of availability of the new chemical substitutes (which influences the level of emissions reductions that can be achieved), the cost of the new chemical substitutes, and the extent to which the new chemical substitutes can be used in existing products.

The method also assumes that the primary mechanism driving the allocation of PROCs across competing uses is price. Although this is a standard assumption for analyses of this type, other factors (such as the relationship between producers and their customers) may influence the allocation of PROCs. To the extent that PROCs are not allocated based on price, the estimates of costs will be biased downward. A related assumption is that manufacturers implement the least costly control options. If more costly controls are undertaken, the cost estimates are also biased downward.

Two types of costs not considered are transition costs and risks. Transition costs (e.g., temporary unemployment or premature retirement of capital equipment) are generally small over the long-term, but may be important when reductions are initially required. Because phase-in times are contemplated, transition costs are likely to be small. Also many of the control options are compatible with existing equipment (thereby avoiding the premature retirement of capital).

The additional health and environmental risks posed by the control options have not been evaluated. Methylene chloride-based options were deleted from consideration due to risks, so that the options used in the analysis may not result in significant risks. However, some examples of risks are evident (e.g., the potential impact of HCFCs on stratospheric ozone), and additional analysis to assess these risks may be warranted.

EXHIBIT F-2
EXAMPLE SOCIAL COST FOR A CHEMICAL SUBSTITUTE

Control Option:	HCFC I Hair Spray Formula
Application Category:	Hair Spray Formula I
PROCs:	Ethanol (solvent), Hydrocarbon Propellant

1. Estimated Use Reduction Potential For Application Category

PROC Use in 1987 (000 KG)	X	Market Penetration (Percent)	X	Reduction Potential (Percent)	=	Use Reduction For Application (000 KG)
10,628		65		81.5		5630

2. Estimated Costs of Replacement Product

Capital Cost and Non-Recurring Costs

	91,520	Capital Cost ($)
+	25,600	Non-Recurring Cost ($)
=	117,120	
÷	3,001,830	Number of Cans
=	0.039	($/can)

Salvage of Capital[a]

	91,520	Capital Cost ($)
x	0.10	Salvage as % of Capital Cost
÷	3,001,830	Number of Cans
=	0.003	($/can)
x	0.906	Present Value Factor = $[1/(1+.02)]^5$
=	0.002	($/can)

Chemical Substitutions Cost

	1.685	Price of HCFC I Product ($/can)
x	1.0	Ratio of Substitute to Current Formulation
=	1.685	
-	0.645	Price of Current Hair Spray I ($/can)
=	1.040	Cost of Substitution ($/can)
x	4.713	Discounted Present Value of Annual Stream = $(1/.02) \times [1-(1/(1+.02))^5]$
=	4.901	Total Discounted Substitution Cost ($/can)

EXHIBIT F-2

EXAMPLE SOCIAL COST FOR A CHEMICAL SUBSTITUTE
(Continued)

3. Annualized Total Cost Per Can and Kilogram of PROC use Reduction

Total Cost Per Can

	0.039	Capital and Recurring Costs ($/can)
-	0.002	Salvage of Capital ($/can)
+	4.901	Total Discounted Substitution Cost ($/can)
=	4.938	Total Discounted Cost ($/can)
x	0.212	Annualization factor = $.02/[1-(1/(1+.02))^5]$
=	1.048	Annualized Total Cost ($/can)
÷	0.188	Kilograms Per Can
=	5.587	Annualized Total Cost ($/KG)
÷	2.2046	Pounds Per Kilogram
=	2.534	Annualized Total Cost ($/LB)

4. Total Annualized Social Cost

	1.048	Annualized Total Cost Per Can
x	3,001,830	Number of Cans
x	0.65	Penetration rate
=	2,044,846	Total Annualized Social Cost

a/ Operating life of Capital is assumed to be 5 years, at the end of which salvage occurs.

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APPENDIX G

EPA RULE ON STRATOSPHERIC OZONE PROTECTION

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Date: August 1, 1988.

Lee M. Thomas,

Administrator.

For the reasons set forth in the preamble, Title 40 CFR Part 82 is amended as follows:

PART 82—PROTECTION OF STRATOSPHERIC OZONE

1. The authority citation for Part 82 continues to read as follows:

Authority: 42 U.S.C. 7157(b).

2. Part 82 is amended by adding §§ 82.1–82.14 and Appendices A through D to read as follows:

Sec.

82.1 Purpose and scope.
82.2 Effective date.
82.3 Definitions.
82.4 Prohibitions.
82.5 Apportionment of baseline production allowances.
82.6 Apportionment of baseline consumption allowances.
82.7 Grant and phased reduction of baseline production and consumption allowances for Group I Controlled Substances.
82.8 Grant and freeze of baseline production and consumption allowances for Group II Controlled Substances.
82.9 Availability of production allowances in addition to baseline production allowances.
82.10 Availability of consumption allowances in addition to baseline consumption allowances.
82.11 Exports to parties.
82.12 Transfers of production and consumption allowances [Reserved].
82.13 Recordkeeping and reporting requirements.
82.14 Payment of fees [Reserved].

* * * * *

Appendix A—Controlled substances and ozone depletion weights.
Appendix B—Parties to the Montreal Protocol [Reserved].
Appendix C—Nations complying with, but not party to, the protocol [Reserved].
Appendix D—Twenty-five-kilotonne parties [Reserved].

§ 82.1 Purpose and scope.

(a) The purpose of these regulations is to implement the *Montreal Protocol on Substances that Deplete the Ozone Layer* under authority provided by section 157 of the Clean Air Act. The Montreal Protocol requires each nation that becomes a Party to the Protocol to limit its total production and consumption (defined as production plus imports minus exports) of certain ozone-depleting substances according to a specified schedule. The Protocol also requires Parties to impose certain restrictions on trade in ozone-depleting substances with nonparties.

(b) This rule applies to any individual, corporate, or governmental entity that produces, imports, or exports controlled substances.

§ 82.2 Effective date.

Section 82.13(f)(1) of this part takes effect September 12, 1988. The remainder of the regulations under this part will take effect when the Montreal Protocol enters into force. The Montreal Protocol will enter into force on January 1, 1989, provided that at least 11 instruments of ratification, acceptance, approval of the Protocol or accession thereto have been deposited by States or regional economic integration organizations representing at least two-thirds of 1986 estimated global consumption of the controlled substances. If these conditions have not been fulfilled by January 1, 1989, the Protocol will enter into force on the ninetieth day following the date on which the conditions have been fulfilled.

§ 82.3 Definitions.

As used in this part, the term:

(a) "Administrator" means the Administrator of the Environmental Protection Agency or his authorized representative.

(b) "Baseline consumption allowances" means the consumption allowances apportioned under § 82.6.

(c) "Baseline production allowances" means the production allowances apportioned under § 82.5.

(d) "Calculated level" means the level of production, exports or imports of controlled substances determined for each Group of controlled substances by:

(1) Multiplying the amount (in kilograms) of production, exports or imports of each controlled substance by that substance's ozone depletion weight listed in Appendix A to this Part; and

(2) Adding together the resulting products for the controlled substances within each Group.

(e) "Consumption allowances" means the privileges granted by this Part to produce and import calculated levels of controlled substances; however, consumption allowances may be used to produce controlled substances only in conjunction with production allowances. A person's consumption allowances are the total of the allowances he obtains under § 82.7 (baseline allowances for Group I controlled substances), § 82.8 (baseline allowances for Group II controlled substances), and § 82.10 (additional consumption allowances upon proof of exports of controlled substances), as may be modified under § 82.12 [1] (transfer of allowances).

(f) "Control periods" means those periods during which the prohibitions under § 82.4 apply. Those periods are:

(1) For Group I controlled substances: [reserved]

(2) For Group II controlled substances: [reserved]

(g) "Controlled substance" means any substance listed in Appendix A to this Part, whether existing alone or in a mixture, but excluding any such substance or mixture that is in a manufactured product other than a container used for the transportation or storage of the substance or mixture. Any amount of a listed substance which is not part of a use system containing the substance is a controlled substance. If a listed substance or mixture must first be transferred from a bulk container to another container, vessel, or piece of equipment in order to realize its intended use, the listed substance or mixture is a controlled substance. Controlled substances are divided into two groups, Group I and Group II, as set forth in Appendix A.

(h) "Export" means the transport of controlled substances manufactured from raw materials or feedstock chemicals (i.e., virgin production) from within the United States or its territories to persons or countries outside the United States or its territories, excluding United States Military bases and ships for on-board use.

(i) Exporter means the person who contracts to sell controlled substances for export, or transfers controlled substances to his affiliate in another country.

(j) "Facility" means any process equipment (e.g., reactor, distillation column) to convert raw materials or feedstock chemicals into controlled substances.

(k) "Import" means the transport of virgin, used and recycled controlled substances from outside the United States or its territories to persons within the United States or its territories.

(l) "Importer" means the importer of record listed on U.S. Customs Service Form 7501 for imported controlled substances.

(m) "Montreal Protocol" means the *Montreal Protocol on Substances that Deplete the Ozone Layer* which was adopted on September 16, 1987, in Montreal, Canada.

(n) "Nations complying with, but not joining, the Protocol" means any nation listed in Appendix C to this Part.

(o) "Party" means any nation that is a party to the Montreal Protocol and listed in Appendix B to this part.

(p) "Person" means any individual or legal entity, including an individual,

[1] Editorial Note: Section 82.12 is currently reserved. The Environmental Protection Agency will add regulations in that section at a future date.

corporation, partnership, association, state, municipality, political subdivision of a state, Indian tribe, and any agency, department, or instrumentality of the United States and any officer, agent, or employee thereof.

(q) "Plant" means one or more facilities at the same location owned by or under common control of the same person.

(r) "Potential production allowances" means the production allowances obtained under § 82.9 (a) and (b).

(s) "Production" means the manufacture of a controlled substance from any raw material or feedstock chemical (i.e., virgin production); however, production does not include the manufacture by one person of controlled substances that are used and entirely consumed in the manufacture by the same person of other chemicals.

(t) "Production allowances" means the privileges granted by this Part to produce calculated levels of controlled substances; however, production allowances may be used to produce controlled substances only in conjunction with consumption allowances. A person's production allowances are the total of the allowances he obtains under § 82.7 (baseline allowances for Group I controlled substances), § 82.8 (baseline allowances for Group II controlled substances), and § 82.9 (c) and (d) (additional production allowances), as may be modified under § 82.12 [1] (transfer of allowances).

(u) "Twenty-five-kilotonne Party" means any nation listed in Appendix D to this Part.

(v) "Unexpended consumption allowances" means consumption allowances that have not been used. At any time in any control period, a person's unexpended consumption allowances are the total of the calculated level of consumption allowances he has authorization under this Part to hold at that time for that control period, minus the calculated level of controlled substances that the person has produced and imported in that control period until that time.

(w) "Unexpended production allowances" means production allowances that have not been used. At any time in any control period, a person's unexpended production allowances are the total of the calculated level of production allowances he has authorization under this Part to hold at that time for that control period, minus the calculated level of controlled substances that the person has produced in that control period until that time.

§ 82.4 Prohibitions.

(a) No person may produce, at any time in any control period, a calculated level of controlled substances in excess of the amount of unexpended production allowances held by that person under the authority of this Part at that time for that control period. Every kilogram of such excess constitutes a separate violation of this regulation.

(b) No person may produce or import, at any time in any control period, a calculated level of controlled substances in excess of the amount of unexpended consumption allowances held by that person under the authority of this Part at that time for that control period. Every kilogram of such excess constitutes a separate violation of this regulation.

(c) A person may not use his production allowances to produce a quantity of controlled substances unless he holds under the authority of this Part at the same time consumption allowances sufficient to cover that quantity of controlled substances, nor may he use his consumption allowances to produce a quantity of controlled substances unless he holds under authority of this Part at the same time production allowances sufficient to cover that quantity of controlled substances. However, consumption allowances alone are required to import controlled substances.

(d) Beginning one year after the effective date of this Part, no person may import any quantity of controlled substances from any nation not listed in Appendix B to this Part (Parties to the Montreal Protocol), unless that nation is listed in Appendix C to this part (Nations Complying with, But Not Party to, the Protocol). Every kilogram of controlled substances imported in contravention of this regulation constitutes a separate violation of this regulation.

§ 82.5 Apportionment of baseline production allowances.

Persons who produced one or more controlled substances in 1986 are apportioned calculated levels of baseline production allowances as set forth in paragraphs (a) and (b) of this section. Each person's apportionment is equivalent to the calculated levels of that person's production of Group I and Group II controlled substances in 1986.

(a) For Group I controlled substances:

Person	Calculated level
Racon, Inc	13,786,088
Kaiser Chemicals	28,187,273
Pennwalt Corp	38,126,229
Allied-Signal, Inc	77,701,820
E.I. du Pont de Nemours & Co., Inc	152,221,000

(b) For Group II controlled substances:

Person	Calculated level
E.I. du Pont de Nemours & Co., Inc	32,200,000
Great Lakes Chemical Corp	20,147,961
ICI Americas, Inc	6,408,452

§ 82.6 Apportionment of baseline consumption allowances.

Persons who produced, imported, or produced and imported one or more controlled substances in 1986 are apportioned calculated levels of baseline consumption allowances as set forth in paragraphs (a) and (b) of this section.

(a) For Group I controlled substances:

Person	Calculated level
Racon, Inc	13,498,026
Kaiser Chemicals	27,816,217
Pennwalt Corp	38,229,889
Allied-Signal, Inc	74,043,943
E.I. du Pont de Nemours & Co., Inc	139,373,484
Atochem, Inc	2,204,113
Pharmachem, Inc	28,802
Sumitomo Corporation of America	229,930
Hoechst Celanese Corp	329,587
Refricentro, Inc	420,831
Kali-Chemie Corp	437,940
National Refrigerants, Inc	3,089,981
ICI Americas, Inc	6,310,917
Holchem, Inc	212,159

(b) For Group II controlled substances:

Person	Calculated level
E.I. du Pont Nemours & Co., Inc	27,731,067
Great Lakes Chemical Corp	19,855,266
ICI Americas, Inc	6,347,800
Ausimont USA, Inc	206,400
Atochem, Inc	2,126,427
Kali-Chemie Corp	1,533,800

§ 82.7 Grant and phased reduction of baseline production and consumption allowances for Group I controlled substances.

(a) For each of the control periods that begins before July 1, 1993, every person is granted 100 percent of the baseline production and consumption allowances apportioned to him under §§ 82.5(a) and 82.6(a).

[1] Editorial note: Section 82.12 is currently reserved. The Environmental Protection Agency will add regulations in that section at a future date.

(b) For each of the control periods that occurs between July 1, 1993, and June 30, 1998, inclusive, every person is granted 80 percent of the baseline production and consumption allowances apportioned to him under §§ 82.5(a) and 82.6(a).

(c) For each of the control periods that begins after June 30, 1998, every person is granted 50 percent of the baseline production and consumption allowances apportioned to him under §§ 82.5(a) and 82.6(a).

§ 82.8 Grant and freeze of baseline production and consumption allowances for Group II controlled substances.

For each of the control periods specified in § 82.3(f)(2), every person is granted 100 percent of the baseline production and consumption allowances apportioned to him under §§ 82.5(b) and 82.6(b).

§ 82.9 Availability of production allowances in addition to baseline production allowances.

(a) Every person apportioned baseline production allowances for Group I controlled substances under § 82.5(a) is also granted a calculated level of potential production allowances equivalent to:

(1) 10 percent of his apportionment under § 82.5(a), for each control period ending before July 1, 1998; and

(2) 15 percent of his apportionment under § 82.5(a), for each control period beginning after June 30, 1998.

(b) Every person apportioned baseline production allowances for Group II controlled substances under § 82.5(b) is granted a calculated level of potential production allowances equivalent to 10 percent of his apportionment under § 82.5(b), for each control year specified in § 82.3(f)(2).

(c) A person may convert potential production allowances, either granted to him under paragraphs (a) and (b) of this section or obtained by him under § 82.12 [1] (transfer of allowances), to production allowances only to the extent authorized by the Administrator under § 82.11 (Exports to Parties). A person may obtain authorization to convert potential production allowances to production allowances either by requesting issuance of a notice under § 82.11 or by completing a transfer of authorization under § 82.12.[1]

(d) Any person may obtain production allowances from, or transfer his production allowances to, a foreign entity in accordance with the provisions of this paragraph.

(1) A nation listed in Appendix D to this part (Twenty-five-kilotonne Parties) must agree to either transfer to the person at a specified time some amount of the calculated level of production that the nation is permitted under the Montreal Protocol or receive from the person at a specified time some amount of the calculated level of production that the person is permitted under this part. The person must obtain from the principal diplomatic representative in that nation's embassy in the United States a document clearly stating that the nation agrees to reduce or increase, as applicable, its allowable calculated level of production by the amount being transferred to or from the recipient for the control period(s) to which the transfer applies and that after the transfer the nation's total allowable production of controlled substances will not exceed 25 kilotonnes.

(2) The person must submit to the Administrator a transfer request that includes a true copy of the document required by paragraph (d)(1) of this section and that sets forth the following:

(i) The identity and address of the person;

(ii) The identity of the Twenty-five-kilotonne Party;

(iii) The names and telephone numbers of contact persons for the person and for the Twenty-five-kilotonne Party;

(iv) The amount of allowable calculated level of production being transferred;

(v) The control period(s) to which the transfer applies; and

(vi) For transfers to Twenty-five kilotonne Parties, the Twenty-five kilotonne Party's total allowable calculated level of production following the proposed transaction.

(3) After receiving a transfer request that meets the requirements of paragraph (d)(2) of this section, the Administrator will complete the following steps:

(i) Review any proposed transfer of production allowances to a Twenty-five-kilotonne Party and approve the transfer if it is consistent with the Montreal Protocol and domestic policy. The Administrator will consider the following factors in deciding whether to approve such a transfer:

(A) Possible creation of economic hardship;

(B) Possible effects on trade; and

(C) Potential environmental implications.

(ii) Notify the Secretariat of the Montreal Protocol of the transfer to the person or to the Twenty-five-kilotonne Party if approved under paragraph (d)(3)(i) of this; and

(iii) Issue the person a notice granting or deducting production allowances equivalent to the calculated level of production transferred, and specifying the control periods to which the transfer applies. The change in production allowances will be effective on the date that the notice is issued.

§ 82.10 Availability of consumption allowances in addition to baseline consumption allowances.

(a) Except as limited by paragraph (b) of this section, any person may obtain, in accordance with the provisions of this subsection, consumption allowances equivalent to the calculated level of controlled substances (other than recycled or used controlled substances) that the person has exported from the United States or its territories. The consumption allowances granted under this section will be valid only during the control period in which the exports departed the United States or its territories.

(1) The exporters of the controlled substances must submit to the Administrator a request for consumption allowances setting forth the following:

(i) The identities and addresses of the exporter and the recipient of the exports;

(ii) The exporter's Employer Identification Number;

(iii) The names and telephone numbers of contact persons for the exporter and the recipient;

(iv) The quantity, calculated level, and type of controlled substances exported, and what percentage, if any, of the controlled substances are recycled or used;

(v) The source of the controlled substance and the date purchased;

(vi) The date on which and the port from which the controlled substances were exported from the United States or its territories;

(vii) The country to which the controlled substances were exported;

(viii) The bill of lading and the invoice indicating the net quantity of controlled substances shipped and documenting the sale of the controlled substances to the purchaser; and

(ix) The commodity code of the controlled substance exported.

(2) The Administrator will review the information and documentation submitted under paragraph (a)(1) of this section, and will assess the quantity of controlled substances (other than recycled or used controlled substances) that the documentation verifies were exported. The Administrator will issue the exporter consumption allowances equivalent to the calculated level of

[1] Editorial note: Section 82.12 is currently reserved. The Environmental Protection Agency will add regulations in that section at a future date.

controlled substances that the Administrator determined were exported. The grant of the consumption allowances will be effective on the date the notice is issued.

(b) No consumption allowances will be granted after January 1, 1993, for exports of controlled substances to any nation not listed in Appendix B to this Part (Parties to the Montreal Protocol).

§ 82.11 Exports to parties.

In accordance with the provisions of this section, any person may obtain authorization to convert potential production allowances to production allowances by exporting controlled substances to nations listed in Appendix B to this part (Parties to the Protocol). Authorization obtained under this section will be valid only during the control period in which the controlled substances departed the United States or its territories. A request for authorization under this section will be considered a request for consumption allowances under § 82.10, as well.

(a) The exporter must submit to the Administrator a request for authority to convert potential production allowances to production allowances. That request must set forth the following:

(1) The identities and addresses of the exporter and the recipient of the exports;

(2) The exporter's Employee Identification Number;

(3) The names and telephone numbers of contact persons for the exporter and for the recipient;

(4) The quantity, the calculated level, the type of controlled substances exported, its source and date purchased, and what percentage, if any, of the controlled substances that are recycled or used:

(5) The date on which and the port from which the controlled substances were exported from the United States or its territories;

(6) The country to which the controlled substances were exported;

(7) The bill of lading and invoice indicating the net quantity shipped and documenting the sale of the controlled substances to the purchaser; and

(8) The commodity code of the controlled substance exported.

(b) The Administrator will review the information and documentation submitted under paragraph (a) of this section, and assess the quantity of controlled substances (other than recycled or used control substances) that the documentation verifies were exported to a Party. Based on that assessment, the Administrator will issue the exporter a notice authorizing the conversion of a specified quantity of potential production allowances to production allowances in a specified control year, and granting consumption allowances in the same amount for the same control year. The authorization may be used to convert potential production allowances to production allowances as soon as the date on which the notice is issued.

§ 82.12 Transfers of production and consumption allowances [Reserved].

§ 82.13 Recordkeeping and reporting requirements.

(a) Unless otherwise specified, the recordkeeping and reporting requirements set forth in this section take effect as follows:

(1) For Group I controlled substances, beginning with the first day of the first control period specified in § 82.3(f)(1).

(2) For Group II controlled substances, beginning with the first day of the first control period specified in § 82.3(f)(2).

(b) Reports and records required by this section may be used for purposes of compliance determinations. The requirements of records and reports is not intended as a limitation on the use of other evidence admissible under the Federal Rules of Evidence.

(c) Unless otherwise specified, reports required by this section must be mailed to the Administrator within 45 days of the end of the applicable reporting period.

(d) Records and copies of reports required by this section must be retained for three years.

(e) In reports required by this section, quantities of controlled substances must be stated in terms of kilograms.

(f) Every person ("producer") who will produce controlled substances during a control period must comply with the following recordkeeping and reporting requirements:

(1) Within 120 days of the date this rule is published in the Federal Register, every producer must provide a report to the Administrator describing:

(i) The method by which the producer in practice measures daily quantities of controlled substances produced;

(ii) Conversion factors by which the daily records as currently maintained can be converted into kilograms of controlled substances produced, including any constants or assumptions used in making those calculations (e.g. tank specifications, ambient temperature or pressure, density of the controlled substance, etc.):

(iii) Internal accounting procedures for determining plant-wide production:

(iv) The quantity of any fugitive losses accounted for in the production figures; and

(v) The estimated percent efficiency of the production process for the controlled substance.

Within 60 days of any change in the measurement procedures or the information specified in the above report, the producer must submit the revised data or procedures to the Administrator.

(2) Every producer must maintain the following:

(i) Dated records of the quantity of each of the controlled substances produced at each facility;

(ii) Dated records of the quantity of controlled substances used as feedstocks in the manufacture of controlled substances and in the manufacture of non-controlled substances and any controlled substances introduced into the production process of new controlled substances at each facility;

(iii) Dated records of the quantity of HCFC-22 and CFC-116 produced within each facility also producing controlled substances;

(iv) Dated records of the quantity of the following raw materials and feedstock chemicals used at each plant for the production of controlled substances: carbon tetrachloride, perchloroethylene, chloroform, hydrofluoric acid, chlorine, bromine, CFC-113, HCFC-22, and CFC-23.

(v) Dated records of the shipments of controlled substances produced at each plant;

(vi) The quantity of controlled substances, the date received, and names and addresses of the source of recyclable or recoverable materials containing controlled substances which are recovered at each plant;

(3) For each quarter, each producer must provide the Administrator with a report containing the following information:

(i) The production by plant in that quarter of each controlled substance, specifying the quantity of any controlled substance used for feedstock purposes for controlled and non-controlled substances for each plant and totaled for all plants owned by the producer;

(ii) The calculated levels of production (expended allowances) for Group I and Group II controlled substances for each plant and totaled for all plants for that quarter and totaled for the control period to-date:

(iii) The shipments of each controlled substance from each plant in that quarter;

(iv) The producer's total of expended and unexpended consumption allowances, potential production allowances, expended and unexpended production allowances and authorization to convert potential production allowances to production allowances, as of the end of that quarter;

(v) The quantity, the date received, and names and addresses of the source of recyclable or recoverable materials containing the controlled substance which are recovered at each plant; and

(4) For any person who fails to maintain the records required by this paragraph, the Administrator may assume that the person has produced at full capacity during the period for which records were not kept, for purposes of determining whether the person has violated the prohibitions at § 82.4.

(g) For Group I controlled substances, beginning with the first control period specified under § 82.3(f)(1), and for Group II controlled substances, beginning one year after the Montreal Protocol enters into force, importers of controlled substances during a control period must comply with the following recordkeeping and reporting requirements:

(1) Any importer must maintain the following records:

(i) The quantity of each controlled substance imported, either alone or in mixtures;

(ii) The date on which the controlled substances were imported;

(iii) The port of entry through which the controlled substances passed;

(iv) The country from which the imported controlled substances were imported;

(v) The port of exit;

(vi) The commodity code for the controlled substances shipped;

(vii) The importer number for the shipment;

(viii) A copy of the bill of lading for the import;

(ix) The invoice for the import; and

(x) The U.S. Customs Entry Summary Form.

(2) For each quarter, every importer must submit to the Administrator a report containing the following information:

(i) Summaries of the records required in paragraph (g)(1)(i)–(vii) of this section for the previous quarter;

(ii) The total quantity imported in kilograms of each controlled substance for that quarter;

(iii) The calculated levels of import (expended allowances) of Group I and Group II controlled substances for that quarter and totaled for the control-period-to-date; and

(iv) The importer's total sum of expended and unexpended consumption allowances at the end of that quarter.

(h) For any exports of controlled substances not reported under § 82.10 (additional consumption allowances) or § 82.11 (Exports to Parties), the exporter who exported the controlled substances must submit to the Administrator the following information within 45 days of the end of the control period in which the unreported exports left the United States:

(1) The names and addresses of the exporter and the recipient of the exports;

(2) The exporter's Employee Identification Number;

(3) The type and quantity of controlled substances exported and what percentage, if any, of the controlled substances that are recycled or used;

(4) The date on which and the port from which the controlled substances were exported from the United States or its territories;

(5) The country to which the controlled substances were exported; and

(6) The commodity code of the controlled substance shipped.

§ 82.14 Payment of fees [Reserved].

APPENDIX A

Controlled substance	Ozone depletion weight
A. Group I:	
CFC13—Trichlorofluoromethane (CFC-11)	1.0
CC12F2—Dichlorodifluoromethane (CFC-12)	1.0
CC12F-CC1F2—Trichlorotrifluoroethane (CFC-113)	0.8
CF2C1-CC1F2—Dichlorotetrafluoroethane (CFC-114)	1.0
CC1F2-CF3—(Mono)chloropentafluoroethane (CFC-115)	0.6
B. Group II:	
CF2BRC1—Bromochlorodifluoroethane (Halon 1211)	3.0
CF3BR—Bromotrifluoroethane (Halon 1301)	10.0
C2F4Br2—Dibromotetrafluoroethane (Halon 2402)	6.0

Appendix B—Parties to the Montreal Protocol [Reserved]

Appendix C—Nations Complying With, But Not Parties to, the Protocol [Reserved]

Appendix D—Twenty-Five-Kilotonne Parties [Reserved]

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